NOTICE INVITING TENDER

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM ON PACKAGE BASIS AT TALCHER FERTILIZERS LIMITED, TALCHER, ODISHA (INDIA)

OPEN DOMESTIC COMPETETIVE BIDDING

(NIT NO : PNMM/PC-183/E- 4020/NCB)

TALCHER FERTILIZERS LIMITED

[A JOINT VENTURE OF M/s GAIL (INDIA) LIMITED (GAIL), M/s RASHTRIYA CHEMICALS & FERTILIZERS LTD. (RCF), M/s COAL INDIA LTD. (CIL), & M/s FERTILIZER CORPORATION OF INDIA LTD (FCIL)]

ISSUED BY

PROJECTS & DEVELOPMENT INDIA LTD.
(A Govt. Of India Enterprise)
PDIL BHAWAN, A-14, Sector-1,
NOIDA U.P. (India)

16th MARCH, 2023

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INVITATION FOR BID (IFB)

SECTION-I
"INVITATION FOR BID (IFB)"

Ref No: PNMM/PC-183/E-4020/NCB Dated: 16.03.2023

To,

PROSPECTIVE BIDDERS

SUB: TENDER DOCUMENT FOR SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM ON PACKAGE BASIS AT TALCHER FERTILIZERS LTD., ANGUL, ODISHA."

Dear Sir/Madam,

1.0 **INTRODUCTION:**

1.1 GAIL (India) Limited (GAIL), Rashtriya Chemicals & Fertilizers Limited (RCF), Coal India Limited (CIL) and Fertilizer Corporation of India Limited (FCIL) have formed a Joint Venture company in the name of Talcher Fertilizers Limited (TFL) hereinafter also referred to as "Owner", intends to carry out the work of Supply, Installation, Testing & Commissioning of Flare System on Package Basis for its Ammonia Urea Plant, an integrated fertilizer and chemical complex comprising of Coal Gasification and Gas Purification Unit, Ammonia Synthesis Unit, Urea Plant, along with necessary offsite and utility facilities at Talcher Unit, Angul district, in the state of Odisha, India.

1.2 GAIL (India) Limited is a Public Sector Unit under the Ministry of Petroleum & Natural Gas and Rashtriya Chemicals & Fertilizers Limited (RCF) & Fertilizer Corporation of India Limited (FCIL) are two Public Sector Units under the Ministry of Chemicals & Fertilizers and Coal India Limited (CIL) is a Public Sector Unit under the Ministry of Coal, Govt. of India.

1.3 Projects and Development India Limited (PDIL), hereinafter referred to as PROJECT MANAGEMENT CONSULTANT (PMC)on behalf of M/s Talcher Fertilizers Ltd. (TFL), hereinafter referred as OWNER, has the pleasure of inviting bids from eligible domestic bidders to submit Bid ONLINE through Central Public Procurement (CPP) Portal under Single Stage Two Bid System, for the subject works.

2.0 The brief details of the tender are as under:

(A)	NAME OF WORK / BRIEF SCOPE OF SERVICE/JOB	SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM ON PACKAGE BASIS AT TALCHER FERTILIZERS LTD., ANGUL, ODISHA."
(B)	NIT NO. & DATE	PNMM/PC-183/E-4020/NCB DATED 16.03.2020 ON OPEN DOMESTIC COMPETITIVE BIDDING BASIS

<table>
<tr><td>(C)</td><td>TYPE OF BIDDING SYSTEM</td><td><table><tr><td>SINGLE BID SYSTEM</td><td></td></tr><tr><td>TWO BID SYSTEM</td><td>√</td></tr></table></td></tr>
<tr><td>(D)</td><td>TYPE OF TENDER</td><td><table><tr><td>E-TENDER (CPP PORTAL)</td><td>√</td></tr><tr><td>MANUAL</td><td></td></tr></table></td></tr>
<tr><td>(E)</td><td>COMPLETION PERIOD</td><td>Please Refer Clause 20.0 of SPECIAL CONDITIONS OF CONTRACT.</td></tr>
<tr><td>(F)</td><td>BID SECURITY /EARNEST MONEY DEPOSIT (EMD)</td><td><table><tr><td>APPLICABLE</td><td>√</td></tr><tr><td>NOT APPLICABLE</td><td></td></tr></table>
EMD value: Rs. 83.17 Lakh (Rupees Eighty Three Lakh and Seventeen Thousand Only)

Exempted Bidders (i.e. MSEs, Start-ups and Govt Dept./PSUs) are required to submit declaration for Bid security as per Form F-2B (Refer clause no.16 of ITB).</td></tr>
<tr><td>(G)</td><td>AVAILABILITY OF TENDER DOCUMENT ON WEBSITE(S)</td><td>(i) CPP Portal (https://eprocure.gov.in/eprocure/app)
(ii) TFL Website - http://tflonline.co.in
(iii) PDIL website - www.pdilin.com</td></tr>
<tr><td>(H)</td><td>LAST DATE OF RECEIPT OF BIDDER'S PRE-BID QUERIES</td><td>NOT APPLICABLE</td></tr>
<tr><td>(I)</td><td>DATE, TIME OF PRE-BID MEETING
(Through Video Conferencing)</td><td>NOT APPLICABLE</td></tr>
<tr><td>(J)</td><td>BID SUBMISSION START DATE</td><td>05.04.2023 at 15:00 Hrs</td></tr>
<tr><td>(K)</td><td>BID CLOSING DATE</td><td>15.04.2023 at 15:00 Hrs</td></tr>
<tr><td>(L)</td><td>BID OPENING DATE</td><td>17.04.2023 at 15:00 Hrs</td></tr>
</table>

(M)	Address for Communication	
(i)	PDIL	M/s Projects & Development India Limited, P.D.I.L Bhawan, A-14, Sector-1, Noida, (PIN 201301) Dist. Gautam Budh Nagar (UP). (India) Kind Attention: Mrs. Anjali Thakur Dy. General Manager (M.M) Fax no. : +91-120-2529801 Tel no. : +91-120-2544063 E-mail : anjali@pdilin.com alam@pdilin.com
(ii)	TFL	M/s Talcher Fertilizers Ltd. (TFL), C/O GAIL Training Institute, PARC Building, Plot No. 24, Sector-16A, Film City, Noida District – G.B. Nagar, U.P. - 201301 Kind Attention : Mr. S. M. BADRUDDOJA DGM (Projects) Tel No. : +91-8859500094 E-mail : sm.badruddoja@gail.co.in ; mannapaul@gail.co.in
(N)	Original Documents to be submitted at	Projects & Development India Limited, (Materials Management Department) P.D.I.L Bhawan, A-14, Sector-1, Noida, (PIN 201301) Dist. Gautam Budh Nagar (UP). (India) Kind Attention: Mrs. Anjali Thakur, Dy. General Manager (M.M) Fax no. : +91-120-2529801 Tel no. : +91-120-2544063. E-mail : anjali@pdilin.com
(O)	Contact Person for Site visit	M/s Talcher Fertilizers Ltd. (TFL), Administrative Building, Talcher, Post: Vikrampur, Dist: Angul, Pincode-759106, Odisha Kind Attention: Mr. Satyabrata Mishra General Manager (Projects) Tel No. : +91-9927339444 E-mail : smishra@gail.co.in

In case the days specified above happens to be a holiday in TFL/PDIL, the next working day shall be implied.

3.0 Bids must be submitted strictly in accordance with Clause No. 11 of ITB (Section-III of tender) depending upon Type of Tender as mentioned at Clause no. 2.0 (D) above. The IFB is an integral and inseparable part of the bidding document.

4.0 Bid must be submitted only on CPP Portal (https://eprocure.gov.in/eprocure/app). Further, the following documents in addition to uploading the bid on CPPP's Portal shall also be submitted in Original (in physical form) within 7 (seven) days(*) from the bid due date, provided the scanned copies of the same have been uploaded in e-tender by the bidder along with e-bid within the due date and time to the address mentioned in Clause no. 2.0 (M) of IFB:-

i) EMD (for all bidders except exempted category) /Declaration for Bid Security (for exempted bidders)
ii) Power of Attorney
iii) Integrity Pact
iv) Original Letter of TPI as per Appendix-I at Section-II

5.0 Bidder(s) are advised to quote strictly as per terms and conditions of the tender documents and not to stipulate any deviations/exceptions.

6.0 Any bidder, who meets the Bid Evaluation Criteria (BEC) and wishes to quote against this Tender Document, may download the complete Tender Document along with its amendment(s) if any from websites as mentioned at 2.0 (G) of IFB and submit their Bid complete in all respect as per terms & conditions of Tender Document on or before the Due Date & Time of Bid Submission.

7.0 Bid(s) received from bidders to whom tender/information regarding this Tender Document has been issued as well as offers received from the bidder(s) by downloading Tender Document from above mentioned website(s) shall be taken into consideration for evaluation & award provided that the Bidder is found responsive subject to provisions contained in Clause No. 2 of ITB (Section-III of tender).

The Tender Document calls for offers on single point "Sole Bidder" responsibility basis (except where JV/Consortium bid is allowed pursuant to clause no. 3.0 of ITB) and in total compliance of Scope of Works as specified in Tender Document.

8.0 Any revision, clarification, corrigendum, time extension, etc. to this Tender Document will be hosted on the website(s) only as mentioned at 2.0 (G) of IFB. Bidders are requested to visit the CPP Portal regularly to keep themselves updated. No complaint/representation shall be entertained from bidders in case they do not see / download the amendments, etc. issued to the tender document by TFL from time to time on the CPP Portal.

9.0 All bidders including those who are not willing to submit their bid are required to submit F-6 (Acknowledgement cum Consent letter) duly filled within 7 days from date of receipt of tender information.

This is not an Order.

Thanking You,
For and on behalf of
Talcher Fertilizers limited

16/3/2023

(Anjali Thakur)
Dy. General Manager (M.M)
Projects & Development India Limited

PHYSICAL DOCUMENTS (EMD/Declaration for Bid Security, POA, Integrity Pact &* Original Letter of TPI*)

Tender Document No. : PNMM/PC-183/E-4020/NCB dated

Description : **Supply, Installation, Testing & Commissioning of Flare System on Package Basis AT TALCHER FERTILIZERS LIMITED, ANGUL, ODISHA (INDIA)**

Due Date & Time : 15.04.2023 at 15:00 Hrs

From:	***To:***
…… ***……*** ***……*** ***……***	M/s Projects & Development India Limited, P.D.I.L Bhawan, A-14, Sector-1, Noida, (PIN 201301) Dist. Gautam Budh Nagar (UP). (India) Kind Attention: Mr. P.R.Sahu, Addl. General Manager (M.M)

(To be pasted on the envelope containing Physical Document)

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SECTION-II

BID EVALUATION CRITERIA

&

EVALUATION METHODOLOGY

SECTION-II

1.0 BID EVALUATION CRITERIA (BEC) FOR SINGLE BIDDER

The following Bid Evaluation Criteria (BEC) is proposed for this tender. The proposed "BEC" is based on TFL approved C&P procedure, as provided by TFL. The BEC, Evaluation Methodology and other salient terms and conditions of NIT are as given below:

Bids are hereby invited from competent Domestic Bidders meeting the technical and financial criteria of respective BEC stated hereunder.

Evaluation of Techno-Commercial offers shall be carried out for only those Bidders who shall meet the BEC.

(A) Technical Criteria:

A.1 The bidder shall be a supplier of Hydrocarbon Flare System. The bidders shall be the single point responsibility vendor (SPRV) for the offered Flare System,

A.2 The bidder must have completed at least One, Two or three **"Similar work**"**, during the last Ten (10) years reckoned from the original bid opening date

(i) The bidder must have completed One **"Similar work"**, having minimum 297 TPH design capacity with height not less than 70 meter.

OR

(ii) The bidder must have completed Two **"Similar work"**, having minimum 212 TPH design capacity with height not less than 70 meter.

OR

(iii) The bidder must have completed Three **"Similar work"**, having minimum 170 TPH design capacity with height not less than 70 meter.

"**Similar work****" shall mean the following:

The bidder should have experience of Supply, Erection/Construction (or supervise erection) and Commissioning of Demountable type Hydrocarbon/Mixed Gas hot Flare system comprising of Flare tip, Molecular seal, Flare riser/pipe, derrick structure and demounting arrangement.

OR

In case, the bidder does not meet the above similar work, the bidder still be considered (with respect to above Similar work), provided:

a) The bidder should have experience of Supply, Erection/Construction (or supervise erection) and Commissioning of Derrick supported Elevated type Fixed Hydrocarbon /Mixed Gas hot Flare system comprising of Flare tip, Molecular seal, Flare riser/pipe, derrick structure.

b) Bidder engages a back-up consultant/technical collaborator/agency for design and engineering of "Derrick structure and demounting arrangement of Demountable Flare", who meets the requirement in respect of design and engineering of "Derrick structure and demounting arrangement of Demountable Flare". However, the ultimate responsibility lies with the bidder.

c) The bidders furnishes along with his bid the MoU (or Letter of Agreement or letter of consent) with the above back-up consultant/technical collaborator/agency/. Above back-up consultant/ technical collaborator/agency shall not be changed thereafter.

A. 3 The **"Similar work" referred at A.2 above** must have been in operation for at least 1 (one) year from the Date of Acceptance / Commissioning of the work.

Note for A.1, A.2 and A.3

Eligibility criteria (for A.1, A.2 and A.3 of Technical BEC) in case bid is submitted on the basis of technical experience of FOREIGN BASED ANOTHER COMPANY (SUPPORTING COMPANY) which holds more than fifty percent of the paid up share capital of the bidder company or vice versa.

Offers of those bidders (not under consortium arrangement) who themselves do not meet the technical experience criteria (A.1, A.2 & A.3) as stipulated in the BEC and are quoting based on the experience of Foreign based another company (Supporting Company) shall also be considered. In such case the supporting company should hold more than fifty percent of the paid up share capital of the bidding company or vice versa.

However, the supporting company should, on it's own, meet the technical experience (A.1, A.2 & A.3) as stipulated in the BEC and should not rely on any other company or through any other arrangement like Technical collaboration agreement.

In that case, as the bidding company is dependent upon the technical experience of another company with a view to ensure commitment and involvement of the companies involved for successful execution of the contract, the participating bidder should enclose the following Agreements/ Guarantees/ Undertakings along with the techno-commercial bid

i. An Agreement (as per prescribed format, F-25) between the bidder and the supporting company.

ii. Guarantee (as per prescribed format, F-26) by the supporting company to TFL for fulfilling the obligation under the Agreement.

iii. Undertaking by Supporting Company to provide a Performance Bank Guarantee**[PBG]**(as per prescribed format), equivalent to 50% of the value of the Contract Performance Security **(CPS)** which is to be submitted by the bidding company, in case of being the successful bidder.

In cases where foreign based supporting company does not have Permanent Establishment in India as per Indian Income Tax Act, the bidding company can furnish Performance Bank Guarantee/CPS for an amount which is sum of CPS/PBG amount to be submitted by the bidder and additional PBG/CPS amount required to be submitted by the supporting company subject to the condition that supporting company have 100% paid up equity share capital of the bidder either directly or through intermediate subsidiaries or vice versa.

In such case, bidding company shall furnish an undertaking that their foreign based supporting company is not having any Permanent Establishment in India in terms of Income Tax Act of India.

iv. Undertaking from the supporting company to the effect that in addition to invoking the CPS/PBG submitted by the bidding company, the CPS/PBG provided by supporting company shall be invoked by TFL due to non-performance of the bidding company.

v. In case Supporting Company fails to submit Bank Guarantee as per (iii) above, EMD/ SD submitted by the bidder shall be forfeited.

The Financial BEC (B.1, B.2 and B.3 below) of tender is to be met by bidder on their own.

A.4 Applicability of Policy for providing preference to domestically manufactured Iron & Steel (DMI & SP) products.

Bidder should have minimum prescribed domestic value addition requirement in line with the Domestic Manufactured iron & Steel Policy (DMI & SP) for the Iron & Steel products involved in execution of the contract. Bidder shall submit affidavit from the domestic manufacturers of such Iron & steel products as per the Form-I mentioned in the policy document.

A bidder who is not manufacturer of Iron & Steel product and is unable to submit the Affidavit from domestic manufacturers at bidding stage, such bidder can submit the Affidavit issued by domestic manufacturers after placement of order. In this case bidder along with his bid shall submit an undertaking as per attached format in NIT.

If a bidder does not submit above affidavit/ undertaking as per format, the offer of bidder shall be rejected.

Additional Notes:

I. Job completed by a Bidder for its own plant/ project cannot be considered as experience for the purpose of meeting BEC of the tender. However, jobs completed for Subsidiary/ Fellow subsidiary/ Holding company will be considered as experience for the purpose of meeting BEC subject to submission of tax paid invoice(s) duly certified by Statutory Auditor of the Bidder towards payments of statutory tax in support of the job completed for Subsidiary/ Fellow subsidiary/ Holding company. Such Bidders to submit these documents in addition to the documents specified to meet BEC.

II. The bidder must submit the completion certificate/acceptance certificate issued by Order issuing authority/end user/ owner (or their consultant who has been duly authorized by them to issue such certificate) only after completion of work/ supply in all aspects.

III. Only documents (Work order, completion certificate, execution certificate etc.) which have been referred /specified in the bid shall be considered in reply to the queries during evaluation of bids.

IV. In case more than one contract/order/agreement/DLOA are emanating against same tender, these contracts are to be considered as single contract for evaluation of credentials of a bidder for meeting their experience criteria.

V. Experience of bidder acquired as a sub-contractor is acceptable against submission of certificate from End User/Owner by such bidder along with other specified documents.

VI. Bids from Consortium / Joint Venture shall not be accepted.

(B) Financial Criteria:

B.1 The Average Annual financial Turnover during the three preceding financial years of the bidder should be minimum **INR 36.80 Crore.**

B.2 Net Worth of the bidder should be positive as per last audited financial year.

B.3 The Bidder should have minimum working capital equal to **INR 7.36 Crore** as per last audited financial year. However, if the bidder's working capital is negative or inadequate, the bidder shall submit a letter from their Bank having Net worth of the bank not less than Rs.100.0 Crore (or equivalent USD), confirming the availability of line of credit for INR 7.36 Crore. The line of credit from bank shall be submitted strictly as per prescribed format.

"Notes for B.1, B.2 & B.3"

Annual Turnover: Preceding 3 financial years mentioned in aforesaid BEC refer to immediate 3 preceding financial years wherever the closing date of the bid is after 30th September of the relevant financial year. In case the tenders having the due date for submission of bid up to 30th September of the relevant financial year, and audited financial results of the immediate 3 preceding financial years are not available, the audited financial results of the 3 years immediately prior to that will be considered. Further, in case bidder is meeting the Annual Turnover criteria of BEC based on Audited Financial Statement of any one of the preceding 3 financial years (as mentioned above), the same shall suffice and bidder may submit prescribed format accordingly.

Net Worth/Working Capital: Immediate preceding financial year mentioned in aforesaid BEC refer to audited financial results for the immediate preceding financial year wherever the closing date of the bid is after 30th September of the relevant financial year. In case the tenders having the due date for submission of bid up to 30th September of the relevant financial year, and audited financial results of the immediate preceding financial year is not available, in such case the audited financial results of the year immediately prior to that year will be considered. Bidder is to submit Audited Financial Statement of immediate preceding financial years (as mentioned above) along with format F-10 accordingly for Networth / Working Capital.

Any shortfall information / documents on the Audited Annual Report / Financial Statement of the Bidder and/or line of credit for working capital issued on or before the final bid due date can only be sought against Commercial queries (CQs). Any information/ documents issued post final bid due date shall not be considered for evaluation.

(C) General Notes (for both Technical BEC and Financial BEC):

Exchange rate for conversion of currency for evaluation of documents relating to BEC (if applicable):

Exchange rate for Conversion of Currency for evaluation of documents submitted by bidders for BEC which are in a currency other than INR, shall be as follows:

a) **BEC (Technical):** Bill Selling (foreign exchange) Rate of State Bank of India as prevailing on the date of award of order / contract submitted by bidder (Not applicable for this tender).

b) **BEC (Financial)**

(i) **For Annual Turnover**: The average of Bill Selling (foreign exchange) Rate of State Bank of India as prevailing on the First date and Last date of the respective Financial Year**.**

(ii) **For Net Worth & Working Capital**: The Bill Selling (foreign exchange) Rate of State Bank of India as prevailing on the Last date of the respective Financial Year

c) In case, the SBI Selling rate is not available as on the date of conversion as specified above for respective cases, the exchange rate for conversion of currency shall be taken from the internet, such as

https://www.xe.com/currencyconverter
https://economictimes.indiatimes.com/markets/forex/currency-converter
https://www.oanda.com/currency/converter

(D) BEC for START-UPS:

The Technical and Financial BEC as stipulated above shall also be applicable for start-ups.

(E) Documents to be submitted for Compliance to BEC

(i) Technical Criteria of BEC:

To meet the criteria of **A.1** above, Bidder must submit copy of Inspection release note (IRN)/Bill of lading/vendor registration certificate with Govt. or PSU's organization/ISO certificate etc.

To meet the criteria of **A.2** above, Bidder must submit copy of Detailed Letter of Acceptance (DLOA) / Work Order /relevant extract of work Order/ Contract Agreement along with detailed scope of work and Completion / Acceptance Certificate. Such certificate shall be issued by order issuing authority/ Owner/End user.

The Detailed Letter of Acceptance (DLOA) / Work Order / Contract Agreement must *inter alia* include Scope of work, completion time, contract value, etc. Similarly, the Completion Certificate/ Acceptance Certificate must clearly indicate reference of relevant work order/DLOA/Contract Agreement, Name of Work, and date of completion. For Flare capacity & other specifications, bidder shall also submit Completion Certificate / Work Order /relevant extract of work Order/GAD/Technical data sheet/ any other documents in support of meeting technical parameters, etc., wherein all technical details are mentioned / specified.

Memorandum of understanding (MoU) (or letter of Agreement or Letter of Consent)/Agreement document with backup consultant/Technical Collaborator/Agency to meet the requirement of clause no. **A.2** Similar work.

In case bid is submitted on the basis of technical experience (A.1, A.2 and A.3 of technical BEC) of FOREIGN BASED ANOTHER COMPANY (SUPPORTING COMPANY), all documents as mentioned in the **"Note for A.1, A.2 and A.3"**shall be submitted by bidder.

To meet the criteria of **A.3,** above certificate in respect of minimum one year successful operation of the Plant/System from the date of acceptance/Commissioning of work issued by the order issuing authority/Owner/End user.

In cases where bidder has executed the work as a sub-contractor, such Completion certificate and Operation certificates (for compliance to **A.2** and **A.3** above) issued by the "Order issuing Authority" is also acceptable, provided that a certificate or letter from End User/Owner is submitted certifying that the bidder has worked as a sub-contractor for that project.

To meet the criteria **A.4** above, Bidder shall submit affidavit from the domestic manufacturers of Iron & steel products as per the Form-I enclosed with the policy documents. A bidder who is not manufacturer of Iron & Steel product and is unable to submit the Affidavit from domestic manufacturers at bidding stage, such bidder can submit the Affidavit issued by domestic manufacturers after placement of order. In this case bidder along with his bid shall submit an undertaking as per prescribed format.

Any other documents to establish the bidder meets BEC requirements.

Note: Above is indicative list of documents. Bidder shall ensure that all requisite documents are furnished in the bid to justify qualification of bidder with respect to bidder qualification requirements.

(ii) Financial Criteria of BEC:

(a) To meet the criteria for Sr. No. **B.1,** Bidder shall submit the Audited Financial Statements of the company for last three (03) preceding financial years.

(b) To meet the criteria for Sr. No. **B.2**, Bidder shall submit the Audited Financial Statements of the last financial year

(c) To meet the criteria for Sr. No. **B.3,** Bidder shall submit the Audited Financial Statements of last financial year along with (i) Bank's Letter (if applicable)

(d) If the bidder's working capital is negative or inadequate, the bidder shall submit a letter from their bank having net worth not less than Rs.100 Crores (or equivalent USD), confirming the availability of line of credit for working capital amount mentioned herein above. The line of credit letter from bank to be submitted strictly as per prescribed format.

For E (ii) above, the "Notes for B.1, B.2 & B.3 under B" (Financial Criteria of BEC) shall apply.

(iii) Bidder shall submit Checklist as per prescribed format in respect of documents to be submitted by bidder towards BEC.

(F) Authentication of documents submitted against BEC

F.1 Technical BEC

All documents in support of "Technical Criteria" of Bid Evaluation Criteria (BEC) furnished by the bidders shall be verified and certified by any one of the following independent third party inspection agency (as per prescribed format):

1. Société Générale de Surveillance (SGS)
2. Gulf Lloyds Industrial Services (India) Pvt. Ltd (GLISPL)

3. International Certification Services (ICS)
4. Bureau Veritas (Ind.) Pvt. Ltd (BVIS)
5. DNV GL
6. TUV Rheinland (India) Pvt. Ltd.
7. TÜV SÜD South Asia Pvt. Ltd.
8. TUV India Pvt. Ltd. (TÜV Nord Group)
9. Intertek India Pvt. Ltd.
10. Moody International (India) Pvt. Ltd.
11. RINA India Pvt. Ltd.
12. Tata Projects Ltd.
13. Competent Inspectorate and Consultants LLP
14. ABS Industrial Verification (India) Pvt. Ltd

Further, TPIA will provide in addition a certificate toward verification and certification of documents pertaining to Technical Bid Evaluation Criteria (BEC) as per prescribed proforma and the same will be submitted by bidder in their bid.

All charges of the Third party for verification and certification shall be borne by the Bidder.

If any above mentioned agency themselves are participating in bidding, then they shall authenticate the documents by a different agency from the list given above.

F.2 Financial BEC

Bidder shall submit "Details of financial capability of Bidder" in prescribed format (F-10) duly signed and stamped by a chartered accountant/ Certified Public Accountant (CPA).

Further, copy of audited annual financial statements submitted in bid shall be duly certified/ attested by Notary Public with legible stamp.

2.0 Evaluation Methodology:

The subject work is indivisible and complete work shall be awarded to successful overall lowest bidder as per evaluation methodology described below:

(i) Total LSTK PRICE/TOTAL CONTRACT PRICE inclusive of all taxes & duties including GST quoted in the format of Schedule of Rates of Section-VII of NIT.

(ii) In case any cess on GST is applicable, same shall also be considered in evaluation.

(iii) In case any unregistered bidder is submitting their bid, their prices will be loaded with applicable GST (CGST & SGST/UTGST or IGST) while evaluation of bid (if applicable as per Govt. Act/Law in vogue).

(iv) The Price Evaluation will be subject to applicability of Purchase Preference Policies as mentioned in the tender document.

3.0 Applicability of Public Procurement (Make in India) Policy

The said policy shall be applicable for this package. Further, as the work is non divisible/non-splittable, therefore, the relevant provisions of policy shall be applicable. The minimum local content and all other provisions shall be as per Public Procurement (Make in India) Policy latest policy no. P-45021/2/2017-PP (BE-II) dated 16th September, 2020 or as updated from time to time.

4.0 Applicability of purchase preference of MSE's

Considering that the subject work falls under "Works Contract", Purchase preference to MSE's Bidders shall not be applicable as per government guidelines.

However, MSEs, Startup and Government Department/ PSUs shall be exempted from payment of EMD and they shall submit Declaration of Bid security as per format.

Appendix-I

Format for Undertaking from TPIA
(on TPIA letter head duly stamped & signed)

Ref.: Date :

To,

Talcher Fertilizers Limited.
……
……..
……

Dear Sir,

Subject: Verification and certification of documents pertaining to Technical Bid Evaluation Criteria (BEC)

Ref : Tender no. …….. for …….

M/s. ……having Registered office at……intend to participate in above referred tender of Talcher Fertilizers Limited having its registered office at Plot 2/H, Kalpana Area, BJB Nagar, Khordha, Bhubaneswar-751014.

The tender conditions stipulates that the BIDDER shall submit Documents pertaining to Technical Bid Evaluation Criteria (BEC) duly verified and certified by designated independent Third Party Inspection Agency.

In this regard, this is to certify that copies of documents pertaining to Technical Bid Evaluation Criteria (BEC) submitted to us by the bidder have been verified and certified by us with the originals and found to be genuine. We have signed and stamped on the copies of all the verified and certified documents.

(Signature of a person duly authorized to
Sign on behalf of the TPIA)
(Seal of the Company)
Name: ……..
Contact No……

Appendix-II

POLICY FOR PROVIDING PREFERENCE TO DOMESTICALLY MANUFACTURED IRON & STEEL PRODUCTS IN GOVERNMENT PROCUREMENT

Annexure - VIII

रजिस्ट्री सं० डी० एल०-33004/99 REGD. NO. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

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इस्पात मंत्रालय

अधिसूचना

नई दिल्ली, 29 मई, 2019

सा.का.नि. 385(अ).—घरेलू रूप से उत्पादित किए जाने वाले लौह एवं स्टील उत्पाद की सरकारी खरीद को प्राथमिकता दिए जाने के लिए संशोधित नीति सामान्य सूचना हेतु प्रकाशित की जाती है।

[फा. सं. 3(2)/2018-आईडीडी]

रसिका चौबे, अपर सचिव

सरकारी खरीद में घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पादों को वरीयता देने के लिए नीति - संशोधित, 2019

1. भूमिका

1.1 यह नीति सरकारी खरीद में घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पादों (डी एम आई एंड एस पी) को वरीयता देती है।

1.2 यह नीति यथा लागू निर्धारित गुणवत्ता मानदंडों के अनुपालन में उत्पादित लौह एवं इस्पात उत्पादों जिसे परिशिष्ट क में दिया गया है और परिशिष्ट ख में दिए गए लौह एवं इस्पात उत्पादों के लिए पूंजीगत माल पर लागू होती है।

1.3 यह नीति सरकार के प्रत्येक मंत्रालय अथवा विभाग और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/प्रतिष्ठानों तथा सरकारी परियोजनाओं के वास्ते लौह एवं इस्पात उत्पादों की खरीद के लिए इन एजेंसियों द्वारा वित्त पोषित परियोजनाओं पर लागू है। हालांकि, यह नीति वाणिज्यिक पुन: बिक्री के उद्देश्य से अथवा वाणिज्यिक बिक्री के लिए वस्तुओं के उत्पादन में उपयोग करने के उद्देश्य से लौह एवं इस्पात उत्पादों की खरीद पर लागू नहीं होगी।

2. परिभाषाएं

2.1 **बोली** लगाने वाला लौह एवं इस्पात का कोई घरेलू/विदेशी निर्माता अथवा उनके बिक्री एजेंट/अधिकृत वितरक/अधिकृत डीलर/अधिकृत आपूर्ति गृह अथवा सरकारी एजेंसियों द्वारा वित्त पोषित निधि परियोजनाओं की बोली लगाने में कार्यरत कोई अन्य कंपनी हो सकती है।

2.2 **घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पाद (डी एम आई एंड एस पी)** वे लौह एवं इस्पात उत्पाद हैं जिनका निर्माण उन प्रतिष्ठानों द्वारा किया जाता है जो भारत में पंजीकृत और स्थापित हैं, जिसमें विशेष आर्थिक क्षेत्र (एस ई जैड) शामिल है। इसके अलावा, इस प्रकार के उत्पाद परिशिष्ट क में किये गये उल्लेख के अनुसार घरेलू न्यूनतम मूल्यवर्धन के मानदंडों को पूरा करेंगे।

2.3 **घरेलू निर्माता** खंड 7 में दिशा-निर्देशों और केंद्रीय उत्पाद शुल्क अधिनियम में दी गई 'निर्माता' की परिभाषा के अनुरूप लौह एवं इस्पात उत्पादों का एक निर्माता है।

2.4 इस नीति के प्रयोजन से **सरकार** का तात्पर्य भारत सरकार से है।

2.5 **सरकारी एजेंसियों** में सरकार के सार्वजनिक क्षेत्र के उपक्रम, सरकार द्वारा स्थापित सोसायटी, ट्रस्ट और सांविधिक निकाय शामिल हैं।

2.6 **एम ओ एस** का आशय इस्पात मंत्रालय, भारत सरकार से है।

2.7 **निवल बिक्री कीमत** बीजक कीमत होगी जिसमें निवल घरेलू कर और शुल्क शामिल नहीं होंगे।

2.8 **अर्ध तैयार इस्पात** का तात्पर्य इनगोट्स, बिलेट, ब्लूम और स्लेब्स से है, जिसे बाद में प्रसाधित कर तैयार इस्पात बनाया जा सकता है।

2.9 **तैयार इस्पात** का तात्पर्य सपाट और लंबे उत्पादों से होगा जिन्हें बाद में प्रसाधित कर निर्मित मद बनाया जा सकता हैं।

2.10 **एल1** का तात्पर्य निविदा अथवा अन्य खरीद संबंधी अनुरोध के अनुसार मूल्यांकन प्रक्रिया में यथाघोषित निविदा, बोली लगाने संबंधी प्रक्रिया अथवा अन्य खरीद संबंधी अनुरोधों में प्राप्त निम्नतम निविदा अथवा निम्नतम बोली अथवा निम्नतम भाव से होगा।

2.11 **खरीद वरीयता के मार्जिन** का तात्पर्य उस अधिकतम सीमा से है जिस सीमा तक किसी घरेलू आपूर्तिकर्ता द्वारा लगाई गई कीमत खरीद वरीयता के प्रयोजन से एल1 से अधिक हो। डी एम आई एंड एस पी नीति के मामले में, खरीद वरीयता का मार्जिन परिशिष्ट ख में मदों के लिए 20 प्रतिशत होगा।

2.12 **लौह एवं इस्पात उत्पाद** का तात्पर्य ऐसे लौह एवं इस्पात उत्पादों से होगा जिनका उल्लेख परिशिष्ट क में किया गया है।

2.13 **घरेलू मूल्यवर्धन** निवल बिक्री कीमत (निवल घरेलू करों और शुल्कों को छोड़कर बीजक कीमत) होगी जिससे प्रतिशत में निवल बिक्री कीमत के एक अनुपात के रूप में भारत में निर्माण संयंत्र (सभी सीमा शुल्कों सहित) में आयात की गई इनपुट सामग्री की पहुंच लागत घटाई गई हो, 'घरेलू मूल्यवर्धन' परिभाषा डी पी आई आई टी (पूर्व में डी आई पी पी) के दिशानिर्देशों के अनुरूप होगी और उसमें भविष्य में डी पी आई आई टी द्वारा परिवर्तन किये जाने की स्थिति में उपयुक्त रूप से संशोधन किया जाएगा। इस नीति दस्तावेज के प्रयोजन के लिए घरेलू मूल्यवर्धन और स्थानीय विषय वस्तु का उपयोग एक दूसरे के स्थान पर किया गया है।

3. अपवर्जन

3.1 इस्पात मंत्रालय द्वारा इस प्रकार की सभी सरकारी खरीदों के लिये निम्नलिखित शर्तों के अध्यधीन छूट प्रदान की जाएगी।

3.1.1 जहां विशिष्ट ग्रेडों के इस्पात का निर्माण इस देश में नहीं किया जाता हो, अथवा

3.1.2 जहां परियोजना की मांग के अनुसार इन मात्राओं को घरेलू स्रोतों के माध्यम से पूरा नहीं किया जा सकता हो।

अपवर्जन संबंधी अनुरोधों को घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पादों के उपलब्ध न होने के पर्याप्त प्रमाण के साथ स्थायी समिति को प्रस्तुत किया जाएगा।

4. स्थायी समिति

इस नीति के कार्यान्वयन का पर्यवेक्षण करने के लिए इस्पात मंत्रालय (एम ओ एस) के अधीन एक स्थायी समिति का गठन किया जाएगा। जिसके अध्यक्ष सचिव इस्पात होंगे। इस समिति में उद्योग/उद्योग संघ/सरकारी संस्था अथवा निकाय/इस्पात मंत्रालय (एम ओ एस) से लिए गए विशेषज्ञ होंगे। इस्पात मंत्रालय में उक्त समिति के पास निम्नलिखित के लिए अधिदेश होगा :

4.1 इस नीति के कार्यान्वयन की मॉनीटरिंग करना

4.2 परिशिष्ट क और परिशिष्ट ख में यथा उल्लिखित लौह एवं इस्पात उत्पादों की सूची और घरेलू बिक्री वर्धन की आवश्यकता से संबंधित मानदंडों की समीक्षा करना और उसे अधिसूचित।

4.3 खंड 3 के अनुसार खरीद एजेंसियों को अपवर्जन की स्वीकृति देने सहित इस नीति के कार्यान्वयन के लिए आवश्यक स्पष्टीकरण जारी करना।

4.4 शिकायत निवारण करने के लिए एक अलग समिति का गठन करना।

4.5 स्थायी समिति इस्पात मंत्रालय को अनुमोदन हेतु अपनी सिफारिशें प्रस्तुत करेगी।

5. सरकार द्वारा खरीदे जाने वाले लौह एवं इस्पात उत्पादों को अधिसूचित करना

5.1 निम्नलिखित दिशानिर्देशों का उपयोग इस नीति के अंतर्गत उपरोक्त उत्पादों की पहचान करने और उसे अधिसूचित करने के लिए किया जा सकता है :

5.1.1 यह नीति परिशिष्ट क में दिए गए अनुसार लौह एवं इस्पात उत्पादों और परिशिष्ट ख में लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल पर लागू है।

5.1.2 परिशिष्ट क में लौह एवं इस्पात उत्पादों की सूची दी गई है जिसका निर्माण अनन्य रूप से घरेलू स्तर पर किया जाना है और उसका आयात इस्पात मंत्रालय के अनुमोदन के बिना नहीं किया जा सकता है।

5.1.3 परिशिष्ट ख में पूंजीगत माल की एक सूची (जो विस्तृत नहीं है) दी गई है जिसके लिए खरीद संबंधी वरीयता घरेलू स्तर पर निर्मित पूंजीगत माल को दी जाएगी, यदि उनकी दी गई कीमत सदृश्य आयात किये गये पूंजीगत माल के लिए दी गई कीमत के 20 प्रतिशत के अंदर आती हो।

5.1.4 इस नीति का उद्देश्य सभी लौह एवं इस्पात उत्पादों को अधिसूचित करना है जिसकी खरीद सरकारी एजेंसियों द्वारा सरकारी परियोजनाओं के लिए की जाती है और न कि वाणिज्यिक पुन: बिक्री के उद्देश्य से अथवा वाणिज्यिक बिक्री के लिए उत्पादों के उत्पादन में प्रयोग करने के उद्देश्य से की गई हो।

5.1.5 यह नीति सरकार के मंत्रालय अथवा विभाग के द्वारा निधि प्रदत्त सभी परियोजनाओं और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/प्रतिष्ठानों पर लौह एवं इस्पात उत्पादों की खरीद के लिए लागू है।

5.1.6 यह नीति उन परियोजनाओं पर लागू होगी जहां लौह एवं इस्पात उत्पादों का खरीद मूल्य 25 करोड़ रुपए से अधिक होता हो। यह नीति अन्य खरीद (गैर परियोजना) के लिए भी लागू होगी जहां उस सरकारी संगठन के लिए लौह एवं इस्पात उत्पादों का वार्षिक खरीद मूल्य 25 करोड़ रुपए से अधिक होता हो।

5.1.7 यह नीति सरकार के मंत्रालय अथवा विभाग अथवा उनके सार्वजनिक क्षेत्र के उपक्रमों की किसी अन्य आवश्यकता को पूरा करने के लिए और/अथवा ई पी सी संविदा को पूरा करने के लिए प्राइवेट एजेंसियों द्वारा लौह एवं इस्पातों की खरीद पर लागू है।

5.1.8 घरेलू लौह एवं इस्पात उत्पादों के विभिन्न ग्रेडों की उपलब्धता का विश्लेषण इस नीति के अंतर्गत अधिसूचित करने से पहले करना होगा। केवल उन लौह एवं इस्पात को उत्पादों को जिनके संबंध में कम से कम एक घरेलू निर्माता मौजूद हो, अधिसूचित किया जाएगा। स्थायी समिति से परामर्श किया जा सकता है।

5.1.9 यह नीति यथा लागू निर्धारित गुणवत्ता मानदंडों के अनुपालन में उत्पादित परिशिष्ट ख में दिए गए लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल के लिए लागू है।

5.1.10 लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत मालों की घरेलू खरीद के लिए नीति लौह एवं इस्पात उत्पादों का निर्माण करने के लिए और न कि वाणिज्यिक पुन: बिक्री के उद्देश्य से पूंजीगत मालों की खरीद के वास्ते और सार्वजनिक क्षेत्र के इस्पात विनिर्माताओं और उनके प्रशासनिक नियंत्रणाधीन सभी एजेंसियों/प्रतिष्ठानों पर लागू है।

5.1.11 यह नीति ई पी सी संविदा और/अथवा सार्वजनिक क्षेत्र से इस्पात निर्माताओं और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/प्रतिष्ठानों की किसी अन्य आवश्यकता को पूरा करने के लिए निजी एजेंसियों द्वारा लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल की खरीद पर लागू है।

5.1.12 सरकारी एजेंसियां जो लौह एवं इस्पात उत्पादों के निर्माण के लिए पूंजीगत माल और लौह एवं इस्पात उत्पादों की खरीद में उन स्थितियों में शामिल है जहां लौह एवं इस्पात उत्पादों का उल्लेख परिशिष्ट क और परिशिष्ट ख में नहीं किया गया हो, स्थायी समिति को निर्धारित मानदंडों के साथ इस उत्पाद के विवरण और तकनीकी विनिर्देशन उपलब्ध करायेगा। स्थायी समिति खंड 3 और खंड 4 में अधिदेश के अनुसार कार्य करेगी।

5.2 इस्पात मंत्रालय (एम ओ एस) परिशिष्ट क में दिए गए न्यूनतम निर्धारित घरेलू मूल्यवर्धन के साथ लौह एवं इस्पात उत्पादों को अधिसूचित करेगा।

5.3 लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल के संबंध में नीतिगत दिशानिर्देश, परियोजना के आकार पर विचार किये बिना परिशिष्ट ख में लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल की सभी खरीदों के लिए सार्वजनिक क्षेत्र के इस्पात निर्माताओं पर लागू होंगे।

5.4 परिशिष्ट क में लौह एवं इस्पात उत्पादों के लिए तथा परिशिष्ट ख में लौह एवं इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल के लिए सुझाव दिए गए न्यूनतम घरेलू मूल्यवर्धन आवश्यकता घरेलू आपूर्तिकर्ता का आधार, आपूर्तिकर्ताओं की संख्या और खपत की तुलना में आयात का अनुपात जैसे कारकों के आधार पर तय किया गया है।

5.5 घरेलू मूल्यवर्धन आवश्यकता संबंधी मानदंडों का इस प्रकार से निर्धारण किया जाएगा जिस से कि यह किसी दिए गए समय में लौह एवं इस्पात उत्पादों के लिए घरेलू उद्योग की औसत/औसत से अधिक निर्माण क्षमता दर्शाता हो। स्थायी समिति द्वारा समय समय पर उपयुक्त रूप से इसकी समीक्षा की जाएगी और आवश्यकता पड़ने पर इस्पात मंत्रालय के अनुमोदन से इसमें संशोधन किया जाएगा।

6. सरकार एवं सरकारी एजेंसियों द्वारा खरीद के लिए निविदा प्रक्रिया

6.1 खरीद करने वाली/सरकारी एजेंसियां डी एम आई एंड एस पी का पालन करते समय वित्त मंत्रालय और सी वी सी के अनुदेशों के अनुसार मानक खरीद संबंधी प्रक्रियाओं का पालन करेगी। यह नीति सभी निविदाओं जहां कीमत बोली नहीं खोली गई है, में इसके अधिसूचना की तिथि से लागू होगी।

6.2 दोनों वस्तुओं की खरीद तथा ई पी सी संविदाओं के लिए निविदा दस्तावेज में लौह एवं इस्पात उत्पादों का निर्माण करने के लिए लौह एवं इस्पात उत्पादों तथा पूंजीगत माल (जैसा कि परिशिष्ट क और परिशिष्ट ख में दर्शाया गया है, के लिए बोली लगाने वाले द्वारा न्यूनतम निर्धारित घरेलू मूल्यवर्धन का पालन करने के लिए अर्हता मानदंडों का स्पष्ट उल्लेख होना चाहिए।

6.3 घरेलू उत्पादों के विकास का सहयोग करने में, लौह एवं इस्पात व्यापार क्रियाकलापों में घरेलू मूल्यवर्धन का लक्ष्य निर्धारित किया गया है जिसे **परिशिष्ट क और परिशिष्ट ख** में दिया गया है।

6.4 परिशिष्ट क में लौह और इस्पात उत्पादों के खरीद की प्रक्रिया केवल उन निर्माताओं/आपूर्तिकर्ताओं के लिए ही खुली रहेगी जिसमें घरेलू मूल्यवर्धन लक्ष्यों को पूरा करने/उससे ज्यादा पूरा करने की क्षमता हो। घरेलू मूल्यवर्धन लक्ष्यों को पूरा न करने वाले निर्माता/आपूर्तिकर्ता बोली लगाने में भाग लेने के लिए पात्र नहीं हैं।

6.5 परिशिष्ट ख में दी गई मदों के मामलों में, यदि खरीद करने वाली कंपनी की राय में, निविदाओं (खरीदी गई मात्रा) को 50:50 के निर्धारित अनुपात में नहीं बांटा जा सकता है, तब उनके पास मात्रा जो 50 प्रतिशत से कम नहीं हो, जो कि विभाज्य हो, के लिए पात्र घरेलू निर्माता को संविदा देने का अधिकार होगा।

6.6 उपर्युक्त शर्त को जारी रखते हुए, परिशिष्ट ख की मदों के लिए, यदि निविदा दी गई मद विभाज्य न हो (खरीद करने वाली कंपनी द्वारा निविदा दस्तावेज में शामिल किए जाने के लिए) यह संविदा समग्र मात्रा के लिए पात्र घरेलू निर्माता को दी जा सकती है।

6.7 परिशिष्ट ख के मदों के मामलों में, यदि घरेलू मूल्यवर्धन की आवश्यकताओं को पूरा करने वाले पात्र निर्माताओं में से कोई भी एल1 की बोली के अनुरूप न हो, तब एल1 की बोली धारण करने वाले मूल बोली लगाने वाला खरीद के पूर्ण मूल्य के लिए आदेश प्राप्त करेंगे।

6.8 वे बोली लगाने वाले जो लौह एवं इस्पात उत्पादों के घरेलू निर्माताओं के बिक्री एजेंट/अधिकृत वितरक/अधिकृत डीलर/अधिकृत आपूर्ति गृह हैं इस नीति के अंतर्गत घरेलू निर्माताओं की ओर से बोली लगाने के लिए पात्र हैं। हालांकि, यह निम्नलिखित शर्तों के अध्यधीन होगा।

6.8.1 बोली लगाने वाले घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पादों की बिक्री करने के लिए घरेलू निर्माता द्वारा जारी किए गए अधिकार प्रमाण पत्र प्रस्तुत करेगा।

6.8.2 यदि खरीद को डी एम आई एंड एस पी नीति के परिशिष्ट क के अंतर्गत शामिल किया गया हो तब बोली लगाने वाला यह घोषणा करते हुए खरीद करने वाली एजेंसी को घरेलू निर्माता द्वारा जारी किया गया स्व-प्रमाणन का शपथ पत्र प्रस्तुत करेगा कि लौह और इस्पात उत्पादों का घरेलू स्तर पर निर्माण निर्धारित घरेलू मूल्यवर्धन के मामले में किया जाता है।

6.8.3 यदि खरीद को डी एम आई एंड एस पी नीति के परिशिष्ट ख के अंतर्गत शामिल किया गया हो तब बोली लगाने वाला यह घोषणा करते हुए घरेलू निर्माता को सांविधिक लेखा परीक्षक द्वारा जारी किया गया प्रमाणन प्रस्तुत करेगा कि लौह और इस्पात उद्योग में उपयोग किये जाने वाले पूंजीगत माल का घरेलू स्तर पर निर्माण निर्धारित घरेलू मूल्यवर्धन के मामले में किया जाता है।

6.8.4 बोली लगाने वाले की यह जिम्मेदारी होगी कि वह इस नीति के अनुसार खरीद करने वाली एजेंसी को घरेलू निर्माता द्वारा जारी किये जाने के लिए अपेक्षित अन्य आवश्यक दस्तावेज प्रस्तुत करे।

7. घरेलू मूल्यवर्धन आवश्यकता

7.1 घरेलू रूप में निर्मित लौह और इस्पात उत्पाद अथवा पूंजीगत माल के रूप में उत्पाद के रूप में पात्र होने के लिए न्यूनतम घरेलू मूल्यवर्धन आवश्यकता का उल्लेख परिशिष्ट क और परिशिष्ट ख में किया गया है।

7.2 घरेलू मूल्यवर्धन निवल बिक्री कीमत (निवल घरेलू करों और शुल्कों को छोड़कर बीजक कीमत) होगी जिसमें से प्रतिशत में निवल बिक्री कीमत के एक अनुपात के रूप में भारत में निर्माण करने वाले संयंत्र में आयात की गई इनपुट सामग्री की पहुंच लागत (सभी सीमा शुल्कों को शामिल करते हुए) घटाई जाएगी।

7.2.1 यदि लौह और इस्पात उत्पादों को घरेलू इनपुट इस्पात (अर्ध तैयार/तैयार इस्पात) का उपयोग करके निर्माण किया जाता हो, तब खरीदी गई मात्रा और अन्य संबंधित दस्तावेजों के साथ वास्तविक घरेलू उत्पादों से खरीद का बीजक खरीद करने वाली सरकारी एजेंसी को अवश्य प्रस्तुत किया जाना चाहिए।

7.2.2 यदि लौह एवं इस्पात उत्पादों ने इनपुट इस्पात का आयात किया हो तब खरीदी गई मात्रा और अन्य संबंधित दस्तावेजों के साथ वास्तविक उत्पादकों से खरीदों के बीजकों को अलग से प्रस्तुत किया जाना चाहिए। घरेलू मूल्यवर्धन की सीमा निकालने के लिए, दोनों इनपुट इस्पातों (आयात किये और घरेलू) की भारित औसत पर विचार यह सुनिश्चित करने के लिए किया जाएगा कि इस नीति की न्यूनतम निर्धारित घरेलू मूल्यवर्धन आवश्यकता का पालन किया गया है।

7.3 यह सिफारिश की जाती है कि निविदा की प्रक्रिया में भाग लेने वाले प्रत्येक बोली लगाने वाले को नीचे दिए गए सूत्र का उपयोग करते हुए घरेलू मूल्यवर्धन की गणना करनी चाहिए ताकि यह सुनिश्चित किया जा सके कि दावा किये गये घरेलू मूल्यवर्धन इस नीति के न्यूनतम निर्धारित घरेलू मूल्यवर्धन के अनुरूप है।

लौह एवं इस्पात उत्पादों के लिए

% घरेलू मूल्यवर्धन

$$= \frac{\text{अंतिम उत्पाद की निवल बिक्री कीमत} - \text{संयंत्र में आयात किये गये लौह अथवा इस्पात की पहुंच लागत}}{\text{अंतिम उत्पाद की निवल बिक्री कीमत}} \times 100\%$$

पूंजीगत माल के लिए

% घरेलू मूल्यवर्धन

$$= \frac{\text{अंतिम उत्पाद की निवल बिक्री कीमत} - \text{संयंत्र में आयात किये गये इनपुट सामग्री की पहुंच लागत}}{\text{अंतिम उत्पाद की निवल बिक्री कीमत}} \times 100\%$$

8. प्रमाणन और लेखा परीक्षण

8.1 परिशिष्ट क में दिए गए उत्पादों के लिए, प्रत्येक घरेलू निर्माता यह घोषणा करते हुए खरीद करने वाली सरकारी एजेंसी को स्व-प्रमाणन का शपथ पत्र प्रस्तुत करेगा कि लौह एवं इस्पात उत्पाद का निर्धारित घरेलू मूल्यवर्धन के संबंध में घरेलू स्तर पर निर्माण किया गया है। परिशिष्ट ख के पूंजीगत माल के लिए, बोली लगाने वाला यह घोषणा करते हुए घरेलू निर्माता को सांविधिक लेखा परीक्षक द्वारा जारी किया गया प्रमाणन प्रस्तुत करेगा कि पूंजीगत माल का निर्माण घरेलू स्तर पर निर्धारित घरेलू मूल्यवर्धन के संबंध में किया गया है। वे बोली लगाने वाले जो लौह एवं इस्पात उत्पादों के घरेलू निर्माताओं का एकमात्र बिक्री एजेंट/अधिकृत वितरक/अधिकृत डीलर/अधिकृत आपूर्ति गृह हैं, ई पी सी के अंतर्गत घरेलू निर्माताओं की ओर से बोली लगाने के लिए पात्र हैं।

बोली लगाने वाला घरेलू निर्माताओं के द्वारा जारी किए गए स्व-प्रमाणन और सांविधिक लेखा परीक्षकों द्वारा जारी किये गये प्रमाणनों को यह घोषणा करते हुए खरीद करने वाली एजेंसी को प्रस्तुत करेगा कि लौह एवं इस्पात उत्पादों का घरेलू स्तर पर निर्माण निर्धारित घरेलू मूल्यवर्धन के संबंध में किया गया है। स्व प्रमाणन का शपथ पत्र इन दिशानिर्देशों से संलग्न **प्रपत्र 1** में प्रस्तुत किया जाएगा।

8.2 घरेलू निर्माता की यह जिम्मेदारी होगी कि वह यह सुनिश्चित करे कि इस प्रकार से दावा किये गये उत्पादों का घरेलू स्तर पर उस उत्पाद के लिए निर्धारित घरेलू मूल्यवर्धन के संबंध में किया गया है। बोली लगाने वाले से यह भी अपेक्षित होगा कि वह घरेलू निर्माता के सांविधिक लेखा परीक्षकों द्वारा विधिवत प्रमाणित अर्धवार्षिक (सितंबर 30 और मार्च 31) आधार पर घरेलू मूल्यवर्धन प्रमाणपत्र उपलब्ध कराये कि पहले 6 महीनों के दौरान इस उत्पाद के लिए किये गये घरेलू मूल्यवर्धन के दावे इस नीति के अनुसार हैं। इस प्रकार के प्रमाण पत्र को संबंधित सरकारी एजेंसियों को प्रत्येक छमाही के शुरू होने के 60 दिनों के भीतर प्रस्तुत किया जाएगा और उस उत्पादों की आपूर्ति को पूरा करने तक प्रस्तुत करता रहेगा।

8.3 खरीद करने वाली एजेंसी बोली लगाने वाले द्वारा प्रस्तुत किये गये इस्पात उत्पाद में घरेलू मूल्यवर्धन के संबंध में स्व-प्रमाणन का शपथ पत्र स्वीकार करेगा। सामान्य तौर पर खरीद करने वाली एजेंसी की यह जिम्मेदारी होगी कि वह इस दावे की सत्यतता की जांच करे। इसकी सत्यतता प्रदर्शित करने की जिम्मेदारी बोली लगाने वाले की होगी जब उसे ऐसा करने के लिए कहा जाए।

8.4 यदि खरीद करने वाली एजेंसी अथवा संबंधित सरकारी एजेंसी द्वारा लौह एवं इस्पात उत्पादों में घरेलू मूल्यवर्धन के संबंध में बोली लगाने वाले के दावे के विरुद्ध कोई शिकायत प्राप्त होती है तब खरीद करने वाली एजेंसी के पास सभी संबंधित दस्तावेजों का निरीक्षण करने और उसकी जांच करने तथा निर्णय लेने का पूर्ण अधिकार होगा। यदि कोई स्पष्टीकरण की आवश्यकता होती है तब मामले को तकनीकी सहायता के लिए अनुरोध के साथ इस्पात मंत्रालय को भेजा जा सकता है।

8.5 सरकारी एजेंसी को भेजे गए किसी शिकायत का निपटारा सभी आवश्यक दस्तावेजों को प्रस्तुत करने के साथ इसे भेजे जाने के 4 सप्ताह के भीतर किया जाएगा। बोली लगाने वाले से यह अपेक्षित होगा कि वह शिकायत दायर करने के 2 सप्ताह के भीतर सरकारी एजेंसी को लौह एवं इस्पात उत्पादों में दावा किये गये घरेलू मूल्यवर्धन के समर्थन में आवश्यक दस्तावेज प्रस्तुत करे।

8.6 यदि इस मामले को इस्पात मंत्रालय के पास भेजा जाता है तब इस्पात मंत्रालय के अधीन गठित शिकायत निवारण समिति सरकारी एजेंसी के दृष्टिकोण पर विचार करने के बाद बोली लगाने वाले से सभी दस्तावेजों के प्राप्त होने और उसका संदर्भ भेजे जाने के 4 सप्ताह के भीतर शिकायत का निपटारा करेगी। बोली लगाने वाले से यह अपेक्षित होगा कि वे इस मामले के संदर्भ के 2 सप्ताह के भीतर इस्पात मंत्रालय के अंतर्गत शिकायत निवारण समिति को लौह एवं इस्पात उत्पादों में दावा किए गए घरेलू मूल्यवर्धन के समर्थन में आवश्यक दस्तावेज प्रस्तुत करे। यदि बोली लगाने वाले द्वारा कोई सूचना प्रस्तुत नहीं की जाती है तब शिकायत निवारण समिति दावे की प्रमाणिकता अधिक करने के लिए सरकारी एजेंसी के परामर्श से आगे आवश्यक कार्रवाई कर सकती है।

8.7 घरेलू मूल्यवर्धन की निर्धारित सीमा का आकलन करने की लागत का वहन खरीद करने वाली एजेंसी द्वारा किया जाएगा यदि घरेलू मूल्यवर्धन प्रमाण पत्र के अनुसार सही पाया गया हो। हालांकि, यदि ऐसा पाया गया हो कि दावा किए गए अनुसार घरेलू मूल्यवर्धन सही नहीं है तब आकलन की लागत बोली लगाने वाले द्वारा भुगतान के योग्य होगी जिन्होंने एक गलत प्रमाण पत्र प्रस्तुत किया है। इसे लागू करने के तरीके को निविदा दस्तावेज में परिभाषित किया जाएगा।

9. प्रतिबंध

9.1 प्रत्येक सरकारी एजेंसी निविदा दस्तावेज में निर्धारित घरेलू मूल्यवर्धन का बोली लगाने वाले के द्वारा गलत घोषणा किए जाने की स्थिति में दण्ड को स्पष्ट रूप से परिभाषित करेगा। इस दण्ड में ऐसे निर्माता/सेवा प्रदाता की ई एम डी को जब्त करना, अन्य वित्तीय दंड लगाना और उसे काली सूची में डालना शामिल हो सकता है।

9.2 संबंधित बोली लगाने वाले के द्वारा इस्पात मंत्रालय को किसी प्रकार की शिकायत भेजे जाने की स्थिति में, 10 लाख रुपए अथवा खरीदी जा रही डी एम आई एंड एस पी के मूल्य का 0.2 प्रतिशत (अधिकतम 20 लाख के अध्यधीन) इसमें से जो भी अधिक हो, का शिकायत शुल्क होगा जिसका भुगतान शिकायतकर्ता द्वारा शिकायत के साथ इस्पात मंत्रालय के अधीन शिकायत निवारण समिति के पास जमा किए गए डिमाण्ड ड्राफ्ट के द्वारा किया जाएगा। यदि, शिकायत को सही नहीं पाया जाता है तब सरकारी एजेंसी के पास उक्त राशि को जब्त करने का अधिकार सुरक्षित है। यदि शिकायत पर्याप्त रूप से सही पाई जाती है तब शिकायतकर्ता द्वारा जमा किए गए शुल्क को बिना किसी ब्याज के वापिस किया जाएगा।

10. इस्पात मंत्रालय द्वारा कार्यान्वयन की मॉनीटरिंग

10.1 इस नीति के प्रावधान प्रकाशन की तिथि से 5 वर्षों की अवधि के लिए लागू रहेंगे। इस नीति की अवधि को इस्पात मंत्रालय के विवेक से और आगे बढ़ाया जा सकता है।

10.2 इस्पात मंत्रालय इस नीति के कार्यान्वयन की मानीटरिंग करने के लिए नोडल मंत्रालय होगा।

10.3 डी एम आई एंड एस पी नीति के अंतर्गत सभी लागू एजेंसियां इस नीति का कार्यान्वयन सुनिश्चित करेंगी और वार्षिक रूप से जून के महीने में एक घोषणा भेजेंगी जिसमें इस नीति के अनुपालन की सीमा और पिछले वित्तीय वर्ष के दौरान उसके अनुपालन न किए जाने के कारणों को दर्शाया जाएगा।

इस्पात मंत्रालय को संदर्भ

किसी ऐसे प्रश्न की स्थिति में कि क्या खरीदी जा रही मद इस नीति के अंतर्गत शामिल किए जाने वाले डी एम आई एंड एस पी है, इस मामले को स्पष्टीकरण के लिए इस्पात मंत्रालय के पास भेजा जाएगा।

परिशिष्ट क – घरेलू स्तर पर निर्मित उत्पादों के लिए अनन्य

क्र. सं.	लौह एवं इस्पात उत्पादों की सांकेतिक सूची	लागू एच एस कोड	न्यूनतम घरेलू मूल्यवर्धन आवश्यकता
1	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, हॉट रोल्ड, न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7208	50%
2	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, कोल्ड रोल्ड (कोल्ड - कम किया हुआ), न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7209	50%
3	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7210	50%
4	600 मि. मी. से कम की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7211	35%
5	600 मि. मी. कम की चौड़ाई का लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, ढका हुआ, प्लेट लगाया हुआ अथवा कोड किया हुआ	7212	35%
6	लौह एवं गैर एलॉय इस्पात का अनियमित रूप से ऐंठा हुआ क्वाइल में बार्स और रॉड, हॉट रोल्ड	7213	35%
7	लौह अथवा गैर एलॉय इस्पात के अन्य बार्स और रॉड्स जिसे फोर्ज किए जाने की तुलना में आगे अधिक वर्क नहीं किया हुआ, हॉट रोल्ड, हॉट ड्रॉन अथवा हॉट एक्सट्रूडेड परंतु रोलिंग के बाद उसे टिविस्ट किये जाने सहित	7214	35%
8	लौह अथवा गैर एलॉय इस्पात का अन्य बार्स एंड रोड्स	7215	35%
9	लौह अथवा गैर एलॉय इस्पात का एंगल, शेप और सेक्शन्स	7216	35%
10	लौह अथवा गैर एलॉय इस्पात का तार	7217	50%
11	600 मि. मी. अथवा उससे अधिक की चौड़ाई का स्टेनलैस इस्पात का फ्लेट रोल्ड इस्पात	7219	50%
12	600 मि. मी. से कम की चौड़ाई का स्टेनलैस इस्पात का फ्लेट रोल्ड इस्पात	7220	50%
13	स्टेनलैस स्टील का अन्य बार्स और रोड्स; स्टेनलैस स्टील का एंगल शेप और सेक्शन्स	7222	50%
14	अन्य एलॉय इस्पात का तार	7229	35%
15	लौह अथवा इस्पात को रेल, रेलवे अथवा ट्रामवे ट्रेक निर्माण सामग्री	7302	50%

16	कास्ट लौह का ट्यूब, पाइप और होलो पाइप	7303	35%
17	लौह (कास्ट आयरन को छोड़कर) अथवा इस्पात का ट्यूब पाइप और होलो प्रोफाइल, सीमलैस	7304	35%
18	लौह अथवा इस्पात का सर्कुलर क्रॉस सेक्शन वाले अन्य ट्यूब और पाइप (उदाहरण के लिए, वेल्ड किया हुआ, रिवेट किया हुआ अथवा समान रूप से बंद किया गया हुआ), जिसकी बाहरी त्रिज्या 406.4 मि. मी. से अधिक हो	7305	35%
19	लौह अथवा इस्पात के अन्य ट्यूब, पाइप और होलो प्रोफाइल (उदाहरण के लिए ओपन सीन अथवा वेल्ड किया हुआ, रिवेट किया हुआ अथवा समान रूप से बंद किया गया हुआ)	7306	35%
20	लौह अथवा इस्पात का ट्यूब अथवा पाइप फिटिंग (उदाहरण के लिए, कनेक्टर/कप्लिंग, एल्बो स्लीव्स)	7307	35%
21	स्टेनलैस स्टील का अनियमित रूप से ऐंठा हुआ कुंडलों में बार्स और रॉड, हॉट रोल्ड	7221	35%
22	स्टेनलैस स्टील का वायर	7223	35%
23	इलेक्ट्रिकल स्टील सहित 600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले अन्य एलॉय स्टील का फ्लेट रोल्ड इस्पात	7225	35%
24	इलेक्ट्रिकल स्टील सहित 600 मि. मी. से कम की चौड़ाई वाले अन्य एलॉय स्टील का फ्लेट रोल्ड इस्पात	7226	35%
25	अन्य एलॉय स्टील का अनियमित रूप से ऐंठा हुआ क्वाइल में बार्स और रोड, हॉट रोल्ड	7227	15%
26	अन्य एलॉय स्टील का अन्य बार्स और रोड्स; अन्य एलॉय स्टील का एंगल, शेप्स और सेक्शन्स; एलॉय अथवा नॉन एलॉय स्टील का होलो ड्रील बार्स और रोड्स	7228	35%
27	लौह अथवा इस्पात की शीट पाइलिंग, चाहे ड्रील किया हुआ हो अथवा नहीं, चाहे पंच किया हुआ हो अथवा नहीं, चाहे असेम्बल किये हुए तत्वों से बना हुआ हो अथवा नहीं; लौह अथवा इस्पात का वेल्ड किया हुआ एंगल, शेप और सेक्शन्स	7301	15%
28	स्ट्रक्चर्स (9406 के शीर्ष का प्रीफेबरिकेटिड भवनों को छोड़कर) और स्ट्रक्चर्स का हिस्सा	7308	15%
29	300 लीटर से अधिक क्षमता का लौह अथवा इस्पात का किसी सामग्री (कम्प्रेस किए हुए अथवा सरलीकृत गैस को छोड़कर) के लिए भंडार, टैंक, वैट और समान कन्टेनर चाहे उसे लाइन किया गया हो अथवा नहीं या उसे हीट से इन्सुलेट किया गया हो अथवा नहीं लेकिन यांत्रिक अथवा तापीय उपक्रम से युक्त न हो	7309	15%
30	अधिकतम 300 लीटर की क्षमता का लौह अथवा इस्पात का किसी सामग्री (कम्प्रेस किए हुए अथवा सरलीकृत गैस को छोड़कर) के लिए टैंक, कास्ट, ड्रम, केन, बॉक्स और समान कन्टेनर चाहे उसे लाइन किया गया हो अथवा नहीं या उसे हीट से इन्सुलेट किया गया हो अथवा नहीं लेकिन यांत्रिक अथवा तापीय उपक्रम से युक्त न हो	7310	15%
31	लौह अथवा इस्पात का कम्प्रेस किया हुआ अथवा सरलीकृत गैस के लिए कन्टेनर	7311	15%
32	लौह अथवा इस्पात का स्टेंडिड वायर, रोप, केबल, प्लेटिड बैंड, स्लिंग और उसके समान वस्तु जिसे विद्युतीय रूप से इन्सुलेट न किया गया	7312	15%
33	लौह अथवा इस्पात का फेनसिंग के लिए उपयोग किये जाने वाला बार किया हुआ वायर; ट्विस्ट किया हुआ हूप अथवा सिंगल फ्लेट वायर, बार्स किया हुआ अथवा नहीं और लूज तरीके से ट्विस्ट किया हुआ डबल वायर	7313	15%
34	लौह अथवा इस्पात तार का ड्रील, नेटिंग और फेनसिंग; लौह अथवा इस्पात का विस्तार किया हुआ धातु	7314	15%

35	लौह अथवा इस्पात का चैन और उसका हिस्सा	7315	15%
36	लौह अथवा इस्पात का टैंकर, ग्रेपनेल्स और उसका हिस्सा	7316	15%
37	लौह एवं इस्पात की वस्तुएं	7317	15%
38	लौह एवं इस्पात की वस्तुएं	7318	15%
39	लौह एवं इस्पात की वस्तुएं	7319	15%
40	लौह अथवा इस्पात का स्प्रिंग और स्प्रिंग के लिए लीव्स	7320	15%
41	लौह अथवा इस्पात का स्टोव्स, रेंज, ग्रेड, कूकर (केंद्रीय हिटिंग के लिए सहायक बायलरों के साथ उन वस्तुओं सहित), बारबेक्यूज, ब्रेजियर्स, गैस रिंग, प्लेट वामर्स और समान गैर-विद्युतीय घरेलू उपकरण और उसका हिस्सा	7321	15%
42	लौह अथवा इस्पात का केंद्रीय हिटिंग के लिए रेडियेटर जिसे विद्युतीय रूप से हीट न किया गया हो और उसका हिस्सा; लौह अथवा इस्पात का हेयर हीटर और हॉट एयर वितरक जिसे विद्युतीय रूप से हीट न किया गया हो, फेन अथवा ब्लोअर जो मोटर से चलती हो और उसके हिस्से को शामिल करते हुए	7322	15%
43	लौह अथवा इस्पात का टेबल और समान घरेलू वस्तुएं और उसका हिस्सा	7323	15%
44	लौह अथवा इस्पात का सेनेटरी वेयर और उसको पार्ट्स	7324	15%
45	लौह अथवा इस्पात का अन्य कास्ट सामान	7325	15%
46	लौह अथवा इस्पात का विद्युतीय इस्पात और अन्य वस्तु	7326	15%
47	रेलवे अथवा ट्रामवे पेसेंजर कोच जो स्वयं आगे नहीं बढ़ता हो	8605	50%
48	रेलवे अथवा ट्रामवे माल वेन और वेगेन जो स्वयं आगे नहीं बढ़ता हो	8606	50%
49	रेलवे अथवा ट्रामवे लोकोमोटिव का हिस्सा अथवा रोलिंग स्टॉक जैसे बोगिज, बिसल बोगिज, एक्सेल और फोज्ड किया हुआ पहिया और उसका हिस्सा	8607	50%

विवरणों में शामिल किए गए उत्पाद सांकेतिक हैं, विनिर्दिष्ट एच एस कोड के अंतर्गत सभी उत्पादों को परिशिष्ट के भाग के रूप में शामिल किया गया है।

परिशिष्ट ख

लौह और इस्पात उत्पादों का निर्माण करने के लिए पूंजीगत माल की सांकेतिक सूची (जो विस्तृत नहीं है)

क्र. सं.	संयंत्र शॉप	पूंजीगत माल	न्यूनतम घरेलू मूल्यवर्धन आवश्यकता
1	कच्चा माल संभाल प्रणाली	चूर्ण की हुई सामग्री के लिए एप्रोन फीडर, बेरल कप्लिंग, हैवी ड्यूटी बियेरिंग, हाइड्रोलिक डिस्क ब्रेक्स, टेंकर एंड कंटेनर, पाइप कंवेयर के लिए कंवेयर बेल्ट, हाई एंगल कंवेयर प्रणाली, क्रशर्स, क्रेन रेल लुब्रिकेशन, चार गरडर ग्राइडर ई ओ टी क्रेन, क्रेन वेइंग प्रणाली, क्रेन ऐयर कंडीशनिंग, फ्यूड कप्लिंग, 4 लिफ्ट ट्रक्स, हाइड्रोलिक मोटर्स, हाइड्रोलिक सिस्टम, लॉकिंग एसेम्बली (फ्रिक्शन ग्रिप), लोड सेल्स, लेवल सेन्र्सस, पाइप कंवेयर प्रणाली, प्लग/पाडेल फीडर, न्यूमेटिक हुलाई – घना एवं लिन फेस, रिक्लेमर्स, रेडियो रिमोट कंट्रोल, रेल फिक्सिंग व्यवस्था (विशेष), रेपिड/फ्लेड लोडिंग प्रणाली, स्टेकर्स, स्पेशल स्क्रीन, स्लिव रिंग बियरिंग, ट्रिप्पलर्स, ट्रांसफर कार, टॉग्स (स्पेशल), वाइब्रेशन, आइसोलेशन प्रणाली (स्परिंग डम्पर) वेगन टिप्पलर्स, वेगन लोडर	50%
2	मिनिरल बेनिफेक्शन (लौह अयस्क और कोयला) उपकरण	इंडस्ट्रीयल क्रशर्स, ग्राइनडिंग मिल, परम्परागत स्क्रीन, स्लूरी पम्पस, हिरेंट थिकनर्स, फिल्टर्स, हाइड्रोक्लोन्स	50%

3	कॉक अवेन	कोक ओवन सिलिका रिफेक्टरी, एन्करेज सिस्टम, ब्रस्च नरडन के साथ वेस्ट गैस वाल, फ्लेस प्लेट, डोर फ्रेम, डोर बॉडी, माइनर कास्टिंग: गुजनेक, वाल बॉक्स, ए पी लिड, चार्जिंग और इंस्पेक्शन होल लिड एंड फ्रेम रिवर्सिंग मेकेनिजम, केंद्रीकृत लूब्रिकेशन प्रणाली हाइड्रोजेट डोर क्लीनिंग तंत्र, कोड कंवेयर सिस्टम, स्किप होइस्ट, डोर लोवरिंग रैक, आइसोलेशन/रिवर्सिंग कॉक्स, II ऑटोमेशन, अवेन मशीन	50%
4	उप-उत्पाद संयंत्र	प्राथमिक गैस कूलर, इलेक्ट्रोस्टेटिक तार प्रेसिपिटेटर, H2S, NH3 और नप्थलिन स्कूबबर, कोम्बी स्ट्रीप्पर, फ्लेशिंग लिकर पम्प, क्लास किन, क्लाक रियेक्टर, वेस्ट हीट बायलर, डिकेंटर्स	50%
5	सिंटर संयंत्र उपकरण	पेलेट कार, ड्राइव/डिस्चार्ज इंड स्प्रोकेट ऐसेम्बली कब्ड रेल, स्लाइड रेल, हॉट सिटर ब्रेकर और ग्रिजली, डिप रेल एंड रनिंग रेल, प्रोसेस फेन के लिए इम्पेलर एसेम्बली, सिन्टर मशीन का ड्राइव एसेम्बली, उच्च तीव्रता वाला मिक्सर और नोडूलाइजर	50%
6	पेलेट संयंत्र उपकरण	पेलेट कार, ड्राइव/डिस्चार्ज इंड स्प्रोकेट ऐसेम्बली कब्ड रेल, स्लाइड रेल, रनिंग रेल वरटिकल रोलर मिल, प्रोसेस फेन के लिए इम्पेलर एसेम्बली, इनडूरेटिंग मशीन का ड्राइव एसेम्बली, उच्च तीव्रता वाला मिक्सर, बालिंग डिक्स, सिंगल डेक्स रोलर स्क्रीन एंड डबल डेक्स रोलर स्क्रीन	50%
7	ब्लास्ट फरनेस उपकरण	ब्लेडर वाल के साथ बेल रहित टॉप प्रणाली, एस जी आयरन स्टेव कूलर, कोपर स्टेव कूलर, स्टॉक लेवल इंडिकेटर (रडार टाइप), मड गन, ड्रिलिंग मशीन एंड मेनिपुलेटर, गैस क्लिलिंग प्लांट प्रणाली, इसके बाइस-पास वाल सहित टॉप रिकवरी ट्रबाइन सिस्टम, डि-ब्रिकिंग मशीन, रि-रेलिंग उपकरण, पी सी आई प्रणाली, पी सी आई के लिए ग्राइनडिंग मिल, स्टॉक लेवल इंडिकेटर, टूयेरे स्टाक एसेम्बली, वेस्ट हीट रिकवरी प्रणाली, बी एफ एवं हॉट ब्लास्ट स्टोव प्रौद्योगिकीय वाल, एब्व ब्रर्डन प्रोब्स, स्लग ग्रेन्यूलेशन यूनिट, टूयेरे एंड टूयेरे कूलर, टोरपेडो लेडल कार, बी एफ हरथ रिफेक्ट्री	50%
8	डायरेक्ट रिडक्शन प्लांट उपकरण	चार्ज डिस्ट्रीब्यूटर, अपर एंड लोअर सील लेग, रिफोमर एंड रि-क्यूरेटर सिस्टम, बर्डन फिडर्स, ट्रबो-एक्सपेंडर, प्रोसेस गैस कम्प्रेशर, सील गैस कम्प्रेशर एवं बोटम सील गैस कम्प्रेशर, सील गैस जेनरेटर एवं डायर्स, प्रोसेस गैस हीटर, CO2 रिमूवल प्लांट	50%
9	बेसिक ऑक्सीजन फर्नेस उपकरण	मुख्य और अनुरक्षण उपकरण जिसमें कंवेटर, गनिंग मशीन, रिफेक्ट्री/स्लग मॉनीटरिंग उपकरण, कंवेटर वेसेल, ट्रनिअन रिंग एंड सस्पेशन प्रणाली, ट्रनिअन बियरिंग और हाउसिंग, कंवेटर बुल गियर यूनिट और टिल्ट ड्राइव सिस्टम, कंवेटर के रोटेरी ज्वाइंट, बोटम स्ट्रिंग सिस्टम, क्लपिंग के साथ लांस बाडी, लांस कोपर टिप्स, ऑक्सीजन ब्लोविंग/बोटम स्टीरिंग के लिए वाल स्टेशन, सब-लान सिस्टम, प्रोसेस मॉड्यूल अर्थात प्रोसेस साफ्टवेयर/हार्डवेयर के साथ ऑफ गैस एनेलाइजर, कंटेनर लैब मेजरमेंट प्रोब, स्विच ओवर स्टेशन, प्राइमरी गैस के लिए आई डी फेन, होट मेटल और स्टील लेडल, लेडल ट्रांसफर कार, लेडल अनुरक्षण उपकरण, सूलेग पोट, स्लग पोट ट्रांसफर कार, स्क्रेप बॉक्स क्रेप ट्रांसफर कार, लांस करेज, लांस गाइड, क्रेन एंड हाइस्ट, लांस होइस्ट एंड ट्राली, लांस टिल्टिंग उपकरण, लांस को लिफ्ट करने के लिए ट्रेवस, विभिन्न आकर के बंकर, बिन बाइब्रेटर, वेइंग हूपर, अनुरक्षण स्टेण्ड, डी डस्टिंग सक्शन हूड, टीमिंग/एच एम, लेडल रिलाइनिंग स्टेंड, स्टेंड कूलिंग स्टेक इंस्पेक्शन उपकरण, हूड ट्रेवर्स केरेज, रिफेक्ट्री, बाइपास एवं आइसोलेशन वाल्व, फ्लेयर स्टेक एवं इगनिगेशन सिस्टम, स्क्रबिंग टोवर सेल – वेट गैस क्लीनिंग सिस्टम, डॉग हाउस लेडल ड्रायर, लेडल	50%

		प्री-हीटर, लेडल कूलर, फ्यूम कॉलेक्शन हूड्स, क्लीन गैस स्टेक, डस्ट सिलो, बेग ब्रिज, स्लग रिटेनिंग उपकरण	
10	इलेक्ट्रिक आर्क फर्नेस	फर्नेस प्रोपर (जिसमें फ्रनेस लोवर सेल, अपर सेल और रूफ, टिलटिंग प्लेटफार्म, फ्रनेस गेन्ट्री शामिल है) और ट्रांसफार्मर, इलेक्ट्रोल रेगूलेशन प्रणाली, , हाइड्रोलिक सिस्टम, रिफेक्ट्री, लेवल I एंड II आटोमेशन सिस्टम के पार्टस। एल एफ – वाटर कूल्ड लेडल रूफ, इलेक्ट्रोड मास्ट एंड आमर्स, इलेक्ट्रोड रेगूलेटिंग सिस्टम, बायर फिडिंग सिस्टम, बोटम इनइरट गैस स्टिरिंग वाल सिस्टम पोरूस प्लग और टॉप लांस के लिए, इमरजेंसी लांसतंत्र, ड्राइव यूनिट के साथ लांस केरेजि सिस्टम, स्वचालित तापक्रम, सेम्पिलिंग और बाथ लेबल/ओ2 मेजरमेंट, तापक्रम और आक्सीजन इम्मजन लांस, ड्राइव यूनिट के साथ लांस केरेज सिस्टम, हाइड्रोलिक सिस्टम, रिफैक्ट्री, लेडल रूफ डेल्टा पोरशन, आर एच प्रोपर (जिसमें लेडल ट्रांसफर कार, वेक्यूम वेसेल, वेसेल लिफिटिंग और लोवरिंग सिस्टम शामिल है, हाइड्रोलिंग सिस्टम, मल्टी फंक्शन लांस, वाल्व रेक्स/स्टेशन, इलेक्ट्रोड क्लेप यूनिट, इलेक्ट्रोड आमर्स का कंडक्टर, वाटर कूल्ड केबल, ए आर स्टेरिंग वाल्व रेक, लांस ट्रांसपोर्ट कार, रिफेक्ट्री लांस, हाइड्रोलिक सिलेंडर, लेडल रूफ लिफटिंग सिलेंडर, लूब्रिकेशन प्रणाली, सक्शन हूड, डम्पर, वाइब्रो फीडर, वेइंग होपर, बायर फिडिंग प्रणाली, इलेक्ट्रोड निपिलिंग स्टेड, क्रेन, होइस्ट, तापमान और सेम्पलिंग टिप्स, लेडल स्टेंड, ई एस पी, डिडक्टिंग हूड, रिफेक्ट्री, बेग फिल्टर, क्रेन इत्यादि।	50%
11	सतत कास्टिंग उपकरण	लाडले टरेट, लेडल कवर मेनिपुलेटर, लेडल शारउड मेनिपुलेटर, टनडिस कार, कंटिन्यूअस टनडिस टेम्पेचर मेजरमेंट सिस्टम, टनडिस स्टोपर रूड मेकेनिजम, इमरजेंसी कट-आफ गेट, मोल्ड एसेम्बली, नोजल ब्रिक चेंज डिवाइस, मोल्ड ओसीलेटर एंड ई एम एस सिस्टम, इलेक्ट्रो-मेगेनेटिक ब्रेकिंग सिस्टम, स्ट्रेड गाइड सेगमेंट, विदड्राबल एंड स्ट्रेघटेनिंग यूनिट (डब्ल्यू एस यू), रोल गेप चेकर इमरजेंसी टार्च कटर, टार्च कटिंग मशीन, डेबरर, मार्किंग मशीन, टेकेनोलोजी कंट्रोल सिस्टम एंड प्रोसेस मोडल, ब्लेक रिफेक्ट्रीज, स्ट्रेंड गन्डे सेग्मेंट, टनडिश, लाडले कवर, रोलर टेबल एंड आक्सीलिरीज, माल्ड एंड सेग्मेंट मेनटेनेस इक्यूपमेंट टनडिस मेनटेनेस इक्यूपमेंट, ई एम बी आर सिस्टम	50%
12	फ्लेट प्रोडक्ट मिल	लार्ज कास्टिंग एंड फाजिंग लाइक मिल हाउसिंग, बेड प्लेट्स वर्क्स रोल, बेकअप रोल, इंड स्पिंडल्स; रोलर टेबल, बेकअप रोल एंड वर्क रोल चक्स क्वाडलर/टेनशन रिल/अनक्वाइलर, ए जी सी सिलंडर, शेयर्स, लेवेलेर्स, लाजेर वेल्डर, पेकेजिंग मशीन, नॉन कान्टेक्ट, गेज/प्रोफाइल गेज, एंटी-फ्रिक्शन रोल नेक बियेरिंग, आयल फिल्म बियेरिंग, गियर बॉक्स, मिल मोटर्स	50%
13	लॉंग प्रोडक्ट मिल	मिलस हाउसिंग, बेड प्लेट, वर्क रोल, बेकअप रोल, स्पिनडेल्स; रोलर टेबल, कॉंयलर /टेशन रिल /अनकॉंयलर, शेयर्स, बिल्डट वेल्डर, पेकेजिंग मशीन, नान-कानटेक्ट गॉज/प्रोफाइल गॉज, एंटी-फ्रिक्शन रोल नेक बियरिंग, आयल फिल्म बियरिंग, फिनिशिंग ब्लाक्स, गियर बॉक्स, मिल मोटर	50%

** परिशिष्ट ख में मदें निर्माण करने वाले इस्पात के लिए पूंजीगत सामानों की एक सांकेतिक सूची है. यह सूची विस्तृत नहीं है। इस्पात के निर्माण के लिए सभी पूंजीगत मालों पर* 50% *की न्यूनतम घरेलू मूल्यवर्धन आवश्यकता के साथ इस नीति के अंतर्गत खरीद वरीयता के लिए विचार किया जाएगा।*

फार्म - 1

100/- **रुपए के स्टाम्प पेपर पर दिए जाने के लिए लौह एवं इस्पात उत्पादों/पूंजीगत मालों में घरेलू मूल्यवर्धन के संबंध में स्व-प्रमाणन शपथ के लिए प्रपत्र :**

मैं _____ सुपुत्र, सुपुत्री, पत्नी, _____ का निवासी _____ _____ एतद् द्वारा निष्ठापूर्वक नीचे दिए गए अनुसार वचन देता हूँ और घोषण करता हूँ :

कि मैं अधिसूचना सं. : _____ के माध्यम से जारी किए गए भारत सरकार की नीति के नियम और शर्तों का पालन करने के लिए सहमत होउंगा।

कि यहां नीचे दी गई सूचना मेरे सर्वोत्तम ज्ञान और विश्वास के अनुसार सही है और मैं घरेलू मूल्यवर्धन का आकलन करने के प्रयोजन से खरीद करने वाली एजेंसी के समक्ष संगत रिकार्ड प्रस्तुत करने का वचन देता हूं।

कि सभी इनपुट्स के लिए घरेलू मूल्यवर्धन जिसमें उक्त लौह एवं इस्पात उत्पाद शामिल हैं का सत्यापन मेरे द्वारा कर लिया गया है और मैं उसमें किये गये दावों की सत्यतता के लिए जिम्मेदार हूं।

कि इसमें उल्लिखित उत्पाद घरेलू मूल्यवर्धन सही नहीं पाये जाने और मूल्यवर्धन के लिए निर्धारित मानदंडों को पूरा नहीं किये जाने की स्थिति में, घरेलू मूल्यवर्धन का आकलन करने के उद्देश्य से खरीद करने वाली एजेंसी के आकलन के आधार पर मैं 36 महीनों की अवधि के लिए किसी सरकारी निविदा से अयोग्य ठहराया जाऊंगा। इसके अलावा मैं इस प्रकार के आकलन की सभी लागतों का वहन करूंगा।

कि मैंने अधिसूचना संख्या _____ जिसमें सरकारी खरीद में घरेलू स्तर पर निर्मित लौह एवं इस्पात उत्पादों को वरीयता दी गई है, में संदर्भित सभी शर्तों का पालन किया है और यह कि खरीद करने वाली एजेंसी को एतद् द्वारा अधिकार दिया जाता है कि वह मेरे ई एम डी को जब्त करे। मैं यह भी वचन देता हूं कि आकलन की लागत का भुगतान करूंगा और निविदा दस्तावेज में यथा उल्लिखित सभी दण्ड राशि का भुगतान करूंगा।

मैं 8 वर्षों की अवधि के लिए कम्पनी के रिकॉर्ड में निम्नलिखित सूचना रखने के लिए सहमत हूं और किसी सांविधिक प्राधिकारी को सत्यापन के लिए इसे उपलब्ध कराऊंगा।

i. बोली लगाने वाले का नाम और ब्यौरा (पंजीकृत कार्यालय, विनिर्माण इकाई का स्थान, कानूनी प्रतिष्ठान की प्रकृति)

ii. वह तिथि जब यह प्रमाण पत्र जारी किया गया है।

iii. लौह एवं इस्पात उत्पाद जिसके लिए इस प्रमाण पत्र को प्रस्तुत किया जाता है।

iv. खरीद करने वाली एजेंसी जिसे यह प्रमाण पत्र प्रस्तुत किया जाता है।

v. दावा की गई घरेलू मूल्यवर्धन की प्रतिशतता और क्या यह निर्धारित घरेलू मूल्यवर्धन के आरंभिक मूल्य को पूरा करता है।

vi. विनिर्माता की इकाई का नाम और संपर्क विवरण

vii. लौह और इस्पात उत्पादों की निवल बिक्री कीमत

viii. संयंत्र तक भाड़ा, बीमा और रखरखाव

ix. लौह एवं इस्पात उत्पादों का निर्माण करने के लिए उपयोग की जाने वाली इनपुट इस्पात (आयात किया गया) की सूची और कुल लागत मूल्य।

x. इनपुट इस्पात जिसकी आपूर्ति घरेलू स्तर पर की जाती है की सूची और कुल लागत

xi. कृपया यदि इनपुट इन हाऊस नहीं हो तब आपूर्तिकर्ताओं से प्राप्त घरेलू मूल्यवर्धन प्रमाणपत्र संलग्न करें।

xii. आयात किये गये इनपुट इस्पात के लिए, सी आई एफ मूल्य, शुल्क और करों, पोर्ट पर उतारने से संबंधित प्रभारों और अंतर्देशीय भाड़े की लागत के ब्यौरे के साथ भारतीय पोर्ट पर पहुंच कीमत।

(प्रतिष्ठान/कंपनी का नाम) के लिए और उसकी ओर से

अधिकृत हस्ताक्षरकर्ता (निदेशक बोर्ड द्वारा विधिवत अधिकृत किये जाने के लिए)

<नाम, पदनाम और संपर्क सं. की प्रविष्टि करें>

MINISTRY OF STEEL

NOTIFICATION

New Delhi, the 29th May, 2019

G.S.R. 385(E).—The revised Policy for providing preference to domestically manufactured Iron & Steel Products in Government procurement is hereby published for general information.

[F. No.3(2)/2018-IDD]

RASIKA CHAUBE, Addl. Secy.

POLICY FOR PROVIDING PREFERENCE TO DOMESTICALLY MANUFACTURED IRON & STEEL PRODUCTS IN GOVERNMENT PROCUREMENT- REVISED, 2019

1 Background

1.1 This policy provides preference to Domestically Manufactured Iron and Steel Products (DMI&SP) in Government procurement.

1.2 The policy is applicable to iron & steel products as provided in Appendix A and capital goods for manufacturing iron & steel products in Appendix B, produced in compliance to prescribed quality standards, as applicable.

1.3 The policy is applicable to every Ministry or Department of Government and all agencies/entities under their administrative control and to projects funded by these agencies for purchase of iron & steel products for government projects. However, this policy shall not apply for purchase of iron & steel products with a view to commercial resale or with a view to use in the production of goods for commercial sale.

2 Definitions

2.1 **Bidder** may be a domestic/ foreign manufacturer of iron & steel or their selling agents/ authorized distributors/ authorized dealers/ authorized supply houses or any other company engaged in the bidding of projects funded by Government agencies.

2.2 **Domestically Manufactured Iron & Steel Products (DMI&SP)** are those iron and steel products which are manufactured by entities that are registered and established in India, including in Special Economic Zones (SEZs). In addition, such products shall meet the criteria of domestic minimum value-addition as mentioned in Appendix A.

2.3 **Domestic Manufacturer** is a manufacturer of iron & steel products conforming to guidelines in section 7 and confirming to the definition of 'manufacturer' as per Central Excise Act.

2.4 **Government** for the purpose of the Policy means Government of India.

2.5 **Government agencies** include Government PSUs, Societies, Trusts and Statutory bodies set up by the Government.

2.6 **MoS** shall mean Ministry of Steel, Government of India.

2.7 **Net Selling Price** shall be the invoiced price excluding net domestic taxes and duties

2.8 **Semi-Finished Steel** shall mean Ingots, billet, blooms and slabs, which can be subsequently processed to finished steel.

2.9 **Finished Steel** shall mean Flat and Long products, which can be subsequently processed into manufactured items.

2.10 **L1** means the lowest tender or the lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

2.11 **Margin of purchase preference** means the maximum extent to which the price quoted by a domestic supplier may be above L1 for the purpose of purchase preference. In case of DMI&SP policy, the margin of purchase preference shall be 20% for items in Appendix B.

2.12 **Iron & Steel Product(s)** shall mean such iron and steel product(s) which are mentioned in Appendix A.

2.13 **Domestic value addition** shall be the net selling price (invoiced price excluding net domestic taxes and duties) minus the landed cost of imported input materials at the manufacturing plant in India (including all customs duties) as a proportion of the net selling price, in percent. The 'domestic value addition' definition shall be in line with the DPIIT(formerly DIPP) guidelines, and shall be suitably amended in case of any changes by DPIIT in the future. For the purpose of this policy document, domestic value addition and local content have been used interchangeably.

3 Exclusions

3.1 Waivers shall be granted by the Ministry of Steel to all such Government procurements subject to the below conditions.

3.1.1 Where specific grades of steel are not manufactured in the country, or

3.1.2 Where the quantities as per the demand of the project cannot be met through domestic sources

The exclusion requests shall be submitted to the Standing Committee along with sufficient proof of unavailability of domestically manufactured iron & steel products

4 Standing Committee

A Standing Committee under the Ministry of Steel (MoS) to be chaired by the Secretary (Steel), shall be constituted to oversee the implementation of the policy. The Committee shall comprise of experts drawn from Industry / Industry Association / Government Institution or Body / Ministry of Steel (MoS). The said Committee in MoS shall have the mandate for the following:

4.1 Monitoring the implementation of the policy

4.2 Review and notify the list of Iron & Steel products and the domestic value addition requirement criteria as mentioned at Appendix A and Appendix B.

4.3 Issue necessary clarifications for implementation of the policy including grant of exclusions to procuring agencies as per section 3

4.4 Constitute a separate committee to carry out grievance redressal

4.5 The Standing Committee shall submit its recommendations for approval to Ministry of Steel.

5 Notifying Iron & Steel Products Procured by Government

5.1 The following guidelines may be used for identifying and notifying the aforementioned products under the policy:

5.1.1 The policy is applicable to iron & steel products as provided in Appendix A and to capital goods for manufacturing iron & steel products in Appendix B.

5.1.2 Appendix A contains list of iron & steel products which are to be exclusively domestically manufactured and cannot be imported without the approval of the Ministry of Steel

5.1.3 Appendix B contains a list (non-exhaustive) of capital goods for which purchase preference shall be provided to domestically manufactured capital goods, if their quoted price falls within 20% of the price quoted for corresponding imported capital good.

5.1.4 The objective of the policy is to notify all iron & steel products which are procured by Government Agencies for government projects and not with a view to commercial resale or with a view to use in the production of products for commercial sale.

5.1.5 The policy is applicable to all projects funded by Ministry or Department of Government and all agencies/ entities under their administrative control for purchase of iron & steel products.

5.1.6 The policy shall be applicable to projects where the procurement value of iron and steel products is greater than Rs. 25 crores. The policy shall also be applicable for other procurement (non-project), where annual procurement value of iron and steel products for that Government organization is greater than Rs. 25 crores.

5.1.7 The policy is applicable to purchase of iron & steel products by private agencies for fulfilling an EPC contract and/or any other requirement of Ministry or Department of Government or their PSUs.

5.1.8 Analysis of the availability of various grades of domestic iron and steel products needs to precede for notification under the policy. Only those iron & steel products, in respect of which at least one domestic manufacturer exists, shall be notified. Consultation may be carried out by the Standing Committee.

5.1.9 The policy is applicable to capital goods for manufacturing iron & steel products in Appendix B produced in compliance to prescribed quality standards, as applicable.

5.1.10 Policy for domestic procurement of capital goods for manufacturing iron and steel products is applicable to all public sector steel manufacturers and all agencies/ entities under their administrative control for purchase of capital goods for manufacturing iron & steel products, not with a view to commercial resale.

5.1.11 The policy is applicable to purchase of capital goods for manufacturing iron & steel products by private agencies for fulfilling an EPC contract and/or any other requirement of public sector steel manufacturers and all agencies/ entities under their administrative control

5.1.12 Government agencies which are involved in procurement of iron and steel products, and capital goods for manufacturing of iron and steel products, in cases where the iron and steel products are not mentioned in Appendix A and Appendix B, shall provide description and technical specifications of the product along with prescribed standards to the Standing Committee. The Standing Committee will act as per mandate in section 3 and section 4.

5.2 The Ministry of Steel (MoS) would notify iron & steel products along with the minimum prescribed domestic value addition, furnished at Appendix A.

5.3 The policy guidelines on capital goods for manufacturing iron & steel products shall be applicable to public sector steel manufacturers for all purchases of capital goods for manufacturing iron & steel products in Appendix B, irrespective of the project size.

5.4 Minimum domestic value addition requirement suggested for iron and steel products in Appendix A, and for capital goods for manufacturing iron and steel products in Appendix B have been decided on the basis of factors such as domestic supplier base, number of suppliers and import to consumption ratio.

5.5 The domestic value addition requirement norm shall be so calibrated that it reflects the average/above average manufacturing capability of the domestic industry for the iron & steel products at a point of time. This shall be suitably reviewed by the Standing Committee from time to time and amended, if required with the approval of Ministry of Steel.

6 Tender procedure for procurement by government and government agencies

6.1 The procuring/ Government agencies shall follow standard procurement procedures, in accordance with instructions of Ministry of Finance and CVC while adhering to DMI&SP. The policy shall come into effect from the date of its notification in all tenders where price bid have not been opened.

6.2 The tender document, for procurement of both Goods as well as for EPC contracts, should explicitly outline the qualification criteria for adherence to minimum prescribed domestic value addition by the bidder for iron and steel products and capital goods for manufacturing iron & steel products(as indicated in Appendix A and Appendix B)

6.3 In supporting the growth of domestic products, the target of domestic value addition in iron and steel business activities has been set as contained in **Appendix A and Appendix B**.

6.4 For iron and steel products in Appendix A, the procurement process shall be open only to the manufacturers / suppliers having the capability of meeting / exceeding the domestic value addition targets. Manufacturers / suppliers not meeting the domestic value addition targets are not eligible to participate in the bidding.

6.5 In case of Appendix B items, if in the opinion of the procuring company, the tenders (procured quantity) cannot be divided in the prescribed ratio of 50:50, then they shall have the right to award contract to the eligible domestic manufacturer for quantity not less than 50%, as may be divisible.

6.6 In continuation to the above clause, for Appendix B items, if the tendered item is non divisible, (to be included in the tender document by procuring company) the contract can be awarded to the eligible domestic manufacturer for the entire quantity.

6.7 In case of Appendix B items, if none of the eligible manufacturers meeting domestic value addition requirements match the L1 bid, the original bidder holding L1 bid shall secure the order for full value of procurement.

6.8 The bidders who are selling agents/ authorized distributors/ authorized dealers/ authorized supply houses of the domestic manufacturers of iron & steel products are eligible to bid on behalf of the domestic manufacturers under the policy. However, this shall be subject to the following conditions:

6.8.1 The bidder shall furnish the authorization certificate issued by the domestic manufacturer for selling domestically manufactured iron & steel products.

6.8.2 In case the procurement is covered under Appendix A of the DMI&SP policy, the bidder shall furnish the Affidavit of self-certification issued by the domestic manufacturer to the procuring agency declaring that the iron & steel products is domestically manufactured in terms of the domestic value addition prescribed.

6.8.3 In case the procurement is covered under Appendix B of the DMI&SP policy, the bidder shall furnish the certification issued by the statutory auditor to domestic manufacturer declaring that the capital goods to be used in Iron & Steel industry are domestically manufactured in terms of the domestic value addition prescribed.

6.8.4 It shall be the responsibility of the bidder to furnish other requisite documents required to be issued by the domestic manufacturer to the procuring agency as per the policy.

7 Domestic value addition requirement

7.1 Minimum domestic value addition requirement to qualify the product as a domestically manufactured iron & steel product or a Capital good are mentioned in Appendix A and B.

7.2 Domestic value addition shall be the net selling price (invoiced price excluding net domestic taxes and duties) minus the landed cost of imported input materials at the manufacturing plant in India (including all customs duties) as a proportion of the net selling price, in per cent.

7.2.1 In case the iron & steel products are made using domestic input steel (semi-finished/ finished steel), invoices of purchases from the actual domestic producers along with quantities purchased and the other related documents must be furnished to the procuring Government agency.

7.2.2 In case the iron & steel products have imported input steel, the invoices of purchases from the actual producers along with quantities purchased and the other related documents must be furnished separately. To derive the extent of domestic value addition, the weighted average of both (imported & domestic) input steel shall be considered to ensure that the minimum stipulated domestic value addition requirement of the policy is complied with.

7.3 It is recommended that each bidder participating in the tender process should calculate the domestic value addition using the below formula below so as to ensure the domestic value addition claimed is consistent with the minimum stipulated domestic value addition requirement of the policy.

For Iron and Steel products

$$\%\ Domestic\ value\ addition = \frac{Net\ selling\ price\ of\ final\ product - Landed\ cost\ of\ imported\ iron\ or\ steel\ at\ plant}{Net\ selling\ price\ of\ final\ product} \times 100\%$$

For Capital Goods

$$\%\ Domestic\ value\ addition = \frac{Net\ selling\ price\ of\ final\ product - Landed\ cost\ of\ imported\ input\ materials\ at\ plant}{Net\ selling\ price\ of\ final\ product} \times 100\%$$

8 Certification and audit

8.1 For products in Appendix A, each domestic manufacturer shall furnish the Affidavit of self-certification to the procuring Government agency declaring that the iron & steel products are domestically manufactured in terms of the domestic value addition prescribed. For capital goods in Appendix B, the bidder shall furnish the certification issued by the statutory auditor to the domestic manufacturer declaring that the capital goods are domestically manufactured in terms of the domestic value addition prescribed. The bidders who are sole selling agents / authorized distributors / authorized dealers / authorized supply houses of the domestic manufacturers of iron & steel products are eligible to bid on behalf of domestic manufacturers under the policy. The bidder shall furnish the Affidavits of self-certification issued by the domestic manufacturers and the certifications issued by the statutory auditors, to the procuring agency declaring that the iron & steel products are domestically manufactured in terms of the domestic value addition prescribed. The Affidavit of self-certification shall be furnished in **Form 1** attached to these guidelines.

8.2 It shall be the responsibility of the domestic manufacturer to ensure that the products so claimed are domestically manufactured in terms of the domestic value addition prescribed for the product. The bidder shall also be required to provide a domestic value addition certificate on half-yearly basis (Sep 30 and Mar 31), duly certified by the Statutory Auditors of the domestic manufacturer, that the claims of domestic value addition made for the product during the preceding 6 months are in accordance with the Policy. Such certificate shall be filed within 60 days of commencement of each half year, to the concerned Government agencies and shall continue to be filed till the completion of supply of the said products.

8.3 The procuring agency shall accept the Affidavit of self-certification regarding domestic value addition in a steel product submitted by a bidder. It shall not normally be the responsibility of procuring agency to verify the correctness of the claim. The onus of demonstrating the correctness of the same shall be on the bidder when asked to do so.

8.4 In case a complaint is received by the procuring agency or the concerned Government Agency against the claim

of a bidder regarding domestic value addition in iron & steel products, the procuring agency shall have full rights to inspect and examine all the related documents and take a decision. In case any clarification is needed, matter may be referred to MoS with a request for technical assistance.

8.5 Any complaint referred to the Government Agency shall be disposed off within 4 weeks of the reference along with submission of all necessary documents. The bidder shall be required to furnish the necessary documentation in support of the domestic value addition claimed in iron & steel products to the Government Agency within 2 weeks of filing the complaint.

8.6 In case, the matter is referred to the Ministry of Steel, the grievance redressal committee setup under the MoS shall dispose of the complaint within 4 weeks of its reference and receipt of all documents from the bidder after taking in consideration, the view of the Government Agency. The bidder shall be required to furnish the necessary documentation in support of domestic value addition claimed in iron & steel products to the grievance redressal committee under MoS within 2 weeks of the reference of the matter. If no information is furnished by the bidder, the grievance redressal committee may take further necessary action, in consultation with Government Agency to establish bonafides of claim.

8.7 The cost of assessing the prescribed extent of domestic value addition shall be borne by the procuring agency if the domestic value addition is found to be correct as per the certificate. However, if it is found that the domestic value addition as claimed is incorrect, the cost of assessment will be payable by the bidder who has furnished an incorrect certificate. The manner of enforcing the same shall be defined in the tender document.

9 Sanctions

9.1 Each Government Agency shall clearly define the penalties, in case of wrong declaration by the bidder of the prescribed domestic value addition, in the tender document. The penalties may include forfeiting of the EMD, other financial penalties and blacklisting of such manufacturer/ service provider.

9.2 In case of reference of any complaint to MoS by the concerned bidder, there would be a complaint fee of Rs. 10 Lakh or 0.2 % of the value of the DMI&SP being procured (subject to a maximum of Rs. 20 Lakh), whichever is higher, to be paid by Demand Draft deposited with the grievance redressal committee under MoS along with the complaint by the complainant. In case, the complaint is found to be incorrect, the Government Agency reserves the right to forfeit the said amount. In case, the complaint is found to be substantially correct, deposited fee of the complainant would be refunded without any interest.

10 Implementation monitoring by Ministry of Steel

10.1 The policy provisions shall be applicable for a period of 5 years from the date of publication. The policy period may further be extended at the discretion of Ministry of Steel.

10.2 MoS shall be the nodal ministry to monitor the implementation of the policy.

10.3 All applicable agencies under DMI&SP policy shall ensure implementation of the policy and shall annually, in the month of June, send a declaration indicating the extent of compliance to the policy and reasons for noncompliance thereof, during the preceding financial year.

Reference to Ministry of Steel

In case of a question whether an item being procured is a DMI&SP to be covered under the policy, the matter would be referred to the Ministry of Steel for clarification.

Appendix A - Exclusive for domestically manufactured products

Sl. No.	Indicative list of Iron & Steel Products	Applicable HS code	Minimum domestic value addition requirement
1	Flat-rolled products of iron or non alloy steel, of a width of 600 mm or more, hot rolled, not clad, plated or coated	7208	50%
2	Flat-rolled products of iron or non alloy steel, of a width of 600 mm or more, cold rolled (cold-reduced), not clad, plated or coated	7209	50%
3	Flat-rolled products of iron or non alloy steel, of a width of 600 mm or more, clad, plated or coated	7210	50%

4	Flat-rolled products of iron or non alloy steel, of a width of less than 600 mm, not clad, plated or coated	7211	35%
5	Flat-rolled products of iron or non alloy steel, of a width of less than 600 mm, clad, plated or coated	7212	35%
6	Bars and rods, hot-rolled, in irregularly wound coils, of iron or non-alloy steel	7213	35%
7	Other bars and rods of iron or non alloy steel, not further worked than forged, hot rolled, hot-drawn or hot-extruded, but including those twisted after rolling	7214	35%
8	Other bars and rods of iron or non alloy steel	7215	35%
9	Angles, shapes and sections of iron or non-alloy steel	7216	35%
10	Wire of iron or non-alloy steel	7217	50%
11	Flat-rolled products of stainless steel, of a width of 600 mm or more	7219	50%
12	Flat-rolled products of stainless steel, of a width of less than 600 mm	7220	50%
13	Other bars and rods of stainless steel; angles, shapes and sections of stainless steel	7222	50%
14	Wire of other alloy steel	7229	35%
15	Rails, railway or tramway track construction material of iron or steel	7302	50%
16	Tubes, pipes and hollow profiles, of cast iron	7303	35%
17	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel	7304	35%
18	Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406.4 mm, of iron or steel	7305	35%
19	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel	7306	35%
20	Tube or pipe fittings (for example, connectors/couplings, elbow sleeves), of iron or steel	7307	35%
21	Bars and rods, hot-rolled, in irregularly wound coils, of stainless steel	7221	35%
22	Wire of stainless steel	7223	35%
23	Flat-rolled products of other alloy steel, of a width of 600 mm or more, including electrical steel	7225	35%
24	Flat-rolled products of other alloy steel, of a width of less than 600 mm, including electrical steel	7226	35%
25	Bars and rods, hot-rolled, in irregularly wound coils, of other alloy steel	7227	15%
26	Other bars and rods of other alloy steel; angles, shapes and sections, of other alloy steel; hollow drill bars and rods, of alloy or nonalloy steel	7228	35%
27	Sheet piling of iron or steel, whether or not drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel	7301	15%
28	Structures (excluding prefabricated buildings of heading 9406) and parts of structures	7308	15%
29	Reservoirs, tanks, vats and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 whether or not lined or heatinsulated, but not fitted with mechanical or Thermal equipment	7309	15%

30	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 L, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	7310	15%
31	Containers for compressed or liquefied gas, of iron or steel	7311	15%
32	Stranded wire, ropes, cables, plaited bands, slings and the like, of iron or steel, not electrically insulated	7312	15%
33	Barbed wire of iron or steel; twisted hoop or single flat wire, barbed or not, and loosely twisted double wire, of a kind used for fencing, of iron or steel	7313	15%
34	Grill, netting and fencing, of iron or steel wire; expanded metal of iron or steel	7314	15%
35	Chain and parts thereof, of iron or steel	7315	15%
36	Anchors, grapnels and parts thereof, of iron or steel	7316	15%
37	Articles of iron and steel	7317	15%
38	Articles of iron and steel	7318	15%
39	Articles of iron and steel	7319	15%
40	Springs and leaves for springs, of iron or steel	7320	15%
41	Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel	7321	15%
42	Radiators for central heating, not electrically heated, and parts thereof, of iron or steel; air heaters and hot air distributors, not electrically heated, incorporating a motor-driven fan or blower, and parts thereof, of iron or steel	7322	15%
43	Tables and similar household articles and parts thereof, of iron or steel	7323	15%
44	Sanitary ware and parts thereof, of iron or steel	7324	15%
45	Other cast articles of iron or steel	7325	15%
46	Electrical steel and other articles of iron or steel	7326	15%
47	Railway or tramway passenger coaches, not self-propelled	8605	50%
48	Railway or tramway goods vans and wagons, not self-propelled	8606	50%
49	Parts of railway or tramway locomotives or rolling-stock; such as bogies, bissel-bogies, axles and forged wheels, and parts thereof	8607	50%

Products included in descriptions are indicative; all products under the specified HS codes are included as part of the appendix

Appendix B

Indicative list of capital goods(non-exhaustive) for manufacturing iron & steel products

Sl. No.	Plant shop	Capital goods	Minimum domestic value addition requirement
1	Raw material handling system	Apron feeder, barrel couplings, heavy duty bearings, hydraulic disc brakes, tanker &container for powdered materials, conveyor belt for pipe conveyors, high angle conveyor system, crushers, crane rail lubrication system, four girder EOT Crane, crane weighing system, crane air conditioning, fluid couplings, fork lift trucks, hydraulic motors, hydraulic system, locking assembly (friction grip), load cells, level sensors, pipe	50%

		conveyor system, plough/ paddle feeder, pneumatic transportation - dense &lean phase, reclaimers, radio remote control, rail fixing arrangements (special), rapid/ flood loading system, stackers, special screen, slew ring bearings, tipplers, transfer cars, tongs (special), vibration, isolation system (spring damper), wagon tipplers, wagon loaders	
2	Mineral benefaction (iron ore and coal) equipment	Industrial crushers, grinding mills, conventional screens, slurry pumps,hirate thickeners, filters, hydroclones	50%
3	Coke oven	Coke Oven Silica Refractory, Anchorage System, Waste gas valve with branch pipe, Flash Plate, Door Frame, door body, Minor Casting: Gooseneck, Valve box, AP Lid, Charging & inspection hole lid and frame Reversing mechanism, Centralised lubrication system, Hydrojet Door Cleaning Mechanism, Spillage code conveyor system, skip hoist, Door Lowering Rack, Isolation/ Reversing Cocks, Level II automation, Oven machines	50%
4	By-product plant	Primary Gas Cooler, Electrostatic Tar Precipitator,H2S, NH3 & Naphthalene Scrubber, Combi Stripper, Flushing Liquor Pump, Claus Kiln, Claus reactors, Waste Heat Boilers, Decanters	50%
5	Sinter plant equipment	Pallet car, Drive/discharge end Sprocket assembly, Curved rail, Slide rails, Hot sinter breaker and Grizzly, Dip rail & running rail, Impeller assembly for Process fan, Drive assembly of Sinter machine, Hi-intensity Mixer &Noduliser	50%
6	Pellet plant equipment	Pallet car, Drive/discharge end Sprocket assembly, Curved rail, Slide rails, running rail, Vertical roller mill, Impeller assembly for Process fan, Drive assembly of Indurating machine, Hi-intensity Mixer, Balling disc, Single deck roller screen and Double deck roller screen	50%
7	Blast furnace equipment	Bell less top system with Bleeder valve, SG Iron stave coolers, Copper stave coolers, Stock level indicator (Radar Type), Mud gun, Drilling machine and Manipulator, Gas Cleaning Plant system, Top Recovery Turbine system including its by-pass valve, De-bricking Machine, Re-railing equipment, PCI system, Grinding mill for PCI, Stock level indicator, Tuyere Stock assembly, Waste Heat Recovery system, BF & Hot Blast Stoves Technological Valves, Above Burden probes, Slag granulation unit, Tuyere&Tuyere cooler, Torpedo Ladle Car, BF hearth refractory	50%
8	Direct reduction plant equipment	Charge distributer, Upper & lower seal leg, Reformer & Re-cuperator system, Burden feeders, Turbo-expander, Process Gas Compressor , Seal gas compressors & bottom seal gas compressors, Seal gas generators & driers, Process Gas Heater, CO2 removal plant	50%
9	Basic oxygen furnace equipment	Main and Maintenance equipment comprising of converter, gunning machine, Refractory/ slag monitoring device, converter vessel, trunnion ring and suspension system, trunnion bearings and housing, Converter bull gear unit and tilt drive system, Rotary joint for converter, bottom stirring system, Lance body with clamping, Lance copper tips, Valve stations for oxygen blowing/ bottom stirring, Sub-lance system, Off gas analyzer with process module i.e. Process software/ hardware, container lab Measurement probes, Switch over station, ID fan for primary gas, Hot metal and steel ladle, Ladle Transfer car, Ladle maintenance equipment, Slag pot, Slag pot transfer car, Scrap boxes, Scrap Transfer car, Lance carriage, Lance guide, Crane & hoist, Lance hoist & trolley, Lance tilting device, Traverse for lifting lances, Bunker of various sizes, Bin Vibrator, Weighing Hopper, Maintenance stands, De dusting suction hood, Teeming/HM, ladle relining stands, Stand Cooling stack inspection device, Hood traverse carriage, Refractories, Bypass & isolation valves, Flare stack & ignition system, Scrubbing tower	50%

		shell - Wet gas cleaning system, Dog house, Ladle drier, ladle pre-heater, ladle cooler, Fume collection hoods, Clean gas stack, Dust silo, Weigh Bridge, Slag retaining device	
10	Electric arc furnace	Furnace proper (includes furnace lower shell, upper shell and roof, Tilting platform, Furnace Gantry) and transformer, Electrode regulation system, Hydraulic system, Refractories, Parts of Level I & Level II Automation system. LF - water cooled ladle roof, electrode mast and arms, electrode regulating system, wire feeding system, Bottom inert gas stirring Valve stand for porous plug and top lance, Emergency lance mechanism, Lance carriage system with drive unit, Automatic temperature, sampling & bath level / O2 measurement, Temp. & oxygen immersion lance, lance carriage system with drive unit, Hydraulic system, Refractories, Ladle roof Delta portion, RH proper (includes Ladle transfer car, vacuum vessel, Vessel lifting & lowering system. Hydraulic system, Multi Function lance, Valve racks/station, Electrode clamp unit, conductor of electrode arms, water cooled cable, A R stirring valve rack, lance transport car, Refractory lance, Hydraulic cylinder, Ladle roof lifting cylinder, Lubrication system, Suction hood, damper, Vibro feeder, weighing hopper, wire feeding system, Electrode nipiling stand, Cranes, hoist, Temperature & sampling tips, ladle stands, ESP, Deducting hoods, Refractories, bag filter, Cranes etc.	50%
11	Continuous casting equipment	Ladle turret, ladle cover manipulator, Ladle Shroud manipulator, tundish car, Continuous tundish temperature measurement system, Tundish stopper rod mechanism, emergency cut-off gate, mould assembly, Nozzle quick change device, mould oscillator and EMS system, Electro-Magnetic braking system, Strand guide segment, Withdrawal & Straightening unit (WSU), Roll gap checker, Emergency torch cutter, Torch cutting machine, Deburrer, Marking machine, Technological control system & process models, Black Refractories, strand gunde segment, tundish, ladle cover, roller tables & auxiliaries, mould& segment maintenance equipments, tundish maintenance equipments, EMBR system	50%
12	Flat product mills	Large castings and forgings like mill housing, bed plates, work rolls, backup rolls, end spindles; roller tables, backup roll and work roll chucks, coilers / tension reels / uncoilers, AGC cylinders, shears, levelers, lazer welders, packaging machines, non-contact gauges / profile gauges, anti-friction roll neck bearings, oil film bearings, gear boxes, mill motors	50%
13	Long product mills	Mill housing, bed plates, work rolls, backup rolls, spindles; roller tables, coilers / tension reels / uncoilers, shears, billet welder, packaging machines, non-contact gauges / profile gauges, anti-friction roll neck bearings, oil film bearings, finishing blocks, gear boxes, mill motors	50%

**Items in appendix B are an indicative list of capital goods for manufacturing steel, the list is not exhaustive. All capital goods for steel manufacturing shall be considered for purchase preference under the policy with a minimum domestic value addition requirement of 50%*

Form-1

Format for Affidavit of Self Certification regarding Domestic Value Addition in Iron & Steel Products/capital goods to be provided on Rs.100/- Stamp Paper Date:

I _____S/o, D/o, W/o, _____ Resident of _____ _____ hereby solemnly affirm and declare as under:

That I will agree to abide by the terms and conditions of the policy of Government of India issued vide Notification No: _____.

That the information furnished hereinafter is correct to the best of my knowledge and belief and I undertake to produce relevant records before the procuring agency (ies) for the purpose of assessing the domestic value addition.

That the domestic value addition for all inputs which constitute the said iron & steel products has been verified by me and I am responsible for the correctness of the claims made therein.

That in the event of the domestic value addition of the product mentioned herein is found to be incorrect and not meeting the prescribed value-addition criteria, based on the assessment of procuring agency (ies) for the purpose of assessing the domestic value-addition, I will be disqualified from any Government tender for a period of 36 months. In addition, I will bear all costs of such an assessment.

That I have complied with all conditions referred to in the Notification No._____ wherein preference to domestically manufactured iron & steel products in Government procurement is provided and that the procuring agency (ies) is hereby authorized to forfeit and my EMD. I also undertake to pay the assessment cost and pay all penalties as specified in the tender document.

I agree to maintain the following information in the Company's record for a period of 8 years and shall make this available for verification to any statutory authority.

i. Name and details of the Bidder (Registered Office, Manufacturing unit location, nature of legal entity)

ii. Date on which this certificate is issued

iii. Iron & Steel Products for which the certificate is produced

iv. Procuring agency to whom the certificate is furnished

v. Percentage of domestic value addition claimed and whether it meets the threshold value of domestic value addition prescribed

vi. Name and contact details of the unit of the manufacturer (s)

vii. Net Selling Price of the iron & steel products

viii. Freight, insurance and handling till plant

ix. List and total cost value of input steel (imported) used to manufacture the iron & steel products

x. List and total cost of input steel which are domestically sourced.

xi. Please attach domestic value addition certificates from suppliers, if the input is not in house.

xii. For imported input steel, landed cost at Indian port with break-up of CIF value, duties & taxes, port handling charges and inland freight cost.

For and on behalf of(Name of firm / entity)

Authorized signatory (To be duly authorized by the Board of Directors)

<Insert Name, Designation and Contact No.>

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Annexure-1

रजिस्ट्री सं. डी.एल.- 33004/99 REGD. No. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

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असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)
PART II—Section 3—Sub-section (i)

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इस्पात मंत्रालय

अधिसूचना

नई दिल्ली, 31 दिसम्बर, 2020

सा.का.नि. 1(अ).—सरकारी प्रापण में देशी निर्मित लोहा और इस्पात उत्पादों को प्राथमिकता प्रदान करने हेतु नीति (डीएमआई एंड एसपी नीति) – परिशोधित, 2019 में संशोधनों को आम सूचना के लिए एतद्वारा प्रकाशित किया जाता है:

"सं. S-13026/1/-2020-आईडीडी

इस्पात मंत्रालय

आईडी प्रभाग

उद्योग भवन,

नई दिल्ली 31 दिसंबर, 2020

विषय : सरकारी खरीद में घरेलू निर्मित लौहा और इस्पात उत्पादों को प्राथमिकता प्रदान करने की नीति-परिशोधित, 2019-में संशोधन/परिवर्धन

सरकारी खरीदमें स्वदेशी निर्मित लौहा और इस्पात उत्पादों को प्राथमिकता प्रदान करने की नीति-परिशोधित, 2019-(डीएमआईएंडएसपी परिशोधित, 2019) में निम्नलिखित संशोधन/ परिवर्धन तत्काल प्रभाव से लागू हैं। ये संशोधन/

परिवर्धन ऐसी निविदा या खरीद पर लागू नहीं होंगे जिनके लिए निविदा आमंत्रित करने वाला नोटिस अथवा अन्य प्रकार का खरीद अधियाचन इस अधिसूचना के जारी होने से पूर्व जारी हुआ है।

I – संशोधन:तालिका 1

क्रम सं.	डीएमआईएंडएसपी परिशोधित 2019 ,में मौजूदा खंड	डीएमआईएंडएसपी परिशोधित 2019 ,में संशोधित खंड
1	**खंड 1.3:** यह नीति सरकार के प्रत्येक मंत्रालय अथवा विभाग और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/ प्रतिष्ठानों तथा सरकारी परियोजनाओं के वास्ते लौह एवं इस्पात उत्पादों की खरीद के लिए इन एजेंसियों द्वारा वित्तपोषित परियोजनाओं पर लागू है। हालांकि, यह नीति वाणिज्यिक पुन: बिक्री के उद्देश्य से अथवा वाणिज्यिक बिक्री के लिए वस्तुओं के उत्पादन में उपयोग करने के उद्देश्य से लौह एवं इस्पात उत्पादों की खरीद पर लागू नहीं होगी।	**खंड 1.3:** यह नीति सरकार के प्रत्येक मंत्रालय अथवा विभाग और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/ प्रतिष्ठानों तथा सरकारी परियोजनाओं के वास्ते लौह एवं इस्पात उत्पादों की खरीद के लिए इन एजेंसियों द्वारा वित्त पोषित परियोजनाओं पर लागू है। केन्द्रीय क्षेत्र की सभी योजनाएं (सीएस)/ केन्द्रीय प्रायोजित योजनाएं (सीएसएस) जिनके लिए राज्यों और स्थानीय निकायों द्वारा खरीद की जाती है, इस नीति की परिधि में आएंगी यदि उस परियोजना/योजना को भारत सरकार द्वारा पूर्णतया/ अंशत: वित्तपोषित किया जाता है। हालांकि, यह नीति वाणिज्यिक पुन: बिक्री के उद्देश्य से अथवा वाणिज्यिक बिक्री के लिए वस्तुओं के उत्पादन में उपयोग करने के उद्देश्य से लौह एवं इस्पात उत्पादों की खरीद पर लागू नहीं होगी।
2	**खंड 2.13:** घरेलू मूल्यवर्धन निवल बिक्री कीमत(निवलघरेलू करों और शुल्कों को छोड़कर बीजक कीमत) होगी जिससे प्रतिशत में निवल बिक्री कीमत के एक अनुपात के रूप में भारत में निर्माण संयंत्र(सभी सीमा शुल्कों सहित) में आयात की गई इनपुट सामग्री की पहुंच लागत घटाई गई हो, 'घरेलू मूल्यवर्धन'परिभाषा डी पी आई आई टी (पूर्व में डी आई पी पी) के दिशानिर्देशों के अनुरूपहोगी और उसमें भविष्य में डी पी आई आई टी द्वारा परिवर्तन किये जाने की स्थिति में उपयुक्त रूप से संशोधन किया जायेगा। इस नीति दस्तावेज के प्रयोजन के लिए घरेलूमूल्यवर्धन और स्थानीय विषय वस्तु का उपयोग एक दूसरे के स्थान पर किया गया है।	**खंड 2.13:** घरेलू मूल्यवर्धन का तात्पर्य है- भारत में वर्धित मूल्य की राशि जो खरीदी/बेची जाने वाली वस्तुओं का कुल मूल्य होगा (निवल घरेलू अप्रत्यक्ष करों को छोडकर)- खरीदी/बेची जाने वाली वस्तुओं के कुल मूल्य के समानुपात के रूप में प्रतिशत में मद में आयातित सामग्री का मूल्य (सभी सीमा शुल्कों सहित)। घरेलू मूल्यवर्धन निवल बिक्री कीमत (निवल घरेलू करों और शुल्कों को छोड़कर बीजक कीमत) होगी जिससे प्रतिशत में निवल बिक्री कीमत के एक अनुपात के रूप में भारत में निर्माण संयंत्र (सभी सीमा शुल्कों सहित) में आयात की गई इनपुट सामग्री की पहुंच लागत घटाई गई हो, 'घरेलू मूल्यवर्धन'परिभाषा डी पी आई आई टी (पूर्व में डी आई पी पी) के दिशानिर्देशों के अनुरूप होगी और उसमें भविष्य में डी पी आई आई टी द्वारा परिवर्तन किये जाने की स्थिति में उपयुक्त रूप से संशोधन किया जायेगा। इस नीति दस्तावेज के प्रयोजन के लिए घरेलू मूल्यवर्धन और स्थानीय विषय वस्तु का उपयोग एक दूसरे के स्थान पर किया गया है।

3	**खंड 5.1.5** यह नीति सरकार के मंत्रालय अथवा विभाग के द्वारा वित्त-पोषित सभी परियोजनाओं और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/ प्रतिष्ठानों पर लौह एवं इस्पात उत्पादों की खरीद के लिए लागू है।	**खंड 5.1.5** यह नीति सरकार के मंत्रालय अथवा विभाग के द्वारा वित्त पोषित सभी परियोजनाओं और उनके प्रशासनिक नियंत्रण के अधीन सभी एजेंसियों/ प्रतिष्ठानों पर लौह एवं इस्पात उत्पादों की खरीद के लिए लागू है।केन्द्रीय क्षेत्र की सभी योजनाएं (सीएस)/ केन्द्रीय प्रायोजित योजनाएं (सीएसएस) जिनके लिए राज्यों और स्थानीय निकायों द्वारा खरीद की जाती है, इस नीति की परिधि में आएंगी यदि उस परियोजना/योजना को भारत सरकार द्वारा पूर्णतया/ अंशत: वित्तपोषित किया जाता है
4	**खंड 5.1.6** यह नीति उन परियोजनाओं पर लागू होगी जहां लौह एवं इस्पात उत्पादों का खरीद मूल्य 25 करोड़ रुपए से अधिक होता हो। यह नीति अन्य खरीद (गैर परियोजना) के लिए भी लागू होगी जहां उस सरकारी संगठन के लिए लौह एवं इस्पात उत्पादों का वार्षिक खरीद मूल्य 25 करोड़ रुपए से अधिक होता हो।	**खंड 5.1.6** यह नीति उन परियोजनाओं पर लागू होगी जहां लौह एवं इस्पात उत्पादों (डीएमआई एंड एसपी नीति का परिशिष्ट-क) का खरीद मूल्य 5लाख रुपए से अधिक होता हो। यह नीति अन्य खरीद (गैर परियोजना) के लिए भी लागू होगी जहां उस सरकारी संगठन के लिए लौह एवं इस्पात उत्पादों का वार्षिक खरीद मूल्य 5 लाख करोड़ रुपए से अधिक होता हो। तथापि, प्रापण इकाइयों द्वारा इस बात को सुनिश्चित किया जाएगा कि इस नीति के प्रावधानों से बचने के प्रयोजनार्थ खरीद का विभाजन न किया जाए।
5	**खंड 7.2** घरेलू मूल्यवर्धन निवल बिक्री कीमत (निवल घरेलू करों और शुल्कों को छोड़कर बीजककीमत) होगी जिसमें से प्रतिशत में निवल बिक्री कीमत के एक अनुपात केरूप में भारत में निर्माण करने वाले संयंत्र में आयात की गई इनपुट सामग्री की पहुंच लागत (सभी सीमा शुल्कों को शामिल करते हुए) घटाई जायेगी।	**खंड 7.2** घरेलू मूल्यवर्धन का तात्पर्य है- भारत में वर्धित मूल्य की राशि जो खरीदी/बेची जाने वाली वस्तुओं का कुल मूल्य होगा (निवल घरेलू अप्रत्यक्ष करों को छोडकर)- खरीदी/बेची जाने वाली वस्तुओं के कुल मूल्य के समानुपात के रूप में प्रतिशत में मद में आयातित सामग्री का मूल्य (सभी सीमा शुल्कों सहित)।
6	**खंड 7.3** यह सिफारिश की जाती है कि निविदा की प्रक्रिया में भाग लेने वाले प्रत्येक बोली लगाने वाले को नीचे दिए गए सूत्र का उपयोग करते हुए घरेलू मूल्यवर्धन की गणना करनी चाहिए ताकि यह सुनिश्चित किया जा सके कि दावा किये गये घरेलू मूल्यवर्धन इस नीति के न्यूनतम निर्धारित घरेलू मूल्यवर्धन के अनुरूप है। **लौह एवं इस्पात उत्पादों के लिए** **% घरेलू मूल्यवर्धन** अंतिम उत्पाद की निवल बिक्री कीमत- संयंत्र में आयात किये गये लौह अथवा इस्पात की पहुंच लागत----------X100%	**खंड 7.3** यह सिफारिश की जाती है कि प्रापण करने वाली सरकारी एजेंसी/ निविदा की प्रक्रिया में भाग लेने वाले प्रत्येक बोली लगाने वाले को नीचे दिए गए सूत्र का उपयोग करते हुए घरेलू मूल्यवर्धन की गणना करनी चाहिए ताकि यह सुनिश्चित किया जा सके कि दावा किये गये घरेलू मूल्यवर्धन इस नीति के न्यूनतम निर्धारित घरेलू मूल्यवर्धन के अनुरूप है। **लौह एवं इस्पात उत्पादों तथा पूंजीगत माल के लिए** **% घरेलू मूल्यवर्धन** खरीदी/बेची जाने वाली वस्तु का कुल मूल्य (निवल घरेलू अप्रत्यक्ष करों को छोड़कर - मद में आयातित सामग्री का मूल्य (सभी सीमा शुल्कों सहित) ---------X100%

	अंतिम उत्पाद की निवल ब्रिकी कीमत **पूंजीगत माल के लिए** **% घरेलू मूल्यवर्धन** अंतिम उत्पाद की निवल ब्रिकी कीमत- संयंत्र में आयात किये गये इनपुट सामग्री की पहुंच लागत----------X 100% अंतिम उत्पाद की निवल ब्रिकी कीमत	खरीदी/बेची जाने वाली वस्तु का कुल मूल्य

II डीएमआईएंडएसपी परिशोधित, 2019 के परिशिष्ट क में निम्नलिखित संशोधन किया जाता है:- जहां कहीं न्यूनतम घरेलू मूल्य वर्धन आवश्यकता कॉलम के अंतर्गत डीएमआईएंडएसपी परिशोधित, 2019 के परिशिष्ट क में 15% का न्यूनतम घरेलू मूल्य वर्धन विनिर्दिष्ट होगा, वहां उसे 20% न्यूनतम घरेलू मूल्यवर्धन से प्रतिस्थापित कर दिया जाएगा (परिशोधित परिशिष्ट-क संलग्न है)

III– परिवर्धन/सन्निवेशन: तालिका 2

क्रम सं	डीएमआईएंडएसपी परिशोधित, 2019 में शामिल/जोड़े गये खंड
1	**खण्ड 5.1.13 को खण्ड 5.1.12 के नीचे निम्नवत जोड़ा जाता है:** खण्ड 5.1.13: लोहे और इस्पात उत्पादों की खरीद से संबंधित निविदाओं के लिए कोई वैश्विक निविदा इन्क्वायरी (जीटीई) आमंत्रित नहीं की जाएगी (डीएमआईऔर एसपीनीति का परिशिष्ट-क)। लोहे और इस्पात उत्पादों के विनिर्माण जिनका अनुमानित मूल्य 200 करोड़ रु तक हो, (डीएमआई और एसपी नीति के परिशिष्ट- ख) के लिए पूंजीगत सामानों की खरीद से संबंधित निविदाओं के लिए कोई वैश्विक निविदा इन्क्वायरी (जीटीई) व्यय विभाग द्वारा यथा नाम-निर्दिष्ट सक्षम प्राधिकारी के अनुमोदन के अलावा आमंत्रित नहीं की जाएगी,
2	खंड6.9 को खंड 6.8 के नीचे निम्नवत जोड़ा जाता है: **खंड 6.9: निविदाओं और अन्य खरीद अधियाचनों में विनिर्देशन:** **6.9.1** प्रत्येक क्रय इकाई यह सुनिश्चित करेगी कि किसी भी निविदा या अधियाचन में निर्धारित पिछले अनुभव के संबंध में पात्रता की शर्तों हेतु अन्य देशों में आपूर्ति के प्रमाण या निर्यात के प्रमाण की आवश्यकता नहीं है। **6.9.2** क्रय इकाइयाँ यह देखने का प्रयास करेंगी कि पात्रता की शर्तें, जैसे टर्नओवर, उत्पादन क्षमता और वित्तीय ताकत जैसे मामलों में वैसे स्थानीय आपूर्तिकर्ता का अनुचित अपवर्जन नहीं होता है 'जो आपूर्तिकर्ता की गुणवत्ता या साख संबंधी पात्रता सुनिश्चित करने के लिए जो आवश्यक है, उससे परे अन्यथा पात्र होंगे। **6.9.3** क्रय इकाइयाँ, इस नीति के जारी होने के 2 महीने के भीतर ऊपर उप-पैराग्राफ 6.9.1 और 6.9.2 के संदर्भ में सभी मौजूदा पात्रता मानदंडों और शर्तों की समीक्षा करेंगी। **6.9.4** यदि इस्पात मंत्रालय इस बात से संतुष्ट है कि लौह और इस्पात उत्पादों के भारतीय आपूर्तिकर्ताओं को प्रतिबंधात्मक निविदा शर्तों के कारण किसी भी विदेशी सरकार द्वारा खरीद में भाग लेने और / या प्रतिस्पर्धा करने की अनुमति नहीं है, जिसका भारतीय कंपनियों को प्रतिबंधित करने पर प्रत्यक्ष या अप्रत्यक्ष प्रभाव पड़ता है, जैसे कि प्रापण देश में पंजीकरण, प्रापण देश इत्यादि में विशिष्ट मूल्य की परियोजना का निष्पादन इत्यादि। यदि उपयुक्त समझा जाएगा तो उस देश के बोलीदाताओं को इस्पात मंत्रालय से संबंधित उस वस्तु तथा/ या अन्य वस्तुओं की खरीद के लिए पात्रता से प्रतिबंधित या अपवर्जित किया जा सकता है। **6.9.5** ऊपर उप-पैरा 6.9.4 के प्रयोजन से, किसी आपूर्तिकर्ता या बोलीदाता को उस देश से माना जाएगा यदि (i) इकाई को उस देश में निगमित किया गया है, या (ii) उसकीशेयरधारिता या इकाई काप्रभावी नियंत्रण उस देश से किया जाता है; या (iii) आपूर्ति की जा रही वस्तु के मूल्य का 50% से अधिक उस देश में शामिल किया गया है। भारतीय आपूर्तिकर्ताओं का अर्थ उन संस्थाओं से होगा जो भारत के संबंध में इनमें से किसी भी मानदंड को पूरा करते हैं। किसी देश की'इकाई'(एन्टिटी) शब्द का अर्थ वहीं होगा जो डीपीआईआईटी की एफडीआई नीति के तहत समय-समय पर यथा संशोधित के अंतर्गत है।

3	खंड 6.10 कोखंड 6.9 के नीचे निम्नवत जोड़ा जाता है: **खंड 6.10:** यदि घरेलू आपूर्तिकर्ताओं के खिलाफ प्रतिबंधात्मक या भेदभावपूर्ण शर्तों को बोली दस्तावेजों में शामिल किया जाता है, तो उस के लिए जिम्मेदारी तय करने के लिए खरीद (इसके प्रशासनिक नियंत्रणाधीन किसी ईकाई द्वारा खरीद सहित) करने वाले प्रशासनिक विभाग द्वारा जांच शुरू की जाएगी। तत्पश्चात, संबंधित प्रावधानों के तहत खरीद संस्थाओं के अधिकारियों के खिलाफ उचित, प्रशासनिक या अन्यथा कार्रवाई की जाएगी। ऐसी सभी कार्रवाई की सूचना डीएमआई और एसपी नीति के तहत स्थायी समिति को भेजी जाएगी।

संशोधित परिशिष्ट क – घरेलू स्तर पर निर्मित उत्पादों के लिए विशिष्ट रूप से

क्र. सं.	लौह एवं इस्पात उत्पादों की सांकेतिक सूची	लागू एच एस कोड	न्यूनतम घरेलू मूल्यवर्धन आवश्यकता
1	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, हॉट रोल्ड, न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7208	50%
2	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, कोल्ड रोल्ड (कोल्ड - कम किया हुआ), न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7209	50%
3	600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7210	50%
4	600 मि. मी. से कम की चौड़ाई वाले लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, न ढका हुआ, प्लेट लगाया हुआ अथवा कोट किया हुआ	7211	35%
5	600 मि. मी. कम की चौड़ाई का लौह अथवा गैर एलॉय इस्पात का फ्लेट रोल उत्पाद, ढका हुआ, प्लेट लगाया हुआ अथवा कोड किया हुआ	7212	35%
6	लौह एवं गैर एलॉय इस्पात का अनियमित रूप से ऐंठा हुआ क्वाइल में बार्स और रॉड, हॉट रोल्ड	7213	35%
7	लौह अथवा गैर एलॉय इस्पात के अन्य बार्स और रॉड्स जिसे फोर्ज किए जाने की तुलना में आगे अधिक वर्क नहीं किया हुआ, हॉट रोल्ड, हॉट ड्रॉन अथवा हॉट एक्सटूडेड परंतु रोलिंग के बाद उसे टिविस्ट किये जाने सहित	7214	35%
8	लौह अथवा गैर एलॉय इस्पात का अन्य बार्स एंड रोड्स	7215	35%
9	लौह अथवा गैर एलॉय इस्पात का एंगल, शेप और सेक्शन्स	7216	35%
10	लौह अथवा गैर एलॉय इस्पात का तार	7217	50%
11	600 मि. मी. अथवा उससे अधिक की चौड़ाई का स्टेनलैस इस्पातका फ्लेट रोल्ड इस्पात	7219	50%
12	600 मि. मी. से कम की चौड़ाई का स्टेनलैस इस्पातका फ्लेट रोल्ड इस्पात	7220	50%
13	स्टेनलैस स्टील का अन्य बार्स और रोड्स; स्टेनलैस स्टील का एंगल शेप और सेक्शन्स	7222	50%
14	अन्य एलॉय इस्पात का तार	7229	35%
15	लौह अथवा इस्पात को रेल, रेलवे अथवा ट्रामवे ट्रेक निर्माण सामग्री	7302	50%

16	कास्ट लौह का ट्यूब, पाइप और होलो पाइप	7303	35%
17	लौह (कास्ट आयरन को छोड़कर) अथवा इस्पात का ट्यूब पाइप और होलो प्रोफाइल, सीमलैस	7304	35%
18	लौह अथवा इस्पात का सर्कुलर क्रॉस सेक्शन वाले अन्य ट्यूब और पाइप (उदाहरण के लिए, वेल्ड किया हुआ, रिवेट किया हुआ अथवा समान रूप से बंद किया गया हुआ), जिसकी बाहरी त्रिज्या 406.4 मि. मी. से अधिक हो	7305	35%
19	लौह अथवा इस्पात के अन्य ट्यूब, पाइप और होलो प्रोफाइल (उदाहरण के लिएओपन सीन अथवावेल्ड किया हुआ, रिवेट किया हुआ अथवा समान रूप से बंद किया गया हुआ)	7306	35%
20	लौह अथवा इस्पात का ट्यूब अथवा पाइप फिटिंग (उदाहरण के लिए, कनेक्टर/ कप्लिंग, एल्बो स्लीव्स)	7307	35%
21	स्टेनलैस स्टील का अनियमित रूप से ऐंठा हुआ क्वाइल में बार्स और रॉड, हॉट रोल्ड	7221	35%
22	स्टेनलैस स्टील का वायर	7223	35%
23	इलेक्ट्रिकल स्टील सहित 600 मि. मी. अथवा उससे अधिक की चौड़ाई वाले अन्य एलॉय स्टील का फ्लेट रोल्ड इस्पात	7225	35%
24	इलेक्ट्रिकल स्टील सहित 600 मि. मी. से कम की चौड़ाई वाले अन्य एलॉय स्टील का फ्लेट रोल्ड इस्पात	7226	35%
25	अन्य एलॉय स्टील का अनियमित रूप से ऐंठा हुआ क्वाइल में बार्स और रोड, हॉट रोल्ड	7227	20%
26	अन्य एलॉय स्टील का अन्य बार्स और रोड्स; अन्य एलॉय स्टील का एंगल, शेप्स और सेक्शन्स; एलॉय अथवा नॉन एलॉय स्टील का होलो ड्रील बार्स और रोड्स	7228	35%
27	लौह अथवा इस्पात की शीट पाइलिंग, चाहे ड्रील किया हुआ हो अथवा नहीं, चाहे पंच किया हुआ हो अथवा नहीं, चाहे असेम्बल किये हुए तत्वों से बना हुआ हो अथवा नहीं; लौह अथवा इस्पात का वेल्ड किया हुआ एंगल, शेप और सेक्शन्स	7301	20%
28	स्ट्रक्चर्स (9406 के शीर्ष का प्रीफेबरिकेटिड भवनों को छोड़कर) और स्ट्रक्चर्स का हिस्सा	7308	20%
29	300 से अधिक क्षमता का लौह अथवा इस्पात का किसी सामग्री (कम्प्रेस किए हुए अथवा सरलीकृत गैस को छोड़कर) के लिए भंडार, टैंक, वैट और समान कन्टेनर चाहे उसे लाइन किया गया हो अथवा नहीं या उसे हीट से इन्सुलेट किया गया हो अथवा नहीं लेकिन यांत्रिक अथवा तापीय उपक्रम से युक्त न हो	7309	20%
30	अधिकतक 300 लीटर की क्षमता का लौह अथवा इस्पात का किसी सामग्री (कम्प्रेस किए हुए अथवा सरलीकृत गैस को छोड़कर) के लिए टैंक, कास्ट, ड्रम, केन, बॉक्स और समान कन्टेनर चाहे उसे लाइन किया गया हो अथवा नहीं या उसे हीट से इन्सुलेट किया गया हो अथवा नहीं लेकिन यांत्रिक अथवा तापीय उपक्रम से युक्त न हो	7310	20%
31	लौह अथवा इस्पात का कम्प्रेस किया हुआ अथवा सरलीकृत गैस के लिए कन्टेनर	7311	20%

32	लौह अथवा इस्पात का स्टेंडिड वायर, रोप, केबल, प्लेटिड बैंड, स्लिंग और उसके समान वस्तु जिसे विद्युतीय रूप से इन्सुलेट न किया गया	7312	20%
33	लौह अथवा इस्पात का फेनसिंग के लिए उपयोग किये जाने वाला बार किया हुआ वायर; ट्विस्ट किया हुआ हूप अथवा सिंगल फ्लेट वायर, बार्स किया हुआ अथवा नहीं और लूज तरीके से ट्विस्ट किया हुआ डबल वायर	7313	20%
34	लौह अथवा इस्पात तार का ड्रील, नेटिंग और फेनसिंग; लौह अथवा इस्पात का विस्तार किया हुआ धातु	7314	20%
35	लौह अथवा इस्पात का चैन और उसका हिस्सा	7315	20%
36	लौह अथवा इस्पात का टैंकर, ग्रेपनेल्स और उसका हिस्सा	7316	20%
37	लौह एवं इस्पात की वस्तुएं	7317	20%
38	लौह एवं इस्पात की वस्तुएं	7318	20%
39	लौह एवं इस्पात की वस्तुएं	7319	20%
40	लौह अथवा इस्पात का स्प्रिंग और स्प्रिंग के लिए लीव्स	7320	20%
41	लौह अथवा इस्पात का स्टोव्स, रेंज, ग्रेड, कूकर (केंद्रीय हिटिंग के लिए सहायक बायलरों के साथ उन वस्तुओं सहित), बारबेक्यूज, ब्रेजियर्स, गैस रिंग, प्लेट वामर्स और समान गैर-विद्युतीय घरेलू उपकरण और उसका हिस्सा	7321	20%
42	लौह अथवा इस्पात का केंद्रीय हिटिंग के लिए रेडियेटर जिसे विद्युतीय रूप से हीट न किया गया हो और उसका हिस्सा; लौह अथवा इस्पात का हेयर हीटर और हॉट एयर वितरक जिसे विद्युतीय रूप से हीट न किया गया हो, फेन अथवा ब्लोअर जो मोटर से चलती हो और उसके हिस्से को शामिल करते हुए	7322	20%
43	लौह अथवा इस्पात का टेबल और समान घरेलू वस्तुएं और उसका हिस्सा	7323	20%
44	लौह अथवा इस्पात का सेनेटरी वेयर और उसकेपार्टस	7324	20%
45	लौह अथवा इस्पात का अन्य कास्ट सामान	7325	20%
46	लौह अथवा इस्पात का विद्युतीय इस्पात और अन्य वस्तु	7326	20%
47	रेलवे अथवा ट्रामवे पेसेंजर कोच जो स्वयं आगे नहीं बढ़ता हो	8605	50%
48	रेलवे अथवा ट्रामवे माल वेन और वेगेन जो स्वयं आगे नहीं बढ़ता हो	8606	50%
49	रेलवे अथवा ट्रामवे लोकोमोटिव का हिस्सा अथवा रोलिंग स्टॉक जैसे बोगिज, बिसल बोगिज, एक्सेल और फोज्ड किया हुआ पहिया और उसका हिस्सा	8607	50%

विवरणों में शामिल किए गए उत्पाद सांकेतिक हैं, विनिर्दिष्ट एच एस कोड के अंतर्गत सभी उत्पादों को परिशिष्ट के भाग के रूप में शामिल किया गया है।"

[फा. सं. एस-13026/1/2020-आईडीडी]

रसिका चौबे, अपर सचिव

MINISTRY OF STEEL

NOTIFICATION

New Delhi, the 31st December, 2020

G.S.R. 1(E).—The amendments in the Policy for providing preference to domestically manufactured Iron & Steel products in Government procurement (DMI&SP Policy)–Revised, 2019 is hereby published for general information.

"No. S-13026/1/2020- IDD

Ministry of Steel

ID Division

Udyog Bhawan,

New Delhi 31st December, 2020

Sub.: Amendments / additions to the Policy for Providing Preference to Domestically Manufactured Iron & Steel Products in Government Procurement - revised, 2019

The following amendments / additions to the Policy for Providing Preference to Domestically Manufactured Iron & Steel Products in Government Procurement - revised, 2019 (DMI&SP revised, 2019) are applicable with immediate effect. These amendments / additions shall not apply to any tender or procurement for which notice inviting tender or other form of procurement solicitation has been issued before the issue of this notification.

I - Amendments: Table 1

Sl. No.	Existing Clause in DMI&SP revised, 2019	Amended Clause in DMI&SP revised, 2019
1	**Clause 1.3:** The policy is applicable to every Ministry or Department of Government and all agencies/entities under their administrative control and to projects funded by these agencies for purchase of iron & steel products for government projects. However, this policy shall not apply for purchase of iron & steel products with a view to commercial resale or with a view to use in the production of goods for commercial sale.	**Clause 1.3:** The policy is applicable to every Ministry or Department of Government and all agencies/entities under their administrative control and to projects funded by these agencies for purchase of iron & steel products for government projects. All Central Sector Schemes (CS)/Centrally Sponsored Schemes (CSS) for which procurement is made by States and Local Bodies, would come within the purview of this Policy, if that project / scheme is fully / partly funded by Government of India. However, this policy shall not apply for purchase of iron & steel products with a view to commercial resale or with a view to use in the production of goods for commercial sale.
2	**Clause 2.13:** Domestic value addition shall be the net selling price (invoiced price excluding net domestic taxes and duties) minus the landed cost of imported input materials at the manufacturing plant in India (including all customs duties) as a proportion of the net selling price, in percent. The 'domestic value addition' definition shall be in line with the DPIIT(formerly DIPP) guidelines, and shall be suitably amended in case of any changes by DPIIT in the future. For the purpose of this policy document, domestic value addition and local content have been used interchangeably.	**Clause 2.13:** Domestic value addition means - amount of value added in India which shall be the total value of the item to be procured / sold (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value of the item to be procured / sold, in percent. The 'domestic value addition' definition shall be in line with the DPIIT (formerly DIPP) guidelines, and shall be suitably amended in case of any changes by DPIIT in the future. For the purpose of this policy document, domestic value addition and local content have been used interchangeably.

3	**Clause 5.1.5** The policy is applicable to all projects funded by Ministry or Department of Government and all agencies/ entities under their administrative control for purchase of iron & steel products.	**Clause 5.1.5:** The policy is applicable to all projects funded by Ministry or Department of Government and all agencies/ entities under their administrative control for purchase of iron & steel products. All Central Sector Schemes (CS)/Centrally Sponsored Schemes (CSS) for which procurement is made by States and Local Bodies, would come within the purview of this Policy, if that project / scheme is fully / partly funded by Government of India.
4	**Clause 5.1.6:** The policy shall be applicable to projects where the procurement value of iron and steel products is greater than Rs. 25 crores. The policy shall also be applicable for other procurement (non-project), where annual procurement value of iron and steel products for that Government organization is greater than Rs. 25 crores.	**Clause 5.1.6** The policy shall be applicable to projects where the procurement value of iron and steel products (Appendix - A of the DMI&SP Policy) is greater than Rs. 5 lakhs. The policy shall also be applicable for other procurements (non-project), where annual procurement value of iron and steel products for that Government organization is greater than Rs. 5 lakhs. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this policy.
5	**Clause 7.2:** Domestic value addition shall be the net selling price (invoiced price excluding net domestic taxes and duties) minus the landed cost of imported input materials at the manufacturing plant in India (including all customs duties) as a proportion of the net selling price, in per cent.	**Clause 7.2:** Domestic value addition means - amount of value added in India which shall be the total value of the item to be procured / sold (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value of the item to be procured / sold, in percent.
6	**Clause 7.3:** It is recommended that each bidder participating in the tender process should calculate the domestic value addition using the below formula below so as to ensure the domestic value addition claimed is consistent with the minimum stipulated domestic value addition requirement of the policy. **For iron and steel products** **% domestic value addition** *Net selling price of final product - landed cost of imported iron or steel at the plant* ---------- *X 100 %* *Net selling price of final product* **For capital goods** **% domestic value addition** *Net selling price of final product - landed cost of imported iron or steel at the plant* ---------- *X 100 %* *Net selling price of final product*	**Clause 7.3:** It is recommended that procuring Government agency / bidder participating in the tender process should calculate the domestic value addition using the below formula so as to ensure that the domestic value addition claimed is consistent with the minimum stipulated domestic value addition requirement of the policy. **For iron and steel products& capital goods** **% domestic value addition** *Total value of the item to be procured / sold (excluding net domestic indirect taxes) - the value of imported content in the item (including all customs duties)* ---------- *X 100 %* *Total value of the item to be procured / sold*

II - Following amendment is made to the Appendix A of the DMI&SP revised, 2019 :- Wherever minimum domestic value addition of **15%** is specified in the Appendix - A of the DMI&SP revised, 2019 under the column Minimum domestic value addition requirement, same shall be replaced with **20%** minimum domestic value addition). (Revised Appendix - A is attached)

III - Additions / Insertions: Table 2

Sl. No.	Added / Inserted Clause in DMI&SP revised, 2019
1	Clause 5.1.13 is inserted below Clause 5.1.12 as: **Clause 5.1.13:** No Global Tender Enquiry (GTE) shall be invited for tenders related to procurement of iron and steel products (Appendix-A of the DMI&SP Policy). No Global Tender Enquiry (GTE) shall be invited for tenders related to procurement of Capital Goods for manufacturing iron & steel products (Appendix- B of the DMI&SP Policy) having estimated value upto Rs. 200 Crore except with the approval of competent authority as designated by Department of Expenditure.
2	Clause 6.9 is inserted below Clause 6.8 as: **Clause 6.9: Specifications in Tenders and other procurement solicitations:** **6.9.1** Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports. **6.9.2** Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier. **6.9.3** Procuring entities shall, within 2 months of the issue of this policy review all existing eligibility norms and conditions with reference to sub-paragraphs 6.9.1 and 6.9.2 above. **6.9.4** If Ministry of Steel is satisfied that Indian suppliers of iron and steel products are not allowed to participate and/ or compete in procurement by any foreign government due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of project of specific value in the procuring country etc., it may, if deemed appropriate, restrict or exclude bidders from that country from eligibility for procurement of that item and/ or other items relating to Ministry of Steel. **6.9.5** For the purpose of sub-paragraph 6.9.4 above, a supplier or bidder shall be considered to be from a country if (i) the entity is incorporated in that country, or (ii) a majority of its shareholding or effective control of the entity is exercised from that country; or (iii) more than 50% of the value of the item being supplied has been added in that country. Indian suppliers shall mean those entities which meet any of these tests with respect to India. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.
3	Clause 6.10 is inserted below Clause 6.9 as: **Clause 6.10:** In case restrictive or discriminatory conditions against domestic suppliers are included in bid documents, an inquiry shall be conducted by the Administrative Department undertaking the procurement (including procurement by any entity under its administrative control) to fix responsibility for same. Thereafter, appropriate action, administrative or otherwise, shall be taken against erring officials of procurement entities under relevant provisions. Intimation on all such action shall be sent to the Standing Committee under the DMI&SP Policy.

IV - Revised Appendix A - Exclusive for domestically manufactured products

Sl. No	Indicative list of Iron & Steel Products	Applicable HS code	Minimum domestic value addition requirement
1	Flat-rolled products of iron or non alloy steel, of a width of 600 mm or more, hot rolled, not clad, plated or coated	7208	50%
2	Flat-rolled products of iron or non alloy steel, of a width of 600	7209	50%

	mm or more, cold rolled (cold-reduced), not clad, plated or coated		
3	Flat-rolled products of iron or non alloy steel, of a width of 600 mm or more, clad, plated or coated	7210	50%
4	Flat-rolled products of iron or non alloy steel, of a width of less than 600 mm, not clad, plated or coated	7211	35%
5	Flat-rolled products of iron or non alloy steel, of a width of less than 600 mm, clad, plated or coated	7212	35%
6	Bars and rods, hot-rolled, in irregularly wound coils, of iron or non-alloy steel	7213	35%
7	Other bars and rods of iron or non alloy steel, not further worked than forged, hot rolled, hot-drawn or hot-extruded, but including those twisted after rolling	7214	35%
8	Other bars and rods of iron or non alloy steel	7215	35%
9	Angles, shapes and sections of iron or non-alloy steel	7216	35%
10	Wire of iron or non-alloy steel	7217	50%
11	Flat-rolled products of stainless steel, of a width of 600 mm or more	7219	50%
12	Flat-rolled products of stainless steel, of a width of less than 600 mm	7220	50%
13	Other bars and rods of stainless steel; angles, shapes and sections of stainless steel	7222	50%
14	Wire of other alloy steel	7229	35%
15	Rails, railway or tramway track construction material of iron or steel	7302	50%
16	Tubes, pipes and hollow profiles, of cast iron	7303	35%
17	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel	7304	35%
18	Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406.4 mm, of iron or steel	7305	35%
19	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel	7306	35%
20	Tube or pipe fittings (for example, connectors/couplings, elbow sleeves), of iron or steel	7307	35%
21	Bars and rods, hot-rolled, in irregularly wound coils, of stainless steel	7221	35%
22	Wire of stainless steel	7223	35%
23	Flat-rolled products of other alloy steel, of a width of 600 mm or more, including electrical steel	7225	35%
24	Flat-rolled products of other alloy steel, of a width of less than 600 mm, including electrical steel	7226	35%
25	Bars and rods, hot-rolled, in irregularly wound coils, of other alloy steel	7227	20%

26	Other bars and rods of other alloy steel; angles, shapes and sections, of other alloy steel; hollow drill bars and rods, of alloy or nonalloy steel	7228	35%
27	Sheet piling of iron or steel, whether or not drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel	7301	20%
28	Structures (excluding prefabricated buildings of heading 9406) and parts of structures	7308	20%
29	Reservoirs, tanks, vats and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 whether or not lined or heatinsulated, but not fitted with mechanical or Thermal equipment	7309	20%
30	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 L, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	7310	20%
31	Containers for compressed or liquefied gas, of iron or steel	7311	20%
32	Stranded wire, ropes, cables, plaited bands, slings and the like, of iron or steel, not electrically insulated	7312	20%
33	Barbed wire of iron or steel; twisted hoop or single flat wire, barbed or not, and loosely twisted double wire, of a kind used for fencing, of iron or steel	7313	20%
34	Grill, netting and fencing, of iron or steel wire; expanded metal of iron or steel	7314	20%
35	Chain and parts thereof, of iron or steel	7315	20%
36	Anchors, grapnels and parts thereof, of iron or steel	7316	20%
37	Articles of iron and steel	7317	20%
38	Articles of iron and steel	7318	20%
39	Articles of iron and steel	7319	20%
40	Springs and leaves for springs, of iron or steel	7320	20%
41	Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel	7321	20%
42	Radiators for central heating, not electrically heated, and parts thereof, of iron or steel; air heaters and hot air distributors, not electrically heated, incorporating a motor-driven fan or blower, and parts thereof, of iron or steel	7322	20%
43	Tables and similar household articles and parts thereof, of iron or steel	7323	20%
44	Sanitary ware and parts thereof, of iron or steel	7324	20%
45	Other cast articles of iron or steel	7325	20%

46	Electrical steel and other articles of iron or steel	7326	20%
47	Railway or tramway passenger coaches, not self-propelled	8605	50%
48	Railway or tramway goods vans and wagons, not self-propelled	8606	50%
49	Parts of railway or tramway locomotives or rolling-stock, such as bogies, bissel-bogies, axles and forged wheels, and parts thereof	8607	50%

Products included in descriptions are indicative; all products under the specified HS codes are included as part of the appendix."

[F. No. S-13026/1/2020-IDD]

RASIKA CHAUBE, Addl. Secy.

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Annexure-1 to Appendix-II

POLICY FOR PROVIDING PREFERENCE TO DOMESTICALLY MANUFACTURED IRON & STEEL PRODUCTS IN GOVERNMENT PROCUREMENT (TO BE SUBMITTED ON BIDDER'S LETTERHEAD) SELF-CERTIFICATE

To,
M/s Talcher Fertilizers Limited

_____

SUB:
TENDER NO:

Dear Sir,

This has reference to "Policy for providing Preference to Domestically Manufactured Iron & Steel Products in Government Procurement" issued by Ministry of Steel, Govt. of India, vide their revised notification "The Gazette of India, Notification No. 385 (E) dated 29.05.2019".

We confirm that we will obtain Affidavit of Self Certification of Domestic value addition in Iron & Steel Products from manufacturer before supply of iron and steel products required under the tender/bidding document.

Sign & Stamp of bidder

SECTION-III

INSTRUCTION TO BIDDERS

[TO BE READ IN CONJUNCTION WITH BIDDING DATA SHEET (BDS)]

SECTION-III

INSTRUCTION TO BIDDERS

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5. Annexure-V : PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA), ORDER 2017
: **FORM-I OF ANNEXURE-V** : Certificate from Statutory Auditor or Cost Auditor of the company (in the case of companies) or from a Practicing Cost Accountant or Practicing Chartered Accountant (in respect of suppliers other than companies)
: **FORM-II OF ANNEXURE-V**: Salient points of Public Procurement (Preference to Make in India) Policy.

6. Annexure-VI : PREAMBLE TO SCHEDULE OF RATES

7. Annexure-VII**:** PROVISION FOR PROCUREMENT FROM A BIDDER WHICH SHARES A LAND BORDER WITH INDIA

: **Form-I to Annexure-VII**: Undertaking on Letter Head

INSTRUCTION TO BIDDERS [ITB]

(TO BE READ IN CONJUNCTION WITH BIDDING DATA SHEET (BDS)

[A] – GENERAL

1 SCOPE OF BID

1.1 The Employer as defined in the "General Conditions of Contract [GCC]", wishes to receive Bids as described in the Invitation For Bid (the **"Tender Document /Bid Document")** issued by Employer. Employer/Owner/TFL occurring herein under shall be considered synonymous.

1.2 SCOPE OF BID: The scope of work/ Services shall be as defined in Section-VI of the Tender documents.

1.3 The successful bidder will be expected to complete the scope of Bid within the period stated in Special Conditions of Contract.

1.4 Throughout the Tender Documents, the terms 'Bid', 'Tender' & 'Offer' and their derivatives [Bidder/Tenderer, Bid/Tender/Offer etc.] are synonymous. Further, 'Day' means 'Calendar Day' and 'Singular' also means 'Plural'.

2 ELIGIBLE BIDDERS

2.1 Provision for procurement from a bidder which shares a land border with India has been attached as **Annexure-VII** herewith.

2.2 The Bidder shall not be under a declaration of ineligibility by Employer for Corrupt/ Fraudulent/ Collusive/ Coercive practices, as defined in "Instructions to Bidders [ITB], Clause No. 39" (Action in case Corrupt/ Fraudulent/ Collusive/ Coercive Practices).

2.3 The Bidder is not put on 'Holiday' by TFL or any of the JV partner of OWNER (viz. GAIL, RCF, CIL) or Public-Sector Project Management Consultant (like PDIL,EIL, MECON only due to "poor performance" or "corrupt and fraudulent practices") or banned/blacklisted by Government department/ Public Sector on due date of submission of bid. Further, neither bidder nor their allied agency/(ies) (as defined in the Procedure for Action in case of Corrupt/Fraudulent/Collusive/ Coercive Practices)are on banning list of TFL or any of the JV partner of OWNER viz. GAIL, RCF, CIL.

If the Bidding documents were issued inadvertently/ downloaded from website, offers submitted by such bidders shall not be considered for opening/ evaluation/Award and will be returned immediately to such bidders.

In case there is any change in status of the declaration prior to award of contract, the same has to be promptly informed to TFL/PDIL by the bidder.

It shall be the sole responsibility of the bidder to inform about their status regarding para 1 of clause 2.2 herein above on due date of submission of bid and during the course of finalization of the tender. Concealment of the facts shall tantamount to misrepresentation of facts and shall lead to action against such Bidders as per clause 39 of ITB.

2.4 The Bidder should not be under any liquidation court receivership or similar proceedings on due date of submission of bid. In case there is any change in status of the declaration prior to award of contract, the same has to be promptly informed to TFL/PDIL by the bidder.

It shall be the sole responsibility of the bidder to inform TFL there status on above on due date of submission of bid and during the course of finalization of the tender. Concealment of the facts shall tantamount to misrepresentation of facts and shall lead to action against such Bidders as per clause no. 39 of ITB.

2.5 Bidder shall not be affiliated with a firm or entity:

(i) that has provided consulting services related to the work to the Employer during the preparatory stages of the work or of the project of which the works/services forms a part of or
(ii) that has been hired (proposed to be hired) by the Employer as an Engineer/ Consultant for the contract.

2.6 Neither the firm/entity appointed as the Project Management Consultant (PMC) for a contract nor its affiliates/ JV'S/ Subsidiaries shall be allowed to participate in the tendering process unless it is the sole Licensor/Licensor nominated agent/ vendor.

2.7 Pursuant to qualification criteria set forth in the bidding document, the Bidder shall furnish all necessary supporting documentary evidence to establish Bidder's claim of meeting qualification criteria.

2.8 **Power of Attorney:**

Power of Attorney (PoA) to be issued by the bidder in favour of the authorised employee(s),in respect of the particular tender, for purpose of signing the documents including bid, all subsequent communications, agreements, documents etc. pertaining to the tender and act and take any and all decision on behalf of the bidder (including Consortium). Any consequence resulting due to such signing shall be binding on the Bidder (including Consortium).

(I) In case of a Single Bidder, the Power of Attorney shall be issued as per the constitution of the bidder as below:

a) **In case of Proprietorship**: By Proprietor
b) **In case of Partnership**: by all Partners or Managing Partner.
c) **In case of Limited Liability Partnership**: by any bidder's employee authorized in terms of Deed of LLP.
d) **In case of Public /Limited Company**: PoA in favour of authorized employee(s) by Board of Directors through Board Resolution or by the designated officer authorized by Board to do so. Such Board Resolution should be duly countersigned by Company Secretary / MD / CMD / CEO.

The Power of Attorney should be valid till award of contract/order to successful bidder.

(II) In case of a Consortium, Power of Attorney shall be issued both by Leader as well as Consortium Member(s) of the Consortium as per procedure defined herein above in favour of employee of Leader of Consortium.

3 BIDS FROM "CONSORTIUM"/"JOINT VENTURES"

Not Applicable for this tender.

4 ONE BID PER BIDDER

4.1 A Bidder shall submit only 'one [01] Bid' in the same Bidding Process either as single entity or as a member of any consortium (wherever consortium bid is allowed). A Bidder who submits or participates in more than 'one [01] Bid' will cause all the proposals in which the Bidder has participated to be disqualified.

4.2 A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices. The bidder found to have a conflict of interest shall be disqualified. A bidder shall be considered to have a conflict of interest with one or more bidders in this bidding process, if:

a) they have controlling partner (s) in common; or
b) they receive or have received any direct or indirect subsidy/ financial stake from any of them; or
c) they have the same legal representative/authorized signatory/agent for purposes of this bid; or
d) they have relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder; or
e) Bidder participates in more than one bid in bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all bids in which the parties are involved. However, this does not limit the inclusion of the components/ sub-assembly/ Assemblies from one bidding manufacturer in more than one bid.
f) a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid;
g) In case of a holding company having more than one independently manufacturing units, or more than one unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidders must proactively declare such sister/ common business/ management units in same/ similar line of business.

Failure to comply this clause during tendering process will disqualify all such bidders from process of evaluation of bids.

4.3 Alternative Bids shall not be considered.

4.4 The provisions mentioned at sl. no. 4.1 and 4.2 shall not be applicable wherein bidders are quoting for different Items / Sections / Parts / Groups/ SOR items of the same tender which specifies evaluation on Items / Sections / Parts / Groups/ SOR items basis.

5 COST OF BIDDING

The Bidder shall bear all costs associated with the preparation and submission of the Bid including but not limited to Documentation Charges, Bank charges all courier charges translation charges, authentication charges and any associated charges including taxes & duties thereon. Further, TFL/PDIL will in no case, be responsible or liable for these costs, regardless of the outcome of the bidding process.

6 SITE VISIT

6.1 The Bidder is advised to visit and examine the site of works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the required job. The costs of visiting the site shall be borne by the Bidder.

6.2 The Bidder or any of its personnel or agents shall be granted permission by the Employer to enter upon its premises and land for the purpose of such visits, but only upon the express conditions that the Bidder, its personnel and agents will release and indemnify the Employer and its personnel, agents from and against all liabilities in respect thereof, and will be responsible for death or injury, loss or damage to property, and any other loss, damage, costs, and expenses incurred as a result of inspection.

6.3 The Bidder shall not be entitled to hold any claim against TALCHER FERTILIZERS LIMITED for non-compliance due to lack of any kind of pre-requisite information as it is the sole responsibility of the Bidder to obtain all the necessary information with regard to site, surrounding, working conditions, weather etc. on its own before submission of the bid.

[B] –BIDDING DOCUMENTS

7 CONTENTS OF BIDDING DOCUMENTS

7.1 The contents of Bidding Documents /Tender documents are those stated below, and should be read in conjunction with any 'Addendum / Corrigendum and Clarification(s)' issued in accordance with "ITB: Clause-8 & 9":

- Section-I : Invitation for Bid [IFB]
- Section-II : BID EVALUATION CRITERIA [BEC] & Evaluation methodology
- Section-III : Instructions to Bidders [ITB], Annexure, Forms & Formats
- Section-IV : General Conditions of Contract [GCC]
- Section-V : Special Conditions of Contract [SCC]
- Section-VI : Scope of Work & Technical Specifications
- Section-VII : Price Schedule/ Schedule of Rates

*'Request for Quotation', wherever applicable, shall also form part of the Bidding document.

For participation in e-tender, instructions are mentioned at Annexure-III to Section-III of tender.

7.2 The Bidder is expected to examine all instructions, forms, terms & conditions in the Bidding Documents. The "Request for Quotation [RFQ] & Invitation for Bid (IFB)" together with all its attachments thereto, shall be considered to be read, understood and accepted by the Bidders. Failure to furnish all information required by the Bidding Documents or submission of a Bid not substantially responsive to the Bidding Documents in every respect will be at Bidder's risk and may result in the rejection of his Bid.

8 CLARIFICATION OF TENDER DOCUMENTS

8.1 A prospective Bidder requiring any clarification(s) of the Bidding Documents may notify TFL in writing or through CPP Portal (https://eprocure.gov.in/eprocure/app)or email at PDIL's mailing address indicated in the BDS no later than 02 (two) days prior to pre-bid meeting (in cases where pre-bid meeting is scheduled) or 05 (five) days prior to the due date of submission of bid in cases where pre-bid meeting is not scheduled. TFL/PDIL reserves the right to ignore the bidders request for clarification if received after the aforesaid period. TFL/PDIL may respond in writing to the request for clarification. TFL/PDIL's response including an explanation of the query, but without identifying the source of the query will be uploaded on the websites mentioned at Clause No. 2.0 (G) of IFB. Hence, bidders are requested to regularly visit the said websites for updates.

8.2 Any clarification or information required by the Bidder but same not received by the Employer at clause 8.1 (refer BDS for address) above is liable to be considered as "no clarification / information required".

9 AMENDMENT OF BIDDING DOCUMENTS

9.1 At any time prior to the 'Bid Due Date', Employer for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by addenda / corrigendum.

9.2 Any corrigendum thus issued shall be integral part of the Tender Document and shall be hosted only on the websites as provided at clause no. 2.0 (G) of IFB. Bidders, in their own interest, are advised to regularly check the websites for any amendment/Corrigendum/Addendum. Bidders have to take into account all such amendment / corrigendum before submitting their Bid.TFL/PDIL will not take any responsibility or entertain any representation whatsoever, in case bidders have not checked/seen/downloaded such amendment/Corrigendum/Addendum or reply to pre-bid queries uploaded on the said websites.

9.3 The Employer, if it considers necessary, may extend the Bid Due Date in order to allow the Bidders a reasonable time to furnish their most competitive bid taking into account the addenda / corrigendum issued thereof.

[C] – PREPARATION OF BIDS

10 LANGUAGE OF BID:

The bid prepared by the Bidder and all correspondence, drawing(s), document(s), certificate(s) etc. relating to the Bid exchanged by Bidder and TFL shall be written in English language only. In case a document, certificate, printed literature etc. furnished by the Bidder in a language other than English, the same should be accompanied by an English translation duly authenticated by the Indian Chamber of Commerce , in which case, for the purpose of interpretation of the Bid, the English translation shall govern.

11. DOCUMENTS COMPRISING THE BID

11.1 Bidders are requested to refer instructions for participating in e-Tendering (Annexure-I to Section III of tender), Ready Reckoner for Bidders and FAQs available in e-portaland bids submitted manually shall be rejected. All pages of the Bid must be digitally signed by the "authorized signatory" of the Bidder holding Power of Attorney. The bids must be submitted on e-tendering website of CPP portal (https://eprocure.gov.in/eprocure/app) comprising following documents:-

11.1.1 **PART-I: "TECHNO-COMMERCIAL / UN-PRICED BID"** shall contain the following:

(a) 'Covering Letter' on Bidder's 'Letterhead' clearly specifying the enclosed Contents with index
(b) 'Bidder's General Information', as per 'Form F-1'.
(c) Copies of documents, as specified in tender document
(d) Copy of Schedule of Rates (SOR) with prices blanked out mentioning quoted / not quoted (as applicable) written against each item as a confirmation that the prices are quoted in requisite format .
(e) 'Letter of Authority' on the Letter Head, as per 'Form F-3'
(f) 'Agreed Terms and Conditions', as per 'Form F-5'
(g) 'ACKNOWLEDGEMENT CUM CONSENT LETTER', as per 'Form F-6'
(h) Duly attested documents in accordance with the "BID EVALUATION CRITERIA [BEC]" establishing the qualification.
(i) Copy of Power of Attorney as per 'F-20'/copy of Board Resolution, in favour of the authorized signatory of the Bid, as per clause no. 2.8 of ITB (Original to be submitted physically).
(j) Copy of EMD / Declaration for Bid Security in original as per Clause 16 of ITB (Original to be submitted physically)
(k) Undertaking as per Form-2 to Annexure-V to Section-III and Certification from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of other than companies) as per Form-3 to Annexure-V to Section-III (Applicable for all bidders irrespective of seeking purchase preference or not).
(l) Undertaking as per Form-I to Annexure VII regarding Provisions for Procurement from a bidder which shares a land border with India.
(m) All forms and Formats including Annexures
(n) 'Integrity Pact' as per 'Form F-14'
(o) 'Indemnity Bond' as per 'Form F-15'

(p) Checklist for Bid Evaluation Criteria (BEC) qualifying documents for bidder as per 'Form F-8A & F-8B

(q) Tender Document, its Corrigendum/Amendment/Clarification(s) duly signed on each page (in case of manual tendering)/ digitally signed (in case of e-Tender) by the Authorized Signatory holding POA.

(r) Additional document specified in BDS, SCC, Scope of Supply or mentioned elsewhere in the Tender Document, its Corrigendum/Amendment/Clarification(s).

(s) Any other information/details required as per Tender Document

Note:

1. All the pages of the Bid must be signed/ digitally signed by the "Authorized Signatory" of the Bidder holding POA.

11.1.2 PART-II: Price Bid

The Prices are to be filled strictly in the Schedule of Rate of the bidding documents and provision mentioned at para 11.1.2 hereinabove and to uploaded in SOR attachment/Conditions of CPP portal.

11.2 "TECHNO-COMMERCIAL/UN-PRICED BID" comprising all the above documents mentioned at 11.1.1 along with copy of EMD/Bid Security, copy of Power of Attorney and copy of integrity pact should be uploaded in the CPP portal. Further, Bidders must submit the original " EMD, Power of Attorney, Integrity Pact (wherever applicable) and any other documents specified in the Tender Document to the address mentioned in IFB, in a sealed envelope, superscribing the details of Tender Document (i.e. tender number & tender for) within 7 days from the date of un-priced bid opening.

Bidders are required to submit the EMD in original by Due Date and Time of Bid Submission or upload a scanned copy of the same in the Part-I of the Bid. If the Bidder is unable to submit EMD in original by Due Date and Time of Bid Submission, the Bidder is required to upload a scanned copy of the EMD in Part-I of Bid, provided the original EMD, copy of which has been uploaded, is received within 7 days from the Due Date of Bid Opening, failing which the Bid will be rejected irrespective of their status/ranking in tendering process and notwithstanding the fact that a copy of EMD was earlier uploaded by the Bidder.

11.3 In case of bids invited under *single bid system*, a single envelope containing all documents specified at Clause 11.1.1 & 11.1.2 of ITB above form the BID. All corresponding conditions specified at Clause 11.1.1 & 11.1.2 of ITB shall become applicable in such a case.

12 BID PRICES

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole works as described in Bidding Documents, based on the rates and prices submitted by the Bidder and accepted by the Employer. The prices quoted by the Bidders will be inclusive of all taxes except **GST (CGST & SGST/UTGST or IGST)**.Applicable rate of **GST (CGST & SGST/ UTGST or IGST)** on the contract value shall be indicated in SOR under column for GST.

12.2 Prices must be filled in format for "Schedule of Rates [SOR] " enclosed as part of Tender document. If quoted in separate typed sheets and any variation in item description, unit or quantity is noticed; the Bid is liable to be rejected.

12.3 Bidder shall quote for all the items of "SOR" after careful analysis of cost involved for the performance of the completed item considering all parts of the Bidding Document. In case any activity though specifically not covered in description of item under "SOR" but is required to complete the works as per Specifications, Scope of Work / Service, Standards, General Conditions of Contract ("GCC"), Special Conditions of Contract ("SCC") or any other part of Bidding Document, the prices quoted shall deemed to be inclusive of cost incurred for such activity.

12.4 All duties, taxes and other levies [if any] payable by the Contractor under the Contract, or for any other cause except final **GST (CGST & SGST/ UTGST or IGST)** shall be included in the rates / prices and the total bid-price submitted by the Bidder.

12.5 Prices quoted by the Bidder, shall remain firm and fixed and valid till completion of the Contract and will not be subject to variation on any account unless any price escalation/variation is allowed elsewhere in Tender Document.

12.6 Bidder shall also mention the **Service Accounting Codes** (SAC) / **Harmonized System of Nomenclature (HSN)** at the designated place in Techno-Commercial / Un-Priced bid.

13 GST (CGST & SGST/ UTGST or IGST)

13.1 Bidders are required to submit a copy of the GST Registration Certificate, while submitting the bids wherever **GST(CGST & SGST/UTGST or IGST)** is applicable

13.2 Quoted prices should be inclusive of all taxes and duties, except **GST (CGST & SGST or IGST or UTGST)**. Please note that the responsibility of payment of **GST (CGST & SGST or IGST or UTGST)** lies with the Contractor only. Contractor providing taxable service shall issue an e- Invoice/ Invoice / Bill, as the case may be as per rules/ regulation of GST. Further, returns and details required to be filled under GST laws & rules should be timely filed by Contractor with requisite details.

Payments to Contractor for claiming **GST (CGST & SGST/UTGST or IGST)** amount will be made provided the above formalities are fulfilled. Further, TFL may seek copies of challan and certificate from Chartered Accountant for deposit of **GST (CGST & SGST/UTGST or IGST)** collected from Owner.

13.3 In case CBIC (Central Board of Indirect Taxes and Customs)/ any tax authority / any equivalent Government agency brings to the notice of TFL that the Contractor has not remitted the amount towards **GST (CGST & SGST/UTGST or IGST)** collected from TFL to the government exchequer, then, that Contractor shall be put under Holiday list of TFL for period of six months after following the due procedure. This action will be in addition to the right of recovery of financial implication arising on TFL.

13.4 For statutory variation in **GST (CGST & SGST/UTGST or IGST), please refer clause no. 13.0 of SCC (Section V of NIT)**

13.5 Where TFL is entitled to avail the input tax credit of **GST (CGST & SGST/UTGST or IGST)**:-

13.5.1 Owner/TFL will reimburse the **GST (CGST & SGST/UTGST or IGST)** to the Contractor at actuals against submission of E-Invoices/Invoices as per format specified in rules/ regulation of GST, to enable Owner/TFL to claim input tax credit of **GST (CGST & SGST/UTGST or IGST)** paid. In case of any variation in the executed quantities, the amount on which the **GST (CGST & SGST/UTGST or IGST)** is applicable shall be modified in same proportion. Returns and details required to be filled under GST laws & rules should be timely filed by supplier with requisite details.

13.6 Where TFL is not entitled to avail/take the full input tax credit of **GST (CGST & SGST/UTGST or IGST)**:

13.6.1 Owner/TFL will reimburse **GST (CGST & SGST/UTGST or IGST)** to the Contractor at actuals against submission of E-Invoices/Invoices as per format specified in rules/ regulation of GST subject to the ceiling amount of **GST (CGST & SGST/UTGST or IGST)** as quoted by the bidder, subject to any statutory variations, except variations arising due to change in turnover. In case of any variation in the executed quantities (If directed and/or certified by the Engineer-In-Charge) the ceiling amount on which **GST (CGST & SGST/UTGST or IGST)** is applicable will be modified on pro-rata basis.

13.7 TFL will prefer to deal with registered supplier of goods/ services under GST. Therefore, bidders are requested to get themselves registered under GST, it not registered yet.

However, in case any unregistered bidder is submitting their bid, Bids will be evaluated as per quoted prices without loading of **GST (CGST & SGST/UTGST or IGST)**, if not quoted. their prices will be loaded with applicable GST (CGST & SGST/UTGST or IGST) while evaluation of bid (if applicable as per Govt. Act/ Law in vogue). Where TFL is entitled for input credit of **GST (CGST & SGST/UTGST or IGST)**, the same will be considered for evaluation of bid as per evaluation methodology of tender document. Further, an unregistered bidder is required to mention its Income Tax PAN in bid document.

13.8 In case TFL is required to pay entire/certain portion of applicable **GST (CGST & SGST/UTGST or IGST)** and remaining portion, if any, is to be deposited by Bidder directly as per **GST (CGST & SGST/UTGST or IGST)** laws, entire applicable rate/amount of **GST (CGST & SGST/UTGST or IGST)** to be indicated by bidder in the SOR.

Where TFL has the obligation to discharge **GST (CGST & SGST/UTGST or IGST)** liability under reverse charge mechanism and TFL has paid or is /liable to pay **GST (CGST & SGST/UTGST or IGST)** to the Government on which interest or penalties becomes payable as per GST laws for any reason which is not attributable to TFL or ITC with respect to such payments is not available to TFL for any reason which is not attributable to TFL, then TFL shall be entitled to deduct/ setoff / recover such amounts against any amounts paid or payable by TFL to Contractor /Supplier.

13.9 Contractor shall ensure timely submission of correct invoice(s)/e-invoice(s), as per GST rules/ regulation, with all required supporting document(s) within a period specified in Contract to enable TFL to avail input credit of GST (CGST & SGST/UTGST or IGST). Further, returns and details required to be filled under GST laws & rules should be timely filed by Contractor with requisite details.

If input tax credit is not available to TFL for any reason not attributable to TFL, then TFL shall not be obligated or liable to pay or reimburse GST (CGST & SGST/UTGST or IGST) claimed in the invoice(s) and shall be entitled to deduct/ setoff/ recover such GST amount (CGST & SGST/UTGST or IGST) or Input Tax Credit amount together with penalties and interest, if any, against any amounts paid or becomes payable by TFL in future to the Contractor under this contract or under any other contract

13.10 **Anti-profiteering clause**

As per Clause 171 of GST Act it is mandatory to pass on the benefit due to reduction in rate of tax or from input tax credit to the consumer by way of commensurate reduction in prices. The Contractor may note the above and quote their prices accordingly.

13.11 In case the GST rating of Contractor on the GST portal / Govt. official website is negative / black listed, then the bids may be rejected by TFL. Further, in case rating of bidder is negative / black listed after award of work, then TFL shall not be obligated or liable to pay or reimburse GST to such Contractor and shall also be entitled to deduct / recover such GST along with all penalties / interest, if any, incurred by TFL.

13.12 GST (CGST & SGST/UTGST or IGST) is implemented w.e.f. 01.07.2017 which subsumed various indirect taxes and duties applicable before 01.07.2017. Accordingly, the provisions of General Condition of Contract relating to taxes and duties which are subsumed in GST are modified to aforesaid provisions mentioned in clause no. 12 and 13 of ITB.

13.13 GST, as quoted by the bidder in Schedule of Rates, shall be deemed as final and binding for the purpose of bid evaluation (applicable for tenders where bidder quotes the GST rates). In case a bidder enters “zero/blank” GST or an erroneous GST, the bid evaluation for finalizing the L1 bidder will be done considering the “Zero” or quoted GST rate GST rate, as the case may be. No request for change in GST will be entertained after submission of bids. In case GST column is left blank in the SOR, the quoted prices shall be considered as “Inclusive of GST” and evaluation shall be done accordingly.

In cases where the successful bidder quotes a wrong GST rate, for releasing the order, the following methodology will be followed:

- In case the actual GST rate applicable is lower than the quoted GST rate, the actual GST rate will be added to the quoted basic prices. The final cash outflow will be based on actual GST rate.

- In case the actual GST rate applicable is more than the quoted GST rate, the basic prices quoted will be reduced proportionately, keeping the final cash outflow the same as the overall quoted amount.

Based on the Total Cash Outflow calculated as above, TFL shall place orders.

13.14 Wherever TDS under GST Laws has been deducted from the invoices raised / payments made to the Contractors, as per the provisions of the GST law / Rules, Contractors should accept the corresponding GST-TDS amount populated in the relevant screen on GST common portal (www.gst.gov.in). Further, Vendors should also download the GST TDS certificate from GST common portal (reference path: Services>User Services> View/Download Certificates option).

13.15 **Provision w.r.t. E- Invoicing requirement as per GST laws:** Supplier who is required to comply with the requirements of E-invoice for B2B transactions as per the requirement of GST Law will ensure the compliance of requirement of E Invoicing under GST law. If the invoice issued without following this process, such invoice can-not be processed for payment by TFL as no ITC is allowed on such invoices.

Therefore, all the payments to such supplier who is liable to comply with e-invoice as per GST Laws shall be made against the proper e-invoice(s) only. Further, returns and details required to be filled under GST laws & rules against such e-invoices should be timely filed by Supplier of Goods with requisite details.

If input tax credit is not available to TFL for any reason attributable to supplier (both for E-invoicing cases and non-E-invoicing cases), then TFL shall not be obligated or liable to pay or reimburse GST (CGST & SGST/UTGST or IGST) claimed in the invoice(s) and shall be entitled to deduct / setoff / recover such GST amount (CGST & SGST/UTGST or IGST) or Input Tax Credit amount together with penalties and interest, if any, by adjusting against any amounts paid or becomes payable in future to the contractor under this contract or under any other supplier .

To ensure compliance, undertaking in requisite format is to be submitted by supplier as per format enclosed at Form F-21 along with documents for release of payment.

13.16 **New Taxes & duties:** Any new taxes & duties, if imposed by the State/ Central Govt. of India after the due date of bid submission but before the Contractual Completion Date, shall be reimbursed to the Service Provider on submission of copy of notification(s) issued from State/ Central Govt. Authorities along with documentary evidence for proof of payment of such taxes & duties, but only after ascertaining it's applicability with respect to the Contract.

13.17 Full payment including GST will be released at the time of processing of invoice for payment, where the GST amount reflects in Form GSTR-2A of TFL. However, in case where the GST amount doesn't reflect in Form GSTR-2A of TFL, the amount of GST will be released after reflection of GST amount of corresponding invoice in Form GSTR-2A of TFL.

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14 BID CURRENCIES:

Bidders must submit bid in Indian Rupees only.

15 BID VALIDITY

15.1 Bids shall be kept valid for period specified in BDS from the final Due date of submission of bid'. A Bid valid for a shorter period may be rejected by TFL as 'non-responsive'.

15.2 In exceptional circumstances, prior to expiry of the original 'Bid Validity Period', the Employer may request the Bidders to extend the 'Period of Bid Validity' for a specified additional period. The request and the responses thereto shall be made in writing or by email. A Bidder may refuse the request without forfeiture of his EMD / Bid Security.

A Bidder agreeing to the request will not be required or permitted to modify his Bid, but will be required to extend the validity of its EMD for the period of the extension and in accordance with "ITB: Clause-16" in all respects.

16 EARNEST MONEY DEPOSIT

16.1 Bid must be accompanied with earnest money (i.e. Earnest Money Deposit (EMD)also known as Bid Security) in the form of '**Demand Draft' / 'Banker's Cheque' / 'Insurance Surety Bond' / 'Fixed Deposit Receipt'** [in favour of **Talcher Fertilizers Limited** payable at place mentioned in BDS] or 'Bank Guarantee' strictly as per the format given in form F-2A (as the case may be) of the Tender Document. Bidder shall ensure that EMD submitted in the form of 'Bank Guarantee' should have a validity of at least "two [02] months" beyond the validity of the Bid. EMD submitted in the form of 'Demand Draft' or 'Banker's Cheque' should be valid for three months.

Bid not accompanied with EMD, or EMD not in requisite format shall be liable for rejection. The EMD shall be submitted in Indian Rupees only.

16.2 The bidder can also submit the EMD through online banking transaction i.e. IMPS/NEFT/RTGS etc. For this purpose, the details of TFL's Bank Account are mentioned under BDS. While remitting, the bidder must indicate EMD and tender/E-tender no. under remarks. Bidders shall be required to submit/ upload the successful transaction details along-with their bid/e-bid in addition to forwarding the details to dealing officer through email/letter with tender reference number immediately after remittance of EMD. In absence of submitting/ uploading the remittance details, the bid is likely to be considered as bid not accompanied with EMD. Further, in case of the online transaction, submission of EMD in original is not applicable.

16.3 OWNER shall not be liable to pay any documentation charges, Bank charges, commission, interest etc. on the amount of EMD. In case EMD is in the form of a "Bank Guarantee", the same shall be from any Indian scheduled Bank (excluding Co-operative banks and Regional Rural bank) or a branch of an International Bank situated in India and registered with "Reserve Bank of India" as Scheduled Foreign Bank. However, in case of „Bank Guarantee" from Banks other than the Nationalized Indian Banks, the Bank must be commercial Bank having networth in excess of Rs. 100 Crores [Rupees One Hundred Crores] and a declaration to this effect should be made by such commercial Bank either in the "Bank Guarantee" itself or separately on its letterhead. Purchaser will verify the BG from issuing bank.

16.4 Any Bid not secured in accordance with "ITB: Clause-16.1 & Clause-16.3" may be rejected by TFL as non-responsive.

16.5 Unsuccessful Bidder's EMD will be discharged/ returned as promptly as possible, but not later than" thirty [30] days" after finalization of tendering process.

16.6 The successful Bidder's EMD will be discharged upon the Bidder's acknowledging the "Award" and signing the "Agreement" (if applicable) and furnishing the Contract Performance Security (CPS)/ Security Deposit" pursuant to clause no. 38 of ITB.

16.7 Notwithstanding anything contained herein, the EMD may also be forfeited in any of the following cases:

(a) If a Bidder withdraws his Bid during the "Period of Bid Validity"
(b) If a Bidder has indulged in corrupt/fraudulent /collusive/coercive practice
(c) If the Bidder modifies Bid during the period of bid validity (after Due Date and Time for Bid Submission).
(d) Violates any other condition, mentioned elsewhere in the Tender Document, which may lead to forfeiture of EMD.
(e) In case of Cartelization of bid.
(f) In the case of a successful Bidder, if the Bidder fails to:
(i) to acknowledge receipt of the "Notification of Award" / Fax of Acceptance[FOA] / Detailed Letter of Acceptance [DLOA]",
(ii) to furnish "Contract Performance Security / Security Deposit", in accordance with "ITB: Clause-38".

16.8 In case EMD is in the form of „Bank Guarantee", the same must indicate the Tender Document No. and the name of Tender Document for which the Bidder is quoting. This is essential to have proper correlation at a later date.

16.9 MSEs (Micro & Small Enterprises) are exempted from submission of EMD in accordance with the provisions of PPP-2012 and Clause 40 of ITB. However, Traders/Dealers/ Distributors /Stockiest /Wholesaler are not entitled for exemption of EMD. The Government Departments/PSUs are also exempted from the payment of EMD. Further, Startups are also exempted from the payment of EMD.

16.10 In case of forfeiture of EMD/ Bid Security, the forfeited amount will be considered inclusive of tax and tax invoice will be issued by TFL. The forfeiture amount will be subject to final decision of TFL based on other terms and conditions of order/contract.

16.11 EMD/Bid Bond will not be accepted in case the same has reference of 'remitter'/'financer' other than bidder on the aforementioned financial instrument of EMD/ Bid Bond submitted by the bidder and bid of such bidder will be summarily rejected.

16.A **DECLARATION FOR BID SECURITY**

MSEs (Micro & Small Enterprises), Start-ups and CPSEs (to whom exemption is allowed as per extant guidelines in vogue) are required to submit, "DECLARATION FOR BID SECURITY" as per prescribed format (F-2B).

17 PRE-BID MEETING (IF APPLICABLE)

17.1 The Bidder(s) or his designated representative are invited to attend a "Pre-Bid Meeting" which will be held at address specified in IFB. It is expected that a bidder shall not depute more than 02 representatives for the meeting.

17.2 Purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage and give hands-on e-tendering.

17.3 Text of the questions raised and the responses given, together with any responses prepared after the meeting, will be uploaded on Central Public Procurement (CPP) Portal (https://eprocure.gov.in/eprocure/app) websites. Any modification of the Contents of Bidding Documents listed in "ITB: Clause-7.1", that may become necessary as a result of the Pre-Bid Meeting shall be made by the Employer exclusively through the issue of an Corrigendum pursuant to "ITB: Clause-9", and not through the minutes of the Pre-Bid Meeting.

17.4 Non-attendance of the Pre-Bid Meeting will not be a cause for disqualification of Bidder.

18 FORMAT AND SIGNING OF BID

18.1 The original and all copies of the Bid shall be typed or written in indelible ink [in the case of copies, photocopies are also acceptable] and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder (as per POA). The name and position held by each person signing, must be typed or printed below the signature. All pages of the Bid except for unamendable printed literature where entry(s) or amendment(s) have been made shall be initialed by the person or persons signing the Bid.

18.2 The Bid shall contain no alterations, omissions, or additions, unless such corrections are initialed by the person or persons signing the Bid.

18.3 In case of e-tendering, digitally Digitally signed documents to be uploaded as detailed in addendum to ITB (Annexure-III of Section –III).

19 ZERO DEVIATION AND REJECTION CRITERIA

19.1 ZERO DEVIATION: Deviation to terms and conditions of "Bidding Documents" may lead to rejection of bid. TFL will accept bids based on terms & conditions of "Bidding Documents" only. Bidder may note TFL will determine the substantial responsiveness of each bid to the Tender documents pursuant to provision contained in clause 29 of ITB. For purpose of this, a substantially responsive bid is one which conforms to all terms and conditions of the Bidding documents without deviations or reservations. TFL's determination of a bid's responsiveness is based on the content of the bid itself without recourse to extrinsic evidence.

Bidder is requested not to take any deviation(s)/exception(s) to the terms & conditions of Tender Document, and submit all requisite documents as mentioned in this Tender Document, failing which their Bid will be liable for rejection. If a Bidder does not reply to the queries in the permitted time frame then its Bid shall be evaluated based on the documents available in the Bid.

As a principle, clarifications from bidders after opening of tenders will not be sought. However, where clarifications / documents from the bidders on important aspects are absolutely necessary for finalization of tender, clarifications from bidder can be asked. The request for clarification shall be given in email/portal, asking the bidder to respond by a specified date, and also mentioning therein that, if the bidder does not comply or respond by the date, his tender will be liable to be rejected. Depending on the outcome, such tenders are to be ignored or considered further. No change in prices or substance of the bid including specifications shall be offered or permitted. No post-bid clarification at the initiative of the bidder shall be entertained. The shortfall information/ documents should be sought only in case of historical documents which pre-existed bids and which have not undergone change since then.

19.2 **REJECTION CRITERIA:** Notwithstanding the above, deviation to the following clauses of Tender document shall lead to summarily rejection of Bid:

a) Bidder not meeting Bid Evaluation Criteria as per Tender Document
b) Firm Price
c) EMD / Declaration for Bid Security (as applicable)
d) Specifications &Scope of Work
e) Schedule of Rates / Price Schedule / Price Basis
f) Duration / Period of Contract/ Completion Period
g) Payment Terms
h) Period of Validity of Bid
i) Integrity Pact
j) Mutually Agreed Damages
k) Overall ceiling on total liability
l) Contract Performance Security
m) Guarantee / Defect Liability Period
n) Arbitration / Settlement of Dispute
o) Governing laws, language & measures
p) Force Majeure
q) Undertaking forms, Form I of Annexure VII for provision for procurement from a bidder which shares a land border with India
r) Bidder quoting less than 20% as minimum Local content (as per make in India PPLC policy)
s) Any other condition specifically mentioned in the tender document elsewhere that non-compliance of the clause lead to rejection of bid

Note: Further, it is once again reminded not to mention any condition in the Bid which is contradictory to the terms and conditions of Tender document.

20 E-PAYMENT

OWNER has initiated payments to Contractors electronically, and to facilitate the payments electronically through **'e-banking'.**

[D] – SUBMISSION OF BIDS

21 SUBMISSION, SEALING AND MARKING OF BIDS

21.1 In case of e-tendering, bids shall be submitted through e-tender in the manner specified elsewhere in tender document. No Manual/ Hard Copy (Original) offer shall be acceptable. Physical documents shall be addressed to the owner at address specified in IFB.

21.2 Deleted

21.3 Bids submitted under the name of AGENT/ REPRESENTATIVE /RETAINER/ ASSOCIATE etc. on behalf of a bidder/affiliate shall not be accepted.

22 DEADLINE FOR SUBMISSION OF BIDS

22.1 In case of e-bidding, the bids must be submitted through e-tender mode not later than the date and time specified in the tender document/BDS (Bidding Data Sheet).

22.2 Deleted.

22.3 TFL may, in exceptional circumstances and at its discretion, extend the deadline for submission of Bids (clause 8 and/or 9 of ITB refers). In which case all rights and obligations of TFL and the Bidders, previously subject to the original deadline will thereafter be subject to the deadline as extended Notice for extension of due date of submission of bid will be uploaded on website only as mentioned in Clause No. 2.0(G) of IFB.

23 LATE BIDS

23.1 Any bids received after the notified date and time of closing of tenders will be treated as late bids.

23.2 In case of e-tendering, e-tendering system of CPP Portal (eprocure.gov.in) shall close immediately after the due date for submission of bid and no bids can be submitted thereafter.

23.3 Physical documents received to address other than one specifically stipulated in the Tender Document will not be considered for evaluation/opening/award if not received to the specified destination within stipulated date & time.

23.4 Unsolicited Bids or Bids received to address other than one specifically stipulated in the tender document will not be considered for evaluation/opening/award if not received to the specified destination within stipulated date & time.

24 MODIFICATION AND WITHDRAWAL OF BIDS

24.1 Modification and withdrawal of bids shall be as follows:-

24.1.1 IN CASE OF E- TENDERING

The bidder may withdraw or modify its bid after bid submission but before the due date and time for submission as per tender document.

24.1.2 IN CASE OF MANUAL BIDDING

Deleted.

[E] – BID OPENING AND EVALUATION

25 EMPLOYER'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS

25.1 TFL reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder(s) or any obligations to inform the affected Bidder(s) of the ground for TFL's action. However, Bidder if so desire may seek the reason (in writing) for rejection of their Bid to which TFL shall respond quickly.

25.2 A bidder is to be permitted to send his representation in writing to dealing officer specified in tender for rejection of bid. But, such representation has to be sent upto 10(ten) days from the date of Notification of Award/FOA. A decision on representation will be taken by TFL within 15 (fifteen) days of the receipt of the representation. Only a directly affected bidder can represent in this regard:

i) Only a bidder who has participated in tender can make such representation

ii) In case technical bid has been evaluated before the opening of the financial bid, an application for review in relation to the financial bid may be filed only by a bidder whose technical bid is found to be acceptable

25.3 However, following decisions of TFL shall not be subject to review:

a) Determination of the need for procurement;
b) Selection of the mode of procurement or bidding system;
c) Choice of selection procedure;
d) Provisions limiting participation of bidders in the procurement process;
e) The decision to enter into negotiations with the L1 bidder;
f) Cancellation of the procurement process except where it is intended to subsequently re-tender the same requirements;
g) Issues related to ambiguity in contract terms may not be taken up after a contract has been signed, all such issues should be highlighted before consummation of the contract by the vendor/ contractor; and
h) Complaints against specifications except under the premise that they are either vague or too specific so as to limit competition may be permissible.

26 BID OPENING

26.1 Unpriced Bid Opening:

TFL/PDIL will open the price bids of those Bidders who meet the qualification requirement and whose bid is determined to be technically and commercially responsive. Techno-commercial bid evaluation status will be are to be informed to all bidders (including informing the techno-commercially not qualified Bidders). Price bids are to be opened in the presence of only techno-commercially acceptable bidders, who are willing to attend the bid opening, at a pre-publicised date, time and place or on the portal in case of e-procurement. The bidder's name, bid price, discount (if any) and any such details considered appropriate shall be read out during the price bid opening. Offers should not, repeat not, be circulated amongst the bidder's representative. Bidders selected for opening of their price bid shall be informed about the date & time of price bid opening. Bidders may depute their authorized representative to witness the price bid opening. The Bidders' representatives, who are present shall sign a Price Bid Opening Register evidencing their attendance and may be required to be present even on a short notice.

26.2 Priced Bid Opening:

26.2.1 TFL will open the price bids of those bidders who meet the qualification requirement and whose bids is determined to be technically and commercially responsive. Bidders selected for opening of their price bids shall be informed about the date of price bid opening.

Bidders may depute their authorized representative to attend the bid opening. The bidders' representatives, who are present shall sign a register evidencing their attendance and may be required to be present even on a short notice.

26.2.2 The price bids of those Bidders who were not found to be techno-commercially responsive shall not be opened.

In case of bids invited under the single bid system, bid shall be opened on the specified date & time.

26.3 Reverse Auction

Shall be intimated later

27 CONFIDENTIALITY

Information relating to the examination, clarification, evaluation and comparison of bids, and recommendations for the award of a contract, shall not be disclosed to bidders or any other person not officially concerned with such a process until the award to the successful bidder.

28 CONTACTING THE EMPLOYER

28.1 From the time of bid opening to the time of contract award, no bidder shall contact TFL on any matter related to the bid, except on request and prior written permission.

28.2 Any effort by the bidder to influence TFL in bid evaluation, bid comparison or contract award decisions will vitiate the process and will result in the rejection of the bidder's bid and action shall be initiated as per the TFL's procedure for action in case Corrupt / Fraudulent / Collusive / Coercive practices in this regard apart from forfeiture of EMD/ Bid Security, if any.

29 EXAMINATION OF BIDS AND DETERMINATION OF RESPONSIVENESS

29.1 The employer's determination of a bid's responsiveness is based on the content of the bid only. Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid:

(a) Meets the "Bid Evaluation Criteria" of the Bidding Documents ;
(b) Has been properly signed;
(c) Is accompanied by the required 'Earnest Money / Bid Security / Bid Security Declaration'
(d) Is substantially responsive to the requirements of the Bidding Documents ; and
(d) Provides any clarification and/or substantiation that the Employer may require to determine responsiveness pursuant to "ITB: Clause-29.2"

29.2 A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bidding Documents without material deviations or reservations or omissions for this purpose employer defines the foregoing terms below:

a) "Deviation" is departure from the requirement specified in the tender documents.
b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirement in the tender documents.
c) "Omission" is the failure to submit part or all of the information or documentation required in the tender document for evaluation of bid.

29.3 A material deviation, reservation or omission is one that,

a) If accepted would,
   i) Affect in any substantial way the scope, quality, or performance of the job as specified in tender documents.
   ii) Limit, in any substantial way, inconsistent with the Tender Document, the Employer's rights or the tenderer's obligations under the proposed Contract.
b) If rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

29.4 The employer shall examine all aspects of the bid to confirm that all requirements have been met without any material deviation, reservation or omission.

29.5 Tenders that do not meet the basic requirements specified in the bid documents are to be treated as unresponsive {both during Techno-commercial evaluation and Financial Evaluation in case of Two Bid System) and will be ignored. All tenders received will first be scrutinized to see whether the tenders meet the basic requirements as incorporated in the Bid document and to identify unresponsive tenders, if any. Unresponsive offers may not subsequently be made responsive by correction or withdrawal of the non- conforming stipulation. Some important points on the basis of which a tender may be declared as unresponsive and be ignored during the initial scrutiny are :

i) The tender is not in the prescribed format or is unsigned or not signed as per the stipulations in the bid document;

ii) The required EMD has not been provided or exemption from EMD is claimed without acceptable proof of exemption;
iii) The bidder is not eligible to participate in the bid as per laid down eligibility criteria
iv) The bid departs from the essential requirements specified in the bidding document (for example, the tenderer has not agreed to give the required contract performance security); or
v) Against a schedule in the list of requirements in the tender enquiry, the tenderer has not quoted for the entire requirement as specified in that schedule (example: in a schedule, it has been stipulated that the tenderer will supply the equipment, install and commission it and also train the TFL's personnel for operating the equipment. The tenderer has, however, quoted only for supply of the equipment).

30 CORRECTION OF ERRORS-

Not Applicable.

31 CONVERSION TO SINGLE CURRENCY FOR COMPARISON OF BIDS

Not Applicable. All bids submitted must be in the currency specified at clause 14 of ITB.

32 EVALUATION AND COMPARISON OF BIDS

Bid shall be evaluated as per evaluation criteria mentioned in Section-II of bidding documents on lowest bid basis.

In case of a tie at the lowest bid (L1) position between two or more bidders, the order/LoA will be placed on the bidder who has higher/ highest turnover in last audited financial year.

In case there is a tie at the lowest bid (L1) position between only startup bidders and none of them has past turnover, the order/FOA will be placed on the startup who is registered earlier with Department for Promotion of Industry and Internal Trade (wherever applicable).

33 COMPENSATION FOR EXTENDED STAY [FOR APPLICABILITY OF THIS CLAUSE REFER BDS]:

Not Applicable

34 PURCHASE PREFERENCE

Purchase Preference as per Policy to Provide Purchase Preference as per Public Procurement (Preference to Make in India), Order 2017 Domestically Manufactured Telecom Products (DMTP) shall be allowed as per Government instructions in vogue, as applicable from time to time.
The Policy to Provide Purchase Preference as per Public Procurement (Preference to Make in India), Order is enclosed as Annexure V to ITB herewith.
Bidders are required to select the applicable purchase preference (i.e. preference category) option while submitting the bid on GePNIC portal. However, evaluation and applicability of purchase preference policy will be based on the confirmations & documents submitted by the bidder in the their bid irrespective of selection made on GePNIC portal.

[F] – AWARD OF CONTRACT

35 AWARD

Subject to "ITB: Clause-29", Owner will award the Contract to the successful Bidder whose Bid has been determined to be substantially responsive and has been determined as the lowest provided that bidder, is determined to be qualified to satisfactorily perform the Contract.

"TFL intends to place the contract directly on the address from where Goods are produced / dispatched or Services are rendered. In case, bidder wants contract at some other address or supply of Goods/ Services from multiple locations, bidder is required to provide in their bid address on which order is to be placed."

TFL will place the Contract directly on the successful bidder from whom the bid has been received & evaluated and will not place order on other entities such as subsidiary, business associate or partner, dealer/distributor etc. of the Bidder.

36 NOTIFICATION OF AWARD / FAX OF ACCEPTANCE

36.1 Prior to the expiry of 'Period of Bid Validity', Notification of Award for acceptance of the Bid will be intimated to the successful Bidder by TFL either by E-mail /Letter or like means defined as the "Fax of Acceptance (FOA)". The Contract shall enter into force on the date of FOA and the same shall be binding on TFL and successful Bidder (i.e. Contractor). The Notification of Award/FOA will constitute the formation of a Contract. The detailed Letter of Acceptance shall be issued thereafter incorporating terms & conditions of Tender Document, Corrigendum, Clarification(s), Bid and agreed variation(s)/acceptable deviation(s), if any. TFL may choose to issue Notification of Award in form of detailed Letter of Acceptance without issuing FOA and in such case the Contract shall enter into force on the date of Detailed Letter of Acceptance only.

36.2 Contract period shall commence from the date of "Notification of Award" or as mentioned in the Notification of Award. The "Notification of Award" will constitute the formation of a Contract, until the Contract has been effected pursuant to signing of Contract as per "ITB: Clause-37".

36.3 Upon the successful Bidder's / Contractor's furnishing of 'Contract Performance Security / Security Deposit', pursuant to "ITB: Clause-38", TFL will promptly discharge his 'Earnest Money Deposit / Bid Security (if applicable)', pursuant to "ITB: Clause-16".

36.4 The Order/ contract value mentioned above is subject to Mutually Agreed Damages clause.

36.5 TFL will award the Contract to the successful Bidder, who, within 'fifteen [15] days' of receipt of the same, shall sign and return the acknowledged copy to TFL.

37 SIGNING OF AGREEMENT

The successful Bidder/Contractor shall be required to execute an 'Agreement' in the proforma given in this Bidding Document) on a 'non-judicial stamp paper' of appropriate value [cost of the 'stamp-paper' shall be borne by the successful Bidder/Contractor] and of 'state of India' specified in Bidding Data Sheet (BDS) only, within 'fifteen [15] days' of receipt of the "Fax of Acceptance (FOA)"by the successful Bidder/Contractor failure on the part of the successful Bidder/Contractor to sign the 'Agreement' within the above stipulated period, shall constitute sufficient grounds for forfeiture of EMD / Security Deposit / Action as per Bid Security declaration.

38 CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT(CPS/SD)

38.1 Within 30 days of the receipt of the notification of Award/ Fax of Acceptance (FOA) by from TFL, the successful bidder shall furnish the Contract Performance Security (CPS) in accordance with of General Conditions of the Contract. The CPS shall be in the form of either Banker's Cheque or Demand Draft or Bank Guarantee or Letter of Credit and shall be in the currency of the Contract. However, CPS shall not be applicable in cases wherein the individual contract value as specified in Notification of Award is less than INR 5 Lakh (exclusive of GST).

38.2 The CONTRACT PERFORMANCE SECURITY shall be for an amount equal specified in Bidding Data Sheet (BDS) towards faithful performance of the contractual obligations and performance of equipment. For the purpose of CPS, Contract/order value shall be exclusive of **GST (CGST & SGST/UTGST or IGST)** .

Bank Guarantee towards CPS shall be from any Indian scheduled bank or a branch of an International bank situated in India and registered with Reserve Bank of India as scheduled foreign bank . However, in case of bank guarantees from banks other than the Nationalized Indian banks, the bank must be a commercial bank having net worth in excess of Rs 100 crores and a declaration to this effect should be made by such commercial bank either in the Bank Guarantee itself or separately on its letterhead.

38.3 Failure of the successful bidder to comply with the requirements of this article shall constitute sufficient grounds for consideration of the annulment of the award and Forfeiture of EMD/action as per declaration of Bid Security.

38.4 The CPS has to cover the entire contract value including extra works/services also. As long as the CPS submitted at the time of award take cares the extra works/services executed and total executed value are within the awarded contract price, there is no need for additional CPS. As soon as the total executed value is likely to burst the ceiling of awarded contract price, the contractor should furnish additional CPS.

38.5 DELETED

38.6 In addition to existing specified form (i.e. Demand Draft (DD)/ Banker's Cheque/ Bank Guarantee) mentioned in tender documents for submission of Security Deposit/ Contract Performance Security, the successful bidder can also submit the Security Deposit/ Contract Performance Security through online banking transaction i.e. IMPS/NEFT/RTGS/SWIFT etc. For this purpose, the details of TFL's Bank Account is mentioned in BDS. Further, in case a successful Bidder is willing to furnish CPS through SWIFT, the details may be obtained from Purchase Officer immediately after receipt of FOA.

While remitting such online transaction, the bidder must indicate "**Security Deposit/ Contract Performance Security against FOA/DLOA no. _____(contractor to specify the FOA/DLOA No.)**" under remarks column of such transaction of respective bank portal. The contractor/vendor shall be required to submit the successful transaction details to the dealing officer immediately through email/letter and necessarily within 30 days from the date of Fax of Acceptance.

38.7 In case of forfeiture of Contract Performance Security/ Security Deposit in terms of GCC, the forfeited amount will be considered inclusive of tax and tax invoice will be issued by TFL. The forfeiture amount will be subject to final decision of TFL based on other terms and conditions of order/ contract.

38.8 The Contractor will also submit covering letter along with CPS as per format at F-4.

38.9 CPBG/Security Deposit will not be accepted in case the same has reference of 'remitter'/'financer' other than bidder on the aforementioned financial instrument of CPBG/ Security Deposit submitted by the Contractor.

38.10 The first payment to vendor is to be released only after submission of CPS / Security Deposit (SD).

38.11 Before the CPS / Security Deposit (SD) is released a "No Claim Certificate" is to be submitted by the supplier/vendor.

38.12 In case, TFL allows additional time for submission of CPBG/SD beyond 30 days, a penal interest of Marginal Cost of Fund based Lending Rate (MCLR) for one year charged by SBI (applicable on due date of submission of CPBG/SD i.e. 30th day after issuance of FOA/Notification of award) plus 4.0% p.a (on CPBG/SD amount) shall be charged for delay beyond 30 days i.e. from 31st days after issuance of FOA.

39 PROCEDURE FOR ACTION IN CASE CORRUPT/FRAUDULENT/COLLUSIVE/ COERCIVE PRACTICES

39.1 Procedure for action in case Corrupt/ Fraudulent/Collusive/Coercive Practices is enclosed at Annexure-I.

39.4 NON-APPLICABILITY OF ARBITRATION CLAUSE IN CASE OF BANNING OF VENDORS/ SUPPLIERS / CONTRACTORS/ BIDDERS/ CONSULTANTS INDULGED IN FRAUDULENT/ COERCIVE PRACTICES

Notwithstanding anything contained contrary in GCC and other "CONTRACT DOCUMENTS", in case it is found that the Contractors/Bidders indulged in fraudulent/ coercive practices at the time of bidding, during execution of the contract etc. and/or on other grounds as mentioned in OWNER's "Procedure for action in case Corrupt/Fraudulent/Collusive/Coercive Practices" (Annexure-Ito Section-III of tender), the contractor/bidder shall be banned (in terms of aforesaid procedure) from the date of issuance of such order by TFL, to such Contractors/Bidders.

The Contractor/ Bidder understands and agrees that in such cases where Contractor/ Bidder has been banned (in terms of aforesaid procedure) from the date of issuance of such order by TFL, such decision of TFL shall be final and binding on such Contractor/ Bidder and the 'Arbitration clause' in the GCC and other "CONTRACT DOCUMENTS" shall not be applicable for any consequential issue /dispute arising in the matter.

40 PUBLIC PROCUREMENT POLICY FOR MICRO AND SMALL ENTERPRISES

40.1 Government of India, vide Gazette of India No. 503 dated 26.03.2012 proclaimed the Public Procurement Policy for Micro and Small Enterprises (MSEs). The following benefit is available in case of work contract also:

i) Issue of tender document to MSEs free of cost.
ii) Exemption to MSEs from payment of EMD/Bid Security .

40.2 **In case Bidder is a Micro or Small Enterprise, the Bidder shall submit Udyam Registration Certificate for availing benefit under Public Procurement Policy for MSEs-2012.**

Vide Gazette notification dated 18.10.2022 of Ministry of MSME, the following is notified:

"In case of an upward change in terms of investment in plant and machinery or equipment or turnover or both, and consequent re-classification, an enterprise shall continue to avail of all nontax benefits of the category (micro or small or medium) it was in before the re-classification, for a period of three years from the date of such upward change"

Accordingly, in case of upward change in status, MSE bidder is required to submit the previous certificate also to get the MSE benefit.

The above documents submitted by the bidder shall be duly certified by the Chartered Accountant (not being an employee or a Director or not having any interest in the bidder's company/firm) and notary public with legible stamp.
If the bidder does not provide the above confirmation or appropriate document or any evidence, then it will be presumed that they do not qualify for any preference admissible in the Public Procurement Policy (PPP) 2012.
Further, MSEs who are availing the benefits of the Public Procurement Policy (PPP) 2012 get themselves registered with MSME Data Bank being operated by NSIC, under SME Division, M/o MSME, in order to create proper data base of MSEs which are making supplies to CPSUs.

41.3 If against an order placed by TFL, successful bidder(s) (other than Micro/Small Enterprise) is procuring material/services from their sub-vendor who is a Micro or Small Enterprise as per provision mentioned at clause no.40.2 with prior consent in writing of the purchasing authority/Engineer-in-charge, the details like Name, Registration No., Address, Contact No.

details of material & value of procurement made, etc. of such Enterprises shall be furnished by the successful bidder at the time of submission of invoice/Bill.

41.4 The benefit of policy are not extended to the traders/dealers/ Distributors /Stockiest/Wholesalers.

41.5 NSIC has initiated a scheme of "Consortia and Tender Marketing Scheme" under which they are assisting the Micro & Small enterprises to market their products and services through tender participation on behalf of the individual unit or through consortia.

Accordingly, if the MSEs or the consortia, on whose behalf the bid is submitted by NSIC, is meeting the BEC and other terms and conditions of tender their bid will be considered for further evaluation.

Further, in such cases a declaration is to be submitted by MSE/ consortia on their letter head (s) that all the terms and conditions of tender document shall be acceptable to them.

40.6 It may be noted that Government of India has implemented Trade Receivable Discounting System (TReDS) to address challenges faced by MSMEs in delayed payments (after receipt/acceptance of Material/Services) from Government buyers leading to shortfall of Working Capital. TReDS is an online electronic institutional mechanism for facilitating the financing of trade receivables of MSMEs through multiple financiers. TFL is already registered on the following TReDS platform:

- M/s Receivable Exchange of India (RXIL), Mumbai
- M/s Mynd Solutions Private Limited (Mynd), New Delhi
- M/s A. TREDS (Invoicemart), Mumbai

MSME Bidders are required to register on the TReDS platform. The MSME vendors can avail the TReDS facility, if they want to.

40.7 Interest payment on delayed payments to MSME is payable in line with Micro, Small and Medium Enterprises Development Act, 2006

42 AHR ITEMS

Not applicable.

42 VENDOR PERFORMANCE EVALUATION

Shall be as stipulated Annexure II to ITB herewith.

43 INCOME TAX & CORPORATE TAX

43.1 Income tax deduction shall be made from all payments made to the contractor as per the rules and regulations in force and in accordance with the Income Tax Act prevailing from time to time.

43.2 Corporate Tax liability, if any, shall be to the contractor's account.

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43.3 **TDS**

(i) TDS, wherever applicable, shall be deducted as per applicable act/law/rule.

(ii) **Higher rate of TDS for non-filers of ITR**
As per Section 206AB of Income Tax Act, 1961, in case of any vendor/customer who does not filed their Income Tax Return for both of the two previous years preceding to current year and aggregate amount of TDS is more than or equal to 50,000/- in each of those previous two years (or limit defined by Govt. from time to time), then TDS will be deducted at the higher of following rates:
(I) Twice the rate mentioned in relevant TDS section.
(II) Twice the rate or rates in force
(III) 5%

43.4 **MENTIONING OF PAN NO. IN INVOICE/BILL**

As per CBDT Notification No. 95/2015 dated 30.12.2015, mentioning of PAN no. is mandatory for procurement of goods / services/works/consultancy services exceeding Rs. 2 Lacs per transaction or as amended from time to time.

Accordingly, contractor should mention their PAN no. in their invoice/ bill for any transaction exceeding Rs. 2 lakhs or as amended from time to time. As provided in the notification, in case contractor do not have PAN no., they have to submit declaration in Form 60 along with invoice/ bill for each transaction.

Payment of contractor shall be processed only after fulfilment of above requirement.

44. DISPUTE RESOLUTION MECHANISM

44.1 QUARTERLY CLOSURE OF THE CONTRACT

During execution of orders, various issues may arise. In order to timely detect and to address the contractual issue(s) during the execution of contracts, TFL has introduced a mechanism of Quarterly Closure of the contract, under which all the related issues /disputes will be monitored and addressed on quarterly basis for resolution. Vendor (hereinafter referred 'Vendor')should first refer any issues/disputes to Engineer-in-Charge(EIC) for LOA/contracts/ Dealing C&P Executive for Purchase Orders and co-operate them for smooth execution of the contract and to timely address the issues, if any. For applicability of 'Quarterly Closure', please refer BDS.

44.2 ARBITRATION

All issue(s)/dispute(s) excluding the matters that have been specified as excepted matters and listed at clause no. 2.6 and which cannot be resolved through Conciliation, such issue(s)/dispute(s) shall be referred to arbitration for adjudication by Sole Arbitrator.

The party invoking the Arbitration shall have the option to either opt for Ad-hoc Arbitration as provided at Clause 2.1 below or Institutionalized Arbitration as provided at Clause 2.2 below, the remaining clauses from 2.3 to 2.7 shall apply to both Ad-hoc and Institutional Arbitration:-

2.1 On invocation of the Arbitration clause by either party, TFL shall suggest a panel of three independent and distinguished persons (Retd Supreme Court & High Court Judges only) to the other party from the Panel of Arbitrators maintained by 'Delhi International Arbitration Centre (DIAC) to select any one among them to act as the Sole Arbitrator. In the event of failure of the other party to select the Sole Arbitrator within 30 days from the receipt of the communication from TFL suggesting the panel of arbitrators, the right of selection of the sole arbitrator by the other party shall stand forfeited and TFL shall appoint the Sole Arbitrator from the suggested panel of three Arbitrators for adjudication of dispute(s). The decision of TFL on the appointment of the sole arbitrator shall be final and binding on the other party. The fees payable to Sole Arbitrator shall be governed by the fee Schedule of ''Delhi International Arbitration Centre'.

OR

2.2 If a dispute arises out of or in connection with this contract, the party invoking the Arbitration shall submit that dispute to any one of the Arbitral Institutions i.e ICADR/ICA/DIAC/SFCA and that dispute shall be adjudicated in accordance with their respective Arbitration Rules. The matter shall be adjudicated by a Sole Arbitrator who shall necessarily be a Retd. Supreme Court/High Court Judge to be appointed/nominated by the respective institution. The cost/expenses pertaining to the said Arbitration shall also be governed in accordance with the Rules of the respective Arbitral Institution. The decision of the party invoking the Arbitration for reference of dispute to a specific Arbitral institution for adjudication of that dispute shall be final and binding on both the parties and shall not be subject to any change thereafter. The institution once selected at the time of invocation of dispute shall remain unchanged.

2.3 The cost of arbitration proceedings shall be shared equally by the parties.

2.4 The Arbitration proceedings shall be in English language and the seat, venue and place of Arbitration shall be New Delhi, India only.

2.5 Subject to the above, the provisions of Arbitration & Conciliation Act 1996 and any amendment thereof shall be applicable. All matter relating to this Contract and arising out of invocation of Arbitration clause are subject to the exclusive jurisdiction of the Court(s) situated at New Delhi.

2.6 List of Excepted matters:

a) Dispute(s)/issue(s) involving claims below Rs 25 lakhs and above Rs 25 crores.

b) Dispute(s)/issue(s) relating to indulgence of Contractor/Vendor/Bidder in corrupt/fraudulent/collusive/coercive practices and/or the same is under investigation by CBI or Vigilance or any other investigating agency or Government.

c) Dispute(s)/issue(s) wherein the decision of Engineer-In-Charge/owner/TFL has been made final and binding in terms of the Contract.

2.7. Disputes involving claims below Rs 25 Lakhs and above Rs. 25 crores:- Parties mutually agree that dispute(s)/issue(s) involving claims below Rs 25 Lakhs and above Rs 25 crores shall not be subject matter of Arbitration and are subject to the exclusive jurisdiction of the Court(s) situated at New Delhi.

44.3 GOVERNING LAW AND JURISDICTION:

The Contract shall be governed by and construed in accordance with the laws in force in India. The Parties hereby submit to the exclusive jurisdiction of the Courts situated at New Delhi for adjudication of disputes, injunctive reliefs, actions and proceedings, if any, arising out of this Contract.

45. DISPUTES BETWEEN CPSE'S/ GOVERNMENT DEPARTMENT'S / ORGANIZATIONS

Subject to conciliation as provided above, in the event of any dispute (other than those related to taxation matters) or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments /Organizations , such dispute or difference shall be taken up by either party for resolution only through AMRCD as mentioned in OPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22-05-2018.

Any party aggrieved with the decision of the Committee at the First level (tier) may prefer an appeal before the Cabinet Secretary at the Second level (tier) within 15 days from the date of receipt of decision of the Committee at First level, through it's administrative Ministry/Department, whose decision will be final and binding on all concerned.

The above provisions mentioned at clause no. 44 & 45 shall supersede provisions relating to Conciliation, Arbitration, Governing Law & Jurisdiction and Disputes between CPSE's/ Government Department's/ Organizations mentioned in General Conditions of Contract (GCC) and elsewhere in tender document.

46 **INAM-PRO (PLATFORM FOR INFRASTRUCTURE AND MATERIALS PROVIDERS)**

INAM-Pro (Platform for infrastructure and materials providers) is a web based platform for infrastructure provides and materials suppliers and was developed by Ministry of Road Transport and Highways (MoRT&H) with a view to reduce project execution delays on account of supply shortages and inspire greater confidence in contractors to procure cement to start with directly from the manufacturers. Presently, numerous cement companies are registered in the portal and offering cement for sale on the portal with a commitment period of 3 years. These companies have bound themselves by ceiling rates for the entire commitment period, wherein they are allowed to reduce or increase their cement rates any number of times within the ceiling rate, but are not permitted to exceed the said ceiling rate.

MoRT&H is expanding the reach of this web-portal by increasing both the product width as well as the product depth. They are working on incorporating 60 plus product categories. The product range will span from large machineries like Earth Movers and Concrete Mixers, to even the smallest items like road studs. MoRT&H intend to turn it into a portal which services every infrastructure development related need of a modern contractor.

TFL's contractors may use this innovative platform, wherever applicable. The usage of web – Portal is a completely voluntary exercise. The platform, however, can serve as a benchmark for comparison of offered prices and products.

47 **PROMOTION OF PAYMENT THROUGH CARDS AND DIGITAL MEANS**

To promote cashless transactions, the onward payments by Contractors to their employees, service providers, sub-contractors and suppliers may be made through Cards and Digital means to the extent possible

48 **CONTRACTOR TO ENGAGE CONTRACT MANPOWER BELONGING TO SCHEDULED CASTES AND WEAKER SECTIONS OF THE SOCIETY**

While engaging the contractual manpower, Contractors are required to make efforts to provide opportunity of employment to the people belonging to Scheduled Castes and weaker sections of the society also in order to have a fair representation of these sections.

49 PROVISIONS FOR STARTUPS (AS DEFINED IN GAZETTE NOTIFICATION NO. D.L-33004/99 DATED 18.02.2016 AND 23.05.2017 OF MINISTRY OF COMMERCE AND INDUSTRY AND AS AMENDED FROM TIME TO TIME) [FOR APPLICABLITY REFER BDS]

As mentioned in Section-II, Technical and Financial BEC shall be applicable for all Startups [whether Micro & Small Enterprises (MSEs) or otherwise].

Further, the Startups are also exempted from submission of EMDs (if applicable).

If a Startup emerge lowest bidder, the LoA on such Startup shall be placed for entire tendered quantity/group/item/part (as the case may be). However, during the Kick of Meeting monthly milestones/ check points would be drawn. Further, the performance of such contractor/ service provider will be reviewed more carefully and action to be taken as per provision of contract in case of failure/ poor performance.

50 PROVISION REGARDING INVOICE FOR REDUCED VALUE OR CREDIT NOTE TOWARDS MAD

MAD is the reduction in the consideration / contract value for the / services covered under this contract. In case of delay in execution of service provider should raise invoice for reduced value as per MAD) clause. If service provider has raised the invoice for full value, then service provider should issue Credit Note towards the applicable MAD amount with applicable taxes.

In such cases if service provider fails to submit the invoice with reduced value or does not issue credit note as mentioned above, TFL will release the payment to service provider after giving effect of the MAD clause with corresponding reduction of taxes charged on service provider's invoice, to avoid delay in payment.

In case any financial implication arises on TFL due to issuance of invoice without reduction in price or non-issuance of Credit Note, the same shall be to the account of service provider. TFL shall be entitled to deduct / setoff / recover such GST amount (CGST & SGST/UTGST or IGST) together with penalties and interest, if any, against any amounts paid or becomes payable by OWNER in future to the service provider's under this contract or under any other contract.

51. UNIQUE DOCUMENT IDENTIFICATION NUMBER BY PRACTICING CHARTERED ACCOUNTANTS

Practicing Chartered Accountants shall generate Unique Document Identification Number (UDIN) for all certificates issued by them as per provisions of Tender Document.

However, UDIN may not be required for documents being attested by Chartered Accountants in terms of provisions of Tender Document.

52. PROVISION FOR PROCUREMENT FROM A BIDDER WHICH SHARES A LANDBORDER WITH INDIA.

The clause regarding provision for procurement from a bidder which shares a land with India is enclosed as Annexure-VII to ITB herewith.

53. ANJANI PORTAL

TFL has implemented "Anjani" e-Measurement Book & e-Billing Portal for ease in submission of measurement book/bill and reduction in paper transaction.
Accordingly, TFL will process the Bill with Measurement Book through "Anjani" e-Measurement Book & e-Billing Portal (link: https://gailebank.gail.co.in/MBAutomation/frmlogin.aspx). Accordingly, Contractor/ Service Provider/ Consultant is requested to forward the RA Bill on "Anjani" e-Measurement Book & e-Billing Portal through concerned EIC/CIC/SIC, whichever is applicable.
Further, User Manual is also available on aforesaid portal.

54. DOCUMENTS FOR PAYMENT:

Payment terms shall be as mentioned in GCC-Works/SCC.

However, for release of payment, Contractor is required to submit invoice along with other documents as mentioned in SCC. The final bill is to be submitted within one month after completion.

Further, TFL is in process of implementing Vendor Invoice Management (VIM). After implementation of same (to be communicated separately), Contractor/ Vendor to forward the invoice on VIM Collection Center or upload digital invoice on Portal (details of same will be provided separately). The copy of invoice and all other document

mentioned above or in order/ contract is to be forwarded to address provided in order/contract.

55. ORDER TRANSMITTAL SYSTEM:

The complete PO/LOA along with all annexures including tender document shall be shared through order/contract transmittal system after intimation through email.

Supplier/Contractor is requested to visit https://gailonline.com/home.html and click on link order/contract transmittal system (It can be found under Vendor Zone (Portal For Suppliers)) or https://gailebank.gail.co.in/GOGA_AUDIT/frmUserLogin.aspx.

Therein, in order to access the detailed order/contract, supplier/contractor shall be prompted to enter your email id. Further an OTP shall be sent on your registered mobile number. After entering OTP, supplier/contractor shall be allowed to download complete PO/LOA along with all annexures including tender document. After downloading the documents, the supplier/contractor shall be required to digitally sign the document (by authorized signatory) for uploading the documents on order/contract transmittal system towards acknowledgement of the same.

55. SUB-LETTING OF WORKS

The following is added to the Clause no. 37 of General Conditions of Contract (GCC)-Works:

(i) Procurement of material, hire of equipment or engagement of labour will not mean sub-contracting.
(ii) Sub-contracting by the contractor without the approval of TFL shall be a breach of contract, unless explicitly permitted in the contract.
(iii) However, If specified in SCC Sub-contracting for Specialized Items of Work is allowed upto certain percentage of work

PROCEDURE FOR ACTION IN CASE CORRUPT/FRAUDULENT/COLLUSIVE/COERCIVE PRACTICES

Annexure-I

A Definitions:

A.1 "Corrupt Practice" means the offering, giving, receiving or soliciting, directly or indirectly, anything of value to improperly influence the actions in selection process or in contract execution.

"Corrupt Practice" also includes any omission for misrepresentation that may mislead or attempt to mislead so that financial or other benefit may be obtained or an obligation avoided.

A2 "Fraudulent Practice" means and include any act or omission committed by a agency or with his connivance or by his agent by misrepresenting/ submitting false documents and/ or false information or concealment of facts or to deceive in order to influence a selection process or during execution of contract/ order.

A3 "Collusive Practice amongst bidders (prior to or after bid submission)" means a scheme or arrangement designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.

A.4 "Coercive practice" means impairing or harming or threatening to impair or harm directly or indirectly, any agency or its property to influence the improperly actions of an agency, obstruction of any investigation or auditing of a procurement process.

A.5 "Vendor/Supplier/Contractor/Consultant/Bidder" is herein after referred as "Agency"

A.6 "Appellate Authority" shall mean Committee of Directors consisting of Director (Finance) and Director (BD) for works centers under Director (Projects). For all other cases committee of Directors shall consist of Director (Finance) & Director (Projects).

A.7 "Competent Authority" shall mean the authority, who is competent to take final decision for Suspension of business dealing with an Agency/ (ies) and Banning of business dealings with Agency/ (ies) and shall be the "Director" concerned.

A.8 "Allied Agency" shall mean all concerns which come within the sphere of effective influence of the banned/suspended agency shall be treated as allied agency. In determining this, the following factors may be taken into consideration:

a) Whether the management is common;

b) Majority interest in the management is held by the partners or directors of banned/ suspended agency;

c) Substantial or majority shares are owned by the banned/ suspended agency and by virtue of this it has a controlling voice.

d) Directly or indirectly controls, or is controlled by or is under common control with another bidder.

e) All successor agency will also be considered as allied agency.

A.9 “Investigating Agency” shall mean any department or unit of TFL investigating into the conduct of Agency/ party and shall include the Vigilance Department of the TFL, Central Bureau of Investigation, State Police or any other agency set up by the Central or state government having power to investigate.

A.10 "Obstructive practice": materially impede the procuring entity's investigation into allegations of one or more of the above mentioned practices either by deliberately destroying, falsifying, altering; or by concealing of evidence material to the investigation; or by making false statements to investigators and/ or by threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or by impeding TFL's rights of audit or access to information.

B Actions against bidder(s) indulging in corrupt /fraudulent/ collusive/ coercive practice

B.1 Irregularities noticed during the evaluation of the bids :

If it is observed during bidding process/ bids evaluation stage that a bidder has indulged in corrupt/fraudulent /collusive/coercive practice, the bid of such Bidder (s) shall be rejected and its Earnest Money Deposit (EMD) shall be forfeited.

Further, such agency shall be banned for future business with TFL for a period specified in para B 2.2 below from the date of issue of banning order.

B.2 Irregularities noticed after award of contract

(i) **During execution of contract:**

If an agency, is found to have indulged in corrupt/fraudulent/ collusive/coercive practices, action shall be initiated for putting the agency on banning list.

After conclusion of process and issuance of Speaking order for putting party on banning list, the order (s)/ contract (s) where it is concluded that such irregularities have been committed shall be terminated and Contract cum Performance Bank Guarantee (CPBG) submitted by agency against such order (s)/ contract (s) shall also be forfeited. Further such order/ contract will be closed following the due procedure in this regard.

The amount that may have become due to the contractor on account of work already executed by him shall be payable to the contractor and this amount shall be subject to adjustment against any amounts due from the contractor under the terms of the contract. No risk and cost provision will be enforced in such cases.

Suspension of order/ contract:

Further, only in the following situations, the concerned order (s)/ contract(s) (where Corrupt/Fraudulent/ Collusive/ Coercive Practices are observed) and payment shall be suspended after issuance of Suspension cum Show Cause Notice:

(i) Head of Corporate Vigilance Department/CVO based on the investigation by them, recommend for specific immediate action against the agency.

(ii) Head of Corporate Vigilance Department/CVO based on the input from investigating agency, forward for specific immediate action against the agency.

Suspension cum Show Cause Notice being issued in above cases after approval of the competent authority (as per provisions mentioned under Clause no. D) shall also include the provision for suspension of Order (s)/ Contract (s) and payment. Accordingly, after issuance of Suspension cum Show Cause Notice, the formal communication for suspension of Order (s)/ Contract (s) and payment with immediate effect will be issued by the concerned person of TFL.

During suspension, Contractor/ Service Providers will be allowed to visit the plant/ site for upkeep of their items/ equipment, TFL's issued materials (in case custody of same is not taken over), demobilizing the site on confirmation of EIC, etc.

In addition to above, Recovery of payments (other than due payments) including balance advance payments, if any, made by along with interest thereon at the prevailing rate shall be recovered.

(ii) After execution of contract and during Defect liability period (DLP)/ Warranty/Guarantee Period:

If an agency is found to have indulged in corrupt/fraudulent/ collusive/coercive practices, after execution of contract and during DLP/ Warranty/Guarantee Period, the agency shall be banned for future business with TFL for a period specified in para B 2.2 below from the date of issue of banning order.
Further, the Contract cum Performance Bank Guarantee (CPBG)/Contract Performance Security (CPS) submitted by agency against such order (s)/ contract (s) shall be forfeited.

(iii) After expiry of Defect liability period (DLP)/ Warranty/Guarantee Period

If an agency is found to have indulged in corrupt/fraudulent/ collusive/coercive practices, after expiry of Defect liability period (DLP)/ Warranty/Guarantee Period, the agency shall be banned for future business with TFL for a period specified in para B 2.2 below from the date of issue of banning order.

B.2.2 Period of Banning

The period of banning of agencies indulged in Corrupt/Fraudulent/Collusive/Coercive Practices shall be as under and to be reckoned from the date of banning order:

S. No.	Description	Period of banning from the date of issuance of Banning order
1	Misrepresentation/False information other than pertaining to BEC of tender but having impact on the	06 months

	selection process. For example, if an agency confirms not being in holiday in TFL/PSU's PMC or banned by PSUs/ Govt. Dept., liquidation, bankruptcy & etc. and subsequently it is found otherwise, such acts shall be considered in this category.	
2 2.1	Corrupt/Fraudulent (except mentioned sl. no. 1 above) /Collusive/Coercive Practices If an agency again commits Corrupt/Fraudulent (except mentioned sl. no. 1 above) /Collusive/ Coercive Practices in subsequent cases after their banning, such situation of repeated offense to be dealt with more severity	2 years (in addition to the period already served)
3	Indulged in unauthorized disposal of materials provided by TFL	2 years
4	If act of vendor/ contractor is a threat to the National Security	2 years

C Effect of banning on other ongoing contracts/ tenders

C.1 If an agency is put on Banning, such agency should not be considered in ongoing tenders/future tenders.

C.2 However, if such an agency is already executing other order (s)/ contract (s) where no corrupt/fraudulent/ collusive/coercive practice is found, the agency should be allowed to continue till its completion without any further increase in scope except those incidental to original scope mentioned in the contract.

C.3 If an agency is put on the Banning List during tendering and no irregularity is found in the case under process:

C.3.1 after issue of the enquiry /bid/tender but before opening of Technical bid, the bid submitted by the agency shall be ignored.

C.3.2 after opening Technical bid but before opening the Price bid, the Price bid of the agency shall not be opened and BG/EMD submitted by the agency shall be returned to the agency.

C.3.3 after opening of price, BG/EMD made by the agency shall be returned; the offer of the agency shall be ignored & will not be further evaluated. . In case such agency is lowest (L-1), next lowest bidder shall be considered as L-1

D. Procedure for Suspension of Bidder

D.1 Initiation of Suspension

Action for suspension business dealing with any agency/(ies) shall be initiated by Corporate C&P Department when

(i) Corporate Vigilance Department based on the fact of the case gathered during investigation by them recommend for specific immediate action against the agency.

(ii) Corporate Vigilance Department based on the input from Investigating agency, forward for specific immediate action against the agency.

(iii) Non performance of Vendor/Supplier/Contractor/Consultant leading to termination of Contract/ Order.

D.2 Suspension Procedure:

D.2.1 The order of suspension would operate initially for a period not more than six months and is to be communicated to the agency and also to Corporate Vigilance Department. Period of suspension can be extended with the approval of the Competent Authority by one month at a time with a ceiling of six months pending a conclusive decision to put the agency on banning list.

D.2.2 During the period of suspension, no new business dealing may be held with the agency.

D.2.3 Period of suspension shall be accounted for in the final order passed for banning of business with the agency.

D.2.4 The decision regarding suspension of business dealings should also be communicated to the agency.

D.2.5 If a prima-facie, case is made out that the agency is guilty on the grounds which can result in banning of business dealings, proposal for issuance of suspension order and show cause notice shall be put up to the Competent Authority. The suspension order and show cause notice must include that (i) the agency is put on suspension list and (ii) why action should not be taken for banning the agency for future business from TFL.
The competent authority to approve the suspension will be same as that for according approval for banning.

D 3 Effect of Suspension of business:

Effect of suspension on other on-going/future tenders will be as under:

D.3.1 No enquiry/bid/tender shall be entertained from an agency as long as the name of agency appears in the Suspension List.

D.3.2 If an agency is put on the Suspension List during tendering:

D.3.2.1 after issue of the enquiry /bid/tender but before opening of Technical bid, the bid submitted by the agency shall be ignored.

D.3.2.2 after opening Technical bid but before opening the Price bid, the Price bid of the agency shall not be opened and BG/EMD submitted by the agency shall be returned to the agency.

D.3.2.3 after opening of price, BG/EMD made by the agency shall be returned; the offer of the agency shall be ignored & will not be further evaluated. . In case such agency is lowest (L-1), next lowest bidder shall be considered as L-1D.3.3 The existing contract (s)/ order (s) under execution shall continue.

D.3.4 Tenders invited for procurement of goods, works and services shall have provision that the bidder shall submit a undertaking to the effect that (i) neither the bidder themselves nor their allied agency/(ies) are on banning list of TFL and(ii) bidder is not banned by any Government department/ Public Sector.

F. Appeal against the Decision of the Competent Authority:

F.1 The agency may file an appeal against the order of the Competent Authority for putting the agency on banning list. The appeal shall be filed to Appellate Authority. Such an appeal shall be preferred within one month from the of receipt of banning order.

F.2 Appellate Authority would consider the appeal and pass appropriate order which shall be communicated to the party as well as the Competent Authority.

F.3 Appeal process may be completed within 45 days of filing of appeal with the Appellate Authority.

G. Wherever there is contradiction with respect to terms of ‘Integrity pact’ , GCC and ‘Procedure for action in case of Corrupt/Fraudulent/ Collusive/Coercive Practice’, the provisions of ‘Procedure for action in case of Corrupt/Fraudulent/ Collusive/Coercive Practice’ shall prevail.

Annexure-II to Section III

PROCEDURE FOR EVALUATION OF PERFORMANCE OF VENDORS/ SUPPLIERS/ CONTRACTORS/ CONSULTANTS

1.0 GENERAL

A system for evaluation of Vendors/ Suppliers/Contractors/ Consultants and their performance is a key process and important to support an effective purchasing & contracting function of an organization.
Performance of all participating Vendors/ Suppliers/Contractors/ Consultants need to be closely monitored to ensure timely receipt of supplies from a Vendor, completion of an assignment by a Consultant or complete execution of order by a contractor within scheduled completion period. For timely execution of projects and meeting the operation & maintenance requirement of operating plants, it is necessary to monitor the execution of order or contracts right from the award stage to completion stage and take corrective measures in time.

2.0 OBJECTIVE

The objective of Evaluation of Performance aims to recognize, and develop reliable Vendors/ Suppliers/Contractors/ Consultants so that they consistently meet or exceed expectations and requirements.
The purpose of this procedure is to put in place a system to monitor performance of Vendors/ Suppliers/Contractors/ Consultants associated with TFL so as to ensure timely completion of various projects, timely receipt of supplies including completion of works & services for operation and maintenance of operating plants and quality standards in all respects.

3.0 METHODOLOGY

i) Preparation of Performance Rating Data Sheet
Performance rating data Sheet for each and every Vendor/ Supplier/Contractor/Consultant for all orders/Contracts with a value of Rs. 50 Lakhs and above is recommended to be drawn up. Further, Performance rating data Sheet for orders/contracts of Vendor/Supplier/Contractor/ Consultant who are on watch list/holiday list/ banning list shall be prepared irrespective of order/ contract value. These data sheets are to be separately prepared for orders/ contracts related to Projects and O&M. Format, Parameters, Process, responsibility for preparation of Performance Rating Data Sheet are separately mentioned.

ii) Measurement of Performance
Based on the parameters defined in Data Sheet, Performance of concerned Vendor/ Supplier/Contractor/ Consultant would be computed and graded accordingly. The measurement of the performance of the Party would be its ability to achieve the minimum scoring of 60% points in the given parameters.

iii) Initiation of Measures:
Depending upon the Grading of Performance, corrective measures would be initiated by taking up the matter with concerned Vendor/ Supplier/Contractor/ Consultant. Response of Vendor/ Supplier/Contractor/ Consultant would be considered before deciding further course of action.

iv) Implementation of Corrective Measures:
Based on the response of Vendor/ Supplier/Contractor/ Consultant, concerned Engineer-in-Charge for the Projects and/or OIC in case of O&M would recommend for continuation or discontinuation of such party from the business of TFL.

v) Orders/contracts placed on Proprietary/OEM basis for O&M will be evaluated and, if required, corrective action will be taken for improvement in future.

4.0 EXCLUSIONS:

The following would be excluded from the scope of evaluation of performance of Vendors/ Suppliers/Contractors/ Consultants :

i) Orders/Contracts below the value of Rs. 50 Lakhs if Vendor/ Supplier/Contractor/ Consultant is not on watch list/ holiday list/ banning list.
ii) Orders for Misc./Administrative items/ Non stock Non valuated items (PO with material code ending with 9).

However, concerned Engineer-in-Charge /OICs will continue to monitor such cases so as to minimize the impact on Projects/O&M plants due to non performance of Vendors/ Suppliers/Contractors/ Consultants in all such cases.

5.0 PROCESS OF EVALUATION OF PERFORMANCE OF VENDORS/ SUPPLIERS/ CONTRACTORS/ CONSULTANTS

5.1 FOR PROJECTS

i) Evaluation of performance of Vendors/ Suppliers/Contractors/ Consultants in case of PROJECTS shall be done immediately with commissioning of any Project.

ii) On commissioning of any Project, EIC (Engineer-in-charge)/ Project-in-charge shall prepare a Performance Rating Data Sheet (Format at Annexure-1) for all Orders and Contracts.

iii) Depending upon the Performance Rating, following action shall be initiated by Engineer-in-charge/Project-in-charge:

Sl.No.	Performance Rating	Action
1	POOR	Seek explanation for Poor performance
2	FAIR	Seek explanation for Fair performance
3	GOOD	Letter to the concerned for improving performance in future
4	VERY GOOD	No further action

iv) Reply from concerned Vendor/ Supplier/Contractor/ Consultant shall be examined. In case of satisfactory reply, Performance Rating data Sheet to be closed with a letter to the concerned for improving performance in future.

v) When no reply is received or reasons indicated are unsatisfactory, the following actions need to be taken:

A) Where performance rating is “POOR” (as per Performance Rating carried out after execution of Order/ Contract and where no reply/ unsatisfactory reply is received from party against the letter seeking the explanation from Vendor/Supplier/Contractor/ Consultant along with sharing the performance rating)

Recommend such defaulting Vendor / Supplier / Contractor / Consultant for the following action:

1. Poor Performance on account of Quality (if marks obtained against Quality parameter is less than 20):

   (a) First Instance: Holiday (Red Card) for one Years

   (b) Subsequent instance (s) in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: Holiday (Red Card) for two Years

2. Poor Performance on account of other than Quality (if marks obtained against Quality parameter is more than 20):

   (a) **First such instance: Advisory notice(Yellow Card)** shall be issued and Vendor/Supplier/Contractor/ Consultant shall be put on watch list for a period of Two (2) Years.

   (b) Second such instance in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: Putting on Holiday (Red Card) for a period of One Year

   (c) Subsequent instances (more than two) in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: **Putting on Holiday (Red Card) for a period of Two Years.**

B) Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant (under clause no. 34.2.3 of GCC)

(a) First instance: **Advisory notice (Yellow Card)** shall be issued and Vendor/Supplier/Contractor /Consultant shall be put on watch list for a period of Two (2) Years.
Further such vendor will not be allowed to participate in the re-tender of the same supply/work/services of that location which has terminated / offloaded. Moreover, it will be ensured that all other action as per provision of contract including forfeiture of Contract Performance Security (CPS) etc. are undertaken.
However, such vendor will be allowed to participate in all other tenders and to execute other ongoing order/ contract (s) or new contract/ order (s).

The Yellow card will be automatically revoked after a period of two years unless the same is converted into Red Card due to subsequence instances of poor/ non-performance in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant.

(b) **Second instances** in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: **Holiday (Red Card)** for period of One Year and they shall also to be considered for Suspension.

(c) **Subsequent instances (more than two)** in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: **Holiday (Red Card) for period of Two Years and they shall also to be considered for Suspension.**

(C) Where Performance rating is "FAIR":

Issuance of warning to such defaulting Vendor/ Supplier/Contractor/ Consultant to improve their performance.

5.2 FOR CONSULTANCY JOBS

Monitoring and Evaluation of consultancy jobs will be carried out in the same way as described in para 5.1 for Projects.

5.3 FOR OPERATION & MAINTENANCE

i) Evaluation of performance of Vendors/ Suppliers/Contractors/ Consultants in case of Operation and Maintenance shall be done immediately after execution of order/ contract.

ii) After execution of orders a Performance Rating Data Sheet (Format at Annexure-2) shall be prepared for Orders by Site C&P and for Contracts/Services by respective Engineer-In-Charge.

iii) Depending upon Performance Rating, following action shall be initiated by EIC:

Sl. No.	Performance Rating	Action
1	**POOR**	Seek explanation for Poor performance
2.	**FAIR**	Seek explanation for Fair performance
3	**GOOD**	Letter to the concerned for improving performance in future.
4	**VERY GOOD**	No further action

iv) Reply from concerned Vendor/ Supplier/Contractor/ Consultant shall be examined. In case of satisfactory reply, Performance Rating data Sheet to be closed with a letter to the concerned for improving performance in future.

v) When no reply is received or reasons indicated are unsatisfactory, the following actions need to be taken:

A) Where performance rating is "POOR" (as per Performance Rating carried out after execution of Order/ Contract and where no reply/ unsatisfactory reply is received from party against the letter seeking the explanation from Vendor/Supplier/Contractor/ Consultant along with sharing the performance rating)

Recommend such defaulting Vendor / Supplier / Contractor / Consultant for the following action:

1. Poor Performance on account of Quality (if marks obtained against Quality parameter is less than 20):
   - **(a) First Instance: Holiday (Red Card) for one Year**
   - **(b) Subsequent instance (s) in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: Holiday (Red Card) for Two Years**

2. Poor Performance on account of other than Quality (if marks obtained against Quality parameter is more than 20):
   - **(a) First such instance: Advisory notice(Yellow Card)** shall be issued and Vendor/Supplier/Contractor/ Consultant shall be put on watch list for a period of Two (2) Years.
   - **(b) Second such instance in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: Putting on Holiday (Red Card) for a period of One Year**
   - **(c) Subsequent instances (more than two) in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant**: **Putting on Holiday (Red Card) for a period of Two Years.**

B) Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant (under clause no. 34.2.3 of GCC)

(a) First instance: **Advisory notice (Yellow Card)** shall be issued and Vendor/Supplier/Contractor /Consultant shall be put on watch list for a period of two (2) Years.

Further such vendor will not be allowed to participate in the re-tender of the same supply/work/services of that location which has terminated / offloaded. Moreover, it will be ensured that all other action as per provision of contract including forfeiture of Contract Performance Security (CPS) etc. are undertaken.

However, such vendor will be allowed to participate in all other tenders and to execute other ongoing order/ contract (s) or new contract/ order (s).

The Yellow card will be automatically revoked after a period of two years unless the same is converted into Red Card due to subsequence instances of poor/ non-performance in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant.

(b) **Second instances** in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: **Holiday (Red Card)** for period of One Year and they shall also to be considered for Suspension.

(c) **Subsequent instances (more than two)** in other ongoing order (s)/ contract (s) or new order (s) /contact (s) on such Vendor/ Supplier/ Contractor/ Consultant: **Holiday (Red Card) for period of Two Years and they shall also to be considered for Suspension.**

(C) Where Performance rating is "FAIR"
Issuance of warning to such defaulting Vendors/Contractors/Consultants to improve their performance.

6.0 REVIEW & RESTORATION OF PARITES PUT ON HOLIDAY

6.1 An order for Holiday passed for a certain specified period shall deemed to have been automatically revoked on the expiry of that specified period and it will not be necessary to issue a specific formal order of revocation.

Further, in case Vendor/ Supplier/Contractor/ Consultant is put on holiday due to quality, and new order is placed on bidder after restoration of Vendor/ Supplier/Contractor/ Consultant, such order will be properly monitored during execution stage by the concerned site.

7.0 EFFECT OF HOLIDAY

7.1 If a Vendor/ Supplier/Contractor/ Consultant is put on Holiday, such Vendor/ Supplier/Contractor/ Consultant shall not be considered in ongoing tenders/future tenders.

7.2 However, if such Vendor/ Supplier/Contractor/ Consultant is already executing any other order/ contract and their performance is satisfactory in terms of the relevant contract, should be allowed to continue till its completion without any further increase in scope except those incidental to original scope mentioned in the contract. In such a case CPBG will not be forfeited and payment will be made as per provisions of concerned contract. However, this would be without prejudice to other terms and conditions of the contract.

7.3. Effect on other ongoing tendering:

7.3.1 after issue of the enquiry /bid/tender but before opening of Technical bid, the bid submitted by the party shall be ignored.

7.3.2 after opening of price, BG/EMD made by the party shall be returned; the offer of the party shall be ignored & will not be further evaluated. In case such agency is lowest (L-1), next lowest bidder shall be considered as L-1.

7.3.3 after opening of price, BG/EMD made by the party shall be returned; the offer of the party shall be ignored & will not be further evaluated. If errant party emerges as the lowest (L1), then such tender shall also be cancelled and re-invited.

8.0 While putting the Vendor/ Supplier/Contractor/ Consultant on holiday as per the procedure, the holding company, subsidiary, joint venture, sister concerns, group division of the errant Vendor/ Supplier/Contractor/ Consultant shall not be considered for putting on holiday list.
Any bidder, put on holiday, will not be allowed to bid through consortium route also in new tender during the period of holiday.

9.0 If an unsuccessful bidder makes any vexatious, frivolous or malicious complaint against the tender process with the intention of delaying or defeating any procurement or causing loss to TFL or any other bidder, such bidder will be put on holiday for a period of six months, if such complaint is proved to be vexatious, frivolous or malicious, after following the due procedure.

10. APPEAL AGAINST THE DECISION OF THE COMPETENT AUTHORITY:

(a) The party may file an appeal against the order of the Competent Authority for putting the party on Holiday list. The appeal shall be filed to Appellate Authority. Such an appeal shall be preferred within one month from the of receipt of Holiday order.

(b) Appellate Authority would consider the appeal and pass appropriate order which shall be communicated to the party as well as the Competent Authority.

(c) Appeal process may be completed within 45 days of filing of appeal with the Appellate Authority.

(d) "Appellate Authority" shall mean Committee of Directors consisting of Director (Finance) and Director (BD) for works centers under Director (Projects). For all other cases committee of Directors shall consist of Director (Finance) & Director (Projects).

11. **ERRANT BIDDER**

In case after price bid opening the lowest evaluated bidder (L1) is not awarded the job for any mistake committed by him in bidding or withdrawal of bid or modification of bid or varying any term in regard thereof leading to re-tendering, TFL shall forfeit EMD if paid by the bidder and such bidders shall be debarred from participation in retendering of the same job(s)/item(s).
Further, such bidder will be put on Watch List (Yellow Card) for a period of two years after following the due procedure. However, during the period in watch list such vendor will be allowed to participate in all other tenders and to execute other ongoing order/ contract (s) or new contract/ order (s).

In case of subsequent instances of default in other tender(s) during aforesaid watch list period, the action shall be initiated as per provision of sl. no. 2 of para A of Clause no. 5.1 (v) and 5.3 (v).

The Yellow card will be automatically revoked after specified period unless the same is converted into Red Card

12. In case CBIC (Central Board of Indirect Taxes and Customs)/ any tax authority / any equivalent government agency brings to the notice of TFL that the Supplier has not remitted the amount towards GST (CGST & SGST/UTGST or IGST) collected from TFL to the government exchequer, then, that Supplier shall be put under Holiday list of TFL for period of six months after following the due procedure. This action will be in addition to the right of recovery of financial implication arising on TFL.

Annexure-1

TALCHER FERTITIZERS LIMITED
PERFORMANCE RATING DATA SHEET
(FOR PROJECTS/ CONSULTANCY JOBS)

i) Project/Work Centre :
ii) Order/ Contract No. & date :
iii) Brief description of Items Works/Assignment :
iv) Order/Contract value (Rs.) :
v) Name of Vendor/Supplier/ Contractor/ Consultant :
vi) Contracted delivery/ Completion Schedule :
vii) Actual delivery/ Completion date :

Performance Parameter	Delivery/ Completion Performance	Quality Performance	Reliability Performance#	Total
Maximum Marks	40	40	20	100
Marks Allocated				

Note:
Remarks (if any)

PERFORMANCE RATING (**)

Note :
(#) Vendor/Supplier/Contractor/Consultant who seek repeated financial assistance or deviation beyond contract payment term or seeking direct payment to the sub-vendor/sub-contractor due to financial constraints, then '0' marks should be allotted against Reliability Performance.
(*) Allocation of marks should be as per enclosed instructions
(**) Performance rating shall be classified as under :

Sl. No.	Range (Marks)	Rating
1	60 & below	POOR
2	61-75	FAIR
3	76-90	GOOD
4	More than 90	VERY GOOD

Signature of Authorised Signatory:

Name:

Designation:

Instructions for allocation of marks

1. Marks are to be allocated as under :

1.1 DELIVERY/ COMPLETION PERFORMANCE **40 Marks**

Delivery Period/ Completion Schedule	**Delay in Weeks**	**Marks**

a) Upto 3 months	Before CDD	40
	Delay upto 4 weeks	35
	" 8 weeks	30
	" 10 weeks	25
	" 12 weeks	20
	" 16 weeks	15
	More than 16 weeks	0
b) Above 3 months	Before CDD	40
	Delay upto 4 weeks	35
	" 8 weeks	30
	" 10 weeks	25
	" 16 weeks	20
	" 20 weeks	15
	" 24 weeks	10
	More than 24 weeks	0

1.2 QUALITY PERFORMANCE **40 Marks**

For Normal Cases : No Defects/ No Deviation/ No failure: 40 marks

i) Rejection/Defects	Marks to be allocated on prorata basis for acceptable quantity as compared to total quantity for normal cases	10 marks
ii) When quality failure endanger system integration and safety of the system	Failure of severe nature - Moderate nature - low severe nature	0 marks 5 marks 10-25 marks
iii) Number of deviations	1. No deviation 2. No. of deviations $\leq$ 2 3. No. of deviations > 2	5 marks 2 marks 0 marks

1.3 RELIABILITY PERFORMANCE **20 Marks**

A.	**FOR WORKS/CONTRACTS**	
i)	Submission of order acceptance, agreement, PBG, Drawings and other documents within time	4 marks
ii)	Mobilization of resources as per Contract and in time	4 marks
iii)	Liquidation of Check-list points	4 marks
iv)	Compliance to statutory and HS&E requirements or	4 marks

	Reliability of Estimates/Design/Drawing etc. in case of Consultancy jobs	
v)	Timely submission of estimates and other documents for Extra, Substituted & AHR items	4 marks
B.	**FOR SUPPLIES**	
i)	Submission of order acceptance, PBG, Drawings and other documents within time	5 marks
ii)	Attending complaints and requests for after sales service/ warranty repairs and/ or query/ advice (upto the evaluation period).	5 marks
iii)	Response to various correspondence and conformance to standards like ISO	5 marks
iv)	Submission of all required documents including Test Certificates at the time of supply	5 marks

Annexure-2

TALCHER FERTILIZERS LIMITED
PERFORMANCE RATING DATA SHEET
(FOR O&M)

i)	Location	:
ii)	Order/ Contract No. & date	:
iii)	Brief description of Items Works/Assignment	:
iv)	Order/Contract value (Rs.)	:
v)	Name of Vendor/Supplier/ Contractor/ Consultant	:
vi)	Contracted delivery/ Completion Schedule	:
vii)	Actual delivery/ Completion date	:

Performance Parameter	Delivery Performance	Quality Performance	Reliability Performance#	Total
Maximum Marks	40	40	20	100
Marks Allocated (*)				

Remarks (if any)

PERFORMANCE RATING (**)

Note :

(#) Vendor/Supplier/Contractor/Consultant who seek repeated financial assistance or deviation beyond contract payment term or seeking direct payment to the sub-vendor/sub-contractor due to financial constraints, then '0' marks should be allotted against Reliability Performance

(*) Allocation of marks should be as per enclosed instructions

(**) Performance rating shall be classified as under :

Sl. No.	Range (Marks)	Rating
1	60 & below	POOR
2	61-75	FAIR
3	76-90	GOOD
4	More than 90	VERY GOOD

Signature of
Authorised Signatory:

Name:

Designation:

Instructions for allocation of marks (For O&M)

1. Marks are to be allocated as under :

1.1 DELIVERY/ COMPLETION PERFORMANCE **40 Marks**

Delivery Period/ Completion Schedule	**Delay in Weeks**	**Marks**
a) Upto 3 months	Before CDD	40
	Delay upto 4 weeks	35

	" 8 weeks	30
	" 10 weeks	25
	" 12 weeks	20
	" 16 weeks	15
	More than 16 weeks	0
b) Above 3 months	Before CDD	40
	Delay upto 4 weeks	35
	" 8 weeks	30
	" 10 weeks	25
	" 16 weeks	20
	" 20 weeks	15
	" 24 weeks	10
	More than 24 weeks	0

1.2 QUALITY PERFORMANCE **40 Marks**

For Normal Cases : No Defects/ No Deviation/ No failure: 40 marks

i) Rejection/Defects	Marks to be allocated on prorata basis for acceptable quantity as compared to total quantity for normal cases	10 marks
ii) When quality failure endanger system integration and safety of the system	Failure of severe nature	0 marks
	- Moderate nature	5 marks
	- low severe nature	10-25 marks
iii) Number of deviations	1. No deviation	5 marks
	2. No. of deviations $\leq$ 2	2 marks
	3. No. of deviations > 2	0 marks

1.3 RELIABILITY PERFORMANCE **20 Marks**

A.	**FOR WORKS/CONTRACTS**	
i)	Submission of order acceptance, agreement, PBG, Drawings and other documents within time	4 marks
ii)	Mobilization of resources as per Contract and in time	4 marks
iii)	Liquidation of Check-list points	4 marks
iv)	Compliance to statutory and HS&E requirements or Reliability of Estimates/Design/Drawing etc. in case of Consultancy jobs	4 marks

v)	Timely submission of estimates and other documents for Extra, Substituted & AHR items	4 marks
B.	**FOR SUPPLIES**	
i)	Submission of order acceptance, PBG, Drawings and other documents within time	5 marks
ii)	Attending complaints and requests for after sales service/ warranty repairs and/ or query/ advice (upto the evaluation period).	5 marks
iii)	Response to various correspondence and conformance to standards like ISO	5 marks
iv)	Submission of all required documents including Test Certificates at the time of supply	5 marks

Annexure-III

INSTRUCTIONS FOR SUBMISSION OF BID ONLINE THROUGH CPP PORTAL

1. The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.
   More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.

2. REGISTRATION
   i. Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link "Online bidder Enrollment" on the CPP Portal which is free of charge.
   ii. As part of the enrollment process, the bidders will be required to choose a unique username and assign a password for their accounts.
   iii. Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
   iv. Bidders are advised to make ensure the accessibility & availability of java software in their system (PC) either download & install the latest version of java software or click on the below link to install the java in their system prior to proceed further.
   https://www.oracle.com/technetwork/java/javase/downloads/index.html
   v. Upon enrollment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
   vi. Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
   vii. Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

3. SEARCHING FOR TENDER DOCUMENTS
   i. There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

ii. Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / email in case there is any corrigendum issued to the tender document.

iii. The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

4. PREPARATION OF BIDS

i. Bidder should take into account any corrigendum published on the tender document before submitting their bids.

ii. Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

iii. Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

iv. To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or ''Other Important Documents'' area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.

5. SUBMISSION OF BIDS

i. Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

ii. The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

iii. Bidder should submit EMD / Declaration for Bid security (as applicable) strictly as per format Form F-2B provided in the NIT. Otherwise the uploaded bid will be rejected.

iv. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard SOR format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the SOR file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the SOR file is found to be modified by the bidder, the bid will be rejected.

v. The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

vi. All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.

vii. The uploaded tender documents become readable only after the tender opening by the authorized bid openers.

viii. Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

ix. The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

6. ASSISTANCE TO BIDDERS

i. Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

ii. Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.

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ANNEXURE-IV

BIDDING DATA SHEET (BDS)

ITB TO BE READ IN CONJUNCTION WITH THE FOLLOWING:

<table>
<tr><th colspan="2">A. GENERAL</th></tr>
<tr><th>ITB clause</th><th>Description</th></tr>
<tr><td>1.1</td><td>The Employer/Owner is: The Employer/Owner is: Talcher Fertilizers Limited</td></tr>
<tr><td>1.2</td><td>The name of the Works/Services to be performed is: “Supply, Installation, Testing & Commissioning of Flare System on Package Basis at Talcher Fertilizers Limited, Angul, Odisha (India)”.</td></tr>
<tr><td>3</td><td>BIDS FROM CONSORTIUM/ JOINT VENTURE:
<table><tr><td>APPLICABLE</td><td>✗</td></tr><tr><td>NOT APPLICABLE</td><td>✓</td></tr></table></td></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">B. BIDDING DOCUMENT</th></tr>
<tr><th>ITB clause</th><th>Description</th></tr>
<tr><td>8.1</td><td>For <u>clarification purposes</u> only, the communication address is:
M/s Projects & Development India Limited,
P.D.I.L Bhawan, A-14, Sector-1,
Noida, (PIN 201301)
Dist. GautamBudh Nagar (UP). (India)

Kind Attention:
Mr. Anjali Thakur, Dy. General Manager (M.M)
Fax no. : +91-120-2529801
Tel no. : +91-120-2544063
E-mail : anjali@pdilin.com
alam@pdilin.com</td></tr>
<tr><th colspan="2">C. PREPARATION OF BIDS</th></tr>
<tr><th>ITB clause</th><th>Description</th></tr>
<tr><td>11.1.1 (r)</td><td>Additional documents to be submitted by the Bidder with its Part-I (Techno-commercial/ Unpriced bid) :As per SCC/Scope of Work.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>13</td><td>Details of Buyer:
<table><tr><td>Services to be rendered at</td><td>M/s Talcher Fertilizers Ltd. (TFL),
Administrative Building,
Talcher, Post: Vikrampur,
Dist: Angul, Pincode-759106,
Odisha</td></tr></table></td></tr>
</table>

	PAN No. AAFCT8667A GST no. 21AAFCT8667A1ZH
14	The currency of the Bid shall be INR
15	The bid validity period shall be 90 days from final 'Bid Due Date'.
16.1, 16.10 and 38.6	In case **'Earnest Money / Bid Security' or "Contract Performance Security**" is in the form of **'Demand Draft'** or **'Banker's Cheque'**, the same should be favour of "Talcher Fertilizers Limited", payable at New Delhi. In case of submission through online banking transaction i.e. IMPS / NEFT / RTGS / SWIFT, etc, the details of TFL's Bank account are as under: Account Holder's Name:Talcher Fertilizers Limited Bank Name: State Bank of India Branch: CAG II, New Delhi Account number: 41256023769 Type (Current/Saving): Current Branch Code-17313 Bidder to mention reference no. "EMD/……." in narration while remitting the EMD / Bid Security amount and to mention reference no. "CPS/……." in narration while remitting the CPS amount in TFL's Bank Account
D. SUBMISSION AND OPENING OF BIDS	
ITB clause	**Description**
18	In addition to the original of the Bid, the number of copies required is one. Not applicable in case of e-tendering.
4.0 of IFB	The submission of physical document as per clause no. 4.0 of IFB shall at following address: M/s Projects & Development India Limited, P.D.I.L Bhawan, A-14, Sector-1, Noida, (PIN 201301) Dist. Gautam Budh Nagar (UP). (India) Kind Attention: Mr. P.R.Sahu, Addl. General Manager (M.M) Fax no. : +91-120-2529801 Tel no. : +91-120-2544063
E. EVALUATION, AND COMPARISON OF BIDS	
ITB clause	**Description**
32	Evaluation Methodology is mentioned in Section-II of tender.

<table>
<tr><td>33</td><td><table><tr><td>Compensation for Extended Stay: APPLICABLE</td><td>✗</td></tr><tr><td>NOT APPLICABLE</td><td>✓</td></tr></table></td></tr>
<tr><td colspan="2">F. AWARD OF CONTRACT</td></tr>
<tr><td>ITB clause</td><td>Description</td></tr>
<tr><td>37</td><td>State of India of which stamp paper is required for Contract Agreement: Uttar Pradesh/ State where Bidder’s Registered or Corporate Office is located.</td></tr>
<tr><td>38</td><td>Contract Performance Security/ Security Deposit

<table><tr><td>APPLICABLE</td><td>✓</td></tr><tr><td>NOT APPLICABLE</td><td>✗</td></tr></table>
<u>The value/ amount of Contract Performance Security/ Security Deposit:</u>

CPS/SD @ 3% of Total Order / Contract value (excluding GST)</td></tr>
<tr><td>41</td><td>Provision of AHR Item :

<table><tr><td>APPLICABLE</td><td>✗</td></tr><tr><td>NOT APPLICABLE</td><td>✓</td></tr></table></td></tr>
<tr><td>44.1</td><td>Quarterly Closure of Contract:

<table><tr><td>APPLICABLE</td><td>✗</td></tr><tr><td>NOT APPLICABLE</td><td>✓</td></tr></table></td></tr>
<tr><td>49</td><td>Applicability of BEC relaxation relating to Startups:

<table><tr><td>APPLICABLE</td><td>✗</td></tr><tr><td>NOT APPLICABLE</td><td>✓</td></tr></table></td></tr>
</table>

Annexure-V

PUBLIC PROCUREMENT

(PREFERENCE TO MAKE IN INDIA), ORDER 2017

Annexure - V

No. P-45021/2/2017-PP (BE-II)
Government of India
Ministry of Commerce and Industry
Department for Promotion of Industry and Internal Trade
(Public Procurement Section)

Udyog Bhawan, New Delhi
Dated: 16th September, 2020

To

All Central Ministries/Departments/CPSUs/All concerned

ORDER

Subject: Public Procurement (Preference to Make in India), Order 2017– Revision; regarding.

Department for Promotion of Industry and Internal Trade, in partial modification [Paras 2, 3, 5, 10 & 13] of Order No.P-45021/2/2017-B.E.-II dated 15.6.2017 as amended by Order No.P-45021/2/2017-B.E.-II dated 28.05.2018, Order No.P-45021/2/2017-B.E.-II dated 29.05.2019 and Order No.P-45021/2/2017-B.E.-II dated 04.06.2020, hereby issues the revised 'Public Procurement (Preference to Make in India), Order 2017" dated 16.09.2020 effective with immediate effect.

Whereas it is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of goods and services in India with a view to enhancing income and employment, and

Whereas procurement by the Government is substantial in amount and can contribute towards this policy objective, and

Whereas local content can be increased through partnerships, cooperation with local companies, establishing production units in India or Joint Ventures (JV) with Indian suppliers, increasing the participation of local employees in services and training them,

Now therefore the following Order is issued:

1. This Order is issued pursuant to Rule 153 (iii) of the General Financial Rules 2017.

2. **Definitions**: For the purposes of this Order:

   'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

   'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

.....Contd. p/2

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for 'Class-I local supplier' under this Order.

'Non - Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a "Class-I local supplier" may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*.

3. Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement

(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by sub-para 3(a) above, and with estimated value of purchases less than Rs. 200 Crore, in accordance with Rule 161(iv) of GFR, 2017, Global tender enquiry shall not be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

.....Contd. p/3

3A. Purchase Preference

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 3(b) above and which are divisible in nature, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.

ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.

(c) In the procurements of goods or works, which are covered by para 3(b) above and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.

ii. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.

iii. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.

.....Contd. p/4

(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

3B. Applicability in tenders where contract is to be awarded to multiple bidders - In tenders where contract is awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

a) In case there is sufficient local capacity and competition for the item to be procured, as notified by the nodal Ministry, only Class I local suppliers shall be eligible to bid. As such, the multiple suppliers, who would be awarded the contract, should be all and only 'Class I Local suppliers'.

b) In other cases, 'Class II local suppliers' and 'Non local suppliers' may also participate in the bidding process along with 'Class I Local suppliers' as per provisions of this Order.

c) If 'Class I Local suppliers' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class I Local suppliers' do not qualify for award of contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class I local supplier' over 'Class II local suppliers'/ 'Non local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class I Local suppliers' taken in totality are considered for award of contract for at least 50% of the tendered quantity.

d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference, subject to its meeting the prescribed criteria for award of contract as also the constraint of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier', falling within 20% margin of purchase preference, and so on.

e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulated in sub-paras above.

4. **Exemption of small purchases**: Notwithstanding anything contained in paragraph 3, procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

5. **Minimum local content**: The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the 'local content' requirement is minimum 20%. Nodal Ministry/ Department may prescribe only a higher

.....Contd. p/5

percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/ 'Class-II local supplier'. For the items, for which Nodal Ministry/ Department has not prescribed higher minimum local content notification under the Order, it shall be 50% and 20% for 'Class-I local supplier'/ 'Class-II local supplier' respectively.

6. **Margin of Purchase Preference**: The margin of purchase preference shall be 20%.

7. **Requirement for specification in advance**: The minimum local content, the margin of purchase preference and the procedure for preference to Make in India shall be specified in the notice inviting tenders or other form of procurement solicitation and shall not be varied during a particular procurement transaction.

8. **Government E-marketplace**: In respect of procurement through the Government E-marketplace (GeM) shall, as far as possible, specifically mark the items which meet the minimum local content while registering the item for display, and shall, wherever feasible, make provision for automated comparison with purchase preference and without purchase preference and for obtaining consent of the local supplier in those cases where purchase preference is to be exercised.

9. **Verification of local content**:

   a. The 'Class-I local supplier'/ 'Class-II local supplier' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class-I local supplier'/ 'Class-II local supplier', as the case may be. They shall also give details of the location(s) at which the local value addition is made.

   b. In cases of procurement for a value in excess of Rs. 10 crores, the 'Class-I local supplier'/ 'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

   c. Decisions on complaints relating to implementation of this Order shall be taken by the competent authority which is empowered to look into procurement-related complaints relating to the procuring entity.

   d. Nodal Ministries may constitute committees with internal and external experts for independent verification of self-declarations and auditor's/ accountant's certificates on random basis and in the case of complaints.

   e. Nodal Ministries and procuring entities may prescribe fees for such complaints.

   f. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.

.....Contd. p/6

g. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities, in the manner prescribed under paragraph 9h below.

h. The Department of Expenditure shall issue suitable instructions for the effective and smooth operation of this process, so that:

   i. The fact and duration of debarment for violation of this Order by any procuring entity are promptly brought to the notice of the Member-Convenor of the Standing Committee and the Department of Expenditure through the concerned Ministry /Department or in some other manner;

   ii. on a periodical basis such cases are consolidated and a centralized list or decentralized lists of such suppliers with the period of debarment is maintained and displayed on website(s);

   iii. in respect of procuring entities other than the one which has carried out the debarment, the debarment takes effect prospectively from the date of uploading on the website(s) in the such a manner that ongoing procurements are not disrupted.

10. **Specifications in Tenders and other procurement solicitations**:

a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.

b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.

c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.

d. **Reciprocity Clause**

   i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc., it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.

.....Contd. p/7

ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all items related to that nodal Ministry/ Department, except for the list of items published by the Ministry/ Department permitting their participation.

iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchases on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/ Department.

iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.

v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.

e. Specifying foreign certifications/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/or for any other reason, the same shall be done only after written approval of Secretary of the Department concerned or any other Authority having been designated such power by the Secretary of the Department concerned.

f. "All administrative Ministries/Departments whose procurement exceeds *Rs.* 1000 Crore per annum shall notify/ update their procurement projections every year, including those of the PSEs/PSUs, for the next 5 years on their respective website."

10A. Action for non-compliance of the Provisions of the Order: In case restrictive or discriminatory conditions against domestic suppliers are included in bid documents, an inquiry shall be conducted by the Administrative Department undertaking the procurement (including procurement by any entity under its administrative control) to fix responsibility for the same. Thereafter, appropriate action, administrative or otherwise, shall be taken against erring officials of procurement entities under relevant provisions. Intimation on all such actions shall be sent to the Standing Committee.

11. **Assessment of supply base by Nodal Ministries**: The Nodal Ministry shall keep in view the domestic manufacturing / supply base and assess the available capacity and the extent of local competition while identifying items and prescribing the higher minimum local content or the manner of its calculation, with a view to avoiding cost increase from the operation of this Order.

12. **Increase in minimum local content**: The Nodal Ministry may annually review the local content requirements with a view to increasing them, subject to availability of sufficient local competition with adequate quality.

.....Contd. p/8

13. **Manufacture under license/ technology collaboration agreements with phased indigenization**: While notifying the minimum local content, Nodal Ministries may make special provisions for exempting suppliers from meeting the stipulated local content if the product is being manufactured in India under a license from a foreign manufacturer who holds intellectual property rights and where there is a technology collaboration agreement / transfer of technology agreement for indigenous manufacture of a product developed abroad with clear phasing of increase in local content.

13A. In procurement of all goods, services or works in respect of which there is substantial quantity of public procurement and for which the nodal ministry has not notified that there is sufficient local capacity and local competition, the concerned nodal ministry shall notify an upper threshold value of procurement beyond which foreign companies shall enter into a joint venture with an Indian company to participate in the tender. Procuring entities, while procuring such items beyond the notified threshold value, shall prescribe in their respective tenders that foreign companies may enter into a joint venture with an Indian company to participate in the tender. The procuring Ministries/Departments shall also make special provisions for exempting such joint ventures from meeting the stipulated minimum local content requirement, which shall be increased in a phased manner.

14. **Powers to grant exemption and to reduce minimum local content**: The administrative Department undertaking the procurement (including procurement by any entity under its administrative control), with the approval of their Minister-in-charge, may by written order, for reasons to be recorded in writing,

    a. reduce the minimum local content below the prescribed level; or
    b. reduce the margin of purchase preference below 20%; or
    c. exempt any particular item or supplying entities from the operation of this Order or any part of the Order.

    A copy of every such order shall be provided to the Standing Committee and concerned Nodal Ministry / Department. The Nodal Ministry / Department concerned will continue to have the power to vary its notification on Minimum Local Content.

15. **Directions to Government companies**: In respect of Government companies and other procuring entities not governed by the General Financial Rules, the administrative Ministry or Department shall issue policy directions requiring compliance with this Order.

16. **Standing Committee**: A standing committee is hereby constituted with the following membership:

    Secretary, Department for Promotion of Industry and Internal Trade—Chairman
    Secretary, Commerce—Member
    Secretary, Ministry of Electronics and Information Technology—Member
    Joint Secretary (Public Procurement), Department of Expenditure—Member
    Joint Secretary (DPIIT)—Member-Convenor

.....Contd. p/9

The Secretary of the Department concerned with a particular item shall be a member in respect of issues relating to such item. The Chairman of the Committee may co-opt technical experts as relevant to any issue or class of issues under its consideration.

17. **Functions of the Standing Committee**: The Standing Committee shall meet as often as necessary, but not less than once in six months. The Committee

    a. shall oversee the implementation of this order and issues arising therefrom, and make recommendations to Nodal Ministries and procuring entities.
    b. shall annually assess and periodically monitor compliance with this Order
    c. shall identify Nodal Ministries and the allocation of items among them for issue of notifications on minimum local content
    d. may require furnishing of details or returns regarding compliance with this Order and related matters
    e. may, during the annual review or otherwise, assess issues, if any, where it is felt that the manner of implementation of the order results in any restrictive practices, cartelization or increase in public expenditure and suggest remedial measures
    f. may examine cases covered by paragraph 13 above relating to manufacture under license/ technology transfer agreements with a view to satisfying itself that adequate mechanisms exist for enforcement of such agreements and for attaining the underlying objective of progressive indigenization
    g. may consider any other issue relating to this Order which may arise.

18. **Removal of difficulties**: Ministries /Departments and the Boards of Directors of Government companies may issue such clarifications and instructions as may be necessary for the removal of any difficulties arising in the implementation of this Order.

19. **Ministries having existing policies**: Where any Ministry or Department has its own policy for preference to local content approved by the Cabinet after 1st January 2015, such policies will prevail over the provisions of this Order. All other existing orders on preference to local content shall be reviewed by the Nodal Ministries and revised as needed to conform to this Order, within two months of the issue of this Order.

20. **Transitional provision**: This Order shall not apply to any tender or procurement for which notice inviting tender or other form of procurement solicitation has been issued before the issue of this Order.

(Rajesh Gupta)
Director
Tel: 23063211
rajesh.gupta66@gov.in

FORM – I of ANNEXURE V

CERTIFICATE FROM STATUTORY AUDITOR OR COST AUDITOR OF THE COMPANY (IN THE CASE OF COMPANIES) OR FROM A PRACTICING COST ACCOUNTANT OR PRACTICING CHARTERED ACCOUNTANT (IN RESPECT OF SUPPLIERS OTHER THAN COMPANIES) TOWARDS MINIMUM LOCAL CONTENT

(FOR SUPPLY OF GOODS/ SERVICES / WORKS / EPC / LSTK)

To,
M/s Talcher Fertilizers Limited

SUB:

TENDER NO:

Dear Sir

A. We…….. the Statutory Auditor / Cost Auditor / Practicing Cost Accountant / Practicing Chartered Accountant) have verified relevant records of M/s ……. **(Name of the bidder)** and certify that M/s …… **(Name of the bidder)** meets the following:

Sl. No.	Description	Confirmation
a	Bidder meets the mandatory minimum Local content requirement of 20% for participating in the Bidding process under Public Procurement (Preference to Make in India) Policy. (In case bidder does not meet the minimum Local content requirement of 20%, such bidders are not allowed to participate in the Bidding process)	Confirmed.
b	The bidder meets mandatory minimum Local content requirement of 50% for claiming purchase preference under Public Procurement (Preference to Make in India) Policy	Confirmed / Not Confirmed

B. The **details of the location** at which the local value addition is made as follows:

Sl. No.	Item Description	Details of the Location(s) where the local value addition is made
1.		
2.		
3.		

Name of Audit Firm / Chartered Accountant: [Signature of Authorized Signatory]
Name:
Date: Designation:
Seal:

Membership No.:
UDIN:

FORM-II of ANNEXURE-V

Salient Points of Public Procurement (Preference to Make in India) Policy

Sr. No.	Description	Parameter / Document
1	**Minimum Local Content (LC) for Availing Preference under this Policy**	50%
2	**Margin of Purchase Preference**	20%
3	**Local Content (LC) % declared by bidder** (Documents to be submitted as per Sr. No. 4 below)	[Tick **(✓)** whichever is applicable] a) LC Equal to or more than 50% ☐ b) LC More than 20% but less than 50% ☐
4	**Documents to be submitted by bidder under this Policy**	Certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost accountant or practicing chartered accountant as per Form-I to be submitted by bidder.
5	**Whether tender is divisible or not divisible**	Not Divisible; Clause No. 3A (c) of revised Policy dated 16.09.2020 shall be applicable

Annexure-VI

PREAMBLE TO SCHEDULE OF RATES

1. The “Schedule of Rates (SOR)” will be in Excel format (password protected) and will be uploaded during tender creation. This will be downloaded by the bidder and bidder will quote price on this Excel file for entire scope of work as per NIT. Thereafter, the bidder will upload the same Excel file during bid submission.

2. The SOR format is provided in a spread sheet file (BoQ_xxxx.xls). The rates offered should be entered in the allotted space only and uploaded after filling the relevant columns. The SOR template must not be modified / replaced by the bidder; else the bid submitted shall be rejected.

3. Bidder shall quote all Prices in INR only.

4. SOR consists Schedule of Rates containing Total Lumpsump Turnkey Price/ TOTALCONTRACT PRICE & GST

5. It is mandatory to quote prices in SOR. It will be the responsibility of the contractor to quote for all Materials/ Equipments /Services/Civil & Structural Works etc. as per scope of work and terms and conditions defined in NIT.

6. CONTRACTOR shall be responsible for payment of all taxes, duties and levies as applicable on performance of WORK under CONTRACT and shall be included in the quoted TOTAL LSTK PRICE /TOTAL CONTRACT PRICE.

7. A copy of SOR, with prices/figures completely blanked out but with the word “QUOTED” in all columns is to be uploaded along with the unpriced bid, as a confirmation of price/data quoted against each head.

Annexure-VII

PROCUREMENT FROM A BIDDER WHICH SHARES A LAND BORDER WITH INDIA

1. Order (PublicProcurementNo.1) dated 23.07.2020, Order (Public Procurement No.2) dated 23.07.2020 and Order (PublicProcurementNo.3) dated 24.07.2020, Department of Expenditure, Ministry of Finance, Govt. Of India refers. The same are available at web-site https://doe.gov.in/procurement-policy-divisions.

2. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority. For details of competent authority refer to Annexure I of Order (Public ProcurementNo.1) dated 23.07.2020.

   Further the above will not apply to bidders from those countries (even if sharing a land border with India) to which the Government of India has extended lines of creditor in which the Government of India is engaged in development projects. Updated lists of countries to which lines of credit have been extended or in which development projects are undertaken are given in the website of the Ministry of External Affairs, Govt. Of India

3. "Bidder"(including the term 'tenderer', 'consultant' 'vendor' or' service provider' in certain contexts) for purpose of this provision means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.

4. "Bidder from a country which shares a land border with India" for the purpose of this:

   a) An entity incorporated, established or registered in such a country ;or
   b) A subsidiary of an entity incorporated, established or registered in such a country; or
   c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
   d) An entity whose beneficial owner is situated in such a country; or
   e) An Indian(or other)agent of such an entity; or
   f) A natural person who is a citizen of such a country; or
   g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

5. **"Beneficial owner"** for the purpose of above (4) will be as under:

   i) In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person(s), has a controlling ownership interest or who exercises control through other means.

      Explanation-

a) "Controlling ownership interest" means ownership of, or entitlement to, more than twenty-five percent of shares or capital or profits of the company;

b) "Control" shall include the right to appoint the majority of the

directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

ii) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

iii) In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

iv) Where no natural person is identified under (i) or (ii) or (iii) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

v) In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

6. **"Agent"** for the purpose of this Order is a person employed to do any act for another, or to represent another in dealings with third persons.

7. **SUBMISSION OF CERTIFICATE IN BIDS:**

Bidder shall submit a certificate in this regard as Form-I to Annexure-VII.

If such certificate given by a bidder who se bid is accepted is found to be false, this would be aground for immediate rejection of the bid/termination and further action as per "Procedure for Action in case of Corrupt /Fraudulent/Collusive / Coercive Practices" of tender document.

8. The registration, wherever applicable, should be valid at the time of submission of bids and at the time of acceptance of bids. In respect of supply otherwise than by tender, registration should be valid at the time of placement of order. If the bidder was validly registered at the time of acceptance / placement of order, registration shall not be a relevant consideration during contract execution.

9. PROVISION FOR WORKS CONTRACTS, INCLUDING TURNKEY CONTRACTS:

The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. The definition of "contractor from a country which shares a land border with India" shall be as in Para4 herein above. A Certificate to this regard is to be submitted by bidder is placed at Form-II

Form-I to Annexure-VII

UNDERTAKING ON LETTERHEAD

To,
M/s Talcher Fertilizers Limited

_____

SUB:

TENDER NO:

Dear Sir

We have read the clause regarding Provisions for Procurement from a Bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; we certify that, bidder M/s_____ ***(Name of Bidder)*** is:

(i)	not from such a country	[ ]
(ii)	if from such a country, has been registered with the Competent Authority. (Evidence of valid registration by the Competent Authority shall be attached)	[ ]

(Bidder is to tick appropriate option (✓or X) above).

We further certify that bidder **M/s**_____ **(Name of Bidder)** will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority.

We hereby certify that bidder **M/s**_____ **(Name of Bidder)** fulfills all requirements in this regard and is eligible to be considered.

Place:
Date:

[Signature of Authorized Signatory of Bidder]
Name:
Designation:
Seal:

FORMS & FORMATS

LIST OF FORMS & FORMATS

Form No.	Description
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F-3	LETTER OF AUTHORITY
F-4	PROFORMA OF "BANK GUARANTEE" FOR "CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT"
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F-21	UNDERTAKING REGARDING SUBMISSION OF ELECTRONIC INVOICE(E-INVOICE AS PER GST LAW)
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F-26	GUARANTEE BY THE FOREIGN BASED SUPPORTING COMPANY/ GUARANTOR
F-27	PROFORMA OF "BANK GUARANTEE" TOWARDS PERFORMANCE SECURITY BY FOREIGN BASED SUPPORTING COMPANY OF THE BIDDING COMPANY
F-28	CERTIFICATE ISSUED BY COMPANY SECRETARY OF THE GUARANTOR COMPANY

F-1

BIDDER'S GENERAL INFORMATION

To,
M/s Talcher Fertilizers Limited

TENDER NO:

1	Bidder Name:	M/s…..
2	Status of Firm	Proprietorship Firm/Partnership firm/ Public Limited/ Pvt. Limited/ Govt. Dept. / PSU/ Others If Others Specify:_____ [Enclose relevant certificates / partnership deed/certificate of Registration, as applicable]
3	Name of Proprietor/ Partners/ Directors of the firm/company	1. 2. 3.
4	Name of Power of Attorney holders of bidder	
5	Number of Years in Operation	
6	Address of Registered Office	_____ City: _____ District: _____ State: _____ PIN/~~ZIP~~ :_____
7	Bidder's address where order/contract is to be placed	_____ City: _____ District: _____ State: _____ PIN/~~ZIP~~ :_____
8	Office responsible for executing the contract with GST no.(In case supply of works are from multiple locations, addresses and GST no. of all such locations are to be provided)	City: District: State: PIN/~~ZIP~~: GST No.:
9	Telephone Number & Contact Information of address where order is to be placed	_____ (Country Code) (Area Code) (Telephone Number) FAX No. : …… e-mail ID: ……
10	E-mail Address	

11	ISO Certification, if any {If yes, please furnish details}	
12	PAN No	[Enclose copy of relevant document]
13	GST No. (refer sl. no. 8 above)	[Enclose copy of relevant document]
14	EPF Registration No.	[Enclose copy of relevant document]
15	ESI code No.	[Enclose copy of relevant document]
16	Whether Micro or Small Enterprise	Yes / No (*If Yes, Bidder to submit requisite documents as specified it ITB: Clause No. 40*)
	Whether MSE is owned by SC/ST Entrepreneur(s)	Yes / No (*If Yes, Bidder to submit requisite documents as specifie it ITB: Clause No. 40*)
	Whether MSE is owned by Women	Yes / No (*If Yes, Bidder to submit requisite documents as specifie it ITB: Clause No. 40*)
17	Whether Bidder is Startups or not	Yes / No (*If Yes, Bidder to submit requisite documents as specifie it ITB: Clause No. 49*)
18	In case of Start-up confirm the following: (i) Date of its incorporation/ registration (ii) Whether turnover for any financial years since incorporation/ registration has exceeded Rs.100 Crores.	

Note: * *TFL intent to place the contract directly on the address from where Works are to be supplied. In case, bidder wants contract at some other address or Works are to supplied from multiple locations, bidder is required to provide in their bid, the address on which contract is to be placed.*

Place:
Date:

[Signature of Authorized Signatory of Bidder]

Name:

Designation:

Seal:

FORMAT F-2A

PROFORMA OF "BANK GUARANTEE"
FOR "EARNEST MONEY / BID SECURITY"
(To be stamped in accordance with the Stamp Act)

To, Talcher Fertilizers Limited (TFL) _____	**Bank Guarantee No.**	
	Date of BG	
	BG Valid up to (Expiry date)	
	Claim period up to (indicate date of expiry of claim period which includes minimum three months from the expiry date)	
	Stamp Sl. No./e-Stamp Certificate No.	

Dear Sir(s),

In accordance with Letter Inviting Tender under your reference No _____ M/s. _____
having their Registered / Head Office at _____ (hereinafter called the Tenderer), wish to participate in the said tender for _____

As an irrevocable Bank Guarantee against Earnest Money for the amount of _____ is required to be submitted by the Tenderer as a condition precedent for participation in the said tender which amount is liable to be forfeited on the happening of any contingencies mentioned in the Tender Document.

We, the _____ Bank at _____having our Head Office _____ (Local Address) guarantee and undertake to pay immediately on demand without any recourse to the tenderers by Talcher Fertilizers Limited, the amount _____ _____ without any reservation, protest, demur and recourse. Any such demand made by TFL, shall be conclusive and binding on us irrespective of any dispute or difference raised by the Tenderer.

This guarantee shall be irrevocable and shall remain valid up to _____ [this date should be two (02) months beyond the validity of the bid].If any further extension of this guarantee is required, the same shall be extended to such required period on receiving instructions from M/s. _____ whose behalf this guarantee is issued.

Notwithstanding anything contained herein:

a) The Bank's liability under this Guarantee shall not exceed (currency in figures) . . . . . (currency in words only) . . . . .
b) This Guarantee shall remain in force upto _____ (this expiry date of BG should be two months beyond the validity of bid) and any extension(s) thereof; and

c) The Bank shall be released and discharged from all liability under this Guarantee unless a written claim or demand is issued to the Bank on or before the midnight of …….(indicate date of expiry of claim period which includes minimum three months from the expiry of this Bank Guarantee) and if extended, the date of expiry of the last extension of this Guarantee. If a claim has been received by us within the said date, all the rights of TFL under this Guarantee shall be valid and shall not cease until we have satisfied that claim.

In witness whereof the Bank, through its authorized officer, has set its hand and stamp on this _____day of _____ 20__ at _____.

WITNESS:

(SIGNATURE)
(NAME)

(SIGNATURE)
(NAME)
Designation with Bank Stamp

(OFFICIAL ADDRESS)

Attorney as per
Power of Attorney No. _____
Date: _____

INSTRUCTIONS FOR FURNISHING "BID SECURITY / EARNEST MONEY" BY "BANK GUARANTEE"

1. The Bank Guarantee by Bidders will be given on non-judicial stamp paper as per "Stamp Duty" applicable. The non-judicial stamp paper should be in the name of the issuing Bank.
2. The expiry date should be arrived at in accordance with "ITB: Clause-16.1".
3. The Bank Guarantee by bidders will be given from Bank as specified in "ITB Clause-16.2".
4. A letter from the issuing Bank of the requisite Bank Guarantee confirming that said Bank Guarantee / all future communication relating to the Bank Guarantee shall be forwarded to the Employer at its address as mentioned at "ITB".
5. Bidders must indicate the full postal address of the Bank along with the Bank's E-mail / Fax / Phone from where the Earnest Money Bond has been issued as per proforma provided below.
6. If a Bank Guarantee is issued by a commercial Bank, then a letter to Employer confirming its net worth is more than Rs. 1,000,000,000.00 [Rupees One Hundred Crores] or equivalent along with documentary evidence in the Bank Guarantee itself.

FORMAT F-2B

DECLARATION FOR BID SECURITY
(To be submitted on Letter head of Bidder)

To,

M/s TALCHER FERTILIZERS LIMITED

_____

SUB:

TENDER NO:

Dear Sir,

After examining / reviewing provisions of above referred tender documents (including all corrigendum/ Addenda), we M/s_____ (Name of Bidder) have submitted ouroffer/ bid no._____.

We, M/s_____ (Name of Bidder) hereby understand that, according to your conditions, we are submitting this Declaration for Bid Security.

We understand that we will be put on watch list/holiday/ banning list (as per polices of TALCHER FERTILIZERS LIMITED in this regard), if we are in breach of our obligation(s) as per following:

(a) have withdrawn/modified/amended, impairs or derogates from the tender, my/our Bid during the period of bid validity specified in the form of Bid; or

(b) having been notified of the acceptance of our Bid by the TALCHER FERTILIZERS LIMITED during the period of bid validity:
   (i) fail or refuse to execute the Contract, if required, or
   (ii) fail or refuse to furnish the Contract Performance Security, in accordance provisions of tender document.
   (iii) fail or refuse to accept 'arithmetical corrections' as per provision of tender document.

(c) having indulged in corrupt/fraudulent /collusive/coercive practice as per procedure.

Place:
Date:

[Signature of Authorized Signatory of Bidder]
Name:
Designation:

Seal

F-3

LETTER OF AUTHORITY

[Pro forma for Letter of Authority for Attending 'Pre-Bid Meetings' /'Un-priced Bid Opening' / 'Price Bid Opening']

Ref: Date:

To,
M/s TALCHER FERTILIZERS LIMITED,

SUB:
TENDER NO:

Dear Sir,
I/We, _____ hereby authorize the following representative(s) for attending any 'Meetings [Pre-Bid Meeting]', 'Un-priced Bid Opening' and 'Price Bid Opening' against the above Tender Documents:

[1] Name & Designation _____ Signature _____
Phone/Cell:

E-mail: …….. @ ……

[2] Name & Designation _____ Signature _____
Phone/Cell:

E-mail: …….. @ ……

We confirm that we shall be bound by all commitments made by aforementioned authorised representative(s).

Place: [Signature of Authorized Signatory of Bidder]
Date: Name:
Designation:
Seal:

(i) Note: This "Letter of Authority" should be on the **"letter head"** of the Bidder and should be signed by a person competent and having the 'Power of Attorney' to bind the Bidder. Not more than 'two [02] persons per Bidder' are permitted to attend 'Pre-Bid Meetings' /'Un-priced Bid Opening' / 'Price Bid Opening'..

(ii) Bidder's authorized representative is required to carry a copy of this authority letter while attending the 'Pre-Bid Meetings' /'Un-priced Bid Opening .

F-4

PROFORMA OF "BANK GUARANTEE" FOR "CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT"
(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

To, M/s Talcher Fertilizers Limited, Noida	**Bank Guarantee No.**	
	Date of BG	
	BG Valid up to	
	Claim period up to (There should be three months gap between expiry date of BG & Claim period)	
	Stamp Sl. No./e-Stamp Certificate No.	

Dear Sir(s),

M/s. _____ having registered office at _____ (herein after called the "contractor" which expression shall wherever the context so require include its successors and assignees) have been placed/ awarded the job/work of _____ vide LOA /FOA No. _____dated_____ for Talcher Fertilizers LImited having registered office at Plot 2/H, Kalpana Area, BJB Nagar, Khorda, Bhubaneswar-751014, Odisha (herein after called the "TFL" which expression shall wherever the context so require include its successors and assignees).

The Contract conditions provide that the CONTRACTOR shall pay a sum of Rs. _____ (Rupees _____) as full Contract Performance Guarantee in the form therein mentioned. The form of payment of Contract Performance Guarantee includes guarantee executed by Nationalized Bank/Scheduled Commercial Bank, undertaking full responsibility to indemnify Talcher Fertilizers Limited, in case of default.

The said M/s._____ has approached us and at their request and in consideration of the premises we having our office at _____ have agreed to give such guarantee as hereinafter mentioned.

1. We_____ hereby undertake to give the irrevocable & unconditional guarantee to you that if default shall be made by M/s. _____ in performing any of the terms and conditions of the tender/order/contract or in payment of any money payable to Talcher Fertilizers Limited we shall on first demand pay without demur, contest, protest and/ or without any recourse to the contractor to TFL in such manner as TFL may direct the said amount of Rupees _____ only or such portion thereof not exceeding the said sum as you may require from time to time.

2. You will have the full liberty without reference to us and without affecting this guarantee, postpone for any time or from time to time the exercise of any of the powers and rights conferred on you under the order/contract with the said M/s. _____ and to enforce or to forbear from endorsing any powers or rights or by reason of time being given to the said M/s._____ and such postponement forbearance would not have the effect of releasing the bank from its obligation under this debt.

3. Your right to recover the said sum of Rs. _____ (Rupees_____) from us in manner aforesaid is absolute & unequivocal and will not be affected or suspended by reason of the fact that any dispute or disputes have been raised by the said M/s. _____ and/or that any dispute or disputes are pending before any officer, tribunal or court or arbitrator or any other authority/forum and any demand made by you in the bank shall be conclusive and binding. The bank shall not be released of its obligations under these presents by any exercise by you of its liberty with reference to matter aforesaid or any of their or by reason or any other act of omission or commission on your part or any other indulgence shown by you or by any other matter or changed what so ever which under law would, but for this provision, have the effect of releasing the bank.

4. The guarantee herein contained shall not be determined or affected by the liquidation or winding up dissolution or changes of constitution or insolvency of the said contractor but shall in all respects and for all purposes be binding and operative until payment of all money due to you in respect of such liabilities is paid.

5. The bank undertakes not to revoke this guarantee during its currency without your previous consent and further agrees that the guarantee shall continue to be enforceable until it is discharged by TFL in writing. However, if for any reason, the contractor is unable to complete the work within the period stipulated in the order/contract and in case of extension of the date of delivery/completion resulting extension of defect liability period/guarantee period of the contractor fails to perform the work fully, the bank hereby agrees to further extend this guarantee at the instance of the contractor till such time as may be determined by TFL. If any further extension of this guarantee is required, the same shall be extended to such required period on receiving instruction from M/s. _____ (contractor) on whose behalf this guarantee is issued.

6. Bank also agrees that TFL at its option shall be entitled to enforce this Guarantee against the bank (as principal debtor) in the first instant, without proceeding against the contractor and notwithstanding any security or other guarantee that TFL may have in relation to the /contractor's liabilities.

7. The amount under the Bank Guarantee is payable forthwith without any delay by Bank upon the written demand raised by TFL. Any dispute arising out of or in relation to the said Bank Guarantee shall be subject to the exclusive jurisdiction of courts at New Delhi.

8. Therefore, we hereby affirm that we are guarantors and responsible to you on behalf of the Contractor up to a total amount of _____(amount of guarantees in words and figures) and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the order/contract and without caveat or argument, any sum or sums within the limits of (amounts of guarantee) as aforesaid, without your needing to prove or show grounds or reasons for your demand or the sum specified therein.

9. We have power to issue this guarantee in your favor under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney, dated _____ granted to him by the Bank.

10. Notwithstanding anything contained herein:

11.

a) The Bank's liability under this Guarantee shall not exceed (currency in figures) _____ (currency in words only) _____
b) This Guarantee shall remain in force upto _____ (this date should be expiry date of defect liability period of the Contract) and any extension(s) thereof; and
c) The Bank shall be released and discharged from all liability under this Guarantee unless a written claim or demand is issued to the Bank on or before the midnight of _____ (indicate date of expiry of claim period which includes minimum three months from the expiry of this Bank Guarantee) and if extended, the date of expiry of the last extension of this Guarantee. If a claim has been received by us within the said date, all the rights of TFL under this Guarantee shall be valid and shall not cease until we have satisfied that claim.

Yours faithfully,

_____
Bank by its Constituted Attorney

Signature of a person duly
Authorized to sign on behalf of the Bank

INSTRUCTIONS FOR FURNISHING "CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT" BY "BANK GUARANTEE"

1. The Bank Guarantee by successful Bidder(s) will be given on non-judicial stamp paper as per 'stamp duty' applicable. The non-judicial stamp paper should be in name of the issuing bank..

2. The Bank Guarantee by Bidders will be given from bank as specified in Cl no. 38.3 of ITB [Section-III] of Tender Document .

3. A letter from the issuing bank of the requisite Bank Guarantee confirming that said Bank Guarantee and all future communication relating to the Bank Guarantee shall be forwarded to Employer.

4. If a Bank Guarantee is issued by a commercial bank, then a letter to Employer and copy to Consultant (if applicable) confirming its net worth is more than Rs. 100,00,00,000.00 [Rupees One Hundred Crores] or its equivalent in foreign currency alongwith documentary evidence OR in the Bank Guarantee itself.

5. Contractor shall submit attached cover letter (Annexure) while submitting Contract Performance Security.

Form-4 (a)

MATTER TO BE MENTIONED IN COVERING LETTER TO BE SUBMITTED BY VENDOR ALONG WITH BANK GUARANTEE (BG)

<table>
<tr><td>1. Bank Guarantee No.</td><td></td></tr>
<tr><td>2. Vendor Name/ VENDOR CODE</td><td><table><tr><td>NAME</td><td></td></tr><tr><td>VENDOR CODE</td><td></td></tr></table></td></tr>
<tr><td>BANK GUARANTEE AMOUNT</td><td></td></tr>
<tr><td>PURCHASE ORDER/LOA</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>1. Nature of Bank Guarantee [Please Tick (□) whichever is applicable]</td><td><table><tr><td>Performance Security (CPS)</td><td>SECURITY DEPOSIT</td><td>ADVANCE</td><td>EMD</td></tr></table></td></tr>
<tr><td colspan="2">2. BG ISSUING Bank DETAILS:</td></tr>
<tr><td>(A) E-MAIL ID</td><td></td></tr>
<tr><td>(B) ADDRESS</td><td></td></tr>
<tr><td>(C) Phone No. / Mobile No.</td><td></td></tr>
</table>

F-5

AGREED TERMS & CONDITIONS

To,
M/s TALCHER FERTILIZERS LIMITED

SUB:
TENDER NO:

This Questionnaire duly filled in, signed & stamped must form part of Bidder's Bid and should be returned along with Un-priced Bid. Clauses confirmed hereunder need not be repeated in the Bid.

Sl.	DESCRIPTION	BIDDER'S CONFIRMATION
1.	Bidder's name, Vendor Code of TFL (If any) and address	Bidder's Name: TFL's Vendor Code: Address:
2.	Bidder confirms the currency of quoted prices is in Indian Rupees	
3.	Bidder confirms quoted prices will remain firm and fixed till complete execution of the order (except where price escalation/variation is allowed in the Tender).	
4.	Bidder confirms that they have quoted **GST (CGST & SGST/ UTGST or IGST)** in Price Schedule / Schedule of Rates (SOR) of Price bid.	Confirmed
4.1	Whether in the instant tender services/works are covered in reverse charge rule of **GST (CGST & SGST/UTGST or IGST)** If yes, Bidder confirms that they have quoted rate of applicable GST (CGST & SGST/ UTGST or IGST**)** in Price Schedule / Schedule of Rates of Price Bid	
4.2	Indicate Harmonized System of Nomenclature (HSN)/Service Accounting Codes (SAC).	HSN/SAC Code (as applicable): _____
4.3	Bidder hereby confirms that the quoted prices are in compliance with the Section 171 of CGST Act/ SGST Act as mentioned as clause no. 13.10 of ITB (Anti-profiteering clause).	
4.4	a. Whether bidder is liable to raise E-Invoice as per GST Act. b. If yes, bidder will raise E-Invoice and confirm compliance to provision of tender in this regard.	a. _____ b. _____
4.5	Whether bidder is liable to raise E-Invoice as per GST Act.	
	If yes, bidder will raise E-Invoice and confirm compliance to provision of tender in this regard.	
5.	Bidder confirms acceptance of relevant Terms of Payment specified in the Bid Document.	

Sl.	DESCRIPTION	BIDDER'S CONFIRMATION
6.	Bidder confirms that Contract Performance Security will be furnished as per Bid Document within 30 days of FOA in case of successful bidder.	
7.	Bidder confirms that Contract Performance Security shall be from any Indian scheduled bank or a branch of an International bank situated in India and registered with Reserve bank of India as scheduled foreign bank. However, in case of bank guarantees from banks other than the Nationalised Indian banks, the bank must be a commercial bank having net worth in excess of Rs 100 crores and a declaration to this effect shall be made by such commercial bank either in the Bank Guarantee itself or separately on its letterhead.	
8.	Bidder confirms compliance to Completion Schedule as specified in Bid document and the same shall be reckoned from the date of Fax of Acceptance.	
9.	(i) Bidder confirms acceptance of Mutually Agreed Damages for delay in completion schedule specified in Bid document. (ii) In case of delay, the bills/invoices shall be submitted after reducing the price reduction due to delay (refer MAD Clause).	
10.	a) Bidder confirms acceptance of all terms and conditions of Bid Document (all sections). b) Bidder confirms that printed terms and conditions of bidder are not applicable.	
11.	Bidder confirms that their offer is valid for period specified in BDS from Final/Extended due date of opening of Techno-commercial Bids.	
12.	Bidder have furnished EMD/Bid Security details as under: a) EMD/ Bid Security No. & date b) Value c) Validity d) Bank Address/e-mail ID/Mobile no. [in case of BG] **OR** Bidder furnishes bid security declaration [applicable for MSEs, Start-Ups and CPSEs (to whom exemption is allowed as per extant guidelines in vogue)]	
13.	As per requirement of tender, bidder (having status as Pvt. Ltd. or Limited company) must upload bid duly digitally signed on e-portal through class-3B digital signature (DS). In case, class of DS or name of employee or name of employer is not visible in the digitally signed documents, the bid digitally signed as submitted by the person shall be binding on the bidder.	
14.	Bidder confirms that (i) none of Directors (in Board of Director) of bidder is a relative of any Director (in Board of Director) of TFL or (ii) the bidder is not a firm in which any Director (in Board of Director) of TFL or their relative is a partner.	Confirmed / Not confirmed

Sl.	DESCRIPTION	BIDDER'S CONFIRMATION
15.	All correspondence must be in ENGLISH language only	
16.	Bidder confirms the contents of this Tender Document have not been modified or altered by them. In case, it is found that the tender document has been modified / altered by the bidder, the bid submitted by them shall be liable for rejection.	
17.	Bidder confirms that all Bank charges associated with Bidder's Bank regarding release of payment etc. shall be borne by Bidder.	
18.	No Deviation Confirmation: It may be note that any 'deviation / exception' in any form may result in rejection of Bid. Therefore, Bidder confirms that they have not taken any 'exception / deviation' anywhere in the Bid. In case any 'deviation / exception' is mentioned or noticed, Bidder's Bid may be rejected.	
19.	If Bidder becomes a successful Bidder pursuant to the provisions of the Tender Document, the following Confirmation shall be automatically become enforceable: "We agree and acknowledge that the Employer is entering into the Contract/Agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood & agreed that the Government of India is not a party to the Contract/Agreement and has no liabilities, obligations or rights thereunder. It is expressly understood and agreed that the Purchaser is authorized to enter into Contract/Agreement, solely on its own behalf under the applicable laws of India. We expressly agree, acknowledge and understand that the Purchaser is not an agent, representative or delegate of the Government of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the Agreement. Accordingly, we hereby expressly waive, release and forego any and all actions or claims, including cross claims, VIP claims or counter claims against the Government of India arising out of the Agreement and covenants not to sue to Government of India as to any manner, claim, cause of action or things whatsoever arising of or under the Agreement."	
20.	Bidder to ensure all documents as per tender including clause 11 of Section III of tender and all Formats are included in their bid.	
21.	Bidder understands that Tender Document is not exhaustive. In case any activity though specifically not covered in description of 'Schedule of Rates' but is required to complete the work as per Scope of Work, Conditions of Contract, or any other part of Bidding document, the quoted rates will deemed to be inclusive of cost incurred for such activities unless otherwise specifically excluded. Bidder confirms to perform for fulfilment of the contract and completeness of the supplies in all respect within the scheduled time frame and quoted price.	
22.	Bidder hereby confirms that they are not on 'Holiday' by OWNER or any of the JV partners of TFL (viz. GAIL, RCF, CIL, FCIL) or	

Sl.	DESCRIPTION	BIDDER'S CONFIRMATION
	Public Sector Project Management Consultant (like PDIL, EIL, Mecon only due to “poor performance” or “corrupt and fraudulent practices”) or banned by Government department/ Public Sector on due date of submission of bid. Further, Bidder confirms that neither they nor their allied agency/(ies) (as defined in the Procedure for Action in case of Corrupt/Fraudulent/Collusive/ Coercive Practices) are on banning list of TFL or any of the JV partner of TFL viz. GAIL, RCF, CIL, FCIL. Bidder also confirms that they are not under any liquidation, court receivership or similar proceedings or 'bankruptcy'. In case it comes to the notice of TFL/PDIL that the bidder has given wrong declaration in this regard, the same shall be dealt as ‘fraudulent practices’ and action shall be initiated as per the Procedure for action in case of Corrupt/Fraudulent/Collusive/Coercive Practices. Further, Bidder also confirms that in case there is any change in status of the declaration prior to award of contract, the same will be promptly informed to TFL/PDIL by them.	
23	Bidder confirms that (i) any variation in GST at the time of supplies for any reasons, other than statutory, including variations due to turnover, shall be borne by them and (ii) any error of interpretation of applicability of rate of GST (CGST & SGST/ UTGST or IGST) on components of an item and/or various items of tender by them shall be dealt as per clause no. 13.13 of Section-III of tender.	
24	Bidders confirm to submit signed copy of Integrity Pact (wherever included in tender). If Bidder is a partnership concern or a consortium, this agreement must be signed by all partners or consortium members.	
25.	Bidder confirms that, in case of contradiction between the confirmations provided in this format and to the terms & conditions mentioned elsewhere in the offer, the confirmations given in this format shall prevail.	
26.	Bidder’s offer No. & Date	
27	Bidder confirms that there is no conflict of interest with other bidders, as per clause no.4.2 of Section-III (ITB) of Tender Document.	

Place:
Date:

[Signature of Authorized Signatory of Bidder]
Name:
Designation:
Seal:

F-6

ACKNOWLEDGEMENT CUM CONSENT LETTER

(On receipt of tender document/information regarding the tender, Bidder shall acknowledge the receipt and confirm his intention to bid or reason for non-participation against the enquiry /tender through e-mail to concerned executive in TFL/PDIL issued the tender, by filling up the Format)

To,
M/s TALCHER FERTILIZERS LIMITED
NOIDA

SUB:
TENDER NO:

Dear Sir,

We hereby acknowledge receipt of a complete set of bidding documents along with enclosures for subject item/job and/or the information regarding the subject tender.

- We intend to bid as requested for the subject item/job and furnish following details with respect to our quoting office:

  Postal Address with Pin Code : .....
  Telephone Number : .....
  Contact Person : .....
  E-mail Address : .....
  Mobile No. : .....
  Date : .....
  Seal/Stamp : .....

- We are unable to bid for the reason given below:

  Reasons for non-submission of bid:

Agency's Name : .....
Signature : .....
Name : .....
Designation : .....
Date : .....
Seal/Stamp : .....

F-7
BIDDER'S EXPERIENCE

To,

M/s TALCHER FERTILIZERS LIMITED
NOIDA

SUB:
TENDER NO:

Sl. No	Detailed Description of Job	LOA /WO No. and date	Full Postal Address & phone nos. of Client. *Name, designation and address of Engineer/ Officer-in-Charge*	Capacity	Value of Contract/ Order (*Specify* Currency Amount)	Date of Commencement	Scheduled Completion Time (Months)	Date of Actual Completion	Reasons for delay in execution, if any	Details of satisfactory operation from the date of Acceptance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

Place:
Date:

[Signature of Authorized Signatory of Bidder]

Name:
Designation:

Seal:

Note: As per Note III of Clause No. A.1 of Section-II, only documents (Work Order, Completion certificate, Execution Certificate etc.) which have been referred/ specified in the bid shall be considered in reply to queries during evaluation of Bids.

F-8(A)
CHECK LIST

Bidders are requested to duly fill in the checklist. This checklist gives only certain important items to facilitate the bidder to make sure that the necessary data/information as called for in the bid document has been submitted by them along with their offer. This, however, does not relieve the bidder of his responsibilities to make sure that his offer is otherwise complete in all respects.

Please ensure compliance and tick (√) against following points:

S. No.	DESCRIPTION	CHECK BOX
1.0	Digitally Signing (in case of e-bidding)/ Signing and Stamping (in case of manual bidding) on each sheet of offer, original bidding document including SCC, ITB,GCC, SOR DRAWINGS Corrigendum (if any)	
2.0	Confirm that the following details have been submitted in the Un-priced part of the bid	
i	Covering Letter, Letter of Submission	
ii	EMD / Declaration for Bid Security as per provisions of Tender (as applicable)	
iii.	Digitally signed (in case of e-tendering) or 'signed & stamped (in case of Manual tender) tender document along with drawings and addendum (if any)	
iv	Power of Attorney in the name of person signing the bid.	
v	Confirm submission of document alongwith unpriced bid as per bid requirement (including cl.no.11.1.1 of Section-III of tender).	
3.0	Confirm that all format duly filled in are enclosed with the bid duly Digitally Signed (in case of e-bidding)/ / Signed and Stamped (in case of manual bidding) by authorised person(s)	
4.0	Confirm that the price part as per Price Schedule format submitted with Bidding Document/uploaded in case of e-bid.	
5.0	Confirm that Undertaking as per *Form-I to Annexure-V to Section-III of tender* and Certification from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of other than companies) as per *Form-II to Annexure-V of Section-II of tender* are submitted.	
6.0	Confirm that Undertaking as per Form-1to Annexure-VII have been submitted by the bidder (Guidelines from Procurement from a Country sharing a Land Border with India)	
7.0	Confirm submission of Checklist against Bid Evaluation Criteria as per format F-8(B)	

Place:
Date:

[Signature of Authorized Signatory of Bidder]

Name:
Designation:

F-8(B)

CHECKLIST FOR BID EVALUATION CRITERIA (BEC) QUALIFYING DOCUMENTS

(refer Section II of Tender document)

Sl. No.	Description	Documents required for qualification	Documents Submitted by Bidder	Documents attested as per Section-II of Tender	Reference Page No. of the Bid submitted
	Technical BEC				
1.	**Experience**	(a) Copy of Detailed Letter of Acceptance (DLOA) / Work Order /relevant extract of work Order/ Contract Agreement along with detailed scope of work and Completion / Acceptance Certificate. Such certificate shall be issued by order issuing authority/ Owner/End user. copy of Inspection release note (IRN)/Bill of lading/vendor registration certificate with Govt. or PSU's organization/ISO certificate etc. (b) The Detailed Letter of Acceptance (DLOA) / Work Order / relevant extract/ Contract Agreement must inter alia include Scope of work, completion time, contract value, etc. Similarly, the Completion Certificate/ Acceptance Certificate must clearly indicate reference of relevant work order/DLOA/Contract Agreement, Name of Work, Completed order value and date of completion (c) Certificate in respect of minimum one year successful operation of the Plant/System from the date of acceptance/Commissioning of work issued by the Owner/End user shall be submitted. (d) Any other documents as per BEC requirement.		Yes/No	
2.	**Experience of bidder acquired as a subcontractor**	certificate from end user		Yes/No	

3.	**Job executed for Subsidiary / Fellow subsidiary/ Holding company.**	Tax paid invoice(s) duly certified by statutory auditor of the bidder towards payment of statutory tax in support of the job executed for Subsidiary / Fellow subsidiary/ Holding company.		Yes/No	
4.	**Any other technical criteria in BEC**	Bidder shall submit affidavit from the domestic manufacturers of such Iron & steel products as per the Form-I enclosed with the policy documents. A bidder who is not manufacturer of Iron & Steel product and is unable to submit the Affidavit from domestic manufacturers at bidding stage, such bidder can submit the Affidavit issued by domestic manufacturers after placement of order. In this case bidder along with his bid shall submit an undertaking as per prescribed format. Any other documents as per BEC requirement		Yes/No	
	Financial BEC				
1.	**Annual Turn Over**	Audited Financial Statements [including Auditor's Report, Balance sheet, Profit & Loss Accounts statements, Notes & schedules etc.] for last Audited Financial Year. [In case the Annual Turnover criteria is not met in last Audited Financial Year, then the Audited Financial Statements for previous two years of last Audited Financial Year is to be submitted]	Submitted (*Mention specific year……)*	Yes/No	
2.	**Net Worth**	Audited Financial Statements [including Auditor's Report, Balance sheet, Profit & Loss Accounts statements, Notes & schedules etc.] for last Audited Financial Year.	Submitted (M*ention specific year …….*)	Yes/No	
3.	**Working Capital**	Audited Financial Statements [including Auditor's Report, Balance sheet, Profit & Loss Accounts statements, Notes & schedules etc.] for last Audited Financial Year. If the bidder's working capital is negative or inadequate, the bidder shall submit a letter (in prescribed format) from their	Submitted (*Mention specific year……)* Submitted/ Not Applicable	Yes/No	

		bank having net worth not less than Rs.100 Crores (or equivalent USD),, confirming the availability of line of credit for at least working capital requirement as stated above. The line of credit letter from bank to be submitted strictly as per prescribed format.	*(Bidder to tick appropriate option)*		
4.	**Format for Details of financial capability of Bidder**	Bidder shall submit "Details of financial capability of Bidder" in prescribed format duly signed and stamped by a chartered accountant / Certified Public Accountant (CPA).	Submitted		

Place:
Date:

[Signature of Authorized Signatory of Bidder]
Name:
Designation:
Seal :

F-9

FORMAT FOR CERTIFICATE FROM BANK
IF BIDDER'S WORKING CAPITAL IS INADEQUATE/NEGATIVE
(To be provided on Bank's letter head)

Date:

To,
M/s. TALCHER FERTILIZERS LIMITED
NOIDA

Dear Sir,

This is to certify that M/s …….. (name of the Bidder with address) (hereinafter referred to as Customer) is an existing Customer of our Bank.

The Customer has informed that they wish to bid for TFL's Tender / NIT no. ..... dated …… for ……..(Name of the supply/work/services/consultancy) and as per the terms of the said Tender/NIT Document they have to furnish a certificate from their Bank confirming the availability of line of credit.

Accordingly M/s …….. (name of the Bank with address) confirms availability of line of credit to M/s …….. (name of the Bidder) for at least an amount of Rs. _____

It is also confirmed that the net worth of the Bank is more than Rs. 100 Crores (or Equivalent USD) and the undersigned is authorized to issue this certificate.

Yours truly

for …… (Name & address of Bank)

(Authorized signatory)
Name of the signatory:
Designation :
Email Id :
Contact No. :
Stamp

Note:

This Declaration/Letter for line of credit shall be from single bank only. Letters from multiple banks shall not be applicable. However, banking syndicate will be acceptable wherein a group of banks can jointly provide line of credit to the bidder.

F-10

FORMAT FOR CHARTERED ACCOUNTANT CERTIFICATE/ CERTIFIED PUBLIC ACCOUNTANT (CPA) FOR FINANCIAL CAPABILITY OF THE BIDDER

We have verified the Audited Financial Statements and other relevant records of M/s…… (Name of the bidder) and certify the following:

A. AUDITED ANNUAL TURNOVER* OF PRECEDING THREE FINANCIAL YEARS:

Year	Amount (Currency)
Year 1:	
Year 2:	
Year 3:	

B. NETWORTH* AS PER AUDITED FINANCIAL STATEMENT OF PRECEDING FINANCIAL YEAR:

Description	**Year** _____
	Amount (Currency)
1. Net Worth	

C. WORKING CAPITAL* AS PER AUDITED FINANCIAL STATEMENT OF PRECEDING FINANCIAL YEAR:

Description	**Year** _____
	Amount (Currency)
1. Current Assets	
2. Current Liabilities	
3. Working Capital (Current Assets-Current liabilities)	

Refer Instructions

Notes:

(i) It is further certified that the above mentioned applicable figures are matching with the returns filed with Registrar of Companies (ROC) [Applicable only in case of Indian Companies]

(ii) We confirm the above figures after referring instructions at page 2 of 2 of Format F-10.

(iii) Practicing Chartered Accountants shall generate Unique Document Identification Number (UDIN) for all certificates issued by them.

Name of Audit Firm:
Chartered Accountant/CPA
Date:

Membership No.:

[Signature of Authorized Signatory]
Name:
Designation:
Seal:
UDIN:

(Page 1 of 2)

Instructions for Format F-10:

1. The Separate Pro-forma shall be used for each member in case of JV/ Consortium (If applicable).

2. The financial year would be the same as one normally followed by the bidder for its Annual Report.

3. The bidder shall provide the audited annual financial statements as required for this Tender document. Failure to do so would result in the Proposal being considered as non- responsive.

4. For the purpose of this Tender document:

   (i) **Annual Turnover** shall be "Revenue from Operations" as per Profit & Loss account of audited annual financial statements
   (ii) **Working Capital** shall be "Current Assets less Current liabilities" and
   (iii) **Net Worth** shall be Aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, if any, but does not include reserves created out of revaluation of assets, write back of depreciation and amalgamation.

5. Above figures shall be calculated after considering the qualification, if any, made by the statutory auditor on the audited financial statements of the bidder including quantified financial implication.

6. This certificate is to be submitted on the letter head of Chartered Accountant/CPA.

F-11 (NOT APPLICABLE FOR THIS TENDER)

FORM OF CONSORTIUM AGREEMENT BETWEEN M/S..... M/S .....FOR BIDDING FOR TENDER FOR ".....VIDE NIT NO. ……...) FLOATED BY M/S …… ON BEHALF OF M/S TALCHER FERTILIZERS LTD.

THIS CONSORTIUM AGREEMENT (hereinafter referred to as "Agreement") executed on this ___ day of _____ (month) of ____ (year)amongst the following members:

1) M/s _____, a company incorporated under the provisions of Companies Act,1956 / partnership firm registered under the Indian Partnership Act, 1932 / Limited Liability Partnership Act, 2008 and having it's Registered Office at _____, (hereinafter referred to as "Lead Bidder/Member-1/Consortium Leader/Leader of Consortium" which expression shall, unless repugnant to the context or meaning thereof, include its successors and permitted assigns);

AND

2) M/s _____, a company incorporated under the provisions of Companies Act,1956 / partnership firm registered under the Indian Partnership Act, 1932 / Limited Liability Partnership Act, 2008 and having it's Registered Office at _____, (hereinafter referred to as "Consortium Member-2/Member-2" which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns);

AND

3) M/s _____, a company incorporated under the provisions of Companies Act,1956 / partnership firm registered under the Indian Partnership Act, 1932 / Limited Liability Partnership Act, 2008 and having it's Registered Office at _____, (hereinafter referred to as "Consortium Member-3/Member-3)" which expression shall, unless repugnant to the context or meaning thereof, include its successors and permitted assigns)

for the purpose of submitting the Bid in response to the Tender and in the event of selection as Selected Bidder to comply with the requirements as specified in the Tender and ensure execution of the Tender's Scope of Work as may be required to be entered into with TFL.

Member 1, Member 2 and Member 3 are hereinafter collectively referred to as the "Parties" and individually as a "Party".

AND WHEREAS

(1) M/s Talcher Fertilizers Limited, a company incorporated under the provisions of Companies Act,1956 and having it's Registered Office at _____ (hereinafter referred to as the "**OWNER/TFL",** which expression shall, unless repugnant to the context or meaning thereof, include its successors and permitted assigns) is proposing to construct … … … … … . (hereinafter referred to as **"PROJECT"**)

vide NIT No. Dated_____ (hereinafter referred to as **"TENDER/NIT"**) and award the above works to qualified and selected contractor on a Lump Sum Turnkey (LSTK) basis.

(2) The Parties are interested in jointly bidding for the Contract as members of a Consortium and in accordance with the terms and conditions of the Tender Bidding Documents in respect of the Contract, and

(3) It is a necessary condition under the Bidding Documents that the members of the Consortium shall enter into a Consortium Agreement (the "Agreement") and furnish the ORIGINAL thereof with the bid.

NOW, THEREFORE, THE PARTIES HERETO AGREE TO WORK TOGETHER AND BINDTHEMSELVES AS FOLLOWS:-

1. We, the members in the Consortium, hereby confirm that the name of the Consortium shall be _____.

2. The Parties herein agree that no party shall, consequent to the successful bidding, withdraw from this Agreement during the execution of the Project in connection with the_____, for any reason, whatsoever.

3. All costs incurred with regard to the submission of Bid/Bidding process shall be borne amongst the members of the Consortium. Each party agrees to render complete assistance for providing to the other PARTY sufficient Data/information required for preparation of the Bid in its entirety.

4. In consideration of the bid submission by us to the Owner and the award of Contract by the OWNER to the Consortium (if selected by the OWNER), we the Members of the Consortium and Parties to the Consortium Agreement do hereby unequivocally agree that M/s. ..... [Insert name of the Lead Bidder], shall act as the Lead Bidder for self and agent for and on behalf of M/s. ..... and M/s. ..... [the names of all the other Members of the Consortium to be filled in here] and confirm that we shall jointly and severally be bound unto the OWNER for execution of the contract in accordance with the contract terms and shall jointly and severally be liable to the OWNER to perform all contractual obligations including technical guarantees. Further, the Lead Bidder/Member-I is authorized to incur liabilities and receive instructions for and on behalf of other members of the Consortium during the entire execution of the contract.

5. The Lead Bidder is hereby authorized by the Members of Consortium and Parties to the Consortium Agreement to bind the Consortium and receive instructions for and on behalf of all Members. The Roles and Responsibilities of all other members shall be as per the **APPENDIX-I (Responsibility Matrix)** to this Agreement.

6. The Lead Bidder shall be liable and responsible for ensuring the individual and collective commitment of each of the Members of the Consortium in discharging all their respective Roles and Responsibilities. Each Consortium Member further undertakes to be individually liable for the performance of its part of the Roles and Responsibilities without in any way limiting the scope of collective liability envisaged in this Agreement in order to meet the requirements and obligations of the Tender.

7. Except as specified in the Agreement, it is agreed that sharing of responsibilities as aforesaid and obligations thereto shall not in any way be a limitation of responsibility of the Lead Bidder under these presents

8. This Agreement defines and fixes the responsibilities governing the relations of the Lead Bidder and other Consortium Members in preparation of the Bid and subsequent execution of the CONTRACT with OWNER.

9. Notwithstanding anything containing hereinbefore, OWNER has got the right to fix the responsibility and accountability on any and/or all members of the Consortium of this Agreement with or without Lead Bidder.

10. The Lead Bidder shall be responsible for

    (i) Preparation of BID.
    (ii) Making the final decision on all strategy for the PROJECT, including performanceof the PROJECT.
    (iii) All negotiation and communications with the OWNER
    (iv) Receive instructions for and on behalf of all Members
    (v) In case of any breach of any of the commitment as specified under this Agreement by any of the Consortium Members, the Leader of Consortium shall be liable to meet the obligations under the Tender
    (vi) Co-ordination responsibility for execution of the contract
    (vii) Any other aspect/issue as described in this Agreement and/or Appendix-I of thisAgreement.

11. At the time of submission of the bid, the PARTIES have jointly agreed to all Schedules, programs, terms and conditions, and all other matters whatsoever necessary for the submission of bid. The division of responsibilities of Scope of Work among different Consortium members is as per **APPENDIX-I (Responsibility Matrix) (Appendix –I of this agreement is to be submitted by PARTIES)** of this agreement, which shall form part of this consortium agreement. It is further agreed that the sharing of responsibilities and obligations shall not in any way be a limitation of the joint and several responsibilities of the Members under the Contract.

    In case of award of the Contract, each PARTY shall perform their respective scope of work and division of responsibilities in accordance with the scope indicated in **APPENDIX-I (Responsibility Matrix).**

12. PARTIES declare and undertake to OWNER that:

    a) It shall be the joint and several responsibility of members of the Consortium to fulfil all obligation as are required under the CONTRACT entered into between OWNER and PARTIES as per the terms of Tender documents issued by OWNER vide NIT No. …… dated……..

    b) Each PARTY shall be jointly and severally liable to fully discharge their obligations and co-operate with one another with respect to the PROJECT during the term of this agreement and act at all times in such a way to further the common interest of the CONSORTIUM.

    c) Without limit to the foregoing, each PARTY reaffirms not to bid for the

PROJECT separately or in combination withany third party.

d) Post Contract Liabilities:

For any loss or damage on account of any breach of this Agreement or the contract for the PROJECT or any shortfall in the execution of the PROJECT, meeting the guaranteed performance / parameters as per technical specifications / documents relating to the TENDER, the “Leader of Consortium” undertakes to promptly make good such loss or damage on OWNER’s demand without any demur. OWNER shall have the right to proceed against any one of the Parties herein in this regard without establishing the individual liability of such party and it shall neither be necessary nor obligatory on the part of OWNER to proceed against the “Leader of Consortium” before proceeding against the other Parties herein

In case of any breach of the said Contract by any PARTY, the remaining members of the consortium hereby agree to be fully responsible for the successful execution/performance of the Contract in accordance of the terms ofthe Contract.

Further, if the OWNER suffered any loss or damage on account of any breach of the Contract or any shortfall in the completed equipment/plant, meeting the guaranteed performance parameters as per the technical specifications/contract documents by “Leader of Consortium”, the Second & Third member of these presents undertakes to promptly make good such loss or damage caused to the OWNER, on the OWNER’s demand without any demure. It shall neither be necessary nor obligatory on the part of the OWNER to proceed against the “Leader of Consortium” to these presents before proceeding against the Second & Third members.

e) In case of award of contract, PARTIES do hereby agree that the Contract Performance Security (CPS) shall be submitted in favour of the OWNER as per terms of the TENDER and such guarantee shall be in the name of Consortium. The Lead Bidder shall be responsible for ensuring timely submission of the CPS.

f) The Parties herein shall at their own expense take out and maintain insurance cover(s) as may be necessary to cover their liabilities as per the TENDER.

13. Any changes or amendments to this agreement shall be made after obtaining approval of the OWNER and are valid only when these are set out in writing as such amendments and signed by the PARTIES.

14. In case of award of contract, the PARTIES shall furnish break up the Schedule of Prices as per cumulative monthly payment schedule corresponding to the supplies/services/civil works assigned to each member of the consortium which shall be approved by Owner/Consultant. Such approved Billing Schedule shall govern the payment to each member of consortium. PARTIES hereby authorise each member of the Consortium to raise separate invoices applicable for their part of scope of work as per the approved Billing Schedule and the OWNER shall pay directly to each member

of the Consortium against such invoices. However, all such invoices shall be forwarded by covering letter issued by Lead Consortium Leader. Consortium leader will remain fully responsible for any excess payment or deficient payment made to consortium members.

15. Notwithstanding the Lead Bidder's liability in terms of this Agreement, each PARTY shall be fully responsible, liable and accountable for all financial transactions under this Agreement and each PARTY shall pay its own taxes and make other statutory and mandatory payments / taxes / duties. The PARTIES herein further undertake to ensure that all applicable legal regulations are observed, appropriate records are kept of all financial transactions and appropriate documentation, including, but not limited to contracts, orders and confirmations, receipts and invoices, time sheets of staff and payroll calculations are retained for all matters pertaining to this Agreement.

16. This agreement shall become valid upon execution by the PARTIES and this agreement shall come to end on the occurrences of any of the events stated herein below in this clause, namely;

    a) Cancellation of PROJECT by OWNER or award of PROJECT by OWNER to a third party; OR
    b) OWNER informing that no award of contract for this project will be made to anybidder; OR
    c) End of Defect Liability Period (in case of award of Contract).

17. This agreement shall in no way restrict any PARTY from engaging in any activities, which are not connected with this PROJECT and are not in direct competition to the activities of the PROJECT.

18. The PARTIES agree to keep confidential all information and data obtained from each other during the course of this agreement for a period of Three years from the effective date of this agreement.

19. Assignment: No PARTY shall have the right to assign or in any way transfer any of its rights or obligations under this agreement to any third party without prior consent in writing of the OWNER and other members of the Consortium.

20. The PARTIES agree that as and when called upon by OWNER, the PARTIES shall execute all further deeds, documents and agreements as may be required by OWNER.

21. It is further agreed that this Consortium agreement shall be irrevocable and shall form an integral part of the CONTRACT and shall continue to be enforceable till such time as mentioned in clause no. 16 above.

22. This Consortium Agreement shall be construed and interpreted in accordance with the Laws of India and Courts at Delhi alone shall have the exclusive jurisdiction in all matters relating thereto and arising there under.

23. Indemnification

All consortium members of this agreement shall fully indemnify, hold harmless and defend OWNER and its officers etc., from and against all claims, liabilities, suits, damages including any criminal liability due to false declaration by the consortium members with regard to this Agreement (or) Tender transaction (or) Contract etc., caused due to negligence/commission/omission of the any of the consortium members (or) its employees and agents including representatives (or) sub-contractors (or) any other person claiming (or) any other person claiming under this tender (or) under the applicable laws of India.

24. The Parties acknowledge and accept that this Agreement shall not be amended by the Parties without the prior approval of OWNER.

IN WITNESS THEREOF, the PARTIES have entered into this agreement effective fromthe date as mentioned herein above.

For and on Behalf of	For and on Behalf of	For and on Behalf of
(Lead Bidder/Member-I) Signature of Auth. Signatory With Company Seal (1)	(Member-II) Signature of Auth. Signatory With Company Seal (2)	(Member-III) Signature of Auth. Signatory With Company Seal (3)

Appendix-I

RESPONSIBILITY MATRIX

Sl. No.	Roles & Responsibility	Lead Bidder	Consortium Partner

F-12

BIDDER'S QUERIES FOR PRE BID MEETING

To,

M/s TALCHER FERTILIZERS LIMITED
NOIDA

SUB:

TENDER NO:

Sl. NO.	REFERENCE OF TENDER DOCUMENT				BIDDER'S QUERY	OWNER'S REPLY
	SEC. NO.	Page No.	Clause No	Subject		

NOTE: The Pre-Bid Queries may be sent by e-mail before due date for receipt of Bidder's queries.

SIGNATURE OF BIDDER: _____

NAME OF BIDDER**:** _____

F-13

E-Banking Mandate Form

(To be issued on vendors letter head)

1. Vendor/customer Name :

2. Vendor/customer Code:

3. Vendor /customer Address:

4. Vendor/customer e-mail id:

5. Particulars of bank account

   a) Name of Bank
   b) Name of branch
   c) Branch code:
   d) Address:
   e) Telephone number:
   f) Type of account (current/saving etc.)
   g) Account Number:
   h) RTGS IFSC code of the bank branch
   i) NEFT IFSC code of the bank branch
   j) 9 digit MICR code

I/We hereby authorize TFL to release any amount due to me/us in the bank account as mentioned above. I/We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or lost because of incomplete or incorrect information, we would not hold the TFL responsible.

(Signature of vendor/customer)

BANK CERTIFICATE

We certify that ---------- has an Account no. ---------- with us and we confirm that the details given above are correct as per our records.
Bank stamp

Date (Signature of authorized officer of bank)

F-14

INTEGRITY PACT

INTEGRITY PACT

INTEGRITY PACT

INTRODUCTION:

TFL as one of its endeavour to maintain and foster most ethical and corruption free business environment, have decided to adopt the Integrity Pact, a tool developed by the Transparency International, to ensure that all activities and transactions between the Company (TFL) and its Counterparties (Bidders, Contractors, Vendors, Suppliers, Service Providers/Consultants etc.) are handled in a fair and transparent manner, completely free of corruption.

Considering the above, the details mentioned at attached Annexure-1 are applicable as stated in Instruction to Bidders of Bid Document in addition to the existing stipulation regarding Corrupt and Fraudulent Practices.

The attached copy of the Integrity Pact at Annexure - 2 shall be included in the Bid submitted by the bidder (to be executed by the bidder for all tenders of value Rs. 1 (One) crore and above). In case a bidder does not sign the Integrity Pact, his bid shall be liable for rejection.

ANNEXURE-1

Bidder is required to sign the Integrity Pact with TFL as per format & terms and conditions enclosed with tender. In case a bidder does not sign the Integrity Pact, his bid shall be liable for rejection.

I COMMITMENTS AND OBLIGATIONS OF THE "COUNTERPARTY"

a) The Counterparty, directly or indirectly (through agent, consultant, advisor, etc.), shall not pay any bribe/ influence or give undue/ unlawful benefit to anyone to gain undue advantage in dealing with TFL.

b) The Counterparty will not engage in collusion of any kind including price fixation etc. with other Counterparts.

c) The counterparty will not pass TFL's confidential information to any third party unless specifically authorized by TFL in writing.

d) The Counterparties shall promote and observe best ethical practices within their respective organizations.

e) The Counterparty shall inform the Independent External Monitor.
   i) If it received any demand, directly or indirectly, for a bribe/ favour or any illegal gratification/ payment / benefit;
   ii) If it comes to know of any unethical or illegal payment / benefit;
   iii) If it makes any payment to any TFL associate.

f) The Counterparty shall not make any false or misleading allegations against TFL or its associates.

II VIOLATIONS & CONSEQUENCES:

a) If a Counterparty commits a violation of its Commitments and Obligations under the Integrity Pact Programme during bidding process, their entire Earnest Money Deposit/ Bid Security, would be forfeited and in addition, action shall be taken as per "Procedure for action in case Corrupt /Fraudulent/ Collusive/Coercive Practices"

b) In case of violation of the Integrity pact by Counterparty after award of the Contract, TFL shall be entitled to terminate the Contract. Further, TFL would forfeit the security deposits/ Contract Performance Bank Guarantee and in addition, action shall be taken as per "Procedure for action in case Corrupt /Fraudulent/ Collusive/Coercive Practices"

INDEPENDENT EXTERNAL MONITORS (IEMS)

Presently the panel consisting of the following Independent External Monitors (IEMs) have been appointed by TFL, in terms of Integrity Pact (IP) which forms part of TFL Tenders / Contracts.

i) Shri Sanjeev Prasad Narain Singh (Email ID: spns108@gmail.com)
ii) .....

This panel is authorised to examine / consider all references made to it under this tender. The bidder(s), in case of any dispute(s) / complaint(s) pertaining to this tender may raise the issue either with the designated tender issuing officer or Nodal Officer (presently Sh. Manna Paul, DGM (C&P) – Email: mannapaul@gail.co.in) in TFL or directly with the IEMs on the panel or IEM c/o Chief Vigilance Officer, Rashtriya Chemicals and Fertilizers Ltd., Priyadarshini Building, Eastern Express Highway, Sion, Mumbai Maharashtra, 400022.

ANNEXURE-2

INTEGRITY PACT

(To be executed on plain paper)

Between Talcher Fertilizers Limited (TFL) [here-in-after referred to as "Principal"].

AND

_____(here-in-after referred to as "The Bidder/ Contractor").

(Principal and the Bidder / Contractor are here-in-after are referred to individually as "Party" or collectively as "Parties").

PREAMBLE

The Principal intends to award under laid down organizational procedures, contract/s for_____. The Principal values full compliance with all relevant laws of land rules, regulations, and economic use of resources and of fairness /transparency in its relations with its Bidder (s) and/or Contractor (s).

In order to achieve these goals, the Principal will appoint Independent External Monitors (IEMs) who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following Principles:-

   i) No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or for a third person, any material or immaterial benefit which the person is not legally entitled to.

   ii) The Principal will, during the tender process treat all Bidder(s) with equity and reasons. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

TALCHER FERTILIZERS LIMITED * NOIDA *

iii) The Principal will exclude from the process all known prejudiced persons.

2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal Code (IPC) / Prevention of Corruption Act (PC Act), or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officers and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder (s)/Contractor (s)

1. The Bidder(s) / Contractor(s) commits themselves to take all measures necessary to prevent corruption. The Bidder(s) / Contractor(s) commits themselves to observe the following principles during participation in the tender process and during the contract execution:

i) The Bidder (s) / Contractor (s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

ii) The Bidder (s) / Contractor (s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other action to restrict competitiveness or to introduce cartelisation in the bidding process.

iii) The Bidder (s) / Contractor (s) will not commit any offence under the relevant IPC/PC Act; further, the Bidder (s) / Contractor (s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

iv) The Bidder (s)/ Contractor (s) of foreign origin shall disclose the name and address of the Agents/ representatives in India, if any. Similarly, the Bidder (s)/ Contractor (s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further, all the payments made to the Indian agent/ representative have to be in India Rupees only.

v) The Bidder (s) / Contractor (s) will, when presenting their bid, disclose any and all payments made, is committed to or intends to make to agents,

brokers or any other intermediaries in connection with the award of the contract.

vi) Bidder(s) / Contractor(s) who have signed the Integrity Pact shall not approach the Courts while representing the matter to IEMs and shall wait for their decision in the matter.

2. The Bidder(s)/ Contractor(s) shall not instigate third person to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder (s) / Contractor (s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put their reliability or credibility in question, the Principal is entitled to disqualify the Bidder (s) / Contractor (s) from the tender process or take action as per provisions of "Procedure for action in case Corrupt /Fraudulent/ Collusive/Coercive Practices".

Section 4 – Compensation for Damages

1. If the Principal has disqualified the Bidder (s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit / Bid Security.

2. If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equal to the Contract Value or the amount equivalent to Performance Bank Guarantee.

Section 5 – Previous transgression

1. The Bidder declares that no previous transgression occurred in the last three years, with any other Company in any country conforming to the anti-corruption approach or with any Public Sector Enterprise in India that could justify his exclusion from the tender process.

2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or actions can be taken as per provisions of "Procedure for action in case Corrupt /Fraudulent/ Collusive/Coercive Practices"

Section 6 – Equal treatment to all Bidders / Contractors / Subcontractors

1. In case of sub-contracting, the Principal contractor shall take the responsibility of the adoption of IP by the sub-contractor. It is to be ensured by him that all sub-contractors also sign the IP.

2. The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

3. The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7 – Criminal charges against violating Bidder (s) / Contractor (s) / Sub-contractor (s)

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

Section 8 –Independent External Monitor / Monitors

1. The Principal appoints competent and credible Independent External Monitor for this Pact after approval by Central Vigilance Commission. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

2. The Monitor is not subject to instructions by the representatives of the parties and performs his/her functions neutrally and independently. The Monitor would have access to all documents / records pertaining to the contract for which a complaint or issue is raised before them, as and when warranted. However, the documents / records / information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed. It will be obligatory for him/her to treat the information and documents of the Bidders / Contractors as confidential. He / she reports to MD, TFL.

3. The Bidder (s)/ Contractor (s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the Monitor, upon his/her request and demonstration of a valid interest, unrestricted and unconditional access to their project documentation. The same is applicable to Sub-contractors.

4. The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an

impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

5. As soon as the Monitor notices, or believes to notice, a violation of this agreement, he/she will so inform the Management of the Principal and request the Management to discontinue or to take corrective action, or to take other relevant action. The monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

6. The Monitor will submit a written report to MD, TFL within 30 days from the date of reference or intimation to him by the 'Principal' and, should the occasion arise, submit proposals for correcting problematic situations.

7. If the Monitor has reported to MD, TFL, a substantiated suspicion of an offence under relevant IPC/PC Act, and MD, TFL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, then, only in case of very serious issue having a specific verifiable Vigilance angle, the matter should be reported directly to the Central Vigilance Commission.

8. The word 'Monitor' would include both singular and plural.

9. In case of any complaints referred under IP Program, the role of IEMs is advisory and would not be legally binding and it is restricted to resolving the issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidder.

10. After award of contract, the IEMs shall look into any issue relating to execution of contract, if specifically raised before them. As an illustrative example, if a contractor who has been awarded the contract, during the execution of contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs.

Section 9 – Pact Duration

This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract, and for all other Bidders 6 months after the contract has been awarded. Any violation to the same would entail disqualification of the bidders and exclusion from future business dealing.

If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by MD, TFL.

Section 10 – Miscelleneous provisions

1. This agreement is subject to Indian Law. Place of performance and exclusive jurisdiction is the Registered Office of the Principal, i.e. New Delhi.

2. Changes and supplements as well as termination notices, if any, need to be made in writing. Side agreements have not been made.

3. If the Contractor/Bidder is a Joint Venture or a partnership concern or a consortium, this agreement must be signed by all partners or consortium members.

4. Should one or several of the provisions of this agreement turn out to be invalid, the remainder of this agreement shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions in such a case.

5. Issues like warranty / guarantee, etc. shall be outside the purview of IEMs.

6. In the event of any contradiction between the Integrity Pact and its Annexure, the Clause in Integrity Pact will prevail.

(For & on Behalf of Principal)
मन्ना पॉल/MANNA PAUL
उप महाप्रबन्धक (संविदा एवं क्रय)/Dy. General Manager (C&P)
तालचेर फर्टिलाइजर्स लिमिटेड/Talcher Fertilizers Ltd.
जी.टी.आई. पार्क बिल्डिंग/GTI PARC Building
प्लॉट नं.– 24, सेक्टर–16ए, नोएडा–201 301 (उ.प्र.)
Plot No. 24, Sec.-16A, Noida-201 301 (U.P.)

(Office Seal)

(For & on Behalf of Bidder/Contractor)

(Office Seal)

Place ----------
Date ----------

Witness 1:
(Sign, Name & Address)
[FOR PRINCIPAL]

[SURA DEOGAM, DM(C&P)]
TALCHER FERTILIZERS LIMITED (TFL),
PLOT NO. 24, SECTOR-16A, NOIDA (U.P.)-201301

Witness 2:
(Sign, Name & Address)
[FOR BIDDER / CONTRACTOR]

.....
.....
.....

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INDEMNITY BOND

WHEREAS TALCHER FERTILIZERS LIMITED (hereinafter referred to as "**TFL**") which expression shall, unless repugnant to the context include its successors and assigns, having its registered office at Plot 2/H, Kalpana Area, BJB Nagar, Khorda, Bhubaneswar – 751014 has entered into a contract with M/s*……. (hereinafter referred to as the "**Contractor"**) which expression shall unless repugnant to the context include its representatives, successors and assigns, having its registered office at *…….. and on the terms and conditions as set out, inter-alia in the ……. **[*mention the work order/FOA/Tender No*.]** and various documents forming part thereof, hereinafter collectively referred to as the '**CONTRACT'** which expression shall include all amendments, modifications and / or variations thereto.

TFL has also advised the Contractor to execute an Indemnity Bond in general in favour of TFL indemnifying TFL and its employees and Directors including Independent Directors from all consequences which may arise out of any prospective litigation or proceedings filed or may be initiated by any third party, including any Banker / financial institution / worker(s) /vendor(s)/ subcontractor(s) etc. who may have been associated or engaged by the Contractor directly or indirectly with or without consent of TFL for above works.

NOW, THEREFORE, in consideration of the promises aforesaid, the Contractor hereby irrevocably and unconditionally undertakes to indemnify and keep indemnified TFL and all its employees, Directors, including Independent Directors, from and against all/any claim(s), damages, loss, which may arise out of any litigations/ liabilities that may be raised by the Contractor or any third party against TFL under or in relation to this contract. The Contractor undertakes to compensate and pay to TFL and/or any of its employees, Directors including Independent Directors, forth with on demand without any protest the amount claimed by TFL for itself and for and on behalf of its employees, Directors including Independent Directors together with direct/indirect expenses including all legal expenses incurred by them or any of them on account of such litigation or proceedings.

AND THE CONTRACTOR hereby further agrees with TFL that:

(i) This Indemnity shall remain valid and irrevocable for all claims of TFL and/or any of its employees and Directors including Independent Directors arising out of said contract with respect to any such litigation / court case for which TFL and/or its employees and Directors including Independent Directors has been made party until now or here-in-after.

(ii) This Indemnity shall not be discharged/ revoked by any change/ modification/ amendment/ assignment of the contract or any merger of the Contractor with other entity or any change in the constitution/structure of the Contractor's firm/ Company or any conditions thereof including insolvency etc. of the Contractor, but shall be in all respects and for all purposes binding and operative until any/ all claims for payment of TFL are settled by the Contractor and/or TFL discharges the Contractor in writing from this Indemnity.

The undersigned has full power to execute this Indemnity Bond for and on behalf of the Contractor and the same stands valid.

SIGNED BY :
For *[Contractor]*

Authorised Representative
Place:
Dated:
Witnesses:1.
2

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FREQUENTLY ASKED QUESTIONS (FAQs)

SL.NO.	QUESTION	ANSWER
1.0	Can any vendor quote for subject Tender?	Yes. A Vendor has to meet Bid Evaluation Criteria given under Section II of Tender document in addition to other requirements.
2.0	Should the Bid Evaluation Criteria documents be attested?	Yes. Please refer Section II of Tender document
3.0	Is attending Pre Bid Meeting mandatory.	No. Refer Clause No. 17 of Instruction to Bidders of Tender Document. However attending Pre Bid Meeting is recommended to sort out any issue before submission of bid by a Bidder.
4.0	Can a vendor submit more than 1 offer?	No. Please refer Clause No. 4 of Instruction to Bidders of Tender Document.
5.0	Is there any Help document available for e-Tender.	Refer FAQs as available on CPP Portal e-Procurement).
6.0	Are there are any MSE (Micro & Small Enterprises) benefits available?	Refer Clause No. 40 of Instructions to Bidders of Tender Document.
7.0	Are there are any benefits available to Startups?	Refer Clause No. 49 of Instructions to Bidders of Tender Document.

All the terms and conditions of Tender remain unaltered.

Form F-17

PROFORMA OF BANK GUARANTEE FOR MOBILISATION ADVANCE
(ON NON-JUDICIAL PAPER OF APPROPRIATE VALUE)

To, M/s Talcher Fertilizers Limited, Noida	**Bank Guarantee No.**	
	Date of BG	
	BG Valid up to	
	Claim period up to (There should be three months gap between expiry date of BG & Claim period)	
	Stamp Sl. No. / e-Stamp Certificate No.	

Dear Sir(s),

In consideration of the Talcher Fertilizers Limited, hereinafter called the "Owner" which expression shall unless repugnant to the context or meaning thereof include its successors, executors, administrators and assignees, having awarded to M/s..... having its registered office at ..... hereinafter referred as the 'CONTRACTOR', which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assignees, a contract hereinafter referred to as the 'Contract' for related works..... referred to as the 'WORK' on terms and conditions set out, inter-alia in the Owner's Contract / DLOA / FOA No.....dated..... valued at..... (in words & figures) and as the Owner having agreed to make an advance payment (herein after referred as Mobilization advance) for the performance of the above contract to the CONTRACTOR amounting to.....(in words & figures) as an advance against Bank Guarantee to be furnished by the CONTRACTOR.

We..... hereinafter referred to as the BANK which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assignees having our office at..... do hereby undertake to give the irrevocable and unconditional guarantee and do hereby undertake to pay the OWNER on first demand without any demur, reservation, contest, recourse, protest and without reference to the CONTRACTOR any and all monies payable by the CONTRACTOR by reason of any breach by the said CONTRACTOR of any of the terms and conditions of the said Contract to the extent of..... till the said advance is adjusted as aforesaid at any time upto..... We agree that the guarantee herein contained shall continue to be enforceable till the sum due to the Owner on account of the said advance is adjusted/ recovered in full as aforesaid or till the Owner discharges this guarantee **in writing.**

The OWNER shall have the fullest liberty without affecting in any way the liability of the BANK under this guarantee, from time to time to vary the advance or to extend the time for performance of the works by the CONTRACTOR. The BANK shall not be released from its liability under these presents by any exercise of the Owner of the liberty with reference to the matter aforesaid.

The Owner shall have the fullest liberty, without reference to CONTRACTOR and without affecting this guarantee to postpone for any time or from time to time the exercise of any powers vested in them or of any right which they might have against the CONTRACTOR, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any power, covenants contained or implied in the Contract between the OWNER and the CONTRACTOR or any other course or remedy or security available to the OWNER and the BANK shall not be released of its obligations under these presents by any exercise by the OWNER of its liberty with reference to matters aforesaid or other acts of omission or commission on the part of the OWNER or any other law would, but for this provision, have the effect of releasing the BANK.

The right of the OWNER to recover the outstanding sum of advance upto Rs.....from the BANK in the manner aforesaid **is absolute and unequivocal and** will not be affected or suspended by reason of the fact that any dispute or disputes has or have been raised by the CONTRACTOR and/or that any dispute or disputes is or are pending before any officer, tribunal or court **or arbitrator or any other authority/forum** and any demand made by OWNER on the BANK shall be conclusive and binding.

The BANK further undertakes not to revoke this guarantee during its currency without previous consent of the OWNER and further agrees that the guarantee contained shall
continue to be enforceable **until it is discharged by TFL in writing.**

The BANK also agrees that the OWNER shall at its option be entitled to enforce this guarantee against the BANK as a principal debtor, in the first instance, notwithstanding any other security or guarantee that OWNER may have in relation to the CONTRACTOR's liabilities towards the said advance.

The amount under the Bank Guarantee is payable forthwith without any delay by Bank upon the written demand raised by TFL. Any dispute arising out of or in relation to the said Bank Guarantee shall be subject to the exclusive jurisdiction of courts at New Delhi.

Therefore, we hereby affirm that we are guarantors and responsible to you on behalf of the Contractor up to a total amount of _____(amount of guarantees in words and figures) and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the contract and without caveat or argument, any sum or sums within the limits of _____(amount of guarantee) as aforesaid, without your needing to prove or show grounds or reasons for your demand or the sum specified therein.
We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do so under the Power of Attorney/ resolution of the Board of Directors dated..... accorded to him by the BANK.

Notwithstanding anything contained herein:

a) The Bank's liability under this Guarantee shall not exceed (currency in figures) _____ (currency in words only) _____
b) This Guarantee shall remain in force upto _____ (three months beyond Completion Period) and any extension(s) thereof; and

c) The Bank shall be released and discharged from all liability under this Guarantee unless a written claim or demand is issued to the Bank on or before the midnight of_____ (indicate date of expiry of claim period which includes minimum three months from the expiry of this Bank Guarantee) and if extended, the date of expiry of the last extension of this Guarantee. If a claim has been received by us within the said date, all the rights of TFL under this Guarantee shall be valid and shall not cease until we have satisfied that claim.

Dated.....this.....day of.....20 .....

Signed by

(Person duly authorised by Bank)

Place:

WITNESS :

1..... (Signature)

..... (Printed Name)

..... (Designation)

2..... (Signature)

..... (Printed Name)

..... (Designation)
(Common Seal)

F-17 (A)
MATTER TO BE MENTIONED IN COVERING LETTER TO BE SUBMITTED BY VENDOR ALONG WITH BANK GUARANTEE (BG)

1. Bank Guarantee No.	
2. Vendor Name	
3. Nature of Bank Guarantee [Please Tick (□) whichever is applicable]	Contract Performance Security (CPS) □ Advance □
Purchase Order (PO) / Fax of Acceptance (FOA) / Detailed Letter of Acceptance (DLOA) No.	
Details of Bank issuing Bank Guarantee (BG)	
A. Name	
B. E-mail ID	
C. Address	
D. Phone No. / Mobile No.	

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PROFORMA FOR BANK GUARANTEE FOR PAYMENTS TOWARDS PLACEMENT OF ALL PURCHASE ORDERS OF MAJOR TAGGED ITEMS.

(To be submitted on Rs. 500/-(five hundred) non judicial stamp paper)

Ref.....
Bank Guarantee No.--------- Date.....

To,
M/s Talcher Fertilizers Limited

Dear Sir(s),

In consideration of the Talcher Fertilizers Limited, hereinafter called the "Owner" which expression shall unless repugnant to the context or meaning thereof include its successors, executors, administrators and assignees, having awarded to M/s..... having its registered office at ..... hereinafter referred as the 'CONTRACTOR', which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assignees, a contract hereinafter referred to as the 'Contract' for related works..... referred to as the 'WORK' on terms and conditions set out, inter-alia in the Owner's Contract / DLOA / FOA No.....dated..... valued at..... (in words & figures) and as the Owner having agreed to make milestone payments (for the performance of the above contract to the CONTRACTOR amounting to.....(in words & figures) against Bank Guarantee to be furnished by the CONTRACTOR.

We..... hereinafter referred to as the BANK which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assignees having our office at..... do hereby undertake to give the irrevocable and unconditional guarantee and do hereby undertake to pay the OWNER on first demand without any demur, reservation, contest, recourse, protest and without reference to the CONTRACTOR any and all monies payable by the CONTRACTOR by reason of any breach by the said CONTRACTOR of any of the terms and conditions of the said Contract to the extent of.....We agree that the guarantee herein contained shall continue to be enforceable till the Owner discharges this guarantee **in writing.**

The OWNER shall have the fullest liberty without affecting in any way the liability of the BANK under this guarantee, from time to time to vary the amount or to extend the time for performance of the works by the CONTRACTOR. The BANK shall not be released from its liability under these presents by any exercise of the Owner of the liberty with reference to the matter aforesaid.

The Owner shall have the fullest liberty, without reference to CONTRACTOR and without affecting this guarantee to postpone for any time or from time to time the exercise of any powers vested in them or of any right which they might have against the CONTRACTOR, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any power, covenants contained or implied in the Contract between the OWNER and the CONTRACTOR or any other course or remedy or security available to the OWNER and the BANK shall not be released of its obligations under these presents by any exercise by the OWNER of its liberty with reference to matters aforesaid or other acts of omission or commission on the part of the OWNER or any other law would, but for this provision, have the effect of releasing the BANK.

The right of the OWNER to recover the outstanding sum upto Rs..... from the BANK in the manner aforesaid **is absolute and unequivocal and** will not be affected or suspended by reason of the fact that any dispute or disputes has or have been raised by the CONTRACTOR and/or that any dispute or disputes is or are pending before any officer, tribunal or court **or arbitrator or any other authority/forum** and any demand made by OWNER on the BANK shall be conclusive and binding.

The BANK further undertakes not to revoke this guarantee during its currency without previous consent of the OWNER and further agrees that the guarantee contained shall continue to be enforceable **until it is discharged by TFL in writing.**

The BANK also agrees that the OWNER shall at its option be entitled to enforce this guarantee against the BANK as a principal debtor, in the first instance, notwithstanding any other security or guarantee that OWNER may have in relation to the CONTRACTOR's liabilities towards the said milestone payment .

The amount under the Bank Guarantee is payable forthwith without any delay by Bank upon the written demand raised by TFL. Any dispute arising out of or in relation to the said Bank Guarantee shall be subject to the exclusive jurisdiction of courts at New Delhi.

Therefore, we hereby affirm that we are guarantors and responsible to you on behalf of the Contractor up to a total amount of _____(amount of guarantees in words and figures) and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the contract and without caveat or argument, any sum or sums within the limits of _____(amount of guarantee) as aforesaid, without your needing to prove or show grounds or reasons for your demand or the sum specified therein.

Notwithstanding anything contained hereinabove, our liability under this guarantee is restricted to _____ and it will remain in force upto and including _____ (this date shall be initially 15 months from date of FOA) and shall be extended from time to time for such periods as may be advised by M/s_____ on whose behalf this guarantee has been given.

We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do so under the Power of Attorney/ resolution of the Board of Directors dated..... accorded to him by the BANK.

Notwithstanding anything contained herein:

9.

a) The Bank's liability under this Guarantee shall not exceed (currency in figures) _____ (currency in words only) _____
b) This Guarantee shall remain in force upto _____ (this date shall be initially 15 months from date of FOA) and any extension(s) thereof; and
c) The Bank shall be released and discharged from all liability under this Guarantee unless a written claim or demand is issued to the Bank on or before the midnight of _____ (indicate date of expiry of claim period which includes minimum three months from the expiry of this Bank Guarantee) and if extended, the date of expiry of the last extension of this Guarantee. If a claim has been received by us within the said date, all the rights of TFL under this Guarantee shall be valid and shall not cease until we have satisfied that claim.

Dated.....this.....day of.....20 .....

Signed by

(Person duly authorised by Bank)

Place:

WITNESS :
1..... (Signature)
..... (Printed Name)
..... (Designation)

2..... (Signature)
..... (Printed Name)
..... (Designation)

(Common Seal)

F-19

FORMAT OF LETTER OF NO DEVIATIONS
(ON BIDDER'S LETTERHEAD)

(NIT NO : PNMM/PC-183/E-4013/NCB DATED 10.03.2022)

We * hereby agree to fully comply with, abide by and accept without variation, deviation or reservation all technical, commercial and other condition whatsoever of the Bidding Documents and all Addenda / Corrigenda / Amendment/ Clarifications issued by OWNER.

We further hereby confirm that the bid is submitted in accordance of Tender Document and contains no deviation and the price bid submitted may be treated to conform to, in all respects, with the terms and conditions of the said tender documents including all Addenda / Corrigenda/ Amendment /Clarifications.

For and on behalf of* : …….....……

Stamp & Signature** : ……

Name : ……

Designation : ……

Date **: ……**

***Here fill in the name of bidder.**

****The Letter of *No Deviation* must be signed by the person (s) authorized to sign as per POA.**

F-20

POWER OF ATTORNEY (POA)

(To be submitted on the Non-Judicial stamp paper / Company's Letter Head)

TENDER NO:

Description of work:

Name of Bidder:_____

"The undersigned _____ (Name of LEGAL PERSON, i.e. CEO/C&MD/Company Secretary/Partners) is lawfully authorized to issue this POA* on behalf of the company M/s _____ (Name of bidder) whose registered address is _____ and does hereby appoint Mr./Ms _____ (name of authorized person signing the bid document) _____ (Designation) of M/s _____ (Name of bidder) whose signature appears below to be the true and lawful attorney/(s) and authorize him/her to sign the bid (both physically & digitally on CPP Portal), conduct negotiation, sign contracts and execute all the necessary matter related thereto, in the name and on behalf of the company in connection with the tender no. _____.

The signature of the authorized person/(s) herein constitutes unconditional obligations of M/s _____ (Name of bidder).

This Power of Attorney (POA) shall remain valid and in full force and effect before we withdraw it in writing (by fax, or mail or post). All the documents signed (within the period of validity of the Power of Attorney) by the authorized person herein shall not be invalid because of such withdrawal.

(*) In case of a single Bidder, the Power of Attorney shall be issued as per the constitution of the bidder as below.

a) **In case of Proprietorship**: By Proprietor
b) **In case of Partnership**: by all Partners or Managing Partner.
c) **In case of Limited Liability Partnership**: by any bidder's employee authorized in terms of Deed of LLP.
d) **In case of Public /Limited Company**: POA in favour of authorized employee(s) by Board of Directors through Board Resolution or by the designated officer authorized by Board to do so. Such Board Resolution should be duly countersigned by Company Secretary / MD / CMD / CEO.

SIGNATURE OF THE LEGAL PERSON

_____
(Name of person with Company seal)

SIGNATURE OF THE AUTHORIZED PERSON
(FOR SIGNING THE BID)

_____
(Signature)
Name of person: _____
E-mail id: _____
DSC (Digital Signature Certificate) No.: _____

F-21

UNDERTAKING REGARDING SUBMISSION OF ELECTRONIC INVOICE (E-INVOICE AS PER GST LAWS)

(to be submitted on letter head along with documents for release of payment)

To,
M/s TALCHER FERTILIZERS LIMITED

SUB:
LOA NO:
Dear Sir,

We _____ (Name of the Supplier/Contractor/Service Provider/ Consultant) hereby confirm that E-Invoice provision as per the GST Law is

(i) Applicable to us [ ]

(ii) Not Applicable to us [ ]

(Supplier/Contractor/Service Provider/ Consultant is to tick appropriate option (✓ or X) above).

In case, same is applicable to us, we confirm that we will submit E-Invoice after complying with all the requirements of GST Laws. If the invoice issued without following this process, such invoice can-not be processed for payment by TFL as no ITC is allowed on such invoices. We also confirm that If input tax credit is not available to TFL for any reason attributable to Supplier/Contractor/Service Provider/ Consultant (both for E-invoicing cases and non-E-invoicing cases), then TFL shall not be obligated or liable to pay or reimburse GST (CGST & SGST/UTGST or IGST) claimed in the invoice(s) and shall be entitled to deduct / setoff / recover such GST amount (CGST & SGST/UTGST or IGST) or Input Tax Credit amount together with penalties and interest, if any, by adjusting against any amounts paid or becomes payable in future to the Supplier/Contractor/Service Provider/ Consultant under this contract or under any other contract.

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:
Designation:
Bidder Name:
Seal:

Form F-22

UNDERTAKING REGARDING SUBMISSION OF CONTRACT PERFORMANCE SECURITY (CPS)/ SECURITY DEPOSIT (SD) WITHIN STIPULATED TIME LINE

(to be submitted on letter head of bidder)

To,

M/s Talcher Fertilizers Limited

_____

SUB:

TENDER NO:

Dear Sir,

We hereby confirm that we have clearly understood the requirement of Contract Performance Security (CPS) / Security Deposit (SD) specified in the tender document.

We also hereby confirm that in case of award of contract / order, we will submit Contract Performance Security (CPS) / Security Deposit (SD) within 30 days from the date of issuance of Fax of Acceptance.

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Bidder Name:

Seal:

F-23

PROFORMA FOR CONTRACT AGREEMENT

(To be executed on non-judicial stamp paper of appropriate value)

DLOA No. ……. dated ……..

TFL's PAN No. …….

Contract Agreement for the work of ---------- of TALCHER FERTILIZERS LIMITED made on ---------- between (Name and Address)---------- , hereinafter called the "CONTRACTOR" (which term shall unless excluded by or repugnant to the subject or context include its successors and permitted assignees) of the one part and TALCHER FERTILIZERS LIMITED hereinafter called the "EMPLOYER" (which term shall, unless excluded by or repugnant to the subject or context include its successors and assignees) of the other part.

WHEREAS

A. The EMPLOYER being desirous of having provided and executed certain work mentioned, enumerated or referred to in the Tender Documents including Letter Inviting Tender, General Tender Notice, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings, Plans, Time Schedule of completion of jobs, Schedule of Rates, Agreed Variations, other documents has called for Tender.

B. The CONTRACTOR has inspected the SITE and surroundings of WORK specified in the Tender Documents and has satisfied himself by careful examination before submitting his tender as to the nature of the surface, strata, soil, sub-soil and ground, the form and nature of site and local conditions, the quantities, nature and magnitude of the work, the availability of labour and materials necessary for the execution of work, the means of access to SITE, the supply of power and water thereto and the accommodation he may require and has made local and independent enquiries and obtained complete information as to the matters and thing referred to, or implied in the tender documents or having any connection therewith and has considered the nature and extent of all probable and possible situations, delays, hindrances or interferences to or with the execution and completion of the work to be carried out under the CONTRACT, and has examined and considered all other matters, conditions and things and probable and possible contingencies, and generally all matters incidental thereto and ancillary thereof affecting the execution and completion of the WORK and which might have influenced him in making his tender.

C. The Tender Documents including the Notice Letter Inviting Tender, General Conditions of Contract, Special Conditions of Contract, Schedule of Rates, General Obligations, SPECIFICATIONS, DRAWINGS, PLANS, Time Schedule for completion of Jobs, Letter of Acceptance of Tender and any statement of agreed variations with its enclosures copies of which are hereto annexed form part of this CONTRACT though separately set out herein and are included in the expression "CONTRACT" wherever herein used.

AND WHEREAS

The EMPLOYER accepted the Tender of the CONTRACTOR for the provision and the execution of the said WORK at the rates stated in the schedule of quantities of the work and finally approved by EMPLOYER (hereinafter called the "Schedule of Rates") upon the terms and subject to the conditions of CONTRACT.

NOW THIS AGREEMENT WITNESSETH AND IT IS HEREBY AGREED AND DECLARED AS FOLLOWS:-

1. In consideration of the payment to be made to the CONTRACTOR for the WORK to be executed by him, the CONTRACTOR hereby covenants with EMPLOYER that the CONTRACTOR shall and will duly provide, execute and complete the said work and shall do and perform all other acts and things in the CONTRACT mentioned or described or which are to be implied there from or may be reasonably necessary for the completion of the said WORK and at the said times and in the manner and subject to the terms and conditions or stipulations mentioned in the contract.
2. In consideration of the due provision execution and completion of the said WORK, EMPLOYER does hereby agree with the CONTRACTOR that the EMPLOYER will pay to the CONTRACTOR the respective amounts for the WORK actually done by him and approved by the EMPLOYER at the Schedule of Rates and such other sum payable to the CONTRACTOR under provision of CONTRACT, such payment to be made at such time in such manner as provided for in the CONTRACT.

A N D

3. In consideration of the due provision, execution and completion of the said WORK the CONTRACTOR does hereby agree to pay such sums as may be due to the EMPLOYER for the services rendered by the EMPLOYER to the CONTRACTOR, such as power supply, water supply and others as set for in the said CONTRACT and such other sums as may become payable to the EMPLOYER towards the controlled items of consumable materials or towards loss, damage to the EMPLOYER'S equipment, materials construction plant and machinery, such payments to be made at such time and in such manner as is provided in the CONTRACT.

   It is specifically and distinctly understood and agreed between the EMPLOYER and the CONTRACTOR that the CONTRACTOR shall have no right, title or interest in the SITE made available by the EMPLOYER for execution of the works or in the building, structures or work executed on the said SITE by the CONTRACTOR or in the goods, articles, materials etc., brought on the said SITE (unless the same specifically belongs to the CONTRACTOR) and the CONTRACTOR shall not have or deemed to have any lien whatsoever charge for unpaid bills will not be entitled to assume or retain possession or control of the SITE or structures and the EMPLOYER shall have an absolute and unfettered right to take full possession of SITE and to remove the CONTRACTOR, their servants, agents and materials belonging to the CONTRACTOR and lying on the SITE.

   The CONTRACTOR shall be allowed to enter upon the SITE for execution of the WORK only as a licensee simpliciter and shall not have any claim, right, title or interest in the SITE or the structures erected thereon and the EMPLOYER shall be entitled to terminate such license at any time without assigning any reason.

   The materials including sand, gravel, stone, loose, earth, rock etc., dug up or excavated from the said SITE shall, unless otherwise expressly agreed under this CONTRACT, exclusively belong to the EMPLOYER and the CONTRACTOR shall have no right to claim over the same and such excavation and materials should be disposed off on account of the EMPLOYER according to the instruction in writing issued from time to time by the ENGINEER-IN-CHARGE.

In Witness whereof the parties have executed these presents in the day and the year first above written.

Signed and Delivered for and on on behalf of EMPLOYER	Signed and Delivered for and on behalf of the CONTRACTOR.
TALCHER FERTILIZERS LIMITED	NAME OF CONTRACTOR

_____ _____

Date :_____ Date :_____

Place:_____ Place:_____

IN PRESENCE OF TWO WITNESSES

1._____ 1. _____

2._____ 2. _____
_____ _____
_____ _____

F-24

NO CLAIM CERTIFICATE
(TO BE SUBMITTED BEFORE RELEASE OF CPS/SECURITY DEPOSIT)

[On the Letter-head of Supplier/Vendor]

We, _____, a company incorporated under the laws of India/ a Consortium between *___ and *____ (*name of Consortium partners to be inserted*)/ a Partnership Firm consisting of *___ and *___ (*name of Partners to be inserted*)/ a Sole Proprietorship (as the case may be), having its registered office at _____ and carrying on business under the name and style M/s. _____ were awarded the contract by TFL. in reference to Tender No. _____ dated _____ ("Order/Contract").

After completion of the above-said items/job under the Order/Contract, we have scrutinized all our claims, contentions, disputes, issues and we hereby confirm that after adjusting all payments received by us against our R.A. Bills and final bill, we have no claims, dues, issues and contentions from TFL.

We further absolve TFL. from all liabilities present or future arising directly or indirectly out of the Contract.

There is no economic duress or any other compulsion on us for submission of this no claim certificate.

Signature with Seal of Supplier/Vendor

Dated:

F-25

FORMAT OF AGREEMENT TO BE EXECUTED BETWEEN BIDDER AND THEIR FOREIGN BASED SUPPORTING COMPANY ON INDIAN STAMP PAPER OF REQUISITE VALUE DULY NOTARIZED.

This agreement made this ___ day of _____ month _____ year by and between M/s. _____ (Fill in Bidder's full name, constitution and registered office address) _____ hereinafter referred to as bidder on the first part and M/s. _____ (Fill in full name, constitution and registered office address company which hold more than fifty percent of the paid up share capital of the bidding company or vice versa) hereinafter referred to as "Supporting Company" of the second part.

Whereas

M/s. Talcher Fertilizers Limited (hereinafter referred to as TFL) has invited offers vide their tender No. _____ for _____and M/s. _____ (Bidder) intends to bid against the said tender and desires to have technical support of M/s. _____ [Supporting Company]

And whereas Supporting Company represents that they have gone through and understood the requirements of the subject tender and are capable and committed to provide the services as required by the bidder for successful execution of the contract, if awarded to the bidder.

Now, it is hereby agreed to by and between the parties as follows:

a) M/s._____ (Bidder) will submit an offer to TFL for the full scope of work as envisaged in the tender document as a main bidder and liaise TFL directly for any clarifications etc. in this context.

b) M/s. _____[Supporting Company] undertakes to provide technical support and expertise, expert manpower and project management including financial support, if so required, to the bidder to discharge its obligations as per the Scope of Work of the tender / Contract for which offer has been made by the bidder and accepted the TFL.

c) The Bidder/ Supporting Company holds more than 50% paid up equity capital of the Supporting Company/ Bidder.

d) This agreement will remain valid till validity of bidder's offer to TFL including extension if any and till satisfactory performance of the contract, the same is awarded by TFL to the bidder.

e) Supporting Company undertakes that this agreement shall remain enforceable even if their stake in Bidder is diminished during the execution of works under the contract between the Bidder and TFL.

f) The bidder shall have the overall responsibility of satisfactory execution of the contract awarded by TFL, however without prejudice to any rights that TFL might have against the Supporting Company

g) It is further agreed that, if contract pursuant to Supporting Company shall be jointly and severely responsible to TFL for the performance of works during contract period and for the satisfactory execution of the contract, and for all the consequences for non-performance thereof.

In witness whereof the parties hereto have executed this agreement on the date mentioned above.

For and on behalf of	For and on behalf of
(Bidder)	(Supporting Company)
M/s.	M/s.
Witness:	Witness:
1)	1)
2)	2)

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GUARANTEE BY THE FOREIGN BASED SUPPORTING COMPANY/ GUARANTOR

THIS DEED OF GUARANTEE executed at …….. this …….. day of …… by M/s …… (mention complete name) a company duly established and existing under the laws of ……. (insert country), having its Registered Office at …… hereinafter called "the Guarantor and/ or the Supporting Company" which expression shall, unless excluded by or repugnant to the subject or context thereof, be deemed to include its successors and permitted assignees.

FOR

M/s …… (bidder) a company duly established and existing under the laws of ……. (insert country), having its Registered Office at …… hereinafter called the "Bidder" which expression shall, unless excluded by or repugnant to the subject or context thereof, be deemed to include its successors and permitted assignees.

TOWARDS

M/s Talcher Fertilizers Limited, a company duly registered under the law of India having its Registered Office at Plot 2/H, Kalpana Area, BJB Nagar, Khurda, Bhubneshwar-751014,Odisha, India, and having Purchase center at …… hereinafter called "TFL" which expression shall unless excluded by or repugnant to the context thereof, be deemed to include its successor and assignees

WHEREAS TFL has invited tender number …… for …….. on …….., and the bidder has submitted it bid number…… in response to the above mentioned tender invited by TFL.

AND WHEREAS the bidder/ Guarantor Company holds more than 50% paid up equity capital of the Supporting Company/ Bidder.

AND WHEREAS one of the condition for acceptance of Bidder's bid against said tender is that in case the bidder is seeking to qualify upon the technical credentials of its Guarantor Company, then the bidder shall arrange a guarantee from its Guarantor Company guaranteeing due and satisfactory performance of the work covered under the said tender including any change therein as may be deemed appropriate by the TFL at any stage.

The Guarantor represents that they have gone through and understood the requirement of the above said tender and are capable of and committed to provide technical and such other supports as may be required by the Bidder for successful execution of the same.

The Bidder and the Guarantor have entered into an agreement dated …… as per which the Guarantor shall be providing technical, financial and such other supports as may be necessary for performance of the work under the tender, if the contract is awarded to the Bidder.

Accordingly, at the request of the Bidder and in consideration of and as a requirement for the TFL to enter into agreement(s) with the Bidder, the Guarantor hereby guarantees and undertakes that upon award of Contract to Bidder against bid number ……, made by the Bidder under tender number……:

1. The Guarantor unconditionally agrees that in case of non-performance by the Bidder of any of its obligations in any respect, the Guarantor shall, immediately on receipt of notice of demand by the TFL , take up the job without any demur or objection, in continuation and without loss of time

and without any cost to the TFL and duly perform the obligations of the Bidder to the satisfaction of the TFL.

2. The Guarantor agrees that the Guarantee contained herein shall remain valid till the satisfactory execution and completion of the work (including discharge of the warranty obligations) awarded to the Bidder.

3. The Guarantor shall be jointly and severally responsible to TFL for satisfactory performance of works during contract period and for the satisfactory execution of the contract, and for all consequences for non-performance thereof.

4. The liability of the Guarantor, under the Guarantee, is limited of the Bidder for non- performance under the contract entered between TFL and the Bidder. This will, however, be in addition to the forfeiture of the Performance and Advance Guarantees furnished by the Bidder.

5. The Guarantor agrees to execute a Corporate Guarantee in favour of TFL, guaranteeing the performance of obligations by the Bidder, in case the Contract is awarded to the Bidder by TFL.

6. The Guarantor represents that this Guarantee has been issued after due observance of the appropriate laws in force in India. The Guarantor hereby undertakes that the Guarantor shall obtain and maintain in full force and effect all the governmental and other approvals and consents that are necessary and do all other acts and things necessary or desirable in connection therewith or for the due performance of the Guarantor's obligations towards TFL.

7. Any dispute arising out of or in connection with this contract, including any question regarding its existence, validity or termination, shall be referred to and finally resolved by arbitration. It is further agreed that Claims by and against the Guarantor, the Bidder and TFL under the different contract to be entered pursuant to their relationship can be brought under a single reference and there shall be no bar on the consolidation of such proceedings before the same arbitral tribunal. The governing law shall be the laws of India and seat of arbitration shall be New Delhi, India. The language of arbitration shall be English.

8. The Guarantor hereby declares and represents that this Guarantee has been given without any undue influence or coercion, and that the Guarantor has fully understood the implications of the same.

9. In case of award of contract to the bidder, the Guarantor shall provide Performance Bank Security to TFL, equivalent to 50% of the value of Performance Bank Security to be submitted by the bidding company, in the prescribed format within 15 days from the date of Fax of Acceptance, as guarantee for performance by the bidder/contractor. The Guarantor hereby expressly agrees that if in the opinion of TFL, the Bidder / Contractor has failed to perform its obligations under the contract in any manner, TFL shall have unfettered right to invoke the said Bank guarantee. The guarantor hereby agrees that decision of TFL about performance of the bidder / contractor shall be final and shall not be questioned by the Guarantor. Guarantor shall have no objection to invocation of the Performance Bank Guarantee submitted by the Guarantor

   OR

   (applicable, subject to meeting the conditions stipulated in BEC in respect of additional Performance Bank Security)

   In case of award of contract to the bidder, the bidder on behalf of the Guarantor shall provide additional Performance Bank Security to TFL, equivalent to 50% of the value of Performance bank Security to be submitted by the bidding company, in the prescribed format within 15 days from the date of Fax of Acceptance, as guarantee for performance by the bidder/contractor. The Guarantor hereby expressly agrees that if in the opinion of TFL, the Bidder / Contractor has failed to perform its obligations under the contract in any manner, TFL shall have unfettered right to

invoke the said Bank guarantee. The Guarantor hereby agrees that decision of TFL about performance of the bidder / contractor shall be final and shall not be questioned by the Guarantor. Guarantor shall have no objection to invocation of the Performance Bank Security submitted by the Bidder on behalf The Guarantor represents and confirms that the Guarantor has the legal capacity, power and authority to issue this Guarantee and that giving of this Guarantee and the performance and observations of the obligations hereunder do not contravene any existing laws.

(Strike through the clause whichever is not applicable)

10. The Guarantor represents and confirms that the Guarantor has the legal capacity, power and authority to issue this Guarantee and that giving of this Guarantee and the performance and observations of the obligations hereunder do not contravene any existing laws.

For & on behalf of (Supporting Company)

M/s _____

Signature_____

Name_____

Designation _____

official seal_____

Witness:

1.Signature_____

Full Name _____

Address_____

2.Signature_____

Full Name _____

Address_____

INSTRUCTIONS FOR FURNISHING GUARANTEE

1. The official(s) executing the guarantee should affix full signature(s) on each page.

2. Resolution passed by Board of Directors of the guarantor company authorizing the signatory(ies) to execute the guarantee, duly certified by Company Secretary should be furnished along with Guarantee.

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PROFORMA OF "BANK GUARANTEE" TOWARDS PERFORMANCE SECURITY BY FOREIGN BASED SUPPORTING COMPANY OF THE BIDDING COMPANY

CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

To,

M/s TALCHER FERTILIZERS LIMITED

_____

Dear Sir(s),

M/s. _____ having registered office at _____ (herein after called the "CONTRACTOR/ SUPPLIER/SERVICE PROVIDER" which expression shall wherever the context so require include its successors and assignees) have been placed/ awarded the job/work of _____ vide PO/LOA /FOA No. _____dated_____ (herein after called CONTRACT/ ORDER) for Talcher Fertilizer Limited having registered office at Plot 2/H, Kalpana Area, BJB Nagar, Khurda, Bhubneshwar-751014, Odisha, India (herein after called the "TFL" which expression shall wherever the context so require include its successors and assignees).

Further, M/s _____ (Name of the Supporting company) having its registered/head office at _____ based on whose experience/technical strength, the CONTRACTOR/SUPPLIER/SERVICE PROVIDER has qualified for award of contract (hereinafter referred to as the 'SUPPORTING COMPANY') which expression shall, unless repugnant to the context or meaning thereof include all its successors, administrators, executors and assignees) has agreed to provide complete technical and other support to the CONTRACTOR/SUPPLIER/SERVICE PROVIDER for successful completion of the contract/order as mentioned above, entered between TFL and the CONTRACTOR/SUPPLIER/SERVICE PROVIDER and TFL having agreed that the 'SUPPORTING COMPANY' shall furnish to TFL a performance guarantee for Indian Rupees/US$ ..... towards providing complete financial and other support to the CONTRACTOR/SUPPLIER/SERVICE PROVIDER for successful completion of the contract/order as mentioned above,

The said M/s._____ (Supporting Company) has approached us and at their request and in consideration of the premises we having our office at _____ have agreed to give such guarantee as hereinafter mentioned.

2. We (name of the bank) _____ registered under the laws of _____ having head/registered office at _____

(hereinafter referred to as "the Bank", which expression shall, unless repugnant to the context or meaning thereof, include all its successors, administrators, executors and permitted assignees) do hereby guarantee and undertake to pay immediately on first demand in writing any/all moneys to the extent of Indian Rs./US$ (in figures) _____ (Indian Rupees/US Dollars (in words)_____) without any demur, reservation, contest

or protest and/or without any reference to the 'SUPPORTING COMPANY'. Any such demand made by TFL on the Bank by serving a written notice shall be conclusive and binding, without any proof, on the bank as regards the amount due and payable, notwithstanding any dispute(s) pending before any Court, Tribunal, Arbitrator or any other authority and/or any other matter or thing whatsoever, as liability under these presents being absolute and unequivocal. We agree that the guarantee herein contained shall be irrevocable and shall continue to be enforceable until it is discharged by TFL in writing. This guarantee shall not be determined, discharged or affected by the liquidation, winding up, dissolution or insolvency of the 'SUPPORTING COMPANY' and shall remain valid, binding and operative against the bank.

3. The Bank also agrees that TFL at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance, without proceeding against the 'SUPPORTING COMPANY' and notwithstanding any security or other guarantee that TFL may have in relation to the 'SUPPORTING COMPANY's liabilities.

4. The Bank further agrees that TFL shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said CONTRACT/ORDER or to extend time of performance by the said CONTRACTOR/SUPPLIER/SERVICE PROVIDER from time to time or to postpone for any time or from time to time exercise of any of the powers vested in TFL against the said CONTRACTOR/SUPPLIER/SERVICE PROVIDER and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said CONTRACTOR/SUPPLIER/SERVICE PROVIDER or for any forbearance, act or omission on the part of TFL or any indulgence by TFL to the said CONTRACTOR(s) or any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

5. The Bank further agrees that the Guarantee herein contained shall remain in full force during the period that is taken for the performance of the CONTRACT/ORDER and all dues of TFL under or by virtue of this CONTRACT/ORDER have been fully paid and its claim satisfied or discharged or till TFL discharges this guarantee in writing, whichever is earlier.

6. This Guarantee shall not be discharged by any change in our constitution, in the constitution of TFL or that of the 'SUPPORTING COMPANY'.

7. The Bank confirms that this guarantee has been issued with observance of appropriate laws of the country of issue.

8. The Bank also agrees that this guarantee shall be governed and construed in accordance with Indian Laws and subject to the exclusive jurisdiction of Indian Courts of the place from where the purchase CONTRACT/ORDER has been placed.

9. Notwithstanding anything contained hereinabove, our liability under this Guarantee is limited to Indian Rs./US$ (in figures) _____ (Indian Rupees/US Dollars (in words) _____ only) and our guarantee shall remain in force until (indicate the date of expiry of bank guarantee) _____.

8. We have power to issue this guarantee in your favor under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney, dated _____ granted to him by the Bank.

Yours faithfully,

_____

Bank by its Constituted Attorney

Signature of a person duly

Authorized to sign on behalf of the

Bank

INSTRUCTIONS FOR FURNISHING

"CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT" BY "BANK GUARANTEE"

1. The Bank Guarantee by successful Bidder(s) will be given on non-judicial stamp paper as per 'stamp duty' applicable. The non-judicial stamp paper should be in name of the issuing bank. In case of foreign bank, the said Bank Guarantee to be issued by its correspondent bank in India on requisite non-judicial stamp paper and place of Bid to be considered as Delhi.

2. The Bank Guarantee by Bidders will be given from bank as specified in Tender.

3. A letter from the issuing bank of the requisite Bank Guarantee confirming that said Bank Guarantee and all future communication relating to the Bank Guarantee shall be forwarded to Purchaser.

4. If a Bank Guarantee is issued by a commercial bank, then a letter to Purchaser and copy to Consultant (if applicable) confirming its net worth is more than Rs. 100,00,00,000.00 [Rupees One Hundred Crores] or its equivalent in foreign currency alongwith documentary evidence.

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CERTIFICATE ISSUED BY COMPANY SECRETARY OF THE GUARANTOR COMPANY

"Obligations contained in deed of guarantee No. _____ furnished against tender No. _____ are enforceable against the Guarantor Company and the same do not, in any way, contravene any law of the country of which the Guarantor Company is the subject."

The above certificate should be enclosed alongwith the Guarantee.

SECTION – IV

GENERAL CONDITIONS OF CONTRACT

CONTENT

SL. NO.	DESCRIPTION
1.0	DEFINITION OF TERMS
2.0	CONTRACT CONFIRMATION
3.0	MODIFICATIONS IN CONTRACT
4.0	USE OF CONTRACT DOCUMENTS AND INFORMATION
5.0	PRICES, TAXES & DUTIES AND OTHER LEVIES
6.0	INCOME TAX
7.0	PATENT INFRINGEMENT AND INDEMNIFICATION
8.0	CONTRACT PERFORMANCE SECURITY (CPS)
9.0	DELETED
10.0	SIGINING OF CONTRACT
11.0	DELETED
12.0	ASSIGNMENT OR SUBLETTING OF CONTRACT AND SUB-CONTRACTING
13.0	STANDARDS
14.0	INSTRUCTIONS, DIRECTIONS
15.0	DELETED
16.0	TIME SCHEDULE, AND PROGRESS REPORTING
17.0	CONTRACTOR TO INFORM HIMSELF FULLY
18.0	SUITABILITY OF PLANT FOR INTENDED PURPOSES
19.0	FEES FOR ROYALTIES AND PATENT RIGHTS
20.0	ACTS OF PARLIAMENT, LOCAL AND OTHER AUTHORITIES REGULATIONS AND BYELAWS
21.0	TIME - PROJECT SCHEDULE
22.0	CONTRACT PRICE
23.0	DEDUCTIONS FROM CONTRACT PRICE
24.0	DELETED
25.0	DELETED
26.0	TAXES APPLICABLE TO CONTRACTOR'S MANPOWER, TURNOVER, EQUIPMENT, ETC
27.0	PACKING, FORWARDING AND SHIPMENT
28.0	INSURANCE
29.0	DELETED
30.0	LIABILITY FOR ACCIDENTS AND DAMAGES
31.0	DELETED
32.0	DELETED
33.0	TIME EXTENSION OF CONTRACT
34.0	TERMINATION OF CONTRACT
35.0	FORCE MAJEURE
36.0	NO WAIVER OF RIGHTS
37.0	BANKRUPTCY AND LIQUIDATION OF CONTRACTOR OR BUSINESS UNDER RECEIVERSHIP
38.0	CERTIFICATE NOT TO AFFECT RIGHT OF OWNER AND LIABILITY OF CONTRACTOR
39.0	SETTLEMENT OF DISPUTES
40.0	ARBITRATION

SL. NO.	DESCRIPTION
41.0	GOVERNING LAWS , LANGUAGE AND MEASURES
42.0	RELEASE OF INFORMATION
43.0	COMPLETION OF CONTRACT
44.0	ENFORCEMENT OF TERMS
45.0	OWNER'S DECISION
46.0	CO-OPERATION
47.0	SUSPENSION OF WORK.
48.0	REPLACEMENT OF PARTS AND MATERIALS (DEFECTIVE/ DAMAGED/ LOST DURING TRANSIT/ERECTION AND COMMISSIONING)
49.0	DEFENCE OF SUITS
50.0	CONTRACTOR'S RESPONSIBILITIES
51.0	PROGRESS REPORTS AND PHOTOGRAPHS
52.0	DELETED
53.0	SECRECY
54.0	CORRESPONDENCE
55.0	MATERIALS AND EQUIPMENTS
56.0	MEASUREMENT, CERTIFYING INSPECTION & PAYMENTS
57.0	UNDER GROUND OBSTRUCTIONS
58.0	REGISTRATION TO THE CONTRACTOR WITH STATUARY AUTHORITIES
59.0	STATUARY OBLIGATIONS
60.0	UTILISATION OF LOCAL RESOURCES
61.0	FUEL REQUIREMENT OF WORKERS
62.0	SURPLUS MATERIAL
63.0	CO-ORDINATION WITH OTHER AGENCIES
64.0	ERECTION OF EQUIPMENT
65.0	ELECTRICAL CONTRACTOR LICENCE
66.0	RENT & ROYALTIES
67.0	GOVT. OF INDIA NOT LIABLE
68.0	SITE CLEANING
69.0	ACCESS TO SITE
70.0	INDEPENDENT CONTRACTOR
71.0	PAYMENT TO THE SUB – CONTRACTOR
72.0	ORDER OF WORKS / PERMISSION / RIGHT OF ENTRY / CARE OF EXISTING SERVICES
73.0	GIFTS, COMMISSIONS,ETC
74.0	LABOUR LAWS-PF, EPF AND ESI
75.0	GENERAL PROVISIONS
76.0	IMPLEMENTATION OF APPRENTICES ACT 1961
77.0	CHANGE IN CONSTITUTION
78.0	ACCESS BY ROAD
79.0	MEMBERS OF THE OWNER NOT INDIVIDUALLY LIABLE
80.0	OWNER NOT BOUND BY PERSONAL REPRESENTATIONS
81.0	LAND FOR CONTRACTOR'S FIELD OFFICE, GODOWN AND WORKSHOP
82.0	ROUNDING-OFF OF AMOUNTS

SL. NO.	DESCRIPTION
83.0	DELETED
84.0	WORK IN MONSOON AND DEWATERING
85.0	GENERAL CONDITIONS FOR CONSTRUCTION AND ERECTION WORK
86.0	ACTION WHERE NO SPECIFICATION IS ISSUED
87.0	CARE OF WORKS
88.0	FIELD MANAGEMENT & CONTROLLING/COORDINATING AUTHORITY
89.0	LOCAL CONDITIONS
90.0	SPECIAL CONDITIONS OF CONTRACT
91.0	POWER OF ENTRY
92.0	LIENS

1.0 DEFINITION OF TERMS AND INTERPRETATION

In the **CONTRACT**, unless the context otherwise requires, the following expressions shall have the following meanings. The singular shall include the plural and the plural include the singular except where the context otherwise requires and the words 'he', 'him', and 'his' shall be taken to mean 'she', 'her' and 'hers' where appropriate.

1. 'APPROVAL' shall mean and include the written approval by the OWNER of documents, drawing or other particulars in relation to this CONTRACT.

2. 'BATTERY LIMIT' shall mean the outer limits of boundaries of the areas within which the Plants and associated facilities shall be located.

3. 'BID' shall mean the proposal/document that the BIDDER submits in the requested and specified form in response to this NIT.

4. 'BIDDER' shall mean the Sole Bidder who shall submit or who have submitted the Bid.

5. 'CHANGE ORDER / AMENDMENT TO ORDER' means an order given in writing by the OWNER to effect additions to or deletion or alteration to the original CONTRACT.

6. 'CODES' shall mean the following, including the latest amendments, and/or replacements, if any:
   a) All relevant Indian Acts, and Rules and Regulations made there under;
   b) ASME Codes
   c) IBR Codes
   d) AIEE Codes
   e) American Society of Testing of Materials (ASTM) Codes
   f) Other internationally applicable standards and/or Regulations the subject matter of the CONTRACT.
   g) Indian Employees Provident Fund Act,
   h) Pollution Control norms of INDIA
   i) Contract Labour
   j) Minimum Wages Act
   k) Any other labour laws of INDIA applicable during execution of contract.
   l) Any other codes/standards specified in the contract documents.

7. 'COMMERCIAL USE' shall mean that use of the PLANT which the CONTRACT contemplates or of which it is commercially capable.

8. 'COMMISSIONING' shall be as defined in Section-VI of Technical Part.

9. 'CONSULTANT/PROJECT MANAGEMENT CONSULTANT (PMC)' shall mean PROJECTS & DEVELOPMENT INDIA LIMITED, who are the consulting engineer to the OWNER for this project and having registered office at PDIL Bhawan, A-14, Sector-1, Noida – 201301, Uttar Pradesh.

10. 'CONTRACT' shall mean the Agreement between the OWNER and the CONTRACTOR for the execution of the works including therein all contract documents.

11. 'CONTRACTOR' shall mean the successful Bidder whose bid has been accepted by the OWNER and who has been selected by the OWNER for the award of Works and shall include his heirs, legal representatives, successors and permitted assigns.

12. 'SCHEDULED/CONTRACTUAL COMPLETION PERIOD' shall mean the time period mentioned in the tender document by which CONTRACT shall be completed, including any time extension granted in writing by OWNER through a CHANGE ORDER/AMENDMENT. Time extensions, if any, shall be without prejudice to other terms and conditions of tender, unless as otherwise stated in CHANGE ORDER/AMENDMENT.

13. 'CONTRACTOR'S EQUIPMENT' means all equipment, construction plant, vehicles, temporary facilities, material, tools or things brought on to the Site by or on behalf of the Contractor for carrying out the Works but not for permanent incorporation in the Plant.

14. 'CONTRACTOR'S SOFTWARE' means standard Software owned by the CONTRACTOR.

15. 'CONTRACTOR'S WORKS' OR 'MANUFACTURER'S WORKS' shall mean the place or places of work used by the CONTRACTOR/SUB-CONTRACTOR/SUB-VENDOR or their collaborator(s) for the manufacture of EQUIPMENT or performance of WORKS.

16. 'COST' means the cost incurred by the Contractor in carrying out any of his obligations under the Contract, and 'Costs' shall be construed accordingly.

17. 'DAY' shall mean a day of 24 hours from midnight to midnight irrespective of the number of hours worked in that day.

    "WORKING DAY" means any day which is not declared to be holiday or rest day by the OWNER.

18. 'DEEMED ACCEPTANCE' shall be as defined in SPECIAL CONDITIONS OF CONTRACT.

19. 'DEFECT' means any work done or any Material or the Plant or any part of it which does not comply with the CONTRACT.

20. 'DEFECT LIABILITY PERIOD' shall be as defined in SPECIAL CONDITIONS OF CONTRACT.

21. 'DOCUMENT(S)/DOCUMENTATION' means any relevant documents in paper or electronic form, including drawings, technical software, images, designs, manuals or records.

22. 'DRAWINGS' or 'PLAN' shall mean all
    a) Drawings furnished by the OWNER as a basis for proposals;
    b) Supplementary drawings furnished by the OWNER to clarify and to define in greater detail the intent of the CONTRACT;
    c) DRAWINGS submitted by the CONTRACTOR with his proposal provided such drawings are acceptable to the OWNER.
    d) DRAWING furnished by the OWNER to the CONTRACTOR during the progress of the works; and
    e) Engineering data and DRAWINGS submitted by the CONTRACTOR during the progress of the work provided such drawings are acceptable to the OWNER.

23. DLOA shall mean DETAILED LETTER OF ACCEPTANCE which shall be issued to successful bidder.

24. 'ENGINEER'S INSTRUCTIONS' shall mean any drawings and/or instructions in writing, details, directions and explanations issued by the OWNER from time to time to the CONTRACTOR/ SUB-CONTRACTOR for carrying out the WORK during the COMPLETION PERIOD

25. ENGINEER IN CHARGE" shall mean the person designated from time to time by the OWNER and shall include those who are expressly authorized by him to act for and on his behalf for operation of this CONTRACT.

26. 'EQUIPMENT' OR 'STORES' shall mean the equipment, machinery and structure of any kind which the CONTRACTOR is obliged to design, supply, deliver, unload, store at site, erect, set to work and test under the CONTRACT.

27. 'FINAL ACCEPTANCE' shall mean that date when all of the conditions set forth in Clause 19 of SPECIAL CONDITIONS OF CONTRACT have been satisfied, all liabilities and obligations under this CONTRACT have been discharged, except those specially to be continued or performed after FINAL ACCEPTANCE. .

28. 'FINAL ACCEPTANCE CERTIFICATE' shall mean that certificate issued by the ENGINEER-IN-CHARGE or OWNER to the CONTRACTOR subject to clause 19 of SPECIAL CONDITIONS OF CONTRACT at the end of the DEFECTS LIABILITY PERIOD.

29. 'FINAL COMPLETION' shall mean the completion of guarantee tests and handing over of the PLANTS and facilities to OWNER.

30. FINAL PROPOSAL means the Offer/Bid submitted by the Bidder against this tender including it's Amendments/Corrigendum/Addendum/etc.

31. 'FORCE MAJEURE' has the meaning stated in Sub-clause 35.0 of GCC.

32. 'FOA' means FAX OF ACCEPTANCE, which shall be issued to successful bidder.

33. GCC' or GENERAL CONDITIONS OF THE CONTRACT shall mean all the

terms and conditions forming part of this agreement as defined in this Section.

34. 'INSPECTOR' shall mean the duly authorised representative of the OWNER for stage wise or final inspection of WORKS or of EQUIPMENT or MATERIALS to be supplied under the CONTRACT.

35. 'LEGISLATION' means all applicable laws, directives, codes, statutes, rules, ordinances, approvals, licences, decrees, authorizations, by-laws, regulations, standards and any other requirement of any governmental authority or agency whether international national, state, municipal, local or other government subdivision, having the force of law in any place where the WORKS or any part of the WORKS are being carried out.

36. 'MANUFACTURER' shall mean a person or firm who is the producer and supplier of material and/ or designer and/or fabricator of equipment to either the OWNER, the CONTRACTOR or both under the CONTRACT.

37. 'MATERIALS' means machinery, plant and other items of equipment and materials intended to form part of the PLANT and other things needed for its operation, to be supplied by the CONTRACTOR.

38. "MECHANICAL COMPLETION" shall be as defined in SPECIAL CONDITIONS OF CONTRACT.

39. 'MONTH' shall mean the calendar month.

40. 'NOTICE IN WRITING', 'WRITTEN NOTICE' shall mean a notice in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post/ Speed Post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered. Fax with Post copy confirmation. Further, emails addressed to designated official(s) of the Company shall also be accepted.

41. 'OTHER CONTRACTOR/OTHERS' shall mean any person(s) having a contract with the OWNER to design, supply, erect, set to work, or do any other thing to or in connection with any other plant and shall include their, heirs, legal representatives, successors and permitted assigns.

42. 'OWNER' shall mean M/s TALCHER FERTILIZERS LIMITED having its registered office at Plot 2/H, Kalpana Area Nagar, Khordha, Bhubaneshwar and Project office at GAIL Training Institute, PARC Building, Sector 16A, Film City, Noida – 201301 Uttar Pradesh and shall include their, heirs, legal representatives, successors and permitted assigns.

43. 'PERFORMANCE & GUARANTEE TESTS RUN (PGTR)'/PLANT TRIAL RUN shall be as defined in SPECIAL CONDITIONS OF CONTRACT.

44. 'PLANT' shall be as defined in the SPECIAL CONDITIONS OF CONTRACT.

45. 'PRELIMINARY ACCEPTANCE' shall be as defined in the SPECIAL CONDITIONS OF CONTRACT.

46. 'PRELIMINARY ACCEPTANCE CERTIFICATE' shall be as defined in the SPECIAL CONDITIONS OF CONTRACT.

47. "PRE-COMMISSIONING" shall be as defined in the SPECIAL CONDITIONS OF CONTRACT.

48. 'PROJECT' shall mean the Project specified in the Technical specification.

49. 'SCC' or SPECIAL CONDITIONS OF THE CONTRACT shall mean all the terms and conditions forming part of the CONTRACT as stipulated elsewhere in the tender document.

50. 'SITE' shall mean and include the land and other places on, into or through which the EQUIPMENT and related facilities shall be erected and any adjacent land, paths, streets or reservoirs which may be allocated or used by the OWNER or CONTRACTOR in the performance of the CONTRACT.

51. 'SOFTWARE' means all forms of software and firmware and their documentation.

52. 'SPECIFICATION' shall mean collectively all the terms and stipulations in the Technical Specifications, schedules, detailed descriptions, statement of Technical Data, performance characteristics, standards & codes etc., and subsequent addenda issued thereto before the date of closing of bid and all written agreements made or to be made pertaining to the method and manner of performing the Work or to the quantities and the qualities of the materials to be furnished under this CONTRACT.

53. 'SUB-CONTRACTOR/SUB-VENDOR' shall mean any person or persons, or firm(s) including his/their, heirs, legal representatives, successors and permitted assigns selected by the CONTRACTOR with prior written approval of the OWNER for undertaking any part of the Works under the CONTRACT or to whom any part of the CONTRACT is sublet by the CONTRACTOR with the consent in writing of the OWNER.

54. 'TAKING OVER' AND 'TAKEN OVER' shall mean OWNER taking possession of and use of the PLANT.

55. 'TEMPORARY WORKS' means all temporary works and structures of every kind constructed at the Site and required for the provision and construction of the PLANT.

56. 'THIRD PARTY SOFTWARE' means standard Software which is owned by a third party.

57. 'TOTAL LSTK PRICE/TOTAL CONTRACT PRICE" shall mean the sum accepted or the sum calculated in accordance with the prices accepted in tender and/or the CONTRACT rates as payable to the CONTRACTOR for the entire execution and full completion of the work, including CHANGE ORDER, if any.

58. 'WEEK' shall mean continuous period of 7 (Seven) DAYS.

59. 'WORK' OR 'WORKS' means the design, engineering and other services to be provided by the Contractor including, but not limited to, the provision and construction of the PLANT and any Temporary Works and the subsequent dismantling or removal of the Temporary Works when no longer required, and any other works to be carried out by the CONTRACTOR in accordance with the CONTRACT.

60. 'WRITING' shall include any manuscript, typewritten or printed statement, under or over signature and/or seal as the case may be.

61. 'NOTICE INVITING TENDER (NIT)/ BIDDING DOCUMENT' means Complete Bidding Document as originally issued and any Addendum /Corrigendum/ Amendment(s) issued thereafter.

62. 'MUTUALLY AGREED DAMAGES' (MAD) shall be as defined in SPECIAL CONDITIONS OF CONTRACT.

2.0 CONTRACT DOCUMENTS

The term 'Contract Documents' shall mean and include the following documents which shall constitute the Contract and shall be deemed to form an integral part of the Contract:

a) Contract Agreement
b) Detailed Letter of Acceptance (DLOA) and all Annexures
c) FAX of Acceptance (FOA)
d) Agreed variations , if any
e) Schedule of Rates
f) Corrigendum/Addendum/Amendment to tender
g) Complete Original Tender Document with all enclosures
h) Integrity Pact (IP) signed between the Owner and the Bidder/Contractor

The above documents are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

2.1 INTERPRETATION OF CONTRACT DOCUMENTS

2.1.1 Notwithstanding the sub-division of the CONTRACT document into these separate documents and/or volumes and/or heads, every part of each separate section/volume/head shall be deemed to be supplementary of every other part and shall be read with and into the CONTRACT so far as it may be practicable to do so.

2.1.2 If in respect of any commercial term or condition, if any provision in the GENERAL CONDITIONS OF CONTRACT is repugnant to or at variance with any provision(s) of the SPECIAL CONDITIONS OF CONTRACT, the provision(s) of the SPECIAL CONDITIONS OF CONTRACT shall be deemed to override the provision(s) of GENERAL CONDITIONS OF CONTRACT, but only to the extent that such repugnancy in the GENERAL CONDITIONS OF CONTRACT cannot be reconciled with the SPECIAL CONDITIONS OF CONTRACT.

2.1.3 Without prejudice to the provisions of the GENERAL CONDITIONS OF CONTRACT, whenever in the Bidding documents it is mentioned or stated that the CONTRACTOR shall perform certain work or provide certain facilities, it is understood that the CONTRACTOR shall do so at his own cost and the TOTAL CONTRACT PRICE shall be deemed to have included the cost of such performance and/or provision, as the case may be.

2.1.4 The MATERIALS, design and workmanship shall satisfy the applicable relevant Indian standards, the job specifications contained herein and the codes referred to by expression or implication. Where the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any standard/specification/code of practice for detailed specifications covering any part of the work covered in this tender, the instructions/directions agreed between OWNER and CONTRACTOR based on good international engineering practice shall be binding on the CONTRACTOR.

2.1.5 The documents forming the Contract are to be read together and interpreted as mutually explanatory of one another. If there is a direct inconsistency in specific obligation(s), then for the purposes of interpretation, and unless otherwise provided in the Contract, the priority of the Contract Documents shall be in accordance with following sequence:

i. The Contract Agreement
ii. Detailed Letter of Acceptance (DLOA) along with its enclosures
iii. Fax of Acceptance (FOA)
iv. Schedule of Rates (SOR)
v. Scope of Works/ Job Specifications (specific to particular job only, wherever provided)
vi. Drawings
vii. Special Conditions of Contract (SCC)
viii. Technical Specifications (wherever applicable)
ix. Instructions to Bidders (ITB)
x. General Conditions of Contract (GCC)
xi. Other Documents

Any amendment / Corrigendum / Addendum to tender issued by PMC/Owner shall take precedence over respective clauses of the original tender document and its annexures.

Similarly, any amendment / change order issued by Owner upon signing of formal Contract shall take precedence over respective clauses of the formal Contract and its annexures.

2.1.6 Should there be any doubt or ambiguity in the interpretation of the CONTRACT documents or contradiction therein or should there be any discernable error or omission in any CONTRACT document, the CONTRACTOR shall, prior to commencing the relative work or supply, as the case may be, apply in writing to the Engineer-In-Charge for his decision for resolution of the doubt, ambiguity or contradiction or correction of the error or making good the omission, as the case may be. Should the CONTRACTOR fail to apply to the ENGINEER-IN-CHARGE for his decision as aforesaid prior to commencing the

relative work or supply, the CONTRACTOR shall perform the said work or make the said supply, as the case may be, at his own risk, and the provisions of NIT shall apply to any such work performed or supply made by the CONTRACTOR.

2.1.7 Notwithstanding anything provided in Clause 2.1.6 hereof above, either the CONTRACTOR or any representative of the OWNER or CONSULTANT may, at any time prior to or during the execution of the work or supply of any material or any part thereof (if the CONTRACTOR has failed to make an application as provided for in Clause 2.1.6), apply to the ENGINEER-IN-CHARGE in writing for his decision in resolution of any doubt, ambiguity or contradiction or for the correction of any error or for making good the omission as the case may be.

2.1.8 The decision of the ENGINEER-IN-CHARGE on any application under Clause 2.1.6 or Clause 2.1.7 hereof shall be in writing and shall be final and binding upon the CONTRACTOR and shall form part of the CONTRACT documents, with the intent that the CONTRACT documents shall be read as though the said decision is and was at all times incorporated therein. It is clarified that in case the Contractor disagrees with the decision of the ENGINEER-IN-CHARGE, the dispute shall be settled as per the provisions of Clause 39.0 of GCC.

2.2 Any work or supply shown, indicated or included in any description of the work, plans, drawings, Specifications and/or Price Schedule or other Contract or Bid documents shall be deemed to form part of the WORK and/or supply contracted for, as the case may be, notwithstanding failure to show, indicate or include such work or supply in any other or others among the documents aforesaid with the intent that the indication or inclusion of the work or supply within any one of the said documents shall be deemed to be a sufficient indication or inclusion of the work or supply, as the case may be, within the work and supply covered by the CONTRACT.

2.3 No verbal agreement, assurance, representation or understanding given by any employee or officer of the OWNER or so understood by the CONTRACTOR, whether given or understood before or after the execution of the contract, shall any-wise bind the OWNER or alter the CONTRACT documents unless specifically given in writing and signed by the OWNER or by the ENGINEER-IN-CHARGE on behalf of the OWNER and issue the amendment of the relative term(s).

2.4 Clause headings given in this or any other contract documents are intended only as a general guide for convenience in reading and segregating the general subject of the various Clauses, but do not form part of the contract documents, with the intent that the Clause headings shall not govern the meaning or import of the Clauses there under appearing or confine or otherwise affect the interpretation thereof.

3.0 MODIFICATIONS IN CONTRACT

3.1 All modifications leading to changes in the CONTRACT with respect to technical or commercial aspects including terms of completion period shall be considered valid only when accepted in writing by OWNER and CONTRACTOR by issuing amendment to the CONTRACT. Issuance of acceptance or otherwise in such cases shall not be any ground for extension of agreed completion date (except in cases where completion period itself is revised by OWNER) and also shall not affect the performance of CONTRACT in any manner except to the extent mutually agreed to, through a modification to CONTRACT. The PARTIES shall have the right to modify or amend the CONTRACT subject to an

adjustment in the CONTRACT PRICE and/ or COMPLETION DATE in accordance with the applicable provision of the CONTRACT, if any, and subject to mutual agreement.

3.2 OWNER shall not be bound by any printed conditions or provisions in the CONTRACT-OR's bid forms or acknowledgement of CONTRACT, packing list and other documents which support to impose any condition at variance with or supplemental to CONTRACT

4.0 USE OF CONTRACT DOCUMENTS AND INFORMATION

4.1 The CONTRACTOR shall not, without the OWNER's prior written consent, disclose the CONTRACT or any provision thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the OWNER in connection therewith, to any person other than a person employed by the CONTRACTOR in the performance of the CONTRACT. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purpose of such performance.

4.2 The CONTRACTOR shall not without the OWNER's prior written consent, make use of any document or information enumerated in Clause 6.1 except for purpose of performing the CONTRACT.

4.3 Any document other than CONTRACT, itself, enumerated in Clause 6.1 shall remain the property of the OWNER and shall be returned (all copies) to the OWNER on completion of the CONTRACTOR's performance under the CONTRACT if so required by the OWNER.

5.0 PRICES, TAXES AND DUTIES AND OTHER LEVIES

The following provisions are in addition to Clause 13 of “Instruction to Bidders” (Section-III)

The prices shall include all duties, taxes and levies etc. including but not limited to customs duty, GST on imports, any tax / duty/ levy as per applicable GST laws, personnel and corporate tax as applicable.

The Bidders are to quote firm prices. In respect of both direct transaction between OWNER and the Bidder and Bought Out Items to be dispatched directly from the sub-vendor’s works to Owner’s site, the payment towards all applicable Indian Taxes and duties like Custom Duty, GST and other tax/duty/levy, will be made by OWNER in Indian rupees at actuals limited to the amount indicated in the Bid.

In case of Bought out items to be dispatched directly from sub-vendor’s works to Owner’s site, the CONTRACTOR shall ensure that his sub-vendors raise tax invoice under the provisions of GST Law, billed to the CONTRACTOR and shipped to Owner’s site. The CONTRACTOR shall further ensure that he raises his corresponding tax invoices under the provision of GST Law in the name of OWNER during transit of the Material before the delivery of Material is taken by OWNER.

5.1 Except as specifically provided to the contrary in the SPECIAL CONDITIONS OF CONTRACT:

(i) The CONTRACTOR shall, within the price of materials and scope of supply, be liable to pay and bear any and all duties, taxes, levies and cesses lawfully

payable on any goods, equipment or materials imported into India or within any local limits for permanent incorporation in the work(s), and on materials sold and supplied to the OWNER pursuant to the CONTRACT.

(ii) The CONTRACTOR shall within the price of services and scope of services be responsible to pay on behalf of the OWNER any and all duties, taxes, levies and cesses including education cess etc. lawfully payable on any goods or equipment imported into India or within any local limits for use in the performance of the work(s), and on services performed pursuant to the CONTRACT.

(iii) The CONTRACTOR shall be liable for and shall pay any and all Indian fees, taxes, duties, levies and cesses including education cess etc., assessable against CONTRACTOR in respect of or pursuance to the CONTRACT. However, GST payment by the CONTRACTOR to the Tax Authority shall be made by the Owner to the CONTRACTOR at actual limited to the Amount indicated in the Bid.

(iii) In addition, the CONTRACTOR shall be responsible for payment of all Indian duties, levies, and taxes etc., assessable against the CONTRACTOR or CONTRACTOR's employees or SUB-CONTRACTOR'S whether corporate or personal or applicable in respect of property.

(iv) CONTRACTOR should comply with the provisions of e-way bill notified by appropriate authorities from time to time. The existing provisions of road permit will continue till such time if applicable.

(v) There will be no materials under the scope of Contract which will be consigned to Owner, unless otherwise specifically mentioned elsewhere in the tender. The Owner will not issue / provide Road permits/e-way bill to the Contactor except in respect of material directly purchased by the Owner.

5.2 **TAX INDEMNITY**

It will be the duty of the CONTRACTOR to duly observe and perform all laws, rules, regulations, orders and formalities applicable under GST and Customs Duty on the manufacture, sale, import and/or supply of any material to OWNER and/or applicable on the services performed by the CONTRACTOR pursuant hereto. The CONTRACTOR shall keep the OWNER indemnified for and against any and all claims, demands, prosecutions, penalties, damages, demurrages and/or other levies whatsoever made or levied by the Court or Customs Authorities with respect to any alleged breach, evasion or infraction of such duties, taxes, charges or levies or any breach or infraction of such laws, rules, regulations, orders or formalities concerning the same and from the consequence thereof.

5.3 The CONTRACTOR confirms that, it has included all taxes, duties, levies etc., as applicable at prevailing rates, in its TOTAL CONTRACT PRICE as quoted in Schedule of Rate. In case, CONTRACTOR has not included any such taxes, duties, levies etc., at all and/or at prevailing rates and CONTRACTOR has to pay such taxes, duties, levies etc., OWNER shall not be liable for payment of such liabilities and/or OWNER shall not reimburse such taxes, duties, levies etc. to CONTRACTOR.

5.4 **The award of work shall be on 'Work Contract Service' basis**.

The contractor shall be responsible for payment of any tax levied on the transfer of property and goods involved with relevant GST act and rules made there under including amendments, if any. The contractor shall be liable to ensure to have registered with the respective tax authorities and to submit self-attested copy of such registration certificate(s) and any taxes/ duties/ levies being charged by the Contractor would be claimed by issuing proper tax invoice/challan indicating details/ elements of all taxes charged and necessary requirements as prescribed under the respective tax laws and also to mention correct and valid registration number(s) on all tax invoices raised to TFL.

5.5 Any other taxes / duties in relation to this CONTRACT, which in terms of relevant legislation is the liability of CONTRACTOR, is discharged by OWNER, would be recovered from the CONTRACTOR from any subsequent payment due to the CONTRACTOR.

5.6 Applicable BOCW shall be included in the quoted TOTAL CONTRACT PRICE. The contractor shall pay the cess under BOCW Act for subject works and submit proof of submission of cess to owner before submitting the next R.A. bill. In case, contractor does not submit the said proof, applicable BOCW shall be deducted at source by the OWNER from the contractor's invoice and deposit the deducted amount to the concerned authority. OWNER does not undertake any further responsibility in this regard.

6.0 **INCOME TAX**

6.1 CONTRACT PRICE shall be inclusive of any and all Indian Income Tax payable in India. OWNER shall deduct Indian Income Tax as per rates prescribed for such contracts from time to time, from the payments due to CONTRACTOR and issue Tax Deducted at Source (TDS) certificate to CONTRACTOR. It will the responsibility of the CONTRACTOR to file proper income tax return and pay taxes thereon if any, or claim refund thereof if any. The CONTRACTOR shall give OWNER all necessary documents relating to its income tax assessments and to keep the OWNER informed about their assessments.

6.2 Personal income tax payable, if any, in respect of salary and perquisites of CONTRACTOR's personnel / SUB-CONTRACTOR's personnel in India shall be payable by the individual so deputed by CONTRACTOR or SUB-CONTRACTOR. It is the responsibility of the individual or CONTRACTOR to file proper income tax return and pay taxes thereon if any, or claim refund thereof if any. The CONTRACTOR shall give OWNER all necessary documents relating to income tax assessments of its personnel and to keep the OWNER informed about their assessments.

7.0 PATENT INFRINGEMENT AND INDEMNIFICATION (WHEREVER APPLICABLE)

7.1 **PATENT INFRINGEMENT**

7.1.1 CONTRACTOR shall at all times, indemnify and keep indemnified OWNER against all claims or suits and defend, at its own cost, any suit or action brought against OWNER and hold OWNER free and harmless against all costs of such claims or suits which may be made against OWNER in respect of any infringement of any rights protected by patent, copyright, trademarks, and trade secrets to the extent that such claim, suit, or action is a result of the use of CONTRACTOR's Technical Information for the construction, maintenance, and operation of PLANT and the use of CONTRACTOR's

and/or any other process licenser's processes used in PLANT. OWNER shall pass on all claims made against it to CONTRACTOR for settlement.

7.1.2 CONTRACTOR declares that to the best of its knowledge and belief the use of CONTRACTOR's Technical Information for the construction, maintenance, and operation of PLANT and the use of CONTRACTOR's processes used in PLANT will not infringe any valid patent rights of a third party. However, if at any time such infringement arises, CONTRACTOR agrees to keep OWNER indemnified and harmless against such claims and costs thereof and make arrangements that will allow OWNER to continue the operation of PLANT.

7.1.3 OWNER shall promptly advise CONTRACTOR in writing of any claim of infringement or any action for infringement of patents brought against it by a third party and based upon the use of CONTRACTOR's Technical Information. If such use is in accordance with instructions given in writing by CONTRACTOR, CONTRACTOR shall undertake the defence, or assist OWNER in the defence, of the claim or suit up to final judgment or settlement.

7.1.4 CONTRACTOR shall undertake the defence on behalf of OWNER and shall have sole charge and direction of the defence, and shall bear all costs related thereto. CONTRACTOR shall further hold OWNER harmless from any damages or other sums that may become payable by OWNER under a final judgment or settlement. However, OWNER shall render to CONTRACTOR all reasonable assistance that may be required by CONTRACTOR in the defence, and shall have the right to be represented therein by advisory counsel of its own selection and at its own expense.

7.1.5 In addition to the measures specified in Clause7.1.4, CONTRACTOR may further, at its option, however, in reasonable consultation with OWNER, seek to abate the alleged infringement by modification of PLANT or its operation without adversely affecting the performance and/or secure for OWNER immunity from suit for infringement. In such case, CONTRACTOR shall bear/ reimburse OWNER for all costs related to said modification and to said immunity.

7.1.6 In the event that OWNER is legally restrained from operating PLANT on account of any infringement action or suit, CONTRACTOR shall take all possible actions to allow OWNER to operate and use PLANT.

7.1.7 Neither CONTRACTOR nor OWNER shall settle or compromise any suit or action without the written consent of the other if settlement or compromise obliges the other to make any payment or part with any property or assume any obligations or surrender any rights or to be subjected to any injunction by reason of such settlement or compromise.

7.2 INDEMNITIES

7.2.1 INDEMNIFICATION FOR LIABILITIES

7.2.1. CONTRACTOR Indemnification for Liabilities

To the fullest extent permitted by Law, CONTRACTOR assumes liability for and agrees to indemnify, protect, save and hold harmless OWNER from and against any and all Liabilities (including, any strict liability), arising out of acts or omissions of CONTRACTOR

or its personnel or its agents in the performance of its obligations under the CONTRACT causing bodily injury, sickness, disease or death, damage to or loss of any property, and whether or not involving damage to WORKS or SITE that may be imposed on, suffered or incurred by or asserted against OWNER and in any way relating to or arising out of (i) WORK, any EQUIPMENT (ii) the presence, discharge, treatment, storage, transportation, disposal, escape or release of any Hazardous Substance, or the threat thereof, at, to or from SITE after commencement of work (any hazardous substance already existing at SITE before commencement of WORK excluded)(iii) The performance of WORK, or as a result of personal injuries (including wrongful death); (iv) the violation by CONTRACTOR or any SUB-CONTRACTOR/VENDOR of any Government Approval or applicable Law relating to WORK (v) any breach of CONTRACT with any SUB-CONTRACTOR/VENDOR, provided, however, that CONTRACTOR shall not be required under this Clause to indemnify OWNER for any liability arising out of or resulting from events or circumstances occurring or existing after PRELIMINARY ACCEPTANCE OF PLANT except where the liability arises from an act or omission of CONTRACTOR or any SUB-CONTRACTOR/VENDOR or any other Person directly or indirectly employed by either of them or anyone for whose acts either of them may be liable that was a contributory cause of such liability.

7.2.2 **CONTRACTOR Indemnification for Taxes**

It is specifically understood that CONTRACTOR hereby accepts and assumes exclusive liability for and save and hold OWNER harmless from and against of all Taxes arising from the performance of WORK, and all such Taxes shall be deemed to be included in CONTRACT PRICE.

7.2.3 **Indemnification by SUB-CONTRACTOR/VENDOR**

CONTRACTOR shall obtain from each SUB-CONTRACTOR/VENDOR, which is an affiliate, and shall use all reasonable efforts to obtain from each SUB-CONTRACTOR/VENDOR, an indemnification materially similar in form and substance to Clause-7.1 and Clause-7.2.2 of which the OWNER shall be named as beneficiary.

7.2.4 **Payment of Amounts under this Clause**

Except to the extent covered by insurance, all amounts payable and due by CONTRACTOR to OWNER under this Clause shall be deducted from CONTRACT PRICE or any other amounts owed by OWNER to CONTRACTOR here under. If such amounts payable by OWNER to CONTRACTOR are less than the amounts payable and due by CONTRACTOR under this Clause, CONTRACTOR shall be liable to OWNER for such excess and shall pay such amount to OWNER immediately upon demand.

7.2.5 **Permits and Certificates**

CONTRACTOR shall procure, at its expense, all necessary permits, certificates and licences required by virtue of all applicable laws, regulations, ordinances and other rules in force at the place where any of the works is to be performed, and CONTRACTOR further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of any asserted or established violation of such laws, regulations, ordinances or other rule. OWNER shall provide the necessary permits for CONTRACTOR's personnel to undertake any work in India in connection with CONTRACT.

7.2.6 **Mechanics Lien**

CONTRACTOR agrees to indemnify and hold harmless OWNER against all labourer's material, man's and/or mechanic's liens arising from its work, and shall keep the premises of OWNER free from all such claims, liens and encumbrances.

8.0 CONTRACT PERFORMANCE SECURITY (CPS)

8.1 The proceeds of **CPS** shall be appropriated by the OWNER as compensation for any loss resulting from the CONTRACTOR's failure to complete their obligations under the CONTRACT without prejudice to any of the rights or remedies the OWNER may be entitled to as per terms and conditions of the CONTRACT.

8.2 The CONTRACTOR shall extend the validity of the **CPS** suitably if it is required due to delay in COMPLETION of the PLANT at it's own cost. The CPS shall be suitably extended in event of repair/replacement of equipment or any part thereof during DEFECT LIABILITY PERIOD to take care of extended warranty period of repair/ replacement. The CPS will be discharged by the OWNER after the CONTRACTOR's performance obligation including any warranty obligation under the CONTRACT. For any component replaced during DEFECT LIABILITY PERIOD, the component should work satisfactorily for a period of 12 months from the date of replacement

The CPS shall be retained by OWNER during the currency of CONTRACT as indicated above or till settlement of all the accounts thereof, whichever is later. In case of any dispute or differences not settled within the validity of CPS, contractor shall arrange to get the CPS extended for the period asked for by OWNER. In case CPS is not extended as asked, OWNER shall have the sole discretion to 'call in' the bank to pay the whole or part of the amount of bank guarantee/CPS. The above deposit shall be deemed to be security for the faithful performance of the CONTRACT and for the purpose of section 74 of the Indian Contract Act, 1872 and for the extension of that section , the CPS shall deemed to be the bond given by the CONTRACTOR for the performance of essential duty. In the event of breach of any of the terms and conditions of the contract, OWNER shall have the right to draw from the CPS whole or part of the value of CPS. The amount so drawn shall not in any way affect any remedy to which OWNER may otherwise be entitled or any liability incurred by contractor under the contract or any law for the time being in force relating thereto or bearing here upon. This CPS shall be refunded 3 months after expiry of Defect Liability Period. It shall be lawful for OWNER if any differences or dispute is likely to arise to defer payment of the CPS or any portion thereof which may be due for release until such differences and dispute has been finally settled or adjusted. CPS amount shall not bear any interest.

NOTE:

In case CPS is submitted by way of Bank Guarantee, the non-judicial Stamp paper of appropriate value only or equivalent document value shall have to be purchased in the name of the bank executing the bank guarantee and not in the name of the CONTRACTOR.

8.3 **Rights of the OWNER to forfeit CPS:**

i) Whenever any claim against the CONTRACTOR for the payment of a sum of money arises out or under the CONTRACT, the OWNER shall be entitled to recover such sum by appropriating in part or whole the CPS of the CONTRACTOR. In the event of the security being insufficient or if no security has been taken from the CONTRACTOR, then the balance or the total sum recoverable, as the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the CONTRACTOR. The CONTRACTOR shall pay to the OWNER on demand any balance remaining due.

ii) All compensation or other sums of money payable by the CONTRACTOR to the OWNER under terms of this CONTRACT may be deducted from or paid by the encashment or sale of a sufficient part of his CPS or from any sums which may be due or may become due to the CONTRACTOR by the OWNER of any account whatsoever and in the event of his Rights of the OWNER to forfeit CPS.

9.0 DELETED

10.0 SIGNING OF CONTRACT

10.1 All documents as per Clause 2.0 of GCC shall be included in the DLOA.

10.2 Every page of the DLOA &CONTRACT agreement shall be initialled by the authorised representatives of OWNER and CONTRACTOR under the Seal of their respective Companies.

10.3 The CONTRACTOR shall present the above CONTRACT AGREEMENT so prepared in two Sets alongwith proper Power of Attorney and other requisite material on the day of signing the agreement.

10.4 Notwithstanding anything mentioned in any other clause, any conditions imposed from time to time by Government of India shall be followed by the CONTRACTOR.

11.0 Deleted

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12.0 ASSIGNMENT OR SUBLETTING OF CONTRACT AND SUB-CONTRACTING

12.1 No part of the CONTRACT nor any share or interest therein shall in any manner or degree be transferred, assigned or sublet by the CONTRACTOR directly or indirectly to any person, firm or corporation whatsoever without the consent in writing, of the ENGINEER/EMPLOYER except as provided for in the succeeding sub-clause.

i. SUB-CONTRACTS FOR TEMPORARY WORKS ETC.:

The EMPLOYER may give written consent to Sub- contract for the execution of any part of the WORK at the site, being entered in to by CONTRACTOR provided each individual Sub- contract is submitted to the ENGINEER-IN-CHARGE before being entered into and is approved by him.

ii. LIST OF SUB-CONTRACTORS TO BE SUPPLIED

At the commencement of every month the CONTRACTOR shall furnish to the ENGINEER-IN-CHARGE list of all SUB-CONTRACTORS or other persons or firms engaged by the CONTRACTOR and working at the SITE during the previous month with particulars of the general nature of the Sub-contract or works done by them

iii. CONTRACTOR'S LIABILITY NOT LIMITED BY SUB- CONTRACTORS

Notwithstanding any sub-letting with such approval as aforesaid and notwithstanding that the ENGINEER-IN-CHARGE shall have received copies of any Sub-contracts, the contractor shall be and shall remain solely responsible for the quality, proper and expeditious execution of the Contract in all respects as if such sub-letting or Subcontracting had not taken place, and as if such work had been done directly by the CONTRACTOR. The CONTRACTOR shall bear all responsibility for any act or omission on the part of sub-contractors in regard to work to be performed under the CONTRACT.

iv. EMPLOYER MAY TERMINATE SUB-CONTRACTS

If any SUB-CONTRACTOR engaged upon the works at the site executes any works which in the opinion of the ENGINEER-IN-CHARGE is not in accordance with the CONTRACT documents, the EMPLOYER may by written notice to the CONTRACTOR request him to terminate such subcontract and the CONTRACTOR upon the receipt of such notice shall terminate such Subcontract and dismiss the SUB-CONTRACTOR(S) and the later shall forthwith leave the works, failing which the EMPLOYER shall have the right to remove such SUB- CONTRACTOR(S) from the site.

v. NO REMEDY FOR ACTION TAKEN UNDER THIS CLAUSE

No action taken by the EMPLOYER under the clause shall relieve the CONTRACTOR of any of his liabilities under the CONTRACT or give rise to any right or compensation, extension of time or otherwise failing which the EMPLOYER shall have the right to remove such SUB-CONTRACTOR(S) from the site

12.2 DELETED

12.3 **Sub-Contracting for WORKS (to be read in conjunction with clause regarding sub-contractors/Sub-vendors sharing land border with India as per Annexure-VII of tender document).**

12.3.1 **General**

All vendors, suppliers, consultants and SUB-CONTRACTORS/SUB-VENDORS providing equipment, materials, construction equipment, or services to CONTRACTOR under a SUBCONTRACT, purchase order or similar purchase form or arrangement with CONTRACTOR for the performance of the WORK under this CONTRACT are herein referred as "SUB-CONTRACTORS"/ “SUB-VENDORS”, and any such SUB-CONTRACTS, purchase orders or similar purchase forms or arrangement entered into by or on behalf of CONTRACTOR with SUB CONTRACTORS/SUB-VENDORS are herein

referred to as "SUB-CONTRACTS" provided that none of OWNER's CONTRACTOR'S or SUB-CONTRACTOR'S/ SUB-VENDOR'S shall be deemed to be a SUB-CONTRACTOR/ SUB-VENDOR under the CONTRACTOR. The CONTRACTOR shall be obligated to select SUB-CONTRACTORS/ SUB-VENDORS it retains in connection with the performance by CONTRACTOR of the WORK from the SUB-CONTRACTOR'S/ SUB-VENDOR'S list which would be finalised and approved by the OWNER. OWNER and CONTRACTOR may by mutual agreement add to or delete from such list from time to time and approve any successor or replacement of any person listed on such list or any other vendor, supplier, material-man, consultant or SUB-CONTRACTOR/SUB-VENDOR.

12.3.2 **Approval of SUB-CONTRACTOR/SUB-VENDOR**

12.3.2.1 The vendor list for procurement of EQUIPMENT and the list of SUB-CONTRACTOR/SUB-VENDOR shall be as attached in the Section VI of NIT. Any changes to such list of SUB-CONTRACTOR/SUB-VENDOR shall require the prior approval of OWNER. CONTRACTOR shall provide name, address, fax number and name of contact person of major SUB-CONTRACTORS/SUB-VENDORS for use in future, to OWNER.SUB-CONTRACTOR/SUB-VENDOR as per agreed Vendor list are not subject to approval.

12.3.2.1.1 Under normal circumstance a CONTRACTOR shall not be allowed to source any equipment/machinery from the vendors other than the Owner's approved vendor list. However, in exceptional circumstance the CONTRACTOR may suggest additional vendors meeting the following requirement for the approval of Owner.

a. The CONTRACTOR should specify, while pre-qualifying the Vendors, that during the past 7 years the Vendor should have supplied at least two similar plant equipments or machinery. The CONTRACTOR should satisfy themselves that sufficient documentary proof is submitted by the Vendors in support of this criterion. However, in case of critical equipment, in addition to above criterion, the Vendor should also be prequalified by Process Licensor.

b. The CONTRACTOR would be ultimately responsible for verifying the credentials, the quality of the equipment, machinery and timely supply.

12.3.2.2 The review, approval and consent by OWNER as to the agreed SUB-CONTRACTOR's/VENDOR List or as to CONTRACTOR's entering into any SUB-CONTRACT / PURCHASE ORDER shall not relieve CONTRACTOR of any of its duties, liabilities or obligations under this CONTRACT and CONTRACTOR shall be liable hereunder to the same extent as if any such Subcontract had not been entered into.

12.3.2.3 (a) CONTRACTOR shall provide to OWNER such information concerning the SUB-CONTRACTORS as OWNER may from time to time reasonably request and shall ensure that each SUB-CONTRACT contains provisions in all material respects not less stringent than the provisions of the CONTRACT and shall include terms and provisions required to be included pursuant to the CONTRACT. In the event of termination of the CONTRACT under Clause 34.0 herein, CONTRACTOR shall forthwith deliver to OWNER a copy of each SUBCONTRACT.

(b) CONTRACTOR shall supervise and direct the work of all SUB-CONTRACTORS/SUB-VENDORS and shall be responsible for all design,

engineering, procurement, manufacturing, transportation, delivery, fabrication, construction, commissioning, start-up and testing means, erection, operation, maintenance, repair, methods, techniques, sequences and procedures of, and for co-coordinating the work of SUB-CONTRACTORS/ SUB-VENDORS.

(c) If CONTRACTOR fails to correct, or commence to correct and execute the correction with due diligence of deficient or defective work performed by any SUB-CONTRACTOR/SUB-VENDORS within reasonable time (provided it doesn't materially impact safe operation of plant), after receipt by CONTRACTOR of a notice from OWNER with respect thereto, OWNER may (but shall not be obligated to), after seven days following receipt by CONTRACTOR of an additional notice, and without prejudice to any other right or remedy take all reasonable steps to remedy such defective or deficient work at risk and cost of CONTRACTOR.

(d) CONTRACTOR shall require all SUB-CONTRACTORS/SUB-VENDORS to perform the SUB-CONTRACTS in accordance with the relevant requirements of the CONTRACT, all APPLICABLE LAWS and APPLICABLE PERMITS, Prudent Utility Practice, Good Engineering Practices, the requirements of the NIT, and all Warranties of SUB-CONTRACTORS/SUB-VENDORS and Manufacturers and all insurance policies relating to the PLANT or the WORK.

(e) CONTRACTOR shall be solely responsible for paying each SUB-CONTRACTOR/SUB-VENDOR and any other person to whom any amount is due from CONTRACTOR for services, equipment, construction equipment, materials or supplies otherwise related to the PLANT or the WORK. CONTRACTOR shall take all reasonable steps and actions to ensure that such services, equipment, construction equipment materials and supplies and the like have been or will be received, inspected and approved and that such services have been or will be properly performed.

(f) In performing the duties incidental to its responsibilities hereunder, CONTRACTOR shall issue to the SUB-CONTRACTORS/SUB-VENDORS such directives and impose such restrictions as may be required to obtain such compliance herewith and with the terms of the SUB-CONTRACTS.

12.3.2.4 **SUB-CONTRACTOR/VENDOR AND MANUFACTURER WARRANTIES**

(a) CONTRACTOR shall ensure that all equipment and other items used in connection with the performance of the WORK or incorporated in the PLANT (other than minor items) will be purchased in compliance with CONTRACT Technical Specifications and requirements in order to allow the Plant to achieve the Guarantee and Warrantee as provided for in the CONTRACT, unless otherwise agreed with OWNER.Any residual warranty from sub-contractor/vendor shall be passed to the OWNER after expiry of DEFECT LIABILITY PERIOD.

(b) Neither CONTRACTOR nor its SUB-CONTRACTORS/SUB-VENDORS nor any person under the control of either thereof, shall take any action which could release, void, impair or waive any Guarantee or Warranty on EQUIPMENT or services relating to the PROJECT or the WORK. Any residual warranty from sub-contractor/sub-vendor shall be passed to the OWNER after expiry of DEFECT LIABILITY PERIOD.

(c) Nothing in this clause shall derogate from the obligations of CONTRACTOR to provide the Guarantees and Warranties described in and to comply with the provisions hereinabove.

(d) CONTRACTOR shall, based on its past professional judgement enforce all guarantees and warranties provided hereunder to the fullest extent thereof till such time they are transferred to the OWNER pursuant to sub-clause (g) below.

(e) Upon the expiration or termination of any of the guarantees or warranties provided by CONTRACTOR pursuant to the CONTRACT, the CONTRACTOR shall assign, and hereby assigns, effective as of such date, or otherwise make available, to OWNER all of CONTRACTOR's rights under all such SUBCONTRACTOR's residual Guarantees and warrantee as per 12.3.2.4(a) & (b)(except to the extent CONTRACTOR has thereof provided warranty services to OWNER and is enforcing CONTRACTOR's rights with respect to such services under the applicable guarantee or warranty) and shall deliver to OWNER copies of all contracts providing for such guarantees and warranties.

(f) CONTRACTOR, in accordance with the CONTRACT, shall require all SUB-CONTRACTORS/SUB-VENDORS to be covered by the insurance covers specified in the CONTRACT, during the time in which they are engaged in performing WORK.

(g) CONTRACTOR shall require all SUB-CONTRACTORS/SUB-VENDORS to release and waive any and all rights of recovery against OWNER including its affiliates, subsidiaries, employees, successors, permitted assigns, insurers and underwriters) and against CONTRACTOR and all other SUB-CONTRACTORS/VENDORS which the releasing SUB-CONTRACTOR/VENDOR may otherwise have or acquire, in or from or in any way connected with any loss covered by policies of insurance maintained or required to be maintained pursuant to this the CONTRACT (other than third party liability insurance policies) or because of deductible clauses in or inadequacy of limits of any such policies of insurance. CONTRACTOR shall further require all SUB-CONTRACTORS/VENDORS to include in all policies of insurance maintained by the SUB-CONTRACTORS/VENDORS clauses providing that each underwriter shall release and waive all of its rights of recovery, under subrogation or otherwise, against OWNER, its promoters, affiliates, subsidiaries, employees, successors, permitted assigns, insurers and underwriters, and against CONTRACTOR and all other SUB-CONTRACTORS/VENDORS.

(h) OWNER shall not be deemed by virtue of the CONTRACT to have any contractual obligation to or relationship with any SUB-CONTRACTOR/VENDOR.

12.3.2.5 **CONTRACTOR's LIABILITY FOR APPROVED SUB CONTRACTOR :**

The review by and approval and consent of OWNER as to the approved SUB-CONTRACTORS list or as to CONTRACTOR entering into any SUB-CONTRACT with any approved SUB-CONTRACTOR or as to any WORK done or supply made or services provided by any such approved SUB-CONTRACTOR/SUB-VENDOR shall not relieve CONTRACTOR of any of his duties, liabilities or obligations under this CONTRACT, and CONTRACTOR shall be liable hereunder to the same extent as if any such SUB-CONTRACT had not been entered into. Any inspection review or approval by OWNER permitted under this CONTRACT of any portion of the work or of any work in progress by CONTRACTOR or SUB-CONTRACTORS/SUB-VENDORS shall not relieve CONTRACTOR of any duties, liabilities or obligations under this CONTRACT.

12.3.3 All WORK performed or EQUIPMENT supplied by SUB-CONTRACTOR/ SUB-VENDOR shall be pursuant to an appropriate SUB-CONTRACT, PURCHASE ORDER or similar agreement which shall, as appropriate, contain provisions that:

12.3.3.1 Preserve and protect all the rights of OWNER here under for WORK to be performed or EQUIPMENT to be supplied under PURCHASE ORDER or SUB-CONTRACT.

12.3.3.2 Require that such WORK be performed or EQUIPMENT be fabricated, supplied and installed in strict accordance with the applicable requirements of this CONTRACT.

12.3.3.3 Obligate such SUB-CONTRACTOR/SUB-VENDOR to consent to and be bound by those obligations under this CONTRACT which by their terms are intended to also obligate such SUB-CONTRACTOR/VENDOR, including the provisions of this Clause.

12.3.3.4 Require such SUB-CONTRACTOR/SUB-VENDOR to provide and maintain adequate insurance consistent with requirements for companies of similar size and performing similar services. Permit the assignment of such SUB-CONTRACT/PURCHASE ORDER by CONTRACTOR to OWNER.

12.3.3 **CONTRACTOR RESPONSIBLE FOR WORK**

12.3.4.1 CONTRACTOR is responsible for WORK, and that the performance thereof conforms in all respects to the requirements of this CONTRACT, regardless of any failure of any SUB-CONTRACTOR/VENDOR to perform or any disagreement between any SUB-CONTRACTOR/VENDOR or between any SUB-CONTRACTOR/VENDOR and CONTRACTOR. CONTRACTOR shall furnish such information relative to its SUB-CONTRACTOR/VENDOR (including copies of unpaid SUB-CONTRACT or PURCHASE ORDER) as OWNER may request.

12.3.5 **DAMAGES**

It is within the discretion of Contractor, that CONTRACTOR shall agree to hold all SUB-CONTRACTOR/VENDOR, including all persons directly or indirectly employed by them, responsible for any damages due to breach of CONTRACT caused by them or any negligent act and to diligently endeavour to effect recoveries in such damages.

13.0 STANDARDS

The goods and services supplied under this CONTRACT shall conform to the standards mentioned in the technical specifications and when no applicable standard is mentioned, CONTRACTOR to follow best engineering practices.

14.0 INSTRUCTIONS, DIRECTIONS

14.1 The materials described in CONTRACT are to be supplied according to the standards, data sheets, tables, specifications and drawings attached hereto and/or enclosed with the CONTRACT itself and according to all conditions both general and specific enclosed with the CONTRACT, unless any or all of them shall have been modified or cancelled in writing as a whole or in part.

A) All instructions and orders to CONTRACTOR shall, except what is herein provided, be given by OWNER/ CONSULTANT.

B) All the work shall be carried out under the direction of OWNER and according to the CONTRACT requirements.

C) All communications including technical/ commercial clarifications and/ or comments shall bear reference to the CONTRACT.

D) Invoice for payment against CONTRACT shall be addressed to OWNER.

E) The CONTRACT/DLOA number shall be shown on all invoices, communications, packing lists, containers and bills of lading etc.

15.0 DELETED

16.0 TIME SCHEDULE AND PROGRESS REPORTING

16.1 Time Schedule Network/Bar Chart

16.1.1 Together with the CONTRACT confirmation, CONTRACTOR shall submit to OWNER, his time schedule regarding the documentation, supply and manufacture of equipment and materials as well as information of his SUBCONTRACTS to be placed with third parties, including the dates on which CONTRACTOR intends to issue such SUB CONTRACTS. A complete activity-wise time schedule shall be furnished by the CONTRACTOR within 30 days from the date of issuance of FOA.

16.1.2 The time schedule will be in the form of a network or a bar chart clearly indicating all main or key events regarding documentation, supply of raw materials, manufacturing, testing, delivery, erection & commissioning.

16.1.3 The original issue and subsequent revisions of CONTRACTOR's time schedule and/or SUB-CONTRACTORS' time schedules shall be sent in two copies to OWNER.

16.1.4 The time schedule network/bar chart shall be updated at least every month using the latest 'Project Management software', i.e. Primavera (latest version), acceptable to the OWNER.

16.2 PROGRESS TREND CHART/MONTHLY REPORT

16.2.1 CONTRACTOR shall report monthly to OWNER of the execution of CONTRACT and achievement of targets set out in time bar chart, in a monthly progress report on 7th working *day* of every Month.

16.2.2 The progress will be expressed in percentages shown in the progress trend chart.

16.2.3 The first issue of the progress trend chart will be forwarded together with the time bar chart along with CONTRACT confirmation.

16.2.4 The monthly reporting will bear the updating of the progress trend chart.

16.2.5 OWNER or his representatives shall have the right to inspect CONTRACTOR's premises to evaluate the actual progress of work on the basis of CONTRACTOR's time schedule documentation.

16.2.6 Irrespective of such inspection, CONTRACTOR shall advise OWNER at the earliest possible date of any anticipated delay in the programme indicating the reasons thereof and corrective measures proposed thereto.

16.2.7 The time for completion and phased time schedule shall be subject to and in accordance with the provision of Sub-Clauses 16.2.8 and 16.2.9 below.

16.2.8 Neither OWNER nor CONTRACTOR shall be considered in default in performance of their obligations if such performance is prevented or delayed by FORCE MAJEURE conditions as stated in Clause 35.0.

16.2.9 Should the CONTRACTOR's preparation for the commencement of the work or any portion of it or its subsequent rate of progress be from any cause whatsoever, so slow and reasons for delay solely attributed to the contractor, the CONTRACTOR will not be able to complete the work or any portion thereof within the stipulated time for completion, the provisions of Clause 34 of GCC shall apply.

16.2.10 In the event that the delay is caused by a delay in the delivery of a sub-contracted EQUIPMENT, CONTRACTOR shall be responsible for such delay and submit details together with copies of the appropriate orders and agreements with SUB-CONTRACTOR/vendor.

17.0 CONTRACTOR TO INFORM HIMSELF FULLY

The CONTRACTOR in fixing his rate shall for all purpose whatsoever reason may be, deemed to have himself independently obtained all necessary information for the purpose of preparing his offer and his offer as accepted shall be deemed to have taken into account all contingencies as may arise due to such information or lack of same. The correctness of the details, given in the Tender Document to help the CONTRACTOR to make up the tender is not guaranteed.

The CONTRACTOR shall be deemed to have examined the CONTRACT DOCUMENTS, to have generally obtained his own information in all matters whatsoever that might affect the carrying out of the works at the schedules rates and to have satisfied himself to the sufficiency of his offer. Any error in description of quantity or omission there from shall not vitiate the CONTRACT or release the CONTRACTOR from executing the work comprised in the CONTRACT according to DRAWINGS and SPECIFICATIONS at the scheduled rates. CONTRACTOR is deemed to have known the scope, nature and magnitude of the WORKS and the requirements of materials and labour involved etc., and as to what all works he has to complete in accordance with the CONTRACT documents whatever be the defects, omissions or errors that may be found in the DOCUMENTS. The CONTRACTOR shall be deemed to have visited surroundings, to have satisfied himself to the nature of all existing structures, if any, and also as to the nature and the conditions of the Railways, Roads, Bridges and Culverts, means of transport and communication, whether by land, water or air, and as to possible interruptions thereto and the access and egress from the site, to have made enquiries, examined and satisfied himself as to the sites for obtaining sand, stones, bricks and other materials, the sites for disposal of surplus materials, the available accommodation as to whatever required, depots and such other buildings as may be necessary for executing and completing the works, to have made local independent enquiries as to the sub-soil, subsoil water and variations thereof, storms, prevailing winds, climatic conditions and all other similar matters effecting these works. He is deemed to have acquainted himself as to his liability of payment of Government Taxes, Customs duty and other charges, levies etc.

Any neglect or omission or failure on the part of the CONTRACTOR in obtaining necessary and reliable information upon the foregoing or any other matters affecting the CONTRACT shall not relieve him from any risks or liabilities or the entire responsibility from completion of the works at the scheduled rates and times in strict accordance with the CONTRACT.

It is, therefore, expected that should the CONTRACTOR have any doubt as to the meaning of any portion of the CONTRACT DOCUMENT he shall set forth the particulars thereof in writing to OWNER in duplicate, before submission of tender. The

OWNER may provide such clarification as may be necessary in writing to CONTRACT, such clarifications as provided by OWNER shall form part of CONTRACT DOCUMENTS.

No verbal agreement or inference from conversation with any effect or employee of the OWNER before, during or after the execution of the CONTRACT agreement shall in any way affect or modify and of the terms or obligations herein contained.

Any change in layout due to site conditions or technological requirement shall be binding on the CONTRACTOR and no extra claim on this account shall be entertained

18.0 SUITABILITY OF PLANT FOR INTENDED PURPOSE

18.1 The CONTRACTOR warrants that the PLANT will be suitable in all respects for the purpose mentioned or inherent in the specification and as defined in the CONTRACT.

18.2 Without limiting the generality of the foregoing clause, the CONTRACTOR shall ensure before complying with any direction, that compliance by the CONTRACTOR with that direction will not render the plant unsuitable in any respect for the aforesaid purposes or otherwise prevent the CONTRACTOR from carrying out the CONTRACT in accordance with the terms thereof.

18.3 The CONTRACTOR shall give notice to the OWNER within Twenty one (21) days after receipt of any requirement or direction which he considers will render the plant unsuitable in any respect or is not in accordance with the meaning and intent of the CONTRACT OR otherwise prevent the CONTRACTOR from carrying out the CONTRACT or as aforesaid and submit to the OWNER a proposal or proposals for modifying the requirement or direction. Failure to file an objection within the allotted time will be considered as acceptance of the OWNER's decision and the decision shall become final and binding.

19.0 FEES FOR ROYALITIES AND PATENT RIGHTS (WHEREVER APPLICABLE)

19.1 Payment Due to be Included in CONTRACT PRICE

19.1.1 All payments for royalties, patent rights and fees due to or payable for or in connection with any matter or thing used or required to be used in performance of the CONTRACT or to be supplied under the CONTRACT, whether payable in one sum or by instalments or otherwise, shall be included by the CONTRACTOR in the prices named in the CONTRACT and shall be paid by CONTRACTOR to whom such payments may be due or payable.

19.1.2 The CONTRACTOR, if licensed under any patent covering equipment, machinery, materials or compositions of matter to be used or supplied or methods and process to be practiced or employed in the performance of this CONTRACT, agrees to pay all royalties and license fees which may be due with respect thereto. If any equipment, machinery, materials, composition of matters, be used or supplied or methods and processes to be practiced or employed in the performance of this CONTRACT, is covered by a patent under which the CONTRACTOR is not licensed then the CONTRACTOR before supplying or using the equipment, machinery materials,

composition method or processes shall obtain such licenses and pay such royalties and license fees as may be necessary for performance of this CONTRACT. In the event the CONTRACTOR fails to pay any such royalty or obtain any such license, any suit for infringement of such patents which is brought against the CONTRACTOR or the OWNER as a result such failure will be defended by the CONTRACTOR at his own expense and the CONTRACTOR will pay any damages and costs awarded in such suit. The CONTRACTOR shall promptly notify the OWNER if the CONTRACTOR has acquired the knowledge of any plant under which a suit for infringement could be reasonably brought because of the use by the OWNER of any equipment, machinery, materials, process, methods to be supplied hereunder. The CONTRACTOR agrees to and does hereby grant to OWNER, together with the right to extend the same to any of the subsidiaries of the OWNER as irrevocable, royalty free license to use in any country, any invention made by the CONTRACTOR or his employee in or as result of the performance of the WORK under the CONTRACT.

19.2 **Payment to the CONTRACTOR by OWNER**

19.2.1 Final payment to the CONTRACTOR by the OWNER will not be made while any such suit or claim remains unsettled. In the event any apparatus or equipment or any part thereof furnished by the CONTRACTOR is in such suit or proceedings, held to constitute infringement, and its use is enjoined, the CONTRACTOR shall, at his option, and at his own expense, either procure for the OWNER the right to continue use of the said apparatus, equipment or part thereof, replace it with non-infringing apparatus or equipment or modify it, so that it becomes non-infringing.

20.0 ACTS OF PARLIAMENT, LOCAL AND OTHER AUTHORITIES REGULATIONS AND BYE-LAWS

20.1 **Complying With Regulations**

20.1.1 Throughout the execution of the WORK, the CONTRACTOR shall comply with the requirements of all applicable laws and regulations, bye-laws or orders made there under and to the requirements of public, municipal and other authorities in any way affecting or applicable to the work. The OWNER shall, when requested by the CONTRACTOR, give all reasonable assistance to the CONTRACTOR in obtaining information concerning local conditions.

20.1.2 Before making any departure from the specification or drawings which may be necessary to conform to such requirements, the CONTRACTOR shall give the OWNER written notice specifying the departure proposed to be made and the reason for making it and applying for instructions thereon. If the CONTRACTOR does not receive such instructions within thirty (30) days, he shall conform to those requirements and inform the OWNER accordingly.

20.2 **Notices and Fees**

The CONTRACTOR shall give all notices required to be given by the Acts, regulations, bye-laws, orders and requirements referred to in sub-clause 20.1 of this clause and shall pay all fees payable in connection herewith.

Any additional fee becoming applicable due to any change of Acts, regulations, by-laws, orders and requirements after date of submission of FINAL PROPOSAL shall be borne by OWNER in accordance with SCC clause 3.0.

21.0 TIME- PROJECT SCHEDULE

21.1 Without prejudice to anything contained in the CONTRACT, the time and the date of completion of the works as stipulated in the CONTRACT shall be deemed to be of the utmost importance. The CONTRACTOR shall so organise his resources and perform his work so as to complete it within the completion period.

21.2 The contractor shall submit the Primavera Level 4 schedule within thirty (30) days from date of issuance of FOA.

The Primavera Level 4 schedule shall be for OWNER´s review and be based on a level 2 schedule as attachment to the CONTRACT. Such level 2 schedule shall show the execution periods for (i) engineering, (ii) procurement & delivery of equipment and materials, (iii) & erection (iv) Mechanical Completion and (v) commissioning, testing.

CONTRACTOR shall be contractually obliged to issue a Primavera Level 4 schedule provided that such schedule shall not (i) accelerate the OWNER obligations (to be agreed upon prior to Contract award) (ii) change the GUARANTEED COMPLETION DATE.

21.3 The above Primavera Level 4 schedule shall be periodically reviewed and reports shall be submitted by the CONTRACTOR as directed by the OWNER.

22.0 CONTRACT PRICE

22.1 CONTRACT PRICE is inclusive of the cost/fees of CONTRACTOR's obligations as given below briefly but not limited to the following:

a. Detailed Engineering
b. Basic Engineering
c. Supply of all, Equipment, Bulk Materials, Chemicals & Lubricants and consumables
d. 2 months vendor supervision assistance if applicable.
e. Supply of spares
f. All applicable taxes and duties including GST, Indian Income Tax, etc.
g. Forwarding charges, if applicable
h. Freight up to SITE including taxes
i. Unloading, storage at Site, Site Assembly, Erection, Pre-Commissioning and Commissioning until Preliminary Acceptance of Plant.
j. Insurance
k. Inspection and expediting charges
l. Project management and overheads,
m. Guarantee test runs and handing over of PLANT to OWNER.
n. All other costs, expenses and outgoings of the CONTRACTOR not otherwise expressly set forth herein necessary, required or incidental to the full, complete and proper performance and discharge of the CONTRACTOR's obligations under and in accordance with the CONTRACT including completion of the PLANT in all respects and overheads of the CONTRACTOR.

22.2 OWNER shall pay to CONTRACTOR a lump-sum fixed CONTRACT PRICE for the due and faithful performance of CONTRACTOR's obligations under the CONTRACT. CONTRACT PRICE provided for in this Clause covers entire consideration payable to CONTRACTOR for all obligations of CONTRACTOR.

22.3 CONTRACT PRICE is inclusive of cost of all travel, accommodation, living costs and all other expenses of management and personnel of CONTRACTOR, SUB-CONTRACTOR, VENDOR for travelling to and from plant SITE and other places/countries as may be necessary for the proper performance of CONTRACTOR's responsibilities under CONTRACT and shall also include all costs and expenses incurred in attending such meetings in connection with CONTRACT as OWNER may reasonably require.

22.4 CONTRACT PRICE is inclusive of cost of all CONTRACTOR's EQUIPMENT, materials, services, etc. required to complete WORK under CONTRACT.

22.5 All taxes, duties, licence fees and other such levies as may be applied to the CONTRACT, including Custom Duty, all applicable taxes & duties under GST, Corporate income tax in respect of the performance of the CONTRACT as well as income tax on the personnel deputed by the CONTRACTOR to India in connection with the CONTRACT shall be to the account of the CONTRACTOR.

23.0 DEDUCTIONS FROM CONTRACT PRICE

All costs, damages or expenses which the OWNER may have paid for which, under the CONTRACT, the CONTRACTOR is liable, will be claimed by the OWNER. All such claims shall be billed by the OWNER to the CONTRACTOR regularly as and when they fall due. Such claims shall be paid by the CONTRACTOR within fifteen days of the receipt of the corresponding bills and if not paid by the CONTRACTOR within the said period, the OWNER may then deduct the amount from any bill due or becoming due by him to the CONTRACTOR under the CONTRACT or may be recovered by action of law or otherwise, if the CONTRACTOR fails to satisfy the OWNER of such claims.

24.0 Deleted

25.0 Deleted

26.0 TAXES APPLICABLE TO CONTRACTOR'S MANPOWER, TURNOVER, EQUIPMENT, ETC.

26.1 The CONTRACTOR shall be liable and pay all taxes, duties, levies, lawfully assessed against the OWNER or the CONTRACTOR in pursuance of the CONTRACT. The CONTRACTOR shall be solely responsible for all taxes that may be levied on the CONTRACTOR's turnover & profit or on the earnings of any of his employees or personnel engaged by him and shall hold the OWNER indemnified and harmless against any claims that may be made against the OWNER in this behalf. The OWNER does not undertake any responsibility whatsoever regarding any taxes levied on CONTRACTOR and/or his personnel by Centre/State/Local Authorities. The Taxes shall be deducted where the said provisions shall be applicable and/or obligatory on the part of the OWNER.

26.2 For CONTRACTORS who have to bring equipment and material from outside Odisha, will have to obtain necessary registrations and take appropriate steps as required under Odisha State Laws. Further, form 38 / E-Waybill / Road Permit shall be issued by the

CONTRACTOR in such cases, wherever applicable. Necessary statutory registrations as required shall be done by CONTRACTOR in this regard.

26.3 CONTRACTOR is responsible for obtaining Customs clearance permit for temporary importation on re-export basis of CONTRACTOR'S EQUIPMENT, tools and tackles etc. If any duties, taxes and expenses are payable on this, the same will be to CONTRACTOR'S account.

27.0 PACKING, FORWARDING AND SHIPMENT

27.1 The CONTRACTOR shall give complete despatch information concerning the weight, size, content of each package including any other information the OWNER may require.

27.2 The CONTRACTOR, wherever applicable shall after proper painting, pack and crate all equipment in such a manner as to protect it from deterioration and damage during rail and road transportation to the site and storage at the site till the time of erection. The CONTRACTOR shall be held responsible for all damages due to improper packing.

27.3 The CONTRACTOR shall notify the OWNER of the date of each shipment from his works, and the expected date for arrival at the site for the information of the OWNER. The CONTRACTOR will be responsible for arranging any requirement of over-dimensional, special rail/road wagon/trailer for transporting.

27.4 The CONTRACTOR shall also give all shipping information concerning the weight, size and content of each package including any other information the OWNER may require. The size of the largest packages being considered as over dimensional consignments shall be as per the latest guidelines.

27.5 The CONTRACTOR shall prepare detailed packing lists of all packages and containers, bundles and loose materials forming each and every consignment despatched to the site. The CONTRACTOR shall further be responsible for making all necessary arrangements for loading, unloading and other handling, right from works till the SITE and also till the EQUIPMENT is erected, tested and commissioned. The CONTRACTOR shall be solely responsible for proper storage and preservation of all equipments& machineries etc.

28.0 INSURANCE

28.1 CONTRACTOR shall take in the joint name of CONTRACTOR and OWNER comprehensive transit insurance for imported and indigenous goods. Transit-cum-Storage-Erection insurance or its equivalents and third party liability insurance policies shall be taken with reputed underwriters to cover ALL RISK whatsoever during the whole period starting with dispatch of GOODS from CONTRACTOR's warehouses/ Exworks in foreign country to CIF port of shipment for imported GOODS and EXW at Contractor's works for indigenous GOODS and shall further cover for performing services in India for transportation, loading, unloading, assembly, erection, testing COMMISSIONING of PLANT till care and custody is transferred to OWNER.

28.1.1 Contractor shall take Public Liability (Third Party) Insurance cover of 10% of TOTAL CONTRACT PRICE.

28.1.2 Contractor shall ensure that in addition to "Erection All risk policy", the coverage in respect of workmen compensation, ESI/Health Insurance, Professional Indemnity (with the amount of minimum excess) has been appropriately taken.

28.2 CONTRACTOR shall be fully responsible for pursuing and settling all claims under the underwriters. In the event of accident, injury, damage or loss likely to form a claim under the above insurance policies, CONTRACTOR shall, as quickly as possible submit the insurance claims by underwriters under intimation to OWNER. CONTRACTOR shall also keep OWNER fully informed about progress of each such case. CONTRACTOR shall undertake immediate repair and replacement of the equipment lost in transit, storage, assembly, erection and COMMISSIONING of PLANT pending settlement of claim thereafter by the underwriters.

28.3 The CONTRACTOR at his cost shall arrange, secure and maintain all insurance as may be pertinent to the works and obligatory in terms of law to protect his interest and interest of OWNER in the project, against all perils detailed herein. The Form and the limit of such insurance as defined herein together with the under-writer in each case shall be acceptable to the OWNER andOWNER´s acceptance shall not be unreasonably withheld. However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage at all times including third party liability during the period of contract shall be as of CONTRACTOR alone. The contractor's failure in this regard shall not relieve him of any of his contractual responsibilities and obligations. The insurance covers to be taken by the CONTRACTOR shall be in the joint names of OWNER and the CONTRACTOR. The CONTRACTOR shall, however, be authorised to deal directly with insurance company or companies and shall be responsible in regard to maintenance of all insurance covers.

28.4 All insurance other than marine insurance for transportation outside India is to be covered from IRDA approved insurance company registered in India. There should be a single cover for marine cum inland transit, storage and erection upto PRELIMINARY ACCEPTANCE OF PLANT.

However adequacy, credibility and maintenance of Insurance policies is sole responsibility of CONTRACTOR and CONTRACTOR shall keep the OWNER indemnified against any such failure.

All insurance covers shall be taken by CONTRACTOR in joint name of CONTRACTOR and OWNER.

Alternatively, the CONTRACTOR has the option to take separate Insurances as

1. Marine Cargo Insurance for transit of all imported and indigenous goods from Ex -Works at CONTRACTOR'S/SUB-CONTRACTOR's works to Site.
2. Erection and All Risk (EAR) Insurance
3. Third Party Liability Insurance

Marine Cargo Insurance and Third Party Liability Insurance can be a part of Global Policy of the CONTRACTOR. However certificate of endorsement in favour of OWNER shall be provided by the CONTRACTOR from the insurance company. These two global policies of Marine Cargo Insurance and Third Party Liability Insurance shall be counter guaranteed by Indian Insurance Company. However, Erection and All Risk (EAR) is to be covered from Insurance Company registered in India and shall be separate dedicated policies for OWNER.

28.5 Any loss or damage to the equipment during handling, transportation, storage, erection, putting the equipment into satisfactory operation and all activities to be performed till the successful completion of trial operation of the plant shall be to the account of the CONTRACTOR. The CONTRACTOR shall be responsible for reference of all claims and

make good the damages or loss by way of repairs and/or replacement of the equipment, damaged or lost. The CONTRACTOR shall provide the OWNER with copies of all insurance policies and documents taken out by him in pursuance of the CONTRACT. Such copies of documents shall be submitted to the OWNER immediately after such insurance coverage. However, if Marine cargo insurance or Third party liability Insurance is a part of their global policies; insurer certificate (including the main terms of policy) shall be submitted by CONTRACTOR. The CONTRACTOR shall also inform the OWNER in the writing at least thirty (30) days in advance regarding the expiry/ cancellation and/or change in any of such documents and ensure revalidation, renewal etc. as may be necessary well in time. However adequacy, credibility and maintenance of Insurance policies is the sole responsibility of CONTRACTOR and CONTRACTOR shall keep the OWNER indemnified against any such failure.

28.6 The perils required to be covered under the insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (erection risks) workman compensation risks, loss or damage in transit, theft, pilferage, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds, war risks (during ocean transportation only) etc. The scope of such insurance shall be adequate to cover the replacement/reinstatement cost of the equipment for all risks till the equipment is taken over by the OWNER. The insurance policies to be taken should be on replacement value basis and/or incorporating escalation clause. Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the CONTRACTOR shall be liable to make good the full replacement/rectification of all equipment/materials and to ensure their availability as per project requirements without additional financial liability to the OWNER.

The workman compensation policy taken by the SUB-CONTRACTOR of the CONTRACTOR shall be passed on to the OWNER.

28.7 CONTRACTOR shall at its own cost and initiative at all times upto the successful completion of PRELIMINARY ACCEPTANCE, take out and maintain all insurable liability, including but not limited to third Party insurance and liabilities under the Motor Vehicles Act, Worker's Compensation Act, Fatal Accidents Act, Personal Injuries Insurance Act, Emergency Risk Insurance Act and/or other Industrial Legislation from time to time in force in India with Insurance Company(ies), such policy(ies) shall not be of lesser limits hereunder specified with reference to the matters hereunder specified, namely:

- Workmen's Compensation Insurance to the limit to which compensation may be payable under Indian laws.

28.8 All cost on account of insurance liabilities covered under the CONTRACT will be to the CONTRACTOR'S account and will be included in the CONTRACT PRICE. The CONTRACTOR, while arranging the insurance, shall ensure to obtain all discounts on premium, which may be available for higher volume or for reason of financing arrangement of the project.

28.9 Irrespective of single or separate insurances, the CONTRACTOR shall take the same in the joint name of OWNER and CONTRACTOR, with OWNER as Primary Beneficiary and CONTRACTOR as Joint Beneficiary, to cover all risk including marine cum erection insurance (MCE), workmen compensation / Employees State Insurance (ESI) under ESI Act 1948 for Contractor's personnel, fire risk policy etc. till handing over of PLANT to OWNER duly commissioned and tested. However, for CONTRACTOR"s EQUIPMENT, CONTRACTOR can be the sole beneficiary.

Further, OWNER shall have the first right over the claim amount for all insurance claims, where owner has made part or full payment to the contractor.

However, OWNER should have first right over the claim amount in case payment for the "equipment damaged" has already been paid to the CONTRACTOR

28.10 The CONTRACTOR shall be fully responsible for pursuing and settling all claims with the underwriters within stipulated timelines. In the event of accident, injury, damage or loss likely to form a claim under the above insurance policies, the CONTRACTOR shall as quickly as possible but not later than the claim period submit such details as are necessary for settling such claims by underwriters and shall also provide information and assistance necessary to settle the claim. The CONTRACTOR shall also keep OWNER fully informed about progress of each such case.

28.11 All charges on account of insurance shall be included in TOTAL LSTK PRICE/TOTAL CONTRACT PRICE.

29.0 Deleted

30.0 LIABILITY FOR ACCIDENTS AND DAMAGES

30.1 Under the CONTRACT, the CONTRACTOR shall be responsible for loss or damage to the PLANT and provide new equipment and machineries in lieu of equipment/machineries lost/damaged beyond repairs, free of cost until the PLANT is handed over after successful completion of performance guarantee test run.

Notwithstanding the provisions in the CONTRACT, the CONTRACTOR shall not be responsible for any loss or damage to the PLANT or any part thereof if and to the extent that such loss or damage is not covered by insurance coverage such as War risk, provided the same is general exclusion of the policy of the EAR insurance. War Risks shall mean any of the following events occurring within India:
War , hostilities, warlike operations (whether a state of war be declared or not), invasion, act of foreign enemy, civil war, rebellion, terrorism, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion, mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war.

30.2 The CONTRACTOR shall indemnify the OWNER in respect of all damage or injury to any person or to any property (other than property forming part of the Work) and against all actions, suits, claims, demands, costs, charges and expenses arising in connection therewith which shall have been occasioned by the negligence of the CONTRACTOR or any SUB-CONTRACTOR, or by defective design (other than a design made, furnished or specified by the OWNER and which the CONTRACTOR has disclaimed responsibility in writing within a reasonable time after receipt of the OWNER's instructions) material or workmanship, any breach of the CONTRACTOR's obligations.

31.0 Deleted

32.0 Deleted

33.0 TIME EXTENSION OF CONTRACT

33.1 The CONTRACTOR shall promptly notify the ENGINEER-IN-CHARGE any event or conditions which might delay the completion of erection work in accordance with the approved schedule and the steps being taken to remedy such situation.

33.2 If the Work is delayed at any time in the commencement or during the progress of the WORK by any act, delay or neglect solely attributable to OWNER or his employees, or by any other contractor utilised by the OWNER or by FORCE MAJEURE conditions, the time of completion shall be extended by OWNER (without levy of Mutually Agreed Damages) in writing for a reasonable period as may be mutually agreed upon, at the time of closure of contract. The CONTRACTOR shall, immediately on occurrence of such special circumstances but not later than 14 working days, bring to the knowledge of OWNER through written application for any such delay as mentioned above.

33.3 OWNER shall have the right to suspend the WORK in whole or in part for such time as may be necessary in order that WORKS shall be well and properly executed. In such events, suitable extension of time shall be granted to CONTRACTOR. However, should the cumulative period of suspension exceed 45 days during the scheduled duration of CONTRACT, the CONTRACTOR shall be compensated as mutually agreed in addition to extension of time, provided the suspension is caused due to reasons not attributable to CONTRACTOR.

34.0 TERMINATION OF CONTRACT

34.1 **Termination due to Legal Incapacity**

If the CONTRACTOR goes into liquidation or has an administrator order made against him or carries on his business or any part of it under an administrator or receiver or manager for the benefit of the creditors or any of them, without prejudice to any other rights or remedies, the OWNER may forthwith by notice in writing terminate the CONTRACT.

34.2 **Termination due to Default by CONTRACTOR**

34.2.1 If the CONTRACTOR is in default in that he:

(a) Neglects to execute the work or part of the work; or

(b) without reasonable cause, suspends or abandons the carrying out the works, either partly or wholly, before their completion; or

(c) Fails to proceed regularly and diligently with the works; or

(d) Defaults in the performance or observance of any conditions or terms of the CONTRACT or neglects to carry out any order, instruction, direction or determination which the OWNER is empowered to give or make under the CONTRACT and which is given or made in writing to the CONTRACTOR,

then, without prejudice to any other rights or remedies which the OWNER may possess, the OWNER may, by notice in writing (which shall specify with reasonable particularity the neglect, default or refusal on the part of the CONTRACTOR) require the CONTRACTOR:

i) to put forward his proposals for

a) Rectifying such neglect, default or refusal as the case may be and

b) Commence and diligently pursue the rectification of the default.

34.2.2 If within 30 days after the posting of the notice addressed to the CONTRACTOR, the CONTRACTOR fails to comply with the notice or if in the opinion of the OWNER, the CONTRACTOR's reasons or proposals are not satisfactory, then the OWNER, without prejudice to any other rights that he may have under the CONTRACT against the CONTRACTOR, may either:

a) DETERMINE THE CONTRACT in which event the CONTRACT shall stand terminated and shall cease to be in force and effect on and from the date appointed by the OWNER on that behalf, whereupon the CONTRACTOR shall stop forthwith any of the CONTRACTOR's work then in progress, except such WORK as the OWNER may, in writing, require to be done to safeguard any property or WORK, or installations from damage, and the OWNER, for its part, may take over the work remaining unfinished by the CONTRACTOR and complete the same through a fresh contractor or by other means, at the risk and cost of the CONTRACTOR, and any of his sureties if any, shall be liable to the OWNER for any excess cost occasioned by such work having to be so taken over and completed by the OWNER over and above the cost at the rates specified in the schedule of quantities and rate/prices.

b) WITHOUT DETERMINING THE CONTRACT, take over the work of the CONTRACTOR or any part thereof and complete the same through a fresh contractor or by other means at the risk and cost of the CONTRACTOR. The CONTRACTOR and any of his sureties are liable to the OWNER for any excess cost over and above the cost at the rates specified in the Schedule of Quantities/ rates, occasioned by such works having been taken over and completed by the OWNER.

In such events of Clause 34.2.2 (a) or (b) above.

(i) The whole or part of the Contract Performance Security furnished by the CONTRACTOR is liable to be forfeited without prejudice to the right of the OWNER to recover from the CONTRACTOR the excess cost referred to in the sub-clause aforesaid, the OWNER shall also have the right of taking possession and utilising in completing the works or any part thereof, such as materials equipment and plants available at work site belonging to the CONTRACTOR as may be necessary and the CONTRACTOR shall not be entitled for any compensation for use or damage to such materials, equipment and plant.

(ii) The amount that may have become due to the CONTRACTOR on account of work already executed by him shall not be payable to him until after the expiry of Six (6) calendar months reckoned from the date of termination of CONTRACT or from the taking over of the WORK or part thereof by the OWNER as the case may be, during which period the responsibility for faulty materials or workmanship in respect of such work shall, under the CONTRACT, rest exclusively with the CONTRACTOR. This amount shall be subject to deduction of any amounts due from the CONTRACT to the OWNER under the terms of the CONTRACT authorised or required to be reserved or retained by the OWNER.

(iii) Before determining the CONTRACT as per Clause 34.2.2 (a) or (b) provided in the judgement of the OWNER, the default or defaults committed by the CONTRACTOR is/are curable and can be cured by the CONTRACTOR if an opportunity given to him, then the OWNER may issue Notice in writing calling the CONTRACTOR to cure the default within such time specified in the Notice.

(iv) The OWNER shall also have the right to proceed or take action as per 34.2.2 (a) or (b) above, in the event that the CONTRACTOR becomes bankrupt, insolvent, compounds with his creditors, assigns the CONTRACT in favour of his creditors or any other person or persons, or being a company or a corporation goes into

voluntary liquidation, provided that in the said events it shall not be necessary for the OWNER to give any prior notice to the CONTRACTOR.

(v) Termination of the CONTRACT as provided for in sub- clause 34.2.2(a) above shall not prejudice or affect their rights of the OWNER which may have accrued upto the date of such termination.

34.2.3 In case of termination of CONTRACT herein set forth (under clause 34.2) except under conditions of Force Majeure and termination after expiry of contract, the CONTRACTOR shall be put under holiday [i.e. neither any enquiry will be issued to the party by Talcher Fertilizers Limited (TFL) or any of it's JV partners against any type of tender nor their offer will be considered by TFL or any of it's JV partners against any ongoing tender (s) where contract between TFL/it's JV partners and that particular CONTRACTOR (as a bidder) has not been finalized],for a period of three years from the date of termination by TFL to such CONTRACTOR.

34.3 **Duration of suspension of payment due to CONTRACTOR:**

34.3.1 Owner shall have right to suspend making any payments to the contractor for the portion of WORK having a bearing with CONTRACTOR's default during the period of rectification of the defaults.

34.4 **Work taken out of the hands of the CONTRACTOR**

34.4.1 Employment of other contractors:

If the OWNER takes action under sub-clause 34.2.2, he may complete the work or any part of it by contracting with or employing any other contractor to execute further and complete work or any part of it and to provide all equipment, materials and labour as may be necessary for such further execution and completion. If practicable the further execution and completion shall be carried out in accordance with the specification and at prices obtained under competitive conditions.

The OWNER may also take possession of and permit such person or persons to use for the purposes of the CONTRACT only such materials, tools and equipment and all other things on or about the SITE which are the property of the CONTRACTOR as are requisite and necessary for such further execution and completion, and the CONTRACTOR shall have no right to any compensation or allowance in respect thereof.

On the completion of such work, all tools and equipment and the surplus of the materials so taken possession of shall be handed over to the CONTRACTOR but without payment or allowance for the fair wear and tear they may have sustained in the meantime, provided that if there by a deficiency as referred to in sub clause 34.4.2 of this clause, and if the CONTRACTOR fails to make good such deficiency such of the tools, equipment and materials as are necessary to make good the deficiency may be sold and a sufficient part of the monies received retained by the OWNER and applied in payment of such deficiency.

In addition the OWNER shall be entitled:

a) To take possession of and remove from the CONTRACTOR's premises within a reasonable period anything (including but without limiting the generality thereof any design, drawings, specification, material or other goods) the property which is vested in the OWNER pursuant to the CONTRACT;

b) To full particulars of any sub-contract made by the CONTRACTOR with any person for the execution of any portion of the WORKS and to peruse and copy any instrument (including but without limiting the generality thereof any agreement, letter or other paper) relating to any such SUB-CONTRACT made by the CONTRACTOR with any person for the execution of any portion of the WORKS.

c) To pursue and copy any standard working drawing or other drawing or data necessary in the opinion of the OWNER for completion of the WORKS and the property which is not vested to the OWNER pursuant to the CONTRACT provided that the OWNER shall in no case make use of any copy made pursuant to sub paragraphs (b) or (c) hereof other than for the purpose of completing the WORKS and that on the fulfilment of the whole of the obligations of the CONTRACTOR under the CONTRACT the OWNER shall return to the CONTRACTOR any such copy.

The CONTRACTOR shall offer to the OWNER all rights of access and all reasonable facilities to enable the OWNER to remove any such thing or pursue or copy any such instrument, drawing or data and shall supply such particulars on request by the OWNER in that behalf.

For the purposes of sub-clause 34.4.2the cost incurred by the OWNER in and about for such removal, perusal or copying or obtaining such particulars shall be deemed to be part of the cost of carrying out that portion of the work taken out of the CONTRACTOR's hands.

34.4.2 **Extra cost to the OWNER of completing work for deduction**:

On completing the terminated portion of WORK as provided under Article 34.4.1 the OWNER shall ascertain the reasonable and direct costs based on the documentary evidence of the cost incurred but such amount shall not include any extra cost due to departures from the specification unless such departures were necessitated by the CONTRACTOR's default. Should the amount so ascertained be greater than the CONTRACT PRICE which would have been paid to the CONTRACTOR, if the whole of the Work had been carried out by him, the difference between the two amounts shall be deducted from any monies which may then be or thereafter become due to the CONTRACTOR or which may have been deposited by him as security under the CONTRACT, and if such monies be less than the amounts to be deducted the deficiency shall be paid by the CONTRACTOR to the OWNER and which may be recovered as provided in sub clause 34.4.1 of this clause or by way of arbitration, jurisdiction or both, such payment of excess amount shall be independent of penalty for delay if the completion of work is delayed.

34.5 **Preservation of rights of the OWNER**

No action taken by the OWNER under sub clause 34.3 and 34.4 of this clause shall vitiate the CONTRACT or shall operate to the prejudice of the right of the OWNER to recover from the CONTRACTOR or to deduct from any monies which may be or may become due to the CONTRACTOR all sums of money which may be or may become due to the OWNER under the CONTRACT as damages, penalties or otherwise.

34.6 Should the OWNER decide to terminate the CONTRACT under sub clause 34.2.2(b) of this clause, he may do so under notice in writing as from the date of such notice, and the termination shall be without prejudice to any right that may have occurred to the OWNER or to the CONTRACTOR under the CONTRACT.

34.7 **Termination of Contract on Account of OWNER's Convenience**

34.7.1 The OWNER, may, by 30 days written notice send to the CONTRACTOR, terminate the CONTRACT, in whole or in part, at any time for his convenience. The notice of termination shall specify that termination is for the OWNER's convenience, the extent to which performance of work under the CONTRACT is terminated and the date upon which such termination becomes effective.

34.7.2. Upon receipt of the notice of termination under GCC Clause 34.7.1, the CONTRACTOR shall either immediately or upon the date specified in the notice of termination.

(a) cease all further work, except for such work as the OWNER may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition.

(b) terminate all subcontracts, except those to be assigned to the OWNER pursuant to paragraph (d)(ii) below.

(c) remove all CONTRACTOR's Equipment from the Site, repatriate the CONTRACTOR's and its SUB-CONTRACTORs' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition.

(d) In addition, the CONTRACTOR, subject to the payment specified in GCC Clause 34.7.2.1, shall

(i) deliver to the OWNER the parts of the PLANT executed by the CONTRACTOR up to the date of Termination.

(ii) to the extent legally possible, assign to the OWNER all right, title and benefit of the CONTRACTOR to the PLANT and Equipment as at the date of termination, and, as may be required by the OWNER, in any subcontracts concluded between the CONTRACTOR and its SUB-CONTRACTORs.

(iii) deliver to the OWNER all non-proprietary drawings, specifications and other documents prepared by the CONTRACTOR or its Sub-CONTRACTORs as at the date of termination in connection with the PLANT.

34.7.2.1 In the event of termination of the Contract under GCC Clause 34.7.1, the OWNER shall pay to the CONTRACTOR the following amounts:

(a) the Contract Price, properly attributable to the parts of the PLANT executed by the CONTRACTOR as of the date of termination

(b) the costs reasonably incurred by the CONTRACTOR in the removal of the CONTRACTOR's Equipment from the Site and in the repatriation of the CONTRACTOR's and its SUB-CONTRACTOR's personnel

(c) any amounts to be paid by the CONTRACTOR to its SUB-CONTRACTORs or Vendors in connection with the termination of any subcontracts or supply agreement, including any cancellation charges

(d) costs incurred by the CONTRACTOR in protecting the PLANT and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Clause 34.7.2

34.7.3 **Termination for Insolvency**

OWNER may at any time terminate CONTRACT giving written notice to CONTRACTOR, if CONTRACTOR becomes bankrupt or otherwise insolvent, provided that such termination will not prejudice or affect any right of action or remedy which has occurred or will accrue thereafter to OWNER.

If the Contract is terminated under GCC Sub-Clauses 34.7.3, the OWNER shall pay to the CONTRACTOR all payments specified in GCC Sub-Clause 34.7.2 as reasonable compensation for all loss or damage sustained by the CONTRACTOR arising out of, in connection with or in consequence of such termination.

34.7.4 **Termination by CONTRACTOR due to default of OWNER**

If the OWNER has failed to pay the CONTRACTOR any sum due under the Contract within the specified period or commits a substantial breach of the CONTRACT, the CONTRACTOR may give a notice to the OWNER that requires payment of such sum or specifies the breach and requires the OWNER to remedy the same, as the case may be. If the OWNER fails to pay such sum or fails to remedy the breach or take steps to remedy the breach within thirty (30) days after receipt of the CONTRACTOR's notice then the CONTRACTOR may give a notice to the OWNER thereof, and if the OWNER has failed to pay the outstanding sum or to remedy the breach within thirty (30) days of such notice, the CONTRACTOR may by a further notice to the OWNER, terminate the CONTRACT.

If the CONTRACT is terminated under GCC Clause 34.7.4, the OWNER shall pay to the CONTRACTOR all payments specified in GCC Clause 34.7.2 as reasonable compensation for all loss or damage sustained by the CONTRACTOR arising out of, in connection with or in consequence of such termination.

34.8 **Surviving Obligations**

Termination of this CONTRACT (a) shall not relieve CONTRACTOR of its obligations with respect to the confidentiality as set forth in this CONTRACT, (b) shall not relieve CONTRACTOR of any obligation hereunder which expressly or by implication survives termination hereof, and (c) except as otherwise provided in any provision of this CONTRACT expressly limiting the liability of CONTRACTOR, shall not relieve CONTRACTOR of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of CONTRACTOR prior to the effectiveness of such termination or arising out of such termination, and shall not relieve CONTRACTOR of its obligations as to portions of SERVICES already performed or of obligations assumed by CONTRACTOR prior to the date of termination, except as otherwise agreed by OWNER in writing.

34.8.1 Termination of this CONTRACT (a) shall not relieve OWNER of its obligations with respect to the confidentiality as set forth in this CONTRACT, (b) shall not relieve OWNER of any obligation hereunder which expressly or by implication survives termination hereof, and (c) shall not relieve OWNER of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of OWNER prior to the effectiveness of such termination or arising out of such termination.

35.0 **FORCE MAJEURE**

35.1 CONDITIONS FOR FORCE MAJEURE: In the event of either party being rendered unable by Force Majeure to perform any obligations required to be performed by them

under the CONTRACT the relative obligation of the party affected by such Force Majeure shall upon notification to the other party be suspended for the period during which Force Majeure conditions lasts. The cost and loss sustained by the either party shall be borne by the respective parties. The term "Force Majeure" as employed herein shall mean acts of God, earthquake, war (declared or undeclared), revolts, riots, fires, floods, rebellions, explosions, hurricane, sabotage, civil commotions and acts and regulations of respective Government of the two parties, namely the OWNER and the CONTRACTOR. Upon the occurrence of such cause(s) and upon its termination, the party alleging that it has been rendered unable as aforesaid thereby, shall notify the other party in writing immediately but not later than 120 (one hundred and twenty) hours of the alleged beginning and ending thereof giving full particulars and satisfactory evidence in support of its claim. Time for performance of the relative obligation suspended by the Force Majeure shall then stand extended by the period for which such conditions lasts.

OUTBREAK OF WAR

(i) If during the currency of the CONTRACT there shall be an out-break of war whether declared or not, in that part of the World which whether financially or otherwise materially affect the execution of the WORK the CONTRACTOR shall unless and until the CONTRACT is terminated under the provisions in this clause continue to use his best endeavour to complete the execution of the WORK, provided always that the OWNER shall be entitled, at any time after such out-break of war to terminate or re-negotiate the CONTRACT by giving notice in writing to the CONTRACTOR and upon such notice being given the CONTRACT shall, save as to the rights of the parties under this clause and to the operation of the clauses entitled settlement of Disputes and Arbitration hereof, be terminated but without prejudice to the right of either party in respect of any antecedent breach thereof.

(ii) If the CONTRACT shall be terminated under the provisions of the above clause, the CONTRACTOR shall with all reasonable diligence remove from the SITE all the CONTRACTOR's equipment and shall give similar facilities to his SUB-CONTRACTORS to do so

35.2 If the CONTRACTOR suffers delay in the due execution of the contractual obligations due to delays caused by Force Majeure as defined above, the agreed time of completion of job covered by this CONTRACT or the obligation of the CONTRACTOR shall be extended by a period of time on account of force majeure conditions, provided that on the occurrence of any such contingency, the CONTRACTOR within120 hours reports to the OWNER in writing, the cause of delay and likely duration of cause of delay with requisite documentary evidence.

35.3 If the works to be executed by the CONTRACTOR are suspended by Force Majeure conditions lasting for more than 2 (two) months, the OWNER shall have the option to terminate the CONTRACT or re-negotiate the contract provisions.

35.4 CONTRACTOR and OWNER shall endeavour to prevent, overcome or remove the causes of FORCE MAJEURE.

35.5 No ground for exemption can be invoked if CONTRACTOR has failed to give timely notice by registered letter/ Speed-Post/Courier/Email/Hand Delivery and subsequently supported it by documentary evidence.

35.6 Delay or non-performance by a party hereto caused by the occurrence of any event of FORCE MAJEURE shall not:

(a) Constitute a default or breach of the CONTRACT,

Or

(b) Give rise to any claim for damages or additional cost or expense occasioned thereby, if such delay or non-performance is caused by the occurrence of any event of FORCE MAJEURE. FORCE MAJEURE conditions are not payable under any circumstances.

35.7 Force Majeure is no one's fault, therefore each party should bear its own cost and a provision to terminate the CONTRACT in case of Force Majeure extending beyond six (06) months is provided. Should OWNER wish the CONTRACTOR to continue further, both parties may sit together and mutually agree on the future course failing which Parties will have the right to terminate. Such termination shall not be considered as Termination for Owner's Convenience. However, outstanding invoices, payment for supplies made and payment to the work already performed will be paid by OWNER on such termination.

Contractor shall have the right to take action to mitigate the impact of the prolonged Force Majeure event in mutual consent with Owner. For instance, Contractor shall have the right to demobilize Contractor's equipment and personnel from the Plant.

36.0 NO WAIVER OF RIGHTS

Neither the inspection by the OWNER or any of their officials, employees, or agents nor any order by the OWNER for payment of money or any payment for or acceptance of, the whole or any part of the WORKS by the OWNER nor any extension of time, nor any possession taken by the OWNER shall operate as a waiver of any provision of the CONTRACT, or of any power herein reserved to the owner or any right to damages herein provided, nor shall any waiver of any breach in the CONTRACT be held to be a waiver of any other subsequent breach.

37.0 BANKRUPTCY AND LIQUIDATION OF CONTRACTOR OR BUSINESS UNDER RECEIVERSHIP

If the CONTRACTOR becomes insolvent or bankrupt, or has a receiving order made against him, or compound with his creditors, or being a corporation commence to be wound up not being a member's voluntary winding up for the purpose of reconstruction or carry on his business under a receiver for the benefit of his credit, the CONTRACTOR shall within fourteen (14) days notify the OWNER accordingly. On the occurrence of any of the happenings stated in the first sentence of this clause, the OWNER shall be at liberty to:

a) Determine the CONTRACT forthwith by notice in writing to the CONTRACTOR or to the receiver or liquidator or to any person in whom the CONTRACT may

have become vested, and act in the manner provided in clause 34.1 (proceedings or default) or,

b) Give to such receiver liquidator or other person in writing the option for a period of one month of carrying out the WORK subject to his providing a guarantee for the due and faithful performance of the CONTRACT upto the CONTRACT value of the work for the time being remaining unexecuted and subject to his taking all reasonable steps to prevent stoppage of the work. In the event of stoppage of the work, the period of the option under this clause shall be fourteen (14) days only.

38.0 CERTIFICATE NOT TO AFFECT RIGHT OF OWNER AND LIABILITY OF CONTRACTOR

No interim payment certificate of the OWNER nor any sum paid on account by the OWNER nor any extension of time for execution of the WORKS granted by the OWNER shall affect or prejudice the rights of the OWNER against the CONTRACTOR or relieve the CONTRACTOR of his obligations for the due performance of the CONTRACT or be interpreted as approval of the WORK done or of the equipment furnished and no certificate shall create liability on the OWNER to pay for alterations, amendments, variations, or additional works not ordered, in writing, by the OWNER or discharge the liability of the CONTRACTOR for the payment of damages whether due certified or not or any sum against the payment of which he is bound to indemnify the OWNER and the Consultant nor shall any such certificate nor the acceptance by him of any sum paid on account or otherwise affect or prejudice the rights of the CONTRACTOR against the OWNER.

39.0 SETTLEMENT OF DISPUTES

39.1 Except as otherwise specifically provided in the CONTRACT, all disputes concerning questions of fact arising under the CONTRACT shall be considered by the OWNER subject to a written appeal by CONTRACTOR to the OWNER.

39.2 Any disputes or differences including those considered as such by only of the parties arising out of or in connection with the CONTRACT shall be to be extent possible settled amicably between the parties.

39.3 If, after 60DAYs from the commencement of such informal negotiations, OWNER and CONTRACTOR are unable to resolve amicably the dispute, either party may require that the dispute be referred for resolution to the arbitration as described under clause 40 below.

40.0 ARBITRATION

40.1 Refer clause no. 44 & 45 of Section-III of NIT.

40.2 Continuation of Work and payments during Arbitration

WORK shall be continued by CONTRACTOR during the arbitration proceedings unless the matter itself is the subject of Arbitration or unless the matter itself is such that WORK cannot practically be continued until the decision of the arbitrator is obtained and CONTRACTOR shall remain liable and bound in all respects under the Contract. Except as otherwise expressly provided in CONTRACT, no payment due and payable by OWNER shall be withheld on account of such arbitration proceedings unless it is the subject matter or one of the subject matters.

41.0 GOVERNING LAWS, LANGUAGE AND MEASURES

41.1 CONTRACT shall be governed and construed according to the Indian Law as in force and shall be subject to the jurisdiction of the Court in Delhi. All disputes arising during the execution of the CONTRACT shall be resolved as per Clause no. 39.0 (Settlement of Dispute) & 40.0 (Arbitration) of GCC and thereafter in accordance with said law.

41.2 The governing language for all communication, notices, Technical Information, etc. pertaining to CONTRACT shall be English. Any literature, correspondence, documents, etc., shall be considered only if its accompanied by English translation. For the purpose of interpretation English translation shall govern and be binding on all parties.

41.3 The metric system of measurement shall be used exclusively in the CONTRACT.

42.0 RELEASE OF INFORMATION

The CONTRACTOR shall not communicate or use in advertising, publicity, sales releases or in any other medium, photographs or other reproduction of the WORKS under this CONTRACT or descriptions of the SITE, dimensions, quantity, quality or other information, concerning the work unless prior written permission has been obtained from the OWNER. Notwithstanding the above, CONTRACTOR is entitled, under intimation to OWNER, to make such public Announcements, as it may be bound to in compliance with the Law, the Rules and any Governmental Agency or Stock Exchange Regulation the CONTRACTOR is subjected to.

43.0 COMPLETION OF CONTRACT

Unless otherwise terminated under the provisions of any other relevant clause, this CONTRACT shall be deemed to have been completed at the expiry of the DEFECT LIABILITY PERIOD.

44.0 ENFORCEMENT OF TERMS

The failure of either party to enforce at any time any of the provisions of this CONTRACT or any rights in respect thereto or to exercise any option herein provided, shall in no way be construed to be a waiver of such provisions, rights or options or in any way affect the validity of the CONTRACT. The exercise by either party of any of its rights herein shall not preclude or prejudice either party from exercising the same or any other right provided in the contract.

45.0 OWNER'S DECISION

45.1 In respect of all matters which are left to the decision of the OWNER/ENGINEER-IN-CHARGE including the granting or withholding of the certificates, the OWNER/ ENGINEER-IN-CHARGE shall, if required to do so, by the CONTRACTOR, give in writing a decision thereon.

45.2 In each case involving a financial commitment, the written APPROVAL of the owner alone shall be binding.

45.3 In matters of difference of opinion on a decision passed by the OWNER/ENGINEER-IN-CHARGE to the CONTRACTOR, stipulations of Clause 39.0 of GCC shall govern.

46.0 CO-OPERATION

46.1 CO-OPERATION WITH OWNER

The CONTRACTOR and OWNER shall co-operate with each other in the discharge of their respective obligation under the CONTRACT with the aim of satisfactory completing the PLANT and the WORKS in accordance with the CONTRACT.

46.1.1 The parties shall deal fairly, openly and in good faith with each other. Subject to Clause 53 (Secrecy) of GCC, each party shall disclose information which the other might reasonably need in order to exercise its rights and to perform its obligations under the CONTRACT. In particular, each party shall promptly disclose full information to the other concerning any matter which will or may prevent the Plant and Works being completed in accordance with the CONTRACT. The parties shall work together in a manner consistent with their respective obligations under the CONTRACT to resolve or mitigate any such problem.

46.1.2 OWNER shall be at liberty to object with reasonably valid reasons to employment of any person at SITE and the objection shall be communicated in writing and CONTRACTOR shall make immediate arrangements for removal of such person.

46.2 COOPERATION WITH OTHER CONTRACTORS

The CONTRACTOR shall not object to the execution of the work by other contractors or tradesmen engaged by OWNER and offer them every facility for the execution of their several works simultaneously with CONTRACTOR's work, provided however that CONTRACTOR'S WORK is not hampered by such co-operation. CONTRACTOR shall at all times provide sufficient fencing, notice boards, lighting and watchmen to protect and warn the public and guard the works and in default thereof, OWNER may provide such facilities at CONTRACTOR's cost, if such failure is attributable to CONTRACTOR.

The CONTRACTOR shall agree to cooperate with the OWNER and OTHERCONTRACTORs and exchange with them such technical information, provided that such CONTRACTOR is bound towards CONTRACTOR on confidentiality and limited use obligations not less stringent than those accepted by OWNER under the CONTRACT and shall not be a competitor of CONTRACTOR as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The OWNER shall be provided with three (3) copies of all correspondence addressed by the CONTRACTOR to other SUB-CONTRACTORS in respect of such exchange of technical information.

47.0 SUSPENSION OF WORKS

(i) Subject to the provisions of sub-para (ii) of this clause, the CONTRACTOR shall, if ordered in writing by the ENGINEER-IN-CHARGE, or his representative, temporarily suspend the WORKS or any part thereof for such written order, proceed with the WORK therein ordered to be suspended until, he shall have received a written order to proceed therewith. The CONTRACTOR shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of the WORKS aforesaid. An extension of time

for completion, corresponding with the delay caused by any such suspension of the WORKS as aforesaid will be granted to the ONTRACTOR should he apply for the same provided that the suspension was not consequent to any default or failure on the part of the CONTRACTOR.

(ii) In case of suspensions of entire WORK, ordered in writing by ENGINEER-IN-CHARGE, for a period of more than two months, the CONTRACTOR shall have the option to terminate the CONTRACT.

48.0 REPLACEMENT OF PARTS AND MATERIALS (DEFECTIVE/DAMAGED/LOST DURING TRANSIT/ERECTION AND COMMISSIONING)

48.1 If during the progress of the WORK, the OWNER shall decide and inform in writing to the CONTRACTOR that the CONTRACTOR has manufactured any plant or part of the plant in an unsound or imperfect manner or has furnished any plant inferior to the quality specified, the CONTRACTOR on receiving details of such defects or deficiencies shall at his own expense, within seven (7) days of his receiving the notice or otherwise within such time as may be reasonably necessary for making it good, proceed to alter, reconstruct or remove such work and furnish fresh equipment upto the standards of the specifications. In case the CONTRACTOR fails to do so, the OWNER may, on giving the CONTRACTOR seven (7) days notice in writing of his intentions to do so, proceed to remove the portion of the works so complained of and at the risk &cost of the CONTRACTOR, perform all such work or furnish all such equipment provided that nothing in this clause shall be deemed to deprive the OWNER of or affect any rights under the CONTRACT which the OWNER may otherwise have in respect of such defects and deficiencies.

48.2 The CONTRACTOR's full and extreme liability under this clause shall be satisfied by the payments to the OWNER of the extra cost, of such replacement procured including erection as provided for in the CONTRACT, such extra cost being the ascertained difference between the price paid by the OWNER for such replacements and the CONTRACT price portion for such defective plants and repayments of any sum/ paid by the OWNER to the CONTRACTOR in respect of such defective plant.

48.3 If the material/ equipment or any portion thereof is damaged or lost during transit and handling, storage, erection, commissioning at site, the replacements of such material / equipment shall be effected by the CONTRACTOR within a reasonable time to avoid unnecessary delays and without waiting for realisation of cost of damages from the insurance company, appointed by him for this purpose. This will not alter the time schedule in any way.

49.0 DEFENCE OF SUITS

49.1 If any action in Court is brought against the OWNER or an officer or agent of the OWNER for the failure omission or neglect on the part of the CONTRACTOR to perform any acts, matters, covenants or things under the CONTRACT, or for damage or injury caused by the alleged omission or negligence on the part of the CONTRACTOR, his agents representatives or his SUB-CONTRACTORS or in connection with any claim based on lawful demands of SUB-CONTRACTORs, workmen, suppliers or employees, the CONTRACTOR shall in all such cases indemnify and keep the owner and/ or his representative harmless from all losses damages, expenses or decrees arising out of such action.

49.2 If any action in court referred to in Clause 49.1 of GCC above is brought against OWNER or an officer or agent of OWNER, OWNER shall promptly give the CONTRACTOR notice thereof and CONTRACTOR may at its own expense and in OWNER's name, conduct such proceedings or claim for the settlement of any such proceedings or claim. If CONTRACTOR fails to notify OWNER within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the OWNER shall have full power and right at his discretion to defend or comprise any suit or pay claim or demand brought or made against him as aforesaid whether pending or threatened as he may consider necessary or desirable and shall be entitled to recover from the CONTRACTOR all sums of money including the amount of damages and compensation and all legal costs, charges and expenses in connection with any compromise or award which shall not be called into question by the CONTRACTOR and shall be final and binding upon him provided however that, unless CONTRACTOR has so failed to notify OWNER within the twenty-eight (28) days period, OWNER shall make no admission which may be prejudicial to the defence of any such proceedings or claim.

50.0 CONTRACTOR'S RESPONSIBILITIES

50.1 In consideration of payment by the OWNER, the CONTRACTOR shall regularly and diligently carry out and complete the WORKS in accordance with the CONTRACT.

50.2 All work carried out by the CONTRACTOR shall be carried out with sound workmanship and materials, safety and in accordance with the Contract requirements.

50.3 The CONTRACTOR shall set out the PLANT by reference to points, lines and levels of reference as defined in the approved SPECIFICATION.

50.4 The PLANT/WORKS as completed by the CONTRACTOR shall in every respect comply with the requirements defined in the Specification or any other provision of the CONTRACT.

50.5 If at any time during the performance of the CONTRACT, the CONTRACTOR is of the opinion that a change to the WORKS or the design or method of operation of the PLANT

a. is necessary to eliminate a potential defect in the PLANT or a specific hazard to any person or party in the performance of the WORKS or in the operation of the PLANT which has occurred or would otherwise occur' or

b. would improve operating or life cycle costs of the PLANT; or

c. would otherwise be beneficial to the OWNER;

the CONTRACTOR shall bring the matter to the attention of the ENGINEER-IN-CHARGE stating the reasons for his opinion and where appropriate, submit his proposals for a Variation in accordance with Clause 3 of SPECIAL CONDITIONSOF CONTRACT.

50.6 The CONTRACTOR shall at all times have and maintain adequate resources available for the proper and timely execution of the WORKS, including financial resources, and competent, appropriately experienced and physically capable staff and labour whether employed by the CONTRACTOR, any SUB-CONTRACTOR or third parties.

50.7 The CONTRACTOR shall provide and maintain records as specified in the CONTRACT.

Unless otherwise agreed, the CONTRACTOR shall, at intervals of not more than one calendar month, report to the ENGINEER-IN-CHARGE on the progress of the WORKS, supporting his reports with appropriate documentation including any revisions to the approved programme.

50.8 The CONTRACTOR shall maintain and cause SUB-CONTRACTORs to maintain, a quality assurance system as specified in the CONTRACT. The existence of such a quality assurance system shall not relieve the CONTRACTOR from any of his other duties, obligations or liabilities under the CONTRACT. The CONTRACTOR shall also prepare and implement a validation plan, if such a requirement is specified in the CONTRACT.

51.0 PROGRESS REPORTS AND PHOTOGRAPHS

51.1 The CONTRACTOR shall furnish soft copy of progress photographs of the work done in his shop/site. Photographs shall be taken when and where indicated by the ENGINEER-IN-CHARGE. Photographs, if required shall be approximately 8 inches by 10 inches in size, including a margin on one 10 inch side for binding. Each photograph shall contain the date, the name of the CONTRACTOR and the title of the view taken. (technical to check, whether to be shifted to SCC)

51.2 Required number of monthly progress reports, in prescribed proforma, shall be submitted by the CONTRACTOR to the ENGINEER-IN-CHARGE for review. These shall detail the status of design, procurement of raw materials and bought outs, approval of the CONTRACTOR's drawings, manufacture of the equipment, statutory approvals taken, inspection of equipment/material, completed despatches, materials received at site, damages, if any, during transit, actions taken or replacement of damaged equipment, progress of erection work and programme of work for succeeding month and statement showing position of payment.

52.0 DELETED

53.0 SECRECY

53.1 The technical information, drawings, specifications and other related documents forming part of the NIT or the CONTRACT or such of those materials prepared during the execution of the project including photographs, micro-films, design, calculations etc. are the property of the OWNER and shall not be used for any other purpose, except for execution of contract. All rights, including rights in the event of grant of a patent and registration of designs are reserved. The technical information, drawings, specifications, records and other documents shall not be copied, transcribed, traced or reproduced in any other form or otherwise in whole and/or duplicated, modified, divulged and/or disclosed to a third party nor misused in any other form whatsoever, without the OWNER's previous consent in writing except to the extent required for the execution of this CONTRACT. Such technical information, drawings specifications and other related documents furnished shall be returned to the OWNER with all approved copies and duplicates, if any, immediately after they have been used for the agreed purposes.

For avoidance of any doubt it may be clarified that this clause relate to documents prepared by OWNER or is a property of OWNER.

In the event of any breach of this provision, the CONTRACTOR shall indemnify the OWNER from any loss, cost or damage or any other claim whatsoever from any parties claiming from or through them in respect of such breach.

All intellectual property rights in documents and calculations prepared by CONTRACTOR shall at all times exclusively vest with CONTRACTOR and be used by OWNER in accordance with the CONTRACT.

53.2 **Records of Contract Documents**

53.2.1 The CONTRACTOR shall at all times make and keep sufficient copies of the DRAWINGS, Specifications and CONTRACT documents for him to fulfil his duties under the CONTRACT.

53.2.2 The CONTRACTOR shall keep at site atleast three copies of each and every Drawing, Specification and CONTRACT document and these copies shall be available at all times for use by the OWNER and EIC and by any other person authorized by the OWNER who needs to know about the PROJECT.

54.0 CORRESPONDENCE

54.1 All correspondences from the CONTRACTOR to the OWNER shall be as per the correspondence distribution schedule. All communications including clarifications and/or comments shall be addressed to OWNER/PMC and shall always bear reference of DLOA No.

54.2 Any notice to the CONTRACTOR under the terms of the CONTRACT shall be served by registered e-mail, Speed Post or courier.

54.3 Any notice to the OWNER shall be served from the CONTRACTOR's Principal office in the same manner.

54.4 Any written order or instruction of OWNER or his duly authorised representative, communicated to authorised representative of the CONTRACTOR at site office shall be deemed to have been communicated to the CONTRACTOR at his legal address.

54.5 A notice shall be effective when delivered or on date of the notice, whichever is later.

55.0 MATERIALS AND EQUIPMENT

55.1 **Materials**

55.1.1 CONTRACTOR shall supply all materials required for incorporation in the works, within the scope of work, necessary to establish, commission and operate the PLANT.

55.1.2 **INVOICES**

CONTRACTOR’s invoices shall be raised as per approved Billing Schedule.

(a) The CONTRACTOR’s invoice shall be in the format with all the requisite information as prescribed under GST Laws.

(b) Before raising GST invoices, CONTRACTOR shall coordinate with the OWNER with respect to address and GSTIN number on which such invoices have to be raised

55.1.3 The CONTRACTOR shall be responsible at his own cost and initiative within the scope of WORK, to take delivery of the materials from the port of delivery in India in respect of imported materials and from the factory or ware-house or other place(s) of delivery in respect of indigenous materials and to transport these to the CONTRACTOR's stockpiles, godowns or other places of storage approved by the ENGINEER-IN-CHARGE, and to transport the same from said godowns or place(s) of storage to the work site for installation in the permanent WORKS.

55.1.4 The work of delivery and transportation of materials shall include (but not be limited to) the following:

i) Clearance of the goods through custom and port clearance including filling and/or filing of all custom manifests, bills of entry, and custom declarations and other documents as may be required for the clearance of the goods from customs or port authorities.

ii) Stevedoring, clearing, forwarding and handling services as required for clearing, forwarding and handling imported and indigenous materials and consignments including payment at CONTRACTOR’s cost of any demurrage, wharfage, port charges, siding charges, retention charges, detention charges or other charges whatsoever and howsoever designated or levied by any railway, air-port, ship and/or other authorities for or in connection with the loading, unloading or detention of any materials or vessels or other means of transport beyond the free period or unloading, clearance, retention or detention or loading, as the case may be, provided by the relevant authority(ies) or carrier(s) in this behalf.

iii) All works and operations necessary to lift and to remove the material from port, ware-house, railway or other siding, factory or other places of delivery, loading, handling, transporting and unloading and safely stacking, placing or storing the same at approved godowns, yards or other place(s) of storage including lashing or other-wise securing or protecting the same in transit and during and in storage.

iv) Supply, procurement, mobilization, and deployment of all labour thereof, equipment & machinery necessary for lifting, loading, handling, removing, transporting, unloading, stacking or securing the materials.

v) Transit and storage insurance of all materials for the full replacement value thereof delivered at site.

vi) All acts, deeds, matters or things required to fulfil all local, municipal and other statutory authorities with respect to the transportation of any materials through or into any State, municipal, local or other barriers or limits or for the import of the materials or any of them within the limits of such barrier, including payment of octroi or other local toll, terminal and/or entry or other taxes payable on the passage or entry of the materials through or within any local limits, for which purpose the OWNER shall give the CONTRACTOR and/or CONTRACTOR's designate(s) any and all authority(ies) as may be reasonably required in this behalf.

vii) All other acts, deeds, matters and things whatsoever ancillary, auxiliary or incidental to the above including but not limited to the grading of the site and/or creation of temporary approaches and ramps etc. as may be required.

55.2 GENERAL PROVISION WITH REGARD TO MATERIALS

55.2.1 The CONTRACTOR shall, within the scope of work, undertake the following activities and responsibilities with respect to and in addition and without prejudice to the activities and responsibilities under Clause 55.1 and associated clauses thereunder in respect of materials:

i) The CONTRACTOR shall be taking delivery, ensure compliance of any condition applicable for delivery from the concerned authority or carrier, and shall be exclusively responsible to pay and bear any detention, demurrage or penalty or other charges payable by virtue of any delay or failure by the CONTRACTOR in lifting the materials or in observing any of the conditions aforesaid, and shall keep the OWNER indemnified from and against all consequences thereof

ii) The CONTRACTOR shall maintain a day-to-day account of all materials indicating the daily receipt(s), consumption(s) and balance of each material and category thereof. Such account shall be in the format, if any, prescribed by the ENGINEER-IN-CHARGE and shall be supported by all documents necessary to verify the correctness of the entries in the account. Such account shall be maintained at the CONTRACTOR office and site(s) and shall be open for inspection and verification (by verification of documents in support of the entry as also by feasible verification of the stock) at all times by the ENGINEER-IN-CHARGE with authority at all times without obstruction to enter into or upon any godown or other place(s) or premise(s) where the materials or any part of them are lying or stored and to inspect the same himself and or through his representative(s).

iii) All materials shall be taken delivery of, held, stored and utilised by the CONTRACTOR as Trustee of the OWNER, and delivery of the material to the CONTRACTOR shall constitute an entrustment thereof to the CONTRACTOR, with the intent that any utilization, application or disposal thereof by the CONTRACTOR otherwise than for permanent incorporation in the contractual works in terms of the contract shall constitute a breach of trust by the CONTRACTOR.

iv) The CONTRACTOR shall at all times be exclusively responsible for any and all losses, damages, deterioration, misuse, wastage, theft, or other application or misapplication or disposal of the materials or any of them contrary to the provisions hereof and shall keep the OWNER indemnified from and against the same and shall forthwith at its own cost and expenses replace any such material, lost, damaged, deteriorated, misused, wasted, stolen, applied, mis-applied and/or disposed as aforesaid with other material of equivalent quality and quantity delivered to site at the CONTRACTOR's risks and costs in all respects.

v) The CONTRACTOR shall take out, at his own cost and keep in force at all times, during transit, handling, storage and erection, till the period as defined in the SPECIAL CONDITIONS OF CONTRACT (SCC),all the Insurance policy(ies) with Insurance Company(ies) for the full replacement value of the materials at site against the risks specified in the CONTRACT. Such policies shall be in the joint names of the OWNER and the CONTRACTOR, with exclusive right in the OWNER to receive all monies due in respect of such policy(ies) and with right in the OWNER (but without obligation to do so) to take out and pay the premia for any such policy(ies) and deduct the premia and any other costs and expense in this behalf from the monies for the time being due or in future becoming due to the

CONTRACTOR. In case of any Insurance claim, the GST leviable on the transfer of the claim money from OWNER to CONTRACTOR shall be over and above the GST cap indicated in the CONTRACT and shall be borne by OWNER.

vi) If the CONTRACTOR shall default in replacing any material lost, damaged, deteriorated, misused, wasted, short, stolen, misapplied or disposed of within the provisions hereof above, the CONTRACTOR shall be liable to pay to the OWNER the cost of such materials.

a) Notwithstanding anything herein provided, the CONTRACTOR shall be and remain solely and exclusively liable to repair, restore or replace, as the case may be, the materials damaged or destroyed as a result of any act or omission, notwithstanding the existence or otherwise of any policy(ies) of insurance aforesaid, with the intent that any policy(ies) of insurance aforesaid taken out by the CONTRACTOR or by the OWNER, on default by the CONTRACTOR, shall not anywise absolve the CONTRACTOR from his full liability up to and until expiry of Defect Liability Period defined in the contract. Further, as provided in respect of the works, the work(s) and all materials incorporated therein shall be and remain at the risk of the CONTRACTOR in all respects, including (but not limited to) accident, lightning, earth-quake, fire, storm, flood, tempest, riot, civil commotion and/or war or otherwise with respect to the materials. The insurance policies for above risks shall constitute merely an additional security and not a substitution of liability.

b) It shall be the exclusive responsibility of the CONTRACTOR to lodge and pursue any or all claims in respect of the insurance covers as above.

c) The CONTRACTOR shall, as a condition to the certification of any Running Account Bill, satisfy the OWNER/ Engineer-In-Charge of the existence of one or more policy(ies) of insurance, covering the materials as specified herein. The policy(ies) of insurance aforesaid shall cover all insurable risks, including but not limited to, any loss or damage commencing from the supplier's ware house in handling, transit, storage and during erection, theft, pilferage, riot, civil commotion, force majeure (including earth quake, flood, storm, cyclone, tidal wave, lightening and other adverse weather conditions), accidents of kinds, fire, war risks and explosion.

55.3.0 BILL OF MATERIALS

55.3.1 The CONTRACTOR shall furnish to the OWNER a detailed "Bill of Materials (BOM)" specifying the materials, which on preliminary determination made by the CONTRACTOR, will be required to be incorporated in the permanent works in order to establish the WORK/ Unit and to operate the PLANT/Unit, including construction materials.

55.3.2 Each item entered in the Bill of Materials shall be priced. The Bill of Materials and said price break–up therein are intended only to form a basis for the purpose of calculating on account payments and for calculating payments due to the CONTRACTOR under Clause 34.0 of GCC upon cancellation of contract, and for no other purpose.

55.3.3 The OWNER shall review or cause to be reviewed the prima facie adequacy, sufficiency, validity and/or suitability of the materials listed in the Bill of Materials for the works for which they are intended and of the prices indicated in the Bill of Materials in respect thereof. Such review shall be performed in conjunction with the design, engineering, specification and other technical reviews to be done by the OWNER and all provisions applicable thereto with reference to critical drawings shall be applicable to the review of the Bill of Materials.

55.3.4 The priced Bill of Materials shall constitute the Bill of Materials envisaged in the contract documents. However, the CONTRACTOR shall have full responsibility under the CONTRACT to sell and supply to the OWNER all materials required for the permanent incorporation in the works and which are required to establish, commission and operate the PLANT/ Unit in accordance with the CONTRACT and the specifications, complete in all respects including spares, tools, tackles and testing equipment, so far as included within the scope of supply, whether or not any particular material is actually included within or omitted in the Bill of Materials and whether or not the price thereof is included in the price indicated in the Bill of Materials and whether or not the price thereof is in conformity with the price thereof indicated in the Bill of Materials. The review and approval of the Bill of Materials and the prices therein are intended only for the satisfaction of the OWNER that the priced Bill of Materials, prima-facie covers the materials required to be supplied by the CONTRACTOR within the scope of supply.

55.4 SUPPLY OF MATERIALS

55.4.1 The CONTRACTOR shall supply the materials required to be supplied within the Contractor's scope of supply for incorporation in the permanent works in accordance with and to meet the requirements in quality, quantity and other particulars of the descriptions, specifications, plans, drawings, designs and other documents applicable thereto, and the CONTRACTOR shall be deemed to have undertaken that all materials selected, procured and supplied by the CONTRACTOR within the scope of supply shall be of the best quality and workmanship and shall be capable of producing the designed desired results and to perform the designed and desired functions to meet the contractual requirements in all respects for the project.

55.4.2 The CONTRACTOR shall undertake and complete the supply of materials within the scope of supply to meet the scheduled progress and requirements of the WORK within the scope of work.

55.4.3 All materials shall be deemed to have been accepted only when the material is received at the project SITE and accepted by the ENGINEER-IN-CHARGE. Such acceptance shall however be subject to the terms and conditions of CONTRACT, including the right of rejection and/or replacement as elsewhere herein specified.

55.4.4 Without prejudice to any other terms of the contract, it is clarified that the mere agreement, acceptance or prescription of a Delivery or other Schedule containing an extended time of commencement or completion in respect of the entire delivery(ies) or any of them shall not anywise constitute an extension of time in a terms of the CONTRACT so as to bind the OWNER or relieve the CONTRACTOR of all or any of his liabilities under CONTRACT, nor shall constitute a promise on behalf of the OWNER or a waiver by the OWNER of any of its rights in terms of the contract relative to the performance of the CONTRACT within the time specified or otherwise, but shall be deemed only (at the most) to be a guidance to the CONTRACTOR for better organising his work on a recognition that the CONTRACTOR has failed to organise his supplies and/or make the same within the time specified in the Delivery Schedule.

55.4.5 If the CONTRACTOR fails to supply the materials in accordance with the dates in this behalf specified in the Delivery Schedule which has an impact on the critical path of the schedule, the CONTRACTOR shall provide the OWNER with a suitable plan to recover the delay, but without prejudice to any other rights, discount or remedy available to the OWNER in respect of such delay or failure.

55.4.6 **MAKE OF MATERIALS**

i) All equipment and materials to be supplied under this CONTRACT shall be from approved vendors as indicated in the Bidding Document or as otherwise approved by the ENGINEER-IN-CHARGE / OWNER.

ii) Where the makes of materials are not indicated in the Bidding document, the CONTRACTOR shall furnish details of proposed makes and supplies and supply the same after obtaining the OWNER's/ ENGINEER-IN-CHARGE's approval.

55.5.0 **CERTIFICATE OF VERIFICATION AND GOOD CONDITION**

55.5.1 The CONTRACTOR shall, before supply of material covered within the scope of supply, at his own risks, costs and initiative, undertake or cause to be undertaken all tests, analysis and inspections as shall be required to be undertaken with regard to the materials under the specifications and any codes, practices, orders and instructions with respect thereto and shall cause the results thereof to be recorded, reported or certified, as the case may be, and shall not offer for delivery or deliver any material(s) which has/have not passed such tests/analysis or inspection and which are not accompanied by the tests results, reports and/or certificates in this behalf provided in the applicable specifications, code(s) and/or practices.

55.5.2 On arrival of the material at site the CONTRACTOR shall give written notice thereof to the ENGINEER-IN-CHARGE or Inspection Agency notified by the OWNER in this behalf, to inspect the materials, and shall keep in readiness for inspection, the materials and the relevant tests results, reports and certificates hereto.

55.5.3 Notwithstanding any other provisions in the contract documents for analysis or tests of materials and in addition thereto, the CONTRACTOR shall, if so required by the ENGINEER-IN-CHARGE or Inspection Agency in writing at his own risks and costs, analyse, test, prove and weigh all materials (including materials incorporated in the works) required to be analysed, tested, proved and/or weighed by the ENGINEER-IN-CHARGE or Inspection Agency in this behalf and shall have such analysis or tests conducted by the agency(ies), or authority(ies) if any specified by the ENGINEER-IN-CHARGE or Inspection Agency. The CONTRACTOR shall provide all equipment, labour, materials and other things whatsoever required for testing, preparation of the samples, measurement of work and/or proof of weighment of the materials as directed by the ENGINEER-IN-CHARGE or Inspection Agency.

55.5.4 If on Inspection or proof, analysis or tests as aforesaid the ENGINEER-IN-CHARGE or Inspection Agency nominated by the OWNER in this behalf is prima facie satisfied that the material received is in conformity with the material requirements of the Bill of Materials and description given in the shipping documents and in the CONTRACTOR's invoices in this behalf and that the test reports/results/certificates given in respect thereof are prima facie in conformity with the relevant result/reports/certificates required in respect thereof in terms of the specifications and/or relevant codes and practices, and that the material appears to be prima facie in good order and condition, the ENGINEER-IN-CHARGE shall issue to CONTRACTOR, a Certificate of Verification and Good Condition in respect of such material, and this shall constitute the Certificate of Verification and Good Condition elsewhere envisaged in the CONTRACT documents. Should the ENGINEER-IN-CHARGE not issue said Certificate within 5 working days following the conformity of the aforementioned requirements, the Certificate of Verification and Good Condition shall be deemed issued.

55.5.5 Such certificate is only intended to satisfy the OWNER that prima facie the material supplied by the CONTRACTOR is in order and shall not anywise absolve the

CONTRACTOR of his/its full responsibility under the CONTRACT in relation thereto, including in relation to,–fulfilment and/or performance of works or other guarantees envisaged in the CONTRACT.

55.5.6 Notwithstanding that any area(s) or source(s) has/have been suggested by the OWNER to the CONTRACTOR from which any material for incorporation in the WORKS can be obtained, the CONTRACTOR shall independently satisfy himself of the suitability, accessibility and sufficiency of the source(s) of supply suggested by the OWNER and suitability of the material available from such source(s) with the intent that any suggestion as aforesaid shall not anywise relieve the CONTRACTOR of his full liability in respect of the suitability and quality of the material(s) obtained from said source(s) and the CONTRACTOR shall obtain material(s) there from and incorporate the same within the permanent works entirely at his own risks and costs in all respects, with the intent that any such suggestion by the OWNER shall only be by way of assistance to the CONTRACTOR and shall not entail any legal responsibility or liability upon the OWNER.

55.6.0 **MATERIALS WITHIN THE CONTRACTOR'S SCOPE OF SUPPLY**

The OWNER does not warrant or undertake the provisions of any materials and the CONTRACTOR shall not imply, by conduct, expression or assurance or by any other means, any promise or obligation on the part of the OWNER in his respect understood by the CONTRACTOR.

55.7.0 **Deleted**

55.8 **PACKING AND FORWARDING**

- The CONTRACTOR shall, wherever applicable, after proper painting, pack and crate all items in such a manner so as to protect them from deterioration and damage during rail and road transportation to the site and during storage at the site till the time of erection. Without prejudice to any other liabilities or obligations of the CONTRACTOR, the CONTRACTOR shall be responsible for all damage(s) due to improper packing.
- The CONTRACTOR shall notify OWNER/ ENGINEER-IN-CHARGE the expected date of arrival materials at the site for the information of OWNER/ ENGINEER-IN-CHARGE.
- The CONTRACTOR's notification shall also give all shipping information concerning the weight, size and content of each packing and such other information as the OWNER/ ENGINEER-IN-CHARGE EIC may require.
- The following documents shall be sent to the OWNER/ EIC in three copies:

a) Signed Invoice(s)
b) Delivery Challan
c) Packing list.
d) Manufacturer's certificate of inspection for shipment duly approved by the CONTRACTOR in one original and one photocopy
e) Third Party Inspection Release Note clearly indicating that material has been inspected and accepted as per QAP approved by OWNER or TPI waiver certificate issued by OWNER.
f) Railway Receipt/LR
g) Intimation to Insurance Company for arranging Transit Insurance
h) Guarantee certificate (wherever applicable)

i) Operation & Maintenance manual (wherever applicable)

55.9 Assembly Marks and Name Plates

55.9.1 All component/parts of EQUIPMENT shall be indelibly hard marked with identification marks, comprising EQUIPMENT, part numbers, and CONTRACT number/PO number which shall also be shown on drawing to facilitate speedy identification, assembling or dismantling.

55.9.2 On each EQUIPMENT, a nameplate indicating basic details, pressure rating, wherever applicable, code number of EQUIPMENT, electrical characteristics in case of electrical EQUIPMENT, name of instrument with tag no., manufacturer's name shall be fixed at proper place.

55.9.3 For packages where marking is not possible at least two metallic nameplates must be affixed. Marking on the plates will be by means of engraving or indelible paint and will include the information listed above.

55.10 **Despatch/Shipping notice**

CONTRACTOR shall notify OWNER by E-mail for its information the expected date of delivery of a consignment, date of readiness of EQUIPMENT for shipment, total gross weight and total volume with dimensions.

55.11 **Heavy Lift Consignment (HLC) or Over Dimensional Consignments (ODC).**

55.11.1 CONTRACTOR shall follow the guidelines of Ministry of Road transport and Highways (MORTH) India, for the shipping/transportation of all packages/consignments. The CONTRACTOR shall be responsible to comply with rules relating to E-way Bills and other related provisions under the GST laws for movement of packages/consignments.

55.11.2 CONTRACTOR shall make his own arrangements for movement of all consignments including ODC/HLC.

55.11.3 CONTRACTOR confirms that it has surveyed the route for transportation of ODC/HLC items of EQUIPMENT and CONTRACTOR further confirms that it has included all cost of repairs of road, civil works, strengthening of bridges, culverts, widening of roads, etc. as required for transportation of ODC/HLC items of EQUIPMENT in its CONTRACT PRICE. OWNER shall not be responsible for repairs of road, civil works, strengthening of bridges, culverts, widening of roads, etc. as required for the transportation of ODC/HLC items of EQUIPMENT and shall not be liable to reimburse the cost of such repairs of road, civil works, strengthening of bridges, culverts, widening of roads, etc. to CONTRACTOR.

55.12 **Marking**

55.12.1 CONTRACTOR shall mark the following on packing three sides i.e. two sides faced and cover (Top) EQUIPMENT with indelible paint in conspicuous printed letters not less than 5 cm. in size in English:

A. For Imported EQUIPMENT

Government of India
A/c TALCHER PROJECT, ODISHA, INDIA.

a) CONTRACT /PO NO. : _____
b) Equipment Description and Item Nos.: _____
c) Package : _____ of _____
d) Gross / Net Weight (Kgs.) : _____
e) Dimension L x W x H cms. : _____
f) WARNING MARKS (FRAGILE, ATTENTION, TOP, KEEP DRY ETC.)
g) Forwarding No. : _____
h) Part shipment/full shipment/final shipment : _____
i) Each package shall bear a symbol contained in the package as follows:

'A' Storage in a closed storehouse.

'B' Storage under a shed.

'C' Storage in the open.

55.12.2 Depending on the characteristics of the contents in the packages, the packages have to be marked with appropriate international marking ("HANDLE WITH CARE"; "THIS SIDE UP"; "SLING MARK"; ETC.) and other indications necessary for correct handling such as Centre of Gravity and points of slinging (in case of heavy loads).

55.12.3 For packages where marking is not possible, at least two metallic nameplates must be affixed. Marking on the plates will be by means of engraving or indelible paint and will include the information listed above.

55.12.4 All corners of the packages shall be painted with indelible 'Blue' paint at least 125 mm in depth for easy identification/location of the packages for clearance and handling at the port.

55.13 **Packing List**

55.13.1 CONTRACTOR will include in each package an item-wise packing List, Invoice No. and associated drawings.

55.13.2 The packing list and any other documents shall be put in a closed polyethylene envelope and included in each package.

55.13.3 A second copy of the packing list shall be placed in a polyethylene envelope on the outside of the each package by means of metallic plate marked "Documents". As regards columns, exchangers and similar equipment, the envelope shall be placed in a nozzle being identified by an arrow, in indelible paint, followed by the word "Document".

55.13.4 Shipping documents must always be presented in the number of copies indicated in this CONTRACT.

55.14 **Shipping Arrangements and Forwarding of Documents**

CONTRACTOR shall avoid the use of over aged vessels for the shipment of the imported EQUIPMENT under this CONTRACT and if so used, the cost of additional insurance, if any, shall be borne by CONTRACTOR.

55.15 **Despatch/Shipment Notice for Insurance.**

55.15.1 CONTRACTOR shall send intimations of despatches indicating items despatched, quantity, value, weight and carrier particulars directly through fax to the insurance company fixed by CONTRACTOR.

55.15.2 Insurance for transit risks and other risks shall be covered by CONTRACTOR.

55.16 UTILITIES AND CONSUMABLES ETC.

Subject to any other provision to the contrary in the CONTRACT, the CONTRACTOR shall be and remain at all times exclusively responsible within the scope of work to provide all utilities, consumables, permits, licenses, easementsand facilities and other items and things whatsoever required for or in connection with the WORK, including but not limited to those indicated by expression or implication in the bid documents and/or other CONTRACT documents or howsoever otherwise as shall be or may from time to time be necessary for or in connection with the WORK.

56.0 MEASUREMENTS, CERTIFYING INSPECTIONS AND PAYMENTS

56.1 Final Measurements:

56.1.1 Within 15 (fifteen) days from the date of certification of works completed /milestone achieved in respect of the WORKS or of any portion of the WORKS, section, group or job site, as the case may be, measurements for the works covered by such certification shall be jointly taken by the ENGINEER-IN-CHARGE and the CONTRACTOR as herein provided.

56.1.2 If the CONTRACTOR fails to apply to the ENGINEER-IN-CHARGE for measurements within15 (fifteen) days from the date of certification of works completed/ milestone achieved as specified in Clause 56.1.1, the ENGINEER-IN-CHARGE shall notify the CONTRACTOR in writing of the date(s) for measurements, and require the CONTRACTOR to be present on date(s) so notified.

56.2 Mode of Measurement

56.2.1 All measurements shall be recorded in the metric system, and shall be taken in accordance with the procedures set forth or provided for in the Schedule of Rates, Specifications and other CONTRACT Documents.

56.2.2 Where the mode of measurement is not provided for in the Contract Documents in respect of any item of work, it shall be measured in accordance with the Indian Standard Specification No. 1200 (latest edition) and in the event of such item not being covered by Indian Standard Specifications, it shall be measured in accordance with the method of measurement in this behalf specified by the ENGINEER-IN-CHARGE, whose decision in this regard shall be final and binding upon the CONTRACTOR. If the Contractor disagrees with the decision of the ENGINEER-IN-CHARGE, the dispute shall be settled as per the provisions of Clause 39.0 of GCC.

56.2.3 All measurements shall be taken jointly by the ENGINEER-IN-CHARGE and the CONTRACTOR or their respective representatives. The CONTRACTOR or his authorized representative shall be entitled to remain present at all times when joint measurements are being taken.

56.2.4 Despite due intimation, if the CONTRACTOR omits or fails to be present to witness joint measurements, the measurements shall be taken in the presence of the ENGINEER-IN-

CHARGE and the measurements so recorded and signed by the ENGINEER-IN-CHARGE as correct, shall be final and binding upon the Parties.

56.2.5 Except in cases covered by Clause 56.2.4, in all other cases measurements shall be signed and dated on each page by the CONTRACTOR / CONTRACT MANAGER and ENGINEER-IN-CHARGE or his representative. If the CONTRACTOR objects to any of the measurements recorded, including the mode of measurement, such objection shall be noted in the measurement book against the item objected to and such note shall be dated and authenticated by the CONTRACTOR / CONTRACT MANAGER and ENGINEER-IN-CHARGE or his representative. In the absence of any objection noted as aforesaid, the CONTRACTOR shall be deemed to have accepted the relative measurements as entered in the Measurement Book / Sheets and shall be barred from raising any objection at a later date in respect of any measurements recorded in the Measurement Book.

56.2.6 All objections noted in the Measurement Book in terms of Clause 56.2.5 shall be considered and decided within 15 days by the ENGINEER-IN-CHARGE. The decision of the ENGINEER-IN-CHARGE relative thereto (whether on the correct measurement to be adopted or on the mode of measurement to be adopted)shall be final and binding upon the Parties. If the Contractor disagrees with the decision of the ENGINEER-IN-CHARGE, the dispute shall be settled as per the provisions of Clause 39.0 of GCC.

56.2.7 The measurement as finally recorded in terms of Clause 56.2.4 or Clause 56.2.5 or 56.2.6, as applicable, shall be the Final Measurement.

56.3 CERTIFYING INSPECTIONS

All provisions referred to in Clauses 56.1 to 56.2, in respect of Mode of Measurement, shall apply to all inspections required to be made in order to qualify the CONTRACTOR for any payment(s) under the CONTRACT and any reference in the said clauses to measurements shall, for the purpose of this clause, be deemed to be a reference to certifying inspections and any reference therein to the measurement book shall, for the purpose of this clause, be deemed to be a reference to the certifying inspection book.

56.4.0 Deleted

56.5.0 PRICE SCHEDULE

56.5.1 The remuneration determined due to the CONTRACTOR as provided for in Clause 56.4.1 hereof shall constitute the entirety of the remuneration and entitlement of the CONTRACTOR in respect of the WORK under the CONTRACT, and no further or other payment whatsoever shall be or become due or payable to the CONTRACTOR under the CONTRACT.

56.5.2 Without prejudice to the generality of the provisions of Clause 56.5.1 hereof, the TOTAL LSTK CONTRACT PRICE shall be deemed to include and cover (unless otherwise expressly specified to the contrary in any CONTRACT document(s)):

(i) All costs, expenses, outgoings and liabilities of every nature and description whatsoever and all risks whatsoever (foreseen or unforeseen, including force majeure) to be taken or which may occur in or relative to execution, completion, testing, commissioning and/or handling over the WORKS to the OWNER and/or in or relative to acquisition, loading, unloading, transportation, storing, working upon, using, converting fabricating, or erecting any item, equipment, system, material or component in or relative to the WORKS, and the CONTRACTOR shall be deemed to have known the nature, scope, magnitude and the extent of the works and items, MATERIALS, EQUIPMENT, and components required for the proper and complete execution of the Works though the CONTRACT documents may not fully and precisely set out, describe or specify them, and the

generality hereof shall not be deemed to be anywise limited, restricted or abridged because in certain cases the CONTRACT documents or any of them shall or may and/or in other cases they shall or may not expressly state that the CONTRACTOR shall do or perform any particular labour or service or because in certain cases the CONTRACT documents state that a particular work, operation, supply, labour or service shall be performed/made by the CONTRACTOR at his own cost or without additional payment, compensation or charge or without entitlement of claim against the OWNER or words to similar effect, and in other cases they do not, or because in certain cases it is stated that the same are included in or covered by the Price Schedule and in other cases it is not so stated.

(ii) The cost of all construction and related vessels, craft, vehicles, movements, plant, equipment, distribution of water and power, construction of temporary roads and access, temporary works, pumps, wiring, pipes, scaffolding, piling, shuttering and other materials, supervision, labour, insurance, fuel, stores, spares, supplies, appliances and materials, items, articles and things whatsoever (foreseen of unforeseen) by expression or implication to be supplied, provided or arranged in or relative to or in connection with the performance and/or execution of the WORKS and/or related or incidental thereto, complete in every respect in accordance with the CONTRACT document, and the plans, drawing, designs, orders and/or instructions;

(iii) The cost of mobilisation including but not limited to mobilisation of vehicles, movements, machinery, equipment, gear, tools, tackle, consumables and other items and goods and personnel necessary for or to perform the WORKS contemplated under the CONTRACT, preparation and erection of work yards and other work places and facilities necessary for or to perform the WORKS contemplated under the CONTRACT and/or to supply the material included within the scope of supplies including all work, labour, inputs, goods, EQUIPMENT, and other items and things whatsoever necessary for the performance of the WORKS, dismantling and/or removal of the same and restoration of the site, lifting the materials and transporting them to CONTRACTOR's stock piles/work yard, job sites and loading, stacking and/or storing the same.

(iv) The costs and risks of all rents, royalties, licenses, permits, permission and other fees, duties, penalties, levies, and damages whatsoever payable for or in respect of any protected or patented goods, materials, equipment or processes employed in or relative to the works and of all rents, royalties, licenses, permits, permissions and any other fee, duty, penalty, levy, loss or damages payable on the excavation, removal or transportation of any material or acquisition or use of any right of way or other right, licenses, permit, privilege, permission or uses required for or relative to the performance of the WORK.

(v) The cost of all taxes and duties within the scope of work, all customs and import duties, Indian Income Tax, applicable GST, quay, warfare, demurrage, detention and landing charges and all other duties, taxes, fees, charges, levies, and/or cesses whatsoever imposed or to be imposed by the Central Government or State Government or Municipal or Local Bodies or other Authorities whatsoever and payable on any materials supplied and/or on works performed without any entitlement to the CONTRACTOR for any exemption, remission, refund or reduction thereof

(vi) The cost of all indemnities under the CONTRACT, and insurance premia on insurance required in terms of the CONTRACT documents or otherwise under any law, rule or regulation, and the cost of all risks whatsoever (foreseen and unforeseen) including but not limited to risks of delay or extension of time or

reduction or increase in the work or scope of work and/or cancellation of CONTRACT, and/or accident, strike, civil commotion, war, strike, labour trouble, third party breach, fire, lighting, inclement weather, storm, tempest, flood, earthquake and other acts of God, Government regulation or imposition or restriction, dislocation of road, rail, sea, air and other transport, access or facility, flooding of site and/or access roads and approaches thereto, suspension of work, sabotage and other cause whatsoever.

(vii) The cost of all inspections, tests and certificates relative thereto including third party tests and/or inspections where necessary, and of items, instruments, plant and/or tools and appliances required to conduct such inspection and tests.

(viii) The cost of all materials supplied and/or intended for incorporation in the WORKS supplied within the scope of work, delivery thereof to the job site, loading, transportation and unloading thereof, waste on materials, and return of empties and surpluses.

(ix) The cost of all escalations (foreseen and unforeseen) including but not limited to increase in Government taxes and duties (beyond contractual completion period and any extension hereof due to reasons attributable to CONTRACTOR), labor costs and material costs and other inputs whatsoever..

(x) All supervision charges, establishment's overheads, finance charges and other costs and expenses and charges to the CONTRACTOR, and the CONTRACTOR's profit of and relative to the WORK and/or supply.

(xi) The cost of all deductions, reductions, discounts, adjustments and withholdings whatsoever under or in connection with the CONTRACT.

(xii) The cost shall be deemed to include and cover the risk of all possibilities of delay and interference with the CONTRACTOR's conduct of WORK which occur from any causes including orders of the OWNER in the exercise of his power and on account of extension of time granted due to various reasons and for all other possible or probable causes of delay.

56.6.0 Deleted

56.7.0 Deleted

56.8.0 CLAIMS BY THE CONTRACTOR

56.8.1 No claim(s) shall on any account be made by the CONTRACTOR after submission of the Final Bill, with the intent that the Final Bill prepared by the CONTRACTOR shall reflect any and all claims whatsoever of the CONTRACTOR against the OWNER arising out of or in connection with the CONTRACT or any supply made or work performed by the CONTRACTOR there under or in relation thereto, and notwithstanding any enabling provision in any law or CONTRACT and notwithstanding any claim that the CONTRACTOR could have with respect thereto, the CONTRACTOR hereby waives and relinquishes any and all such claims not included in the Final Bill and absolves and discharges the OWNER from and against the same, even if in not including the same as aforesaid, the CONTRACTOR shall have acted under a mistake of law or of fact, or shall claim to have acted under economic compulsion or necessity.

56.8.2 If required by the OWNER, the ENGINEER-IN-CHARGE shall be authorised to require the CONTRACTOR to furnish, and the CONTRACTOR shall, upon the request of the ENGINEER-IN-CHARGE/OWNER, furnish all invoices, vouchers and accounting records as may be deemed necessary by the ENGINEER-IN-CHARGE/OWNER for the purpose of verifying any CONTRACTOR's claim.

56.9 DISCHARGE OF OWNER'S LIABILITY

56.9.1 The acceptance by the CONTRACTOR of any amount paid by the OWNER to CONTRACTOR in respect of the Final Bill of the CONTRACTOR in settlement of all said dues to the CONTRACTOR under the Final Bill shall, without prejudice to the claims of the CONTRACTOR included in the Final Bill in accordance with the provisions of clause 56.4.2 of GCC, be deemed to be in full and final settlement of all such dues to the CONTRACTOR notwithstanding any qualifying remarks, protest or condition imposed or purported to be imposed by the CONTRACTOR related to the acceptance of such payment, with the intent that upon acceptance by the CONTRACTOR of any payment made as aforesaid, the CONTRACT (including the arbitration clause) shall stand discharged and extinguished insofar as relates to and/or concerns the entitlements of the CONTRACTOR under the CONTRACT except for the CONTRACTOR's right, if any, to receive payment in respect of his notified claims included in his Final Bill and the right to receive payment of the unadjusted balance of the Contract Performance Security in accordance with the provisions of Clause 56.10.3 on successful completion of the DEFECT LIABILITY PERIOD. However, nothing herein stated shall affect the CONTRACTOR's undischarged liabilities and obligations under the CONTRACT.

56.9.2 The acceptance by the CONTRACTOR of any amount paid by the OWNER to the CONTRACTOR in respect of the notified claims of the CONTRACTOR included in the Final Bill, in settlement of the claims of the CONTRACTOR, shall be deemed to be in full and final settlement of all claims of the CONTRACTOR and, the CONTRACT shall stand discharged and extinguished insofar as relates to and/or concerns the claims of the CONTRACTOR except for the CONTRACTOR's rights to receive payments of the unadjusted balance, if any, of the Contract Performance Security in accordance with clause 56.10.3.0 hereof on successful completion of the DEFECT LIABILITY PERIOD. However, nothing herein stated shall affect the CONTRACTOR's undischarged liabilities and obligations under the CONTRACT.

56.9.3 Notwithstanding anything provided in Clause 56.9.1 and/or Clause 56.9.2, the CONTRACTOR shall be and remain liable for defects in terms of DEFECT LIABILITY PERIOD and associated clause thereunder and for any indemnity to the OWNER in terms of Clause 56.10.2 and shall be and remain entitled to receive the unadjusted balance of the Contract Performance Security remaining in the hands of the OWNER in terms of Clause 56.10.3 and associated clauses thereunder.

56.10.0 Deleted

56.11 CLAIMS OF OWNER

56.11.1 The release/payment of any unadjusted balance of the Contract Performance Security (furnished in the form of a Bank Guarantee or otherwise) by the OWNER to the CONTRACTOR as aforesaid or otherwise shall not be deemed or treated as a waiver of any right(s) or claim(s) of the OWNER existing before the issuance of the FINAL ACCEPTANCE CERTIFICATE or shall not stop or prevent the OWNER from thereafter making or enforcing any claim or any rights existing before the issuance of the FINAL ACCEPTANCE CERTIFICATE against the CONTRACTOR with the intent that the claims of the OWNER, against the CONTRACTOR shall continue to survive and shall not get extinguished notwithstanding the issue of FINAL ACCEPTANCE CERTIFICATE and/or the release of Contract Performance Security to the CONTRACTOR.

57.0 UNDERGROUND OBSTRUCTIONS

The soil investigation report furnished in the NIT is indicative only and is enclosed purely for information/guidance purpose to the bidders. The contractor shall carry out its own detailed soil investigation for the proposed plant. Design of the foundation system of the plant shall be based, only on the site specific report. Nothing extra shall be paid in case of any variation arising out of the soil report conducted by the bidders and the data given in the tender. In the event, CONTRACTOR encounters any underground obstructions, the same shall be removed by CONTRACTOR without any extra cost implications to the OWNER.

In the event, CONTRACTOR encounters any underground obstruction which entails cost implication to the CONTRACTOR, the OWNER shall consider to compensate the CONTRACTOR reasonable cost compensation and/or time extension, depending on merit of the case after mutual discussion. The decision of the ENGINEER-IN-CHARGE in this regard shall be in writing and shall be final and binding upon the CONTRACTOR. It is clarified that in case the CONTRACTOR disagrees with the decision of ENGINEER-IN-CHARGE, the dispute shall be settled as per the provision of clause 39 of GCC.

57.1 ARTICLES OF VALUE FOUND:

All gold, silver and other minerals of any description and all precious stones, coins, treasure relics, antiquities and other similar things which shall be found in, under or upon the SITE, shall be the property of the OWNER and the CONTRACTOR shall duly preserve the same to the satisfaction of the ENGINEER-IN-CHARGE and shall from time to time deliver the same to such person or persons indicated by the OWNER.

58.0 REGISTRATION OF THE CONTRACTOR WITH STATUTORY AUTHORITIES

Within 30 days of execution of the CONTRACT, the CONTRACTOR shall, insofar as necessary, register itself at their own cost with the applicable statutory authorities as required under the rules and regulations governing in India. The CONTRACT PRICE shall be deemed to include all costs towards the same. A copy of all documents related to all such registration shall be submitted to OWNER for record.

59.0 STATUTORY OBLIGATIONS

59.1 CONTRACTOR shall comply with the requirements of statutory provisions and shall be solely responsible for fulfilment of all legal obligations under Contract Labour (Regulation and Abolition) Act, Inter-state Migrant Workmen (Registration of Employment and Condition of Service) Act, Payment of Wages Act, Workmen Compensation Act, Factories Act, Employees Provident Fund and Misc. Provisions Act, Payment of Bonus Act, Payment of Gratuity Act, Industrial Disputes Act and all other applicable Industrial/Labour enactment and Rules made there under as applicable from time to time. In case OWNER incurs any liability towards payment of any kind whatsoever, due to non-fulfilment of statutory provisions under any industrial/labour law by CONTRACTOR, the same shall be made good by CONTRACTOR.

59.2 SUB-CONTRACTOR engaged by CONTRACTOR for performing civil and erection work/other jobs at SITE shall have PF Code No. in its name issued by Regional Provident Fund Commissioner (RPFC).

59.3 The CONTRACTOR shall ensure that the SUB-CONTRACTOR shall comply with the Statutory Requirements, as applicable, for the execution of this CONTRACT.

60.0 UTILISATION OF LOCAL RESOURCES

60.1 The CONTRACTOR shall ascertain the availability of local SUB-CONTRACTORS and skilled/unskilled manpower and engage them to the extent possible for performance of the WORKS.

60.2 The CONTRACTOR shall not recruit personnel of any category from among those who are already employed by the other agencies working at the site, but shall make maximum use of local labour available.

61.0 FUEL REQUIREMENT OF WORKERS

The CONTRACTOR shall be responsible to arrange for the fuel requirement of his workers and staff without resorting to cutting of trees and shrubs. Cutting of trees and shrubs is strictly prohibited for this purpose. The CONTRACTOR shall abide by the conditions put forth by the Environmental Clearance for the SITE as regards to construction workers.

62.0 SURPLUS MATERIAL

Notwithstanding anything provided elsewhere, all surplus materials shall be dealt as follows:

62.1 Any balance Indigenous/imported surplus MATERIALS including scrap shall belong to the CONTRACTOR upon completion of the WORKS and will be allowed to be taken back by CONTRACTOR after compliance of statutory formalities.

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62.2 For taking out balance indigenous/imported surplus MATERIALS as mentioned above upon the completion of the project, the CONTRACTOR shall have to furnish proof of entry and ownership of such MATERIALS inside the SITE, certification of ENGINEER-IN-CHARGE and OWNER in this regard.

62.3 Following clause will apply only in case of applicability of concessional custom duty (presently, there is no applicability of concessional custom duty):

All imported surplus materials other than CONSTRUCTION EQUIPMENT which is brought to the SITE shall be the OWNER's property and shall be returned by the CONTRACTOR to the OWNER's designated stores. All such materials shall be subject to reconciliation and a proper accounting procedure shall be developed and strictly followed by the CONTRACTOR recorded in the inspection reports, proforma of which will be approved by the ENGINEER-IN-CHARGE. These reports shall form part of the completion DOCUMENTS. Inspection and acceptance of the WORK shall not relieve the CONTRACTOR from any of his responsibilities under this CONTRACT. However, indigenous Surplus Material as certified by the OWNER will be allowed to be taken back by Contractor after compliance of statutory formalities.

63.0 COORDINATION WITH OTHER AGENCIES

63.1 CONTRACTOR shall be responsible for proper coordination with other agencies operating at the site so that WORK may be carried out concurrently, without any hindrance to others. The ENGINEER-IN-CHARGE shall resolve disputes, if any, in this regard, and his decision shall be final and binding on the CONTRACTOR.

63.2 If and when required for the coordination of the WORKS with other agencies involved at SITE, the CONTRACTOR shall within the scope of work, re-route and/or prepare approaches and working areas as may be necessary.

64.0 ERECTION OF EQUIPMENT

All erection shall be carried out by deploying a crane(s) of suitable capacity. Erection by derrick shall not be permissible. The CONTRACTOR shall submit erection schemes for erection of critical equipment to ENGINEER-IN-CHARGE for his APPROVAL. No EQUIPMENT shall be erected in the absence of an approved erection scheme for such EQUIPMENT.

The quoted rates of the CONTRACTOR shall be deemed to include load testing of the crane as required to establish the lifting capacity of the crane.

65.0 ELECTRICAL CONTRACTOR'S LICENCE

65.1 The CONTRACTOR or its nominated SUB-CONTRACTOR(s), as the case may be, shall have a valid electrical contractor's license for working in the State in which the job site is located. The CONTRACTOR shall furnish a copy of the same to ENGINEER-IN-CHARGE before commencement of any electrical work or work pertaining to Electrical System.

65.2 No electrical work or work pertaining to electrical system(s) shall be permitted to be executed without a valid Electrical Contractors License being produced by the CONTRACTOR or SUB-CONTRACTOR, as the case may be, intending to execute the WORK.

66.0 RENTS & ROYALTIES

Unless otherwise specified, the CONTRACTOR shall pay all tonnage and other royalties, rents and other payments or compensation (if any) for getting stone, sand, gravel, clay, bricks or other materials required for the WORKS or any temporary works.

67.0 GOVERNMENT OF INDIA NOT LIABLE

It is expressly understood and agreed by and between the CONTRACTOR and the OWNER that the OWNER is entering into this agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood and agreed that the Government of India is not a party to this agreement and has no liabilities, obligations or rights thereunder. It is expressly understood and agreed that the OWNER is an independent legal entity with power and authority to enter into contracts, solely in its own behalf under the applicable laws of India and general principles of Contract. The CONTRACTOR expressly agrees, acknowledges and understands that the OWNER is not an agent, representative or delegate of the Government of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions commissions, breaches or other wrongs arising out of the CONTRACT. Accordingly, CONTRACTOR hereby expressly waives, releases and foregoes any and all actions or claims, including cross claims or counter claims against the Government of India arising out of this CONTRACT and covenants not to sue the Government of India on

any matter, claim, and cause of action or thing whatsoever arising of or under this CONTRACT.

68.0 SITE CLEANING

The CONTRACTOR shall take care to keep clean the job site at all times for easy access to the job site and also from the safety point of view in accordance with the CONTRACT requirements.

69.0 ACCESS TO SITE

69.1 The CONTRACTOR shall at his own cost and initiative arrange for and provide any access to the work area and stringing or other yards for labour, EQUIPMENT and MATERIAL as may be necessary for any cause in addition to the ingress and egress available. Any arrangements in respect thereof as may be entered into by the CONTRACTOR with any person interested in the land through which access is sought, shall be in writing and a copy of the writing (certified by or on behalf of the CONTRACTOR to be true copy thereof) shall forthwith be lodged with the OWNER. Such a writing shall specifically stipulate that the OWNER shall not be responsible for any claims under the CONTRACT or for any damage, loss or injury to the land or any material, item or thing thereon or in, and the CONTRACTOR shall keep the OWNER indemnified from and against any claim, action or proceedings in respect thereof.

69.2 The CONTRACTOR shall at his own cost and initiative arrange for and obtain all necessary permissions, permits, consents and licenses as may be necessary to transport the MATERIALS, tools, EQUIPMENT, machinery and labour along or across any highway, roadway, or other way, or railway, tramway, bridge, dyke, dam or embankment, or lake, pond, canal, river, state terminal toll octroi, or other line, border or barrier. Traffic study if required, shall be carried out by CONTRACTOR independently without any liability on OWNER.

70.0 INDEPENDENT CONTRACTOR

70.1 Neither CONTRACTOR nor any SUB-CONTRACTOR nor the employees, agents or representative of either shall be deemed to be employees, agents or representative of the OWNER in the performance of the CONTRACT.

71.0 PAYEMENT TO THE SUB-CONTRACTOR

CONTRACTOR shall indemnify and hold harmless OWNER for any claim brought by SUBCONTRACTOR against OWNER in relation to CONTRACTOR's payment obligations for the relevant purchase orders and sub-contracts.

71.1 CONTRACTOR agrees that he shall furnish to OWNER, if requested, satisfactory evidence that all SUB-CONTRACTORS, including vendor to CONTRACTOR have been paid on the time and in full for work done or goods supplied, in connection with the performance of the WORK.

71.2 If evidence is not supplied, then the OWNER shall not be bound to make any further payment to CONTRACTOR for that part of work until it is paid by CONTRACTOR.

71.3 CONTRACTOR shall notify OWNER of any dispute of any kind between CONTRACTOR and any of his SUB-CONTRACTOR or vendors stating the nature of dispute, the amount of any payment which is being withheld by CONTRACTOR, the reasons thereof and the CONTRACTOR's plan to settle the dispute.

72.0 ORDER OF WORKS / PERMISSION / RIGHT OF ENTRY / CARE OF EXISTING SERVICES

CONTRACTOR is required to submit to OWNER the various details with respect to their personnel(s) to be deputed for the execution of WORK such as name(s), nationality and passport details in case of Foreign Nationals (Passport No., Date of Issue, Date of Expiry etc.). These details are required for granting permission to enter and work in the existing fertilizer complex. The OWNER reserves the right to declare any person(s) as non grata. No claim whatsoever shall be entertained by OWNER on this account.

OWNER shall have the right to object to any Representative or personnel deputed to India by CONTRACTOR for execution of WORK or in connection with WORK, due to their misconduct or breach of law and regulation or who are found to be incompetent or negligent. CONTRACTOR shall remove such persons from SITE forthwith and take immediate action for replacement at no cost to OWNER.

73.0 GIFTS, COMMISSIONS, ETC.

Any gift, commission or advantage given, promised or offered by or on behalf of the CONTRACTOR or his partner, agent, officers, directors, employee or servant or anyone on his or their behalf in relation to the obtaining or to the execution of this or any other contract with the OWNER, shall in addition to any criminal liability which it may incur, subject the CONTRACTOR to the cancellation of this and all other contracts and also the payment of any loss or damage to the OWNER resulting from any cancellation. The OWNER shall then be entitled to deduct the amounts so payable from any monies otherwise due to the CONTRACTOR under the CONTRACT.

74.0 LABOUR LAWS- PF, EPF AND ESI

74.1 The CONTRACTOR shall obtain necessary license from the Licensing Authority under the Contract Labour (Regulation & Abolition) Act 1970 and the Central Rules framed there under and produce the same to the ENGINEER-IN-CHARGE before start of WORK.

74.2 The CONTRACTOR shall not undertake or execute or permit any other agency or SUB-CONTRACTOR to undertake or execute any work on the CONTRACTOR'S behalf through contract labour except under and in accordance with the license issued in that behalf by the Licensing Officer or other authority prescribed under the Factories Act or the contract labour (Regulation & Abolition) Act 1970 or their applicable lay, rule or regulation, if applicable.

74.3 The provision of EPF & MP Act, 1952 and Rules scheme there under shall be applicable to the CONTRACTOR and the employees engaged by him for the WORK. The CONTRACTOR shall furnish the code number allotted by the RPFC Authority, to the ENGINEER-IN-CHARGE before commencing the WORK.

74.4 The CONTRACTOR shall be exclusively responsible for any delay in commencing the work on account of delay in obtaining a license under clause 74.1 above or in obtaining the code number under clause 74.3 above and the same shall not constitute a ground for extension of time for any purpose.

74.5 The CONTRACTOR shall enforce the provisions of ESI Act and Scheme framed from time to time there under with regard to all his employees involved in the performance of the CONTRACT and shall deduct employee's contribution from the wages of each of the employees and shall deposit the same together with employer's contribution of such total wages payable to the employees in the appropriate account.

74.6 All liabilities like salaries, wages and other statutory obligations in respect of the persons engaged by the CONTRACTOR shall be borne by the CONTRACTOR during the period

of agreement. In view of the provisions of the ESI Act, PF and EPF Act and other Acts, as may be applicable to OWNER, the CONTRACTOR shall take necessary steps to cover its employees under the said enactments and shall submit proof of such compliance to ENGINEER-IN-CHARGE periodically or at any date upon such request, as may be made by ENGINEER-IN-CHARGE to the CONTRACTOR. In the event of non-compliance with the statute or the provisions thereof, referred to above, it shall be open to OWNER to withhold such amount as in its opinion is due and payable by the CONTRACTOR in respect of its employees from and out of dues, payable by OWNER to the CONTRACTOR and such due shall be held by OWNER with it until proof is submitted by the CONTRACTOR to OWNER indicating compliance with such statutes within reasonable time, failing which OWNER shall deposit such amounts with the authorities concerned on behalf of the CONTRACTOR and inform the CONTRACTOR of such deposit or deposits.

75.0 GENERAL PROVISIONS

75.1 Confidential Information

75.1.1 **Non-disclosure**

Each party agrees to hold in confidence any information imparted to it or in the case of CONTRACTOR, to any of its SUB- CONTRACTOR / VENDOR, by the other Party which pertains to that other party's business activity in any manner, and which is not be subject of general public knowledge, including, without limitation, proprietary processes, technical information and know-how, information concerning other projects, management policies, economic policies, financial and other data and the like. The preceding non-disclosure requirements shall not apply to:

i) Information furnished without restriction by the other Party prior to the date hereof
ii) Information in the public domain; or
iii) Information obtained by a Party from a third Person not under obligation of non-disclosure to the other party.
(iv) Information required to be disclosed in pursuance of an order, judgement, decree of the Court, Tribunal or Statutory Authority.

75.1.2 **Disclosure to Govt. Agency**

Either Party may disclose any such information to the extent that such Party is required by any Government Agency to make such disclosure. In addition, OWNER may disclose such information to the extent that such disclosure is required by any Lender / Lender's Representative, etc. provided that such Lenders signed a confidentiality agreement containing confidentiality and limited use obligations not less stringent than those accepted by OWNER under the CONTRACT and License Agreement, if any and such parties are not competitor of CONTRACTOR or its Licensors.

75.1.3 Upon completion of the Works or in the event of termination pursuant to the provisions of the CONTRACT, CONTRACTOR shall immediately return to the OWNER all drawings, plans, specifications and other documents supplied to the CONTRACTOR by or on behalf of the OWNER or prepared by the CONTRACTOR solely for the purpose of the performance of the WORKS, including all copies made thereof by the CONTRACTOR.

75.1.4 This clause shall survive and remain in full force for a period of ten years following the issue of FINAL ACCEPTANCE CERTIFICATE.

75.2 **Cut-Off Dates**

No claims or correspondence on claims on this CONTRACT shall be entertained by either parties after 6 months after expiry of the Contract Performance Security unless specified otherwise in CONTRACT.

75.3 **Recovery of Sums / Dues**

75.3.1 All costs, damages or expenses which OWNER may have incurred, for which CONTRACTOR is liable under CONTRACT, shall be notified to CONTRACTOR and shall be recovered by OWNER from any payment due to or becoming due to CONTRACTOR under this CONTRACT or other CONTRACT and/or shall be recovered by action at law or otherwise. If the payment due to CONTRACTOR is not sufficient for recovery of the said sums/dues, CONTRACTOR shall pay immediately to OWNER such sums/dues or the balance sums/dues on demand.

75.3.2 All MUTUALLY AGREED DAMAGES applicable and to be recovered from CONTRACTOR under CONTRACT, shall be recovered by OWNER from any payment due to or becoming due to CONTRACTOR under this CONTRACT or other CONTRACT and/or shall be recovered by action at law or otherwise. If the payment due to CONTRACTOR is not sufficient for recovery of the said MUTUALLY AGREED DAMAGES, CONTRACTOR shall pay immediately to OWNER such MUTUALLY AGREED DAMAGES. or the balance MAD on demand.

75.3.3 For avoidance of doubt all the rights and remedies of OWNER/CONTRACTOR and liabilities of the CONTRACTOR/OWNER as set out in the CONTRACT shall be to the exclusion of any other rights, remedies or liabilities available at law.

75.4 **Payments etc. not to affect rights of OWNER**

No sum paid on account by OWNER nor any extension of the date for completion granted by OWNER shall affect or prejudice the rights of OWNER against CONTRACTOR or relieve CONTRACTOR of its obligation for the faithful performance of CONTRACT.

75.5 **Site Working and Safety Conditions**

CONTRACTOR shall follow the SITE working and safety conditions enclosed as Section VI-13.

75.6 **Miscellaneous**

75.6.1 No CONTRACT or understanding in any way modifying the conditions of CONTRACT shall be binding upon either parties hereto unless made in writing and approved by both parties.

75.6.2 Without prejudice to FORCE MAJEURE, CONTRACTOR shall, during inclement weather, carry out WORK in accordance with CONTRACT and CONTRACTOR shall not be entitled to any additional payment over and above the CONTRACT PRICE payable under CONTRACT by reason of its being unable to carry out WORK owing to inclement weather.

76.0 Implementation of Apprentices act 1961

The CONTRACTOR shall comply with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the CONTRACT and the ENGINEER-IN-CHARGE may, at his discretion, cancel the CONTRACT. The CONTRACTOR shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions, of the Act.

77.0 Change in constitution

Where the CONTRACTOR is a partnership firm, the prior approval of the OWNER shall be obtained in writing, before any change is made in the constitution of the firm. Where the CONTRACTOR is an individual or a Hindu undivided family business concern, such approval as aforesaid shall, likewise be obtained before such CONTRACTOR enters into any agreement with other parties, where under, the reconstituted firm would have the right to carry out the work hereby undertaken by the CONTRACTOR. In either case if prior approval as aforesaid is not obtained, the CONTRACT shall be deemed to have been allotted in contravention of clause 12 of GCC and the same action may be taken and the same consequence shall ensure as provided in the said clause.

78.0 Access by Road

CONTRACTOR, if necessary, shall build other temporary access roads to the actual site of construction for his own work at his own cost. The CONTRACTOR shall be required to permit the use of the roads so constructed by him for vehicles of any other parties who may be engaged on the project site. The CONTRACTOR shall also facilitate the construction of the permanent roads should the construction there of start while he is engaged on this work. He shall make allowance in his tender for any inconvenience he anticipates on such account. Non-availability of access roads, railway siding and railway wagons for the use of the CONTRACTOR shall in no case condone any delay in the execution of WORK nor be the cause for any claim for compensation against the OWNER.

79.0 Members of the OWNER not individually liable

No Director, or official or employee of the OWNER/ PMC shall in any way be personally bound or liable for the acts or obligations of the OWNER under the CONTRACT or answerable for any default or omission in the observance or performance of any of the acts, matters or things which are herein contained.

80.0 OWNER not bound by personal representations

The CONTRACTOR shall not be entitled to any increase on the scheduled rates or any other right or claim whatsoever by reason of any representation, explanation statement or alleged representation, promise or guarantees given or alleged to have been given to him by any person.

81.0 Land for Contractor's Field Office, Godown and Workshop

The OWNER will, at his own discretion and convenience and for the duration of the execution of the work make available near the site, land for construction of CONTRACTOR's Temporary Field Office, godowns workshops and assembly yard required for the execution of the CONTRACT. The CONTRACTOR shall at his own cost construct all these temporary buildings and provide suitable water supply and sanitary arrangement and get the same approved by the ENGINEER-IN-CHARGE. On completion

of the works undertaken by the CONTRACTOR, he shall remove all temporary works erected by him and have the SITE cleaned as directed by ENGINEER-IN-CHARGE. If the CONTRACTOR shall fail to comply with these requirements, the ENGINEER-IN-CHARGE may at the expenses of the CONTRACTOR remove such surplus, and rubbish materials and dispose-off the same as he deems fit and get the site cleared as aforesaid; and CONTRACTOR shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such surplus materials disposed off as aforesaid. But the OWNER reserves the right to ask the CONTRACTOR any time during the pendency of the CONTRACT to vacate the land by giving 7 days' notice on security reasons or on national interest or otherwise. Rent may be charged for the land so occupied from contractor by the OWNER. The CONTRACTOR shall put up temporary structures as required by them for their office, fabrication shop and construction stores only in the area allocated to them on the project site by the OWNER or his authorized representative. No tea stalls/canteens should be put up or allowed to be put up by any CONTRACTOR in the allotted land or complex area without written permission of the OWNER. Un-authorized buildings, constructions or structures should not be put up by the CONTRACTOR anywhere on the project site. For uninterrupted fabrication work, the CONTRACTOR shall put up temporary covered structures at his cost within Area in the location allocated to them in the project site by the OWNER or his authorized representative. No person except for authorized watchman shall be allowed to stay in the plant area/CONTRACTOR's area after completion of the day's job without prior written permission from ENGINEER-IN-CHARGE.

82.0 Rounding-Off of Amounts

In calculating the amount of each item due to the CONTRACTOR in every certificate prepared for payment, sum of less than 50 paise shall be omitted and the total amount on each certificate shall be rounded off to the nearest rupees, i.e., sum of less than 50 paise shall be omitted and sums of 50 paise and more upto one rupee shall be reckoned as one rupee.

83.0 Deleted

84.0 Work In Monsoon and Dewatering

(i) Unless otherwise specified elsewhere in the tender, the execution of the WORK may entail working in the monsoon also. The CONTRACTOR must maintain a minimum labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon.

(ii) During monsoon and other period, it shall be the responsibility of the CONTRACTOR to keep the construction work site free from water at his own cost.

85.0 General conditions for construction and erection work:

(i) The working time at the site of work is 48 hours per week. Overtime work is permitted in cases of need and the OWNER will not compensate the same. Shift working at 2 or 3 shifts per day will become necessary and the CONTRACTOR should take this aspect into consideration for formulating his rates for quotation. No extra claims will be entertained by the OWNER on this account. No extra claims will be entertained by the OWNER on this account. For carrying out work beyond working hours the CONTRACTOR will approach the ENGINEER-IN-CHARGE or his authorized representative and obtain his prior written permission.

(ii) The CONTRACTOR must arrange for the placement of workers in such a way that the delayed completion of the WORK or any part thereof for any reason whatsoever will

not affect their proper employment. The OWNER will not entertain any claim for idle time payment whatsoever.

(iii) The CONTRACTOR shall submit to the OWNER/ENGINEER-IN-CHARGE reports at regular intervals regarding the state and progress of WORK. The details and proforma of the report will mutually be agreed after the award of CONTRACT. The CONTRACTOR shall provide display boards showing progress and labour strengths at worksite, as directed by the ENGINEER-IN-CHARGE.

86.0 Action where no specification is issued

In case of any class of WORK for which there is no SPECIFICATION supplied by the OWNER as mentioned in the Tender Documents such WORK shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same, the WORK should be carried out as per standard Engineering Practice subject to the approval of the ENGINEER-IN-CHARGE.

87.0 Care of Works:

i) From the commencement to completion of the WORK, the CONTRACTOR shall take full responsibility for the care for all works including all temporary works and in case any damages, loss or injury shall happen to the WORK or to any part thereof or to any temporary works from any cause whatsoever, shall at his own cost repair and make good the same so that at completion the WORK shall be in good order and in conformity in every respects with the requirement of the CONTRACT and the ENGINEER-IN-CHARGE's instructions**.**

ii) **Defects Prior To Taking Over**: If at any time, before the WORK is taken over, the ENGINEER-IN-CHARGE shall: a) Claim that any works done or materials used by the CONTRACTOR or by any SUB-CONTRACTOR is defective or not in accordance with the CONTRACT, or that the works or any portion thereof are defective, or do not fulfill the requirements of CONTRACT (all such matters being hereinafter, called `Defects' in this clause), and b) As soon as reasonably practicable, gives to the CONTRACTOR notice in writing of the said decision, specifying particulars of the defects alleged to exist or to have occurred, then the CONTRACTOR shall at his own expenses and with all speed make good the defects so specified. In case CONTRACTOR shall fail to do so, the OWNER may take, at the cost of the CONTRACTOR, such steps as may in all circumstances, be reasonable to make good such defects. The expenditure so incurred by the OWNER will be recovered from the amount due to the CONTRACTOR. The decision of the ENGINEER-IN-CHARGE with regard to the amount to be recovered from the CONTRACTOR will be final and binding on the CONTRACTOR. As soon as the WORK has been completed in accordance with the CONTRACT (except in minor respects that do not affect their use for the purpose for which they are intended and except for maintenance thereof provided in clause 3.0 (22) of General Conditions of Contract) and have passed the tests on completion, the ENGINEER-IN-CHARGE shall issue a certificate (hereinafter called Completion Certificate) in which he shall certify the date on which the WORK have been so completed and have passed the said tests and the OWNER shall be deemed to have taken over the WORK on the date so certified. If the WORK has been divided into various groups in the CONTRACT, the OWNER shall be entitled to take over any group or groups before the other or others and there upon the ENGINEER-IN-CHARGE shall issue a Completion Certificate which will, however, be for such group or groups so taken over only. In such an event if the group /section/

part so taken over is related, to the integrated system of the work, notwithstanding date of grant of Completion Certificate for group/ section/ part.

iii) **Defects After Taking Over**: In order that the CONTRACTOR could obtain a COMPLETION CERTIFICATE he shall make good, with all possible speed, any defect arising from the defective materials supplied by the CONTRACTOR or workmanship or any act or omission of the CONTRACT or that may have been noticed or developed, after the works or groups of the works has been taken over, the period allowed for carrying out such WORK will be normally one month. If any defect is not remedied within a reasonable time, the OWNER may proceed to do the WORK at CONTRACTOR's risk and expense and deduct from the final bill such amount as may be decided by the OWNER. If by reason of any default on the part of the CONTRACTOR a COMPLETION CERTIFICATE has not been issued in respect of any portion of the WORK within one month after the date fixed by the CONTRACT for the completion of the WORK, the OWNER shall be at liberty to use the WORK or any portion thereof in respect of which a completion certificate has not been issued, provided that the WORK or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completing these works for the issue of Completion Certificate.

iv) COMPLETION CERTIFICATE' where ever mentioned shall be read as 'PRELIMINARY ACCEPTANCE CERTIFICATE'

88.0 Field Management & Controlling / Coordinating Authority:

i) The field management will be the responsibility of the ENGINEER-IN-CHARGE, who will be nominated by the OWNER. The ENGINEER-IN-CHARGE may also authorize his representatives to assist in performing his duties and functions.

ii) The ENGINEER-IN-CHARGE shall coordinate the works of various agencies engaged at site to ensure minimum disruption of work carried out by different agencies. It shall be the responsibility of the CONTRACTOR to plan and execute the work strictly in accordance with site instructions to avoid hindrance to the work being executed by other agencies.

89.0 Local Conditions:

i) It will be imperative on each tenderer to inform himself of all local conditions and factors which may have any effect on the execution of WORK covered under the Tender Document. In their own interest, the tenderer are requested to familiarize themselves with the Indian Income Tax Act 1961, Indian Companies Act 1956/2013, Indian Customs Act 1962 and other related Acts and Laws and Regulations of India with their latest amendments, as applicable. TFL shall not entertain any requests for clarifications from the tenderer regarding such local conditions.

ii) It must be understood and agreed that such factors have properly been investigated and considered while submitting the tender. No claim for financial or any other adjustments to VALUE OF CONTRACT, on lack of clarity of such factors shall be entertained.

90.0 Special Conditions of Contract:

i) Special Conditions of Contract (SCC) shall be read in conjunction with the General Conditions of Contract (GCC), specification of Work, Drawings and any other documents forming part of this CONTRACT wherever the context so requires.

ii) Notwithstanding the sub-division of the documents into these separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the CONTRACT so far as it may be practicable to do so.

iii) Where any portion of the General Condition of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, unless a different intention appears the provisions of the Special Conditions of Contract shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.

iv) Wherever it is mentioned in the specifications that the CONTRACTOR shall perform certain WORK or provide certain facilities, it is understood that the CONTRACTOR shall do so at his cost and the VALUE OF CONTRACT shall be deemed to have included cost of such performance and provisions, so mentioned.

v) The materials, design and workmanship shall satisfy the relevant INDIAN STANDARDS, the JOB SPECIFICATIONS contained herein and CODES referred to. Where the job specification stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

91.0 POWER OF ENTRY:

1) If the CONTRACTOR shall not commence the WORK in the manner previously described in the CONTRACT documents or if he shall at any time in the opinion of the ENGINEER-IN-CHARGE -

i) fail to carry out the WORK in conformity with the CONTRACT documents, or

ii) fail to carry out the WORK in accordance with the Time Schedule, or

iii) substantially suspend work or the WORK for a period of fourteen days without authority from the ENGINEER-IN-CHARGE, or

iv) fail to carry out and execute the WORK to the satisfaction of the ENGINEER-IN-CHARGE, or

v) fail to supply sufficient or suitable construction plant, temporary works, labour, materials or things, or

vi) Commit, suffer, or permit any other breach of any of the provisions of the CONTRACT on his part to be performed or observed or persist in any of the above mentioned breaches of the CONTRACT for fourteen days, after notice in writing shall have been given to the CONTRACTOR by the ENGINEER-IN-CHARGE requiring such breach to be remedied, or

vii) if the CONTRACTOR shall abandon the WORK , or

viii) If the CONTRACTOR during the continuance of the CONTRACT shall become bankrupt, make any arrangement or composition with his creditors, or permit any execution to be levied or go into liquidation whether compulsory or voluntary not being merely a voluntary liquidation for the purpose of amalgamation or reconstruction

then in any such case, the OWNER shall have the power to enter upon the WORK and take possession thereof and of the materials, temporary WORK, construction plant, and stock thereon, and to revoke the CONTRACTOR's license to use the same, and to complete the WORK by his agents, other CONTRACTORS or workmen or to relate the same upon any terms and to such other person, firm or corporation as the OWNER in his absolute discretion may think proper to employ and for the purpose aforesaid to use or authorize the use of any materials, temporary work, CONSTRUCTION PLANT, and stock

as aforesaid, without making payment or allowance to the CONTRACTOR for the said materials other than such as may be certified in writing by the ENGINEER-IN-CHARGE to be reasonable, and without making any payment or allowance to the CONTRACTOR for the use of the temporary said works, construction plant and stock or being liable for any loss or damage thereto, and if the OWNER shall by reason of his taking possession of the WORK or of the WORK being completed by other CONTRACTOR (due account being taken of any such extra work or works which may or be omitted) then the amount of such excess as certified by the ENGINEER-IN-CHARGE shall be deducted from any money which may be due for work done by the CONTRACTOR under the CONTRACT and not paid for. Any deficiency shall forthwith be made good and paid to the OWNER by the CONTRACTOR and the OWNER shall have power to sell in such manner and for such price as he may think fit all or any of the construction plant, materials etc. constructed by or belonging to and to recoup and retain the said deficiency or any part thereof out of proceeds of the sale.

92.0 LIENS:

1) If, at any time there should be evidence or any lien or claim for which the OWNER might have become liable and which is chargeable to the CONTRACTOR, the OWNER shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the OWNER against such lien or claim and if such lien or claim be valid, the OWNER may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the CONTRACTOR. If any lien or claim remain unsettled after all payments are made, the CONTRACTOR shall refund or pay to the OWNER all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses. OWNER reserves the right to do the same.

2) The OWNER shall have lien on all materials, equipments including those brought by the CONTRACTOR for the purpose of erection, testing and commissioning of the WORK.

3) The final payment shall not become due until the CONTRACTOR delivers to the ENGINEER-IN-CHARGE a complete release or waiver of all liens arising or which may arise out of his agreement or receipt in full or certification by the CONTRACTOR in a form approved by ENGINEER-IN-CHARGE that all invoices for labour, materials, services have been paid in lien thereof and if required by the ENGINEER-IN-CHARGE in any case an affidavit that so far as the CONTRACTOR has knowledge or information the releases and receipts include all the labour and material for which a lien could be filled.

4) CONTRACTOR will indemnify and hold the OWNER harmless, for a period of two years after the issue of FINAL ACCEPTANCE CERTIFICATE, from all liens and other encumbrances against the OWNER on account of debts or claims alleged to be due from the CONTRACTOR or his SUB-CONTRACTOR to any person including SUB-CONTRACTOR and on behalf of OWNER will defend at his own expense, any claim or litigation brought against the OWNER or the CONTRACTOR in connection therewith. CONTRACTOR shall defend or contest at his own expense any fresh claim or litigation by any person including his SUB-CONTRACTOR, till its satisfactory settlement even after the expiry of two years from the date of issue of FINAL CERTIFICATE.

SECTION – V

SPECIAL CONDITIONS OF CONTRACT

CONTENT

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	GENERAL
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2.0	OWNER'S OBLIGATIONS
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23.0	PLANNING & DESIGNING IN PURVIEW OF VULNERABILITY ATLAS OF INDIA
24.0	STANDARD CONDITIONS OF SCC

GENERAL

The SPECIAL CONDITIONS OF CONTRACT shall be read in conjunction with the GENERAL CONDITIONS OF CONTRACT, specifications of work, DRAWINGS and any other document forming part of this CONTRACT wherever the context so requires.

Where any portion of the GENERAL CONDITIONS OF CONTRACT is repugnant to or at variance with any other provisions of the SPECIAL CONDITIONS OF CONTRACT, then unless a different intension appears, the SPECIAL CONDITIONS OF CONTRACT shall be deemed to over-ride the provisions of GENERAL CONDITIONS OF CONTRACT and shall prevail to the extent of such repugnancy or variations.

1.0 CONTRACTOR'S OBLIGATIONS

1.1.0 General Responsibility

1.1.1 The CONTRACTOR acknowledges that this CONTRACT is a Lumpsum turnkey contract and CONTRACTOR'S obligation hereunder, notwithstanding anything to the contrary contained herein, is to provide OWNER with fully operational PLANT, complete in all respects under and in accordance with the provision of CONTRACT, within the stipulated time and for the purpose designated herein by OWNER, and to do, furnish and provide everything necessary in connection therewith.

Without prejudice to the foregoing and except as otherwise expressly set forth in the CONTRACT as within the scope of OWNER's obligations under the CONTRACT, the CONTRACTOR shall perform or cause to be performed all WORK and services required in connection with the detailed design, engineering, manufacturing, supply of equipment, procurement(including, without limitation, all transportation services in connection therewith), Third Party Inspection (TPI) as applicable, testing, painting, Expediting, Site Survey and Condition Assessment, Insurance, Construction and Erection of all Civil & structural, Mechanical, Electrical and Instrumentation Works, Assembly and Installation of Equipments, obtaining all necessary Statutory Approvals, Pre-Commissioning, Commissioning including conductance of Plant trial runs , demonstration of guarantees & calibration and other work and services upto the PRELIMINARY ACCEPTANCE OF PLANT by the OWNER and in connection therewith provide all materials, equipment, machinery, tools, labour, transportation, administration and other services and items required to complete the PLANT in all respects upto the PRELIMINARY ACCEPTANCE OF PLANT and having the performance as guaranteed under the CONTRACT by the CONTRACTOR on a total, fixed price basis in accordance with this CONTRACT.

PLANT' for this NIT shall mean the 'FLARE SYSTEM' as defined in the Section VI of NIT.

The WORK shall, without prejudice to the generality of the foregoing or those enumerated in Clause 1.2.0 include but not be limited to the following:

(a) All engineering and design services including necessary investigation required for a completely engineered PLANT including necessary documentation;

(b) Provision of all equipment, systems, materials, processes, CONTRACTOR's EQUIPMENT, temporary works and all other items, whether of a temporary or permanent nature including those required for the design, erection, Pre-commissioning, commissioning, conducting of Plant trial runs and remedying of DEFECTS during DEFECT LIABILITY PERIOD.

(c) Transportation from works, port of entry and import clearance and handling services in and into India and inland transportation from the relevant points of delivery of EQUIPMENT required in connection with the completion of the PLANT, and the performance of the other WORK

(d) Project management.

(e) Receipt of EQUIPMENT at SITE including stores management.

(f) Construction infrastructure services, civil and structural construction; mechanical, electrical and instruments erection and installation services, inspection, testing and commissioning, Plant trial runs and PRELIMINARY ACCEPTANCE of PLANT including all relevant applicable permits, with CONTRACTOR having responsibility for overall co-ordination of permits required by the OWNER/ PMC and all training activities;

(g) Provision of all necessary superintendence, labour, construction fuels and construction chemicals, tools, supplies and other consumables and services;

Construction water (at one point within factory premises and CONTRACTOR to arrange the line upto their Battery Limit) and Construction Power (1 No. 415V feeder of 63A at Existing Substation Near 132 kV Switchyard and CONTRACTOR to arrange tap off Power from this feeder) shall be provided within 3 months of issuance of FOA on chargeable basis (presently @ of Rs 4.50/$m^3$for Construction Water and Rs 5.915/KWH for Construction Power. In case of any escalation by statutory authorities in the unit rates during execution of Contract, the same shall be borne by Contractor)

Utilities as defined in Technical part of Section VI-8.0 of NIT and shall be made available to the LSTK CONTRACTOR at one point of battery limit 2 months before scheduled Completion Period. However required utilities prior to this will be arranged by LSTK CONTRACTOR.

(h) Rectification of defects during DEFECT LIABILITY PERIOD.

1.1.2 CONTRACTOR shall provide services, for PLANT, in accordance with good engineering practice. CONTRACTOR shall provide services of engineers, designers, draftsmen, buyers, inspectors, expediters and other persons required for the performance of WORK pursuant to CONTRACT.

1.1.3 In the event that there is any item of EQUIPMENT or WORK of the type provided for in CONTRACT, which is not specifically mentioned in the specifications or drawings set out in FINAL PROPOSAL, but which is necessary (even though not mentioned in CONTRACT) for normal, safe and continuous operation of PLANT, CONTRACTOR shall include such item of EQUIPMENT in the design and perform such items of WORK, for such EQUIPMENT or WORK free of cost to OWNER as if the same had been originally included in its Scope of Work/FINAL PROPOSAL.

1.1.4 Subject to prior consent of OWNER/PMC, CONTRACTOR may make use of the services of SUB-CONTRACTOR/ VENDOR (approved in writing by the OWNER/PMC) in accordance with the provisions in CONTRACT provided, however, the CONTRACTOR shall remain responsible and liable for the work done by such SUB-CONTRACTOR/vendor.

1.1.5 The CONTRACTOR shall be responsible for obtaining necessary approvals which are to be issued in the CONTRACTOR's name from the various statutory authorities. All approvals/permissions other than Environment Clearance and Consent to Establish/Operate shall be obtained by the CONTRACTOR.

1.1.6 The CONTRACTOR shall provide necessary full technical assistance to OWNER/ PMC including follow-up for obtaining the necessary approvals to be issued in the name of OWNER from the various statutory authorities.

1.1.7 The CONTRACTOR shall furnish CONTRACT PERFORMANCE SECURITY as per the enclosed format in line with the provisions of bidding document.

1.1.8 The enumeration in subsequent Clauses of SPECIAL CONDITIONS OF CONTRACT, in GENERAL CONDITIONS OF CONTRACT and other documents of CONTRACT shall not in any manner limit the general scope of obligations and responsibilities of designing, engineering, procurement, supply, construction, commissioning, conducting Plant trial runs and proving the performance guarantees of PLANT within the scope of CONTRACT.

1.2.0 CONTRACTOR's Scope of Work

1.2.1 CONTRACTOR shall provide and be responsible for the tasks specified in this Clause under the following heads:

1.2.2 Deleted

1.2.3 Design & Engineering

1.2.3.1 CONTRACTOR shall provide all design and engineering services necessary for completion of the PLANTS in conformity with the CONTRACT and Good Engineering Practices and the NIT including but not limited to:

(a) Preparation of

- Project design book which shall form the basis of PLANT design;
- The conceptual design; and
- The engineering and design necessary to describe and detail the PLANT and the Project.

(b) Provision of criteria for the detailed design by other suppliers of equipment/system/structures for incorporation into the PLANTS.

(c) Preparation of design, engineering, drawings, plans, bill of material, schedule and estimates for the PLANT and the project and the performance by CONTRACTOR of its obligations hereunder so that the PLANT constructed and commissioned by the CONTRACTOR is capable of meeting the performance guarantees and will be such as could be legally, safely and reliably placed in commercial operation by the OWNER.

(d) CONTRACTOR shall perform the design and engineering for PLANT so that when constructed and commissioned, PLANT shall be capable of meeting the guarantees with respect to plant performance , and Pollution Level as guaranteed under CONTRACT and as per statutory norms and shall be reliable and safe and operable in accordance with the sound engineering practice. CONTRACTOR shall ensure design capacity of all sections of PLANT in accordance with CONTRACTOR's experience vis-a-vis as indicated in this NIT and expertise for obtaining a full throughput under varying conditions within the limits specified in CONTRACT. PLANT shall be designed so as to be capable of performing at full plant capacity when operated as specified in CONTRACT. CONTRACTOR shall review the basic design conditions and other conditions furnished by OWNER/ PMC in NIT. If CONTRACTOR observes any inconsistency or insufficiency in these data, CONTRACTOR shall bring to the notice of OWNER/ PMC the same, before its use.

1.2.4 Deleted

1.2.5 Codes and Standards

1.2.5.1 The engineering shall be performed and EQUIPMENT shall be manufactured and supplied according to acceptable international standards, as specified in the Technical Specification/FINAL PROPOSAL, meeting safety and other requirements of various national/international Codes and Regulations being in force as on submission of the FINAL PROPOSAL. The design of PLANT shall be based on the criteria enumerated in CONTRACT. However, it shall be CONTRACTOR's responsibility to follow all Indian Rules and Regulations as applicable.

CONTRACT shall comply with and shall cause the WORK and all components thereof (including, without limitation, the design and engineering of the PLANT) to comply with all APPLICABLE LAWS and APPLICABLE PERMITS as they may be in effect at the time of CONTRACTOR's performance under the CONTRACT.

The CONTRACTOR shall ensure that all actions on its behalf in connection with the WORKS shall be in compliance with applicable laws of India. The CONTRACTOR agrees to take all reasonable steps to ensure that Persons appointed by it in connection with the WORK shall comply with the applicable laws/ regulations/ guidelines and obligations.

1.2.6 **Drawings and Documents**

1.2.6.1 CONTRACTOR shall prepare or secure and furnish to OWNER/ PMC all data, specifications, drawings, plans and other documents as required/used for WORK as specified in Technical Specifications.

1.2.7 **Owner's/PMC Review**

1.2.7.1 ENGINEER-IN-CHARGE shall review all documents and give its comments to CONTRACTOR within 14 (Fourteen) working days from the date of receipt of the same. Review as aforesaid by OWNER/PMC and furnishing of comments by OWNER/PMC or the failure of OWNER/PMC to review or comment as aforesaid shall not relieve CONTRACTOR in any manner of its obligations including performance guarantees under this CONTRACT.

1.2.8 **Procurement Services**

1.2.8.1.1 As part of the WORK, CONTRACTOR shall procure and pay in CONTRACTOR's name as an independent contractor and not as agent for OWNER/ PMC, all CONTRACTOR and SUB-CONTRACTOR's labour, materials, equipment, supplies, soil, gravel and similar materials and manufacturing, fabrication and related services (whether on or off the PLANT Site) for construction and incorporation in the PLANT or which are otherwise required for completion of the WORK in accordance with the Specification and the CONTRACT and are not explicitly specified to be furnished by OWNER/ PMC pursuant to the terms and provisions of the CONTRACT including FINAL PROPOSAL.

1.2.8.1.2 CONTRACTOR shall procure and provide all EQUIPMENT required for PLANT. EQUIPMENT procured shall be according to specifications as set forth in the CONTRACT, proven record of performance and with suitable delivery time to meet the Contractual COMPLETION PERIOD. EQUIPMENT shall be procured from the vendor list agreed between CONTRACTOR and OWNER/ PMC.

ln connection with its procurement work, CONTRACTOR shall be responsible for the shipping, transportation and delivery of all items fabricated, manufactured, constructed or procured as set forth in the FINAL PROPOSAL and the CONTRACT. All such items and equipment, materials and supplies to be provided by the CONTRACTOR pursuant to the CONTRACT shall be new and of required quality, free from improper workmanship or defects and properly warranted or guaranteed in accordance with the CONTRACT. Any apparent omission or error in the equipment specifications will be corrected by the CONTRACTOR to the extent required by the CONTRACT.

1.2.8.2 **Equipment**

1.2.8.2.1 CONTRACTOR agrees that EQUIPMENT procured shall be strictly in accordance with the specifications as provided, however, that any apparent omission or error in the specifications will be corrected by CONTRACTOR if it is necessary for the functioning of EQUIPMENT. CONTRACTOR shall inform OWNER/ PMC for such omission or error or ambiguity in the specifications and corrections made for the same.

1.2.8.2.2 Completeness of EQUIPMENT shall be the responsibility of CONTRACTOR. Any fittings, accessories, etc. which may not be specifically mentioned in Technical Specifications but which is required for the satisfactory functioning of EQUIPMENT and realization of PERFORMANCE GUARANTEES shall be provided by CONTRACTOR without any extra cost.

1.2.8.2.3 CONTRACTOR shall ensure that the modern practices in the manufacture of high grade EQUIPMENT are followed notwithstanding any omission in the specifications.

1.2.8.2.4 The supplies including fittings, accessories, etc. shall be in strict compliance to the applicable specifications/codes/standards. Components for which no relevant standards exist, the same shall be designed and manufactured as per good engineering practices.

1.2.8.2.5 The true intent and meaning of this Clause is that CONTRACTOR shall in all respects design, engineer, ensure quality of manufacture and supply EQUIPMENT in a thorough workman like manner, within prescribed time and in accordance with good engineering practice in order to enable proper operation of EQUIPMENT and PLANT.

1.2.8.2.6 CONTRACTOR shall furnish drawings and documents of EQUIPMENT as described in Technical part, Section VI. These documents shall include but not limited to technical documents, final drawings, preservation instructions, operation and maintenance manuals, test certificates, spare parts catalogues, etc. in a bound book for all rotating EQUIPMENT and in a folder for other EQUIPMENT, before despatch of EQUIPMENT under intimation to OWNER/ PMC.

1.2.8.2.7 The documents, required for statutory approvals once submitted during construction period by CONTRACTOR shall be firm and final and not subject to subsequent changes unless such subsequent changes are approved by statutory agencies. CONTRACTOR shall be responsible for any payment of penalty as imposed by the Statutory Agencies consequent to furnishing of any incorrect data/drawings.

1.2.8.2.8 All dimensions and weights shall be in metric system.

1.2.8.2.9 EQUIPMENT to be supplied and WORK to be carried out under CONTRACT shall conform to and comply with the provision of relevant Regulations/Acts (or both) as may be applicable in the State of ODISHA and in India to the type of EQUIPMENT/ WORK carried out and necessary certificates shall be furnished.

1.2.8.2.10 CONTRACTOR shall provide cross sectional drawings wherever applicable to identify the spare part numbers and their location, e.g. the size of bearings/ seals, their make and number shall be furnished.

1.2.8.3 CONTRACTOR shall furnish unpriced copy of Purchase Orders/Work Order/Contract for equipments and major items as per the list to be mutually agreed(including Priced copy of Purchase Orders/Work Order/Contract as required by the statutory authority) together with spares and special maintenance tools covering accurately all terms and conditions such as specifications requirements for quality, inspection, and test, warranties and guarantees, erection and commissioning assistance by vendor, delivery schedule, packing, transportation and insurance, and documentation.

1.2.8.4 CONTRACTOR shall arrange & furnish/provide to OWNER/ PMC,

a) Lubrication schedule from VENDOR, if required ,

b) Mechanical specifications and equipment data sheets for review by OWNER/ PMC for CRITICAL EQUIPMENT before manufacture is started,

c) Shop fabrication drawings as made available by vendor,

d) Characteristic curves for pumps and compressors, etc. as made available by vendor,

e) Certified drawings including civil scope drawing and loading data, pertinent bulletin, installation, operation and maintenance manuals and test certificates as received from vendor,

f) Final revised vendor's drawings, as described in Technical Specifications, before PRELIMINARY ACCEPTANCE.

g) Any other information as may be sought by OWNER/ PMC.

Any changes necessary during commissioning period can be incorporated in the as- built drawing and will be submitted after PAC as per the mutually agreed schedule.

1.2.8.5 CONTRACTOR shall provide services of vendor's specialist for installation and commissioning of EQUIPMENT whenever necessary.

1.2.8.6 Deleted

1.2.8.7 **Inspection, Expediting & Testing**

1.2.8.7.1 CONTRACTOR shall establish an inspection and expediting system and use its services for obtaining EQUIPMENT which conforms to the required technical and quality specifications and delivery schedule according to Purchase Order. CONTRACTOR shall send copies of expediting and inspection reports regularly to

OWNER/ PMC. CONTRACTOR shall arrange Third Party Inspection and quality certification of EQUIPMENT, as described in CONTRACT .Copies of all test results/report of the tests shall be furnished promptly by the CONTRACTOR to the OWNER/ PMC.

Third party Inspection shall be carried by LLyods/BV/TUV/DNV/.

1.2.8.7.2 OWNER/ PMC or its INSPECTOR shall have the right to inspect and/or to test EQUIPMENT to check its conformity to the specifications laid down in the CONTRACT and as per approved QAP (Quality Assurance Plan). CONTRACTOR shall specify the inspections and tests to be carried out giving reference of applicable codes/standards and the location of inspection/test to OWNER/ PMC. OWNER/ PMC shall notify CONTRACTOR in writing the name of INSPECTOR retained for this purpose. Expediting by OWNER/ PMC's representative in no way relieves the CONTRACTOR of his obligation under the terms and conditions of this CONTRACT.

1.2.8.7.3 The inspection and tests may be conducted at the premises of CONTRACTOR or SUB-CONTRACTOR/vendor before delivery and/or at SITE. All reasonable facilities and assistance including access to all drawings and production data shall be furnished to INSPECTOR at no charge to OWNER/ PMC.

1.2.8.7.4 Should any inspected or tested EQUIPMENT fail to conform to the specifications, OWNER/ PMC may reject it and CONTRACTOR shall either replace the rejected EQUIPMENT or make all alterations necessary to meet specification requirements free of cost.

1.2.8.7.5 OWNER/ PMC's right to inspect and wherever necessary, comment about EQUIPMENT after its arrival at SITE or its participation in tests in respect of any EQUIPMENT shall in no way be limited or waived by reason of EQUIPMENT having previously been inspected, tested and passed by OWNER/ PMC or INSPECTOR/representative prior to its shipment/despatch.

1.2.8.7.6 INSPECTOR shall follow the progress of the manufacture of EQUIPMENT under CONTRACT to ensure that the requirements outlined in CONTRACT are not being deviated from with respect to Schedule and Quality.

1.2.8.7.7 CONTRACTOR shall allow INSPECTOR to visit, during working hours, the workshops relevant to execution of CONTRACT during the contractual period and INSPECTOR will have the right to inspect EQUIPMENT at all stages of manufacture right from identification of material up to its shipment/despatch, to the extent that the delivery schedule shall not be delayed, with prior notice to CONTRACTOR in writing.

1.2.8.7.8 In order to enable INSPECTOR to obtain entry visa in time, CONTRACTOR shall notify OWNER/ PMC two months before assembly, testing and packing of main EQUIPMENT and if requested assist INSPECTOR in getting visa in the shortest possible time.

1.2.8.7.9 CONTRACTOR shall place at the disposal of INSPECTOR free of charge all tools, instruments and other apparatus necessary for the inspection and/or testing of EQUIPMENT. INSPECTOR is entitled to prohibit the use and despatch of EQUIPMENT that has failed to comply with the characteristics/specifications of EQUIPMENT during test and inspection.

1.2.8.7.10 CONTRACTOR shall ensure that the permission for inspection/test is granted by its SUB-CONTRACTOR/VENDOR.

1.2.8.7.11 In respect of the inspection, CONTRACTOR shall advise in writing of any delay in the programme at the earliest possible date, describing in detail what has caused the delay and the proposed corrective action.

1.2.8.7.12 All tests and trials in general of EQUIPMENT shall be witnessed by INSPECTOR. Therefore, CONTRACTOR shall confirm to OWNER/ PMC by E-mail about the exact date of inspection at least 15DAYS in advance. CONTRACTOR shall specify the items and quantities ready for testing and indicate whether a Preliminary or Final Test is to be carried out. On receipt of this notice, if OWNER/ PMC decides to waive the right to witness the test, information shall be given to CONTRACTOR within 15 DAYS of receipt of the notice from CONTRACTOR and CONTRACTOR then shall have right to proceed with the inspection

1.2.8.7.13 CONTRACTOR shall be held responsible for any possible delay in the approval or testing phase as well as for any possible delay in the remittance of necessary certificates. Delay on the part of the Inspection institutions will not be considered a case of 'Force Majeure'.

1.2.8.7.14 Any and all expenses incurred in connection with tests, preparation of reports and analysis made by qualified laboratories, necessary technical documents, testing documents and drawings shall be at CONTRACTOR’s cost. Technical documents shall include the references and numbers of the standard used in the fabrication/construction and, wherever deemed practical by INSPECTOR. INSPECTOR shall attach importance to the views given by CONTRACTOR or its SUB-CONTRACTOR/VENDOR. Any and all expenses for boarding, lodging and airfare/rail fare incurred in connection with OWNER/PMC’s INSPECTOR shall be borne by OWNER/PMC.

1.2.8.7.15 Participation or presence of OWNER/PMC or their representatives at any tests or their failure to be present at or to witness any tests to be undertaken pursuant here to shall not in any way or manner relieve or release the CONTRACTOR from any of its warranties, guarantees or other obligations under the CONTRACT.

1.2.8.7.16 Nothing in Clause -1.2.8.7.2 to 1.2.8.7.15 shall in any way relieve CONTRACTOR from any warranty or other obligations under this CONTRACT.

Not performing or failing to perform the inspection by OWNER/ PMC hereunder shall not be a waiver of any of CONTRACTOR's obligations hereunder nor it be construed

as an approval or acceptance of any of the WORK hereunder nor it shall absolve the CONTRACTOR in any way or manner of its liabilities, responsibilities and obligations under the CONTRACT.

1.2.8.7.17 Arrangements for all inspections required by Statutory Authorities and as specified in Technical Specifications shall be made by CONTRACTOR. If certain category of EQUIPMENT/piping fall under the jurisdiction of Indian Boiler Regulations (IBR), irrespective of the fact whether these are proprietary in nature or not, certification from an internationally recognised agency approved by IBR is considered necessary to enable local IBR authorities to allow their installation and operation. In such cases, inspection and certification from such authorities will also have to be arranged by CONTRACTOR. CONTRACTOR shall also submit, as may be required by IBR authorities, necessary design calculations from respective fabricators and/or manufacturers of such EQUIPMENT.

1.2.8.7.17 **Rejections, Removal of Rejected EQUIPMENT and Replacement**

1.2.8.7.17.1 Preliminary inspection at SUB-CONTRACTOR's / vendor's works by INSPECTOR shall not prejudice OWNER/ PMC for commenting on EQUIPMENT including its specifications on final inspection at SITE or claim under warranty provisions.

1.2.8.7.17.2 If EQUIPMENT is not of specification or fail to perform specified duties, OWNER/ PMC shall be entitled to reject EQUIPMENT or part thereof and ask for modification, repair or free replacement within reasonable time subject to the relevant provisions in the CONTRACT.

1.2.8.7.17.3 In the event of such rejection, OWNER/ PMC shall be entitled to use EQUIPMENT in a reasonable and proper manner for a time reasonably sufficient to enable it to obtain replacement, without any liability to CONTRACTOR. After free replacement of such rejected EQUIPMENT, the rejected equipment shall become the property of CONTRACTOR.

1.2.8.7.17.4 Nothing in this Clause shall be deemed to deprive OWNER and/or affect any of its rights under CONTRACT which it may otherwise have in respect of such defects or deficiencies or in any way relieve CONTRACTOR of its obligation under CONTRACT.

1.2.8.7.17.5 EQUIPMENT rejected by OWNER/ PMC shall be removed by CONTRACTOR, within reasonable time, at its own cost after replacement of the said EQUIPMENT. OWNER/ PMC shall in no way be responsible for any deterioration or damage to rejected EQUIPMENT under any circumstances whatsoever.

1.2.8.7.17.6 In case, the rejected EQUIPMENT is to be taken out of OWNER's premises for repair,Owner shall have the right to withhold the payment for such cost of equipment to the extent of payment made by Owner towards the equipment until the equipment is returned / replaced.

1.2.8.8 **Packing**

1.2.8.8.1 CONTRACTOR shall ensure that packing of EQUIPMENT is as required to prevent their damage or deterioration during transit to its final destination.

1.2.8.8.2 The packing, markings and documentation within and outside the packages shall comply strictly with the provisions of CONTRACT.

1.2.8.8.3 CONTRACTOR shall be responsible for any eventual consequence occurred to EQUIPMENT due to improper packing of the same.

1.2.8.9 **Delivery/Time Schedule and Documents**

1.2.8.9.1 Time schedule shall include time for submission of documents/drawings for review/approval, incorporation of comments, if any, and final review of drawings by ENGINEER-IN-CHARGE. Within 14(Fourteen) working days after receipt by ENGINEER-IN- CHARGE of any document requiring OWNER/ PMC's review, ENGINEER-IN-CHARGE shall either return one copy thereof to CONTRACTOR as it is, if ENGINEER-IN-CHARGE has no comments or with its comments and reasons thereof.

1.2.8.9.2 Special care shall be taken by CONTRACTOR to furnish Manufacturer's Test Certificates, material of construction, make, type, pressure ratings wherever applicable and included in the scope of supply of EQUIPMENT.

1.2.8.9.3 In case of delay beyond the stipulated COMPLETION PERIOD, for reasons not attributable to OWNER, FORCE MAJEURE and suspension of WORK by OWNER, even though provisional extension of COMPLETION PERIOD time is allowed by OWNER, all extra costs on account of changes of statutory regulations/Acts or increase in price on any other account, shall not apply to CONTRACT PRICE and the same shall be borne by CONTRACTOR.

1.2.8.10 **Despatch, Transportation/Shipping**

1.2.8.10.1 CONTRACTOR shall be responsible for despatch of EQUIPMENT by sea/ rail/ road/air after proper packing and protection. The consignment shall be despatched after inspection by OWNER/ PMC unless otherwise agreed to in writing however such inspection shall not constitute waiver of the CONTRACTOR's obligations, responsibilities for the EQUIPMENT including care, safety and preservation in any way and manner and the CONTRACTOR's responsibility and obligation in this behalf shall continue till PRELIMINARY ACCEPTANCEOF PLANT.

1.2.8.10.2 Generally, on-Deck shipment shall not be made without prior permission of OWNER/ PMC. However, in case of towers, reactors, vessels and other large-sized EQUIPMENT, CONTRACTOR may, at its own discretion, make on-deck shipment, without OWNER/ PMC's prior permission. In case of damage to such EQUIPMENT, during delivery or at any stage before PRELIMINARY ACCEPTANCE OF PLANT, CONTRACTOR shall be responsible for repair/replacement of EQUIPMENT.

1.2.8.10.3 Clean on-board bill of lading for all offshore supplies shall be drawn as under:

For CIF/FOB/FAS/FCA shipments

Shipper = CONTRACTOR/Supplier
Consignee = CONTRACTOR

1.2.8.10.4 **Property in EQUIPMENT**

1.2.8.10.4.1 In case of all EQUIPMENTS/MATERIALS, the title of Ownership shall pass on to OWNER on PRELIMINARY ACCEPTANCE of Plant. However, the OWNER shall have Lien on all EQUIPMENTS/MATERIALS including those brought by the Contractor for the purpose of Erection, testing and commissioning of the WORK. However, in case of Termination of Contract the Transfer of Title shall pass automatically to OWNER.

1.2.8.10.4.2 CONSTRUCTION EQUIPMENT used by the CONTRACTOR and its SUB-CONTRACTORS in connection with the execution of works shall remain the property of CONTRACTOR or its SUB-CONTRACTORS. All duties, levies, taxes etc payable on account of CONSTRUCTION EQUIPMENT shall be borne by the CONTRACTOR. CONTRACTOR shall indemnify the OWNER on this count.

1.2.9 **Spares, Special Maintenance Tools, Lubricants, Chemicals and Consumable**

1.2.9.1 CONTRACTOR shall procure and supply commissioning spares, special maintenance tools and fixtures for EQUIPMENT, lubricants, chemicals and consumable in sufficient quantity for COMMISSIONING and maintenance of PLANT. The commissioning spares, special maintenance tools, lubricants, chemicals and consumable procured and supply shall be optimum, so as not to fall short during COMMISSIONING, and TRAIL RUNS. CONTRACTOR shall obtain for these items the appropriate guarantees and warranties. CONTRACTOR shall also ensure that the commissioning spares and special maintenance tools and fixtures are procured alongwith the related items of EQUIPMENT and form part of PURCHASE ORDER for the related items of EQUIPMENT.

1.2.9.2 **Lubricants, Chemicals, Consumable etc.**

CONTRACTOR shall supply Consumables, lubricants and chemicals, as required for 100% full load run for 6 months operation after successful commissioning (and include the cost in CONTRACT PRICE). Consumables, lubricants and chemicals to be supplied in phased manner and shall be mutually agreed between OWNER and CONTRACTOR considering the consumption and storage capacity.

1.2.9.3 **Special Maintenance Tools**

CONTRACTOR shall supply special devices or tools required for normal maintenance, special handling and lifting of EQUIPMENT with main EQUIPMENT. The cost of such special maintenance tools shall be included in CONTRACT PRICE.

1.2.9.4 **Bidder's Recommended Operational Spares**

CONTRACTOR shall provide Itemised Price List for Bidder's recommended operational spares 6 months prior to Mechanical Completion with validity of 2 Years. The recommended spares shall be optimum so as not to cause any short fall or excessive inventory. The price of above shall NOT be included in CONTRACT PRICE.

1.2.9.5 **Special Tools & Tackles**

CONTRACTOR shall supply special tools, tackles and fixture, required during normal operation & maintenance of PLANT. The cost of such special tools & tackles shall be included in CONTRACT PRICE.

1.2.9.6 **Chemicals**

CONTRACTOR shall supply all chemicals, for first filling and make-up, if required as indicated in Technical Section of NIT. The cost of these chemicals shall be included in the CONTRACT PRICE.

1.2.9.7 **Lubricants**

1.2.9.7.1 CONTRACTOR shall supply lubricants in sufficient quantity for the first filling and make-up required as indicated in Technical Section of NIT. The cost of lubricants shall be included in the CONTRACT PRICE.

1.2.9.7.2 CONTRACTOR shall furnish the name of recommended lubricants indicating their commercial/trade name, quality and grade and equivalent quality lubricants (in case of imported lubricants) available in India to OWNER/ PMC.

1.2.9.8 **Commissioning spares and Consumables**

CONTRACTOR shall supply spares and consumables required for construction, PRE COMMISSIONING, COMMISSIONING, start-up and testing of PLANT. The cost of such spares and consumables shall be included in TOTAL CONTRACT PRICE.

1.2.9.9 **Mandatory Spares**

CONTRACTOR shall provide Mandatory Spares as per Section VI-19.0, of Technical Document. Notwithstanding anything contained in this CONTRACT, the Prices for Mandatory Spares/Insurance Spares shall be included in TOTAL CONTRACT PRICE.

The price for "Mandatory Spares/Insurance Spares" shall be included in the supply portion of TOTAL CONTRACT PRICE. However, details along with breakup for the above shall be submitted by successful bidder during execution.

1.2.9.10 **General**

1.2.9.10.1 CONTRACTOR shall furnish to OWNER, the blue prints/ PMC, drawings and specifications of the spare parts.

1.2.9.10.2 CONTRACTOR shall provide to OWNER all addresses and particulars of its SUB-CONTRACTOR/VENDOR on whom PURCHASE ORDER for EQUIPMENT covered under CONTRACT has been placed and will further ensure with its SUB-CONTRACTOR/VENDOR that, OWNER if so desires, shall have the right to place order for two years spare parts directly on them on mutually agreed terms based on offers of such SUB-CONTRACTOR/ VENDOR.

1.2.9.10.3 Spare parts shall be new and as per engineering standards/codes, free of any defects (even concealed), deficiency in Design, Materials and Workmanship and also shall be completely interchangeable with the corresponding parts.

1.2.9.10.4 Type and sizes of bearing/seals and bearing number with make shall be clearly indicated.

1.2.9.10.5 Spare parts shall be packed for long storage under tropical climatic conditions in suitable cases, clearly marked as to their intended purpose.

1.2.10 **Warrantees and Guarantees**

1.2.10.1 Materials and Workmanship Warranty

1.2.10.1.1 CONTRACTOR warrants that EQUIPMENT supplied under CONTRACT are new, unused, of the recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in CONTRACT. CONTRACTOR further warrants that EQUIPMENT supplied under this CONTRACT shall be according to specifications, have no defect (even concealed) arising from design, materials or workmanship or form any act or omission of CONTRACT that may develop under normal use of the supplied EQUIPMENT in the conditions prevailing in the country of final destination.

1.2.10.1.2 The warranty period for the EQUIPMENT/PLANT supplied by CONTRACTOR shall be valid for minimum 12 months for all EQUIPMENT from the date of PRELIMINARY ACCEPTANCE.

1.2.10.1.3 The warranty shall be valid for the period as described under Clause -1.2.10.1.2 from the date of PRELIMINARY ACCEPTANCE and shall be governed by Clause 17 of SPECIAL CONDITIONS OF CONTRACT. Should any DEFECTS be noticed in design, material and/or workmanship within the said warranty period, ENGINEER-IN-CHARGE shall inform CONTRACTOR and CONTRACTOR shall immediately on receipt of such intimation depute their personnel within 10 DAYS to investigate the causes of DEFECTS and arrange rectification / replacement / modification of the defective EQUIPMENT at SITE without any cost to OWNER, within a reasonable period. If

CONTRACTOR fails to take proper corrective action to replace/ repair defective Equipment satisfactorily within a reasonable period, OWNER shall be free to take such corrective action as may be deemed necessary at CONTRACTOR's risk and cost, after giving notice to CONTRACTOR. OWNER shall promptly notify CONTRACTOR in writing of any claims arising under this warranty.

The cost of any special or general overhaul rendered necessary during the guarantee period due to defects for which CONTRACTOR is liable under CONTRACT in the PLANT or defective work carried out by the CONTRACTOR shall be borne by the CONTRACTOR.

1.2.10.1.4 After the issue of the PRELIMINARY ACCEPTANCECERTIFICATE and upto the defect liability period, in the event of an emergency where, in the judgement of the OWNER, delay would cause serious loss or damage, repairs or adjustments may be made by the OWNER or a third party chosen by the OWNER without advance notice to the CONTRACTOR and the documented and direct cost of such work shall be paid by the CONTRACTOR but only to the extent that the repair or adjustment was due a defect attributable to CONTRACTOR.

1.2.10.1.5 In case defects are of such nature that EQUIPMENT shall have to be taken to CONTRACTOR's/ SUB-CONTRACTOR's/ vendor's works for rectification etc., CONTRACTOR shall take EQUIPMENT at its cost after giving necessary undertaking or security as may be required by OWNER. OWNER shall, if so required by CONTRACTOR, despatch EQUIPMENT by quickest mode on freight to pay basis to CONTRACTOR's / SUB-CONTRACTOR's / vendor's works. After repairs CONTRACTOR shall deliver EQUIPMENT at SITE on freight paid basis. All transit risks to and from site shall be borne by CONTRACTOR.

1.2.10.1.6 EQUIPMENT or part thereof so repaired or replaced shall have further warranty for a period of 12 months from the date of its acceptance after repair/replacement and the Contract Performance Security shall be suitably extended for the same. The value of the Contract Performance Security during the extended warranty period shall be 03 (Three) percent of the cost of such repaired/replaced EQUIPMENT or its parts for which documentary evidence to be submitted.

However, extended DEFECTS LIABILITY PERIOD shall have an upper limit of 24 months for extended DEFECTS LIABILITY PERIOD, starting from the PRELIMINARY ACCEPTANCE.

At the end of the DEFECT LIABILITY PERIOD or the extended DEFECT LIABILITY PERIOD, the CONTRACTOR's liability ceases. In respect of goods supplied by the SUB-CONTRACTORS to the CONTRACTOR where a long guarantee (more than 12 months) is provided by such SUBCONTRACTORs/SUB- VENDOR(s), the OWNER shall be entitled to the benefit of such longer guarantees.

1.2.10.1.7 If the repairs, replacements or modifications referred to above are of such nature which may affect the efficiency of EQUIPMENT, OWNER shall have right to give notice in

writing to CONTRACTOR within one month of such repair/ replacement/ modification to carry out tests as may be required for acceptance of EQUIPMENT.

1.2.10.1.8 If CONTRACTOR fails to meet its obligation to repair or replace defective EQUIPMENT and make it good within a reasonable period of time and or if CONTRACTOR refuses to carry out WORK under the guarantee clause and implied guarantee conditions and/or in case of severe urgency, OWNER shall be entitled to carry out repair/replacement/WORK or arrange to carry out repair/ replacement/WORK by a third party. The entire cost of such repair/ replacement/WORK including transit insurance, freight, taxes and duties etc. shall be borne by the CONTRACTOR. In case, the cost of such repair/replacement has been incurred by OWNER, CONTRACTOR shall reimburse the same immediately on demand by OWNER with a document substantiating such costs.

1.2.10.1.9 Damages to EQUIPMENT deriving from incomplete, erroneous instructions issued by CONTRACTOR will be considered CONTRACTOR's fault and will be treated according to the provision of warranty clause. Normal wear and tear shall not come under purview of this clause.

1.2.10.1.10 The acceptance of any equipment by the OWNER/ PMC shall in no way relieve the CONTRACTOR of his obligation under this clause.

1.2.10.1.11 During the GUARANTEE PERIOD, the CONTRACTOR shall provide if required by the OWNER, the services of operation engineers to advise the OWNER for such period and in such number as may be mutually agreed upon. The CONTRACTOR's operation engineers shall also train the OWNER's personnel, act as a liaison between the OWNER and the CONTRACTOR, assist the OWNER in ordering and obtaining spare parts, generally monitoring operation and maintenance and trouble shooting and supervising repair work under guarantee.

1.2.10.2 **Design and Vendors'/ Sub-Contractors' Guarantees**

1.2.10.2.1 CONTRACTOR shall guarantee the design and engineering work carried out by him against mistakes, errors, defective specifications, inadequacy and other such items which lead to the supply of inadequate PLANTS and Facilities. In case of detection of such mistakes, errors, deficiencies etc. the CONTRACTOR shall redo the design and/or engineering work to overcome all such mistakes, errors, deficiencies etc. at no extra cost to OWNER.

1.2.10.2.2 CONTRACTOR shall be responsible for all the items of the EQUIPMENT procured by him from VENDORS/ SUB-CONTRACTORS. Further, CONTRACTOR shall replace or repair any item of EQUIPMENT which is demonstrated to be defective under normal operating conditions within DEFECT LIABILITY PERIOD.

1.2.11 **Performance Guarantee of PLANT(S)/ EQUIPMENT**

1.2.11.1 CONTRACTOR guarantees that the performance of PLANTS supplied under CONTRACT shall be strictly in conformity with the specifications and shall perform the duties and have consumption and other guarantees set forth in CONTRACT.

1.2.11.2 If the performance of PLANTS and/or any of EQUIPMENT fails as guaranteed and set forth in CONTRACT, CONTRACTOR shall investigate the causes and provide free of cost to OWNER, design, engineering, MATERIALS and services and EQUIPMENT within a reasonable period to prove guarantees. CONTRACTOR's liability in this respect shall be limited as per the provisions of 22.0 of SCC.

1.2.12 **STATUTORY APPROVALS**

1.2.12.1 Unless otherwise specified in Bidding Documents, it shall be the CONTRACTOR's sole responsibility to obtain all approvals from any authority (except for environment clearance and Consent to Establish/Operate, however the data and information required for the same shall be made available by the LSTK contractor) required under any statute, rule or regulation of the Central or State Government concerned with the performance of the CONTRACT and/or the contractual Work. The application on behalf of the OWNER for submission to relevant authorities along with copies of required certificates complete in all respects shall be prepared and submitted by the CONTRACTOR well ahead of time so that the actual execution of the WORKS is not delayed for want of the APPROVAL/inspection by the concerned authorities. The CONTRACTOR shall arrange for the inspection of the works by the authorities and will undertake necessary coordination and liaison required and shall not be entitled to any extension of time for any delay in obtaining such approval. All statutory fees shall be paid by the CONTRACTOR and the same shall be reimbursed by the OWNER upon production of documentary evidence by the CONTRACTOR.

1.2.12.2 Any deficiency(ies) as pointed out by any such authority shall be rectified by the CONTRACTOR within the scope of relative supply and/or WORK at no extra cost to the OWNER. The inspection and acceptance of the WORKS by such authorities shall, however, not absolve the CONTRACTOR from any of its responsibilities under this CONTRACT.

1.2.12.3 No extension of time shall be granted for meeting the requirement and/or obtaining APPROVAL of statutory authorities.

1.2.12.4 **Government Clearances, Permits and Certificates**

CONTRACTOR shall procure at its expenses, all necessary APPLICABLE PERMITS, certificates and licenses required by virtue of all APPLICABLE LAWS, regulations, ordinances and other rules in effect at the place where any of WORK is to be performed, and CONTRACTOR shall further hold OWNER harmless from liability or penalty which might be imposed by reason of any asserted or established violation of

such laws, regulations, ordinances or other rules. OWNER/ PMC will provide the necessary assistance to CONTRACTOR for obtaining PERMITS for CONTRACTOR's personnel to undertake WORK in India in connection with CONTRACT.

1.2.12.5 CONTRACTOR shall furnish necessary technical information, data, drawing, etc. as and when required by OWNER/ PMC for submission to Government/Statutory Agencies.

1.2.13 **Network Schedule**

1.2.13.1 OWNER/ PMC would be using a computerized time and cost monitoring system and CONTRACTOR shall provide necessary input data for the same. CONTRACTOR shall prepare within 30 (thirty) days from date of FOA and provide to OWNER/ PMC a PROJECT MASTER SCHEDULE indicating the important milestones of activities relating to WORK from date of FOA to the date of PRELIMINARY ACCEPTANCE. This PROJECT MASTER SCHEDULE shall be discussed with and approved by OWNER/ PMC. Based on the approved PROJECT MASTER SCHEDULE, CONTRACTOR shall also prepare network schedules for activities relating to WORK. CONTRACTOR shall obtain the details of progress of various activities of WORK from SUB-CONTRACTOR and vendor wherever required and update the network schedules and PROJECT MASTER SCHEDULE incorporating the progress achieved by CONTRACTOR, SUB-CONTRACTOR and vendor and submit the same to ENGINEER-IN-CHARGE on monthly basis.

1.2.13.2 CONTRACTOR shall clearly indicate any delay in WORK in the above schedules and shall inform ENGINEER-IN-CHARGE the action taken to achieve the COMPLETION PERIOD.

1.2.14 **Transportation and Storing of EQUIPMENT**

1.2.14.1 CONTRACTOR shall be responsible for proper packing, transportation from vendor's workshop to port or railway station (whether by road, rail, ship or aircraft), handling and clearances at port or railway station including loading and unloading, customs clearance, carriage to SITE, unloading at SITE, warehousing, coding and tagging, storage including proper preservation, etc. of EQUIPMENT. Any special clearance, lifting, handling, loading/unloading, and transport arrangements for over dimensional consignments shall also be done by CONTRACTOR. CONTRACTOR shall ensure timely delivery of EQUIPMENT. CONTRACTOR shall endeavour to have the consignments in the upper part of the hold to enable early discharge at the Port of disembarkment. The above arrangement shall be in accordance with the guidelines set forth in the Co-ordination Procedure which shall be finalised mutually after issuance of FOA. CONTRACTOR shall be responsible for inspection of EQUIPMENT on receipt at SITE and for maintenance and management of stores and warehousing of EQUIPMENT at SITE including all activities connected with the issue of EQUIPMENT, accounting and final reconciliation and handing over of stores to OWNER.

1.2.14.2 OWNER/ PMC shall provide area at SITE for making shed/covered stores etc. for storing EQUIPMENT. CONTRACTOR shall be responsible for making shed/covered stores etc. for safe storage of EQUIPMENT.

1.2.15 **Construction**

1.2.15.1 CONTRACTOR shall be responsible for, insulation& painting works, erection, site fabrication, piping, instrumentation, electrical installation, and other miscellaneous construction jobs of PLANT leading to MECHANICAL COMPLETION and PRELIMINARY ACCEPTANCE of PLANT. CONTRACTOR shall organise these activities in appropriate sequence and use proper methods giving due regard to the requirements of safety, quality, sound engineering practice, compliance with relevant Codes and Regulations, and for achieving PRELIMINARY ACCEPTANCE of PLANT on or before COMPLETION PERIOD.

The CONTRACTOR shall within the scope of work observe in addition to specifications, all national and local laws, ordinances, rules and regulation and requirements pertaining to the WORK.

Various procedures and methods to be adopted by CONTRACTOR during the construction as required in the respective specifications shall be submitted to OWNER in due time and well in advance of the specific work for approval.

The CONTRACTOR shall carry out required supervision as per Quality Assurance Plan and furnish all assistance required by the OWNER in carrying out inspection work. The OWNER will have authorized representatives present who shall have free access to the work at all times. If an OWNER's representative notifies the CONTRACTOR's representative of any deficiency in any work or in the supervision thereof, the CONTRACTOR shall make every effort to carry out such instructions consistent with best industry practice.

The CONTRACTOR shall so far as reasonably feasible employ skilled workers who are Certified Tradesmen in the field(s) of their relative activities(s).

1.2.15.2 CONTRACTOR shall submit and adhere to the completion schedule of construction leading to PRELIMINARY ACCEPTANCE.

1.2.15.3 In case of delay in completion beyond the stipulated completion period as specified in Invitation For Bid (IFB) under clause 2 (E) for reasons attributable to Contractor, all extra costs on account of changes of statutory regulations / Acts, shall not apply to Contract price and the same shall be borne by Contractor.

1.2.15.4 **Civil Work Warranty**

1.2.15.4.1 CONTRACTOR shall certify that the all civil works, reinforced concrete, structures, permanent buildings and foundations has been designed in accordance with stipulations of relevant BIS Codes.

1.2.16 **Safety and Plant Security**

1.2.16.1 CONTRACTOR shall observe and also use its best efforts to ensure that all parts of WORK carried out at SITE is being done in a safe and satisfactory manner conforming to the applicable Safety Rules and Regulations. Further, CONTRACTOR shall observe and make provisions in SUB-CONTRACT that employees working for PLANT observe all the Safety Rules as required under the Factories Act and Regulations and other Local Laws and SUB-CONTRACTOR to provide safety apparel and equipment to its employees. OWNER/ PMC shall have the right to object to any unsafe practice followed by SUB-CONTRACTOR's employees or any CONTRACTOR's personnel and direct them to carry out the job in a manner considered safe by OWNER/ PMC. CONTRACTOR shall further abide by all the Security Regulations imposed by OWNER/ PMC.

1.2.16.2 CONTRACTOR shall observe all safety rules so that no harm is done to OWNER/ PMC's employees or property. If on account of CONTRACTOR, OWNER/ PMC's property or personnel are likely to suffer any damage, in such cases any directions issued by OWNER/ PMC shall be carried out by CONTRACTOR.

1.2.17 **PRE-COMMISSIONING**

1.2.17.1 CONTRACTOR shall render and be responsible for pre-commissioning activities leading to MECHANICAL COMPLETION. These activities will include relevant checking, adjustment, testing, calibration, running in and trial runs of individual items of EQUIPMENT, and other similar jobs. OWNER shall provide experienced/trained and suitable operating and maintenance personnel who will perform their tasks under the supervision and direction of CONTRACTOR.

1.2.17.2 CONTRACTOR shall provide experienced personnel as required for carrying out the PRE-COMMISSIONING activities with OWNER's personnel.

1.2.17.3 CONTRACTOR shall provide SUB-CONTRACTOR's/VENDOR's specialists wherever required. Suitable provision for such services shall be made by CONTRACTOR in PURCHASE ORDER/CONTRACT with their Sub-Vendor/Sub-Contractor.

1.2.17.4 "PRE-COMMISSIONING" shall mean preparation of PLANT so that it is capable of operating on a continuous basis at or near rated capacity for carrying out COMMISSIONING activities

1.2.18 **MECHANICAL COMPLETION**

1.2.18.1 CONTRACTOR shall be responsible for completing the design, engineering, procurement, inspection and expediting, arranging for transportation of EQUIPMENT, construction and PRE-COMMISSIONING for making PLANT ready for MECHANICAL COMPLETION.

MECHANICAL COMPLETION" shall mean completion of erection to such an extent that PLANT is ready for commissioning. This shall happen when:

A. The EQUIPMENT capable of producing to rated capacities are installed, aligned and grouted (wherever applicable) in accordance with drawings, specifications as per finally approved P&I Diagrams in accordance with all applicable codes, and laws.

B. All pressure EQUIPMENT are hydrostatically or pneumatically tested once either in CONTRACTOR'S shop or in the field in accordance with Technical Specifications.

C. Deleted

D. Pumps, Machinery etc. are cold aligned. Couplings are assembled and guards installed as applicable.

E. Instruments, control system, instrument cable, safety interlock are installed, inspected and such non-operating checks are made as to ensure operability in the manner required for the process application. Instrument air lines are checked for correct hook up. Airlines are leak tested.

F. Deleted

G. Piping is hydrostatically or pneumatically tested in accordance with the specifications. Special treatment such as chemical cleaning is done as required by drawing or specifications. Suction screens are installed and test blinds are removed. Spring support anchors and guide are checked for removal of all shipping locks.

H. The electric system is installed and tested in accordance with and to the extent required by electrical specifications. All wiring is checked for correct hook up. Motor rotation is checked. All power system protective devices are set.

I. Insulation and drying out are completed to the extent necessary to permit start of commissioning.

J. Pipe support system installed as per drawings.

K. Painting is completed. EQUIPMENT /MACHINERY, piping duly marked and labelled.

L. Safety equipments, systems are installed and checked for operations. Effluent management and treatment systems are installed and operational.

M. All Emergency & Instrument power system are checked and operating.

N. All chemical & lubricants are charged into the system.

O. PRECOMMISSIONING has been completed.

P. The PLANT is ready to take feed

Q. All packing and bed support materials are installed.

R. Liquidation of all punch list applicable for achieving MECHANICAL COMPLETION. Balance items of punch list, if any, shall be liquidated as mutually agreed

S. Temporary constructions facilities are removed to extent necessary to permit start of commissioning of Plant

1.2.19 **COMMISSIONING**

1.2.19.1 CONTRACTOR shall be responsible for COMMISSIONING after Mechanical Completion have been completed giving due regard to safety of EQUIPMENT in accordance with the procedures as per the requirement of Contract document after successful testing, pre-commissioning & trial run and per sound engineering practices. LSTK CONTRACTOR shall provide operating and maintenance personnel for the same. The COMMISSIONING activities shall be conducted as detailed in Section VI-14.0 of NIT)

1.2.19.2 CONTRACTOR shall provide engineers as required to commission the PLANT.

1.2.20 **Plant Trial Runs**

PLANT TRAIL RUNS ' shall mean all operational checks and tests required to determine and demonstrate capacity, efficiency and operating characteristics and proving guarantees as applicable as specified in the CONTRACT documents.

CONTRACTOR shall successfully complete PERFORMANCE TEST as specified in Technical Section-VI, 16.0 of NIT.

PGTR wherever mentioned in the tender document shall be read as Plant Trial Runs.

1.2.21 Deleted

1.2.22 Deleted

1.2.23 **Laws and Regulations**

1.2.23.1 CONTRACTOR shall abide, while fulfilling its obligations, by all applicable codes and APPLICABLE LAWS from time to time in force in the State of ODISHA and in India. FINAL PROPOSAL shall be based on the codes, and regulations applicable on the date of submission of the FINAL PROPOSAL.

In the event of change in any codes, legislation, laws or regulation applicable to PLANT WORK or any part thereof after date of submission of FINAL PROPOSAL, which alters the scope of CONTRACTOR's obligations under CONTRACT, CONTRACTOR shall agree to make the necessary changes in scope of WORK. Such changes shall be governed by CHANGE IN WORK as per the provisions of Clause -3 of SCC. Any additional fee becoming applicable due to any change of Acts, regulations, by-laws, orders and requirements after date of submission of FINAL PROPOSAL shall be borne by OWNER in accordance with SCC clause 3.0.

1.2.24 Deleted

1.2.25 **Progress Monitoring and Reporting**

1.2.25.1 CONTRACTOR shall develop a suitable system for monitoring and reporting progress on the various activities up to PRELIMINARY ACCEPTANCE. CONTRACTOR shall submit PROJECT MASTER SCHEDULE and detailed Network Schedule covering the activities and milestones starting from date of FOA until PRELIMINARY ACCEPTANCE, as described under Clause -1.2.13 above. These schedules shall include the activities of CONTRACTOR, SUB-CONTRACTOR/Sub-Vendor. CONTRACTOR shall monitor progress continuously and submit to EIC monthly progress reports giving the status of the activities, indicating those delayed and action being taken, or required to be taken, to bring back those activities on schedule. These reports will also include progress at vendor's workshops and shall be supplemented with photographs, wherever necessary. The Network Schedule shall be updated once in a month. CONTRACTOR shall also furnish information to ENGINEER-IN-CHARGE as may be required by any other Government Authority or any other agency such as Financing Institution etc.

1.2.26 **Technical Information**

1.2.26.1 CONTRACTOR shall furnish to OWNER/ PMC, CONTRACTOR's Technical Information and know-how as may be necessary for the operation of PLANT and relating to its process according to the provisions of Article 53 of General Conditions of Contract. CONTRACTOR shall grant or cause to be granted to OWNER an irrevocable right to use all such above technical information for PLANT and shall further advise OWNER for a period of five (5) years from date of PRELIMINARY ACCEPTANCE of any improvements in process, know-how, engineering, operation methods, and other conditions which will result in more efficient operation of PLANT that are developed by CONTRACTOR or process licensor or have come to the knowledge of CONTRACTOR, at no extra cost to OWNER. OWNER shall also grant to CONTRACTOR, at no extra cost to CONTRACTOR, to the benefit of process licensor the same right on OWNER's improvements as per the provisions of this Clause. Notwithstanding the generality of the foregoing, ownership of data, technical information processes, technology or software proprietary to CONTRACTOR and/or SUBCONTRACTORS shall remain with CONTRACTOR and/or SUBCONTRACTOR. CONTRACTOR and/or SUBCONTRACTOR shall ensure that OWNER is legally entitled to use of such data, processes, technology and software in the form of a

perpetual, non-terminable, non-exclusive, royalty-free License for the purpose of the operation and maintenance of the PLANT.

1.2.27 **Work of SUB-CONTRACTOR and vendor**

1.2.27.1 CONTRACTOR shall remain responsible for proper execution of such part of WORK as are carried out by its SUB-CONTRACTOR and vendor and any failure of SUB-CONTRACTOR/vendor shall not relieve CONTRACTOR of its obligations under CONTRACT. Furthermore, in the event of any default by SUB-CONTRACTOR/vendor, CONTRACTOR shall either take over SUB-CONTRACTOR/vendor's part of WORK on mutually agreed terms or take remedial action as may be necessary in order to comply with COMPLETION PERIOD and any other activities leading to PRELIMINARY ACCEPTANCE.

1.2.28 **Co-ordination**

1.2.28.1 CONTRACTOR shall render all necessary assistance to ENGINEER-IN-CHARGE required for overall co-ordination of all activities connected with WORKS. For this purpose, CONTRACTOR and ENGINEER-IN-CHARGE shall agree on a meeting as soon as practicable after issuance of FOA, with SUBCONTRACTOR/vendor's and such other parties as are necessary to settle the following:

a) Review the basic design conditions set forth in FINAL PROPOSAL and where appropriate, review possibilities of standardisation.
b) Assess the priorities and key dates required to be included in CONTRACTOR's PROJECT MASTER SCHEDULE.
c) Make an assessment of all items requiring co-ordination.
d) Fix up a date and agenda of any subsequent meeting as may be required in association with OWNER/ PMC.
e) Discuss with ENGINEER-IN-CHARGE and furnish all technical information.

In the event, ENGINEER-IN-CHARGE pursuant to its responsibilities of overall co-ordination requests CONTRACTOR to make any alteration to the programme, scope of responsibility under CONTRACT, CONTRACTOR shall do the same, subject to the provisions of Clause 3.0.

1.2.29 Notices and Reports

1.2.29.1. CONTRACTOR shall submit the following copies of notices to ENGINEER-IN-CHARGE as part of the Scope of Work:

a) Immediate notification of safety incidents and accidents, including near misses, of any kind or type followed as soon as possible after such event by a full report.

b) Notices from any Government / Statutory Agency or any other Person for a violation of any Law or Government Approval, immediately upon receipt by CONTRACTOR and no later than twenty-four (24) hours after its receipt.

c) Inspection reports by any inspector whether relating to any accident, accepting any test reports or otherwise immediately upon receipt by CONTRACTOR and no later than two (2) working DAYs after its receipt.

d) Any other matter/issue that involves OWNER's interest.

1.2.30 CONTRACTOR's Representative and Key Personnel

1.2.30.1 CONTRACTOR shall with prior consent of ENGINEER-IN-CHARGE, appoint a CONTRACT MANAGER to manage the execution of WORK and to be nominated as CONTRACTOR's Representative. CONTRACTOR's personnel stationed at SITE for providing services during the execution of WORK shall work under the supervision and guidance of CONTRACT MANAGER. The CONTRACT MANAGER shall have the full authority to make binding and enforceable decisions in the name of CONTRACTOR and shall receive all notices/correspondence that OWNER serves on CONTRACTOR.

1.2.30.2 CONTRACTOR shall be responsible for the work performed by CONTRACT MANAGER and CONTRACTOR's personnel and shall under no circumstances be relieved of its responsibilities and obligations under CONTRACT on account of acts or omissions of CONTRACT MANAGER and personnel.

1.2. 30.3 The Key Personnel shall hold the staff positions as indicated in CONTRACT. CONTRACTOR shall use reasonable efforts to ensure that such Key Personnel will be engaged in the execution of WORK continuously until their role is completed unless prior release is approved by OWNER/ PMC, such approval not to be unreasonably withheld or delayed. Replacement of or addition to Key Personnel shall only be made with persons having qualifications and experience equal to or better than those replaced or added to, and shall be similarly subject to OWNER/ PMC's prior approval. In the event, any person identified in CONTRACT decides to leave the employment of CONTRACTOR, CONTRACTOR shall use reasonable efforts to retain the services of such person until his portion of WORK is complete. CONTRACTOR further agrees not to remove from WORK Key Personnel, which OWNER/PMC considers to be necessary for the proper performance of WORK without the prior written approval of OWNER/PMC.

1.2.31 General Warranties

a) CONTRACTOR shall perform WORK in full compliance with its FINAL PROPOSAL and all other terms and conditions set forth herein.

b) WORK shall be performed, in a good and workmanlike manner and in accordance with the FINAL PROPOSAL, all other terms and conditions of this CONTRACT, all DOCUMENTS, all Government Approvals, all APPLICABLE LAWS, and Good Industry Practices.

c) All EQUIPMENT, installed as part of PLANT, (i) shall be free from any encumbrance or lien and shall conform to the specifications and descriptions set

forth in CONTRACT and (ii) shall be new and unused, free from DEFECTS and Deficiencies of any kind and shall meet the requirements of the Scope of Work.

d) The completed PLANT shall be free of DEFECTS and Deficiencies and shall be designed, constructed and engineered, in compliance with the Scope of Work.

e) PLANT shall be designed, engineered, constructed, tested, completed and delivered based on Good Industry Practices, CONTRACTOR's specifications and guidelines for operation and maintenance in accordance with the Scope of Work, for CONTRACT PRICE and no later than the COMPLETION PERIOD.

f) All SUB-CONTRACTOR/vendor shall perform their portion of the Scope of Work or supply or install EQUIPMENT in accordance with the applicable terms set forth herein.

g) Adherence to the Operations Manual shall allow safe start-up, operation, maintenance and shut-downs of the completed PLANT, in accordance with CONTRACTOR's guidelines and will not impair any warranty or guarantee of EQUIPMENT incorporated or to be incorporated into PLANT.

1.2.32 General

1.2.32.1 CONTRACTOR shall incorporate during design stage maximum utilization of goods manufactured and/or available in India and also avail shipping, insurance, banking, catering and any other services available from India-owned companies for installation of plant, if quality, delivery and overall cost characteristics are equivalent.

1.2.32.2 CONTRACTOR shall arrange insurance pursuant to Clause 28.0 of GCC, at its own cost.

1.2.32.3 CONTRACTOR shall provide necessary information, documentation, and assistance for obtaining any approvals from Financial Institutions or any other agencies or authorities.

2.0 OWNER/ PMC'S OBLIGATIONS

OWNER/ PMC shall be responsible for fulfilling all obligations as specified under the following heads:

2.1 Deleted

2.2 Overall Co-Ordination

The objective of overall co-ordination is to organise orderly execution of WORK, bring about requisite integration amongst the various project activities of executing agencies, to avoid interference between the various activities of the parties in order to achieve the earliest possible completion of WORK. The aim will be to integrate, have

compatibility between plants and uniform standardisation of design, engineering, layout, etc.

2.3.0 Review and Approval of Work

2.3.1 CONTRACTOR shall associate OWNER/ PMC's representatives with WORK as carried out by CONTRACTOR's personnel. For this purpose, OWNER/ PMC shall associate with WORK at all stages. Specifically, OWNER/ PMC shall undertake the following tasks:

a) Review/APPROVAL of drawings as per Technical Section and other documents connected with basic and detailed engineering.

b) Review of specifications for EQUIPMENT, lists of spare parts and special maintenance tools, and lists of special construction aids, tools, tackles, and fixtures.

c) Participation in inspection, expediting and testing of EQUIPMENT at SUB-CONTRACTOR's / vendor's works and at SITE, wherever considered necessary by OWNER/ PMC.

2.3.2 For the smooth functioning, OWNER/ PMC will nominate an individual who will act as Engineer in charge (EIC) under the CONTRACT. The EIC will have full authority to act on behalf of the OWNER/ PMC in connection with the CONTRACT. Except as otherwise provided in the CONTRACT, all communications between the OWNER and the CONTRACTOR relating to the WORKS shall be between the ENGINEER-IN-CHARGE and the CONTRACT MANAGER.

2.4 Deleted

2.5 Facilities for CONTRACTOR's Personnel

OWNER shall assist CONTRACTOR in obtaining Visas and other PERMITS from the appropriate authorities for CONTRACTOR's and SUB-CONTRACTOR's / vendor's expatriates to enter and stay in India as necessary for performance of WORK. OWNER shall also provide facilities to CONTRACTOR's expatriates in accordance with the provisions described in Clause-2.8.

2.6 Operating and Maintenance Personnel

OWNER may associate its personnel with the construction and erection of PLANT to familiarise the personnel with WORK, and generally to prepare for proper operation and maintenance of PLANT.

2.7 Utilities

OWNER/ PMC shall make available the utilities as specified in Section VI-8.0 of bid document for commissioning and PLANT TRAIL RUNS.

2.8 Site Facilities

OWNER/ PMC shall provide the following SITE facilities:

a) Land for Construction Activities
b) General safety and security without prejudice to Contractor's obligations.
c) Construction Power & Construction Water shall be provided as per clause 1.1.1 (g) above
d) Free and unrestricted access to SITE for CONTRACTOR's Authorized Personnel
e) OWNER shall NOT provide any accommodation and facilities for travelling to and from SITE to the place of residence to the personnel of CONTRACTOR/ SUB-CONTRACTOR, deputed at SITE for performing WORK under CONTRACT.
f) Area for making shed/covered storage for storing EQUIPMENT, as available.

3.0 CHANGES IN WORK/CHANGE ORDER

3.1 OWNER/ PMC may at any time order change in work scope. OWNER shall have the right to request in writing changes in WORK within the scope of CONTRACT. When the request for a change in WORK by OWNER/ PMC has been agreed and complied by CONTRACTOR, CONTRACTOR's obligations under CONTRACT shall remain unaffected unless otherwise agreed.

Changes may consist of additions, deletions or revisions of the Scope of Work, and may cause the CONTRACT PRICE, the work schedule or the COMPLETION PERIOD or any other CONTRACTOR's WARRANTEES to be adjusted.

CONTRACTOR shall be entitled to an extension of time to COMPLETION PERIOD suffered and/or payment of additional costs incurred as a result of any change in law or legislation, by way of a CHANGE ORDER, in case it is necessitated or if it becomes applicable.

3.2 The ENGINEER IN CHARGE shall have the right to make any alterations in, omission from, additions to or substitutions for in the scope of work, the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the WORK and the CONTRACTOR shall be bound to carry out the such altered/ extra/ new items of WORK in accordance with any instructions which may be given to him in writing signed by the ENGINEER IN CHARGE, and such alterations, omissions, additions or substitutions shall not

invalidate the CONTRACT and any altered, additional or substituted work which the CONTRACTOR may be directed to do in the manner above specified as part of the WORK shall be carried out by the CONTRACTOR on the same conditions in all respects on which he agreed to do the main WORK. The time of completion of WORK may be extended for the part of the particular job at the discretion of the ENGINEER IN CHARGE, for only such alterations, additions or substitutions of the WORK, as he may consider as just and reasonable. The rates for such additional, altered or substituted WORK under this clause shall be worked out in accordance with the following:-

CONTRACTOR shall, within 7 days of the date of receipt of order to carry out the WORK, inform the ENGINEER IN CHARGE of the rates which it is his intention to charge for such class of WORK, supported by analysis of the rate or rates claimed, and the ENGINEER IN CHARGE shall determine the rate or rates on the basis of the prevailing market rates, labour cost at schedule of labour rates plus 10% to cover contractor's supervision, overheads and profit and pay the CONTRACTOR accordingly. The opinion of the ENGINEER IN CHARGE as to current market rates of materials and the quantum of labour involved per unit of measurement will be final and binding on the CONTRACTOR.

3.3. If it is established that a request for Change in Work asked by Owner does not fall under original Scope of Contract, then CONTRACTOR shall promptly submit cost estimate, and / or time extension and / or terms of payment (as applicable) for making the requested change in WORK together with the details of any variation required to be made to any of CONTRACTOR’s or OWNER’s obligations and/or guarantees as per clause 3.2 above.

3.4 If in CONTRACTOR's opinion fulfillment of any of its obligations under CONTRACT would be jeopardized by a CHANGE IN WORK requested by OWNER, then CONTRACTOR shall explain in writing to OWNER the reasons for not accepting these changes within fifteen(15) days of receipt of OWNER's written request.

3.5 OWNER and CONTRACTOR shall agree upon the basis and terms of the CHANGE IN WORK in writing.

3.6 It is understood that no change shall become effective and no change will alter the scope of WORK until all of the matters referred to in this *Clause 3* have been mutually agreed upon in writing by OWNER/ PMC and CONTRACTOR.

3.7 It is agreed by both parties that the following changes shall not be considered a CHANGE IN WORK in the meaning in this Clause:

a) Minor changes requested by OWNER and accepted by CONTRACTOR which do not involve any substantial additional cost or man-hour effort, and have no effect on contractual completion period, and/or

b) Any change necessitated due to requirements of prevalent laws in India up to the time of submission of FINAL PROPOSAL.

3.8 This clause is to be read in conjunction with Clause No. 5.0 of GCC.

4.0 ACCEPTANCE OF PLANTS AND FACILITIES

CONTRACTOR's liabilities for the Performance Guarantees given for the PLANTS and Facilities in respect of capacity, consumption, and pollution level shall be discharged only when the PLANT TRAIL RUNS as stipulated in Technical, Section VI-2 of NIT have been successfully carried out as per Plant Acceptance criteria specified at Clause 5.0 below and OWNER has issued PRELIMINARY ACCEPTANCE CERTIFICATE.

5.0 PLANT ACCEPTANCE CRITERIA

Subject to fulfilling PLANT TRAIL RUNS as per Section VI-16.0 of NIT and Clause 18.0 of SCC, OWNER shall be in readiness to accept the PLANT. CONTRACTOR shall take all steps to fulfil the provisions of the CONTRACT for OWNER to issue PRELIMINARY ACCEPTANCE CERTIFICATE**.** The care and custody of the PLANT shall be passed on to OWNER on PRELIMINARY ACCEPTANCE of the PLANT.

6.0 PRELIMINARY ACCEPTANCE

PRELIMINARY ACCEPTANCE shall mean that following milestones have been achieved for each PLANT (i) MECHANICAL COMPLETION has occurred, (ii) PRE-COMMISSIONING and COMMISSIONING of the PLANT have been accomplished, , (iv) PLANT TRAIL RUNS has been conducted by LSTK Contractor and accepted by OWNER (v) All statutory approvals in the scope of Contractor, required to operate and maintain the PLANT have been obtained (vi) OWNER has received all DOCUMENTS required hereunder to start up, operate and maintain the PLANT(vii) OWNER has received all operations, maintenance, and spare parts manuals and instruction book necessary to operate and maintain the PLANT in a safe, efficient and effective manner (viii) all special tools and spare parts purchased by CONTRACTOR as provided herein have been delivered to OWNER;

6.1 ISSUANCE OF PRELIMINARY ACCEPTANCE CERTIFICATE

Within 30 (thirty) DAYs from completing successfully all activities as defined at clause 6.0 above by the CONTRACTOR and CONTRACTOR fulfilling all the obligations under the provision of the CONTRACT, OWNER shall issue PRELIMINARY ACCEPTANCE CERTIFICATE to CONTRACTOR . On issue of this Certificate by OWNER, CONTRACTOR shall become entitled to receive all associated payment as per provisions of the CONTRACT due to CONTRACTOR subject to CONTRACTOR’s fulfilling the obligations stipulated under CONTRACT.

7.0 LABOUR AND STAFF

7.1 The CONTRACTOR shall make his own arrangement for labour, erection and COMMISSIONING engineers and all other staff required for carrying out the WORK. The necessary permissions from Government of India regarding work permit and visa requirement shall be obtained by the CONTRACTOR.

7.2 The CONTRACTOR shall make his own arrangements for providing canteen service to his labour and staff. Open space for this purpose may be provided by OWNER.

7.3 The CONTRACTOR shall at his own cost provide office and other accommodation for his staff and workmen. The CONTRACTOR shall also provide communication, transport and medical facilities to his staff and workmen.

7.4 The CONTRACTOR shall be responsible for all statutory obligations and any other laws in this regard in force from time to time regarding the employment or conditions of service of CONTRACTOR's labour, workman or employees.

7.5 The CONTRACTOR shall observe all safety rules as required under various rules, regulations and laws in India and shall also strictly adhere to safety regulations of OWNER.

8.0 Deleted

9.0 MODE OF CONTRACTING

9.1 Notwithstanding anything stated elsewhere in the CONTRACT documents, the CONTRACT is awarded on Lumpsum turnkey basis with single point responsibility.

9.2 The CONTRACT shall be in all respect being construed and governed in accordance with the Indian laws.

9.3 The Contract shall be treated as a "WORK CONTRACT SERVICE".

10.0 FINAL BILL

10.1 On the basis of the LUMPSUM PRICE provided in the CONTRACT and subsequent Change Order(s)/Amendment(s), if any and the approved billing schedule, the CONTRACTOR shall prepare a Final Bill in the prescribed form. Additions claimed to the LUMPSUM PRICE or reductions thereof on account of CHANGE ORDER(s) shall be separately indicated in the Final Bill with reference to the relative CHANGE ORDERS(s).

10.2 The Final Bill shall, in addition to the payment entitlements arrived at according to the provisions of Clause 10.1 hereof shall separately state and include therein all claims of the CONTRACTOR, if any, with full particulars of the nature of such claim and grounds on which it is based and the amount claimed.

10.3 The Final Bill drawn in accordance with Clause 10.1 shall be submitted together with the PRELIMINARY ACCEPTANCE CERTIFICATE to the ENGINEER-IN-CHARGE for certification, who shall certify the Final Bill, if drawn in accordance with Clause 10.1 After certification of the ENGINEER-IN-CHARGE, the Final Bill shall be submitted in quadruplicate (or in such other number of copies as the OWNER may prescribe) accompanied by the PRELIMINARY ACCEPTANCE CERTIFICATE to the OWNER for payment.

10.4 All amounts payable under the CONTRACT for WORKS to be performed and MATERIALS to be supplied up to and including successful completion and final tests and commissioning of the system and performance tests shall become due and payable to the CONTRACTOR only after submission to the OWNER of the Final Bill prepared in accordance with the provisions of Clause 10.1 hereof and associated provisions there under accompanied by the PRELIMINARY ACCEPTANCE CERTIFICATE in respect of the WORKS.

10.5 Payments of the amount(s) due on the Final Bill to the extent certified by the ENGINEER-IN-CHARGE, shall be made within 84 (Eighty Four) days from the due date as specified in Clause 10.4 hereof, subject to the deductions provided in Clause 10.6.

10.6 All payments due to the CONTRACTOR on the Final Bill shall be subject to, tax deductions as provided for in Clause 11.0 and associated clauses there under and any other deduction provided in the CONTRACT or required to be made under any law, rule or regulation having the force of law for the time being applicable, or elsewhere provided for in the CONTRACT documents.

11.0 **Deleted**

12.0 **Deleted**

13.0 **STATUTORY VARIATION IN TAXES AND DUTIES**

13.1 No variation on account of taxes and duties, statutory or otherwise, (other than due to change in turnover) shall be payable by OWNER to CONTRACTOR, except for GST. Any statutory variation in GST, shall be payable up to COMPLETION PERIOD against documentary evidence. Any reduction in the amount of GST resulting from a reduction in the rate of GST or remission or exemption from GST with respect to Goods and Services provided to the OWNER shall be refundable to the OWNER at actuals within the COMPLETION PERIOD and also during the delayed contractual Project completion, if any. The CONTRACTOR shall submit a copy of the 'Government Notification' to evidence the rate as applicable on the Bid due date and on the date of revision.

13.2 Any new taxes, duties, cess, levies notified or imposed after the submission of Price Bid but before COMPLETION PERIOD shall be to OWNER’s Account.

13.3 In case of delayed completion beyond the COMPLETION PERIOD, even though extension of completion time is allowed by OWNER, for reasons solely attributable to

Contractor, all extra costs on account of changes of statutory regulations/ acts shall not apply to the Contract price and shall be borne by the CONTRACTOR.

However, any decrease in taxes and duties during the delayed period shall be passed on to the OWNER.

In case the COMPLETION PERIOD is extended for reasons solely attributable to OWNER, then any increase on account of statutory changes in GST until the extended period shall be borne by OWNER. Further, any new taxes, duties, cess, levies notified or imposed after the submission of Price Bid during such extended COMPLETION PERIOD shall be to OWNER's Account.

13.4 Claim for payment of GST (CGST & SGST/UTGST or IGST)/ Statutory variation, should be raised within two [02] months from the date of issue of 'Government Notification' for payment of differential (in %) GST (CGST & SGST/UTGST or IGST), otherwise claim in respect of above shall not be entertained for payment of arrears.

The base date for the purpose of applying statutory variation shall be the Bid Due Date.

14.0 TERMS OF PAYMENT

14.1 Payments shall be made by OWNER to the CONTRACTOR through RTGS / NEFT.

14.2 **Deleted**

14.3 Subject to the other provisions of the Contract documents, payments shall be made as follows:

14.3.1 Deleted

14.3.2 FOR SUPPLIES INCLUDING SPARES, LUBRICANTS ETC:

i) Deleted

ii) **AGAINST PROOF OF SHIPMENT / DESPATCH OF MATERIALS:**

40% (Forty percent) on pro-rata basis as indicated in the approved Billing schedule (refer clause 15.0 below). Stage payment against "Proof of despatch of Materials" shall be released on submission of the following documents:

i. Signed Invoice(s)

ii. Delivery Challan
iii. Packing list.
iv. Manufacturer's certificate of inspection for shipment duly approved by the CONTRACTOR in one original and one photocopy
v. Third Party Inspection Release Note clearly indicating that material has been inspected and accepted as per QAP approved by OWNER/PMC, or waiver certificate issued by OWNER/PMC.
vi. Railway Receipt/LR
vii. Certificate of Insurance Policy
viii. Guarantee certificate (wherever applicable)
ix. Operation & Maintenance manual (wherever applicable)

iii) **AGAINST RECEIPT OF MATERIAL AT SITE** :

45% (Forty Five Percent) on pro-rata basis as indicated in the approved Billing schedule on submission of:

(a) Signed Invoices.
(b) Photocopy of Third Party Inspection certificate as per QAP approved by OWNER along with Test Certificate.
(c) Entry gate pass duly endorsed by OWNER's security for verification of physical entry of material to SITE.
(d) Incoming Material Inspection Report signed by PMC & Owner.

iv) 5% (Five percent) as indicated in the approved Billing schedule on issue of MECHANICAL COMPLETION Certificate against CONTRACTOR's certified running Accounts Bill(s).

v) 8% (Eight percent) as indicated in the approved Billing schedule on issue of PRELIMINARY ACCEPTANCE CERTIFICATE against the CONTRACTOR's certified Running Account Bills.

vi) 2% (Two percent) as indicated in the approved Billing schedule on completion of balance jobs, if any, against the CONTRACTOR's Certified Final Bill.

14.3.3 FOR SERVICES (including transportation, insurance, installation Erection & Commissioning)

i) 85% (Eighty Five Percent) of the Services Price component shall be paid on pro-rata basis against progress of Service duly certified by the PMC &Owner for the quantum of work completed and field quality billed as per the approved Billing Schedule/monthly progress report.

ii) 5% (Five percent) on issue of MECHANICAL COMPLETION Certificate against CONTRACTOR's certified running Accounts Bill(s).

iii) 8% (Eight percent) as indicated in the approved Billing schedule on issue of PRELIMINARY ACCEPTANCE CERTIFICATE against the CONTRACTOR's certified Running Account Bills.

iv) 2% (Two percent) on completion of balance jobs, if any, against the CONTRACTOR's Certified Final Bill.

14.3.4 Deleted

14.4 All payments shall be released only after finalization of the planning and monitoring documents and Progress Schedule.

All invoices shall be submitted in quadruplicate to EIC by the Bidder. The payment shall be released within 30 days of submission of invoice.

14.5 **Payment Methodology**

CONTRACTOR shall enclose all documents as per check list issued by PMC/OWNER. After receipt of complete RA Bill as per terms and conditions of the contract and duly certified by Engineer-in-Charge (EIC) / PMC, on-account payment equivalent to seventy percent (70%) of the net payable certified amount of the RA Bill will be released to the Contractor within a period of seven (07) working days from submission of certified bill by PMC to TFL. The balance amount will be released within a period of 15 days from submission of certified bill by PMC to TFL.

14.6 All invoices shall be submitted in quadruplicate to EIC by the Bidder.

15.0 **BILLING SCHEDULE**

The CONTRACTOR shall submit all invoices for a particular month under a single covering letter (once in a month) based on the billing schedule duly certified by OWNER/ PMC with related documents.

The Billing Schedule shall consist of the following Heads:

1.0	**SUPPLIES (Break-up in line with the Material Control Index-MCI)**
a.	Total of Supplies (excluding Spares , Chemicals, Lubricants)
b.	Mandatory/Insurance Spares as per list enclosed in Section VI-10
c.	Lubricants& Consumables
d.	Others
2.0	**SERVICES**

a.	Basic Engineering(Break-up In line with the Document Control Index-DCI)
b.	Detailed Engineering(Break-up In line with the Document Control Index-DCI)
c.	Civil And Structural Works
d.	Installation
e.	Mechanical Completion
f.	Erection
g.	Commissioning
h.	PLANT TRAIL RUNS
i.	Insurance
j.	Transportation Charges
k.	Others

The CONTRACTOR shall raise “Tax Invoices” on the OWNER against the GST to enable OWNER to reimburse the same

The GST paid on the local procurements by the CONTRACTOR have to be shown separately with all the supporting documents to enable the owner to reimburse the same.

The Bill of Entry shall have to be filed by the CONTRACTOR within the stipulated time with the appropriate authorities.

Note:

1. Bidder shall indicate all Prices in INR only

2. Spares for Start-up /Commissioning and Mandatory Spares/ Insurance Spares are in CONTRACTOR’s scope of supplies and are to be included in the quoted TOTA LCONTRACT PRICE.

3. It will be the responsibility of the contractor to include prices of all materials/equipments/Services/Civil & Structural Works required for completion of work as per the CONTRACT.

4. The total price payable under the CONTRACT shall be restricted to TOTALCONTRACTPRICE.

5. The Civil & Structural Works shall include but not limited to the Price of Piling, Equipment Foundation, Buildings, Structural Works ,etc.

6. Total price of SUPPLIES shall not exceed 70% of the TOTAL CONTRACT PRICE. The

SUPPLIES shall include but not limited to the Price of all materials complete in all respect including Commissioning and Mandatory Spares, etc.

7. Total price of Basic Engineering and Detailed Engineering quoted in shall not exceed 10% of the TOTAL CONTRACTPRICE. The supply of Services shall include but not limited to the Price of all services complete in all respect including Basic Engineering, Detailed Engineering, installation/Erection Services including site fabrication, Transportation, Insurance, Pre- Commissioning, Commissioning, Plant trail runs etc.

8. CONTRACTOR shall be entirely responsible for all taxes, cess, stamp duties, and other such levies applicable, on performance of WORK under CONTRACT, outside OWNER's country. CONTRACTOR and shall also be responsible for payment of all taxes, duties and levies such as custom duty, GST, income tax, etc. as applicable on performance of WORK under CONTRACT, in India. All such taxes, stamp duties, cess, licence fees, and other such levies applicable shall be included in the quoted TOTAL CONTRACT PRICE.

16.0 DEEMED ACCEPTANCE

In case COMMISSIONING & PLANT TRAIL RUNS of a PLANT is delayed by 12 months from successful MECHANICAL COMPLETION of the PLANT due to reasons solely attributable to the OWNER, the PLANT shall be considered as DEEMED ACCEPTED with a DEFECT LIABILITY PERIOD of another 12 months from DEEMED ACCEPTANCE.

In case of DEEMED ACCEPTANCE, a reasonable cost for conductance of Plant trial runs shall be worked out mutually and shall be retained by OWNER. Payment against PRELIMNARY ACCEPTANCE, less the aforesaid retention amount shall be released upon DEEMED ACCEPTANCE of the PLANT. The CONTRACT PERFORMANCE SECURITY shall be extended by the CONTRACTOR so as to ensure validity of three (03) months beyond the date of completion of DEFECT LIABILITY PERIOD.

This provision of DEEMED ACCEPTANCE shall not be applicable in case reasons for delay solely attributable to the OWNER are resolved before the completion of 12 months from successful MECHANICAL COMPLETION. In that case, remaining activities including PLANT TRAIL RUNs shall be completed as per the terms & conditions of the CONTRACT and CONTRACT PERFORMANCE SECURITY shall be extended, accordingly, by the CONTRACTOR so as to ensure minimum validity of 3 months beyond the expiry of DEFECT LIABILITY PERIOD.

Even after the DEEMED ACCEPTANCE, CONTRACTOR shall not be absolved from his obligations of carrying out COMMISSIONING including PLANT TRAIL RUNS. However, in such case, the CONTRACTOR shall have no obligation to prove the Guarantee Parameters.

The CONTRACTOR may, in consultation with the OWNER, demobilise the team from the Site. It shall remobilise at the time of conductance of COMMISSIONING & TRAIL RUNS by OWNER which shall be within DEFECT LIABILITY PERIOD. The OWNER shall reimburse the reasonable cost to be incurred by the CONTRACTOR for remobilization.

In case of DEEMED ACCEPTANCE, OWNER shall be responsible for care, custody and proper maintenance of the PLANT. However, OWNER, at its option, may retain the CONTRACTOR's services for watch, ward and preservation of the PLANT and reimburse the CONTRACTOR a mutually agreed reasonable cost incurred to do so.

After Deemed Acceptance, on performance of TRAIL RUNS by the CONTRACTOR, if the Guaranteed parameters are not achieved, then the CONTRACTOR shall furnish the Recommendation/Report for corrective action to be implemented by OWNER to achieve the desired Guaranteed parameters.

17.0 DEFECT LIABILITY PERIOD AND LIABILITY FOR DEFECT

17.1 The DEFECT LIABILITY PERIOD shall be for a period of 12 (Twelve) months from the date of PRELIMINARY ACCEPTANCE/DEEMED ACCEPTANCE

If at any time before the PRELIMINARY ACCEPTANCE or during the DEFECT LIABILITY PERIOD stated below, the OWNER:

(a) Claims that any matter is a DEFECT; and

(b) as soon as reasonably practicable gives to the CONTRACTOR notice of the particulars of the DEFECT; the CONTRACTOR shall as soon as possible make good the DEFECT so notified and the OWNER shall so far as may be necessary place the PLANT at the CONTRACTOR's disposal for this purpose. The CONTRACTOR shall, if so required by the EIC, submit his proposals for making good any DEFECT to the EIC for his approval.

17.2 If any DEFECT arises from any breach of the CONTRACT by the CONTRACTOR, the CONTRACTOR shall bear his own cost of making good the DEFECT. In the case of any other matter made good by the CONTRACTOR, the work done by the CONTRACTOR shall be the subject of CHANGE ORDER.

17.3 The performance guarantees are demonstrated only through the plant trail runs carried out before the achievement of the PRELIMINARY ACCEPTANCE CERTIFICATE.

CONTRACTOR shall carry out further test(s) on the repaired/replaced item during the DEFECT LIABILITY PERIOD having the sole purpose to verify that said item is capable of working in compliance with contractual requirements. Such test(s) shall not be intended as a repetition of the performance tests already performed.

If DEFECT is made good after the issue of a PRELIMINARY ACCEPTANCE CERTIFICATE, the EIC may require the CONTRACTOR to repeat any appropriate performance test for the purpose of establishing that the DEFECT has been made good. The CONTRACTOR shall be responsible for the cost of any repeat inspection or test in the event of an inspection or test failure.

17.4 If in the course of making good any DEFECT which arises during the DEFECT LIABILITIES PERIOD and CONTRACTOR repairs, replaces or renew any part of the PLANT, this Clause 17 shall apply to the repair or to that part of the PLANT so replaced or renewed and shall

further apply until the expiry of a period of 12 months from the date of such repair, replacement or renewal (the extended DEFECT LIABILITY PERIOD). However, extended DEFECT LIABILITY PERIOD shall have an upper limit of 24 months, starting from the date of Commissioning. .

17.5 If the CONTRACTOR does not make good with a reasonable time any DEFECT which he is liable to make good under Sub-Clause 17.1 then the OWNER may, in addition to any other remedies or relief available to him under the CONTRACT, proceed to do the work, provided that the OWNER gives at least fourteen DAYS notice of his intention.

17.6 If the OWNER reasonably requires that any DEFECT notified to the CONTRACTOR under Sub-clause 17.1 which arises during the DEFECT LIABILITY PERIOD be made good urgently and the CONTRACTOR is unable or refuses to comply within a reasonable time, the OWNER may, in addition to any other remedies or relief available to him under the CONTRACT, proceed to do the work in such a manner as the ENGINEER-IN-CHARGE may decide, including the employment of a third party.

17.7 If the OWNER has made good a DEFECT in accordance with Sub-clause 17.5 or 17.6, the CONTRACTOR shall reimburse the OWNER his reasonable cost of so doing provided that the OWNER gives a notice to the CONTRACTOR of his intention and submits a claim supported by DOCUMENTS. The ENGINEER-IN-CHARGE and the CONTRACTOR may agree the amount to be paid by the CONTRACTOR, or in the absence of agreement the ENGINEER-IN-CHARGE shall decide such amount as may be reasonable. Such amount shall be:

a) deducted from any money that would otherwise be payable under the CONTRACT; or

b) paid by the CONTRACTOR to the OWNER

17.8 If the PLANT cannot be used because of a DEFECT to which this Clause 17 applies, the DEFECT LIABILITY PERIOD, or if applicable the extended DEFECT LIABILITY PERIOD, shall be extended by a period equal to the period during which it cannot be used. Similarly the DEFECT LIABILITY PERIOD, or if applicable the extended DEFECT LIABILITY PERIOD shall be extended by any period wherein the PLANT cannot be used by reason of the CONTRACTOR putting the PLANT into such condition that it passes any relevant performance test or attempting to do so.

18.0 PERFORMANCE TESTS

18.1 The performance tests to be carried out on the PLANT shall be as specified in Technical, Section VI-16.0 of NIT.

18.2 The performance test shall be carried out by the CONTRACTOR in the presence of OWNER/PMC.

The CONTRACTOR shall give a notice to the EIC/OWNER about his readiness to carry out the performance tests, including a proposal for the time at which the tests would commence.

The CONTRACTOR shall then confirm, at least fifteen (15) DAYS before the commencement of the performance tests.

18.3 Every test shall be carried out to completion unless the EIC or the CONTRACTOR shall order it to be stopped because its continuance would be unsafe or unacceptable to either party.

18.4 If PLANT TRAIL RUNS fails due to any reason, CONTRACTOR has to make necessary adjustments and modifications and take all remedial measures at his own cost and demonstrate PLANT TRAIL RUNS.

The OWNER shall permit to CONTRACTOR to make adjustments and modifications to any part of the Plant before the repetition of any performance test.

The CONTRACTOR shall submit details of the adjustments and modifications which he proposes to make.

18.5 If any performance test is stopped before its completion, due to reasons attributable to OWNER, such test shall be repeated as soon as practicable thereafter. However, the OWNER shall have the option to operate the plant in accordance with the Operating Manuals provided by CONTRACTOR, whereupon care and custody of the PLANT shall pass on to the OWNER and DEFECT LIABILITY PERIOD shall start. The OWNER shall exercise the option to allow CONTRACTOR to carry out the Performance Tests with grant of extension of time by such number of days of deferment. Such deferment shall not exceed more than 90 days. In case the deferment exceeds 90 days, the Owner shall reimburse the additional cost of remobilisation incurred due to such deferment. However, the outer limit of such deferment shall be 12 months from COMMISSIONING and the provisions of Clause 16 shall apply thereafter. If the PLANT fails to pass any performance test, such test shall, subject to Sub-clause 18.7, be repeated as soon as practicable thereafter. The OWNER shall permit to CONTRACTOR to make adjustments and modifications to any part of the Plant before the repetition of any performance test and shall, if the CONTRACTOR reasonably requires, shut down any part of the PLANT for such purpose and restart it after completion of the adjustments and modifications, which shall be made by the CONTRACTOR with all reasonable speed.

The timing of such shutdown shall be agreed between the CONTRACTOR and the EIC, provided that if any or both i.e. the timing of shutdown or repetition of Performance Test, is required to be deferred, the agreed period of Performance Test Period shall be accordingly extended.

The CONTRACTOR shall, if so required by the EIC, submit to the EIC for his information details of the adjustments and modifications which he proposes to make.

The CONTRACTOR shall make such adjustment and modifications at his own cost.

18.6 The result of the performance tests shall be compiled by the CONTRACTOR and to be submitted to OWNER/PMC for evaluation.

18.7 If the results of the performance tests are outside the limits, OWNER may at his option:

a) instruct the CONTRACTOR to investigate or to co-operate with the EIC or others in the investigation of the reasons in its WORK for the shortfall in the performance;

b) instruct the CONTRACTOR to propose remedial measure and work necessary to correct the shortfall whether as the result of any such investigation or not;

and/or

c) Recommend the CONTRACTOR to carry out, at CONTRACTOR'S option, whatever remedial measures and work within its scope of WORK may be necessary to correct the shortfall.

Thereafter the EIC or CONTRACTOR may require that the PLANT TRAIL RUNS be repeated, the result of which shall be subject to this Sub-clause 18.7 (i).

The CONTRACTOR shall bear his own cost of work undertaken in accordance with (a), (b) or (c) above.

iii. After 3 (three) failed Performance Tests as specified at Section VI-16.0 of NIT for reasons attributable to the CONTRACTOR, the OWNER shall have right to proceed with the encashment of Contract Performance Security and other provisions also take all action as per Clause 34 of GCC shall further apply.

19.0 FINAL ACCEPTANCE CERTIFICATE

19.1 As soon as DEFECT LIABILITIES PERIOD for the PLANT has expired or the CONTRACTOR has made good all DEFECTS that have within such period appeared in the PLANT in accordance with Clause 17 (Liability for Defects), whichever is later, the EIC shall issue a FINAL ACCEPTANCE CERTIFICATE to the CONTRACTOR certifying that the CONTRACTOR has performed his obligations in respect of the DEFECT LIABILITY PERIOD and associated clauses there under, and until issue of such FINAL ACCEPTANCE CERTIFICATE, the CONTRACTOR shall be deemed not to have performed such liabilities notwithstanding issue of the PRELIMINARY ACCEPTANCE CERTIFICATE or payment of the Final Bill by the OWNER.

19.2 The FINAL ACCEPTANCE CERTIFICATE shall constitute conclusive evidence for all purposes and in any proceedings whatsoever between the OWNER and the CONTRACTOR that the CONTRACTOR has completed the PLANT and made good all DEFECTS therein in all respects in accordance with his obligations under the CONTRACT.

No FINAL ACCEPTANCE CERTIFICATE shall be conclusive as stated above if FINAL ACCEPTANCE CERTIFICATE was issued in reliance upon any fraudulent act, misrepresentation or concealment.

19.3 In the event that OWNER fails to issue the FINAL ACCEPTANCE CERTIFICATE, or fails to notify CONTRACTOR the reason for not issuing said certificate of acceptance, within a period of 60 days from CONTRACTOR's application, the FINAL ACCEPTANCE CERTIFICATE shall be deemed as issued by OWNER for all contractual purposes.

19.4 Upon application for the FINAL ACCEPTANCE CERTIFICATE, the CONTRACTOR shall:

(i) Be deemed to have warranted that it had been fully paid and satisfied all claims for or arising out of the WORK, labour, MATERIALS, supplies and EQUIPMENT used in or connected with the CONTRACT and all other liabilities whatsoever touching or affecting the CONTRACT, or its performance, including in relation to SUB-CONTRACTORS and suppliers, and

(ii) To have undertaken to indemnify and keep indemnified the OWNER from and against all claims, demands, debts, liens, obligations and liabilities whatsoever arising there from or relating thereto.

19.5 Upon issue of the FINAL ACCEPTANCE CERTIFICATE, the CONTRACTOR shall be deemed to have released, acquitted and discharged the OWNER from and against all claims (known or unknown), liens, demands or causes of action of any kind whatsoever arising out of or relating to the CONTRACT or otherwise howsoever touching or affecting the same.

19.6 Forthwith on application made by the CONTRACTOR in this behalf accompanied by the FINAL ACCEPTANCE CERTIFICATE, or within 84 (Eighty Four) days of the OWNER passing the CONTRACTOR's Final Bill, whichever shall be later, the OWNER shall cancel and return to the CONTRACTOR all previous Bank Guarantees remaining unutilised in the hands of the OWNER, and upon such cancellation and return, the OWNER shall stand discharged of all obligations/ liabilities under the CONTRACT provided that the cancellation and return of any Bank Guarantee(s) furnished by the CONTRACTOR as and by way of Contract Performance Security shall be subject to the CONTRACTOR replacing such Bank Guarantee(s) covering 10% (ten percent) of the value (or as determined by the OWNER) of equipments/works replaced or repaired during the DEFECT LIABILITY PERIOD for the unexpired term of extended defect liability period in respect thereof plus a 6 (six) months period. The claims or demands made during such additional 6 months period shall refer to events which has occurred before the expiry of the DEFECT LIABILITY PERIOD.

20.0 **COMPLETION PERIOD:**

Completion period for the entire package shall be 16 (Sixteen) months from the date of FOA.

21.0 MUTUALLY AGREED DAMAGES (MAD)

21.1 For Delay in Completion

21.1.1 The CONTRACTOR agrees that the work shall be commenced and carried on at such points, and in the order of precedence and at such times and seasons as may be directed by the OWNER/ PMC in accordance with the schedule for the completion of work as outlined in the CONTRACT. The CONTRACTOR declares that he has familiarised himself with the site and rights of way, ground conditions, with all the local conditions, and with all the circumstances which may or are likely to affect the performance and completion of the work and that he has allowed for such conditions in the preparation of this schedule. The progress of work shall be checked at regular monthly intervals and the percentage progress achieved shall be commensurate with the time elapsed after the award of the CONTRACT.

21.1.2 However, it is not incumbent upon the ENGINEER-IN-CHARGE to notify the CONTRACTOR when to begin or to cease or to resume work, nor to give early notice of the rejection of a faulty work, nor in any way to superintend so as to relieve the CONTRACTOR of responsibility of any consequence of neglect or carelessness by him or his subordinates.

21.1.3 The time stipulated in the CONTRACT for the execution and completion of the works shall be deemed to be of utmost importance of the CONTRACT. In the event the CONTRACTOR fails to attain the PRELIMINARY ACCEPTANCE of PLANT within the CONTRACTUAL COMPLETION SCHEDULE due to the reasons not attributable to OWNER, then the CONTRACTOR shall pay to the OWNER as MAD at the rate of 0.5% of the TOTAL CONTRACT PRICE (excluding taxes) per week of delay or part thereof. The total deductions under this head shall not exceed 5% of the TOTAL CONTRACT PRICE (excluding taxes).

The OWNER may, without prejudice to any method of recovery, deduct the amount for such damages from any amount due or which may become due to the CONTRACTOR. In the event of extension of time being granted by the OWNER in writing for completion of the WORKS without levy of MAD (Mutually Agreed Damages), this clause will be applicable after expiry of such extended period. GST at the prevailing rate, if applicable on “MUTUALLY AGREED DAMAGES” shall be recovered extra from the CONTRACTOR on the amount of such MUTUALLY AGREED DAMAGES levied as per the Contractual terms.

OWNER shall raise separate Tax Invoice for recovery of MAD along with applicable GST.

Mutually Agreed Damages represent, without prejudice to the respect of the contractual obligation under the CONTRACT by CONTRACTOR, the sole and exclusive remedy of OWNER for such delay.

The decision of the OWNER on the applicability of MAD shall be final and binding on the CONTRACTOR.

22.0 **OVERALL CEILING ON TOTAL LIABILITY**

22.1 The Maximum Overall Liability under the CONTRACT on account of (a) Delay in execution of project (b) Deleted % (c) Termination of CONTRACT (d) Carrying out balance work at the risk and cost of the CONTRACTOR, re-engineering, make good, mechanical warranty (e) Patent infringement and (f) any other liabilities (if any) defined in the NIT shall be capped to 100% of the TOTAL CONTRACT PRICE.

22.2 Except for criminal negligence or wilful misconduct, the Contractor shall not be liable to the Owner, whether in contract, tort, or otherwise, or any indirect or consequential loss or damage, loss of use, loss of production, or loss of profit or interest cost, provided that this exclusion shall not apply to any obligation of the Contactor to pay liabilities to the Owner, as defined in clause 22.1 above.

23.0 "PLANNING AND DESIGNING IN PURVIEW OF VULNERABILITY ATLAS OF INDIA:

Vulnerability Atlas of India (VAI) is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT- wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation stage.

This atlas is one of its kind single point source for the various stakeholders including policy makers, administrators, municipal commissioners, urban managers, engineers, architects, planners, public etc. to ascertain proneness of any city/location/site to multi-hazard which includes earthquakes, winds, floods thunderstorms, cyclones and landslides. While project formulation, approvals and implementation of various urban housing, buildings and infrastructures schemes, this Atlas provides necessary information for risk analysis and hazard assessment.

The Vulnerability Atlas of India has been prepared by Building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website www.bmtpc.org.

It is mandatory for the bidders to refer Vulnerability Atlas of India for multi hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of

i. Seismic zone (ll to V)for earthquakes,
ii. Wind velocity (Basic Wind Velocity: 55, 50, 47, 44, 39 & 33 m/s)
iii. Area liable to floods and Probable max, surge height
iv. Thunderstorms history

v. Number of cyclonic storms/severe cyclonic storms and max sustained wind specific to coastal region
vi. Landslides incidences with Annual rainfall normal
vii. District wise Probable Max Precipitation.

24.0 STANDARD CONDITIONS OF SCC: PART I TO PART III

The Contractor has to fully comply with all applicable Labour Laws and Regulations passed, modified and notified from time to time by the Central, State and Local Government agencies/authorities. Brief guidelines and Annexures related to labour laws/Acts for Workmen/labour are enclosed as STANDARD CONDITIONS OF SCC: PART I to PART III.

25.0 ASSIGNMENT OF CONTRACT

Nothing contained in this Contract shall affect the right of the Owner to assign this Contract in favour of and/or for the benefit of the banks and financial institutions (or their security trustee or their authorised representative) extending credit facilities of any nature to the Owner and the consent of the Contractor shall not be required for undertaking such assignment of this Contract

STANDARD CONDITIONS OF SCC: PART I

Compliances under various Labour Laws

The Contractor has to fully comply with all applicable Labour Laws and Regulations passed, modified and notified from time to time by the Central, State and Local Government agencies/authorities. Specific attention of the Contractor is drawn to the following obligations amongst others:

1. **The Minimum Wages Act, 1948, Payment of Wages Act, 1936 and Payment of Bonus Act 1965** or **The Code on Wages, 2019 (after it comes into force)**

1.1. **Minimum Wages:**

a. During the tenure of the contract, the Contractor must ensure the payment of minimum wages, as notified by the Central Government or State Government whichever is higher, as per the provisions of the Minimum Wages Act, 1948 / Code on Wages, 2019 (after it comes into force).

b. **Wage period and monthly wages**: Wage period shall be monthly and wages for a month shall be calculated by multiplying daily rate of Minimum Wages by 26. The monthly wages include the wages of the weekly days of rest as applicable to the office/establishment of TFL. Deduction in case of any days of absence other than weekly days of rest shall be calculated using the following formula:

Deduction for absence = days of absence x (monthly wages / number of days in the relevant month)

However, in case the resource has worked for less than 7 working days in a particular month, the payment of wages is to be made as per the actual number of days worked based on notified wage rate per day.

Illustration I (05 days per week working pattern):

Sl. No.	Month	Nos. of days in the month	Nos. of weekly off	Nos. of days absence	Nos. of days present	Daily wage as notified	Monthly wage	Deduction	Wage to paid
1	Feb.	28	8	2	18	603	15678	1119.86	14558.14
2	March	31	10	5	16	603	15678	2528.71	13149.29
3	April	30	8	10	12	603	15678	5226	10452.00
4	May	31	10	-	4	603	2412	0	2412.00

Illustration II (06 days per week working pattern):

Sl. No.	Month	Nos. of days in the month	Nos. of weekly off	Nos. of days absence	Nos. of days present	Daily wage as notified	Monthly wage	Deduction	Wage to paid
1	Feb.	28	4	2	22	603	15678	1119.86	14558.14
2	March	31	5	5	21	603	15678	2528.71	13149.29
3	April	30	4	10	16	603	15678	5226	10452.00
4	May	31	5	-	4	603	2412	0	2412.00

1.2. **Payment of Wages:**

The Contractor shall disburse monthly wages **through e-banking / digital mode through cashless transaction only**, and avoid illegitimate deductions and maintain records /returns as prescribed. The Contractor shall be solely responsible for the payment of wages and other dues to the resources, if any, deployed by him latest by 7th day of the subsequent month as per the provisions of the Payment of Wages Act, 1936 / as applicable under Code on Wages, 2019 (after it comes into force) in the presence of Engineer In-charge (EIC) or authorized representative of TFL. After disbursement of wages, the representative of the Contractor and EIC/ authorised representative of TFL have to certify the payment of wages to the resources and sign the Wage Register - Form B (under The Ease of Compliance to Maintain Registers under various Labour Laws Rules, 2017) / FORM-I of Code on Wages, 2019 (after it comes into force) with specific seal detailing name/designation/Company.

1.3. **Payment of Bonus:**

Contractor shall ensure payment of bonus as per the provisions of the Payment of Bonus Act, 1965 / Code on Wages, 2019 (after it comes into force). Present minimum rate of payment of Bonus as per the Payment of Bonus Act, 1965 is 8.33% of minimum wages per month or 8.33% of Rs.7,000/- per month whichever is higher. The rate shall be subject to amendments made from time to time to the legislation.

Payment of Bonus / ex-gratia (if Bonus is not applicable) shall be made preferably before Deepawali festival falling after the end of relevant financial year(s) and the balance payment at the time of closure of contract.

The amount towards the payment of bonus/ex-gratia shall be released / reimbursed to the contractor, after submission of proof of payment.

2. Leaves/ Leave with wages/ Holiday:

The Contractor shall comply with all the applicable leave Rules including leave with wages in terms of applicable labour legislations i.e. Factories Act, 1948 / Shops & Establishment Act/ Industrial Establishment (national & festival holidays, casual & sick leave) Act, 1965.

The Contractor shall extend the leave with wages and maintain the Register of Leave pertaining to the resource deployed. The payment towards un-availed leave, as per the Factories Act, 1948

/ Shops & Establishment Act, shall be settled with the resource at the time of closure of the contract or separation of resource from the contract by the contractor.

i. As per the **Factories Act, 1948 (if applicable)**:-Annual Leave with Wages @ 01 day for every 20 days of work performed by him in the previous calendar year becomes due.

ii. As per the **Shops & Establishment Act (if applicable)** : Privilege Leave not less than 15 days and Sickness/Casual Leave not less than 12 days (this provision may vary from state to state).

iii. As per the **Industrial Establishment (national & festival holidays, casual & sick leave) Act, 1965 (if applicable)**: (a) three national holidays of one whole day each on the 26th January, 15th August and 2nd October (b) five other holidays on any of the festivals specified in the - Schedule appended to this Act. (c) Every worker shall in each calendar year, be allowed by the employer 07 casual leave and 14 sick leave in such manner and on such conditions as may be prescribed (This provision may vary from state to state).

3. The Employees' Provident Fund & Miscellaneous Provisions Act 1952

a) The Contractor shall have independent PF code no. with the RPFC as required under the Employees' PF & Misc. Provisions Act, 1952.

b) The Contractor has to ensure compliance (as per prevailing rates) and extend benefits under the Employees' Provident Fund Scheme 1952, the Employees' Pension Scheme 1995 & the Employees' Deposit Linked Insurance Scheme, 1976 to the resources deployed by him.

c) The Contractor is required to submit copies of ***separate e-Challans / ECR alongwith proof of payment/receipt*** in respect of resources engaged through this contract only, on monthly basis. **Common challans would not be acceptable in TFL**. The Contractor should submit copies of previous months EPF e-Challans / ECR alongwith current month's bill. The TRRN. No. of the ECR would be verified online from EPFO portal by the Engineer-in-charge to confirm the status of payment and names of the resources deployed.

d) **PF is mandatory irrespective of the number of resources deployed** by the Contractor under this contract. PF membership and deposit of PF contribution is also mandatory even if the wage payment to the resource is exceeding the prescribed monthly wage ceiling (i.e. Rs. 15,000/-) under the Employees' PF & Misc. Provisions Act, 1952 and in such case the liability of the Contractor towards PF contribution shall be limited to the prescribed monthly wage ceiling notified from time to time (i.e. Rs. 15,000/- currently).

e) In case, the Contractor deploys any "**International Worker**", the Contractor should also make compliance under para 83 of EPF Scheme, 1952 i.r.o the "International Workers" and must register on the ***International Worker Portal of EPFO***.

4. The Employees' State Insurance Act, 1948 (If applicable and as per prevailing rates)

a) The Contractor shall have his own ESI code No. allotted by Employees' State Insurance Corporation (ESIC) as required under the Employees' State Insurance Act, 1948.

b) The Contractor has to arrange **Smart Cards (i.e. ESI Identity Card) /e-Pehchan Card** for the resource(s) engaged by him from the Corporation.

5. The Employees' Compensation Act 1923 (wherever applicable)

In case, the work place is out of the notified coverage area under ESIC i.e. ESIC is not implemented in the area **or** in case of excluded employees under ESIC, the Contractor is required to take Employee Compensation / Workmen Compensation Policy from IRDAI approved Insurance Company taking into consideration the **maximum compensation liability** as per provisions of Employees' Compensation Act, 1923. It must be ensured that the contractor/contracting firm should extend coverage to the contract workers through Employee Compensation Policy, to meet the **Compensation Liability** under **Employee's Compensation Act, 1923** along with **Medi-claim Policy** within the overall premium @ 3.25 % of Minimum wages (i.e. employer contribution towards ESI).

6. Group Personal Accident Insurance Policy

The Contractor is required to take a Group Personal Accident Insurance Policy with coverage of **Rs. 3 Lakhs** per resource for the entire period of contract covering all resources deployed under the contract.

7. **The Payment of Gratuity Act, 1972**

In case of Death or permanent disablement of a resource during execution of work under the contract, the Contractor has to pay the Gratuity as per the provision under the Payment of Gratuity Act, 1972 to the nominee(s) of the resource as per the details maintained in the duly signed Nomination Form maintained by the Contractor. The proof of disbursement may be submitted to the EIC for claiming reimbursement of amount paid towards death Gratuity from TFL.

8. **The Contract Labour (R&A) Act, 1970**

a) The Contractor is required to obtain Labour license under the provisions of the Contract Labour (R&A) Act, 1970 from the office of Licensing Officer, Central Labour Authority, Ministry of Labour and Employment, Govt. of India having jurisdiction of the Region.

b) The Contractor shall discharge obligations as provided under the Contract Labour (R&A) Act, 1970 rules and regulations framed under the same and enforced from time to time.

c) The Contractor shall ensure regular and effective supervision and control over the resources deployed for which a supervisor / representative of the Contractor should be available at all the times for giving suitable direction for undertaking the Contractual Obligations.

d) The Contractor is solely responsible for payment of wages to each resource deployed by him and such wages shall be paid before the expiry of such period as may be prescribed.

e) It shall be the duty of the Contractor to ensure the disbursement of wages to resource(s) through e-banking/digital mode. In case the resource does not have a bank account, the disbursement of wages may be made in cash in the presence of the Engineer-in-charge /

authorized representative of TFL initially and Contractor shall simultaneously arrange for opening the bank account of each contract labour deployed by him.

f) In case, the Contractor fails to make payment of wages and deposit of PF contribution within the prescribed period or makes short payment of wages / short deposit of PF contribution, then TFL, as Principal Employer, will make payment of wages in full or the unpaid balance due, as the case may be, to the resource(s) deployed by the Contractor and deposit the PF contribution with PF authorities. Such amounts will be recovered from the Contractor either by deduction from any amount payable to the Contractor under any contract or as a debt payable by the Contractor.

9. The contractor is required to comply with all applicable labour laws and regulations including, but not limited to the following:

a) The Factories Act, 1948 / The Shops & Establishment Act, 1948 (which ever applicable)
b) The Maternity Benefit Act, 1961
c) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1979 & Building and Other Construction Workers Welfare Cess Act, 1996
d) The Inter State Migrant Workmen (RECS) Act 1979 (if applicable)
e) Contract Labour (R&A) Act-1970
f) Employees' Provident Fund & Misc. Provisions Act- 1952
g) Employees' State Insurance Act-1948
h) Employees' Compensation Act, 1923
i) Payment of Gratuity Act, 1972
j) Minimum of Wages Act,1948
k) The Payment of Wages Act,1936
l) The Payment of Bonus Act,1965

STANDARD CONDITIONS OF SCC: PART II

Responsibilities of the Contractor

1. The Contractor shall be solely responsible and indemnify TFL against all charges, dues, claim etc. arising out of the disputes relating to the dues and employment of resources, if any, deployed by him.

2. The Contractor shall indemnify TFL against all losses or damages, if any, caused to it on account of acts of the resource(s) deployed by him.

3. The Contractor shall indemnify TFL from all claims, demands, actions, cost and charges etc. brought by any court, competent authority / statutory authorities against TFL.

4. The Contractor shall also indemnify TFL for any action brought against him for violation, non-compliance of any act, rules & regulation of center / state / local statutory authorities.

5. All resources deployed by the Contractor are deemed to be on the rolls of the Contractor.

6. **Age**: No resource below the age of **18 years** and above age of **58 years** shall be deployed by the contractor for the execution of the contract.

7. **Appointment/Nomination of supervisor:**
   As a part of the contract, the Contractor is required to appoint/nominate a supervisor (s) who will supervise, control and give directions to the resource(s) for discharging the contractual obligations. Accordingly, the Contractor has to give in writing the name and contact details of the supervisor (s) to the EIC. A copy of the same is also to be sent to HR In-charge and Security In-charge for records.

8. A copy of the Letter of Acceptance (LOA) should be submitted to the Security Department by the Contractor / his representative or supervisor for facilitating the movement of resource(s) including machine & materials involved in the contract.

9. The resources to be deputed/ deployed by the Contractor shall observe all security, fire and safety rules of TFL while at the site/work. All existing and amended safety / fire rules of TFL are to be followed at the work site by the Contractor and his deployed resource(s).

10. **Personal Protective Equipment / Safety Kit and Liveries**: Contractor shall ensure adequate supply of personal protective equipment / Safety Kit and Liveries as mentioned in the Scope of Work to all such resources deployed.

11. In case of accident, injury or death caused to the resource(s) while executing the Work under the contract, the Contractor shall be solely responsible for payment of adequate compensation, insurance money etc. to the next kith & kin of injured / diseased. Contractor shall indemnify TFL from such liabilities.

12. The Contractor shall not deploy any resource suffering from any contagious or infectious disease. The Contractor shall get the deployed resource(s) examined from a civil Govt. Doctor / TFL's Doctor.

13. No resource(s) or representatives of Contractor (including Contractor) are allowed to consume alcoholic drinks or any narcotics within the premises of TFL (including Plant, Office and Residential etc.). If found under the influence of above, the Contractor shall immediately replace that resource(s) with intimation to the EIC.

14. While engaging / deploying the resources, the Contractor is required to make efforts to provide opportunity of employment to resources belonging to **Schedule Caste, Schedule Tribe** and **Other Backward Class** in order to have a fair representation of these sections of the society.

15. While engaging the resources, the Contractor is required to make efforts to provide an **opportunity to** candidates with experience of **apprentice training in TFL** under the provisions of the Apprentices Act, 1961.

16. The Contractor is required to maintain all Registers and other records in an **office** within the premises of TFL or at a place **within a radius of three kilometers**.

17. Contractor shall provide proper **Employment cards (FORM XII)** for the resource to be deployed by him, duly signed by the Contractor or authorized person on behalf of Contractor.

18. **Gate/ Entry Pass or Authorization:**
    Entry to the premises of TFL is restricted and is subject to appropriate entry authorization in the prescribed format of a Gate Pass or any other entry authorization w.r.t police verification as per instruction of Security department from time to time. Similarly, entry for material/ equipment's/ tools/ tackles etc. is restricted & subject to entry authorization by security department.

19. The Contractor shall issue **Identity cards** in his firm's name to the resource deployed.

20. Discipline of the resource(s) during discharge of duties must be regulated by the Contractor himself or by his representative.

21. **Police verification**
    a) The Contractor (including his sub-Contractors/Petty Contractors etc, if allowed) will undertake police verification in respect of the resource(s) engaged by him in TFL's premises. Such verification will have to be carried out from concerned police station of their permanent place of residence/present place of residence.
    b) Further, the Contractor is advised not to deploy any resource having past criminal record in the establishment/premises of TFL under this contract awarded to him.
    c) In the event of violation of above clauses at (a) and (b), the Contractor will be solely responsible for the same.
    d) If any such resource(s) having criminal record is deployed by the Contractor in the premises of TFL and has come to the notice of TFL at any point of time, the Contractor shall immediately replace that resource(s), failing which that particular resource(s) of the Contractor will not be allowed to enter into the premises of TFL.

22. While confirming to any of these conditions, the Contractor must ensure that all applicable Laws of State regarding labour, their welfare, conduct etc. are complied.

STANDARD CONDITIONS OF SCC: PART III

Compliance of Government of India Directives

1. Pradhan Mantri Suraksha Bima Yojna (PMSBY) and Pradhan Mantri Jeevan Jyoti Bima Yojna (PMJJBY)

Contractor shall, ensure that all its resources deployed under this contract have obtained additional insurance coverage under the Pradhan Mantri Suraksha Bima Yojana (PMSBY) and Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) through the participating banks and submit the proof of such insurance coverage to the satisfaction of TFL. The cost has been included in the estimate mentioned in SOR and the Contractor shall submit evidence / proof to TFL in this respect. Both the schemes are to be regulated continuously on yearly basis and the same should be renewed on each successive relevant date in subsequent years during the period of the contract.

2. Labour Identification Number (i.e. LIN) Registration (Mandatory)

The Unified Shram Suvidha Protal, developed by Government of India, facilitates reporting of Inspections & submission of Returns and has also been envisaged as a single point of contact between employer, resources and enforcement agencies bringing in transparency in their day-to-day interactions. For integration of data among various enforcement Agencies, the Contractor, as an inspectable unit, is required to register and obtain Labour Identification Number (i.e. LIN) from Shram Suvidha Portal and submit the same in TFL.

3. Pradhan Mantri Rojgar Protsahan Yojna (PMRPY) – if applicable

In order to support the Govt. of India's Initiative on Employment Generation, the Contractor must register for Pradhan Mantri Rojgar Protsahan Yojna (PMRPY) Scheme. The Contractor shall inform TFL/Engineer in Charge about the benefit availed, if any, against the scheme for adjustment against the invoice(s) / bill(s).

Annexure-i

Details in support of RA Bill for the Month of _____, 20__

(1) Name of the Firm/Agency/Contractor _____
(2) Nature of Contract: Job/ Service _____
(3) Period of Contract: From _____to _____
    (a) Extension Period of Contract, if any from _____to _____
    (b) Place where contract workmen are working _____
(4) Postal address of the Contractor: _____
(5) Phone No. of the Contractor: _____
(6) Fax No. and Email of the Contractor: _____
(7) Name and Address of PF office from where EPF Code No. has been allotted: _____
(8) EPF Code No. allotted by PF office: _____
(9) Name and Address of ESIC office from where ESI Code No. has been allotted: _____
(10) ESI Code No. allotted by ESIC office: _____
(11) Labour License No. _____ dated _____
(12) Validity period of Labour License from _____to _____
(13) Detail of Resource engaged by the Contractor:

Category	**No. of Resources**		**Prevailing Minimum Wages**
	Male	**Female**	
Unskilled			
Semi-skilled			
Skilled			
Highly skilled			
Total			

(14) Copy of Wage Register in FORM – B (to be replaced by FORM-I as per Code on Wages-2019, after it comes into force)
(15) Details of deposit of contribution towards EPF:
    a) EPF Challan No. _____Amount _____ Date_____
(16) Details of Deposition of contribution towards ESI
    a) ESI Challan No. _____Amount _____ Date _____
(17) Whether any arrangement / agreement has been entered with any resource for extending benefits under Inter-state Migrant Workmen (RE&CS) Act, 1979: ____ (Yes / No)
    If Yes, No. of such Inter-state Migrant Workers: _____

SIGNATURE OF CONTRACTOR/AUTHORIZED REPRESENTATIVE

Place:
Date:

Annexure- ii

UNDERTAKING

(To be submitted along with un-priced bid)

I/We hereby undertake that I/We have completely understood the terms & conditions of the Tender including minimum resources required to be deployed and the cost involved thereof in deployment of resources.

I/We further undertake to ensure all compliances of the tender conditions. Any non-compliance may be construed as deficiency in the performance of the contract. If such non-compliance is noticed TFL/owner is at liberty to take action in line with the tender conditions including termination of the contract.

Signature of Bidder……..
Name of Bidder……..

Annexure - iii

Summary of Insurance Policies

Contractor is required to cover all resources deployed by him with the following insurances / schemes:

Sl. No.	SCHEME	APPLICABILITY	PREMIUM/ CONTRIBUTION	SUM ASSURED/ BENEFITS	REMARKS
1	The Employees' State Insurance Act, 1948	Applicable to all resources of the Contractor (within ESI wage limit) working in notified area.	3.25% of wages by employer 0.75% of wages by employees	Benefits under the Employees' State Insurance Act, 1948.	
2	The Employees' Compensation Act, 1923 (in lieu of ESI – mentioned at Sl. 1)	Applicable to excluded employees under ESI and those who are working in non-notified area to extend similar benefits as available under ESI Act, 1948	Premium to be calculated considering wage limit under EC Act, 1923 (i.e. Rs. 15,000/- p.m currently)	Maximum **Compensation Liability** under Employee's Compensation Act, 1923 along with **a Mediclaim policy** within overall premium @ 3.25 % of Minimum wages (i.e. employer contribution towards ESI)	Provides compensation and medical facility to resources.
3	Group personal Accident Insurance	Applicable to all resources of the Contractor	Based on the coverage	Insured value: Rs. 3 Lakh to cover expenses associated with any accident.	Death, permanent disablement, temporary total disability or any other medical expenses related to accident.
4	Pradhan Matri Suraksha Bima Yojana (PMSBY)	Eligibility – age group 18 to 70 years	Rs. 12/- per annum	**Accidental** death and permanent disability: (i) Permanent total disability – Rs. 2 lakhs. (ii) Permanent partial disability – Rs. 1 Lakh.	
5	Pradhan Mantri Jeevan Jyoti Bima Yojana(PMJJB)	Eligibility – age group 18 to 50 years. (can continue upto 55 years)	Rs. 330/- per annum.	Risk coverage – Rs. 2 Lakhs- in case of **death due to any reason**	

TECHNICAL SPECIFICATION

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF DEMOUNTABLE FLARE SYSTEM

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL GASIFICATION BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

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1.0 INTRODUCTION:

It is proposed to set up a Coal Gasification based Fertiliser complex consisting of Coal Gasification unit, Ammonia-Urea unit, Steam generation plant & offsites & utilities.

Capacity of main process plants are as follows.

Ammonia 2200 MTPD

Urea 3850 MTPD

The entire flaring requirement for Ammonia plant & Coal gasification plant (CGP) shall be provided to the Flare package B/L to cater the discharge of mitigated flare load from respective units.

Following flare gas headers shall be connected to the flare package B/L-

- Dry Acid flare gas header (from CGP)
- SRU flare gas
- Dry seal flare gas (from CGP)
- Merged header for Ammonia flare gas (from A & U) stream and Ammonia Flare gas (from CGP) stream
- Dry seal flare gas (from A & U)
- Wet acid flare gas (from CGP)
- Merged header for HP flare gas & Fuel gas stream (from CGP)

Above headers along with required utilities shall be considered in yard piping (by elsewhere contract).

Above mentioned flare headers shall be connected to the flare package B/L. Flare stack including flare system (Flare knock out drum, associated instrumentation and fittings, flame front generation panel Flare tip, molecular seal, riser, derrick structure with demounting arrangement etc.) shall be under bidder's scope of work excluding piping work from battery limit of CGP, Ammonia & Urea plant upto flare system B/L which shall be considered in yard piping for which (Design & engineering) shall be carried out by PDIL/owner.

Flare stack shall be complete with

i. Flare tip with flame protection shield
ii. Molecular seal
iii. Flare pipe
iv. Ignition panel
v. Flame propagation pipes
vi. Pilot burners
vii. Main burners

Elaborate instrumentation is foreseen for flare stack, flare header, fuel line, air supply line and other utility lines.

2.0 GENERAL DESCRIPTION:

All blow out gases coming from the following units shall be connected to the B/L which is finally connected to a dedicated flare header which connects to dedicated flare stacks (refer schematic PC183-7517-0046).

- Ammonia & Urea unit
- Coal gasification unit

2.1 Tempurge system (by Flare vendor)

HP flare gas flaring (coming from CGP) is at more than 340 Deg C. During the flare operation when this stream is being flared, the temperature of all the wetted parts of the system shall be very high & subsequently when this stream flaring reduces & stops, the entire surface of the flare header & the flare stack shall be subjected to very rapid cooling due to the big temperature difference between that of the flare gas & atmosphere.

A large amount of purge gas (N_2) called Temporary purge is required to be introduced at a very high rate for a short duration to ensure that the entire system is made free of air or any explosive mixture.

Bidder to provide the Tempurge system alongwith its supply, installation, erection, testing & commissioning.

Minimum required instruments (but not limited to) shall be provided by bidder as under:

- 1 no. SOV operated on-off valve
- 1no. Temperature transmitter
- 1 no. Pressure Transmitter
- 1 no. Flow transmitter
- 1 no. Pressure reducing valve

This system is operating based on the feedback from thermocouple fitted on the flare tip and also sensing the temperature & pressure of the flare gas from flare header (at Flare vendor B/L) and allows sufficient amount of temporary purge to the flare header for the required period.

Required logic also shall be implemented by bidder in its control system placed at Ammonia & Urea control room (CCR2).

Bidder to mention the required utilities for Tempurge system alongwith the bid.

TABLE-1

Flare gas streams from Ammonia & Urea plant (A & U) B/L											
Type of flare	**Source**	**Destination**	**Required /Generated quantity (Min/ Nor/ Max/Design)**	**Unit Of Measurement.**	**Composition % (mol %)**	**Pressure at B/L (Kg/cm2g) (Min/Nor/Max/ design)**	**Temperature (Deg C) Min/Nor/Max/design)**	**Line size (inch)**	**Line MOC & rating**	**Connection Method**	**Remark**
Ammonia Flare gas	Ammonia-Urea Plant	Flare Unit (OSBL)	Case – 1 133920 Case – 2 133280 Case – 3 266200	kg/h	Case 1: H2: 74.76, N2: 25, Hg: 1ppmv (max), Ar: 0.1, CO + CO2+ other Oxygen bearing components: 5 ppmv (Max.), NH3: 0.02 Case 2: H2: 0.04, N2: 0.02, Ar: 0.01, NH3:99.93 Case 3: H2: 49.95, N2: 16.67, Ar: 0.01, NH3:33.39	-/2.3/-/3.5	Case – 1 -/12/-/188 Case – 2 -/120/-/188 Case – 3 -/65/-/188	28	Killed CS & 150LB	–	Intermittent
Dry Seal Flare Gas	Ammonia-Urea Plant	Flare Unit (OSBL)	0/259/549/549	kg/h	H2-8.47 N2- 82.83 NH3-8.70	-/0.25/0.5 (allowable Backpressure)/ 3.5	22.6/35.3/88.3 /120	4	CS & 150LB	–	Continuous

Flare gas streams from Coal Gasification Plant (CGP) B/L											
Type of flare	**Source**	**Destination**	**Required /Generated quantity (Min/PDC Nor/EDC Nor/ Design)**	**Unit Of Measurement.**	**Composition % (mol %)**	**Pressure at B/L (Kg/cm2g) (Min/Nor/Max/ design)**	**Temperature (Deg C) Min/Nor/Max /design)**	**Line size (inch)**	**Line MOC & rating**	**Connection Method**	**Remark**
HP Flare Gas (Note 1)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design: 424038 EDC design: 420185	kg/h	PDC Case: H2: 47.0164, H2O: 1.0480, CO: 1.4204, CO2: 38.8393, H2S: 1.5588, N2: 7.0267, Ar: 0.0471, COS: 0.0184, CH3OH: 3.0099, CH4: 0.0016, NH3: 0.0094, HCN: 0.0040 EDC Case:	Allowable backpressure: 1.9 Design: 6.0	Min.: 29 PDC: 75.5 EDC: 69.5 Max: 340 Design: 400	44	CS & 150LB	Above ground	Intermittent, start up or failure case.

					H2: 44.7820, H2O: 1.0923, CO: 1.4387, CO2: 41.3971, H2S: 0.3015, N2: 8.3947, Ar: 0.0544, COS: 0.0134, CH3OH: 2.5088, CH4: 0.0004, NH3: 0.0113, HCN: 0.0054						
			PDC design: 2376 EDC design: 2880	kg/h	H2: 0.011, H2O: 0.034, CO: 0.082, CO2: 1.37, H2S: 0.0001, N2: 98.51	Allowable backpressure: 1.9 Design: 6.0	Nor: 340 Design: 400	44	CS & 150LB	Above ground	Continuous
Ammonia Flare Gas (Note 1)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design: 29073 EDC design: 23831	kg/h	PDC Case: NH3: 100 EDC Case: NH3: 100	Allowable backpressure: 3.6 Design: 6.0	Min.: 40 PDC: 110 EDC: 110 Max: 110 Design: 130	12	CS & 150LB	Above ground	Intermittent, failure case.
Wet Acid Flare Gas (Note 1, 2)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design: 6240.3 EDC design: 5766	kg/h	PDC Case: H2: 0.4564, H2O: 37.9527, CO: 0.1443, CO2: 6.1318, H2S: 0.5128, N2: 53.1058, Ar: 0.0005, COS: 0.0206, NH3: 1.6401, HCN: 0.0351 EDC Case: H2: 0.4170, H2O: 37.9141, CO: 0.1261, CO2: 6.7061, H2S: 0.1136, N2: 52.7184, Ar: 0.0006, COS: 0.0040, NH3: 1.9636, HCN: 0.0365	Allowable backpressure: 0.6 Design: 3.5	Min.: 90 PDC: 97.8 EDC: 97.8 Max: 100 Design: 180	12	SS-316L & 150LB	Above ground	Continuous
Dry Acid Flare Gas (Note 1)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design:15832 EDC design:5378	kg/h	PDC Case: H2: 3.2130, CO: 0.5792, CO2: 58.2870, H2S: 0.0004, N2: 37.9160, Ar: 0.0000, COS: 0.0000, CH3OH: 0.0049 EDC Case: H2: 2.2030, CO: 0.4493, CO2: 71.9530, H2S: 0.0001, N2: 25.3890, Ar: 0.0001, COS: 0.0000, CH3OH: 0.0057	Allowable backpressure: 0.4 Design: 3.5	Min.: 22 PDC: 22 EDC: 23 Max: 40 Design: 65	16	CS & 150LB	Above ground	Continuous
			PDC design:11049 EDC design:3251	kg/h	PDC Case: H2: 0.082, CO: 0.0086, CO2: 45.073, H2S: 53.592, N2: 0.4105, Ar: 0.0004, COS: 0.7131, HCN:0.0037, CH3OH: 0.1172 EDC Case: H2: 0.0238, CO: 0.0268, CO2: 59.886, H2S: 29.129, N2: 8.412, Ar: 0.0024, COS: 2.1680, HCN: 0.0085, CH3OH: 0.1306	Allowable backpressure: 0.4 Design: 3.5	Nor: 35 Design: 65	16	CS & 150LB	Above ground	Intermittent, start up or failure

Fuel gas	Coal Gasification Plant	Flare Unit (OSBL)	13006/26012/ 42338	Nm3/hr	H2: 1.82, CO:15.81, N2:81.84, Ar: 0.53	1.2/1.4/1.5/6.0	20/20/30/65	20	CS & 150LB	Above ground	Continuous
Dry Seal Flare Gas (Note 1)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design: 420 EDC design: 420	kg/h	PDC Case: N2: 85.6970, NH3: 14.0031, other (H2, CO, H2S etc.) ~0.2998. EDC Case: N2: 85.6970, NH3: 14.0031, other (H2, CO, H2S etc.) ~0.2998.	Allowable backpressure: 0.5 Design: 3.5	Min.: 40 PDC: 80.5 EDC: 80.5 Max: 180 Design: 210	4	CS & 150LB	Above ground	Continuous
SRU Flare Gas (Note 1, 2)	Coal Gasification Plant	Flare Unit (OSBL)	PDC design: 10996 EDC design: 3890	kg/h	PDC Case: H2: 3.0823, H2O: 6.7034, CO: 0.0546, CO2: 34.9852, H2S: 2.5459, N2: 52.0027, Ar: 0.6222, COS: 0.0036 EDC Case: H2: 1.1698, H2O: 23.4062, CO: 0.6734, CO2: 41.3386, H2S: 0.9084, N2: 31.5382, Ar: 0.3165, COS: 0.1321, SO2: 0.4546, S6: 0.0103, S8: 0.0416	Allowable backpressure: 0.1 Design: 3.5	Min.: 40 PDC: 41 EDC: 170 Max: 170 Design: 200	20	CS & 150LB	Above ground	Intermittent, start up or failure case.

Notes:

1. Flare gas specification in tie-in list only shows the governing case of each flare system; however, the governing case can not reflect the Max. operating parameters (ie. temperature) of all streams. Therefore, the flare system designer should consider these factors when design the flare pipelines and Flare Unit.
2. Steam traced flare gas line

General Notes:

1. PDC-Process design case, EDC-Equipment design case

Vent gases streams (HP Flare gas, Ammonia Flare gas, Wet acid flare gas, SRU flare gas, dry acid flare gas, and Dry seal flare gas) from different units of Coal gasification plant (CGP) are connected to the B/L of flare system-OSBL.

Vent gases streams (Ammonia flare gas & Dry seal flare gas) from different units of Ammonia & Urea plant (A&U) are connected to the B/L of flare system-OSBL.

All these above mentioned vent streams are being connected to the dedicated flare headers based on individual stream composition and required available pressure at the ISBL.

As per above table-1, following headers have been envisaged:

- Dry acid flare gas header
- SRU Flare gas header
- Dry seal flare gas header (coming from CGP)
- Dry seal flare gas header (coming from A & U)
- Merged stream header for Ammonia flare coming from CGP & Ammonia flare coming A&U.
- Wet acid flare gas header
- Merged stream header for HP flare gas & Fuel gas stream (from CGP)

From the above flare gas streams are going to the respective Flare stacks as mentioned in below table (for details refer Annexure-8):

TABLE-2

HP gas flare stack	Ammonia Flare stack	Acid gas flare stack
Merged header HP flare gas & fuel gas stream coming from CGP	Merged header for streams Ammonia Flare gas from CGP and Ammonia Flare gas from A&U	Dry acid flare gas
	Dry seal flare gas from A & U	SRU Flare gas
	Dry seal flare gas from CGP	Wet acid flare gas

The entire headers mentioned above connected to the dedicated flare stack (as mentioned in above table). Location of connection in stack shall decided by bidder based on available pressure of stream at B/L.

Bidder also to check & consider adequate flare header size based on the inputs mentioned in the table1 for all the flare streams coming from ISBL. Line size (refer schematic/P&ID) calculated is based on the flow rate mentioned in table-1. Respective Flare header is connected to the dedicated flare stack. Flare

stacks shall be Demountable type Derrick structure and generally consisting of flare tip Assembly, Molecular seal, pilot burner, ignition system with Panel, K.O. Drum with water seal and interconnecting piping, fittings &valves, instrumentation and other associated system.

During the normal operation, quantity of blow out gases are zero (minimal) or very small. In case of upset conditions and / or during start up and shut down operations large quantity of blow out gases are released. Blow out gases from flare header are fed to the K.O drum. Liquid shall be drained out from KOD of HP Flare stack & Acid gas flare stack via water seal. Only Ammonia Flare KOD have steam coil at bottom to evaporate the liquid ammonia component.

This specification which covers the requirements of dedicated flare stacks are envisaged to handle, Ammonia flare gas (ammonia bearing gases) vented from the Ammonia & Urea plant, Ammonia flare gas & Dry seal flare gases (from CGP and A&U), Dry acid flare gas & Wet acid gas SRU flare gas &, HP flare gas from Coal gasification plant, located at TFL, Angul, Odisha.

- All considered flare stacks (Demountable type) shall be supported from a Derrick Structure.
- During normal operation, quantity of blow-out gases are zero (minimal) or very small.
- During upset conditions (start-up and shutdowns) large amount of blow out gases will be released.
- The entire above mentioned stream coming from ISBL is connected to dedicated flare stacks namely HP gas flare stack, Ammonia flare stack & Acid gas flare stack.
- HP gas (44”) & fuel gas (20”) coming from CGP are merged & connected through a common 48” NB header to HP/gas flare stack.
- Dry seal flare gas stream (6”) from A & U to Ammonia flare stack
- Dry seal flare gas stream (6”) from CGP to Ammonia flare stack
- Ammonia flare gas stream (12”) coming from CGP and Ammonia flare gas (28”) coming from Ammonia & urea unit are merged & connected through a common 42” header to Ammonia flare stack. Flare header is designed to carry total Flare gas load coming from ISBL via 42” header (through yard piping) to the Ammonia Flare Stack, through Bidders B/L interface.
- Dry acid flare gas, wet acid flare gas, SRU flare gas coming from CGP through 16”, 14” & 24” NB headers respectively are individually connected to the acid flare stack at different tap-in points (Bidder to connect the stream at suitable point). SRU flare gas stream as being operating at very low pressure, bidder to connect the stream at suitable point of the flare stack based on the available pressure at their interface.

TABLE-3

A. Details of Flare gas streams coming from Coal gasification plant(CGP) B/L& Ammonia-Urea (A&U) B/L:

S. No.	Flare streams	Streams	Source	Flow rate, Kg/hr	Line size, inch @ ISBL	Pressure @ ISBL (kg/cm 2 g)	Design Temp @ ISBL, Deg C	Remarks
1.	Acid flare gas	Wet acid flare gas	CGP	6240.3	12	0.6	180	Continuous
		SRU stream	CGP	10996	20	0.1	200	Intermittent
		Dry acid flare gas	CGP	Case – 1 11049 Case – 2 15832	16	0.4	65	Case1: Intermittent Case 2: Continuous
2.	Ammonia flare gas	Ammonia flare gas from CGP	CGP	29073	12	3.6	130	Intermittent
		Ammonia flare gas from A & U	A & U	266200	28	2.3	188	Intermittent
3	HP Flare gas	HP Flare	CGP	424038	44	1.9	400	Intermittent
4	Fuel gas	Fuel gas	CGP	42338 NM3/Hr	20	1.2	65	Continuous
5	Dry Seal flare gas	Dry Seal flare gas from CGP	CGP	420	4	0.5	210	Continuous
6	Dry Seal flare gas	Dry Seal flare gas from A & U	A & U	549	4	0.25	120	Continuous

TABLE-4

B. Flare gas stream/header (in yard piping-PDIL/Owner's scope) from coal gasification plant B/L and Ammonia & Urea plant B/L (for details refer attached P&ID):

S. No.	Flare gas stream	Streams	Flow rate, Kg/hr	Line size, inch @ ISBL	Pressure @ ISBL (kg/cm2 g)	Design Temp @ ISBL, Deg C	Remarks	Header line size, inch (considered in yard piping/connection at Flare B/L)	Pressure at Vendor B/L, (kg/cm 2 g)
1.	Acid flare gas	Wet acid flare gas	6240.3	12	0.6	180	Continuous	14	0.4
		SRU stream	10996	20	0.1	200	Intermittent	24	0.06
		Dry acid flare gas	Case – 1 11049 Case – 2 15832	16	0.4	65	Case1: Intermittent Case 2: Continuous	16	0.15
2.	Ammonia flare header	Ammonia flare gas from CGP	29073	12	3.6	130	Intermittent	42	0.4
		Ammonia flare gas from A & U	266200	28	2.3	188	Intermittent		
3	HP Flare gas header	HP Flare	424038	44	1.9	400	Intermittent	48	1.13
		Fuel gas	42338 NM3/Hr	20	1.2	65	Continuous		
4	Dry Seal flare gas header	Dry Seal flare gas (from CGP)	420	4	0.5	210	Continuous	6	0.36
5	Dry Seal flare gas header	Dry Seal flare gas (from A & U)	549	4	0.25	120	Continuous	6	0.17

Bidder to furnish the break-up of calculated pressure drop across Flare tip, Molecular seal, Flare Stack, KOD and piping, during DED and along with Bid.

TABLE-5

C. **Details of Flare load for flare stack coming through respective flare header from ISBL:**

S. No	Streams	Source	Flare header	Intermittent Flow in Kg/hr	Continuous flow (in normal operation) in Kg/hr	Flare stack	Remarks (Peak load for individual Stack)
1	HP Flare Gas	CGP	HP flare gas header	**424038**	2376	HP gas flare stack	Fuel gas flaring will not happen simultaneously with the HP flaring. So Peak Load is 424038 Kg/Hr.
2	Fuel gas	CGP			42338 NM3/Hr		
3	Ammonia flare gas from CGP	CGP	Ammonia flare gas header	**29073**	-	Ammonia flare stack	Intermittent Relief from both the sources (i.e. Ammonia flare gas from CGP and Ammonia flare gas from A&U) may occur simultaneously. So Peak Load is 29073+266200+420+549 = 296242 Kg/Hr
4	Ammonia flare gas from A & U	A & U		**266200**	-		
5	Dry Seal flare gas from CGP	CGP	Dry seal flare gas header from CGP	-	420		
6	Dry Seal flare gas from A & U	A & U	Dry seal flare gas header from A&U	-	549		
7	Wet acid flare gas	CGP	Wet acid flare gas header	-	**6240.3**	Acid flare stack	Intermittent Relief from SRU stream may occur simultaneously with continuous load of Wet Acid flare gas and Intermittent Relief load from Dry Acid Flare gas or Continuous Relief load from Dry Acid Flare gas. Vendor to calculate the governing Load based on 2 case for stack height calculation: Case A: 10996 + 6240.3+11049 = 28285.3 Kg/ Hr Case B: 10996 + 6240.3+15832 = 33068.3 Kg/ Hr
8	SRU stream	CGP	SRU flare gas header	**10996**	-		
9	Dry acid flare gas	CGP	Dry acid flare gas header	11049	**15832**		

TABLE-6

D. **Details of Simultaneous flaring at same time in HP gas Flare Stack and Ammonia Flare Stack**

S. No	Streams	Source	Flare header	Flow in Kg/hr	Pressure at Vendor B/L, (kg/cm2 g)	Composition	Flare stack
1	HP Flare Gas	CGP	HP flare gas header	424038	1.13	H2: 47.0164, H2O: 1.0480, CO: 1.4204, CO2: 38.8393, H2S: 1.5588, N2: 7.0267, Ar: 0.0471, COS: 0.0184, CH3OH: 3.0099, CH4: 0.0016, NH3: 0.0094, HCN: 0.0040	HP gas flare stack
3	Ammonia flare gas from CGP	CGP	Ammonia flare gas header	29073	0.4	NH3: 100	Ammonia flare stack
4	Ammonia flare gas from A & U	A & U		133280		H2: 0.04, N2: 0.02, Ar: 0.01, NH3:99.93	
5	Dry Seal flare gas from CGP	CGP	Dry seal flare gas header from CGP	420	0.36	N2: 85.6970, NH3: 14.0031, other (H2, CO, H2S etc.) ~0.2998.	
6	Dry Seal flare gas from A & U	A & U	Dry seal flare gas header from A&U	549	0.17	H2-8.47 N2- 82.83 NH3-8.70	

Bidders to calculate the Flare stack height to meet flare radiation intensity at desired location for all cases mentioned below & submit the calculation (radiation graph) for all cases during DED & along with technical Bid.

1. Individual peak load in HP gas flare stack (mentioned in Table 5).
2. Individual peak load in Ammonia flare stack (mentioned in Table 5).
3. Individual peak load in Acid flare stack (mentioned in Table 5).
4. Simultaneous flaring at same time in HP gas Flare Stack and Ammonia Flare Stack i.e. 424038 Kg/Hr in HP Flare Stack from CGP and 163122 in Kg/Hr Ammonia Flare Stack. (Detailed break-up is mentioned in Table-6).

Height of the all Flare stacks to be kept same as the maximum height of any of the stack calculated based on above cases. However, minimum Height of Flare Stack shall be 70 Meter.

3.0 SITE DATA:

3.1 Site Climatic Condition

Parameters	Temperature, Deg C
Maximum Dry bulb (summer)	46.3
Minimum Dry bulb (winter)	1.0
Average temp	31.9
Wet bulb	32.0
Max. for Mechanical/ Civil/ Structural	35.0
Min. for winterization (Average)	18.7

3.2 Relative Humidity:

Maximum: 100 %

3.3 Barometric Pressure

Average recorded: 1008 mbar

3.4 Rainfall

Annual (Average): 1329mm

Design rainfall (per hour) 116 mm

3.5 Wind

Prevailing direction: West/North-west.

Max wind speed: - Basic wind speed shall be taken as 50 (IS-875(Part-3)

Design wind speed: -Design Wind speed and design wind pressure shall be evaluated based on design criteria in accordance with IS-875(Part-3)

Design wind load: For design against wind forces, wind load shall be increased by 30% to cater for the effect on piping systems, platforms, ladders, etc. Wind Load Design: as defined in latest IS: 875 Part 3

3.6 Ambience

Due to its location within an industrial complex, the air may contain particles of sand, urea and coal dust. The air may accidentally contain ammonia vapor, and for this reasons no part in direct contact with the atmosphere may be constructed from copper or copper alloys. The region is not affected by cyclones or floods.

4.0 SCOPE OF WORK/SUPPLY:

The Bidder's scope of work shall include Detailed Design & Engineering complete with all equipment & accessories, procurement of complete materials & bought-out items deemed necessary for process, all Civil foundations & structural work mechanical, electrical & instrumentation, fabrication at shop/site, loading, unloading & transportation, storage at site, assembly, erection of mechanical, electrical & instrumentation system, inspection, testing, painting, insulation, statutory approvals, commissioning, trial runs and demonstration of guarantees, calibration & supply of complete Flare stack along with all the mandatory spares & maintenance tools etc. A tentative schematic arrangement proposed for the Flare system has been presented (refer P&ID/Schematic). This is indicative only and it is the responsibility of the bidder to do the detailed engineering. Operation shall be done locally with display of all indications and alarms shall be available in central control rooms, to monitor and control all important variables, to hear & attend alarm and shut down the plant during abnormal condition. Bidder shall integrate its all control system (ignition system, FFG panel etc) to Ammonia-urea control room via suitable communication protocol for controlling & monitoring purpose of all critical parameters related to the flare system. Bidders to provide the indication of pilot failure alarms etc, in local panel and main control room of Flare stack.

The scope of supply for Flare stack shall include but not limited to the items as listed below:

a) The flare system (Demountable type) shall consist of, but not limited to, the following basic components:-

- The material of flare stack shall be as follows:
  - For Ammonia flare stack material of construction shall be in principle low temperature carbon steel/KCS except for the flare tip.
  - For Acid gas flare stack material of construction shall be in principle SS 316L,
  - For HP gas flare stack MOC shall be in principle Carbon steel.
- Horizontal / Vertical knock out drum for separation of possible condensate from HP flare gas coming from coal gasification plant.
- Horizontal / Vertical knock out drum for separation of condensate from wet acid flare gas coming from coal gasification plant.

- Horizontal / Vertical knock out drum for separation of condensate from Ammonia flare gas coming from Ammonia Plant and CGP Plant.
- Horizontal / Vertical knock out drum for SRU flare gas stream at suitable location.
- Bidder to provide KOD as per their engineering practice.
- During upset conditions or startup or shut down, large amount of flow out gases will be released. Furthermore, the flare shall burn satisfactorily for each specified emission down to zero capacity.
- Flare tip along with flame stabilizers & wind shield
- Molecular seal, to be located just at the bottom of flare tip and prevent entry of air.
- Lowering, raising & canting / overturning system including demountable facility consisting of hydraulic winch mechanism (installed spare pump along with motor) along with required no of sheaves / pulleys, wire ropes, tilting tables & tilting beds & any other accessories.
- Auxiliary winch for transporting tools & tackles to operating platform.
- Hydraulic power pack for both the winches may be common or separate, as per vendor's design.
- Any other facility, which is required but not listed for demounting type flare system.
- All instruments relating to the Ignition system comprising of pilot burners, ignitors, temperature sensors, flame front generator panel, flame detector & flame failure alarm (including gauge & transmitter).
- All required instruments, its instrumentation, DCS & logic connections shall be in the bidder's scope.
- All required fittings shall be in the bidder's scope. Fittings provided in the utility piping (refer schematic) are minimum required. Required arrangement of fittings shall be by bidder.
- Bidder to provide Tempurge system for HP flare header alongwith its instrumentation, required logic to be implemented in CCR2 (Ammonia-Urea control room) for the Tempurge System.
- Thermocouple extension cable.
- Infrared CCTV Camera to be installed at suitable location.
- Start-up of the flare stack shall be done locally, which shall be connected through DCS/PLC in control room.
- Aviation obstruction light shall be placed in flare stacks in conformity with requirements.
- Lightning Arrestor
- Derrick Structure of structural steel shall be in the scope of Bidders. Foundation design shall be included in Bidder's scope.
- Stream tracing required, wherever applicable.

b) For scope of Vendor supply refer to - Annexure no: 6.0, P&ID/schematic of Flare system package (PDIL Doc No: PC183-7517-0046).

c) For Detailed Piping Specification in flare stacks system Vendor to refer piping class specification as an Annexure no: 3.0.

d) Ignition system complete with Flame front generator panel, flame detector, flame failure alarm, instruments and control panel, located at the bottom of flare stack unit has been envisaged. The number of pilot burners shall be determined by Bidders**.** (For Detailed specification Refer to – Section-VI-9.0).Alternate arrangement for igniting pilot burner to be indicated on P&ID.

e) In order to purge the entire flare system, provisions will be made for addition of continuous inert gas at various points.

f) LED type Aviation obstruction lighting shall be provided by Bidder on flare stack in conformity with requirements. (For detailed Specification Refer to Annexure no - 2.0 Electrical specifications)

g) Fuel gas will be burnt in the pilot burners of flare tip mounted on top of flare stack and shall be controlled from the control panel of pilot ignition / control system. Flare tip and pilot shall handle both fuel gas and LPG.

h) K.O. drum mentioned in the tender is minimum required. However, bidder to provide K.O. drum wherever required as per their best engineering practice. Flare stack height, diameter and K.O. drum sizing shall be done by Bidders. (For Detailed specification Refer to Attachment No: - 4, Pressure Vessel Specification.

i) Piping loads shall be provided at the B/L of Bidder scope of work and supply, for carrying out interface piping during detail engineering and while incorporation by flare stack supplier".

j) To prevent back firing of flame and combustible gases, a small amount of continuous N2 gas will be introduced.

k) All required utilities connections and pipes for pilots, ignition device, seal etc.

l) Civil structural work(inside battery limit of flare system-by Bidder) shall be as follows:

- Flare stack shall be supported from derrick type structure made of structural steel.
- Structural steel shall have minimum yield stress of 250 Mpa conforming to grade B of IS: 2062 and shall be painted with chlorinated rubber.
- Design of all items shall be for worst combination of loads & shall be approved by the Owner/PMC prior to execution.
- Dead load, imposed loads, wind/ seismic loads, floor loads, etc. shall be as per relevant IS codes / Vendor supplied loads.
- Deflection etc. shall be within limits specified in relevant codes /as per sound engg. practice / Bidders specification.
- Design, supply & erection of flare stack along with its foundation is included in this scope.
- Foundation bolt shall be as per specifications given in civil engg. specification.
- Foundation load data along with detail design to be furnished by the bidder.

m) Dispersion analysis & study report of emissions from flare stack shall be in the bidder's scope.

Details of CAT Ladders, Details of Grating & Details of Hand rail are as attached in annexure no: 5 – Civil specification.

Other Civil details like Design requirement for wind load & Design requirement for Earth quake Loads shall be as per the section 5.0.CIVIL AND STRUCTURAL DESIGN BASIS.

These include, Engineering coordination, necessary analyses, and compliance with sub suppliers, Platforms, ladders, handrails and attachment clips, Lifting lugs for erection,

Fireproofing, surface preparation & painting, Drawings & data, Testing & Inspection, Capital spares, Start-up & commissioning spares, Special tools, cables, field and control room instrumentation etc. as required for completing the systems per the specifications. Any other item not specifically mentioned above but which is essential as per good engineering practice for operating the system safely at all times shall be included in scope of supply by Bidder.

5.0 SCOPE OF SERVICES:

The scope of services shall include but not limited to the following:

a) Detailed design of the Flare Stack system including equipment, instrumentation, electrical and control system, control and logic diagram, interlock schemes, P&IDs, Raw materials & Utility summery etc.
b) Detailed design of structural work, clearly mentioning all assumptions standard codes & practices, used in design.
c) Detailed equipment layout, piping GAD & isometrics, battery limit hook-ups, with elaborate hook-up tables, stress analysis, support schedule and other works, as required.
d) Procurement of raw materials, bought out components, fabrication and assembly at shop & at site.
e) Inspection and testing, including approved third party inspection (in case of domestic supplies also) at shop and at site.
f) Erection & Installation of all equipment at site including mechanical, electrical & instrumentation work.
g) Piping works as per piping specification (inside flare battery limit-by bidder).
h) Mechanical Completion.
i) Hydro testing, Pre-commissioning, Commissioning, Reliability Runs, Plant trails runs and handing over of the Flare stack.
j) Arrange all necessary instruments, fittings, tools/tackles required for Pre-Commissioning, Commissioning and Plant trail runs, has to be arranged by bidder.
k) Loading on top of civil pedestal.
l) Foundation bolt details.
m) All foundation levels, i.e. bottom of base plates etc.
n) All structural steel requirements (inside flare Battery limit-by bidder).
o) All statutory approvals including IBR for piping/steam coils (Assistance in approval).
p) Clear the Battery Limit of all construction aids debris etc and provide a tidy work plan.
q) Flare system has been designed by vendor to achieve complete combustion and should be smokeless.
r) Fire water system, Fire Detection / Alarm System, fire extinguishers required, if any, shall be considered in Flare package vendor scope as per TAC/OISD/NFPA standard, after taking tapping point at package area battery limit. Tapping from existing main firewater network including

isolation valve at tie-ins locations, Strainer, fittings, RO, By-pass valve arrangement etc shall be in bidder's scope.

5.1 ADDTIONAL TECHNICAL DETAIL:

a) International System of units (SI) system and English language shall be used for all drawings and documents.
b) Use of copper and copper alloy is not allowed.
c) Maximum allowed noise level is 85 dBA at 1 meter distance from source with maximum sound emission.
d) The facility shall be designed with following considerations which are of paramount importance.

- ❖ Safety
- ❖ Reliability and ease of operation
- ❖ Minimum man power requirement for operation

e) Bidder shall quote main proposal strictly as per technical specification for all equipment& systems attached.
f) Heat shield to be provided at first platform level, within sterile area, to protect plant personnel.
g) Bidders to take care of differential expansion between flare stack and pilot line.
h) The platform and ladder for the maintenance & access to flare stack, to be provided by Bidders.
i) Maximum NO_x level to be calculated and specified by bidder.

5.2 FLARE STACK COMPONENTS:

a) The flare stack components include the flare tip with pilot burners, gas seal, flame front generator and relevant hardware.
b) Noise level at the base shall not exceed 85dBA
c) Ignition of pilot burners shall be through flame front generator
d) Location of flame front generator shall be such that the pilot flame is visible from it.
e) The flame front generator panel shall be suitable for outdoor location. Suitable weather hood shall be provided. The flame front generator shall be gas-electric type suitable for manual ignition unless otherwise specified.
f) Gas seal shall be provided to ensure safe flare operation by preventing ingress of air into the stack. Flare tips upto and including 900mm dia. shall have integral gas seal with the tip. Flare tips more than 900mm dia. shall have molecular seal fitted upstream of the tip. The seal shall be designed to minimize purge gas requirement.
g) Bidder shall ensure smokeless complete combustion during any condition. Tip shall be provided with windshield for prevention of flame lift-off.
h) Bidder to specify their considered design flare load & smokeless flare load (in kg/hr) of specified flared gas.

i) Continuous pilot burners with flame sensors (thermocouples) shall be provided. Pilot burners shall be low gas consumption (low energy) type.

j) Heat resistant alloy steel shall be used for the flare tip and the integral gas seal.

k) Suitable provision of retractable davit for trouble free tip replacement shall be provided. A ground winch with wire rope shall be used for replacement of the tip.

l) It is a regulatory requirement that toxic flares where greater than 1% hydrogen sulphide is flared be fitted with electronic sparking ignition systems or automatically reigniting pilots.

m) Bidder to consider that when flaring streams contain trace amounts of HCN, flare stack height is frequently determined by possible atmospheric emissions rather than thermal considerations.

6.0 DESIGN BASIS :

6.1 Codes & Standard Practices to be followed:

i) Design of Flare shall be in accordance with API recommended practice API-RP-521 (Latest Edition)

ii) Height of Flare Stack (From knock-out drum outlet flange to Seal inlet flange) shall be minimum 70 Meter or higher to meet the all radiation intensity mentioned in below table 7. The flare system design shall be such that the maximum acceptable heat radiation (Excluding solar radiation 0.98 KW/M^2) in case of flaring shall not exceed the values listed in the table-7.

iii) Maximum acceptable heat radiation in case of flaring:

Table – 7

Location	**Radiation levels(kW/M^2)** (Excluding solar radiation 0.98 KW/M^2)
At any point within 90m sterile boundary from stack base at ground level	1.58

iv) Radiation calculations shall be carried out with 10 m/sec. wind velocity in any direction.

v) Flare system shall be suitable and adequate to burn satisfactorily all specified emissions from 100% down to 10%.In other words flexibility of operation shall be 10 % - 100 %.

vi) The flare system shall normally handle Non-Continuous flows of flare gas.

vii) Special windshield which will ensure flame stability and will minimise effect of wind at any flaring gas load, shall be provided by Bidder.

viii) Potential damage to Flare Tip, at low flow rates, is not permissible. Bidder to make arrangements for avoiding it.

ix) Hazardous Area Classification shall be, Group IIC, Zone-1, and Temperature Class T3.

x) Stack velocity (not flare tip velocity) should not increase 0.5 mach.

xi) Copper or copper alloys shall not be used.

6.2 Support of Flare Stack:

- Flare stack along with flare tip, molecular seal etc shall be supported from Derrick structure
- The Flare system is made of three flares which have a common supporting structure with Demounting arrangement.

6.3 Material of Construction & Other Special Features:

The Height & Diameter of Flare stack shall be determined by Bidders. Bidders shall also submit the radius of the sterile area/radius based on the peak flaring/ simultaneous scenario i.e., peak flaring load from all stacks. The type of flare stack is Demountable Derrick type. Effect of wind, soil and earthquake shall be considered for design of the Demountable Derrick type Flare stack.

The flare tip will be influenced by heat. Bidder shall specify the suitable material for the tip. It shall being principle SS capable of withstanding the elevated combustion temperature. Copper or copper alloys shall not be used. Flare tip shall be able to burn completely the above-mentioned gases (mentioned in table 1)

All instruments and electrical parts shall be explosion proof and these shall have suitable protection from radiant heat from the flare stack.

The number of the pilot burners shall be determined by Bidders. The pilot burner shall be ignited one by one by operator. Bidders shall give the NG gas / LPG consumption for the pilot. Continuous consumption of NG / LPG for the pilot burners shall be verified and confirmed or revised, if necessary, by the flare tip manufacturer.

Each pilot burner flame shall be monitored by a thermocouple. A burn back thermocouple for flare burner shall be provided to detect any flame ingress into the flare stack

6.3.1 Flare Tip Assembly:

- Type of Flare Tip : Complete combustion and Smoke-Less type
- Fittings in Flare Tip : i) Flame Stabilisers
  ii) Wind Deflectors / Wind Shield
- Material of Construction : SS 316 (*)
- Minimum Thickness of metal Parts : By bidder
- Operating Pressure & Temp : By Bidder
- Maximum Allowable Pressure Drop in Flare Tip : By bidder

***** Damage to flare tip at low flow rates due to impingement on outside and inside of flare tip is not permissible.

6.3.2 Molecular Seal:

- Type : Gas inversion type causing upward direction of flow of gas to be flared
- Location : Just below flare tip
- Hand hole : By bidder
- Operating Pressure : By Bidder
- Material of Construction for Body & Flanges of Seal : KCS/LTCS for Ammonia flare stack
SS-316L for Acid gas flare stack
CS for HP Gas flare Stack
- Other connections : i) For external drain
ii) For Nitrogen addition
- Maximum allowable Pressure Drop in molecular seal : By Bidder in kg/cm^2

6.3.3 Flare Stack riser Pipe:

a. Ammonia Flare

- Type : 150 lbs rating pipe
- Material of Construction : LTCS
- Support : From Demountable type Derrick Structure
- Special requirements : Platform (with handrail) and ladder for the maintenance and access of flare stack to be provided.
- Operating Pressure : By Bidder
- Maximum Allowable Pressure Drop : By Bidder (in kg/cm^2)
- Design Pressure : By Bidder
- Corrosion Allowance : 3 mm.
- Max. Operating/Design Temp. : By bidder
- Level transmitters (1 Nos.) to be provided.

b. HP gas Flare

- Type : 150 lbs rating pipe
- Material of Construction : CS (Bidder to decide)
- Support : From Demountable type Derrick Structure
- Special requirements : Platform (with handrail) and ladder for the

maintenance and access of flare stack to be provided.

- Operating Pressure : By Bidder
- Maximum Allowable Pressure Drop : By Bidder (kg/cm^2)
- Design Pressure : By Bidder
- Corrosion Allowance : 3 mm.
- Max. Operating/Design Temp. : By bidder
- Level transmitters (1 Nos.) to be provided.

c. Acid gas Flare

- Type : 150 lbs rating pipe
- Material of Construction : SS 316L
- Support : From Demountable type Derrick Structure
- Special requirements : Platform (with handrail) and ladder for the maintenance and access of flare stack to be provided.
- Operating Pressure : By Bidder
- Maximum Allowable Pressure Drop : By Bidder (kg/cm^2)
- Design Pressure : By Bidder
- Max. Operating/Design Temp. : By bidder
- Level transmitters (1 Nos.) to be provided.

6.3.4 Knock-Out Drum:

a. Ammonia Flare from Ammonia & CGP Plant

- Type : Cylindrical and Horizontal / Vertical
- Location : At base of flare stack
- Operating Pressure : By bidder
- Steam Coil Parameters : By bidder
- Operating / Design Pressure : - /3.5 kg/cm^{2}g
- Operating / Design Temperature : 40^{0}C /150^{0}C & (-)33^{0}C
- Entry of Gas : Preferably tangential, or any other alternative arrangement
- Internal Attachments : i) Internal baffles for separation (optional)

ii) Steam coil (for vaporization of condensate Separated from gas)
iii) Steam coil area : By Bidder's

- MOC of KOD : KCS/LTCS (as applicable)
- Manway flange 24" with blind flange
- Level gauges
- Level transmitters with remote indication and High Alarm (2 Nos.)
- MOC of Steam Coil : SS304
- Corrosion Allowance of KOD : 3 mm.
- Corrosion Allowance for Steam Coil : Nil
- Slope of all inlet & outlet Flare gas lines from KOD, shall be towards KOD.

b. <u>HP gas Flare from CGP Plant</u>

- Type : Cylindrical and Horizontal / Vertical
- Location : Near base of flare stack
- Operating Pressure : By Bidder
- Operating / Design Pressure : - / 6.0 kg/cm^2g
- Operating / Design Temperature : - / 400^0C
- Entry of Gas : Preferably tangential, or any other alternative arrangement
- Internal Attachments : i) Internal baffles for separation (optional)
- MOC of KOD : CS
- Manway flange 24" with blind flange
- Level gauges
- Level transmitters with remote indication and High Alarm (2 Nos.)
- Corrosion Allowance of KOD : 3 mm.

- Slope of all inlet & outlet Flare gas lines from KOD, shall be towards KOD.
- Knock-out Drum and Water Seal (refer schematic / P&ID) should be designed as per API 521 (Latest Edition). The seal should be designed for a minimum of 175% of the drum's maximum operating pressure. For water seal, continuous service water shall be used.

c. Wet Acid gas Flare

- Type : Cylindrical and Horizontal / Vertical
- Location : Near base of flare stack
- Operating Pressure : By Bidder
- Operating / Design Pressure : - / 3.5 kg/cm^2g
- Operating / Design Temperature : - / 150^0C
- Entry of Gas : Preferably tangential, or any other alternative arrangement
- Internal Attachments : i) Internal baffles for separation (optional)
- MOC of KOD : SS316 L
- Manway flange 24" with blind flange
- Level gauges
- Level transmitters with remote indication and High Alarm (2 Nos.)
- Slope of all inlet & outlet Flare gas lines from KOD, shall be towards KOD.
- Knock-out Drum and Water Seal (refer schematic / P&ID) should be designed as per API 521 (Latest Edition). The seal should be designed for a minimum of 175% of the drum's maximum operating pressure. For water seal, continuous service water shall be used.

d. SRU Flare

- Type : Cylindrical and Horizontal / Vertical
- Location : Bidder to decide
- Operating Pressure : By Bidder
- Design Temperature : 200^0C
- Steam Coil Parameters:
- Operating / Design Pressure : - / 3.5 kg/cm^2g

- Operating / Design Temperature : -/ 200^{0}C
- Entry of Gas : Preferably tangential, or any other alternative arrangement
- Internal Attachments : i) Internal baffles for separation (optional)
- MOC of KOD : CS
- Manway flange 24" with blind flange
- Level gauges
- Level transmitters with remote indication and High Alarm (2 Nos.)
- Corrosion Allowance of KOD : 3 mm.
- Slope of all inlet & outlet Flare gas lines from KOD, shall be towards KOD.
- Knock-out Drum and Water Seal (refer schematic / P&ID) should be designed as per API 521 (Latest Edition). The seal should be designed for a minimum of 175% of the drum's maximum operating pressure. For water seal, continuous service water shall be used.

6.3.5 Ignition system comprising of Pilot Burners & Flame Front Generator:

6.3.5.1 Ignition System with pilot burners

- The flare tip shall be equipped with number of pilots. The no. of pilots shall be determined by bidders. Special nozzle designs of pilot burners shall guarantee flare stability for wind speed up refer 4.0.CIVIL AND STRUCTURAL DESIGN BASIS.
- The pilot burner nozzles shall have in-built flame retention provisions and shall include a shield to ensure stable flame.
- Ignition of the pilot burner shall be via a flame front, generated at a remote panel, and fed to the pilot burner nozzle through an igniter tube.
- The pilot burners have to be designed, such that, the flame from the flame front generator shall be able to ignite the pilot burner at Design Wind Conditions.
- For flame indication (i.e. whether burning or flame failure), a heat resistant thermo – couple shall be fitted internally inside the nozzle and gas mixture tube. There the thermo-couple wire shall be protected from the main flame and cooled by the flow of gas passing over the thermo-couple.
- It is very important for bidder to note that, proper considerations and care need to be taken for addressing differential expansion between flare stack pipe and pilot burner igniter line.
- Material of construction :

- Pilot burner nozzle ……..SS 309
- Pilot burner igniter tube……SS 321
- Pilot burner flame thermo-couples shall be , chromel / alumel (type K)

- No. of thermo-couples, K (type)…….. 2 nos. per each pilot burner.

- IR Camera for each flare to be mounted remotely for physical flame visibility in the Ammonia & Coal gasification plant central control room.

- Separate ignition lines shall be provided for each burner. Bidder to note that no deviation in this regard shall be acceptable to Owner.

- Instrumentation shall be adequate to operate the facility remotely from the PLC installed in the central control room (CCR-2 Ammonia & Urea control room), to monitor and control all important variables, to hear & attend alarm and shut down the plant during abnormal condition. Bidders to provide the indication of pilot failure alarms etc. in local panel and main control room of all the three stacks. Vendor to provide Logics and it is to be implemented in the existing PLC with Instruments hardwired to the same PLC. The implementation of logic shall be done by the bidder. Logic implemented in the PLC shall be checked and verified by the Vendor at Site. Operation shall be done locally but all indications and alarms shall be available in central control rooms. Bidder shall integrate its all control system (ignition system, FFG panel etc) to Ammonia-urea & CGP CCR via suitable communication protocol for controlling & monitoring purpose of all critical parameters related to the flare system. All accessories along with mandatory spares related to integration shall be in bidder's scope (for details refer section 9.0 of the NIT)

- The ignitor for pilot burner with local operating and monitoring panel shall be located at the ground level, at safe location, and without fail in the barren / sterile area of the flare stack.

- Lightning Arrestor system to be provided as per code.

- All connecting cables shall be properly dressed and supported.

For flare, a pilot burner with ignitor is associated. The ignition panel is located at ground level, in a safe area. Each pilot burner is fed by two separate lines. The first line is to the flame distributor for the ignition flame front and the second line is dedicated fuel gas line to the pilots. Each pilot burner is equipped with a dedicated flame detector complete with relevant signal lamps. Emergency power is provided for Flame front generator. No. of pilots shall be decided by bidder.

6.3.5.2 Flame Front Generator Panel:

- Flame front Generator Panel, is an important part of the Flare stack Ignitor system, for which special care has to be taken by Bidder.

- Location: Ground level and in safe sterile area of flare stack.

- Type : Skid mounted Panel, shall be suitable for anchoring to the ground and shallbe protected by a mechanically strong canopy of sound design.
- Material :

Frame : Carbon steel,
Piping : SA 106 Gr.B,
Flange : ANS/ 16.5
Painting : Flame Front Generator Panel, along with canopy for Generator Panel, shall be painted with a suitable corrosion & heat resistant primer and paint.

- All electrical equipment shall be suitable for hazardous area, as mentioned earlier.
- The flame Front Generator Panel shall essentially consist of, but not limited to the following:

i) Instrument Air / Process Air Line, with
- Pressure reducer
- Pressure Indicator
- Calibrated orifice (for flow measurement). Tentative line size is ½" to 3"/4. Bidder to confirm.

ii) Fuel Gas Line, with
- Pressure reducer
- Pressure Indicator
- Calibrated Orifice (for flow measurement)

Fuel Gas for the pilot burner's shall be mainly NG. LPG shall be used as stand-by under certain conditions.

iii) Mixing Chamber

iv) Mixing Venturi.

v) Ignition transformers, housed inside EEx box, along with push buttons and suitable cables.

vi) Diversion Valve for selection of pilot burner

vii) 1(one) no. control box, which shall essentially include,
- Power switch
- Lamp power "on" indication (for pilot burner monitoring)
- Test button (for ignition)
- Green lamps pilot "on"
- Red lamps pilot "off"

viii) Indication of pilot burner flame failure alarm to Owner DCS/PLC in central control rooms.

ix) Vendor to ensure, least no. of bends in the spark travel pipe from FFG panel to pilot burners and all elbows should to long-radius type.

x) Bidder shall take special care to see that, all instruments (monitoring & control) and electrical parts shall be,
- Explosion proof
- Suitably protected from the radiation heat from the flare stack.

xi) Emergency power for FFG panel to be provided.

6.3.6 Thermocouple Extension Cable:

- Thermocouple extension cable shall extend all along from the pilot burners at the top (near 'flare tip' top), to flame front generator, located at the ground level.

- Bidder to take special care regarding its safe installation.

- Type : 'K' type
- Material: Cromel / Alumel

6.3.7 Aviation Obstruction Light:

Purpose: Serving as warning light for Aircraft.

Nos. reqd.: 1 (one)

Type: 'LED' type

Location : Near top of highest 'Flare Tip'.

Note: Shall be placed in conformity with the requirements.

6.3.8 Derrick Structure:

Purpose: Demountable type Derrick structure to be designed for housing Flare Stack with all its accessories. Derrick drawing/ engineering shall be prepared & approved for derrick structure bearing three nos. stack pipe as mentioned above upto 90 meters separation distance between blocks/facilities (as per OISD-118). However, the supply of the structure material shall be only upto flare stack height in the subject NIT.

Nos. reqd.: 1 (one)

Material: Structural Steel

Foundation: Design, supply, erection& commissioning shall be in the scope of Bidder.

6.4 Conditions and Analysis of Flare Vent Gases & Fuel Gas:

The basis of design of flare stack and flare system as a whole, shall depend on conditions, gas analysis, operation philosophy, etc as elaborated in table-1 and the table given below :

6.4.1 Fuel Gas (Natural gas) analysis/quality/Composition:

S. No.	Description	Composition (Mole %)
1	Methane	93.093 - 98.713
2	Ethane	5.839 - 1.130
3	Propane	0.563 - 0.0002
4	Isobutane	0.124 - 0.0020
5	Neobutane	0.132 - 0.0020
6	IsoPentane	0.008- 0.0001
7	Neopetane	0.002-0.0002

8	Nitrogen	0.239 – 0.1525

Specific Gravity	0.59370 – 0.56103
Total Sulphur (ppm by wt. max.)	10
Average GCV in Kcal/SCM	9531.853 – 9088.752
Average NCV in Kcal/SCM	8599.226
Normal/Design Temperature, deg. C	Amb/65
Min/normal/max./design Pressure, Kg/cm2g	4.0/4.5/6.0/10.0
Line size & MOC	3", CS, 150LB

Operating Temperature –Ambient

Fuel LPG: Bidders shall provide the complete system including pressure regulator for LPG cylinder manifold(for Six (6) nos cylinders) located near to Flame Front generator (FFG) dedicated for each flare stack. Fuel LPG will be supplied by bidder in the portable industrial LPG cylinder. LPG to be used as Back-up to Fuel Gas for Pilot Gas & Flame Front Ignition purpose.

.6.4.2 REQUIRED QUANTITY OF FUEL GAS AND UTILITIES

Bidders shall submit the required quantity of fuel and LPG and other required utilities for normal and maximum use for the entire three Flare stack.

7.0 CODES & STANDARD FOR RADIATION INTENSITY

As per NIT

8.0 UTILITY SYSTEMS:

The specification for the utilities such as instrument air, plant air, steam, nitrogen, LP Steam, service water, fuel gas, LPG and electric power is as mentioned below. Actual required quantity shall be calculated by bidder.

a. All the necessary utilities shall be provided by owner at bidder's battery limit. Distribution of the various utilities inside the battery limit shall be in the scope of the bidder. Bidder shall indicate the normal and max requirement of each utility.

b. Normal electric power & emergency power connection shall be provided to the bidder at his battery limit. Bidder shall indicate the minimum & maximum power requirement for the flare stack assembly line. Following utility shall be provided-

- Natural gas for firing burner
- Nitrogen
- Service water
- LP Steam

- Instrument air
- Plant air
- Electric Power

Nitrogen:		
1	Pressure,Kg/cm2g (Min/Nor/Max/Design)	6.0/8.0/9.0/10.5
2	Temperature ^{0}C	Amb.
3	N2+Inerts, Vol%, min	99.99%
4	O2 Vol PPM	< 10
5	Quantity required, Nm3/hr	By bidder

Instrument Air:		
1	Pressure,Kg/cm2g (Min/Nor/Max/Design)	6.0/8.0/10.0/10.5
2	Temperature ^{0}C (Nor/Max/Design)	Amb./ 50 /65
3	Dew Point	(-40 ^{0}C) @ atm pressure
4	Quantity required, Nm3/hr	By bidder

LP Steam:		
1	Pressure,Kg/cm2g (Min/Nor/Max/Design)	3.0/3.5/4.5/6.0
2	Temperature ^{0}C (Nor /Design)	180 /250
	Quantity required, kg/hr	By bidder

Cooling Water:		
1	Pressure, Kg/cm2g (Nor/Design)	3.5/8
2	Temperature ^{0}C (Nor/Design)	33/70
	Delta T ^{0}C	10
	Delta P Kg/cm2 across battery limit	1 max
	Quantity required, kg/hr	By bidder

Plant air		
1	Pressure, Kg/cm2g (Nor/Design)	7/10.5
2	Temperature ^{0}C (Nor/Design)	40/65
	Moisture	Saturated
	Oil Content	Nil
	Quantity required, Nm3/hr	By bidder

Service Water:

Sr. No.	Parameters	Unit	Treated raw water quality
1.	Temperature	Deg C	Amb.
2.	Supply Pressure,	kg/cm2-g (Min/Nor/Max)	9/9.5/10
3.	Supply Temperature,	deg c	Ambient
4.	Mechanical Design Temperature,	deg c	65
5.	Mechanical Design Pressure,	kg/cm2-g	11.5
6.	Quantity required	Kg/hr	By bidder

Electric Power:

Refer section (PC183-E-4013-SEC VI-Annex 1) Design philosophy-Electrical

TECHNICAL SPECIFICATION

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM

CONTRACTOR SCOPE OF WORK - INSTRUMENTATION

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED ROM BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

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ANNEXURE NUMBER	DESCRIPTION
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ANNEXURE-5	Hardwire Console
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ATTACHMENT NUMBER	DESCRIPTION
GSTD-0202	General Specification For PLC System
GSTD-9998	Inspection And Test Requirements

1. SCOPE

The description and requirements contained in this specification are concise by necessity and cannot include all details. However, it is the responsibility of the contractor to execute the job on a turnkey basis in accordance with the specifications and internationally recognized good engineering practices for smooth and successful operation of FLARE STACK. Any activity specifically not listed in this document, does not absolve the contractor of their responsibility to include such activities in their scope of work and supply, which otherwise is necessary, to complete instrumentation work for the FLARE STACK. All such activities shall be carried out by the contractor without any implication.

This section outlines the general requirements and specifications for Instrumentation and Control System for Design, engineering, procurement, fabrications, supply, inspection, testing, painting, transportation, calibration, supervision of erection and commissioning supervision of FLARE STACK INCLUDING FLARE HEADER with associated facilities at TFL.

SCOPE includes supply of complete instrumentation including spares and documentation , inspection / testing at manufacturers works in accordance with this specifications , other documents , P & I Diagrams etc. They shall also comply with the requirements of the relevant codes , and good Engineering practices. Vendor may include additional instruments as per the standard practice for making operations safe and efficient.

- The Flare package plant shall be provided with PLC based control system (Kindly refer General Specification of PLC system-GSTD-0202 for control system spec attached with the Tender). This control system will accommodate all control/trip and monitoring signal/functions for the unit
- Single PLC has been considered for Flare Package and bidder to ensure segregation of individual plant level signals at AI/AO/DI/DO card level so as to ensure the reliability of the system.
- 1 no. OS with dual LED monitors and 1 no. OS cum Engineering having the feature of SOE also (placed in console area of engineering room), shall be provided by the bidder.
- One no. Aux. Console with Ann. window, push buttons, switches for critical trip and alarm shall also be provided.
- RIO shall not be considered anywhere in the package.
- All the required protections & interlocks shall be carried out in PLC. All the features such as graphics, alarms, and process parameters display diagnosis for plant equipment shall be displayed in package's operator station installed in the CCR.
- Network securities shall be provided by Vendor in control room as per IEC 62443 for protection of the system from both internal and external threat. The requirement includes all USB port blocking (including all monitors / CPU), provision of sufficient firewalls, and antivirus update for one year, patch update; unauthorized logging recording with events etc. must be addressed by Vendor.

- Bidder to note that all the Operator /Engineering Console & printer table etc. supplied by Bidder shall preferably match with the Client's installed consoles in the Main Plant CCR. Details regarding existing consoles shall be provided to the bidder at later stage.

- For important operating data and indications required for surveillance and monitoring, a provision shall be made to repeat the signals in Client's DCS/ ESD from Flare Package unit Control system, wherever applicable. For this bidder to provide communication redundant port (MODBUS TCP/IP) / OPC server for communication to Client's DCS. Bidder to provide necessary interfacing cards to achieve the purpose. It is preferable to offer Control system of the same make as the existing DCS/ESD in central control room. Existing DCS/ESD make shall be discussed during detail ENGG.Any Hardware / software required for seamless integration for interfacing from Package Control system to CCR shall be in the scope of bidder.

Completeness and correctness:

a.) Vendor shall ensure that system is complete in all respects , the models and prices quoted include all components , accessories , services , documentation and other cost required to meet these specification , so that the package can be commissioned and put on line without any additional accessory / service(s).

b.) If after placement of order , it is found necessary that vendor has to change the model number / add accessories / components or additional services are required to meet the requirements , vendors shall do so at their cost , even if model nos. might have been approved , provided the requirements remain unchanged.

c.) Vendor alone is fully responsible for correctness of the models and completeness of the Instrumentation.

d.) All equipments/instruments/system oriented items (with all its sub-systems) shall be of field proven quality both with respect to design and materials. Prototype instruments or instruments of an experimental nature shall not be offered or supplied. In general, all the supplied items by supplier shall have a well proven performance record of operating satisfactorily in an Acid /Pharmaceuticals /Oil and Gas sector/Power/Chemical/Fertilizer Plants for minimum of one year. No instrument requiring special maintenance or operating facilities shall be offered or supplied as far as possible. PTR for field instruments shall be considered min for 2 years. The detailed specification of Individual item as and when required shall be shared during detailed engg and the same shall be treated as part of the Tender.

Bidder to carry out:

- Preparation of engineering and construction documents like functional schematics, I/O list, logic diagrams for interlocks as per ISA 5.2 with functional descriptions, configuration diagram, electrical load list, cable schedule, cable tray/trench layout, instrument air requirement, nameplate schedule, JB schedule, instrument location layout, electrical instrument signal interface, instrument index, layout drawings, loop diagrams, primary and secondary sketches and bill of materials.

- Co-ordination with Control system vendor for Serial links RS-485, MODBUS RTU to PLC of Flare system placed in central control room (CCR-2) of Ammonia Urea

plant. Panel system engineering, implementation, software testing, supply and final commissioning supervision and site acceptance tests shall be in Bidder Scope

- Co-ordination with all instrumentation vendors for obtaining sufficient information in the form of documents, drawings for engineering and approval from OWNER.

- Preparation of specification for erection materials like cables (Signal, power, control, Optical fiber etc), cable trays, pipe & pipe fittings, air tubing, junction boxes, air distribution pots etc.

- Bidder to provide all sufficient information in the form of documents, drawings for engineering and approval from OWNER.

- Bidder to supply complete instrumentation system with all necessary erection material like valves, fittings, tubes/pipes, cables, cable glands and cable trays Junction box and any other erection material for the completeness of the job.

- Bidder to refer Area plot plan elsewhere attached with the Tender in order to finalise cable length, distances, cable routing etc.

- Bidder to also refer Schematic arrangement for Flare System package elsewhere attached with the Tender for the scope of supply, installation & erection of Instruments along with spares shown in yard piping area. Their Signal shall be hooked to the same control system for Flare Package. The necessary cable, cable trays, Junction box, and all other accessories for wiring up to control system shall be in bidders scope.

- UPS power supply shall be tapped from 2 Nos. 240V feeders and 1 Nos. 115V feeder at Owner's Offsite & Utilities Substation and further distribution shall be in LSTK Contractor's SCOPE. The tentative distance of Offsite & Utilities Substation from Flare Area is approx 1500 meter. And The tentative distance between Substation OSBL to PLC control room is approx 500 meter. However Bidder to refer area plot elsewhere attached with the Tender to measure exact distance.

- Tapping of power supply from Offsite & Utilities Substation (including supply of all required material), structural supports for cable tray, cable trays, cables, cable termination etc. Shall be in LSTK Contractor's scope. Further distribution to equipment. through proper type and size of cables, their supply, erection, testing and commissioning etc. shall be in LSTK Contractor's scope.

- Please refer Electrical chapter for detailed scope of UPS & its accessories.

- Bidder shall supply, install & commission all field instruments, local cables, junction boxes, cable trays, Air Distribution Pots. All local cabling shall be terminated in Field Junction Boxes/Local Panels by the bidder and the same from JB/Local panel shall be taken to Central Control Room through Multi-core cables by the Bidder. Supervision for erection/commissioning shall also be provided by the bidder at site.

- Bidders shall provide necessary support for interfacing till the control room.

		Supply	Installation/ Erection/Commissioning	Assistance Erection/Commissioning
1.	Field Instruments	By Bidder	By Bidder	By Bidder
2.	Control system	By Bidder	By Bidder	By Bidder
3.	Package Battery Limit to Central Control Room (CCR-2) through multi-pair cables & cable trays	By Bidder	By Bidder	By Bidder
4.	Interface Control system (Hardware/Software)	By Bidder	By Bidder	By Bidder
5.	Earthing/Earthing cables & Earth Pits	By Bidder	By Bidder	By Bidder

2.0 DOCUMENTATION

Sl.No	Description	With Bid (Y/N)	For Review/ Approval	For Information	Final/ Approved/ As-built
	INSTRUMENTATION				
1	Drawing & document schedule		Y		Y
2	Instrument Index			Y	
3	Instrument sizing calculations (control vales, safety valves & flow elements)			Y	
4	Utility requirements			Y	
5	Level sketches			Y	
6	Material Requisition		Y		Y

7	Purchase Requisition			Y	
8	Vendor Drawings			Y	
9	Functional Schematic			Y	
10	Logic Diagrams as per ISA 75.2			Y	
11	Instrument loop drawings			Y	
12	Control room layout		Y		Y
13	Layout of equipment inside control room		Y		Y
14	Power supply distribution		Y		Y
15	Wiring diagram for panels			Y	
16	Configuration diagram		Y		Y
17	I/O assignment		Y		Y
18	DCS/PLC graphics, report/log formats & other DCS/PLC docs.		Y		Y
19	Instrument duct / tray layout			Y	
20	Instrument cable schedule			Y	
21	Instrument location plans			Y	
22	Instrument installation drawings			Y	
23	Bill of material for installation items			Y	
24	Spare part list for :				
	a. Mandatory Spares			Y	
	b. Start up & commissioning			Y	
25	Inspection & test procedures			Y	
26	Complete catalogues with part list for all vendor supplied instruments, control etc.			Y	
27	Installation, operation & maintenance manuals			Y	
28	As Built Drawings			Y	

29	System Architecture	Y			Y
30	Instrument Control Philosophy	Y			Y

3.0 INSTRUMENTATION CODE AND PRACTICES

IEC 13	Diagrams, Charts and Tables, Preparation of Logic Diagrams
IEC 534	Industrial - Process Control Valves
IEC 584	Thermocouples
IEC 605	Equipment Reliability Testing elements
IEC 611-12	Part 12 Graphical Symbols for Diagrams. Binary Logic
IEC 654	Measurement and Control equipment
IEC 751	Industrial Platinum Resistance Thermometer Sensor
IEC 801	Electromagnetic Compatibility for Industrial Process measurement and Control Eqpt.
IEC 848	Preparation of Function Charts for Control Systems
IEC 902	Industrial Measurement and Control Terms and Definitions
ISA S-5 .1	Instrumentation Symbols and Identification
ISA S-5.2	Binary Logic Diagrams for Process Operation
ISA S-5 3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Symbols
ISA-S20	Instrumentation specification formats
ANSI/ISA S 5.1	Process Instrumentation Terminology
ANSI/ ISA S71.04	Environmental conditions
ANSI/ ISA S75.01	Control Valve Equations
ANSI/ ISA S75.02	Control Valve Procedure Capacity Test
ANSI/ ISA S75.03	Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies
ANSI/	Quality Control Standard for Control Valve Seat
FCI 70.02	Leakage

BS 6020	Instruments for the Detection of Combustible Gases
DIN 43760	Measurement Standard for RTD.
DIN 19243	Measurement and Control Electrical Sensors, Electrical Position Sensors and Signal Converters used for Intrinsically safe two-wire DC System.
EN-50-014/020	Electrical Apparatus for Potentially Explosive Atmospheres
EN 54 Part I	Components of Automatic Fire Detection System Introduction.
EN 54 Part 5	Heat sensitive Detectors - Point Detectors containing a Static Element.
ISO 3511.1	Process Measurement Control Functions and Instrumentation Representation Part I: Basic requirements.
ISO 3511.2	Process Measurement Control Functions and Instrumentation Representation Part 2: Extension of Basic Requirements.
ISO 3511.4	Process Measurement Control Functions and Instrumentation Representation Part 4: BasicSymbol for Process Computer, Interface and shared Display/Control Systems.
ISO 4200	Plain End Steel Tubes, Welded and Seamless - General Table of Dimensions and Masses per Unit Length.
ISO 5167	Measurement of Fluid by Means of Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section Conduits Running Full.
API RP 520	Sizing, selection and Installation of Pressure relieving devices in Refineries
API RP 521	Guide for Pressure Relieving and Depressuring System
API RP 2000	Venting Atmospheric and low-pressure storage tanks
API-RP-550	Manual on Installation of refinery Instruments Part I and Control System
ANSI - B 16.104	Control Valve seat leakage
ISA-S 75.01	Control Valve sizing
ISA S 18.1	Specifications and guides for the use of general Annunciators.
IEC 529	Environmental Protection of equipment
ANSI B 2.1	Pipe threads
ANSI B 16.5	Steel pipe flanges, flanged valves and fittings
IEC 79.11/	Intrinsic safety code and practice
IEC-79.14	International Boiler Regulation

IS 2148 Flameproof enclosure of electrical apparatus

4.0 HAZARDOUS AREA CLASSIFICATION & ELECTRICAL EXECUTION

Irrespective of area classification, the execution of instrumentation shall be as per area Zone 2, group IIC, T6, Exia and Protection.

Electrical / Electronic instruments	IP 67
Sensors; RTD, T/C, etc.	IP 65
Local Gauges; PG, etc.	IP 55
Pneumatic instruments	IP 54
Solenoid valves	IP 67
Local Panel / Skid Mounted Panels	IP 55

EMC compatibility and electrical safety as per latest IEC standard.

Electrical instrument equipment shall be designed for and supplied as intrinsic safe certified.

Analysers, solenoid valves and other equipment that cannot be classified intrinsic safe shall be ex-proof in accordance with the above mentioned electrical specification.

Certification for installation in hazardous areas in accordance with IEC 60079 series is shown below:

Transmitters, Positioners, Limit Switches , etc.	Ex ia IIA/IIB T6
Field Switches:	Ex de IIA/B T6
Analysers and Panels:	Ex p IIA/B T6
Solenoid Valves:	Ex ia IIA/B T6 (Ex md not allowed)
Junction Boxes and Cable Glands:	Ex e/Ex d

5.0 ELECTRICAL SUPPLY

The electrical supply will be as follows:

S.No.	Description	110 V AC 50Hz UPS	110 V DC	24V DC	110 V AC Non UPS	240V AC 50Hz (Non UPS)	415 V AC-3 phase	Remarks
1	Control System	YES						
2	Package Units	YES				YES		Non UPS for Lighting

3	Alarm Annunciator	YES						
5	Solenoid Valves			YES				
6	Smart Positioners, I/P, Transmitters			YE S				
7	I/P Interrogation Voltage			YE S				
8	Gas Detectors			YE S				
9	Analyzers and Analyzer System	YES						
11	Level Gauge Illumination					YES		
12	Cabinets Fan					YES		
13	Cabinets Lighting					YES		
14	Control Room					YES		
15	Local Panel	YES		YES		YES		Non UPS for Lighting
16	Analyzer Cabinet Air Conditioning	YES						
17	Analyzer Shelter HVAC						YES	

6.0 INSTRUMENTATION PHILOSOPHY

- All instruments and equipments shall be suitable for use for specified site climatic conditions and industrial environment in which corrosive gases and/or chemicals may be present. As a minimum, all instruments and enclosures in field shall be dust proof and weatherproof to IP-67 as per IEC-60529 or equivalent NEMA 4X enclosure rating or better and secure against the ingress of fumes, dampness, insects and vermin. All external surfaces shall be suitably treated to provide protection against corrosive plant atmosphere.

- The design of electronic instruments shall be in compliance with the electromagnetic compatibility requirements as per IEC 61000-4 ''Electromagnetic compatibility for Industrial Process measurement and Control equipment''.

- Process switches, shall be realized through field transmitters only. If for some packages, process switches are unavoidable same shall be provided with sealed micro switch contacts rated for the specified application. Contacts shall be 1 no. DPDT preferably. Otherwise 2 nos. SPDT can be considered. All switch contacts except those used in intrinsically safe circuits shall be silver plated. Contacts used

in intrinsically safe circuits shall be suitable for the applications. Switches shall be hermetically sealed type. Switches shall be connected through interposing relays.

- All Field transmitter supports should be properly clamped with SS304 accessories to the pipe for pre-fabricated wherever required and closed couple installation. No air gap shall be kept between support clamp and pipe.

- All Solenoid valves shall be Intrinsically Safe type (24 V DC), SIL3 certified with details inside the design basis. Solenoid valve body material shall be SS316. All critical loops must have redundant SOV's.

- The minimum instrument accuracy shall be as defined in Annexure-1.

- Universal HART Protocol with Latest Revision shall be used in all cases.

- SIL certification rating for all the instruments shall be minimum as per following list :-

  - All Smart Positioners - SIL 2
  - All Transmitters - SIL2
  - All Solenoids - SIL 3
  - All Gas Detectors - SIL 2
  - All switches - SIL-3 or maximum SIL rating available

- All system cables/fiber optic cables in the field (including communication between Ignition panel systems to Central Central room of Ammonia & Urea) shall be routed in HDPE Hard pipe. Fillings shall be used for joining the HDPE pipe. HDPE pipes shall be ORANGE in colour with BLACK fillings. All system cables/fiber optic cables shall be routed in the middle 150mm portion of the tray. Wherever it is absolutely necessary to route these cables underground, it should be routed in the RCC Trenches only. Separate route should be followed for redundant system cables. Supply of Cable trays and laying of cables through trenches upto CCR are in bidder scope.

- No copper or copper alloy shall be used for the parts coming either in contact with process fluid or outside atmosphere.

- Junction box shall be of die-cast aluminum alloy (LM-6) anti corrosive painted all Bolting SS, Weatherproof IP 65 minimum with mounting brackets, hinged door , all bottom entries with Canopy , 2 Entries for Multicore. JB colour shall be Grey for Non I.S. , Blue for intrinsically safe loops , Terminals - PVC , Phoenix terminals , Screwed.

- General Earthing & Instrument Earthing shall be provided separately (Panel and power earthing, Control System earth and Instrument signal earth is minimum envisaged).

- All wetted part materials for all instruments (sensing elements) shall be min SS316L.
- The instrument item like control valve, pressure relief valve, orifice flanges, level instrument, thermowell etc., coming on pipe and vessel under IBR services shall be certified by IBR or IBR authorised representative, even for SS metallurgy.
- Turbine flowmeter shall not be used.
- All Contacts shall be 2 SPDT or 1DPDT.
- No Direct Process Switches (Pressure / Level/ Flow / Temp.) shall be used.
- All field transmitters for pressure, d/p, level and flow shall be microprocessor based (dual compartment) SMART transmitters with “UNIVERSAL HART” protocol with latest revision. The transmitter selection shall be such that the operating maximum upper limit shall be around 70% of the total measurement range of the transmitter. All Field transmitters for pressure, d/p, level and flow shall be provided with 10 years stability with accuracy (0.1%).
- The control system and its software must be of latest version and supplied with latest anti-virus software.
- All equipment/materials supply shall include spares required for 2 years operation and separate consumable for commissioning.
- All Instruments including volume bottle must be painted with Corrosive resistant epoxy paint.
- Local indicators, start /stop switches, emergency stop switches shall also be provided near package units/rotating machines where local start up of the equipment is advisable.
- For instrumentation electrical interface, input and output contacts shall be in separate multicables (should be signal cables).
- All trip solenoids shall be dual redundant, and configured and hooked up properly in such a way that failure of one solenoid doesn’t initiate a false trip. Trip solenoids shall be normally in energised condition and shall be de-energised to initiate trip.
- All trip interlocks must be designed on 2oo3 philosophy.
- Emergency stop and critical stops must have transparent protective cover.
- PB’s , Annunciator , EPB must be available on console placed in Central Control Room.
- Air fails to open, Close or Hold of any control valve shall be as per process requirement , to take care of process, plant and human safety. For Piston actuators

necessary air volume chambers and lock up relay shall be provided to achieve the fail-safe condition.

- All Analysers shall be Ex.proof (Minimum IP65 or better) irrespective of area of installation.
- All control valves / On – Off Valves / MOVs shall be flanged type.
- Control valve / on-off valve, pneumatic valve shall be designed for minimum 4 Kg/cm2 air pressure.
- Actuator design shall be of 1.5 times of shut off pressure with guidelines as below:-
- Vendor shall ensure that the actuator torque produced at maximum air supply pressure (MAWP) does not exceed the shear torque of the valve stem/shaft. As a guideline, actuator torque values shall be in accordance with the following :
- Minimum actuator torque of 1.5 x required highest starting torque to commence movement of the ball in the case of maximum differential across the valve.
- Shear torque of stem/shaft greater than 1.5 x maximum torque produced by actuator at maximum air supply pressure
- Valve body MOC in steam service shall be of WCC or better irrespective of pipe class.
- Air distribution pots shall be of stainless steel (SS304). Inst. Impulse pipes for process parameters shall be in accordance with piping specifications.
- Hart Compatible gas-detectors to be provided. Electrochemical type gas detectors shall not be considered. Bidder to submit suitable gas detectors as per OEM recommendation/ as per ITB as specified elsewhere. Bidder to submit gas detectors quantity calculation along with layout. Bidder to provided hooters (electric type) & beacon (rotating type with light flash).
- All line mounted instruments like in-line SOVs, Magnetic flow meter, Rotameter, Mass flow meters etc shall be provided with block & bypass arrangement, with their indications in system as per requirement, which will be discussed in detailed engineering.
- Separate Sample handing system shall be used for each analyzer. Multi Channel with stream selector can be used, provided the total system including sample handling system shall be imported. Necessary sequence shall be inbuilt in the analyzer for draining the condensate.
- For double acting valve, air accumulator (with MOC as SS304) shall be used for achieving fail safe operation.

- FRP Canopies (UV stabilized 3 mm thick), 2" Pipe mountable, are required for Transmitter, JBs, LCPs, Control Valve positioner, Temp Elements, Proximity level switch, remote mounted electronics, mass flowmeter, ultrasonic flowmeter etc. FRP Canopy shall be prefabricated type. Canopy for transmitters shall cover top and 3 sides. SS canopy instead of FRP, if offered by package vendor, shall also be acceptable. No separate canopy shall be required for instruments located under shed like compressor shed etc.

- System / Marshalling/ Packages cabinet size shall be 2100 (H) X 1200 / 800 (W) X 800 (D) Rittal make.

- Separate Tapping shall be used for each instrument coming for trip, control & monitoring, local display. No More than 3 set of taps allowed.

- Smart positioner shall be considered for all Control Valves. For high temperature services (Above 200 Deg C) remote feedback shall be used for the smart positioned (i.e positioned shall be installed remotely).

- Positioner shall be of valve OEM or as per approved vendor list.

- For all Local panels rain cover to be provided. The gasket of local panels must be acid resistant preferably Silicone/EPDM or better which will be discussed during detailed engineering.

- For Analysers separate feeders to be directly taken from UPS. No sub-branching is allowed at any place.

- No Switches to be used. If in pump seal plan, if level measurement is requirement, GWR to be used.

- Fibre optic cables shall be armoured, multicore type. All fibre optics cable must be laid through HDPE conduit. The make of fibre optic cables shall be Belden / Leoni.

- All cables inside package battery limit shall be supplied and laid by Package vendor through instrument cable trays supplied by Package vendor. All cables inside skids/modules shall be supplied in pre-wired & pre-tested condition.

- All Instrument Hookups shall be approved by owner/PMC.

- All fittings shall be SS316 and in inch only.

- All tubing shall be SS316 and must be made from hot extrusion process only.

- The manifolds (3 valve/5-valve/2 valve) material shall be SS316L.

- All the soft parts of Local panels/JB/SOVs etc shall be of acid resistance, preferably silicone, EPDM or better which will be discussed during detailed engineering. .

- Load and Unload SOV must be of SIL3 and redundant.

- For all Diaphragm Seal Type DP Transmitters/Gauges on Vessels, min size and rating shall be 3" 300# RF.
- The vessel having two LT's shall be based on two different principles.
- Flushing ring for remote diaphragm seal shall be provided where extended diaphragm seal cannot be provided for pad type nozzles.
- For LT,PT, DPT, PG proper vent /drain facility using manifold/drip ring shall be provided.
- For vent, drain ,1/2" gate isolation valve shall be provided
- For ON/off Valve, open/close indication, SOV(either redundant or 2oo3),PST, feedback of SOV if 2oo3 ,if any signal from switch is going to ESD ,2oo3 shall be provided.
- For control Valve, open/close indication, SOV(either redundant or 2oo3), feedback of SOV if 2oo3 shall be provided.
- For MOV, open signal, close signal,open/close command, position feedback, fault , if any signal is going to ESD ,position feedback 2oo3 shall be provided.
- Bidders to provide the indication of pilot failure alarms etc. in local panel and CCR control room.

7.0 FIELD INSTRUMENTS

Pilot Gas system

The following shall be provided as a minimum , but not limited to :

- Pilot Gas Pressure reducing valves (PRV)
- Relief valves at outlet of Pressure reducers
- Pressure gauges up & down-stream of PRVs (SS casing, SS Bourden, SS movement) 1% accuracy 1/2" NPTM connection, 100 mm dia. dial,; conform to IS 3624 with micrometer zero adj. and blow out protection.
- Installation of Gauges as per API, & Gauge saver for PG on downstream of PRV
- Pressure transmitter for pilot gas pressure to Burners (after PRVs)
- Aspirator for mixing
- Mixing unit,
- Ignition unit
- Pilot gas Piping, manifold
- Solenoids,EEXd II C T3,IP65, SS body, Class H Insulation, ½"NPTF cable entry, internal terminals(No Flying leads)
- Pilot burners assembly
- Rota meter (metal tube) for pilot gas flow indication and valve to regulate flow
- Flame Arresters as necessary (After PRV before mixing, At Pilot Burner Nozzle)

Air for Pilot Flame Front Generation

a. In case air at higher Pressure is available, suitable Pr. reducers to be used. PRV having built-in relief feature shall be used for reducing air pressure for fuel air mix for Flame Front Generation.
b. Flame arresters at appropriate locations to be provided.

Flame Front Generation Panel Ignition System

Typically the following shall be provided at FFG Panel :-

- Manual initiation through Push Buttons shall be available.
- Once pilot flame has started the same shall be monitored through a MI Thermocouple sensor (ungrounded).
- Suitable electronic trip amplifiers for generating Pr. & Temp. thresholds to be used (DIN Rail mounted MTL / P&F units trip amplifier that supply power to field Trans. and contact outputs, continuously adjustable set points).
- Lamps (LED clusters) shall be available for Power-On, Ignition -On, Ignition- Off , Low Pilot Gas Pressure and Sensor Failure.
- Lamps shall have shrouds for better visibility in day time.
- Two Potential free output contacts -one for Ignition failure and one Pilot gas Pr. shall be provided for external connection to main control room.
- Common Flame Front Generation (FFG) system for all the three flare stack.
- FFG shall have Auto ignition & Auto re ignition system in case of pilot flame failure & also provision for push button for manual ignition

FFG Panel

- Panel shall be (mounted on)self standing Structure with canopy and fluorescent lamp.
- Panel shall have proper Power Isolation Switch , fuses / MCB's for power supply to different users such as Ig. Trans; Temp./Pr. Switches, lamps, etc.
- Others shall be as specified elsewhere in this specification (refer Panel specifications).
- Bidder to provide dedicated FFG Panel for each flare system

IR SCANNER

- flame Detection for flare system shall be used with PESO certification
- The distance from Pilot of IR scanner (on Fence) to be min 100 Mtr.

IR CCTV

- One number IR CCTV camera to be mounted remotely at suitable location for physical flame visibility in the Central Control room of Ammonia Urea Plant.The CCTV camera shall be connected to the existing CCTV network provided by Client . All cables and its accessories upto CCR shall be in Bidder scope. No. of CCTV shall be provided during detail engineering.

ROTAMETER

- Glass tube Rotameter NOT to be used. Metal tube type shall be used.
- Connection flanged; rating as per piping spec ; direction – vertically upwards ;
- Tube & Float material – 316 SS .
- Meter unit in Nm^3/hr ; Rated Accuracy - +/- 2 % of FSD or better .

LEVEL INSTRUMENTS

- No switches shall be used.
- Differential pressure type level instruments may be used.
- Instruments of this type shall be similar to Differential Pressure instruments.
- Differential pressure instruments with remote seal diaphragms will be considered for pressurized storage tank application if required and wherever being asked for. In such case capillary length should not be more than 5m. Otherwise radar type Level Transmitter is preferable.
- Non- contact type : Special level Instruments like radar type etc. may be used , if they have proven satisfactory for similar applications, not affected by vibrations.
- All instrument tappings shall be provided with root isolation valves.
- Two wire loop powered Instruments with integral LCD indications are required.
- Local as well as remote configuration shall be possible.(Latest HART).

LEVEL GAUGES

- Gauge glasses shall normally be transparent type without illuminator.
- Large chamber glasses shall be used where operating temperatures are below ambient, where the liquid is near to its boiling point / where operating temperatures are nearby the boiling point of liquid. They shall be heavily insulated and preferably installed without gauge cocks.
- Pressure rating shall meet piping specification, except that minimum rating is 40 Kg/Cm2g at 400C.
- Glasses Boro Silicate of KLINGER /MAXOS make.
- Body shall be forged , material same as piping class. studs & nuts- SS bolts & Nuts for SS body.
- Level Gauges shall be provided with offset integral ball check isolation valves. Body forged , Trim 316SS, back-seated type.Process connections 1.5 “ ANSI/ASME flanged.RF for <= 600#, RTJ for >= 900#.
- Separate ½ “drain and vent valves (needle) shall be provided for each gauge. Valve Body forged , Trim 316 SS back-seated type.O S & Y construction, adjustable gland flange. Min rating Class 800 Lbs.
- Tubular Type Gauge glasses shall not be used.
- Magnetic Level Gauges are not to be used.

PRESSURE INSTRUMENTS

Pressure Gauges :

- Shall be 6 ” (150 mm) dia. dial , SS casing , SS wetted parts , SS movements , Micrometer pointer , Accuracy shall be + 1 % , 1/2 ” NPTM process connection , with Glycerin filling to avoid vibrations of pointer , Blowout disc in general according to IS - 3624 or equivalent.
- For pressure above 40 Kg /Sq. Cmg , Solid front type pr. gauge shall be provided

- Low pressure draft gauges shall be SS bellows / diaphragm , mounting bracket , over range protection where needed.
- SS 2 way valve manifolds with bleed / vent on outlet side shall be provided for zeroing / checking. Vent side with 1/2 " SS plug.
- Snubbers , overpressure protectors (all SS) to be provided as needed.

Pressure / Differential Pressure Transmitters : Pressure / Differential Pressure Transmitters shall be 4 ~ 20 mA + HART loop powered shall be SMART type.

Differential Pressure Transmitters with 3 Valve integrally mounted manifold supported on 2" NB pipe (mounting accessories), all 316 SS wetted parts & Bolting , Integral Digital output meters (configurable in engg. units) , Accuracy of ± 0 . 075 % or better. Minimum rating / over pressure - 1500 # , O - rings PTFE or EP - 851 (No Viton).

Pressure Transmitters with 2 valve supported on 2" NB pipe (mounting accessories) , 316 SS manifolds **including handle, which will be tack welded ,** integrally mounted & bolted. All bolting of Stainless steel. Accuracy of ± 0 . 075 % or better. O - rings shall be PTFE / EP - 851 (No Viton).

Pressure Switches :

a. No direct switches are to be used ; instead transmitters **with control room mounted limit detector** shall be used **for reliability.**

TEMPERATURE INSTRUMENTS

Thermocouples

Thermocouples shall normally be the sheathed type with high purity magnesium oxide insulation. The hot junction shall be isolated from ground. Sheath diameter shall normally be 6mm (1/4") Inconel 600 sheath material shall be used for design temperatures above 400 degree C, whereas ordinary SS material can be used below 400 degree C. The nominal wire diameter shall be approximately 0.19 x sheath OD. The casing material must be SS316L.

Inputs from thermocouples shall be provided with cold junction compensation and downscale burns out feature for high temperature shut downs and vice versa for low. A passive alarms shall warn about the burn-out.

In general type K thermocouples shall be used according to IEC 584, class-1. All temperature elements shall be duplex type, one connected and the second one shall be used as spare.

Thermocouple head must be of die cast aluminium with epoxy paint to withstand the corrosive environment.

Unless otherwise specified, thermocouples cable colour coding shall be in accordance with the latest edition of ANSI-MC 96.1.

The type of thermocouple shall be selected based on the following guidelines as minimum:

Copper-Constantan (ISA-Type-T)	(-) 200 to 200°C
Chromel-Constantan (ISA-Type-E)	(-) 200 to 600°C
Iron-Constantan (ISA-Type-J)	(-) 40 to 750°C
Chromel-Alumel (ISA-Type-K)	(-) 180 to 800 °C
NiCrSil - NiSil (ISA-Type-N)	0 to 1200 °C
Platinum Rhodium-Platinum (ISA-Type-S or B)	600 to 1600°C

Resistance Temperature Probes

Resistance Temperature Probes shall be considered for applications where very narrow spans and high accuracy are required as well as low temperature service. They shall be 6mm (1.4") stainless steel sheath type similar to the thermocouples and with a Pt 100 ohms (0 degree C) element. The sensors shall be duplex type and shall be spring loaded for vibration proof. The elements shall conform to DIN 43760 or IEC 751. The casing material must be SS316L. RTD head must be of die cast aluminium with epoxy paint to with stand the corrosive environment.

Class 'A' / Class '1' tolerance as per IEC 751 / 584-2 shall be specified for all RTD and thermocouple sensors in complete temperature measurements for all open/closed loops and interlocks/Logic.

Temperature Transmitters

Temperature transmitters shall be Remote mounted type (on 2" Pipe), Smart with latest HART protocol and integral digital output meter, dual compartment type.

Head mounted transmitters shall not be used.

Conventional transmitter shall have universal input for thermocouple / RTD and output 4-20 mA DC for 2 wire system.

Transmitter output signal shall be linear and directly proportional to the measured temperature with overall accuracy of +/- 0.1% FS. TT body must be of die cast aluminium with epoxy paint to with stand the corrosive environment

Thermocouple transmitters shall have cold junction compensation and thermocouple linear characterization. Resistance temperature transmitters shall have resistance element linear characterization.

Burnout protection (selectable Up Scale / Down Scale) must be provided for all temperature transmitters.

No temperature switches are to be used..

Temperature transmitters are to be provided for all temperature measurement (closed/open/interlock) loops. All process temperature measurements shall be done through Temp. Transmitters.

Thermometers

Thermometers shall normally be bi-metallic, heavy duty, weatherproof (IP 65), adjustable angle connected type with 150 mm dial as a minimum, dials of smaller size may be used for auxiliary services on machinery. Casing material shall be SS316L.

Liquid filled indicators will be used only where indication is required to be remote Case and stem shall be in stainless steel. Dials shall be of white, non-rusting metal with black figures.

For local temperature control upto a maximum scale range of 530 deg C, liquid filled sensors with capillary extension shall be used.

Filled system instruments when used shall be fully compensated for ambient temperature variations.

Capillary shall be SS armoured and length of which will not generally exceed 3 mtrs.

Range should be selected so that normal operating temperature is approximately 70% of full scale, and the maximum expected temperature is approximately 90% of full scale.

Thermowells

Thermowells shall normally be made from bar stock material.

Flanged thermowells shall be used of 1 1/2" size, threaded thermowells shall not be used, except where accepted by piping specifications, in such case they shall be 1" NPT(M) and real welded. Flanges rating, facing and material shall be in accordance with the equipment or piping standard. Thermowell flange rating shall be 11/2" 300# minimum.

Thermowell shall be used for thermocouples, bimetallic thermometers, filled system and for temperature test points (TW).

Thermowells in vapor-liquid applications, inside columns, shall be located in the liquid phase, unless otherwise dictate by process requirements.

Test wells shall be equipped with threaded plugs and chains.

The preferred mounting position of thermowells, in horizontal pipelines, shall be in the upper half ofthe pipe.

For lines up to 2 inch size, the pipe shall be enlarged to 4 inches.

Thermowell material in general shall be of AISI 316L SS.

Immersion length of thermowells for different line sizes shall be as follows:-

Line Size	Immersion length (U)
4" to 6"	280 mm
8" and above	320 mm
Vessels	400 mm

Immersion length is based on 200 mm length between flange face and inner well of pipe and approx. 60% insertion in the pipeline. In vessels, where fouling with vessel internals is expected, the immersion length shall be suitably modified. Other sizes and immersion lengths may be considered based on special condition/actual requirements.

The design of the wells shall be verified by means of stress analysis, resulting from stream velocity condition. The wake frequency shall not exceed 66% of the thermowell natural frequency. Wake frequency calculation is required for all thermowells. Bidder has to submit Wake frequency calculations for all thermowells as per latest PTC 19.3. Velocity collars not to be used.

IGNITION PANEL:-

FFG System signal goes to relay based Flame Front Generator panel. From FFG panel hardwire (Pot free) contact provided to PLC for controlling & monitoring purpose. Rest all signal directly goes to same PLC . The PLC shall be supplied by bidder. The local control panel shall be provided with push button and indication lamp for local operation.

For Thermocouples,FFG panel and pilot burners at IGNITION SYSTEM FOR FLARES also refer to spec. Below:-

IGNITION SYSTEM FOR FLARES

SITE CONDITIONS	Climate / Area	■ Wet Tropical	☐ Coastal	☐					
	Installation	■ Open Air	■ Under Shade	■ Onshore	☐ Offshore	☐			
	Amb. Temp Min / Max ° C	☐ 4	☐ 10	☐ 45	■ 67	☐			
	Relative Humidity Max	☐ 80%	☐ 90%	■ 95%	☐	☐			
	Area Classification	☐ Safe	■ Hazardous	☐ IEC / EN	■ IS	☐ NEC			
		☐ Zone 1	☐ Zone 2	☐ Group II A	☐ Group II B	☐ Gr. I I C			
		☐ T 1	■ T 3	☐ T 4	☐ T				
GENERAL	Tag No /Service								
	Protection	■ IP 65 /NEMA 4X, Tropicalised, & according to Area class specified							
	EMI /RF /LVD spec.	■ CE marked /equivalent approval compliance. to EN 50081-2, 50082-2, 61010-1							
		for installation in Industrial area ,Immunity to / from nearby electrical apparatus-							
	POWER SUPPLY	■ 110 V + - 10 %, 50 + - 3 HZ AC ; 3 WIRE (Line ,Neutral ,Ground)							
	Cable Entries	☐ 3/4" ; 1/2 " NPTF + others as per Requirements (entries with metallic Plugs)							
PILOT BURNERS	Number	■ Vendor to specify ☐							
	Flame Monitoring sensor	■ One Thermocouple for each Pilot Burner , Type **K** (ANSI)							
	Thermocouple Requirements	☐ SIMPLEX , ■ DUPLEX	■ 0.9mm	☐ AWG	■ Ungrounded				
		■ 6 mm OD, **AISI 321** SS sheathed MI -compacted MgO insulated (NO ceramic beads),							
		■ MI Thermocouple upto	■ Intermediate JB	☐ FFG Panel					
		■ T/C Extn cable from Intermediate JB to FFG panel							
FLAME FRONT GENERATOR PANEL	Operation	■ Manually initiated first time	☐ Automatic ignition on flame failure .						
	Timers for	☐ Re ignition ☐	■ FF alarm ☐						
	Lamps (LED Cluster)	■ Power On	■ Flame On	■ Flame Off	■ Sensor failure ☐				
	Push Buttons with Flap	■ Start Ignition	☐ Reset	☐					
	Temp switch	■ Each Pilot	■ Auto.CJ Comp	☐ Adj. Set Pt	_	_			
	PressureTransmitter for	■ Pilot gas to Pilot burners							
	Pressure switch	■ Pilot Gas Pr	☐	☐					
	Aspirator / Mixing unit	■ Separate Air suply after Pr.reduction	☐						
	Wiring	☐ Stranded tinned **Cu** conductors,105 deg C grade PVC Insul.colour coded,ferruled ends							
		■ External IS-1554 for power.	■ Internal IS-694 ,						
		☐	☐	☐	☐				
	Certification	☐ **IP-65, EE x p II , T 3 approved by CMRI & CCOE**							
	Other Accessories	■ Ignition Transformer ; Ignitor; HT cable; Aspirator cum Mixing unit; Flame arrestors;							
	Alarm contact common,	■ 1 No SPDT 24 V DC, 0.5 amps rating , Opens for alarm- for flame failure (common)							
		☐ 1 No SPDT 24 V DC, 0.5 amps rating , Opens for alarm- for Pilot Gas pressure Low.							
OTHERS	Pressure Reducing Valves	■ For Pilot gas							
		☐ For Air Supply to mixing unit							
	Aspiration for	☐							
	FLOW-METER TYPE	■ Rotameter (Metal tube) , SS wetted metallic parts, PTFE O-rings, for Pilot gas							
		☐ Rotameter (Metal tube) for Aspirator Air							
Document.	Spec Sheets	■ Makes, models, Product data sheets,Instruction sheets of all components/insts;							
	Layout dwgs	■ FFG panel - installation, mounting, layout,dimensional, , layout of Insts.							
	Wiring Dwgs	☐ FFG panel Internal; external connection details; interconnection wiring.							
	Operational instructions	■ for complete system.							

REMARKS

1. Documentation as asked in other places in this BID.
2. Inspection by PDIL &TFL applicable. QAP shall be approved by PDIL/TFL

CONTROL VALVES & SOLENOIDS / SAFETY VALVE

Control Valves

All Control valves shall have 316 SS Trim hardened where required , complete with pneumatic positioner and Air sets , mounted & tubed. 1/4 ", 1/2 " OD SS tubing , Swagelok / Parker SS Compression fittings. Yoke of Cast steel material. Hand wheel shall be Side mounted.
Self regulating valves shall be used in Ignition / Pilot line and Instrument air line , if asked for. Outlet pressure shall be around 1.4 kg/cm2g (adjustable). Trim material shall be of SS 316 & Diaphragm material shall be hardened (nitrile). Set Range shall be 0 to 3 Kg/cm2g.

Ball Valves shall generally be used as block valves. Characterized balls shall be used as control valves when the fluid tends to crystallize or where a high Cv is required. Ball valves shall be suitable for bi-directional shut-off , unless otherwise specified.

Body Materials shall be selected in accordance with the process fluid characteristics and the Piping Specifications.

Connections and Pressure Ratings - As per line specifications, valves preferably with flanged connections with rating and facing in accordance with the Piping Specification. If welding is specified , butt-welding as per ASME B16.25 is foreseen. Flanges shall conform to ASME B16.5. Face-to-face dimensions shall conform to ASME B16.10 , ASME 16.34 or API STD 609.

1 " is the minimum control valve body size. 1+1/4" , 2+1/2" and 5" shall not be used.

Cobalt-based alloys must not be used for hard-facing in boiler feed water service.

Yoke shall be Cast steel / fabricated steel / or equivalent (Grey cast iron not acceptable).

The Control valve Trims shall be of austenitic stainless steel SS 316 as a minimum. Hardened stainless steel **or** solid stellited or stellite facing will be furnished for valve plugs and seat rings where **(i)** pressure drop exceed 5 Kg / Cm^2 , **(ii)** for flashing / cavitations liquid services , **(iii)** in systems for fluids containing solid particles , **(iv)** for steam services , **(v)** temperature is above 270 Degree Celsius.

For flashing / cavitations service an energy absorbing trim is requested (Cavitrol or equivalent). Other trims or materials recommended by the manufacturers may be considered.

Anti-cavitation trim is selected for high-pressure drop applications to prevent the onset of cavitation.

Anti-noise trim is selected for reducing the noise generated by the fluid.

Seat Leakage Classifications per ANSI / FCI 70 - 2 . Vent valves that are normally losed shall be very tight to minimize leak losses ; class IV is the minimum. Process stream valves shall be class IV minimum. Block valves in double block-and-bleed arrangement shall be class V-VI.

Packing - The packing design for linear motion valves shall include a packing flange. PTFE shall be used as standard packing material for bonnet temperatures below 200°C and graphite for higher temperatures. Packing design and material shall be selected carefully for minimum stem friction and live-loading packing boxes shall be considered for PTFE packing.

Flow Tendencies - For valves in shut-off service, flow tendency shall comply with the action required to put the plant in a safe condition in the case *of* power failure. In some cases it is the back-flow scenario that shall be considered.

Actuators - Control valves shall be equipped with pneumatic actuators with a spring range from 0**.2** ~ 1**.**0 kg/cm2 g in order to obtain small and fast actuators. If feasible **,** higher ranges may be used for bigger valves **,** but the maximum range pressure should not exceed the minimum instrument air supply pressure minus 10%. If not otherwise specified **,** actuators shall be sized to obtain a stroke time in seconds that does not exceed the valve size in inches.

Maximum permissible velocity for ordinary liquids at valve outlet is 5-6 m/sec. and for gases it is Mach 0.35 at the outlet of the downstream pipe reducer. No extra noise is generated if velocity is Mach 0.3 or less. Maximum sound pressure level shall be 85 dBA measured one meter downstream from the valve at a distance of one meter from the pipe. The manufacturer shall size vent valves with noise attenuation equipment. The sound pressure level for atmospheric vents shall be measured four meters down from the vent exhaust at a downward of 45°.

Shutdown Valves are generally selected in line size. Valve size criteria shall also be considered. Line size body and full-size trim shall be used. Soft-seated valves shall be approved fire-safe. Triple offset butterfly valves shall be specified for high shut-off pressures.

The diaphragm- or piston-type actuators for shutdown valves shall generally be spring-to safe position. Stroking time shall be considered carefully.

Tubing- Air tubes and fittings shall be in stainless steel. Size shall be adequate for the stroking time required. Tubing shall be thin-walled with an OD of not less than 1/4". Larger valves require tubing with a larger diameter. Actuator tubing shall be ¼" or ½" as required; tubes in mm size shall not be used.

Hand Wheels are normally required when no bypass valves are specified. Hand wheels are not be required for shutdown valves. Hand wheels shall be side mounted on yoke for **>** 1 " valve.

a) Noise level limit shall be </= than 85 dBA for normal operation and for short duration.

b) **Air Filter Regulators :** Aluminium alloy **,** with metallic Bowl **,** SS drain cock **,** metallic knob **Miniature AFR not acceptable.**

Solenoids

The valves shall be supplied with **3- way solenoid valves**. The solenoid valves shall be direct-operated (no pilots), high capacity valves ensuring the desired stroking time. The detail spec for solenoid are given elsewhere in this document.

a. All solenoid valves shall be direct acting **,** suitable for operation at 24V DC/110 V AC certified for the hazardous area without flying leads. SOV shall be IP 65 or better **,** EEx d II C T3 or better **,** 1/2 **"** NPT cable entry **,** SS double compression cable gland.

b. Further the valves shall be designed for operating under tropical conditions with relative humidity upto 100 % and with a shade temperature upto 46 ^{0}C.

c. The valve body shall be Stainless steel **,** normally with 1/4 **"** NPT (F) connections **,** however **,** the size shall be **,** if necessary **,** increased to ensure quick exhausts of control / shut-off valve actuators **,** especially where only one valve is used to operate double block and bleed manifolds. The trim

shall be stainless steel with soft seats. Solenoids on Gas / Fuel cut off lines it blocks and Bleed Valves to burners shall be manual reset (MR) type.

d. The solenoid shall be with class **" H "** high temperature insulation for continuous operation in 85 ^{0}C (max. surface temperature in the sun). The valves shall be designed for instrument air at 10 kg / cm^{2}g. The operating differential shall be from 10 to 0 kg / cm^{2}g.

e. Limit switches shall be P&F Proximity sensors **,** SS casing **,** 1/2 **"** NPTF cable entry wherever possible. Wherever feasible proximity sensors shall be mounted in weatherproof IP 65 Box (Non-incendiary Alluminium alloy) to avoid collection of moisture & dust. **Limit switches shall be hermetically - sealed NAMUR proximity switches.**

f. Solenoid valves and limit switches shall have enclosure protection class IP 65 with screw terminals for **2.5mm^2** wire.

g. Solenoid valves shall be redundant , i.e. , 2nos of solenoids shall be used for each control valve so that in case of failure of one the other will take care of operations.

PRESSURE-RELIEVING DEVICES

Pressure-relieving devices protecting pipes, vessels and equipment shall normally be sized in accordance with API RP 520 and/or API RP 521. ASME Code, Section I shall apply for steam drum and super-heater valves. Relieving devices protecting atmospheric or low- pressure storage tanks shall be sized according to API STD 2000.

Percentage Over-pressure, Accumulation and Blow-down used in the calculation of orifice sizes of relieving devices shall be as follows: Over-pressure 3%- Steam service where ASME Power Boiler Code (Section I) applies, 10% - Gas or vapour service, 10%- For liquids, 21%- Fire exposure on unfired pressure vessels, 10%- For liquids (non-certified). **Accumulation** 6%- Steam service where ASME Power Boiler Code (Section I) applies, 10%- Gas, vapour and liquid where ASME Pressure Vessel Code (Section VIII) applies , 16% - Gas, vapour and liquid where ASME Pressure Vessel Code (Section VIII) applies and the system is protected by means *of* multiple valves, 21% - Fire exposure on unfired pressure vessels. **Blow-down-**4%- Maximum for steam service where ASME Power Boiler Code (Section I) applies, 5-7%- For vapour, gas and steam service, 10-20%- For liquid service.

Nomenclatures shall be in accordance with API RP-520.

Safety and Relief Valves shall generally be flanged, direct spring-loaded types with high lift, high-capacity and top-guided disc. Balanced bellow valves shall be furnished for relief into closed flare and blow-down systems if the sum *of* variable superimposed backpressure and the built-up back-pressure exceeds the allowable accumulation, or for toxic substances. Bellows shall also be specified for liquid relief valves in case *of* any variable back-pressure.

Materials for Construction shall be selected in accordance with API STD 526, the process fluid characteristics and the Vessel and Piping Specifications.

End Connections shall normally be flanged with facing and rating in accordance with the Piping Specification. However, where applicable API STD 526 sizes and ratings shall always govern. Centre-to-face dimensions shall be in accordance with API STD 526 where applicable.

PSV design should be such that online testing is possible (i.e. On line testing arrangement can be fitted on it).

PANEL INSTRUMENTS
Indicators & Controllers , wherever applicable

- Microprocessor based , Half DIN size casings
- suitable for installation On Pressurized Panel
- shall accept - ATLEAST two analog inputs , CONTACT INPUTS , one analog output
- Digital indications (LED Display) for process variables - inputs and output. Accuracy + 0 . 5 %
- Receiver instruments shall be with repeat signals for external connection to Main Control room.
- Controllers should have bumpless & procedureless Auto / Manual transfer facility.
- Flow Inst. / controllers shall be configured for automatic pressure / temperature compensation / corrections.
- Temp. indicators shall accept universal inputs.

Alarm Annunciator , wherever applicable

- Alarm Annunciator shall be IS (intrinsic safe).
- Alarm annunciation on panel shall in general be in accordance with ISA – S 18.1 sequences selectable at site channel wise.
- Pre alarms shall be auto reset type.
- Trips & shutdowns shall be First-out sequence & manual reset type.
- Windows 70 x 50 mm size , one channel per window , LED cluster back lighted ,
- Test , Ack. & Reset PBs with Flap / cover.

CONTROL PANEL for field termination and panel mounted Instruments as per approved P & Id and requirements given by process -

- Cubicle type , twin leaf, back doors , 100 X 50 X 6 MS channel base frame integrally bolted , anti vibration mounts at the bottom of base frame.
- Panel for field termination shall be purzed type.
- Isolating fuses with MCB for 230 V & also for 110 V stabilized voltage incomer (large terminals), Power distribution as per good Engineering Practice with isolating fuses , MCBs for different Instruments so as to isolate and restrict false from spreading further.
- Separate open able terminals with fuses on both leads for Solenoid valves .
- Power packs shall be 100 % HOT redundant type.

- Push Buttons shall be such as to avoid accidental/ inadverant operation (Recessed or with Flap).
- Terminals – segregated as per service , voltage level – Exi , Non – Exi , Analog input / output to field (Exi signals may be terminated directly to isolators avoiding intermediate terminals) , digital Input , digital output to field ; analog signals to / from DCS , Digital; signals to / from Main PLC ; Power – DC / AC- Voltage levels .
- Terminals shall be stack type DIN railed mounted , Wago / Weidmullar / Phonix make, shall accept 0.5 ~ 2.5 mm2 conductors , with mechanical separators between different signals. Blue terminals shall be used for Exi loops.
- Double Decker terminals are not to be used.
- Isolators / repeaters - MTL / P & F . Dual output isolators to be used for repeating signals .
- 20% spare space minimum to be provided for subsequent mounting of additional instruments and be equally distributed over the panels.

8. MARKING

- The service and Tag nos. of the individual Lamps , push buttons etc. shall be clearly labeled below each. The labels shall be made of white / black / white plastic laminate with 5 mm engraved letters. The labels shall be fastened with stainless steel screws.
- All individual instruments, power supplies , etc. shall be furnished with a permanent label indicating name of manufacturer , serial number etc. for proper identification.
- All terminals shall be grouped and individually identified. All cables and wires shall be marked on each end. Cross ferruling to be provided.
- Terminals for external customer connections shall be segregated.

9. HANDLING:

Lifting lugs for field handling shall be provided on the frame.

10. EXPLOSION PROTECTION:

- Panel for termination in field shall be purzed type Panel and certified accordingly. Inside Panel shall be made such that it will be safe area.
- Air supply for Instrument air users in local control panels shall comprise two parallel reducing stations with block valves and filters. The headers shall have relief valves. The capacity of each reducing station shall be sized for 4.0 kg/cm2g upstream and 1.2 kg/cm2g downstream pressure. Relief valve shall be set at 1.4 kg/cm2g and sized to relieve the full capacity of the header. Valve take-off shall be provided in the top of the header for each instrument or spare space. Headers shall slope away from the reducing stations and have drain valves at the low points. Each instrument shall have an individual air supply line with block valves. A pressure indicator with an approx. diameter of 100mm with 0~3 bar g range and with a bottom connection complete with isolation valve and gauge fittings shall be provided at the outlet of air filter regulator stations.

11. OTHER REQUIREMENTS

Terminals

- All terminals shall be easily accessible. The terminals shall be of the WAGO/ Weidmuller / Klippon type SAK 2.5 KrG or approved equivalent. Each terminal strip / terminal box shall have spare terminals equal to 20 % of the total terminals. Direct screw-down terminations shall be avoided.
- Terminals for power wiring and others having a potential higher than 24 V shall be covered by a transparent Perspex to protect the maintenance personnel from accidental contact. Solenoids supplies shall be provided with Fused Terminals (both leads).

Panel Wiring

- Power and signal wiring shall be separated and intrinsically safe wiring shall be separated from all other wiring.
- PVC insulated Copper conductor cables complying with IS - 694 / 1554 as applicable. 85 deg. C Insulation grade PVC.
- The minimum conductor size shall be 1 mm2 for signal wiring and 1.5 mm2 for power wiring within panel.
- The conductors shall preferably be tinned solid copper. If stranded or multi-stranded wires are used they shall be fitted with lugs suitable for the terminals.
- All wiring shall run in PVC trunking / strapped as required and suitable cable ties shall be provided at regular intervals.

Cable Entries shall be through the bottom of the panel. Entries at the side are NOT permitted. The panels shall be provided with Flameproof double compression SS cable glands suitable for the customers incoming cables and provision for fastening of the cables near the terminals.

12. EQUIPMENT PROTECTION AND ISOLATION:

- The main instrument power supply isolation switch will be provided with a double pole fused isolator (vendor to state the power consumption).
- Equipment protection and isolation shall be by double pole miniature circuit breakers , one per consumer.

Illumination: The interior of the panels shall be well illuminated with fluorescent fixtures mounted at the top or sides of the panels. A single-phase socket outlet shall be provided for portable lighting etc.

Certificates -

The following certificates either ' type tested ' or for individual item as applicable

- Authority approval certificates - IBR , EEx i / EEx d / e / p , CMRI , CCOE , DGMS etc. as applicable.
- Manufacturers' Test Certificates - Materials , Physical , calibration etc.
- Quality Assurance Certificate

- Compliance with specifications by inspecting agency
- Any other documents related with supplier's activities

13. INSPECTION AND TESTING

Inspection Requirements

a) All supplies shall be inspected by approved Third party agency**.**

b) QAP shall be approved by PDIL/TFL.

c) 15 days clear notice to be given for inspection.

Also refer GSTD-9998 Inspection and test Requirements attached with the Tender

Testing of System (at Shop) + (FAT , if applicable)

All the system functions shall be checked thoroughly for proper functioning. These shall include but not limited to the following tests **:**

- Visual
- Complete panel integration checking
- Demonstration of all functions
- Checking of all displays
- Demonstration of all diagnostics
- Checking of outputs - functional requirements, connection details.

The input signals shall be simulated by disconnecting the field wires for all inputs. Wherever control room mounted Transmitters / Converters / Receiver switches are used (repeat signals / alarms etc.) the repeat functioning of same shall also be checked .

14. GUARANTEE / WARRANTEE

Vendor shall be fully responsible for the manufacture in respect of proper design, quality, workmanship and operation of all the equipment, accessories etc. supplied by the vendor. The Warranty or Defects Liability period for the control systems,field Instruments etc shall be 24 months from date of commissioning.

15. DELETED

16. ERECTION , INSTALLATION & COMMISSIOING

The bidder shall be responsible for the installation, calibration & testing, commissioning of the complete instrumentation and controls as defined in this specification as minimum. All the instruments & systems installed by the bidder as per scope subject to inspection,

checking, calibration & testing to prove their operational fitness. Testing & calibration shall be done by the bidder, if required , all the required tools, tackles, calibration instruments, qualified skilled manpower for conducting these tests shall be provided by the bidder.

Testing & calibration may be witnessed by representative Client/PMC and/or manufacturer's representative.

Instrument location

- The location of instruments, control valves. Including junction boxes shall permit easy access from grade, permanent platforms or stairways for operation, inspection and maintenance.
- The use of portable ladder or mobile platform shall be limited to access root valves, thermowells and line mounted flowmeters.
- Locations shall be decided to minimize the possibility of damage from passing or falling objects and the possibility of tripping hazard or obstruct on walkway.

Instrument cable

Overhead Runs

- Instrument main cable tray from field junction boxes to main control building shall generally be laid in aboveground cable tray with protection cover. Tray protection cover shall be provided only for the tray on top of tray layer.
- Instrument branched cable runs from junction box or local panel to each instrument in the field shall also be routed aboveground and supported with trays, steel angles and channels.
- Aluminium perforated cable trays/cable ducts shall generally be used for main cable trays. Single pair cables from instrument to junction box and branch cable tray shall be through perforated Aluminium cable trays.
- The scope of supply includes Aluminium perforated type cable trays, FRP accessories such as Bends, tees, crosses, reducers & connector plates and accessories like bolts, nuts etc.
- Aluminium trays shall be vinyl ester resin based and all tray shall be manufactured using the PULTRUSION process.
- For Signal 900mm/ 600mm tray and for power 600mm/ 300 mm tray to be considered or shall be discussed during detail Engineering.
- Cable tray segregation shall be based on the voltage level. Cable tray shall be supported at every 3M. 20% spare to be considered in the cable tray filling.
- Instrumentation cables that form part of intrinsic safe (IS) circuits, if any, Shall be segregated from other instrument signal cables.
- Instrument power supply (AC) cables shall not run in the same tray of instrument signal cables. Cable tray shall be dedicated for laying instrument power cables separately from the signal cable tray.

- Alternatively, cable ducts of suitable size shall also be considered for main cables. When common cable ducts are used for running both power and signal cables, necessary air gap partition shall be used to segregate the cables

Cables

- All cables shall have PVC insulated primary insulation of 85°C PVC as per IS-583. Inner and outer jacket shall be made of extruded flame retardant 90 ac PVC to IS-5831
- All cables shall be FRLS as per standard IEC 332-3 Part 3 Cat. A. Fire resistance cables whenever specified shall be as per me 331 Cat. A.
- The insulation grade shall be 600 V/11000 V as a minimum arid shall meet insulation resistance, voltage and spark test requirements as per BS-5308 Part-2
- All cables shall be armoured. Armour over inner jacket shall be of galvanized steel wire/flat as per IS-1554 part I I IEC 502. All the cores of single pair or multi-pair shall be twisted and numbers of twist shall not be less than 10 per meter.
- For signal and control cables, inner jacket colour shall be black. Outer jacket color shall be light blue, for intrinsically safe application and black for others. For thermocouple extension cables the inner and outer jacket colour shall be as per IS-8784.
- L/R ratio of adjacent cores shall not exceed 40 MicroH/ohm for cables with 1.5 mm2 conductor Electrical Properties of Cables shall be in line with EN50288-7:2005.
- Contractor shall ensure a minimum of 20% of quantity of each type of cables supplied as spare including any special cable and in each multipair cables 20% pairs shall be kept as spare.

Instrument Signal Cable

- Single pair shielded signal/alarm cables shall be used between all field instruments including switches and junction boxes/local control panels.
- Triad cable shall be used between GDs/RTDs to JB/Transmitter respectively.
- Multipair individually and overall shielded signal/alarm cables shall be used between junction boxes/local control panels and control room.
- The single pair/triad cables shall be 1.5 mm2 conductor size made of annealed electrolytic copper conductor of 7 strands with each strand of 0.53 mm diameter. Multipair cables with 1.5 mm2 conductor size shall have 7 strands of annealed electrolytic grade copper conductor with each strand of 0.3 mm diameter. Multi triad cable or multi pair cable with 1.5 mm2 conductor shall have 7 strand with each strand of 0.53 mm diameter. Colour of core insulation shall be black blue in pair and black, blue and brown in a triad.
- Shield shall be aluminium backed mylar/polyester tape bonded together with the metallic side down helically applied with either side having 25% overlap and 100% coverage. The minimum shield thickness shall be 0.05 mm in case of single pair/triad and 0.075 mm in case of multipair/triad cable.
- Drain wire shall be provided for individual pair and overall shield which shall be 0.5 mm2 multi stranded bare tinned annealed copper conductor. The drain wire shall be in continuous contact with aluminium side of the shield.

- All multi pair cables shall have 6 pair/12 pairs only while multitriad cable shall have 6 triads/8/12 triads only. Size for multipair cable will be 1.5 mm2 with drain and overlap as above.

Cables and Multicore Cables for Solenoids etc.

- Cables and multicore cables for such items as solenoid valves and flame detectors shall normally have a conductor size of 2.5 mm2. However, conductor sizes for power cables shall be co-ordinated with the Electrical Group to avoid too many different cable types.
- Signals (4-20 mA or switch 'contact): 6/12 pair individually and over all shielded (screened) and armoured, twisted, 0.75 mm2 conductor.

Thermocouple Extension Wires

- Single pair shielded thermocouple extension cables shall be used between thermocouple head and junction boxes transmitters/ local control panel mounted instruments.
- Multipair individually and overall shielded thermocouple extension cables shall be used between junction boxes and main control room mounted devices.
- The type of thermocouple extension cables shall be compatible with thermocouple used. In addition the colour coding of the primary insulation shall be as per ANSI.
- The cable shall have 16 AWG and 18 AWG solid conductors for single and multipairs respectively.
- All thermocouple extension cable shall be matched and calibrated in accordance with MC-96.1.
- Shield shall be aluminium backed by mylar/polyester tape bonded together helically applied with the metallic side down with either side having 25% overlap and100 % surface. Minimum shield thickness shall be 0.05 mm for single pair and0.075 mm for multipair cable. Drain wire shall be 0.5-mm2 multi-strand bare tinned annealed copper conductor. The drain wire shall be in continuous contact with the aluminium side of the shield.
- Inductance shall not exceed 4mH/Km.
- All multi-pair cables shall have 6 pairs/12 pairs only.

Power supply Cables

All power supply cables shall be as per IS-1554 Part I and shall have copper conductors. Minimum conductor size shall be 2.5 mm2. The cables shall be PVC insulated and armoured. The higher size conductors shall be used incase of long distance power cable where voltage drops more than 3 volts than required supply.

Any other special cable required for instruments that should also be supplied as per requirements. CONTRACTOR shall ensure that these cables are armoured type and shall meet all other requirements.

a) In all JBs, cable entries shall be from Bottom only. Further after commissioning, all JB's should be covered with Aluminum tapes at its periphery to prevent water ingress.

b) Junction box shall be of die-cast aluminium alloy (LM-6) anti corrosive painted. All junction box shall be weatherproof to IP-65 as well as flameproof. Junction box shall have screwed covers. All cable entries to junction boxes shall be side or bottom.

In general a junction box shall contain only signal of same class. The signal class is categorized as following type:

i) Signal Level

- Analog
- Digital
- T/C
- Solenoid Valve
- Instrument Power
- Gas Detectors

ii) Type of protection

- Non IS, Exd
- IS, Exe

c) All JB extra entries shall be plugged with SS316 plug. Each junction box shall be provided with 2 multi-cable entries from the bottom of the junction box with one plugged. All Cable entry shall be at the bottom only, and not from side or top.

d) All spare cable cores shall be terminated in the Junction box, at the marshalling panel end and wired through spare barriers / isolators or relays (as the case may be) right upto the corresponding spare channel of I/O module.

e) All spares hole of JBs, T/C head etc to be plugged with metallic plugs. The metallic plugs, Junction box hinges, Handle, DIN rail, Allen screws shall be SS 316 material of construction.

f) For ease of identification shutdown JB’s shall be colored should be marked with RED.

g) Cable glands shall be provided with Cables shrouds. 20% spare terminals shall be supplied in each junction box.

Cable glands

a) Contractor shall supply all cable glands required for glanding the above mentioned cables both at field instrument and local control panel side, junction boxes side and at control room side.

b) All cables glands shall be of SS316 ex-proof and they shall be double compression type suitable for armoured cables. Glands shall be in line with Area classification

c) Flame proof glands wherever required 'shall be supplied with EX'd' certification.

Instrument valves and manifolds

a) Contractor shall supply instrument valves (miniature type) and valve manifolds wherever required.

b) Body rating shall be as per piping class or better. All valves and manifolds shall be forged type only.

c) Valve body and trim material shall be SS 316L unless otherwise specified. Superior trim material shall be selected as requirement by process conditions. Packing material in general shall be of PTFE

Instrument impulse lines

a) In general ½" OD annealed seamless SS 316 tubing shall be used in preference to piping.

b) Tubing standard shall be used upto 600 # only where the same is required as per job specification. For rating above 600 # and hydrogen/lethal service, only piping standard shall be used. The tubing shall be 1/2" OD tube with all fittings suitable for the same. Valves used shall be threaded. At the first isolation / root valve end suitable pipe tag to tubing conversion fittings shall be used. For remote installation suitable unions / couplings shall be used.

c) Piping standard shall be used for all installation where specified in job specification. For rating upto 600#, the connection to the transmitters shall be with a male connector and tubing 1/2" OD. For rating higher than 600 #, no tubing shall be used. The connection to the transmitters shall be with 1/2" piping with flanges in between piping standard, all pipes shall be 1/2" NB unless higher sizes required to meet the "requirements, with all fittings suitable for the piping. All the joints shall be welded or flanged as required. For instrument end connection i.e root valve of orifices and other items, level gauges vent and "drain connection, seal welding shall be provided. For non diaphragm seal instruments and instruments where provided with threaded connection, no welding is required at instrument end

d) All instruments shall be provided with isolation, drain and/ or vent valves with vent/drain end duly capped. This isolation valve shall be SS304 GATE type. It shall be in addition to the first isolation /root valve provided on the pipe or vessel at instrument take off.

f) For diaphragm seal type instruments, spacer ring with vent and drain connection along with vent / drain valve with end capped.

g) Contractor shall supply flareless compression type of tube fitting and of three piece construction with design similar to Swagelok/Parker Hannifen etc.

h) Socket-weld type forged pipe fittings of suitable material and rating shall be supplied for pipe fittings. The minimum rating shall be 3000 #. Weld neck fittings shall be used where socket weld type are not allowed by piping class.

i) All pipe fittings shall be according to piping material specification as per piping class of the pipe on which instrument is connected. In case of vessel/equipment / reactor, PMS of equivalent piping class shall be considered.

Instrument air supply distribution

Instrument air headers, pipes and distributors shall be of S.S 304. Instrument air manifold shall be used for supplying instrument air to control valves and other instruments. These shall be with 10 nos. of tappings and be with ½" NPT (F), SS 304 valves. From the nearby air manifold, instrument air shall be supplied to the control valves. For the purpose, all tubing shall be used shall be of SS316, ¼", 1/2" OD, seamless tubes, laid in perforated

aluminium trays. All intermediate fittings shall be double compression, SS316 MOC, Swaglok or equivalent make only.

Instrument air shall be provided at one point. Package vendor has to develop air distribution scheme.

17. MCT Blocks

Cable entry to main control room shall be through MCT blocks.

Entry into the Panels in the control room shall be through bottom mounted MCT blocks.

Bidder shall provide minimum 8+8x6 MCT frame along with multi-dia blocks with peeling of arrangement and centre plug, with wedge, lubricant, stay plate. Bidder shall provide at least 20% installed spares with mult-dia blocks with peeling of arrangement and centre plug. (Qty of frame shall be submitted by the bidder during bidding stage with typical cable arrangement).

18. PROTECTION AND PAINTING

All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale rust, dirt and other foreign materials by wire brushing / sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be SA 2. as per Swedish standard SIS 055900-1967.

- Non – ferrous materials. Austenitic stainless steels, plastic or plastic coated materials.
- Insulated surfaces of equipment and pre-painted items shall need not be painted.
- Stainless steel surfaces, both inside and outside. Shall be pickled and passivated.
- Machined and bearing surfaces shall be protected with varnish or thick coat of grease.
- **Depending on the environment the following primer and finish coats shall be applied:**

S. No.	Environment	Description	Minimum Requirements
1	Normal – Industrial	Primer	2 coats of Red oxide
			Zinc phosphate each 30-35 microns thick
		Finish Coat	2 coats of synthetic enamel, each 25 microns (min.) thick.
2	Corrosive – Industrial	Primer	2 coats of epoxy zinc chromate, Each 35 microns (min.) thick.
		Finish Coat	2 coats of epoxy high build paint, each 100 microns (min.) thick.
3	Coastal and Marine	Primer	2 coats of high build chlorinated rubber. Zinc phosphate, each 50 microns (min.) thick.
		Finish Coat	2 coats of chlorinated rubber coat paint. Each 35 microns (min.) thick.
			(Any values refer to dry film thickness).

Colour Band shall be provided on loading arm as per Product colour code at site.

19. PACKAGING AND IDENTIFICATION

All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment. All assemblies shall be properly match marked for site erection.

Attachments, spare parts of the equipment and small items shall be packed separately in wooden cases. Each item shall be appropriately tagged with identification of main equipment. Item denomination and reference number of the respective assembly drawing.

Detailed packing list in waterproof envelope shall be inserted in the package together with equipment Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture. Equipment number, name of manufacturer, etc.

20. LETTER WRITING:

LETTER WRITING FOR ALPHA-NUMERIC TAGGING (WITH SYNTHETIC ENAMEL). :- Letter writing of different sizes on Instrument Panels/misc. Instruments/ Equipments with synthetic enamel paints (Asian/ Jonson & Nicolson/ Berger /Nerolac Make) suitable for a temp. of 100 degree Celsius for writing of letters, figures etc. Job includes cleaning of surface on panels/instruments/misc. instruments etc. All complete with labour and materials as per drawings, specifications, Name plate schedule and directions of Engineer-in-Charge. (Supply of paints is in contractor scope)

ANNEXURE -1

INSTRUMENT ACCURACIES

The instrument reference accuracies shall be as per the table below. Accuracy of the Instruments shall be minimum as follows.

Type of Instrument	Accuracy
Belt weighers	+/- 0.5 % of range
Differential pressure & Pressure transmitter - SMART	± 0.050% of span within TD ratio of 1: 100 or better
Diaphragm seal transmitter & Pressure transmitter - SMART	± 0.050% of span within TD ratio of 1: 100 or better
Variable area type flow meter with transmitter	± 2.0% FS Note (1)
Vortex flow meter	± 0.7 % FS
Positive displacement flow meter	
- Raw material and Product	± 0.2% FS
- Others	± 0.5% FS
- Turbine meter or Mass flow meter	
- Raw material and Product	± 0.2% FS
- Others	± 0.5% FS
- Magnetic type flow meter	± 0.5% FS
- Mass flow meter (Coriolis Type)	± 0.1% of reading
- Ultrasonic type flow meter	± 0.5% of reading
- Ultrasonic type flow meter(5 – path)	± 0.1% of reading
Orifice plate : Normal Application	+/- 2% of flow rate
Orifice plate : Special Application	+/- 1.5% of flow rate
Venturi	+/- 1 % of flow rate
- Displacement type level indicator	± 1.0% FS
- Displacement type level transmitter	± 0.2% FS (Smart)
- Tank gauge (Custody Transfer)	± 1 mm with +/- 1 mm resolution
- Servo type tank gauge	± 2 mm (up to 20 m height)
- Radar type tank gauge	± 1 mm or better for custody transfer ± 5 mm or better for normal application
	± 0.2% of span within TD ratio of 1: 100
- Pressure gauge	± 1.0% of span for Bourdon type , 1.5% for diaphragm
- Temperature Transmitter	± 0.15 % of calibrated span for RTD & T/C
- Filled system/Bimetallic	± 1.0% FS

- Small size pressure gauge	± 3.0% FS
- Draft gauge	± 3.0% FS
- Receiver gauge	± 1.5% FS
- Thermocouple & Resistance Bulb	Applicable Codes/Standards

Note: 1. Vendor's standard accuracy is applied to local indicator type.
2. Accuracy for custody transfer/mass balance instruments shall be ±% of reading and shall be supplied with wet calibration certification.

Remarks: 1. Accuracy of instrument and special articles except for the above mentioned instrument shall be in accordance with the applicable codes/standards, or Vendor's standards as approved by Purchaser.
2. FS: Full scale.
3. Overall range ability of transmitter except for draft range shall be 1: 100. Draft range transmitter range ability shall be 1: 30 for the accuracy indicated above.

ANNEXURE -2

Field instrument connections shall be as follows.

Instrument Type	Process / Vessel Connection	Instrumentation Connections
DP Flow Instruments	½" NPT (M)	½" NPT
External Displacer on Vessel (Min. Rating ANSI 300#)	2" Flanged	2" Flanged
Internal Displacer (Min. Rating ANSI 300#)	4" Flanged	4" Flanged
External Ball Float on Vessel (Min. Rating ANSI 300#)	2" Flanged	2" Flanged
Internal Ball Float (Min. Rating ANSI 300#)	4" Flanged	4" flanged
Magnetic Level Gauge (Min. Rating ANSI 300#)	2" Flanged	2" Flanged
D/P Level	½" NPT (M)	½" NPT
D/P Level with Remote Seal Diaphragm (Min. Rating ANSI 300#)	3" Flanged	3" Flanged
D/P Level Direct Vessel Mounted (Min. Rating ANSI 300#)	3" Flanged	3" Flanged
RADAR – Direct Mount on vessel (Min. Rating ANSI 300#)	3" flanged	3" flanged
GW RADAR – Side/Side Chamber Mounted on vessel (Min. Rating ANSI 300#)	2" flanged	2" flanged
Internal GWR on Equipment (Min. Rating ANSI 300#)	4" Flanged	4" flanged
Special Level Instrument on Equipment (Capacitance/ Ultrasonic/R.F.Probe)	2" flanged	2" flanged
Tank Level Instruments (Servo) on Atmospheric tank/ Pressurized Equipment	6" flanged	6" flanged
Tank Level Instruments (Radar) on Atmospheric tank clean service / Pressurized Equipment	8" flanged	8" flanged
Tank Level Instruments (Radar) on Atmospheric tank viscous service / Pressurized Equipment	24" flanged	24" flanged
Tank Level Instruments (Capacitance/ Ultrasonic/R.F.Probe) on Atmospheric tank / Pressurized Equipment	2" flanged	2" flanged
Pressure Instruments	½" NPT (M)	½" NPT
Press. Gauge	½" NPT (M)	½" NPT
Pressure with diaphragm seal, (Min. Rating ANSI 300#)	3" Flanged	3" Flanged

Pressure Instruments on Vessel	1 ½" Flanged	½" NPT
Diaphragm Seal pressure Instrument gauge on Vessel	2" Flanged	2" Flanged
Thermowell (Min. Rating ANSI 300#)	1 ½" Flanged	1 ½" Flanged
Multipoint Temperature Element for Tanks	2" Flanged / 3" Flanged	2" Flanged / 3" Flanged
Standpipe	3" Flanged	-

Note:-

a. There shall be a separate tapping for each of the instruments on any pipeline/vessel. No multiple instruments from one tapping is acceptable (for example PG and PT from single pipe line tapping with single or double mechanical isolation valves are not acceptable). However, as an exception to this, three transmitters on clean gas services from one orifice (with two pairs of tapping) is acceptable, where multiple (2 out of 3, etc.) transmitters are to be installed.
b. All type of instrument tapping flange rating shall be minimum ANSI 300#, irrespective of minimum design pressure. However for pressure rating of 600# class and above, RTJ flange shall be used. At few locations, double isolation valves shall be used as per table given below.

INSTALLATION	**PRESSURE TAPPINGS**	**LEVEL TAPPINGS**	**FLOW ELEMENTS**	**CONTROL VALVE**
RATING				
300 #	SINGLE	SINGLE	SINGLE	SINGLE
600 #	DOUBLE	SINGLE	DOUBLE	SINGLE
900 # / 1500 # / 2500 #	DOUBLE	DOUBLE	DOUBLE	SINGLE

Annexure - 3

SYSTEM CONFIGURATION

Control system package (latest model at the time of supply)

1 No. Operator Stations with, 22" TFT, COLOR, LED type dual monitors to be placed in control room

1 No. ES/OS having the feature of SOE also, dual personality, 22" TFT, COLOR, LED type

1 no. of Membrane Operator's Keyboard and 1 no. of QWERTY engineer's keyboards with mouse with each operator station

All USB ports must be blocked and the system must have latest anti-virus.

Note: All OS and ES shall be of latest configuration which shall be freezed during detail engineering.

Printers

1 No. A3 Heavy duty colour HP make or equivalent Laser printer

Annexure - 4

OPERATOR STATION SUB-SYSTEM

* Model No. _By Vendor__

A. **General Requirement**

1	Number of Operator Consoles	ONE
2	Inter-changeability between operator consoles	Required
3	On-line system diagnostics on Console Monitor	Required at Module level
4	On-line configuration change	Required
5	Console configuration	Dual

B. **OPERATOR CONSOLE**

1	Console's basic electronics	Individual electronics for each monitor
	µp Type	64 bit
	µp Manufacturer/ model	Note-1
	Memory size /Cache size	16_GB (Vendor to check the suitability of memory size)
2	Type of Database	Functionally Separate

Database Storage Devices:

Sr. No.	ITEM MODEL No.	FUNCTION	REDUNDANCY (Refer Note)	REMARK
1.	HDD	Note-1	REQUIRED	
2.	Combo drive	Note-1	REQUIRED	
3.	Vendor recommended	Note-1	REQUIRED	
4.			REQUIRED	

(Note: Full Redundancy is required if Centralized global database is provided)

STORAGE DEVICES ARE APPLICABLE IN EACH OPERATOR STATION.

3 Number of Devices (per console)

S. No	TYPE OF DEVICE	Description OF DEVICES REQUIRED	NO. OF DEVICES	REMARKS
1.	MONITOR	22" TFT, COLOR, LED type dual monitors (Control system architecture)	1 per console	
2.	KEYBOARD SETS	1 no. of Membrane Operator's Keyboard and 1 no. of QWERTY engineer's keyboards with mouse.	1 per console	
3.	ALARM & EVENT, LOG A4 PRINTER	1 Nos A3 Heavy duty Colour –HP or equivalent make	1	
7.	DVD DRIVE		1 per console	

4 Inter-changeability between Monitors Required

5 Spare memory requirement Min. 40%

6. Keyboard Set

a) Keyboard Security against unauthorized access Required with Key-lock

Note: Key-lock Password shall be provided for each operator console.

b) Maximum number of keystrokes for accessing views as per standard display hierarchy:

S.No.	TYPE OF VIEW	REQUIRED	OFFERED	REMARKS
1.	GROUP VIEW	TWO		
2.	LOOP VIEW	THREE		
3.	LOOP IN ALARM	TWO		
4.	GRAPHICS VIEW	TWO		

c) Assignable function keys for single keystroke access Required

d) Number of Assignable function keys per Monitor 64

7 a) Number of devices for cursor control Two/Monitor

b) Devices for cursor control Keyboard **[X]** Mouse **[X]**

8 Monitors and Displays

a) Size of Monitor 22" diagonal

b) Type of Monitor TFT LED

c) Surface Treatment Hard Coating anti Glare

d) Length of tag number (characters) 16 alphanumeric

e) Length of description (characters) 24 alphanumeric

f) Display update rate 2 s

g) Dynamic graphics Required

h) Multi Window Capability Required

i) Control through dynamic graphics Required

j) Screen displays and Call-up time

S.No.	TYPE OF DISPLAY	REQUIRED	CALL-UP TIME(S)*	REMARKS
1.	OVERVIEW	YES		
2.	GROUP DISPLAY	YES		
3.	LOOP DISPLAY	YES		
4.	DYNAMIC GRAPHICS	YES		
5.	REAL-TIME TREND	YES		
6.	HISTORIC TREND	YES		
7.	ALARM SUMMARY	YES		
8.	ALARM HISTORY	YES		
9.	CONFIGURATION	YES		
10.	DIAGNOSTIC	YES		

k) Display Hierarchy

S. No.	DESCRIPTION	REQUIREMENT	SYSTEM CAPABILITY	REMARKS
1.	NO. OF OVERVIEW PAGES	AS REQD.		
2.	NO. OF GROUPS/OVERVIEW	AS REQD.		
3.	NO. OF LOOPS / GROUP	8		
4.	NO. OF GRAPHIC PAGES	AS REQD.		
5.	NO. OF POINT IN ALARM SUMMARY	AS REQD.		
6.	NO. OF POINTS IN ALARM HISTORY	AS REQD.		
7.	NO. OF TRENDS PER DISPLAYS	AS REQD.		
8.	NO. OF MULTI-TREND DISPLAYS	AS REQD.		
9.	OTHERS	AS REQD.		

l) Multi Windowing facility Required

Note: Opening of more than four windows on the same Monitor shall be restricted by the system .

m) Trending functions: Each Operator Console shall be capable of trending all analog points.

n) Real-time trend

Number of parameters Required for ALL TAGS (AI trip signals tends must be configured in a separate group with 0.5 sec trending)

o) Historical trend

Number of parameters Required for ALL TAGS

Time period 1 year

9) Logging Function

a) Number of tags to be logged Required for ALL TAGS

b) Number of log reports:

Alarm History per shift

Event logging

Hourly logs

Shiftly logs

Daily logs

Weekly logs

Shutdown report

Trip initiated log

Others (Note)

Note: Other log reports as required shall be furnished during execution stage.

c) Log formats — User definable

10 System boot-up from — Engineer console

11 Auto boot-up on power On — Required

12 Storage disks

a) Type of storage disk — HDD — Optical (DVD)

b) Number of disks and capacity

Sl. No.	TYPE OF DISC	NUMBER (MINIMUM)	MEMORY CAPACITY PER DISK	REMARKS
1	HDD	One Per Monitor	AS per latest configuration	
2.	OPTICAL	One Per Monitor	AS per latest configuration	
3.	Other			

13 Any other feature available as a standard:

a)_____

b) _____

14 CPU Loading — 60 %

15 Memory Utilization — 60 %

16 Operating System — Latest must have validation with the system

17 Antivirus/Network Security — Required as per latest IEC standard

ENGINEERING Cum OPERATOR STATION with SOE Facility SUB-SYSTEM

- Model No. ____By vendor

1. Number of Engineering cum Operator Station — One
2. Number of Monitors per Engg. Station — One
3. Type of electronics — Individual per Monitor
   - µP type — 64 bit
   - Memory size — NOTE-1
   - Model No. — NOTE-1
4. Number of engineering keyboards — One per Monitor
5. Number of Operation keyboards — One per Monitor
6. Functional Capability — Same as operator station subsystem
7. Basic functions of Engineering Console
   a) System configuration and reconfiguration
   b) Group & multi-groups alarm inhibiting
   c) Plant views with/ without plant operation
   d) Graphic page compilation
   e) Setting/ resetting real-time clock
   f) Loop tuning on selectable basis
   g) System maintenance and diagnostics
8. Monitor specification — As per operator station subsystem
9. Keyboard specification — As per operator station subsystem
10. Data storage Devices and capacity

Sr. No.	TYPE OF DISC	NUMBER (MINIMUM)	MEMORY CAPACITY PER DISK	REMARKS
1	HDD	One	As per Latest configuration	
2.	DVD writer	One		
3.	OPTICAL(DVD)	One	As per Latest configuration	
5.	OTHER			

11. Antivirus/Network SecurityRequired

ANNEXURE -5

HARDWIRED CONSOLE

- Model No. ____By vendor

1. One no. of Hardwired/Aux. console:
2. Instrument Located on Hardwired consoles: (AS REQUIRED)

INSTRUMENT TYPE	NUMBER REQUIRED ON HARDWIRED CONSOLE WITH	
		CONSIDERED BY VENDOR
ASSIGNABLE RECORDERS	N.A.	
HARDWIRED ANNUNCIATORS	AS REQUIRED	
INDICATING LAMPS	AS REQUIRED	
SWITCHES	AS REQUIRED	
PUSHBUTTONS	AS REQUIRED	
OTHERS	AS REQUIRED	

3 Power supply Alarm/Annunciator 110 V AC, 50 Hz **[X]**

4 Power supply for switches, lamps, pushbuttons etc. 24 V DC **[X]**

APPENDIX –1

Type of Signal	Inst to JB (1P,1T)		JB to Control Room (6P/12P/6T/8T/12T)		Control Room to MCC/MCC to Control Room (Multi-conductor cable)	
	Size (mm2)	Type	Size (mm2)	Type	Size (mm2)	Signal
AI	1.5	Signal	0.75	Signal	1.5	Signal
AO	1.5	Signal	0.75	Signal	1.5	Signal
DI	1.5	Signal	0.75	Signal	1.5	Signal
DO	1.5	Signal	0.75	Signal	1.5	Signal
RTD	1.5	Signal	0.75	Signal	1.5	Signal
TC	1.5	Signal	0.75	Signal	1.5	Signal
GD	1.5	Signal	1.5	Signal	-	-
SOV	2.5	Signal	2.5	Signal	-	-
POWER	2.5	Power	2.5	Power	2.5	Power
TC Extension cable	Special compensation cable between Element to transmitter					
RTD Extension cable	Triad cable between Element to transmitter of 1.5mm2					
Analysers	1.5	Signal	0.75	Signal or serial communication as the case may be.		

***Note:** Above size is minimum. Further cable size may be increase based on voltage drop calculation.

GENERAL SPECIFICATION

FOR

PROGRAMMABLE LOGIC CONTOROLLER (PLC)

0	05.12.2016	05.12.2016	For Tender	Ritu Agarwal	Sanjay Kr Tripathi	Sanjay Kr Tripathi
REV	REV DATE	EFF DATE	PURPOSE	PREPD	REVWD	APPD

AC	:	Alternating Current
API	:	American Petroleum Institute
BIS	:	Bureau of Indian Standards
CCOE	:	Chief Controller of Explosives
CPU	:	Central Processing System
DC	:	Direct Current
DCS	:	Distributed Control System
DGMS	:	Director General of Mines Safety
DMR	:	Dual Modular Redundant
DVD	:	Digital Versatile Disc
EMI	:	Electromagnetic Interference
ERTL	:	Electronic Regional Testing Laboratory
ESD	:	Emergency Shutdown System
FAT	:	Factory Acceptance Test
FMEDA	:	Failure Modes, Effects and Diagnostic Analysis
HART	:	Highway Addressable Remote Transducer
HW	:	Hardware
HWC	:	Hardwired Console
I/O	:	Input / Output
IEC	:	International Electrotechnical Commission
IEEE	:	Institute of Electrical and Electronic Engineers
IS	:	Indian Standards
ISA	:	International Society of Automation
ISO	:	International Organization for Standardization
LAN	:	Local Area Network
LCD	:	Liquid Crystal Display
LCIE	:	Laboratorie Central Industries Electriques
LED	:	Light Emitting Diode
MTBF	:	Mean Time Between Failure
MTTR	:	Mean Time to Repair
OPC	:	OLE for Process Control(Open Platform Communication)
P&ID	:	Piping and Instrumentation Diagram
PC	:	Personal Computer
PESO	:	Petroleum and Explosives Safety Organisation
PID	:	Proportional, Integral and Derivative
PLC	:	Programmable Logic Controller
PTB	:	Physlkalisch Technische Bundersanstalt
QMR	:	Quadruple Modular Redundant
RFI	:	Radio Frequency Interference
SAT	:	Site Acceptance Test
SER	:	Sequence of Event Recorder
SIL	:	Safety Integrity Level
SIS	:	Safety Instrumented System
TCP / IP	:	Transmission Control Protocol /Internet Protocol
TFT	:	Thin Film Transistor
TMR	:	Triple Modular Redundant
TUV	:	Technische Uberwachungsvereine

UHF	:	Ultra High Frequency
UL	:	Underwriter's Laboratories
UPS	:	Uninterrupted Power Supply
VDU	:	Video Display Unit
VHF	:	Very High Frequency

Triple Modular redundant (TMR), Quadruple Modular Redundant (QMR)configuration, Flexible Modular Redundant (FMR) configuration, Virtual Modular Redundant (VMR),Dual Modular Redundant (DMR)

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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the Material Requisition defines the minimum functional requirements for the design, hardware, software and firmware specifications, nameplate marking, testing and shipping of Programmable Logic Controllers (PLC) designed for reliable effective and optimum control and monitoring of a process plant .

1.1.2 The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the purchaser's enquiry:

APIRP 552	Transmission Systems
EEMUA 191	Alarm System -A Guide to Design, Management and Procurement
EN 10204	Metallic Products -Types of Inspection Documents
EN 50039	Electrical Apparatus for Potentially Explosive Atmospheres: Intrinsically Safe Electrical System 'I'
IEC 60079	Electrical Apparatus for Explosive Gas Atmosphere
IEC 60529	Degree of Protection Provided by Enclosures
IEC-60584	Thermocouple Part 2: Tolerances
IEC 60617	Graphical Symbols for Diagram
IEC-60751	Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors
IEC 61000-4-3	Electromagnetic Compatibility (EMC) -Testing and Measurement Techniques - Radiated, Radio Frequency, Electromagnetic Field Immunity
IEC-61000-4-4	Electromagnetic Compatibility (EMC) -Testing and Measurement Techniques - Electrical Fast Transients / Bust Immunity Test
IEC-61000-4-5	Electromagnetic Compatibility (EMC) -Testing and Measurement Techniques – Surge Immunity Test
IEC-61000-6-2	Electromagnetic Compatibility (EMC) -Generic Standards -Susceptibility - Industrial
IEC 61508	Functional Safety of Electrical/Electronic / Programmable Electronic Safety-related Systems
IEC 61131	Programmable Logic Controllers
IEC 61511	Functional Safety -Safety Instrumented Systems for the Process Industry Sector

IEEE 802.3	Telecommunication and Information Exchange between Systems -Local and Metropolitan Area Networks -Specific Requirements -Part 3: Carrier Sense Multiple Access with Collisions Detection (CSMA / CD) Access Method and Physical Layer Specifications
IS 2148	Flameproof Enclosures of Electrical Apparatus
IS-3043	Code of Practice for Earthing
IS 13947	Specifications for Low Voltage Switchgears and Control Gears
ISA 5.1	Instrumentation Symbols and Identification
ISA 5.2	Binary Logic Diagrams for Process Operations
ISA 5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer System.
ISA 5.4	Instrument Loop Diagrams
ISA 5.5	Graphic Symbols for Process Displays
ISA 18.1	Annunciator Sequences and Specifications
ISA 71.01	Environmental Conditions for Process Management and Control Systems: Temperature and Humidity
ISA 71.04	Environmental Conditions for Process Measurement and control Systems: Airborne Contaminants
ANSI/ISA	Security Technologies for Industrial Automation and Control Systems TR 99.00.01 Manufacturing and Control System
ISO 216	Writing Paper and Certain Classes of Printer matter-Trimmed Sizes-A & B Series
ISO 9241-5	Workstation Layout and Postural Requirements
ISO 9241-7	Display Requirements with Reflections

1.1.3 In the event of any conflict between this specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

a) Design Philosophy / Statutory regulations

b) Data Sheets

c) Standard Specifications

d) Codes and Standards

1.1.4 In addition to meeting purchaser's specifications in totality, vendor's extent of responsibility shall also include the following:

a) Purchaser's data sheets specify the minimum acceptable functional requirements for the programmable logic controllers. It shall be vendor's responsibility to select proper hardware, software and firmware to meet the specified functional requirements.

b) Purchaser's data sheets specify the scan time / cycle time / response time and loading requirements. Vendor shall be responsible for sizing and selecting their standard product i.e. hardware, software and firmware to meet the requirements specified in the purchaser's data sheets.

c) Selection of proper and adequate hardware, software and firmware to meet system requirements specified in the purchaser's specifications, keeping the integrity of functional blocks specified in the configuration 'diagram attached with the material requisition.

d) Adequacy of Bill of Material selected to meet purchaser's requirements. Vendor to note that bill of material shall not be verified by the purchaser during evaluation stage. Any hardware, software and firmware required to meet the purchaser's specified requirements shall be provided by the vendor without any implication.

e) Providing adequate mandatory spares including consumable spares as specified in the purchaser's specifications as per SEC-VI 19.0 Instrumentation Spare parts . Vendor shall be responsible to meet mandatory spare requirements specified by the purchaser.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the material requisition. Vendor's quotation shall enumerate and include the detailed specification of each subsystem and each module of programmable logic controller, detailed system configuration, hardware and software capabilities, programming aids, display facilities and other relevant information.

1.2.2 Whenever a detailed technical offer is required, vendor's quotation shall include the following:

a) Compliance to the specifications.

b) Detailed specification sheets for each sub-system. The specification sheet shall provide information regarding hardware specifications, software specifications, redundancy requirements, capacity, power consumption etc. of the programmable logic controllers and its accessories. The material specifications and unit of measurement for various items in vendor's specification sheets shall be to the same standards as those indicated in purchaser's data sheets.

c) System security features and design details.

d) Proven references for each offered model in line with clause 1.2.4 of this specification whenever specifically indicated in the purchaser's specifications.

e) A copy of approval for flameproof enclosure, intrinsic safety etc whenever

specified, from local statutory authority, as applicable, like Petroleum and Explosive Safety Organization (PESO) / Chief Controller of Explosives (CCOE), Nagpur or Director General of Mines Safety (DGMS) in India along with:

i) Test certificate from recognized house CIMFR (Central Institute of Mines & Fuel Research) / ERTL (Electronics Research and Test Laboratory) etc. for specified protection class as per relevant Indian Standard for all Indian manufactured equipments or for equipments requiring DGMS approval.

ii) Certificate of conformity from agencies like LCIE, Baseefa, PTB, CSA, UL etc., for compliance to ATEX or other recognized standards for all equipments manufactured outside India.

f) Deviations on technical requirements shall not be entertained. In case vendor has any valid technical reason to deviate from the specified requirement, they must include a list of deviations item wise, summing up all the deviations from the purchaser's data sheets and other technical specification along with the technical reasons for each of these deviations.

g) Catalogues giving detailed technical specifications, model decoding details and other related information for each item / sub-system covered in the bid.

1.2.3 Vendor shall offer only their standard proven product i.e. system hardware, system software and firmware, which shall be configured to meet the functional requirements specified in the material requisition. Moreover, the equipment being offered / supplied shall be of latest proven version available in the current manufacturing range and meeting the requirements specified in clause 1.2.4 of this standard specification.

1.2.4 The system hardware, software and firmware as offered, shall be field proven and should have been completed trouble free satisfactory operation for a period of minimum 4000 hours on the bid due date in the similar application with equal or higher than the proposed system size with respect to number of inputs and outputs specified in the purchaser's data sheet. Items with prototype design or items not meeting proneness criteria specified above shall not be offered or supplied.

1.2.5 The detailed scope of work, specific job requirements, exclusions, deviations, additions etc. shall be indicated in the job specifications which shall be part of material requisition.

1.2.6 Whenever specified, vendor shall furnish tested values of failure rates, probability of failure on demand and test intervals for safety integrity level analysis.

1.2.7 All documentation submitted by the vendor including their quotation, catalogues, drawings, installation, operation and maintenance manuals shall be in English language only.

1.2.8 Vendor shall also quote for the following:

a) Two year's operational spares for each sub-system and their accessories which shall include the following as a minimum:

i) All type of electronic modules e.g. I/O modules, processor modules,

communication modules, memory modules, disc controller module, power supply modules etc.

ii) All type of auxiliary items e.g. barriers / isolators, hardwired instruments, annunciator modules, receiver switches, trip amplifiers, temperature element converters etc.

iii) Switches, lamps, fuses, connectors, terminals, pre-fabricated cables, circuit breakers, relays etc.

iv) Video display units, keyboards, disc drives, PC's, network items (e.g. switches, hubs etc.) etc. \

b) Any special tools and test equipments needed for the maintenance of PLCs and other items being offered by vendor. Vendor must confirm in their offer if no special tools or test equipments are needed for maintenance other than those specifically indicated in purchaser's data sheet.

1.3 Drawing and Data

1.3.1 Detailed drawings, data, catalogues and manuals required from thy vendor are indicated by the purchaser in vendor data requirement sheets. The required number of prints and soft copies shall be dispatched to the address mentioned, adhering to the time limits indicated.

1.3.2 Final documentation consisting of design manuals, installation manual, operation and maintenance manual etc., submitted by the vendor after placement of purchase order shall include the following, as a minimum:

a) Specification sheet for each sub-system, auxiliary instrument and bought out item.

b) Certified drawings for complete system including the following:

i) GA drawings for panels, cabinets, marshalling racks, hardwired consoles, operator console, programming terminal etc with complete dimensional details, internal construction and weight in kilograms.

ii) Control room layouts e.g. console room, rack room and engineering room layout with all dimensions in millimetres.

iii) Channel base frame drawing for console room, rack room and engineering room.

iv) Input / output assignment.

v) Logic / Ladder diagrams.

vi) Loop wiring diagram.

vii) Power supply distribution diagram.

viii) Memory loading calculations/Scan time calculation.

ix) Protocol/Pin Details.

x) Dynamic graphic diagrams.

xi) System grounding drawing.

c) Design manuals and functional design specifications which shall include hardware design manual, software design manual and special software specifications.

d) Copy of type test certificates.

e) Copy of test certificates for all tests indicated in this specification.

f) Installation manual containing installation procedure for programmable logic controllers and other items covered in the material requisition.

g) Power-on, start-up and internal testing procedures.

h) Software debugging and system configuration procedures.

i) Calibration and maintenance manual containing maintenance procedures including replacement of parts, application modification etc.

j) Any other drawings and documents specifically indicated in job vendor data requirement enclosed with the material requisition.

All system manuals and documentation shall be supplied in hard dover loose ring folders in 'A4' size as per ISO 216 i.e. of size 210mm x 297mm. All drawings and sketches shall be in multiple of'A4' size like 'A3' (297mm x 420mm) or 'A2' type (420mm x 594mm) etc. but folded to 'A4' size.

2.0 DEFINITIONS

The various terms used in this specification are defined as follows:

2.1 Programmable Logic Controller

The class of control systems which can be programmed to execute plant shutdown and / or interlock / sequence logics to the specified safety integrity levels.

2.2 Accessible

A system feature that is viewable by and interactive with the operator and allows the operator to perform user permissible control action e.g. set point change, auto-manual transfers or on-off actions.

2.3 Assignable

A system feature that permits an operator to direct a signal from one device to another without the need for change in wiring, either by means of switches or via other data entry

devices like keyboard commands to the system.

2.4 Configurable

The capability to select and connect standard hardware modules to create a system or the capability to change functionality or sizing of software functions by changing parameters without having to modify or regenerate software.

2.5 I/O

Input / Output with respect to process / operator

2.6 PLC Console (Operator)

PLC console (Operator) is the operator's main plant interface device through which operator can view, monitor and control the plant and can give instructions to peripherals to execute commands, and shall have protective access to configure and maintain the system.

2.7 **PLC Console (Programming Terminal)**

PLC console (Programming Terminal) shall be the engineer's main interface device through which engineer can configure / program and maintain the system, and shall have protective access to monitor and control the plant, give instructions to peripherals to execute commands.

2.8 Local Level

All those sub-systems;' which directly interface with field devices shall be referred to as local level.

2.9 Central Level

Operator Console and Programming Terminal, which present data acquired from local level devices shall be referred as Central Level.

2.10 Database

Database shall be defined as the information stored temporarily or permanently in the system which can be accessed by various programs to meet all its functional requirements.

2.11 Loop Integrity

A system shall be said to have loop integrity if the failure of one component in the system/ sub-system does not affect more than one loop.

2.12 System Loading

System loading for a sub-system is defined as the percentage of time a sub-system spends in carrying out various activities referred to the use of memory, CPU time and communication capacity in the worst case of high sub-system operation out of the designed / designated cycle time of the sub-system.

2.13 Redundancy

A system component shall be termed as redundant if it takes over automatically the operation in the event of the failure of the main component without causing any interruption in the system and upsetting the process. The repaired or replaced device shall be brought in-line only through operator action without upsetting system operation.

2.14 Switchover Time

Time required for a back up instrument / system to come on-line automatically in case of the failure of the main instrument / system.

2.15 Processor Cycle Time (tpc)

Processor cycle time is the measure of the processing speed of a processor. Processor cycle time for a sub-system ofthe programmable logic controller shall be defined as follows:

Processor cycle time for programmable logic controller shall be defined as the total time taken by the processor to read input supplied by input module, execute all computations (analog as well as logic as configured) and write the outputs for the output module.

2.16 Scan Time (ts)

Scan time of a logic loops is the end-to-end response time of a sub-system and shall be defined as follows:

The scan time for a logic loop shall be defined as the total time taken by a sub-system e.g. programmable logic controller to read input from the input terminal, process input, execute logic, updating logic output and write output at the output terminal for all the logics configured within the subsystem.

2.17 User's Memory

Free memory space available after utilization of memory required for system operation, configuration and implementation of application and other system related functions for implementation of user defined specific programs such as plant calculations, process optimization or MIS (like free formatting of certain logs). The programs shall either be written in high level language or system specific language.

2.18 Event

An event shall be defined as any action taken by the operator via operator keyboard or switches on hardwired console like change of set point, change of control mode, start/stop of motor, open/close of shut down valves, alarm acknowledge etc.

2.19 Sequence of Event (SOE)

Arranging events in the sequence of their occurrence in time with a specified time resolution by a program is defined as sequence of event.

2.20 Sequence of Event Recorder (SER)

System or sub-system which presents and / or records the events in the sequence of their occurrence in time with a specified time resolution utilizing its hardware and software capabilities is termed as sequence of event recorder.

2.21 Real Time Trend

Real time trend shall be defined as a continuously progressing graphical record showing updated parameter with most recent value and a past record of minimum of 10 minutes without pressing any additional key for moving backward in time.

2.22 Plant Information Network

High-level communication network which serves various users within a plant and transfer information for the purpose of unit / plant monitoring. This network is different than control network and is generally realised using open communication protocol network e.g. OPC etc.

2.23 Tag

A Tag is a collection of attributes that specify either a control loop or a process variable, or a measured input, or a calculated value, or some combination of these, and all associated control and output algorithms. Each tag is unique.

3.0 SPARES PHILOSOPHY

3.1 The system including sequence of event recorder, hardwired instruments etc. shall meet the following spare philosophy. This philosophy shall also be applicable for items like barriers, relays, terminals, lamps, push buttons etc.

3.1.1 Mandatory Spares

Vendor shall also include following mandatory spares in their scope of supply apart from SEC-VI 19.0 Instrumentation Spare parts:

3.1.1.1 Installed Engineering Spares

Installed engineering spares shall be provided in each sub-system for each type of module to enhance the specified" system functional requirements by 20%. The basis of offering installed engineering spares shall include:

a) For a system with conventional and / or smart analog input / output, discrete (contact) input / output, 20% spare input / output of each type shall be considered for calculating I/O modules and all other related accessories.

b) For all serial input / outputs to the system, 20% spare serial\I/O ports ofeach type of serial input / output shall be provided.

c) 20% spare accessories like relays, switches, lamps, fuses, circuit breakers, barriers, isolators, terminals etc.

d) The engineering spares shall be wired up to the field cable interface and shall be in ready-to-operate condition when field cable is connected to spare assigned

terminals.

e) Spare pairs of the incoming cables shall be terminated on spare terminals in the marshalling / barrier cabinets as applicable.

f) The system shall be fully engineered considering 20% installed engineering spares including processor loading.

3.1.1.2 Spare Space Requirement

In addition to installed engineering spares specified in Clause 3.1.1.1 of this specification, the system shall be provided with following spare space:

a) I/O racks of programmable logic controller shall have 10% usable spare space for installing additional I/O cards of each type in future. However internal wiring for the same shall be connected up to the I/O terminals.

b) Processor system of programmable logic controller shall have capability to execute additional 20% logics.

c) Each operator console shall contain 20% usable spare group and related display capability in addition to as specified in para 3.1.1.1 of this specification.

d) The system shall have capability to extend its historical trending, logging and user's memory by 20% to meet future expansion with/without adding additional memory modules.

e) The communication sub-system shall have sufficient capacity to handle additional data contributed by addition of 20% I/O over and above installed engineering spares.

f) Usable spare space in panels and cabinets to install 10% spare hardwired items like relays, switches, lamps, fuses, circuit breakers, barriers, isolators, terminals, panel mounted instrument etc. in future.

The processor Loading shall not be more than 50% if the Processor Loading is more than 50% , separate Processor shall be provided by the bidder. The PLC offered shall be Dual Modular Redundant (at least). It shall be having Redundant Processor, Power Supply and Communication Module installed in Hot Standby Mode.

Loading Philosophy shall be (with 20 % installed spare and 20% future expansion)

Control Processor	50%
Communication Processor	50%
Communication Bus	50%

3.1.1.3 Spare Memory Requirement

a) The system shall be provided with a minimum of 40% spare memory capacity, as required for application program and data base to meet specified functional requirements.

b) It shall be possible to extend the memory by at least 20% over and above the actual requirement at a later date.

3.1.1.4 Spare Software Capability

a) Sufficient additional software capacity shall be available in the system to take care of spares requirement as specified in para 3.1.1.1 and 3.1.1.2 of this specification to meet all functional requirements as per para 4.0 of this specification.

b) Unless specifically indicated otherwise, the offered system shall have software licenses to cover all the tag numbers indicated in the material requisition, including installed engineering spares and spare space indicated in clause 3.1.1.1 and 3.1.1.2 of this specification.

3.1.1.5 Predefined Mandatory Spares

a) Mandatory spares shall be ware-house spares and shall be supplied as loose items.

b) Mandatory spare module of 5% or one module of each type, whichever is higher, must be supplied for each type of modules being used excluding modules used in consoles, servers, Personal Computers.

c) For items like, Video Display Units, keyboards, disc drives, network components, hardwired instruments like barriers, lamps, fuses and circuit breakers, complete item limited to 5% or minimum one of each type shall be supplied' as predefined mandatory spare. But this shall not include hardware like hard discs, terminals.

3.1.1.6 Consumable Spares

Any paper, ribbon, printer heads, toner and ink required for printers, video copier or any other consumable item shall be supplied along with system required for minimum of six months duration after system acceptance.

3.1.1.7 Commissioning Spares

Unless otherwise specified, vendor shall be responsible to supply all spares which are found necessary to replace failed modules, failed sub-systems, or corrupted / faulty softwares while performing pre-commissioning and commissioning activities.

3.1.2 Two Years Operational Spares

Two years operational spares shall be as per Clause 1.2.8(a) of this specification and shall be quoted separately.

4.0 DESIGN AND CONSTRUCTION

4.1 Design Requirements

4.1.1 Programmable logic controller shall be microprocessor based system which shall be used to execute all the process and safety shut-down logic of the plant. When specified, it shall also execute plant interlock logics and sequence operation. Programmable logic controller shall be an independent unit and shall not depend on any of its functionality on any other system including Distributed Control System.

4.1.2 The system shall be of modular construction and expandable in future by adding additional modules which shall be easily accessible for maintenance and repair. The type of modules shall be kept to the minimum possible in order to have interchangeability and low inventory.

4.1.3 System Availability

a) The system shall be designed 'fault tolerant' as a minimum by selecting high grade components of proven quality and proper design of system electronics.

Redundancy shall be provided, as a minimum, as per this specification to improve system availability and reliability. Due considerations shall be given to the environmental conditions particularly for field mounted sub-system, if specified in job specifications, during system design.

b) The system shall have a high MTBF value and shall have well proven record of operating in hydrocarbon plants.

c) The system shall be designed with 99.995% or greater availability. The availability shall be defined as follows:

$$\text{Availability} = \frac{\text{Mean Time Between Failure (MTBF)}}{\text{MTBF + Mean time to repair (MTTR)}}$$

For the purpose of calculations, consider mean time to repairs as four (4) hours unless the manufacturer recommends higher value for MTTR. It is therefore necessary that:

i) Vendor covers all necessary spare parts in 2 years recommended operational spares which shall be necessary to meet specified MTTR time.

ii) Vendor provides adequate training to owner's personnel and cover all necessary maintenance related topics in their training programmes to ensure specified MTTR time.

4.1.4 Operating Environmental Conditions

4.1.4.1 Environmentally Controlled Location Installation

a) All subsystem of Programmable Logic Controllers located in Control Room, Local Control Room or in Satellite Rack Room shall be able to operate satisfactorily from

5°C to 50°C and 10% to 90% non condensing humidity.

b) In addition to above, all such sub-systems shall also be able to operate satisfactorily in case of air conditioning failure with ambient temperature of 50°C and 90% no condensing humidity until the system safe operating limits are exceeded. The minimum period of continuous operation in such condition shall be 48 hours at least once in a month without any damage or degradation of system performance. Vendor, therefore, shall provide continuous temperature monitoring for each enclosed cabinet housing items / equipments generating heat, such as system cabinets, barrier cabinets, relay cabinets etc and also provide alarm for operator alert in case the safe operating temperature limits are exceeded.

c) Chemical filters have been provided in the incoming air conditioning air to limit the concentration of contaminants below following limits:

Contaminants (Corrosive Gases)	Concentration
SOx	< 0.01 ppm by volume
NOx	< 0.05 ppm by volume
H2S	< 0.003 ppm by volume
Cb	< O.OOlppm by volume
NH3	< 0.5 ppm by volume
SPM	< 200 ugm/m'
RSPM	< 100 ugm/nr'

All sub-systems and system components shall be suitable for operating continuously in the above mentioned corrosive environments

4.1.4.2 Outdoor Installations

a) Sub-systems or system components which are installed outdoor shall be suitable to continuously operate at ambient temperature and humidity specified under ambient conditions. The heat generation effect of current carrying for the electronic modules shall also be considered. For this purpose the system shall be\rated for minimum 5 deg C more than the maximum ambient temperature specified. In case the system is not suitable for the above conditions, necessary cooling arrangement shall be provided.

b) Unless otherwise specified, all PLC sub-systems or system components installed outdoor shall have corrosive environmental protection coating meeting the environmental classification class G3 as per ISA-S71.04.

4.1.5 Transient, Static and EMI / RFI Protection

4.1.5.1 The system shall be internally protected against system errors and hardware damage

resulting from:

a) Electrical transients on power wiring.

b) Electrical transients on signal wiring.

c) Connecting and disconnecting devices or removing or inserting printed circuit boards in the Programmable Logic Controller (PLC).

4.1.5.2 All sub-systems and system components shall be capable of accepting various signal inputs for its direct use while preventing noise errors due to electromagnetic interference (EMI) or radio frequency interference (RFI) including nearby radio stations, hand held two way radios, solenoids, relays or contactors carrying heavy currents as per levels of Environmental electromagnetic phenomenon defined in IEC-61000-6-2. The system shall have total noise immunity from UHF / VHF radio communication equipments, (RFI) and (EMI) noise generating equipments as per IEC-61000-4.

4.1.5.3 For interplant, inter unit and other system cables routed in the field, the level of surge immunity required for equipment signal ports shall be increased to level 4 as defined in IEC-61000-4-5 and the system shall operate according to performance criterion B as defined in IEC-61000-6-2.

4.1.6 On-line Replacement

4.1.6.1 On-line replacement of any module of programmable logic controller shall be possible in such a way that removal and addition of the module shall be possible and safe without de-energising the system. Furthermore, there shall not be any interruption of the system while replacing a faulty module wherever redundant modules are provided.

4.1.6.2 Apart from system modules, power supply units shall be replaceable on-line without disrupting the process and without affecting the system redundancies. It shall be possible to hot swap any faulty system module without degrading the system safety or operation or freezing the output status. The switchover to the healthy module shall be bumpless. The swapped module shall take over the function of the failed module without any manual programming.

4.1.7 Electrical Isolation

Galvanic or optical isolation shall be provided for all field signals. The isolation levels shall be as follows:

Analog I/O channel to system ground 1500V AC

Discrete I/O channel to system ground 500V AC

External isolator shall be provided, if necessary to meet the above.

Isolation shall also be provided between Engineering / operator cbnsole/PLC programming terminal and related sub-systems connected to it if there is any possibility of high voltage being transmitted to the sub-systems.

4.1.8 Design Requirements of Equipments in Hazardous Area

4.1.8.1 Unless specifically indicated, the field devices are beyond the scope of this specification. However vendor shall be fully responsible for integrating these devices with their system.

4.1.8.2 General requirements

a) Unless otherwise specified, all instruments in hazardous area shall be intrinsically safe type. Other concepts shall be used when specified.

b) For conventional instrumentation, entity concept shall be used for selecting proper barriers / isolators.

4.1.9 Repeat Signals

4.1.9.1 Unless otherwise specified in the job specifications, following philosophy shall be followed for repeat signals:

a) Whenever repeat contact outputs are required as per job specifications following philosophy shall be followed:

i) For intrinsically safe input contacts, isolating barrier with dual contact output shall be utilized.

ii) For all other contact inputs, repeat contact shall be provided using electro-magnetic relays.

4.1.10 The system shall be designed fault tolerant and shall utilize high quality components of proven quality. Any single system fault shall not degrade the system safety or functionality or affect operation. The system shall have certified Safety Integrity Level as per IEC61508/ 61511 as applicable and specified in job specification. Unless otherwise specified, it shall meet the availability requirement specified in Clause 4.1.3 ofthis specification.

4.1.11 Unless otherwise specified, the scan time of programmable controller shall be of the order of 250 milliseconds for PLCs. Scan time for a PLC shall be as defined under para 2.16 of this specification.

4.1.12 Operation of the PLC shall be completely unaffected by a momentary power loss of the order of 20 milliseconds.

4.1.13 The system shall be programmed in principle as per the logic diagrams furnished during detailed engineering. Vendor shall prepare their own Logic/Ladder diagrams depending upon the capability of the programmable logic controller offered by them. Owner / Consultant reserve the right to revise or review the logic diagrams even after acceptance of any offer. The programming language of offered PLC shall be as per IEC 61131.

4.1.14 Whenever the requirement of SIL is specified for the PLC, it shall meet the requirements of SIL level specified and shall be certified by an independent body (e.g. TUV) for complying requirements of IEC-61508 / 61511 as specified.

4.1.15 The system shall have extensive set of self diagnostics hardware and software for easy and

fast maintenance of PLC. Routine checks should run automatically at frequent intervals for identifying any fault in software or hardware. Diagnostics shall be required at local as well as console level. \

4.1.16 Safety barriers shall be provided by the vendor for intrinsically safe input/output circuits wherever specified. In such cases, the system shall be designed intrinsically safe based on entity concept. The barriers shall be certified by a statutory authority like Baseefa, LCIE, CSA, UL, PTB, CIMFR etc., for the use in the area classification as specified elsewhere in the job specifications. The proper selection of the safety barriers shall be the vendor's total responsibility. In case of smart transmitter, the entity parameters of the hand held terminals shall also be considered while selecting proper barriers.

4.1.17 Unless otherwise specified all intrinsically safe barriers shall be 3 port isolating type only providing isolation between;

i) Input and output (non-hazardous to hazardous side of barriers)

ii) Power supply and input

iii) Power supply and output

The minimum isolation level shall be 250V.

4.2 System Configuration

4.2.1 General

a) PLC system configuration / architecture shall be as specified in the job specification. For emergency shutdown system application the system configuration shall be DMR as per the job specification and shall be certified by independent agency e.g. TUV.

b) Regardless of the action feature selected (except for single architecture), the failure of single component shall not result in a failure of correctly executed safety function.

c) In general, the PLC system shall comprise of various sub-systems as described in the subsequent clauses of 4.2.

4.2.2 Input/ Output Subsystem

4.2.2.1 Each I/O module shall have its own processor. I/O modules configured m redundant configuration, shall have their processors properly synchronised.

4.2.2.2 Unless otherwise specified, system shall accept analog 4 -20mA inputs and contact inputs. The maximum number of Input/Output per I/O module shall be limited as per the following table.

Sl No.	Type of Configuration	Maximum No. I/O s
1	Single I/O system	8

2	Dual I/O system	16
3	Triple Modular Redundant system (TMR)	32
4	Quadruple Modular redundant System (QMR), Flexible Modular Redundant (FMR) configuration, Virtual Modular Redundant (VMR)	16

4.2.2.3 Each I/O shall be galvanically isolated from external control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1000 volts DC.

4.2.2.4 Each I/O shall be protected against the reversal of polarity of the power voltage to I/O.

4.2.2.5 Each input shall be provided with filters to filter out any noise in the input line and contact bouncing noise, as applicable.

2.2.2.6 All the inputs / outputs shall be double ended i.e. two wires per input / output and not with common return for all inputs.

4.2.2.7 The interrogation voltage to the inputs and power supply for 2-wire instruments shall be powered from separate redundant power supply / supplies and shall not be a part of PLC, unless otherwise specified. This power supply shall be supplied at one point and shall be distributed by the vendor.

4.2.2.8

a) Each module shall have a LED per channel to indicate the status of each input output.

b) When specified, input module shall be capable of monitoring the input contacts for any wire open fault and short circuit.

4.2.2.9 Analog Input Module

a) Input module shall be able to accept 4~20 rnA DC input from smart transmitters (e.g. 4 -20mA HART).

b) The module shall have 12 bit Analog to Digital resolution accuracy of ±0.2S% of full scale over the entire range, unless otherwise specified.

4.2.2.10

a) Output contacts from the PLC shall be potential free dry contacts with contact rating as per para 4.2.2.10 b) of this specification. Vendor must provide arc suppression device for each output contact.

b) The output contact rating shall be as follows:

SL.No.	APPLICABLE FOR	VOLTAGE RATING	CURRENT RATING
1	All output cards driving solenoid valve and alarm annunciator system unless otherwise specified Category -I Category -II	**24VDC**	0.5 A 2A
2	All motors/pumps/compressor output cards unless otherwise specified. Category –I Category -II	**240 V AC** **220 V DC**	5.0A 0.2 A

c) The category of contacts shall be specified in the material requisition. Each output shall be short circuit proof and protected by fuse. Visual indication of fuse blown must be provided for each module.

d) When specified contact output module shall have monitored\ output features like wire open and short circuit.

4.2.2.11 Where inputs or outputs have multiple field devices for the same measurement or device, the corresponding inputs / outputs shall be configured in separate I/O modules.

4.2.2.12 Where single input signal is available for DMR configuration, inputs shall be multiplied to feed inputs to each input modules / channels.

4.2.2.13 PLC shall be provided with Auto I/O testing facility as a standard diagnostics features. PLCs which do not have auto I/O testing facility, manual testing facility shall be provided to detect any system fault. For manual testing, manual switches shall be provided to bypass each input at a time and its effect on the output shall be monitored.

4.2.3 Processor System

4.2.3.1 The processor shall have capability to implement all the control functions required to implement the logic scheme as logic/ladder diagram.

4.2.3.2 The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes and other functional requirements. Offer shall indicate the amount of memory capacity occupied by the actual program and spare capacity available for future program modifications or additions.

4.2.3.3 Memory shall be non-volatile. However in case volatile memory is provided, battery backup shall be provided with a minimum of 3 months lifetime to keep the program storage intact. A battery drain indication shall be provided at least one week before the battery gets drained. Spare shall be well protected, preserved Processor battery shall be provided for each preinstalled PLC Processor battery.

4.2.3.4 Watchdog timer shall be a software device. The healthiness of processors shall be continuously monitored by watchdog timer. Any hardware or software problem in the processor system, which shall include, CPU, memory, power supply, communication interface etc. shall cause the watch dog timer to report processor failure.

4.2.3.5 Wherever dual redundant processor is specified, redundancy shall be provided in such a way that in case of failure of the main processor, the standby shall take over automatically. The changeover shall be bump less. Redundancy shall be provided for complete processor system including processor, power supply and communication sub system.

4.2.3.6 In case of triple modular redundant system all the three processors shall execute the same instructions/program and check their results and vote to correct any faulty result. The faulty processor diagnostic shall be made available.

4.2.3.7 In case of QMR system, individual processor shall execute the same instructions/ programs and check their results within same CPU module and majority vote to correct any faulty result. The faulty processor diagnostic shall be made available.

4.2.3.8 Failure of a single processor in dual redundant, triple redundant system and two processors in QMR system shall not affect the system. In case of failure of complete processor system

i.e. both processors in case of dual configuration, two or more in case of triple redundant system and more thah two in case of QMR system, outputs shall take failsafe state automatically unless otherwise specified in the data sheets.

4.2.3.10 It shall be possible to generate the first out alarm contact by the PLC in case where a group of parameters are likely to trip a system.

4.2.4 PLC Console (Programming Terminal)

4.2.4.10 The PLC console (Programming Terminal) shall be used for programming, program storing, fault diagnostics and alarm monitoring. Whenever specified, it shall also be possible to use this console for plant operation. The functionality to operate as engineering / programming terminal or operator terminal or both shall be as specified in the job specification.

4.2.4.2 It shall consist of at least one coloured 22" LED monitor with TFT technology and one programming / operating keyboard, mouse and printer unless specified otherwise.

4.2.4.3 PLC console when used for plant operation shall also meet the functional requirements as per clause 4.2.5 of this specification

4.2.4.4 The keyboard shall preferably be touch sensitive sealed type, easy to operate with each key clearly identified.

4.2.4.5 All illegal entries shall be rejected by the terminal and shall be identified by warning signal on VDU.

4.2.4.6 Manual forcing of any input or output contact connected to PLC shall be possible from keyboard. Forced functions shall have an associated audit trail.

4.2.4.7 It shall be possible to modify, add or delete the application program on line without affecting the outputs.

4.2.4.8 PLC Console shall display logic and/or ladder diagram indicating power flow and shall show description and status of each contact. It shall also be possible to display process alarms and diagnostic messages as and when they appear. Further it shall also be able to display I/O

map in a user defined format.

4.2.4.9 I t shall be possible to print out the ladder/logic diagram on the dedicated PLC printer. The printer in addition shall also print out:

a) The diagnostic messages as and when generated and diagnostic reports, when called for.

b) Process alarms connected to the programmable logic controller as and when they appear and alarm report whenever initiated. The choice of printing alarms on this printer shall be operator selectable from a key lock / password protected switch on PLC console.

c) The I/O maps showing status of all inputs and corresponding outputs in a user defined format.

4.2.4.10 The PLC console shall be provided with self diagnostics feature which shall display error messages and initiate an audible alarm if the fault is detected. Wherever specified, a potential free contact for diagnostic group alarm shall be provided which shall be connected to the hardwired alarm 'annunciator system.

4.2.4.11 The system shall be able to identify the failure at least up to the module level including I/O system and redundant processor and report print out.

4.2.5 PLC Console (Operator)

4.2.5.1 Where dedicated PLC operator console is specified, it shall be used for operation of plant, fault diagnostics, alarm monitoring and report generation.

4.2.5.2 It shall consist of colored 22" LED monitor with TFT technology, operator keyboard and printer unless specified otherwise.

4.2.5.3 At least two number cursor control devices shall be provided in addition to keyboard which may include touch screen, mouse, track ball etc.

4.2.5.4 PLC operator console shall have complete graphic capability and shall be able to display process dynamic graphics, overview and group view displays. It shall be possible to operate the plant i.e. start and stop of rotating machinery, opening and closing of valves, Pill function etc. from dynamic graphics and group displays available on PLC operator console.

4.2.5.5 It shall be possible to monitor, historise and print out all process alarms, diagnostic alarms and alarm reports.

4.2.5.6 Unless otherwise specified, the time stamping of all alarms shall be as per PLC processor time stamping.

4.2.5.7 The system shall be able to store and display stored data wherever required. The minimum storage capacity shall be for 30 days at 1 minute sample rate for all the inputs specified, diagnostic alarms, process and first out alarms, manipulation data etc.

4.2.5.8 The system shall be able to generate shiftly, hourly, daily, weekly and monthly reports. The

log format shall be furnished during detailed engineering.

4.2.5.9 The system shall be supplied with first out alarm generation capability. The resolution of alarm shall be as per processor cycle time, as a minimum.

4.2.6 Communication Subsystem

4.2.6.1 The PLC communication subsystem shall be a digital communication bus that provides a high speed data transfer rapidly and reliably between the processor, I/O sub-system, PLC console and other devices connected in the PLC system.

4.2.6.2 Redundancy in PLC communication subsystem shall be provided as follows unless otherwise specified:

a) For single architecture, the communication subsystem between PLC processor and I/O subsystem shall be single unless otherwise specified. This shall include single communication bus and single interfaces/buffers.

b) For dual I/O configuration, each I/O sub set shall have separate communication interface and bus for connecting to PLC processors.

c) For the triple redundant system, each processor shall have a separate set of PLC communication subsystem.

d) For the QMR systems each I/O subset shall have separate communication interface and bus for connecting to respective CPU module.

e) The communication subsystem between processor subsystem and PLC console shall be dual redundant, consisting of two separate communication interfaces and two buses, each one configured in redundant mode, unless this is only used as programming aid.

4.2.6.3 In case of redundant PLC communication sub system, on the failure of the active device, the redundant device shall take over automatically without interrupting the system operation. Information about the failed device shall be displayed at local as well as on PLC console. It shall be possible to manually switch over the communication from main bus / device to redundant bus / device without interrupting any system function.

4.2.6.4 The mechanism used by the system for error checks and control shall be transparent to the application information / program. Error checking shall be done on all data transfers by suitable codes.

4.2.6.5 In general, PLC shall provide data m a well established protocol format preferably MODBUS protocol.

4.2.7 System Power Supplies

4.2.7.1 Unless specified otherwise, the programmable logic controller shall operate on uninterrupted power supply (UPS). However the system shall be capable of operating satisfactorily at the following power supply specifications:

Voltage	220 V ±10%
Frequency	50 Hz±3 Hz
Harmonic contents less than	5%
Power interruption	10 millisec

4.2.7.2 The power supply system shall be supplied with dual PLC feeders each capable of handling 100% of the total power supply load requirements. In case of failure of one feeder, redundant feeder shall supply the total load.

4.2.7.3 Each I/O rack shall be provided with separate power supply unless otherwise specified in job specifications. Each power supply shall be sized to take full load of the I/O rack/signal conditioning panel. Each rack shall be provided with dual redundant power supply.

4.2.7.4 Processor subsystem shall be provided with separate power supply, as a minimum, unless otherwise specified in job specification. Failure of one power supply shall not affect the system operation/processor switchover in case of dual processor system. Wherever triple redundant system is specified each processor shall preferably be provided with a separate power supply. Also separate power supply must be provided for each multiplied process I/O channel.

4.2.8 Self Diagnostics

4.2.8.1 The system shall have an extensive set of self diagnostic routines which shall be able to identify all permanent and transient system faults / failures at least up to module level including redundant components and power supplies through detailed VDU displays and report print out.

4.2.8.2 At the local level, failure of a module in any subsystem shall be identified by an individual LED.

4.2.8.3 Diagnostic software shall have the capability to provide information about the failed module/system either in the form of a system configuration display or provide information in the form of a "statement".

4.2.8.4 Self diagnostic software shall have capability to detect faults which make the system permanently close/open in the I/O modules or I/O signal conditioning modules (in case of triple redundant system, whenever specified in the job specifications, this may be achieved by automatically running the testing software at cyclic intervals), The automatic cyclic testing feature shall also be provided for dual I/O configuration and dual I/O signal conditioning for triple redundant system. The testing software cycle time may be considered once in 30 minutes however this shall be field adjustable by engineer. However, system performance shall not be degraded whenever testing feature is specified.

4.2.8.5 System for the following functionalities shall be supplied when specified:

a) Long storage historisation

b) Log report generation

c) First out alarm generation

4.2.8.6 System diagnostics shall be capable of identifying, locating and reporting the following faults, as a minimum:

a) Processor fault

b) Communication fault

c) I/O module fault

d) Power supply fault

e) Over temperature monitoring

f) Permanently close / open (stuck on or off) fault

g) Memory fault

h) Signal redundancy fault

Any other additional diagnostic alarm if available as a standard shall also be provided by vendor.

4.2.8.7 Testing software shall be capable of detecting faults in case of normally closed system as well as in normally open system.

4.2.8.8 Feedback must be provided in case of triple redundant system and QMR system from the output voter system to detect any latest faults of the system in addition to other diagnostic software.

4.2.9 System Software

4.2.9.1 The system software shall include all programs for the PLC and PLC console which are required to perform all the PLC functions including communication and self-diagnostics. Whenever PLC is specified for shutdown application, the system shall be designed and engineered in full compliance with the requirement of IEC-61511. Whenever different functional logics are combined within a common PLC, the safety related I/O's of each functionality shall be kept segregated within the system.

4.2.9.2 Logic program shall also be recorded on the external most reliable electronic media like DVD which shall be delivered in triplicate together with the system.

4.2.9.3 The PLC programming language for implementation of logic operations shall be based on the following representations:

a) Logic diagrams -Binary logic symbols such as AND, OR, NOT Gates, Timers and Flip-Flops.

b) Ladder diagram -Series / parallel connection of relay contacts.

c) Combination of (a) & (b) above.

4.2.9.4 Diagnostic package and its related equipment and software shall be supplied. A list of additional diagnostic packages available and the packages provided, including the description and capabilities, shall be provided with separate quote, wherever asked.

4.2.9.5 It shall be possible to print out the ladder/logic diagram on a dedicated printer. The printer shall also print out all diagnostic reports. Vendor must supply the off line software package to enable the owner to modify/add/delete any part of program and for documentation.

4.2.9.6 Software for the generation of various displays including dynamic graphics wherever specified to be provided as per given below:

4.2.9.6.1 It shall be possible to display dynamic graphic of plant on the operator console VDU screens. Graphic displays shall be field configurable only through PLC Console (Programming terminal) with standard / user defined graphic symbols. Dynamic graphic displays of different sections of the plant shall be displayed on different pages.

4.2.9.6.2 The system shall have graphic symbol library as per ISA-5.! and 5.3. In addition standard industrial symbols like distillation columns, heat exchangers, pumps, compressors, tanks etc. shall also provided as a standard.

4.2.9.6.3 Graphic displays shall be interactive type through which it shall be possible to control the process. It shall also be possible to send motor start/stop and shutdown valve open/close commands, as specified in job specifications, from this display

4.2.9.6.4 It shall be possible to view the process variable and alarm points and view and change set point value, manipulated variable, controller mode etc. from the graphic display. Also rotating machinery (i.e. compressor / pump) status and valve status shall be displayed on the graphic display with different colours

4.2.9.6.5 Various colours used in the generation of graphics like colour of the process lines, utility lines, Instrument signal lines and event modifier conditions shall be finalised during detailed engineering. The colours used to identify event modified conditions shall generally be as follows unless otherwise indicated during detailed engineering

Red -	All points alarm
Blue-	Valve open, pump running
Green -	Valve closed, pump stopped
Flashing green -	Shut down valve transition state

4.2.9.6.6 It shall be possible to go from any graphic page to related graphic pages or any group view or alarm summary in single key stroke using soft key function.

4.2.9.7 The software for printing alarms, system as well as process, and events on the PLC printer must be provided. All alarms must be printed as and when they appear.

4.2.9.8 Software package for displaying I/O map showing status of inputs and corresponding output

providing tag numbers as per logic diagram shall be offered. The I/O map format shall be user definable.

4.2.10 Power Supply Distribution

4.2.10.1 All type of power supplies shall be made available at one point. Further distribution of power supply shall be in vendor's scope.

4.2.10.2 In general, all output contacts and solenoids shall be powered with 1l0V±10% DC/ 24V±10% DC power supply. However, the actual interrogation voltages shall be as per job specifications and logic diagrams.

4.2.10.3 The distribution network for interrogation voltage shall be designed such that a single fault in any branch shall not cause trip of the logic other than where the fault has occurred.

4.2.10.4 Sequential starting of various load centers shall be provided whenever specified.

4.2.10.5 Power distribution network must use bus bars of adequate capacity with DPDT (Double Pole Double Throw) switches and HRC (High Rupture Capacity) fuses in each branch network. Vendor may select circuit breaker if short circuit characteristics do not match the HRC fuse.

4.2.10.6 All cubicles lighting shall be on 240 V, 50 Hz AC normal power supply.

4.2.11 PLC System Cabinets

4.2.11.1 All PLC system cabinets shall be completely wired with all modules in place. Inside cabinet wiring shall preferably be done using ribbon type pre-fabricated cables.

4.2.11.2 All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables. Cabinet structure shall be sound and rigid. Cabinet shall be provided with removable lifting lugs to permit lifting of the cabinets.

4.2.11.3 Cabinet shall be fabricated from cold rolled steel sheet of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors shall be fabricated from cold rolled steel sheet of minimum 1.6 mm thickness. Cabinets shall be thoroughly deburred and all sharp edges shall be grounded smooth after fabrication.

4.2.11.4 Cabinet finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between two coats. Two coats of paint in the cabinet colour shall be given for non-glossy high satin finish. Colour of the cabinets shall be as per job specification. Final coat shall be given after assembly at site when specified in the job specifications.

4.2.11.5 Each cabinet shall be maximum 2100 mm high (excluding 100 mm channel base), 800 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks. All cabinets shall be of same height.

4.2.11.6 Cabinets shall be equipped with front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal.

4.2.11.7 In order to effectively remove dissipated heat from the cabinets, ventilation fans along with

vent louvers backed by wire fly screen shall be provided as required. Ventilation fans shall be provided in all cabinets where the temperature rise with all doors closed and all internal and external loads ertergised shall exceed 10° C above the ambient temperature. A temperature element (resistance temperature detector) shall be provided in each cubicle for temperature measurement. Ventilation fans shall be provided in dual configuration, as a mmimum.

Each fan shall have a separate dedicated assembly and shall be replaceable on-line without shutting down any equipment / panel/cabinet / console in part or in complete. \

Ventilation fan assembly shall operate at 240V AC power supply. Each fan shall have its own dedicated circuit breaker.

Each ventilation fan shall be fitted with a protection type finger guard. Whenever, the numbers of cabinets are compacted (supplied in mechanical joined conditions), each cabinet shall be provided with separate ventilation fan assembly.

The maximum noise level with all fans operating and cubicle doors open shall not exceed 85dBA.

Following signals and alarms shall be provided for each cabinet:

i) Fan failure alarm for each cubicle in PLC.

ii) Temperature indication of each cabinet or compacted combination, as applicable in PLC.

iii) A common alarm each for high temperature and fan-failure shall be made available.

4.2.11.8 Internal illumination shall be provided for cabinets to ensure proper illumination level of250 lux for performing maintenance activities. Illumination shall be provided for all cabinets by incandescent lamps, which shall be activated individually by door operated magnetic switches. The lamps shall activate when door is opened and deactivate when the door is closed. The magnetic switches selected shall have undergone life cycle cyclic test of at least 1000000 operations. A manual over-ride switch shall be provided inside the cabinet which shall keep the lamp deactivated even when the door is open.

4.2.11.9 Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided and supplied by vendor for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.

4.2.12 Control Panels/ Hardwired Console

4.2.12.1 Control panels, if required, shall be non-graphic self supporting, free standing cubicle with back doors made up of sectional steel panels. Each section shall be maximum 2100 mm high, 1200 mm wide and 1000 mm deep and shall be mounted on 100 mm high channel base. Care shall be taken to ensure that the face of the panel is truly flat and smooth.

4.2.12.2 Panels / hardwired console shall be fabricated from 3.0 mm thick cold rolled steel sheet. Angle iron frame shall use a minimum section of 50x50x4mm angle.

4.2.12.3 Front of panel/console instrument nameplates shall be black laminated plastic with white core. Nameplate shall be provided on the rear of the panel also for each instrument.

4.2.12.4 Document pocket / wallet shall be provided on the inner side of front and rear doors of each cabinet and on the inner side of the door of each panel. Similar arrangement shall also be made on the inner side of doors of console.

4.2.13 Wiring Requirements'!

4.2.13.1 All wiring shall conform to API RP 552-Transmission Systems. Different signal level cables shall be routed with separation distances as recommended by this code.

4.2.13.2 All wiring inside racks, cabinets, and back of the panels shall be housed in covered, non-flammable plastic raceways arranged to permit easy assembly to various instruments for maintenance, adjustments, repair and removal. \

4.2.13.3 All wiring in the raceways shall be properly clamped. All incoming cable and outgoing cables shall be terminated by vendor at marshalling rack. Total wiring cross-sectional area shall not exceed 50% of the raceway cross sectional area.

4.2.13.4 Separate wiring raceways shall be used for power supply wiring, DC and low level signal wiring, and intrinsically safe wifing. Parallel runs of AC and DC wiring closer than 300mm shall be avoided.

4.2.13.5 Vendor can alternately offer prefabricated cables for interconnection between different cabinets and panels.

4.2.13.6 Wire termination shall be done using self insulating crimping lugs. More than two wires shall not be terminated on one side of single terminal. The use of shorting links for looping shall be avoided.

4.2.13.7 Terminal housing shall be strictly sized with considerations for accessibility and maintenance. Minimum distance required between various components is listed below. These distances are clear distances and are excluding the width of the raceways or any other component / item mentioned herein. Following clearances should be considered:

a) Distance between terminal strip and side of the cabinet parallel to the strip, up to 50 terminals, shall be minimum 50 mm.

b) Distance between terminal strip and, top and bottom of the cabinet shall be minimum 75mm.

c) Distance between two adjacent terminal strips shall be minimum 100 mm.

d) Additional distance for each additional 25 terminals shall be minimum 25 mm.

e) Distance between cable gland plate and the bottom of the strip shall be minimum 300 mm.

4.2.13.8 All terminal/terminal blocks shall be DIN Rail mounted type and shall be easily removable. The size of the terminal blocks / terminals of different types shall be consistent and identical.

All terminal blocks shall be mounted on suitable anodised metallic or plastic stand-off.

4.2.13.9 No splicing is allowed in between wire/ cable straight run.

4.2.13.10 Terminal strips shall be arranged group-wise for incoming and outgoing cables separately. Terminal blocks for intrinsically safe wiring shall be separate. 20% spare terminals shall be provided, as a minimum, preferably in each terminal strip. Terminals shall be suitable for wires up to 2.5 sq. mm base solid or stranded conductor in general. For power cables, higher size terminals shall be used.

4.2.13.11 Cabinet and rack layout shall be made considering proper accessibility and maintenance.

4.3 Earthing

4.3.1 All system equipments such as panels, marshalling cabinets, system cabinets and other powered equipments shall be provided with following type grounding system:

a) Protective Earth/ Electrical Earth

b) System Earth! Signal Earth

c) Safety Earth! Barrier Earth (when required)

Both system earth and safety earth shall be totally separate from protective earth.

4.3.2 Protective Earth / Electrical Earth

a) Each metallic enclosure / cabinet / panel/console etc. shall be provided with electrical earth lug, as a minimum.

b) Unless recommended otherwise by vendor, all earthing lugs of metallic equipments indicated in Clause 4.3.2 (a) above shall be connected individually to electrical protective earthing system bus-bar / earthing station using ,a maximum of 10sq mm solid copper conductor PVC insulated wires.

c) Where multiple cabinets are multiplexed together, earth looping with permanent shorting link cables shall be acceptable. Two earthing connection wires as indicated in Clause NoA.3.2 (b) above shall be used for connecting multiplexed cabinets to protective earth station / bus-bar.

4.3.3 System Earth

a) System earth shall be totally noise free dedicated earthing system and shall be fully isolated from electrical protective earth. This earth must be very high integrity system and shall be used to ground zero volt references and signal cable grounds.

b) System earth shall be less than one (l) ohm grounding system with its own dedicated earthing pits. These earth pits shall be away from any heavy noise plant equipment. Outside the control room building is the most appropriate location.

c) Wherever supply of earth pit is kept in vendor's scope in the Material Requisition, the earth pit design shall be as per IS-3043 code of practice for earthing. A minimum of four (4) number of earth pits shall be provided for grounding system integrity. In case number of pits required to meet 1 ohm resistance are more than (2), the number of earth pits shall be two times the actual number of pits required to meet resistance criteria. All these pits shall be securely connected with each other to form a one homogeneous system earth grid.

d) Each marshalling / system cabinet / panels etc shall be provided with system earth bus-bar which shall be insulated from the metallic body frame. This bus-bar shall be used to earth also signal zero volt references and signal cable screens. Terminals used for termination of spare conductor pairs / cores of multi-pair signal/control cables shall be connected to system earth bus-bar. Shorting links shall be used for spare terminal looping.

e) System bus-bars in the multiplexed cabinets can be joined together by permanent shorting links. System bus-bars of other cabinets can also be connected together provided they are permanently joined using 35 sq mm stranded copper conductor cable.

4.3.4 Safety Earth / Zener Barrier Earth

a) Whenever Zener barriers are selected or used to meet intrinsically safe requirements, the earthing terni'inal of the zener barriers shall be connected to a separate earth bus bar.

b) This earth shall meet all the requirements specified in Clause 4.3.3 of this specification.

c) Safety earth bus bar shall be directly connected to earth pits using dual insulated cable. Cable conductor size shall be minimum 95 sq. mm (c~pper).

4.4 Interface with DCS

The PLC shall be required to be interfaced to the Distributed Control System bus whenever specified. A suitable interface shall be offered in order to achieve the following functions:

a) Display of all input points under alarm/first out alarm connected to PLC or generated by PLC, continuous indication for analog signal on the main DCS operator console.

b) Generate shutdown reports on the logging printer of Distributed Control system.

c) To receive certain operational commands from the operator console for the operation of certain output devices connected to PLC

d) To display diagnostic message of PLC.

In general, PLC shall provide data in a well established MODBUS protocol format.

The interface shall be dual redundant unless otherwise specified.

The speed of data transfer shall be such that any change in I/O which is to be updated on the operator console shall not exceed 3 second from the time event to update on the operator console screen considering one second standard update rate in DCS operator console.

4.5 Sequence of Event (SOE) Function Requirement

Sequence of Event, whenever specified, for analog and digital inputs shall be generated and time stamped in PLC. The maximum resolution between two events shall not exceed specified PLC scan time unless specified otherwise. A separate SOE PC with 21" size TFT screen and printer shall be provided for PLC sub-system unless specified otherwise.

5.0 TESTING, INSTALLATION, COMMISSIONING AND ACCEPTANCE

5.1 General

5.1.1 This specification defines the basic guidelines to vendor for factory testing and acceptance, installation, commissioning and field acceptance of the complete PLC system. On the basis of this specification, vendor shall submit their own detailed testing, installation, commissioning and acceptance procedure. For hardware, the procedure shall include test name, purpose of test, test equipment / set up, definition of input, test procedure, results expected and acceptance criteria. Similarly for software, it shall include test name, details of the method, list of tests, sequence of execution, results expected and acceptance criteria.

5.1.2 The testing and acceptance of the system shall be carried out on the approved testing procedures and criteria based on this specification and vendor's standard testing requirements and procedures.

5.2 Factory Acceptance Tests (FAT)

5.2.1 Vendor shall test and demonstrate the functional integrity of the system hardware and software. No material or equipment shall be transported until all required tests are successfully completed and certified "Ready for Shipment" by the owner/consultant.

5.2.2 The purchaser reserves the right to be involved and satisfy himself at each and every stage of inspection. The purchaser shall be free to request any specific test on any equipment considered necessary by him although not listed in this specification, as a part of approval of factory testing procedure. The cost of performing all tests shall be borne by the vendor.

5.2.3 Vendor to note that acceptance of any equipment or the exemption of inspection or testing shall in no way absolve the vendor of the responsibility for delivering the equipment meeting all the requirements specified in Material Requisition.

5.2.4 It shall be vendor's responsibility to modify and/or replace any hardware and modify the software if the specified functions are not completely achieved satisfactorily during testing and factory acceptance.

5.2.5 Schedule of FAT shall be included in the Vendor's proposal.

5.2.6 Vendor shall not replace any system component/module/sub-system unless it is failed. A log of all failed components/modules in a sub-system shall be maintained which shall give description of the failed component/module, effect of failure on the sub-system, cause of failure and number of hours of operation before it failed. If malfunction of a component/ module in a sub-system repeats, the test shall terminate and vendor shall replace the faulty component/ module. Thereafter the test shall commence all over again. If even after this replacement, the sub-system fails to meet the requirements, vendor shall replace the full sub-system by the one meeting the requirements and the system shall be tested all over again. If a sub-system fails during the test, which is not repaired and made operational within four hours of active repair time after the failure, the test shall be suspended and restarted all over again only after the vendor has replaced the device in the acceptable operation.

5.2.7 Testing and FAT shall be carried out in two phases. The minimum requirements for testing during these two phases shall be as follows:

5.2.7.1 Under the first phase, vendor shall perform tests at his works to ensure that all components function in accordance with the specification for each type of test. A test report shall be submitted for purchaser review within one week of completion of this test. Phase II testing (witness inspection) shall start only after this.

All subsystem shall undergo a minimum of 30 days burn in period. The burn-in time shall start after the sub-system is fully assembled and is powered up. It may include any such time for which the system has been kept powered on even for system generation and Phase I testing.

Following tests shall be performed by the vendor and reports shall be forwarded to purchaser:

a) Quality control test which shall be carried out to assure quality of all components and modules in accordance with vendor's quality control and assurance procedures.

b) System pre-test which shall be physical check of all modules, racks, cabinets etc.

c) System power-up test which shall test functionally all hardware and software. This shall include testing of redundancy, System performance on power supply variations, application software testing and system diagnostic verification.

5.2.7.2 The second phase of testing shall systematically, fully and functionally test all hardware and software in the pre~ence of purchaser representatives. All subsystems shall be interconnected to simulate, as close as possible, the total integrated system. Following minimum tests shall be carried out:

a) Visual and mechanical testing, which shall be carried out in principle to assure correct, proper, good and neat workmanship by the vendor This testing shall include dimensional verification, Layout verification as per approved GA drawings, Verification of Sheet thickness / Quality of painting (outer and inner) / N~meplates, identifiers and tag plates / Adherence to ferruling philosophy / Dressing of wires / prefabricated cables and clearances / Locks and handles as a minimum.

b) Verification of Bill of Material. The Bill of material verification shall include both hardware and software.

c) Functional testing:

This shall include the simulation of each input and output to verify proper system response. The testing as a minimum shall include:

i) Complete system configuration loading.

ii) Demonstration of all PLC system builder functions including addition/deletion of an input/output, addition/ deletion of a rung or an element in a rung, generation of dynamic graphics and other views, report generation etc.

iii) 100% checking of logics configured in the PLC by connecting switch/lamp at input/output, by simulating inputs and verifying outputs preferably using simulator, other related functions like forcing, first out shall also be verified.

iv) Checking of scan time. Scan time verification shall be carried out using high resolution storage oscilloscope during Factory Acceptance Test based on the specified requirements considering discrete input by given step change. The scan time values so observed shall be within 90% confidence level. Incase of analog inputs, input shall be ramp or minimal step, however such reading for analog inputs should be noted only for reference.

v) Checking of all PLC console displays, keyboard and touch-screen operation (wherever specified), printer/hard copier functions etc.

vi) System redundancy check including correct change over of the back-up unit in case of failure of main unit.

vii) System diagnostic checking for all subsystems on local level as well as on console, including checking of the testing software for I/O modules/signal conditioning modules, when specified.

viii) Checking of output status on processor failure.

ix) Checking of first-out alarm generation.

x) Simulation of power failure and system restart auto boot-up of system configuration and program after power restoration.

5.2.8 Vendor shall notify the purchaser at least three (3) weeks prior to factory acceptance test. In the event that representative arrives and the system is not ready for testing, vendor shall be liable for back charges for any extra time and expenses incurred.

5.3 Installation, Testing and Commissioning

5.3.1 Vendor shall offer the services of an installation team which would install the equipment in the control room, lay the interconnecting cables inside control room, check-out, test and

commission the system.

All technical personnel assigned to the site by the vendor shall be fully conversant with the supplied system and software package, and shall have both hardware and software capability to bring the system on line quickly and efficiently with a minimum of interference with other concurrent construction and commissioning activities

5.3.2 Vendor's responsibility at site shall include all activities necessary to be performed to complete the job as per material requisition including:

a) Receipt of hardware/software and checking for completeness of supplies.

b) Installation of the system including for free supply equipment, if any.

c) Field cable termination and inter-cabinet cabling and termination.

d) Check out equipment installation.

e) Checking of interconnections, hardware and software configuration, overall system

f) Loop checking.

g) Field tests.

h) Commissioning and on-line debugging of the system.

i) Involvement during plant commissioning and performance of final acceptance test.

j) Co ordination for integration with DCS / other third party system.

5.3.3 Field Inspection

5.3.3.1 All equipments shall be inspected thoroughly by vendor after its receipt at site for completeness and proper functioning. Vendor must initiate the remedial action, in case unsatisfactory operation of any item is observed, with intimation to Engineer-in-charge.

5.3.3.2 Vendor must document all observations including details of any malfunction observed. Items/ equipments requiring total replacement must document the reasons for the same.

5.3.4 Loop Checking

5.3.4.1 Loop checking shall be carried out by vendor including checking the interconnections, configuration and overall system functioning.

5.3.4.2 Vendor's scope of work as a part of system installation and loop checking shall include termination of field cables in the control room, checking of interconnection between instrument/equipment, glanding, ferruling/tagging of interconnecting cables in control room, ferruling of field cables in control room and performing overall loop performance check.

5.3.4.4 The input signals shall be simulated by disconnecting/connecting the field wires for all field switches connected to 'PLC. All field transmitters connected to control room shall be loop checked at 0%, 50% & 100% of full scale (for both increasing and decreasing signals).

Wherever receiver cards are used, the set point shall be generated by giving the input signal to receiver card. All outputs shall be checked in field, either for actual operation of solenoid valve or actual pick-up of electrical contractor for rotary equipments. Shutdown schemes shall be checked for proper functioning, configuration and actuation.

5.3.4.5 After loop checking is completed, vendor shall connect back any ~erminals and connections removed for loop checking.

5.4 System Acceptance

5.4.1 The owner shall provisionally takeover the system from vendor after System acceptance test. System acceptance test shall be started only after the satisfactory performance of loop checking and verification of all loop checking records by Engineer-in-charge.

5.4.2 The system acceptance test shall be carried out in the presence of owner's representative and Engineer-in-charge or his authorised representative. The tests carried out in System acceptance test shall be fully recorded and duly signed by all representatives participating in the System Acceptance Testing. .

5.4.3 Vendor shall carry out the following functional tests, as a part of system acceptance test, as a minimum.

a) Hardware verification as per final Bill of Material.

b) Visual and mechanical check-up for proper workmanship, identification, ferruling, nameplates etc.

c) System configuration as per approved configuration diagram.

d) Demonstration of all system function, display and diagnostics.

e) Checking of correct change-over of redundant devices.

f) Checking of various peripheral devices like printers and printing of all reports.

g) Complete checking of logic system, loading of user's program and checkout of results.

h) Checking of proper functioning of all disc drives, alarm summary, alarm history etc.

i) Proper information transfer on the information network by verifying system displays and printout.

5.5 Final Acceptance Test

The owner will take over the system from the vendor after the final acceptance test, which is defined as successful uninterrupted operation of the integrated system for three weeks. Vendor's personnel shall be present during the test. Any malfunctioning of the system components shall be replaced / repaired as required. Once the system failure is detected, the acceptance test shall start all over again from the beginning. The warranty period commences

from the day owner takes over the system.

6.0 GENERAL REQUIREMENTS

6.1 Vendor shall comply fully with the general requirements of PLC system including logistic support services, documentation, warranty, maintenance contract and shipping instructions.

Post Warranty Maintenance Contract

Vendor shall quote separately for post warranty maintenance contract after warranty period for five years for the complete PLC system as per commercial terms and condition of the requisition and the type (i.e. comprehensive or non-comprehensive) of post warranty maintenance shall be as specified in job specification. The personnel deployed during post-warranty maintenance shall have thorough knowledge of the system and at least two years of experience on the maintenance of similar system. Any other conditions of contract required by vendor shall be explained in the offer.

7.0 SHIPPING

7.1 All the materials used for packing, wrapping, sealers, moisture resistant barriers and corrosion preventers shall be of recognised brands and shall conform to the best standards in the areas for the articles which are packed

7.2 Workmanship shall be in accordance with best commercial practices and requirements of applicable specification. There shall be no defects, imperfections or omissions which would tend to impair the protection offered by the package as a whole.

7.3 The packing shall be suitable for storing in tropicalised climate, the ambient conditions, being specified injob specifications.

7.4 Shipment shall be thoroughly checked for completeness before final packing and shipment. Vendor shall be responsible for any delay in installation or commissioning schedule because of incomplete supply of equipments.

INSPECTION AND

TEST REQUIREMENTS

FOR INSTRUMENTATION

CONTENT

Sl. No.	DESCRIPTION
1.0	Inspection and Tests
1.1	General
1.2	Visual Inspection
1.3	Dimensional Inspection
1.4	Material Inspection
1.5	Non-Destructive Examination
1.6	Pressure Test
1.7	Pneumatic Test
1.8	Seat Leakage Test
1.9	Performance Test
1.10	Steam Test
1.11	Insulation Resistance Test
1.12	High-voltage Test

ATTACHMENT

Sl. No.	DESCRIPTION
Table-A	Table-A- Table of Inspection and Test Items

1. INSPECTION AND TESTS

1.1 General

1.1.1 All instruments and system-oriented items shall undergo factory testing and inspection by authorized Third party representatives / Owner and PMC unless specified otherwise.

1.1.2 Wherever inspection at manufacturer's shop is waived because of any reason, the sub vendor's own testing reports shall be verified before despatch. In no case items shall be released without proper inspection verification.

1.1.3 The inspection and testing shall be carried out as per related specifications, international codes and practices/standards, approved documents and/or any other documents attached along with specifically suggesting testing to be carried out at manufacturer' works.

1.1.4 Items, for which 'Witness Inspection' is specifically exempted, manufacturer shall forward the test certificates as desired for review. The material shall be despatched only after obtaining written despatch clearance.

1.1.5 No system or system oriented item shall be despatched without integrated factory testing witnessed by representatives of / Third party inspector / Owner /PMC. The testing procedures shall be detailed out, based on testing requirements indicated in individual system specifications and shall be approved by Owner/ PMC. It must certify that the system is actually ready before calling the Owner/PMC for FAT. Also all the necessary documents and literature are to be submitted before calling for FAT.

1.1.6 Testing and inspection for all items shall be carried out as per approved factory testing procedures.

1.1.7 Performance specifications must be detailed out on each time which shall be verified by third party agency / by Owner / PMC during factory testing.

1.1.8 Acceptable criteria for Radiography and other NDT requirements for the instruments / instrument castings shall be inline with those specified in 'Piping Specifications' have been attached elsewhere in this package.

1.1.9 IBR certifications shall be provided by in the appropriate format duly signed by IBR authority or their authorised agency.

1.1.10 Verification of setpoint of rupture disc shall be part of witness inspection. Testing shall be carried out on the rupture disc, which are part of the actual rupture disc batch of manufacturer. This shall be in addition to the 3 numbers of spare rupture discs already indicated in the requirements. The testing, in general, shall be as per ASME section VIII.

1.1.11 Inspection and test items, witness inspection items for each kind of instrument at FAT (Factory acceptance test) shall be as shown in Table A.

1.1.12 Inspection and acceptance standards

Inspection and acceptance standards shall be as follows.

1.2 Visual Inspection

1.2.1 Conformation items

1. Type and model
2. Tag no.
3. Rating
4. Range, Scale and symbol of unit
5. Set pressure and capacity of safety valves
6. Valve characteristics and CV value of control valves
7. Name of materials
8. Nameplate
9. Colour of painting
10. Die Marking (nominal size, material of flange and direction of flow)
11. Accessories
12. Quantity

1.2.2 Harmful defects

- Defect such as cracks, deformation and flaws shall not be found in the casting, forging and machined surface of the pressure rating part.
- Defect such as inside surface weld protrusion; lack of fusion and incomplete penetration shall not be found in welded places of pressure retaining part.

1.2.3 The instrument shall be in rugged design and assembly of all components within the enclosure fixed firmly to avoid loosening or falling-off of any parts.

1.2.4 Painting of instrument's surface shall be such that there is no defect or lack of uniformity.

1.3 Dimensional Inspection

[X] Main parts
[ ]
[ ]

Check and conform to the requirement of Purchaser's Spec, approved drawings or applicable code and standards.

1.4 Material Inspection

1.4.1 Mill test certificates

Manufacturer shall submit the mill test certificates for the following parts.

1. ANSI class 900 or above (ALL material used at the P.T. ratings)

2. The following parts made of steel for :
   - High temperature service (Alloy steel above C-Mo steel used at temperature of 400ºC or over)
   - Low temperature service (Iron and steel material of design temperature bellow minus 11ºC containing Al-killed steel)
   - Corrosion-resistant materials

I.	Temperature detective parts	: **[X]**	Flange and Thermowell
II.	Orifice assembly	: **[X]**	Flange
III.	Venturi tube, Flow nozzle and Low-loss tube	: **[X]**	Body
IV.	Positive displacement flow meter and	: **[X]**	Body, Strainer and

	Turbine meter		Straightner
V.	Area type flow meter	: **[X]**	Body and Flange
VI.	Displacement type liquid level meter	: **[X]**	Chamber and Flange
VII.	Glass Gauge	: **[X]**	Body and Flange
VIII.	Control valve	: **[X]**	Valve body, Bonnet, Plug, Seat and Vane
IX.	Safety valve	: **[X]**	Valve body, Nozzle and Disc
X.	Condensate pot	: **[X]**	Body
XI.	Gas eliminator	: **[X]**	Body

1.4.2 Material grade 316SS or 316L SS of stainless steel, Purchaser may require Vendor to carry out the qualitative analysis for molybdenum.

1.5 Non-Destructive Examination

1. Control valve and safety valve
   Following Par. 1.5.2 and 1.5.3

2. Other instruments
   Shall be carried out in accordance with manufacture's standards approved by Purchaser

1.5.1 Ultrasonic Examination

1. Forging material on Orifice flange and Flow nozzle
   [X] ANSI class 900 or above

1.5.2 Radiography Examination

[ ] The pressure retaining casting parts

1. Applicable material and quantity (refer table VI)
   - Welded parts : [ ] JIS Z 3104, Z 3106
     [X] ASME VIII Division 1 uw-51 "Radiographic & Radioscopic Examination of Welded Joints"

2. Acceptant standards and grade
   - Casting : [ ] JIS G 0581
     [X] ASTEM E 446-9 or 186-93

Table VI Radiography Examination

Materials			Quantity
Casting	class 1500 or over	C-steel	One out of total quantity of the same type, size and rating for pressure retaining critical parts(a)
	class 900 or over	C-Mo steel	
	class 600 or over	Cr-Mo steel Stainless steel	
	class 300 or over	Al-killed steel 2.5 Ni steel 3.5 Ni steel	
Pressure retaining welded parts	class 1500 or over	C-steel C-Mo steel	One spot on each welded parts per same material and same welder. All welded crossing parts
	class 300 or over	Cr-Mo steel Stainless steel	
	class 150 or over	Al-killed steel 2.5 Ni steel 3.5 Ni steel	

a. Following parts are Critical parts.
- Groove-welded parts of cast body
- Flange neck and valve seat's vicinity of cast body
- Other welded parts included in pressure retaining parts

Note: 1. In case of practical difficulty to perform Radiography Test, Manufacture shall notify Purchaser in advance, and for such case, magnetic particle or liquid penetrant examination may be used in accordance with Par. 1.5.3 with Purchaser's approval.

2. For the welded parts having nominal size of 1-1/2 in. or below, magnetic particle or liquid penetrant examination in Par. 1.5.3 may be used.

1.5.3 Magnetic Particle or Liquid Penetrant Examination

[X] For the pressure retaining parts

Table VII Magnetic particle / Liquid penetrant examination

Materials			Quantity
Casting	class 900 or over	C-steel	20% of total quantity of the same type, size and rating for pressure retaining critical parts (a)
	class 600 or over	Cr-Mo steel Cr-Mo steel Stainless steel	
	class 150 or over	Al-killed steel 2.5 Ni steel 3.5 Ni steel	
Pressure retaining welded parts (b)	class 150 or over	All materials	20% of total welded parts

a. Refer to Par. 1.5.2(1).
b. Including butt groove-welded parts at site.

1.6 Pressure Test

1.6.1 Control Valve

1. Body and Bonnets

[X] Hydrostatic test with Applicable codes and standards

2. Body of special type

[X] Hydrostatic test

Test pressure and Hold time

[X] 1.5 times of max. Operating pressure / min. 2 kgcm2g
[X] Minimum 5 minutes.

3. Permanent distortion or Leakage

[X] shall not be found

1.6.2 Safety Valve or Safety Relief Valve

1. Pressure retaining parts

[X] Hydrostatic test before assembling

i. Test pressure and Hold time

[ ] 1.5 times of Max. Operating pressure / min. 2 kgf/cm2g.
[X] 2.2 times of Max. Operating pressure.
[X] Minimum 5 minutes.

ii Distortion or leakage
[X] shall not be found

2. The out side parts of enclosed type
[X] Hydrostatic test after assembling

i. Test pressure and Hold time
[X] 1.5 times. Nominal pressure of flange
[ ] 2.2 times. Nominal pressure of flange
[X] Minimum 5 minutes.

ii. Defects
[X] Shall not be found

3. Special type valves

[X] Hydrostatic test with the manufacturer's standards approved by purchaser, where Par. 1.6.2(1) and (2) are not applicable

1.6.3 The pressure retaining parts of instrument

[X] Hydrostatic test or Pneumatic test as per applicable codes and standard

I Test pressure and Hold time
[X] 1.5 time of Max. Operating pressure / Min. 2 kg/cm2g
[X] Min. 5 minutes

ii Permanent distortion or Leakage
[X] Shall not be found

If the above mentioned test is technically difficult, the test shall be carried out in accordance with the manufacturer's standards approved by purchaser.

1.7 Pneumatic Test

1.7.1 The pneumatic test for instrument

I Test pressure & Hold time

[X] Max. Operating Pressure. (Design press.)
[X] Minimum 5 minutes

ii Permanent distortion or Leakage

[X] Shall not be found

1.8 Seat Leakage Test

1.8.1 Control Valve

Allowable leakage valve / (code):

[X] ANSI B16.104 (FCI 70-2)

Unless other wise specified, butterfly valves shall not require the seat leakage test.

1.8.2 Safety valve

Seat leakage test (closing property) as follows.

1. Safety valve for Steam

   i. Test pressure

   [X] 90% of set pressure

   ii. Leakage

   [X] Shall not be found

2. Safety valve for Gas

   i. Test pressure

   [X] 90% of set pressure

   ii. Allowable leakage value (Refer Table – VIII)

Table VIII - Allowable leakage value of Safety valve

Type	Orifice Area (mm)	Number of Bubbles (min)	Leakage Value (cm3/min)
General	16.0 and less 20.5 and over	40 20	11.80 5.90
Balance bellows	16.0 and less 20.5 and over	50 30	14.75 8.85

3. Relief safety valves, Vacuum breakers and atmospheric valve
   [X] Manufacture's standard (approved by Purchaser)

1.9 Performance Test

For each instruments, the performance test shall be carried out in accordance with procedure approved by Client / PMC.
Acceptance standard shall be in accordance with applicable codes & standard, All specification, and manufacture's standard shall be approved by Client / PMC.

1.10 Steam Test

Steam test shall be performed as follows:

[ ] Valves used for steam service Temperature of 450°C or more, and the body ratings of class 600 and above.

[ ] After attaining the steady surface temperature same as temperature of the service with the pressure of service condition.

In the case, when steam test has been performed and the report is submitted for the valve of same type, same bore size and material from the same lot, the steam test for the other valves may be omitted.

1. Leakage

   i. Body : [ ] Shall not be found
   ii. Seat : [ ] As per specified leakage value

2. Operation

   [ ] To be smooth

   After the steam test, the test of Par. 1.6 and Par. 1.8 shall be carried out.

1.11 Insulation Resistance Test

1. Power supply circuit & alarm circuit : 10M Ω or over (instrument panel: 3 MΩ or over/each panel)

2. Signal circuit : 5M Ω or more (instrument panel: 3 MΩ or More per panel)

The test shall be carried out in accordance with the applicable codes & Standards. Due to any technical constraint to measure, this test can be omitted

1.12 High-voltage Test

1. A-C power supply and alarm circuits

   i. Voltage level less than 250 V : **[X]** A-C 1500 V

   ii. Voltage level 250 V and above : **[X]** A-C 2E + 1000V

   'E' is the rated voltage.

2. D-C power supply circuits : **[X]** A-C 500V

   Test can be omitted in case of any technical constraint.

Table A : Table of Inspection and Test Items

Kind of Instrument	Inspection and Test Items										
	Visual insp.	Dimensional insp.	Material insp.	Non-destructive exam	Pressure test	Pneumatic test	Seat Leakage test	Performance test	Insulation resistance test	High voltage test	Steam test
1 Thermocouple	○ ●T	○●T	—	—	—	—	—	□●T	□●T	□●T	—
2 Resistance thermometer bulb	●T ○	●T ○	—	—	—	—	—	●T □	□●T	□●T	—
3 Compensating lead wire	○●T	○●T	—	—	—	—	—	□●T	□●T	□●T	—
4 Bimetallic thermometer	○●T	○●T	—	—	—	—	—	□●T	—	—	—
5 Gas or liquid-filled thermometer	○●T	○●T	—	—	—	—	—	●T □	—	—	—
6 Thermowell	○●T	○●T	○ □●T	○ □●T	○ □●T	—	—	—	—	—	—
7 Orifice plate	○●T	○ □●T	○●T	—	—	—	—	—	—	—	—
8 Orifice flange	○●T	○●T	○ □●T	○ □●T	—	—	—	—	—	—	—
9 Restriction orifice	○●T	○ □●T	○●T	—	—	—	—	—	—	—	—
10 Flow nozzle low-loss tube	○●T	○●T	○ □●T	○ □●T	○ □●T	—	—	—	—	—	—
11 Venturi tube	○●T	○●T	○ □●T	○ □●T	○ □●T	—	—	—	—	—	—
12 Positive displacement flow meter	●T ○	●T ○	●T ○ □	●T ○ □	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
13 Area type flow meter	○●T	○●T	○ □●T	○ □●T	○ □●T	—	—	○ □●T	○ □●T	○ □●T	—
14 Thermal mass flow meter	●T ○	●T ○	●T ○	—	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
15 Turbine meter	●T ○	●T ○	●T ○ □	●T ○ □	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
16 Differential pressure flow meter	●T ○	●T ○	—	—	●T ○ □	—	—	●T ○ □	●T ○ □	●T ○ □	—
17 Differential pressure transmitter	●T ○	●T ○	—	—	●T ○ □	—	—	●T ○ □	●T ○ □	●T ○ □	—
18 Magnetic flow meter	●T ○	●T ○	●T ○	●T ○ □	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
19 Bourdon gauge	○●T	○●T	—	—	○ □●T	—	—	○ □●T	—	—	—
20 Draft gauge	○●T	○●T	—	—	—	—	—	○ □●T	—	—	—
21 Differential pressure gauge	○●T	○●T	—	—	○ □●T	—	—	○ □●T	—	—	—
22 Pressure transmitter	○●T	○●T	—	—	○ □●T	—	—	○ □●T	○ □●T	○ □●T	—
23 Displacement type level indicator, controller	●T ○	●S ○ □	●T ○	●T ○	●S ○ □	—	—	●S ○ □	●S ○ □	●T ○ □	—
24 Chamber for displacement type level meter	○●T	○ □●T	○ □●T	○ □●T	○ □●T	—	—	—	—	—	—
25 Glass gauge	○●T	○ □●T	○ □●T	○ □●T	○ □	—	—	—	—	—	—

Kind of Instrument	Inspection and Test Items										
	Visual insp.	Dimensional insp.	Material insp.	Non-destructive exam	Pressure test	Pneumatic test	Seat Leakage test	Performance test	Insulation resistance test	High voltage test	Steam test
26 Float type level meter,	●T ○	●S ○	●T ○ □	●T ○ □	●S ○ □	—	—	●S ○ □	●S ○ □	●T ○ □	—
27 Differential pressure type level meter	○●T	●T ○	●T ○	—	●T ○ □	—	—	●T ○ □	●T ○ □	●T ○ □	—
28 Purge type level meter	○●T	○●T	—	—	—	—	—	○ □●T	—	—	—
29 Capacitance type level meter	○●T	●T ○ □	●T ○	—	—	—	—	●T ○ □	●T ○ □	●T ○ □	—
30 Conductivity type level meter	○●T	●T ○	●T ○	—	—	—	—	●T ○ □	●T ○ □	●T ○ □	—
31 Conductivity type level meter	●T ○	●S ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—
32 Weight sounding type level meter	●T ○	●S ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—
33 Radiation type level meter	●T ○	●S ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—
34 Pneumatic type control valve	●T ○	●S ○	●T ○ □	○ □●T	●S ○ □	—	●S ○ □	●S ○ □	●T ○ □	●T ○ □	
35 Hydraulic type control valve	●T ○	●S ○	●T ○ □	●T ○ □	●S ○ □	—	●S ○ □	●S ○ □	●T ○ □	●T ○ □	
36 Motor-operated control valve	●T ○	●S ○	●T ○ □	●T ○ □	●S ○ □	—	●S ○ □	●S ○ □	●S ○ □	●S ○ □	
37 Self-acting control valve	○●T	○●T	○ □●T	○ □●T	○ □●T	—	—	○ □●T	—	—	—
38 Indicator	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
39 Recorder unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
40 Controller unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
41 Integrator unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
42 Alarm setting unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
43 Computing unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
44 Converter unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
45 Limiter unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
46 Power source unit	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
47 Instrument panel	●T ○	●S ○	—	—	●T ○ □	●S ○ □	—	●S ○ □	●T ○ □	●T ○ □	—
48 Instrument desk	●T ○	●S ○	—	—	—	—	—	●S ○ □	●T ○ □	●T ○ □	—
49 Gauge board	●T ○	●S ○	—	—	●T ○ □	●S ○ □	—	●S ○ □	●T ○ □	●T ○ □	—
50 Safety valve	●T ○	●S ○ □	●T ○ □	●T ○ □	●T ○ □	—	●S ○ □	●S ○ □	—	—	—
51 Pilot operated safety relief	●T	●S	●T	●T	●T	—	●S	●S	—	—	—

Kind of Instrument	Inspection and Test Items										
	Visual insp.	**Dimensional insp.**	**Material insp.**	**Non-destructive exam**	**Pressure test**	**Pneumatic test**	**Seat Leakage test**	**Performance test**	**Insulation resistance test**	**High voltage test**	**Steam test**
valve	○	○ □	○ □	○ □	○ □		○ □	○ □			
52 Vacuum breaker	●T ○	●S ○ □	●T ○ □	●T ○ □	●T ○ □	—	●S ○ □	●S ○ □	—	—	—
53 Atmospheric valve	●T ○	●S ○ □	●T ○ □	●T ○ □	●T ○ □	—	●S ○ □	●S ○ □	—	—	—
54 Gas chromato-graph	●T ○	●T ○	—	—	—	●T ○ □	—	●S ○ □	●S ○ □	●T ○ □	—
55 Mass spectro-meter	●T ○	●T ○	—	—	—	●T ○ □	—	●S ○ □	●S ○ □	●T ○ □	—
56 Infrared type gas analyzer	●T ○	●T ○	—	—	—	●T ○ □	—	●S ○ □	●S ○ □	●T ○ □	—
57 Magnetic type gas analyzer	●T ○	●T ○	—	—	—	●T ○ □		●S ○ □	●S ○ □	●T ○ □	—
58 Thermal conductivity type analyzer	●T ○	●T ○	—	—	—	●T ○ □	—	●S ○ □	●S ○ □	●T ○ □	—
59 Combustion type gas analyzer	●T ○	●T ○ □	—	—	—	●T ○ □	—	●S ○ □	●S ○ □	●T ○ □	—
60 Density type gas analyzer	●T ○	●T ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—
61 Photo-electric type analyzer	●T ○	●T ○	—	—	—	—	—	●T ○ □	●T ○ □	●T ○ □	—
62 Moisture analyzer	○●T	●T ○	—	—	—	—	—	●T ○ □	●T ○ □	●T ○ □	—
63 pH meter	○●T	○●T	—	—	—	—	—	○ □●T	○ □●T	○ □●T	—
64 Turbidity analyzer Water quality analyzer	●T ○	●T ○	—	—	●T ○ □	—	—	●T ○ □	●T ○ □	●T ○ □	—
65 Density meter	○●T	○●T	—	—	○ □●T	—	—	○ □●T	○ □●T	○ □●T	—
66 Electric conductivity meter	○●T	○●T	—	—	○ □●T	—	—	○ □●T	○ □●T	○ □●T	—
67 Flame detector	●T ○	●T ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—
68. Mass Flow meter	●T ○	●T ○	●T ○ □	●T ○ □	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
69. Vortex Flow Meter	●T ○	●T ○	●T ○ □	●T ○ □	●T ○ □	—	—	●S ○ □	●T ○ □	●T ○ □	—
70 Gas detector	●T ○	●T ○	—	—	—	—	—	●S ○ □	●S ○ □	●T ○ □	—

○ : Tested by Manufacturer.
● : Tested by manufacturer & witnessed by 3rd party inspector(TPI).
□ : Manufacturer will submit Inspection & test records.
T : Total Inspection by TPI.
S : Sample inspection by TPI.(10% of total quantity of the same type & rating.

Notes: PMC/OWNER may witness any or all testing in stages during manufacturer or at final stage before shipment.

10.0 INFORMATION TO BE FURNISHED BY BIDDER:

- Bidders are required to furnish all information regarding the new proposed flare system. Inability to furnish the information mentioned below, is discouraged from selection point of view :

A) Information on Overall Basis:

i) Description of the flare system with sizes of main equipment / components.
ii) Radiation intensity at the Base of the Flare Stack.
iii) Pressure Drop profile in the flare system, i.e. pressure drop break-up in a) Flare Tip, b) Molecular seal, c) Flare Stack pipe d) Knock-out Drum & e) Piping
iv) Total flare height (from ground level), to be confirmed by Bidder.
v) Flare exit velocity
vi) VOC (volatile organic compounds) heating value
vii) NOx at the exit of Flare Tip.
viii) Nominal Diameter of Flare Tip to be confirmed by Bidder.
ix) Noise Level at 90 m Sterile Boundary
x) Detail utilities requirements like,

a) Fuel NG or LPG for pilot burnersPlant air
b) Instrument air
c) LP Steam
d) Electricity
e) Nitrogen for purge
f) Nitrogen for Tempurge
g) Service water

The above requirements to be given separately for

- Design case (Worst Case)
- Case of Ignition of Flare (Normal operation)

B) Detail Information

i) Flare Tip :

- Tip exit velocity
- Mach No.
- Pressure drop in Flare Tip
- Consumption of fuel gas / pilot burner
- Length (height) of flare tip
- Operating temperature & operating pressure
- Nominal Diameter of flare tip
- Material for, Tip/ Wind shield / Flame stabilizers
- Number of pilots
- Size of pilot
- Material for, burner nozzle/ ignition pipe

ii) Molecular Seal :

- Height x Diameter
- Inlet / outlet Nozzle sizes
- N_2 connection provided, size
- Drain connection (external), size
- N_2 reqd. for purging,
- Nitrogen required forTempurge,

- Pressure drop in molecular seal

iii) Flare Stack Pipe:
- Height (length) x diameter
- Provision of lifting lugs
- Platform provided for access to flare stack?
- Ladder provided for access to flare stack?
- Pressure drop in stack pipe

iv) Knock – Out Drum :
- Dimensions, height / diameter
- Internals
  - Steam coils dimensions / Surface area requirement
  - Baffle plates
- Condensate outlet system
- Control arrangement for introducing LP Steam.
- Pressure drop in knock out drum

C) Utilities Requirements & other information :
- Heat Release from flare tip, maximum / design
- Flame length, maximum / design
- Plant Air, instrument air Consumption
- Nitrogen Consumption for Tempurge
- N_2 Consumption for purging
- MP/LP Steam consumption
- Electrical power consumption

The above information required for maximum / design case and during Pilot Burner ignition case.

11.0 EXCLUSIONS:

The following are excluded from the Bidder's scope of work.

a. Supply of Instrument Air, power (power except Air blower) & other utilities upto flare system battery limit.
b. Operating staff are excluded, but operation supervisors and maintenance personnel shall be arranged by the Bidders during Pre- Commissioning, Commissioning & plant trial runs.

12.0 QUALITY ASSURANCE & CONTROL:

a. Quality Assurance (QA) shall mean the organizational set up, procedures as well as test methods and facilities to be developed by the bidder in order to assure that all equipment leaving bidder's/ manufacturer's shop are of the highest possible quality that is either equal to or better than the specified requirement.

b. Quality control (QC), shall mean all the tests, measurements, checks and calibration's which are to be carried out at bidder's/ manufacturer's shop in order to compare the actual characteristics of the equipment/ unit/ system with the specified ones, along with furnishing of the relevant documentation (certificates/ records) containing the data or result of these activities.

c. Bidder shall submit a comprehensive description (manual) of QA/QC measures contemplated by him for implementation with regard to this specification. It is contractual obligation of the bidder to develop and implement adequate QA/QC systems.

d. QA/QC system shall cover all products and services of the contract i.e. documentation material, shop and site fabrication, transportation and site works, including job sub contracted by the bidder.

13.0 PROGRESS REPORTING:

Bidder shall prepare a monthly progress report under the following broad heads, indicating schedule and actual status of individual items and submit it to the Owner/PMC as per the Performa in standard milestone chart.

- Basic Design
- Detailed Engineering
- Procurement (Ordering)
- Manufacture
- Delivery
- Construction
- Mechanical Completion
- Pre-Commissioning
- Commissioning
- Plant trail runs

SECTION – VI – 14.0

CONSTRUCTION/ERECTION, PRE-COMMISSIONING, COMMISSIONING AND START-UP

PLANT: **AMMONIA-UREA PLANT BASED ON COAL GASIFICATION**

PROJECT: **INTEGRATED COAL BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)**

0	01.09.2022	Issued for Tender	JKY	DKC	RRK
REV	REV ATE	PURPOSE	PREPD	REVWD	APPD

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Sl. No.	DESCRIPTION	
1	General Scope of Works and Services Construction / Erection	
2	General Scope of Works and Services Pre-commissioning	
3	Basic Plan for Temporary Services	
4	Mechanical completion	
5	Commissioning	
6	Start up	

LIST OF ANNEXURES

ANNEXURE NUMBER	DESCRIPTION	NUMBER OF SHEETS
ANNEXURE-7-1	LSTK Contractor's Work Definition	
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1 General scope of Work and services - Construction/Erection

LSTK CONTRACTOR shall be responsible for construction and erection of the Plant/ Unit including but not limited to the following:

1.1 Construction and erection of Plant/Unit and perform all other activities required to be performed for implementation of the WORK.

1.2 Provide and supply in due course all construction Equipment and Materials, tools, and temporary facilities necessary for implementation of the WORK.

1.3 Establish and operate adequate material control system in site for receipt, unloading, inspection, maintenance, handling, storage and utilization to ensure all Equipment and Materials are preserved and available as necessary for completion of the Plant/Unit.

1.4 Provide and supply all staff, tradesmen and labours for implementation of the WORK.

1.5 Establishment of overall construction policy and procedures for the Plant/Unit.

1.6 Provision of overall management and control of construction phase of the Plant/Unit.

1.7 Ensuring that all parts of the Plant/Unit are constructed and tested strictly in accordance with the specifications and applicable codes and standards asked for in the project documents.

1.8 Ensuring that construction is accomplished in accordance with the schedules.

1.9 Provide transportation of all Equipment and Materials to be provided and supplied by LSTK CONTRACTOR under the CONTRACT either from inside or outside to Site.

1.10 Construct, operate and maintain all temporary facilities required for its personnel involved in the WORK.

1.11 Provide transportation in the area of the Site and between Site and temporary facilities for all its personnel involved in the implementation of the WORK, including field labour, administrative staff, etc.

1.12 Recruit field and organize, manage and supervise its Sub Contractors and field labour for the WORK.

1.13 Provide liaison with OWNER, Sub Contractors, Licensors and Vendors to ensure that the Plant/Unit is constructed in accordance with the respective standard and specifications, set forth in the CONTRACT.

1.14 Establish with OWNER adequate procedures, control and reporting systems to provide close control of the progress of the WORK.

1.15 Provision of labour and facilities for loading, unloading and transportation of the Equipment within the site area.

1.16 Performance and/or provision of all other works and/or services required for performance of the WORK.

1.17 Execution of the whole civil, structural and building works of the Plant/Unit and/or utilities and off-site facilities.

1.18 Prefabrication of piping spools in a shop on the Site.

1.19 Erection and installation of EQUIPMENT and auxiliary facilities associated with the Plant/Unit.

1.20 Erection and field fabrication of structural steelwork, cladding ladders, handrails, stairs and platform of the Plant/Unit and/or utilities and off-site facilities.

1.21 Installation of pipe work including field fabrication at site.

1.22 Installation and testing of all instrumentation network and equipment of the Plant/Unit.

1.23 Installation and testing of electrical system and equipment of the Plant/Unit.

1.24 Installation of rubber lining, refractory brick lining & C-Brick lining, FRP/PVC/HDPE lining, as required for the Plant/Unit.

1.25 Painting of steelworks, piping, Equipment and building of the Plant/Unit.

1.26 Maintenance of construction equipment, vehicles and tackles of the Plant/Unit, during construction and erection period.

1.27 Pre-commissioning, Commissioning and Start-up of the Plant/Unit.

1.28 Carrying out Mechanical Completion.

1.29 Perform all material identification as per application codes and standards.

1.30 Provide winterization during construction.

1.31 Provide drawings and documents as required.

1.32 Supply to OWNER complete test records within three (3) days after completion of actual testing.

1.33 Installation and testing of all underground piping, if any.

2.0 General scope of WORK and Services- Pre-commissioning

LSTK CONTRACTOR shall be responsible for the pre-commissioning phase of the Plant.

LSTK CONTRACTOR shall provide at SITE an adequate number of qualified pre-commissioning engineers to direct and control pre-commissioning activities.

LSTK CONTRACTOR shall also ensure that all special tools and test equipment required for pre-commissioning are available at its own cost.

LSTK CONTRACTOR shall provide adequate construction labour, construction tools and equipment for pre-commissioning.

Pre-commissioning which shall be performed by LSTK CONTRACTOR shall include, but not limited to the following:

2.1 Cleaning, flushing, draining blowing out, steaming out, drying and purging of Equipment and their linings and piping systems, including the installation and removal of temporary blinds, strainers, screens etc., and the replacement of all permanent items removed while the WORK is in progress.

2.2 Chemical cleaning wherever required, including but not limited to compressor suction piping and lube and seal oil piping, heaters, supply of chemical and disposal of wastes.

2.3. Chemical cleaning of feed water systems, and steam systems. Supply of chemical and disposal of wastes.

2.4 Chemical cleaning of any other parts, which have corroded to an extent, which, will detrimentally affect Plant/Unit performance or run length for such reasons as increased fouling due to rust. Supply of chemical and disposal of wastes.

2.5 Checking, Testing, calibration simulation test and adjustment of instruments, equipment and systems including control valves and safety devices, and installation and checking of orifices plates and other sensor devices in so far as this can be done before actual operation of the item concerns of complete system and loops.

2.6 Function test and checking out of electrical systems including substations, transformers, cables and switchgear, checking of all interlocks and setting of all relays. This shall include drying out operations, filtering of oil if required.

2.7 For motor driven equipment, amperage checking of motors and removal of temporary safety screens.

2.8 Cleaning of screens and filters replacement and adjustment of packing and seals and tightening of flanges.

2.9 Introduction of fuels.

2.10 Introduction of lubricants and oil flushing for machinery.

2.11 Introduction of chemical into and initial operation of treatment plant.

2.12 Boiling out, bringing up to pressure and performing all required code tests on steam generation facilities and associated instrumentation.

2.13 Drying out of stacks and all refractory lined equipment.

2.14 For all piping systems, installation and removal of temporary blinds as required, circulation and commissioning of systems including process systems, services, effluent and drainage, utilities distribution, relief and blow down and interconnecting lines.

2.15 Test running of all other rotating equipment for 24 hours wherever possible.

2.16 Adjustment of all piping expansion and support devices.

2.17 Air-drying of Plant/Unit, which is required to be water-free.

2.18 Testing (including running, tightness and vacuum) of systems, as necessary to ensure that the sections and components of Plant/Unit are ready for operation.

2.19 All such further works which LSTK CONTRACTOR judges to be necessary or in the reasonable opinion of OWNER is necessary to bring the Plant/Unit to a state of readiness for the introduction of feedstock into Process Plant/Unit for processing requirements and for safe commencement of operation.

3.0 Basic Plan for Temporary Services

Temporary Construction Facilities

The LSTK shall arrange following facilities at his own cost for Construction/Erection purpose. Demolition and cleaning of temporary facilities developed for construction purpose shall also be under LSTK Contractor's scope.

1. 1 No. 11 kV Feeder (rated for 2 MVA) at Existing Substation near 132 KV Switchyard shall be made available. Tapping of Construction Power (on chargeable basis) from this feeder (including supply & erection of all required materials like structural supports for cable tray, cable trays, power cables, control cables, protection & metering, cable termination etc. as well as underground cabling work) and further distribution shall be in LSTK Contractor's scope.
2. Construction Water (on chargeable basis) shall be made available
3. Construction sheds

4. Construction offices
5. Temporary Communication facilities
6. Office furniture
7. Labour colony during construction.

3.1 Sewage & Refuse Disposal

All temporary building like site office, canteen etc. shall be provided with individual septic tanks and soak pits for treatment and disposal of sanitary sewers. Construction site shall be provided with a network of temporary drain for disposal of rain water.

4.0 Mechanical Completion

Mechanical Completion means the time when all construction, erection & installation work per finally approved P&ID after HAZOP study and pre-commissioning related to the Plant is completed in accordance with the Project drawings and specifications, and all mechanical and pressure tests, including but not limited to hydro-testing, non-operating adjustments, cold alignment checks, final cleanup, hot bolting, refractory drying, field calibration of safety valves, calibration of all instruments, instrument loop checking and testing, monitoring / control / safety systems checking and testing, and all pre-commissioning activities have been completed, all incoming & outgoing services and utilities have been connected to each unit of the PLANT, interconnections of process lines and interconnection are completed and the Plant/Unit is ready in every respect for commissioning and for the first introduction of feed materials.

When OWNER is satisfied that Mechanical Completion of the plant has been achieved, OWNER shall issue certificate of Mechanical Completion to CONTRACTOR in accordance with the CONTRACT for Owner's Approval.

In order to meet this, LSTK CONTRACTOR shall perform all necessary mechanical works, tests and checks.

5.0 COMMISSIONING

5.1 **Schedule for Commissioning**

LSTK CONTRACTOR shall prepare a schedule for commissioning, start-up, and performance testing and initial operation in conjunction with OWNER. This shall be issued at least three months before pre commissioning of the first facility.

This schedule shall include all activities as detailed herein and any other special activities, which require to be performed during commissioning.

5.2 **Commissioning**

LSTK CONTRACTOR shall be responsible to perform commissioning of the Plants and to provide necessary facilities during commissioning of the Plant including the Performance Tests. LSTK CONTRACTOR shall provide commissioning engineers and supporting staff and adequate commissioning labour. LSTK Contractor shall associate OWNER's engineers and operating staff with the commissioning work.

6.0 START UP

LSTK CONTRACTOR shall be responsible to perform start-up of the Plant/Unit. LSTK CONTRACTOR shall provide necessary facilities and for Start Up of the PLANT.

NOTE:

Detail COTRACTOR'S scope of work in relation with the construction / erection, and pre-commissioning, commissioning and start-up from the point of scope of execution as well as performing way are described in detail in the following Sub-Annexes of Section-7.0.

Sub-Annexure:

Annex 7 - 1 : LSTK Contractor's Work Definition

Annex 7 - 2 : Detail Technical Scope

Annex 7 - 3 : Quality Control Procedures and Inspection Requirement

Annex 7 - 4 : Schedule Progress Evaluation and Progress Reporting

Annex 7 - 5 : General Notes

ANNEXURE-7-1

LSTK CONTRACTOR'S WORK DEFINITION

LSTK CONTRACTOR shall perform/provide the following activities but not limited to:

1. LSTK CONTRACTOR scope of work shall broadly consist of construction / erection, refurbishing, pre-commissioning, commissioning and Start Up of the Plant under the management of commissioning team it includes but not limited to civil works, fabrication & erection of structural steelwork, field assembly, mechanical erection and / or assembly and installation of all equipment and machinery, piping, electrical systems and network, instrumentation, insulation, painting, etc., except in so far as "Contract" otherwise provides, the provision of all temporary facilities, staff, tradesmen, labour, tools, tackle, construction equipment and materials, insurance, consumables and everything whether of temporary or permanent nature necessary and required in and for the work, so far as the necessity for providing the same is specified or reasonably inferred in or from the contract.

2. Perform all civil and building works as per Annex7 - 2A, titled civil and building works.

3. Perform all structural steel works as per Annex 7 - 2B, titled structural steelwork.

4. Perform all piping fabrication and erection works as per Annex7 - 2C, titled piping fabrication and erection work.

5. Perform all equipment erection works as per Annex 7 - 2D, titled equipment erection work.

6. Perform all electrical works as per Annex7 - 2E, titled electrical work.

7. Perform all instrumentation works as per Annex 7 - 2F, titled instrumentation works.

8. Perform all insulation works as per Annex 7 - 2G, titled insulation works.

9. Perform all painting works as per Annex 7 - 2H, titled painting Specification/work**.**

   Supply the materials in order to execute WORK as per CONTRACT.

10. LSTK CONTRACTOR shall be responsible for providing services and materials for construction of all temporary facilities, which are essential for successful completion of construction and erection.

    The LSTK CONTRACTOR shall establish, operate and maintain all temporary facilities, such

as, but not limits to:

a) Labour camp/officers camps

b) Fabrication shops/yard

c) Workshop for maintenance of construction/testing equipment.

d) Field drawing office

e) Temporary warehouses, including open storage yards.

f) Construction offices (including facilities for photocopying, drawing reproduction, etc.)

g) First aid along with ambulance

h) Lab facilities, including NDT, for testing calibration, etc.

i) All temporary or approach roads for carrying out the WORK including temporary approach roads for access to LSTK CONTRACTOR'S site office/workshop/camp, etc. ground preparation for heavy lifts including approaches to cranes for heavy lifts. OWNER does not take any responsibility for making temporary roads.

j) Canteen & catering facilities for all LSTK CONTRACTOR'S work force.

k) All drainage around the facilities created for his WORK, and sewage disposal arrangements for labour camps/officers camps, site offices, etc.

l) Necessary transport for movement of its personnel, construction Equipment and Materials, consumables, etc.

n) Watering of roads through water tankers for dust suppression.

o) All temporary lighting for working during night.

p)All temporary hutments, sanitary & potable water and domestic sewerage requirements of LSTK Contractor's work force.

11. Supply to OWNER complete survey report within three (3) working days after completion of any survey.

12. All excess soil shall be disposed of by LSTK CONTRACTOR outside the premises in a location designated by OWNER representative.

13. Perform all nondestructive, hydrostatic and pre commissioning testing required.

14. Supply to OWNER complete test records within three (3) days after completion of actual testing.
15. Perform all welding including radiography required.
16. Provide drawings and documents as required.
17. Provide mobilization and demobilization, temporary material and temporary facilities and utilities required executing work.
18. Provide winterization during construction.
19. Provide scheduling, planning and reporting as per CONTRACT.
20. Keep complete administration and control of work, specified in CONTRACT.
21. Provide maintenance on all construction and permanent plant material as required during the CONTRACT period.
22. Perform all material identifications as per CONTRACT.
23. Perform all transportations as required.
24. Perform quality assurance, control and supply quality control documentation.
25. Perform all pre-commissioning activities as defined in the CONTRACT.
26. Provide and supply all procedures for execution of the work in accordance with drawings specifications, and applicable codes and standards.
27. Perform all other works and activities and supply all other materials which are required for completeness of the Work either mentioned in the CONTRACT or they are necessary for completeness of the work, in compliance with highest available standards and good quality.

ANNEXURE- 7 - 2

DETAIL TECHNICAL SCOPE

See accompanying by discipline

Annexure-7 - 2A	Civil and Building work
Annexure-7 - 2B	Structural steel work
Annexure-7 - 2C	Pipe prefabrication and Erection
Annexure-7 - 2D	Equipment erection
Annexure-7 - 2E	Electrical work
Annexure-7 - 2F	Instrumentation work
Annexure-7 - 2G	Insulation work
Annexure-7- 2H	Painting work (For detail refer **TS-2001**)

ANNEXURE- 7 - 2A

CIVIL AND BUILDING WORK

1.0 **SURVEYING**

1.1 Base line and base elevation will be furnished to LSTK CONTRACTOR. LSTK CONTRACTOR will furnish all surveys from this base line and elevation.

1.2 OWNER shall have the authority at anytime to determine, in accordance with the drawings or written directives, the correctness on completeness of the lines in use by LSTK CONTRACTOR.

1.3 Any erroneous WORK shall be corrected to OWNER'S satisfaction at LSTK CONTRACTOR'S expense.

2.0 **SITE**

Finish grading elevation to be as shown on drawing.
LSTK CONTRACTOR'S access to the WORK areas shall be via existing roads.
Any other roads required by LSTK CONTRACTOR are to be developed by LSTK CONTRACTOR.

3.0 **EXCAVATION AND BACKFILL**

3.1 **Excavation**

- Provide all excavation by machine or by hand according to the specifications.

- Excavation is to be executed by LSTK CONTRACTOR in a manner that will provide adequate space for performance, inspection and timely completion of the WORK. Supply dewatering as required. The method of dewatering shall be subject to Approval by OWNER.

- Temporary water drainage routing requires prior Approval by OWNER.

3.2 **Backfill**

All backfills shall be according to the specifications.

All excavations shall be kept dry and workable prior to and during backfiring and compacting.

Material that LSTK CONTRACTOR excavates in the course of WORK and which can be used for backfill, must be approved by OWNER prior to use. All other backfill material as required in this scope of work, drawings and specifications, shall be supplied by LSTK CONTRACTOR.

Back filling shall be to ground level as shown on drawing. The placing of backfill may only

start after approval by OWNER.

LSTK CONTRACTOR will inform OWNER to arrange for the required proctor tests. Tests shall be done by OWNER on his account.

4.0 PILES AND CONCRETE FOUNDATIONS

4.1 Install Piles and major and minor concrete foundations in accordance with the specification and drawings.

4.2 Blinding to Underside Foundation Work

Prior to placing a blinding layer of concrete, LSTK CONTRACTOR shall supply, place, compact and prepare the surface of excavated area. After this LSTK CONTRACTOR shall supply a blinding layer of concrete. Blinding layer to be in accordance with specifications and / or drawings.

4.3 Reinforcement of Concrete

Cut and bend to bar bending schedules, all type of reinforcing bars.

Store and protect all reinforcing bars against corrosion and any other deleterious effects prior to placing.

Installation of reinforcement including installation of spacers, supports, tying, wire in accordance with the specifications and drawings.

4.4 Anchor Bolts

Install all anchor bolts, in accordance with the specifications and drawings.

The following WORK is included but not limited to LSTK CONTRACTOR'S scope for installation of anchor bolts:

- Deliver of all templates.
- Store and protect against corrosion and any other deleterious effects.
- Place anchor bolts accurately in formwork or by templates, if required, or in pockets.
- Clean and grease anchor bolts threads after Concrete pour and protect bolts after greasing with plastic covers.

4.5 Inserted and Embedded Item

Install all concrete inserts and embedded items, including but not limited to the following items in accordance with the specifications and to the detail drawings to be furnished by LSTK CONTRACTOR.

- Cement - In sockets.
- Cinch anchors.

- Steel sleeves, various size angle.
- Channel shapes with anchors. Curb angles and steel plates.
- Anchor rails.
- Pipe sleeves of heavy duty PVC pipe.

The WORK shall include but not limited to:

Store and protect against corrosion and damage place accurately in Formwork or by templates, if required, or by temporary bars for proper positioning.

4.6 The following WORK is included but not limited to LSTK CONTRACTOR'S scope for installation of major and minor foundations:

- All excavation, including sheet piling, if required, backfill, compacting and the transportation of surplus material, neatly stockpiled at a location, chosen by LSTK CONTRACTOR and approved by OWNER. The supply, installation and maintenance of a complete concrete batch plant, including concrete testing laboratory. Installation of selected backfill material, if required. Supply and delivery and installation of all formwork, assembly and disassembly of all reusable formwork, inclusive if any and all required supporting, bracing, pockets, cutouts, recesses, etc.

- Bending and installation of concrete reinforcement bars to the requirements and supply of items as defined in 4.3 above.

- Installation of all anchor bolts (including fabrication of templates), to the requirements and supply of items as defined in 4.4 above.

- Installation of embedded and inserted items, to the requirements and supply of items as defined in 4.5 above.

- Installation of construction and expansion joints where required.

- Mixing, delivery and pouring of concrete in accordance with specifications. Stripping of formwork and removal of all surplus material to LSTK CONTRACTOR'S yard or locations designated by OWNER.

- All temporary storage of formwork at SITE shall be of an orderly nature. In case storage does not comply with the above-mentioned rule, OWNER shall have the right to remove formwork from SITE within forty eight (48) hours after first warning and back charge LSTK CONTRACTOR for all related costs. OWNER shall not be held responsible for any of LSTK CONTRACTOR'S losses.

- The finishing of concrete, where required to a finish in compliance with the specifications.

A copy of all-concrete mix truck delivery slips if applicable.

Concrete composition analysis of the concrete batch plant.

All scaffolding required.

All required dewatering to keep the excavations / backfill dry for the WORK.

5.0 CONCRETE STRUCTURES AND ELEVATED SLABS

Install concrete structures, in accordance with the specifications and drawings.

6.0 The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of concrete elevated slabs:

See 4.6; however with -following exceptions: No-excavation, no backfill and- no dewater

7.0 YARD PAVING AND FINAL SURFACING

7.1 Excavation

Setting out and grading by machine and/or by hand for yard paving to the shape and depth in accordance with the specifications and drawings.

Disposal of all excavated material and neatly stock piling to a location chosen by LSTK CONTRACTOR and approved by OWNER.

7.2 Concrete Yard Paving

- Mix and install concrete for heavy duty paving areas, in accordance with the specifications and drawings.

- Mix and install concrete for light and medium duty paving areas in accordance with the specifications and drawings.

- The following work is included but not limited to LSTK CONTRACTORS scope for installation of concrete yard paving: See 4.6 above

- Surface preparation, including the supply and placing of waterproof building paper or similar waterproof material, well lapped at joints, laid on top of the well compacted sand layer and before pouring concrete.

- Reinforcement for heavy duty paving at top and bottom face and for light duty paving at top face only, with square mesh fabric reinforcement including protection against corrosion, the cutting, the bending and placement.
- Mixing and pouring of concrete in accordance with specifications, sufficient vibrating. Stopping clear from bases, plinths and piers and forming around surface and lay to give levels and falls.

- Installation of construction / expansion joints.

7.3 **Unpaved Areas**

Install gravel, tiles or crushed stone on leveled unpaved areas, all in accordance with the specifications and drawings.

7.4 **Concrete Tiles for Walkways**

Install well compacted sub-base layer and install the tiles on the sub-base all in accordance with specifications and drawings.

8.0 **CONCRETE PIPE SLEEPERS**

Fabricate and install reinforced concrete sleepers for pipe, complete with foundations in accordance with the specifications and drawings.

9.0 **MANHOLES AND CATCH BASINS, TRENCHES**

9.1 Fabricate and install pre-cast or formed and poured in situ concrete manholes and catch basins and trenches in accordance with the specifications and drawings.

9.2 The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of manholes and catch basins. All excavation including sheet piling of required, backfill, compacting and the transportation of surplus material, neatly stockpiled at a location, designated by LSTK CONTRACTOR and approved by OWNER.

For Poured in Site

- Delivery and installation of all formwork, inclusive if any and all required supporting, bracings, pockets, cutouts recesses etc.
- Bending and installation of concrete reinforcement bars to the requirements and supply of items as defined in 4.3 above.
- Fabrication and installation of embedded and inserted items, if any, to the requirements and supply of items as defined in 4.5 above.
- Mixing and pouring of concrete in accordance with specifications.
- Stripping of formwork and removal of all surplus material to LSTK CONTRACTOR'S yard or locations designated by OWNER.
- All required dewatering to keep the excavations *I* backfill dry for installation work.
- Install cast - iron manhole frames and solid cover and fabricate and install steelwork catch basin grating and frames in accordance with specifications.

10.0 **COLLECTION BASINS, PITS, SUMPS, RETAINING WALLS AND CULVERTS**

10.1 Fabricate and install concrete collecting basins in accordance with the specifications and drawings.

10.2 Fabricate and install concrete sumps and pits in accordance with the specifications and drawings.

10.3 Fabricate and install concrete walls around tanks and other retaining walls in accordance with the specifications and drawings.

10.4 Fabricate and install concrete pipe and bridge culverts including head walls in accordance with the specifications and drawings.

11.0 **DITCHES AND TRENCHES**

11.1 Fabricate and install earthen and concrete ditches and trenches including connection pipes and boxes in accordance with the specifications and drawings.

12.0 **STEEL SLIDING PLATES AND PTFE SLIDING PLATES**

12.1 **Steel Sliding Plates**

- Fabricate and install steel sliding plates in accordance with specifications and drawings.
- The following work is included, but not limited to LSTK CONTRACTOR'S scope for fabrication and installation of steel sliding plates
- Pick up materials, storage and protection against corrosion and any other deleterious effects.
- Fabricate, place in pockets, level and grout, protect against possible damage and corrosion.

12.2 **PTFE Sliding Plates**

- Install sliding plates, in accordance with the specification and drawings.

The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of sliding plates pick up materials, transport, store and protect

- Place in pockets, level and grout, protect against possible damage.

13.0 **GROUTING**

13.1 Mix and install grouting in accordance with the specifications and drawings.

13.2 LSTK CONTRACTOR shall grout under all structural steel columns and under all equipments, as specified.

13.3 The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of grouting:

- Prepare top surface of base and /or plinth, pockets, sleeves etc., prior to placing grout.
- Mix and install grout mortar in accordance with specifications.

- Grout mortar shall be used between steel base plate and concrete foundations.

- Mix and install non-shrink grout between reciprocating rotary equipment base frame including the filling of the equipment steel frame, if required, and concrete foundation in accordance with manufacturer specifications and project specifications.

13.4 Grouting of equipment shall proceed only when equipment setting has been accepted by OWNER.

14.0 ASPHALT PAVING

14.1 Mix and install asphalt paving over base courses installed by LSTK CONTRACTOR, in accordance with the specifications and drawings.

- Roads/ Driveways/ Parking areas/ Sidewalks/ Tank pads

14.2 The following work is included but not limited CONTRACOR'S scope for installation of asphalt paving to.

- Installation of all materials necessary to make a complete installation.

- Installation of sub-grade, sub-base and base courses all properly compacted.

- Delivery and installation of all formwork, inclusive if any and all required supporting, bracing, pockets, cutouts, recesses, etc.

- Installation of expansion joints where required and/or construction joints

- Stripping of formwork and removal of all surplus material to LSTK CONTRACTOR'S yard or locations designated by OWNER.

- Mixing, delivery, installation, spreading and compaction of asphalt paving mixture in accordance with specifications.

- Any and all measures for proper asphalt paving installation and curing.

15.0 ROAD REPAIR AND MAINTENANCE

15.1 Supply and deliver necessary materials, equipments and labour to repair and maintain all plant roads, as necessary.

- Repair work shall be in accordance with the specifications.

- LSTK CONTRACTOR shall be responsible for repair of roads, all on the indication of OWNER due to the damage to the roads, caused by LSTK CONTRACTOR'S activities and construction operations, or due to faulty construction by LSTK CONTRACTOR. LSTK

CONTRACTOR is not entitled for compensation for such repair work.

16.0 **REPAIR OF DYKES, SLOPES AND DITCHES**

16.1 Supply and deliver necessary materials, equipment and labour to effect repairs on dykes, slopes and ditches as necessary.

- Repair WORK shall be in accordance with the specifications.

- LSTK CONTRACTOR shall be responsible for repair of dykes, slopes and ditches all on the indication of OWNER'S representative, due to damage to the dykes, slopes and ditches caused by LSTK CONTRACTOR'S activities and construction operations, or due to faulty construction by LSTK CONTRACTOR.

- LSTK CONTRACTOR is not entitled for compensation for such repair work.

17.0 **UNDERGROUND SEWERS AND PIPING SYSTEMS**

17.1 Install the underground piping systems, in accordance with the specifications and drawings.

17.2 The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of underground piping systems.

- Excavation including sheet piling, if required, backfill, compacting and the transportation of surplus material, neatly stockpiled at a location designated by LSTK CONTRACTOR and approved by OWNER.
- Installation of sand backfill if required

- Receiving unload, inspect and transport LSTK CONTRACTOR'S supplied materials and store and protect.

- Installation of piping materials necessary for a complete installation.

- The installation of above ground fire hydrants, fire monitors and standpipe as well as the underground firewater system.

- The fabrication and installation of supports and thrust blocks for the piping as required.

- Surface preparations and installation of coating and wrapping of the underground piping, if required as per Technical specification Mentioned in **Annexure- 7 - 2C**

- Installation of glass fiber reinforced epoxy piping in accordance with manufacturer's instructions as well as the specifications.

- Hydrostatic pressure testing of the underground piping systems including test apparatus,

test piping, test blinds, bolts and gaskets in accordance with the specifications.

17.3 **Hydro Testing of Sewers and Underground Lines**

- Tests all sewers and underground piping systems as per test instructions. Testing is to be witnessed and approved by OWNER. A test schedule by test system shall be prepared by LSTK CONTRACTOR. Testing and completion shall be in accordance with project system priorities.

- Piping systems shall be tested with suitable water.

- Develop test system procedures and follow priorities established by OWNER. LSTK CONTRACTOR shall prepare detailed schedules based on this data for submittal to OWNER for his approval.

- The water for testing purposes is to be provided by LSTK CONTRACTOR.

- Inexpensive temporary gaskets shall be used in place of permanent gaskets where test blinds are located for hydrostatic testing. On successful completion of a test, the permanent gasket shall be installed when the blinds are removed.

- After hydro testing, LSTK CONTRACTOR shall perform the following activities:

- Flushing
- Remove temporary blinds
- Install permanent gaskets.
- Flange connection bolts tightened.
- Coat and wrap welds.
- Holiday testing and coating repairs.
- Backfill and compaction.

18.0 **CIVIL PART FOR UNDERGROUND ELECTRICAL GROUNDING SYSTEM**

18.1 Excavation of the routing for the direct buried cables, for the road crossing and for the branch conduit and sleeves in accordance with layout and detail drawings.

18.2 Transport of the excavated soil, neatly stockpiled to location chosen by LSTK CONTRACTOR and approved by OWNER.

18.3 Installation of all protection conduits and installation materials in accordance with the specification, and design and detail drawings.

18.4 Transport of excavated soil and backfill including compacting of the round up to finished plant level.

19.0 **CIVIL PART FOR UNDERGROUND CABLE TRENCHES (AND CABLE) CIVIL PART**

19.1 Excavation of the routing for the concrete cable trenches for the direct buried cables, for the crossings and for the branch conduit and pipe sleeves by machine or by hand as dictated by local conditions.

19.2 Transport the excavated soil, properly stockpiled to a location off chosen by LSTK CONTRACTOR and approved by OWNER.

19.3 Installation of the concrete cable trenches in accordance with the specification and the design and detail drawings.

19.4 For scope of installation of concrete cable trenches see item 11.

19.5 Installation of the road culverts, protection sleeves and cable ducts at road crossing in accordance with layout and detail drawings. For scope of installation see item 10

19.6 Transport of the excavated soil and backfill of the surrounding area of the concrete trenches up to finished plant level.

19.7 Transport of the excavated soil and backfill of road crossing up to road including the supply and installation of the repair of the paving and / or asphalt road covering.

19.8 Transport and backfill of the trenches with a layer of clean sand, free from stones equalized up to the bottom level of the first (bottom) cable layer.

19.9 Transport and backfill of the layer of clean sand between cable. Layers and above top cable layer.

19.10 Transport of excavated soil and backfill including compacting of the ground up to the layer of concrete tiles or trench covers.

19.11 Installation of the cable protection covers and/or trench covers and /or cable routing colored marking tape.

19.12 Transport of the excavated soil and backfill including compacting of the ground above the layer of concrete tiles up to finished plant level.

19.13 Installation of the cable route designated, trench markers.

20.0 STORAGE TANK PADS AND DYKES

20.1 Install tank pads as specified and as quantified on the specifications and drawings.

20.2 Install tank dykes and ramps as specified and as quantified on the specifications and drawings.

20.3 Install impervious clay layer inside the dyked tankage areas in accordance with specifications and drawings.

21.0 **PERMANENT PLANT FENCING**

21.1 Install permanent plant fencing, including personnel gates and truck gates as located, specified and quantified in the specifications and drawings.

22.0 **SCAFFOLDING**

22.1 Supply and erect all scaffolding for WORK.

22.2 Scaffolding shall be supplied, erected and maintained in strict accordance with local and governmental regulations as well as OWNER'S safety requirements. If there are conflicts, the more stringent shall prevail.

LSTK CONTRACTOR shall dismantle all its scaffolding at the completion of its WORK.

23.0 **TESTING**

23.1 All necessary tests in order to control the quality of the field works shall be done and all such test certificates should be kept in record, such as but not limited to

- Soil compaction tests.
- Concrete testing
- Asphalt testing
- Reinforcing bars testing

23.2 If any test fails LSTK CONTRACTOR shall replace those items, which do not meet the requirements.

All costs for replacements shall be borne by LSTK CONTRACTOR.

24.0 **WELDING PROCEDURES SPECIFICATIONS AND WELDING PROCEDURE QUALIFICATION RECORDS**

24.1 Provide within two months before starting the construction execution, its welding procedures (for A.G, U.G piping and any structural steel) for comment and approval. Approval of welding procedures by OWNER is required before the start of welding.

24.2 Prior to start of filed welding LSTK CONTRACTOR shall submit one (1) copy of all welders' qualification paper and applicable welding procedures approved and stamped by regulating authorities to OWNER.

25.0 **DRAWINGS AND DOCUMENTS**

25.1 LSTK CONTRACTOR will carry out all construction activities directly from the AFC construction drawings and specifications.

25.2 LSTK CONTRACTOR shall submit reports of each test or inspection within three (3) days after actual test or inspection. Failure to comply with the above rule may result in OWNER arranging for additional tests or inspections. Costs of which will be back charged to LSTK CONTRACTOR.

25.3 LSTK CONTRACTOR shall submit material certificates and quality records of the materials, as specified in previous sections and the applicable engineering specifications and standards.

25.4 LSTK CONTRACTOR shall also furnish a concrete installation record within two (2) weeks after completion of the WORK indicating, date of installation and quantity of concrete of each foundations, floor slab, elevated slab, frames, columns, etc.

This concrete installation record shall also show a reference with the concrete compression test certificates of the respective concrete pours and the concrete delivery slip numbers.

Failure to comply with the above time may result in the preparation of the documents by OWNER in which case all related costs will be back charged to LSTK CONTRACTOR.

26.0 **MISCELLANEOUS**

26.1 LSTK CONTRACTOR shall be fully responsible for the correct and accurate setting out of all elevations, positions, dimensions, alignments, profiles. etc, of all parts of the WORK and for the provision of all necessary instruments, appliances and labour in connection therewith The checking of any such matter by OWNER shall not relieve LSTK CONTRACTOR of its responsibility for the correctness thereof.

26.2 If during the construction or maintenance of WORK, any error is discovered in WORK, LSTK CONTRACTOR shall at its own cost rectify such error to the satisfaction of OWNER. LSTK CONTRACTOR shall in such case take all necessary actions such as overtime, etc. in order not to endanger the agreed upon time schedule.

26.3 All dimensions shown on the plans and drawings are given in the SI system, unless otherwise stated.

26.4 All costs for setting out the earthwork and for assisting OWNER in checking the various points, lines, levels, profiles, etc. shall be deemed to be included in the price.

26.5 LSTK CONTRACTOR shall under no circumstances extend its operations outside the limits of the area appropriated for WORK. LSTK CONTRACTOR will ensure that its operations shall not interfere in any way with properties of others.

26.6 No excavation work shall be started before the exact positions of the WORK have been marked by means of stakes controlled and approved by OWNER.

26.7 OWNER shall notify LSTK CONTRACTOR of all known existing underground pipes, cables,

drains, manholes, etc, in current use, together with the approximate locations and hazards involved and LSTK CONTRACTOR shall ensure that they will not be broken or damaged in any way by the execution of WORK. Hand labour shall be used for excavation within a horizontal distance of 1.5 meters from existing utilities.

26.8 Any damage as referred to above shall be reported by LSTK CONTRACTOR. LSTK CONTRACTOR shall repair the damage.

26.9 The discovery of any unregistered pipes, drains, cables, etc., shall be promptly reported to and deals with as directed by OWNER. Excavation, as required to determine the exact location of existing underground pipes, drains, cables etc. shall be considered as a part of WORK.

26.10 LSTK CONTRACTOR shall take precautions i.e. mats, lining with timber, etc. not to cause damage to permanent plant roads curbing and sidewalks with its construction equipment.

26.11 LSTK CONTRACTOR shall provide and be responsible for the construction of all temporary dewatering. Drainage, sheet piling, timbering etc. to ensure the stability of slopes, trenches, embankments, etc. during excavation work and that all areas are adequately drained to the satisfaction of OWNER.

26.12 LSTK CONTRACTOR is responsible for all soil slides that may occur during the execution of the WORK and for any detrimental effect of the same. LSTK CONTRACTOR shall as directed by OWNER either correct or repair the damage to the satisfaction of OWNER at its own expense or pay for the cost of repair by others of all damage caused to the WORK or adjacent property. No additional payments shall be made to LSTK CONTRACTOR to compensate the financial consequences of soil slides.

26.13 Collapse, cave-in, or movement of excavations, trenches, or the like shall be the responsibility of LSTK CONTRACTOR. LSTK CONTRACTOR acknowledges this responsibility and instructions of the OWNER.

26.14 Trenches, excavations, and the like shall be maintained in strict accordance with the requirements of the applicable national and local regulations.

26.15 LSTK CONTRACTOR shall be held entirely responsible for any effect or damage, which the execution of any of the earthwork may have upon, or which may be caused to any portion of WORK or any of the surrounding property.

26.16 Excavation will proceed until all unsuitable material is removed.

26.17 LSTK CONTRACTOR is responsible for the excavation required to installing bottom of footings at elevations as shown on drawings. The removal of a poor soil below the intended bottom of excavation is included in the CONTRACT. Any unnecessary over excavation will be in LSTK CONTRACTOR'S account.

26.18 Backfill shall be to the elevation shown on the approved drawings or as directed in writing

by OWNER.

26.19 Special care must be taken in compaction operations over underground pipelines.

26.20 LSTK CONTRACTOR shall furnish all field engineering, surveying, layout, and checking to properly install all foundations to meet all requirements of the drawings and specifications, on completion of each foundation LSTK CONTRACTOR shall mark all foundations with a clear center line, locating both North, South, East and West and a bench elevation mark. LSTK CONTRACTOR shall stencil or by other means, paint equipment and column designation and coordinates, to all foundations installed by LSTK CONTRACTOR. All markings shall be located above high point of paving. These markings shall be preserved for use by others.

26.21 LSTK CONTRACTOR shall design concrete mix specification and furnish by means of reports from OWNER'S laboratory, proof that the materials and mixes for concrete conform to the specifications and codes prior to pouring the first concrete on SITE. LSTK CONTRACTOR shall furnish all field labour to make concrete tests and fill cubes quality of concrete aggregates and mix design will be checked by OWNER'S laboratory regularly.

26.22 All aboveground concrete for supports for steel structures must be smooth finished, and exposed edges of concrete to have a chamfer.

The top of the foundations shall be poured so as to ensure true surfaces and designated slopes in all cases. LSTK CONTRACTOR is to avoid damage or movement of already installed reinforcement and/or other structures, formwork, etc., when pouring concrete.

26.23 All concrete pours for a given element must be monolithic, except where noted on the drawing or approved by OWNER.

25.24 If pouring cannot be finished within normal working hours, necessary actions shall be taken, sufficiently in advance for requesting permits for overtime. All pouring must be continued until the element is complete. OWNER shall be informed at least twenty-four (24) hours in advance.

26.25 Damaged formwork must be repaired in such a way as not to mark the concrete finish. All formwork must be braced adequately and be of a rigid construction. Gravel nests, surfaces crack, honeycombs, etc., and shall be repaired to the satisfaction of OWNER.

26.26 LSTK CONTRACTOR shall use immersion-vibrating equipment but it needs to be of a type approved by OWNER prior and also during use. Vibration of formwork and fresh concrete WORK is not allowed. OWNER will have the right to require replacement of inadequate during all phases of the WORK. A must condition shall be maintained after pouring as set forth in specifications. The WORK involved in this is to be included in the pricing.

26.27 OWNER reserve the rights to reject any WORK already poured which is not in accordance with drawing and specifications and of adequate quality.

Serious inclusions appearing in concrete shall be reason for the rejection of WORK and LSTK CONTRACTOR requested to repair or replace at his own expense.

26.28 All costs involved in demolition, removal and replacement of rejected WORKS shall be the responsibility of LSTK CONTRACTOR all materials, equipment or auxiliaries not accepted by OWNER shall be removed immediately from the OWNER'S property.

26.29 Ready - mixed concrete shall be delivered without segregation. The concrete batch plant has to be approved by OWNER. Small quantities of concrete may be made at SITE after approval of OWNER.

26.30 The pouring of any reinforced concrete may only start after having obtained Approval of OWNER.

26.31 LSTK CONTRACTOR shall provide, during the period of this CONTRACT, temporary drainage ditches in WORK so that water will not be pended and so that all areas are adequately drained to the satisfaction of OWNER.

26.32 LSTK CONTRACTOR shall provide, during the period of this WORK, systems for the dewatering of all its WORK areas as required to properly execute the WORK. All dewatering methods shall be subject to the approval of OWNER.

26.33 All excavated boulders will be removed from SITE by LSTK CONTRACTOR.

26.34 Manholes are to be marked with M.H. Number.

26.35 Underground service lines have to be marked at their installation limits to aboveground piping, indicating line size, and service and line number.

26.36 Prefabricated concrete -items are to - be marked with date of fabrication, size, Length, identification code and installation north arrow.

27.0 **BUILDINGS**

27.1 LSTK CONTRACTOR shall do the construction of the buildings, including all activities and installations as specified, in drawing and specifications including the fabrication of all items that are not standard hardware components.

28.0 Quality of all civil and building materials shall be approved by OWNER before usage in the PLANT.

ANNEXURE- 7-2B

STRUCTURAL STEELWORK

1. Delivery of all materials and fabricated structural steel to SITE, including all required transport, storage, intermediate storage, etc., including loading and unloading of materials.

2. LSTK CONTRACTOR will carry out all construction from the AFC construction / erection drawings and specifications.

3. LSTK CONTRACTOR shall be held entirely responsible for any effect or damage, which the erection of the structural steel may have upon, or which may be caused to any portion of WORK or any of the surrounding property.

4. **Erect Structural Steel-Structure Frames**

   This item covers all activities required to erect prefabricated structural steel framing for single and multilevel structures.

   It includes, but is not limited to, the following :

   - Provision of all tools, equipment and consumables used in the course of the work.
   - Shimming of foundations and joints.
   - Erecting.
   - Cutting, drilling, welding and bolting to achieve fitment.
   - Rectification required, if any.
   - Final levelling, aligning and bolting (including torquing).
   - Grouting of components and areas supplied unpainted or requiring finish coats, as per specifications.
   - Touch up painting of damaged areas.
   - Also included in this item are all clips plates, stiffeners, gussets, and connection material supplied loose for field installation.

5. **Fabricate and Erect Structural Steel-Structure**

This item covers all activities required to fabricate and erect structural steel framing for single and multilevel structures, from raw steel, if any, sections, plates, rounds, etc. It including, but is not limited to the following:

- Provision of all tools, equipment and consumables used in the course of the work.
- Preparation of detailed fabrication drawings and getting them approved from Owner.
- Shimming of foundations and joints.
- Measuring, cutting, bending, bolting and / or welding.
- Erecting.
- Cutting, drilling, welding and bolting to achieve fitment.
- Final levelling, aligning, bolting and /or welding (including torquing)
- Grouting of support piers.
- Painting as per specifications.

6. **Fabricate and Erect Ladder and Safety Cages**

This item covers all activities required to fabricate, assemble and erect ladders and safety cages in steel structures, from raw steel (unpainted) sections, plates rounds, etc.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Preparation of detailed fabrication drawings and getting them approved from Owner.
- Measuring, cutting, bending, bolting and / or welding.
- Assembly and erecting including cutting, drilling, bolting, welding to achieve fitment.
- Cutting, drilling, welding and bolting to achieve fitment.
- Final Bolting and / or welding in position.
- Fabrication and installation of safety barrier rail and gate.
- Installation of raw bolts and forming of concrete pads, or connecting to a lower platform.
- Painting as per specifications.

7. **Fabricate and Erect Platform and Walkways**

This item covers all operations required to fabricate erect platforms and walkways on vessels, towers, structures, etc or on the ground from raw steel (unpainted) sections, plates, rounds, etc.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Preparation of detailed fabrication drawings and getting them approved from Owner.
- Measuring, cutting, bending, bolting and / or welding.
- Erecting including any, cutting, drilling, welding for fitment.

- Final levelling, bolting and / or welding.
- Installing anchor bolts and grouting.
- Painting as per specifications.

Not including is the installation of flooring or the erection of handrail.

8. **Fabricate and Erect Welded Handrail**

This item covers all operations required to fabricate and erect double rail handrail and tope plate of all welded construction, from raw steel (unpainted) sections, plates rounds, etc.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Preparation of detailed fabrication drawings and getting them approved from Owner.
- Fabrication including cutting, bending, welding, etc.
- Erecting of posts, top and middle rails toe plate including any cutting, trimming for figment and welding.
- Grinding smooth of all cut edges and welds.
- Painting as per specifications.

9. **Fabricate and Erect Galvanized Tubular Handrails**

This item covers all operations required to fabricate and erect double rail tubular galvanized hand railing including all standards, fittings, bends, etc., from raw steel (unpainted) sections, plates, tubes, etc.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Fabrication including cutting, trimming edge stripping to required size & shape.
- Erecting into position.
- Bolting and/or welding.
- Trimming to suit platform structure and providing openings for pipe or cable, etc.
- Making good edges, and touch up painting including cold galvanizing of cut or welded parts.
- Painting of unpainted steel sections

10. **Fabricate and Install Floor Grating**

This item covers all activities required to fabricate and install galvanized floor grating from large sheets ready for cutting, trimming, etc., to platform shapes.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Fabrication including cutting, trimming, edge stripping to required size & shape.
- Erecting into position.
- Bolting and/or welding.
- Trimming to suit platform structure and providing openings for pipe or cable, etc.
- Making good edges, and touch up painting including cold galvanizing of cut or welded parts.

11. **Fabricate and Install Chequer Plate Flooring**

This item covers all activities required to fabricate and erect chequer plate flooring, from sheets.

It includes, but is not limited to, the following:

- Provision of all tools, equipment and consumables used in the course of the work.
- Fabrication including cutting, trimming edge stripping to required size & shape.
- Erecting into position.
- Bolting and/or welding.
- Cutting to suit platform structure and providing opening for pipe or cable, <etc.

12. **Erect Davits**

This item covers all activities required to erect fabricated davits on exchangers, vessels or in structures.

It includes, but is not limited to, the following :

- Delivery of davits and all other materials.
- Provision of all tools, equipment and consumables used in the course of the work.
- Erecting up painting of damaged areas.

13. **Roof and Wall Sheeting**

This item covers all activities required to erect by bolting of roof and wall sheeting.
It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Cutting and fitting of sheeting including all shrilling, trimming and notching to facilitate openings.

- All flashing of ridges, corners gables, door jambs, etc.

14. **Down pipes and Gutters**

This item covers all activities required to install metal downpipes and gutters.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Erecting including fitting, trimming supporting and jointing.

15. **Roof or Ridge Ventilator**

This items covers all activities required for the erection of roof or ridge ventilators on a steel clouded building.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Erecting on roof including any trimming or figment.

16. **Install Gantry Crane Rails**

This item covers all activities required to install rails.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Erecting jointing levelling, aligning, and bolting or welding in passion.

17. **Install Gantry/Overhead Travelling Crane**

This item covers all activities required to erect and complete the installation of overhead cranes.

It includes, but is not limited to, the following :

- Provision of all tools, equipment and consumables used in the course of the work.
- Erecting into rails.
- Installing all controls, both mechanical and electrical.
- Testing and running of crane.

18. **Install Travelling Trolleys**

This item covers all activities required for the installation of beam mounted travelling trolley.

It includes, but is not limited to, the following :

- provision of all tools, equipment and consumables used in the course of the work.
- Erecting into position.
- All levelling and shimming of trolley beam as required.
- Marking of all beams and trolley with safe Working Load.
- All testing and running as required.

19. **Inspection and Testing**

- Inspection of steel structure shall be in accordance with the codes and standards.

- LSTK CONTRACTOR shall provide NDE services acceptable to OWNER. NDE inspection shall be carried out in accordance with standards, codes and specifications .

- LSTK CONTRACTOR shall be responsible for the repair of faulty welds and for all required extra radiography and inspection of the faulty welding work. In case of a faulty weld, 100% radiography on LSTK CONTRACTOR'S account can be done as per code.

ANNEXURE- 7 – 2C

PIPE PREFABRICATION AND ERECTION

1.0 **PIPING**

1.1 **Magnitude of Piping**

LSTK CONTRACTOR shall prefabricate, install and test all piping as shown on the plan drawings and isometrics.

2.0 **PIPING FABRICATION AND ERECTION**

2.1 Piping systems and pipe supports shall be designed, fabricated, inspected, and tested in accordance with rules, codes, specifications and drawings.

2.2 Miscellaneous piping materials for vents, drains, instrument connections, etc. on equipment shall be installed using P & ID'S and equipment drawings.

2.3 The fabrication and erection of piping includes field welds. It is LSTK CONTRACTOR'S responsibility to choose the number and location of field welds to ensure efficient transportation and handling during erection. Furthermore LSTK CONTRACTOR shall locate the field welds in such a way that final adjustment for fit-up purposes will be possible.

For alloy piping that has to be stress relieved after welding the number of filed welds shall be kept to a bare minimum. LSTK CONTRACTOR shall thoroughly evaluate the need for each field weld in alloy piping he deems necessary.

2.4 LSTK CONTRACTOR will furnish OWNER with a marked up set of isometrics identifying all spool pieces, and weld numbers. All piping spools shall be clearly identified, per isometric by means of stainless steel tags affixed with wire.

2.5 LSTK CONTRACTOR shall erect all prefabricated and straight run piping as required by the drawings and specifications.

The erection and installation of the piping shall include but not be limited to the following

- Control valves.
- Safety valves
- Rapture disks.
- Level instrument and gauges.
- External level displacers.
- Special fittings.
- Breaching of vents, drains, instrument connections, etc.
- Rota meters.

- Orifice flanges.
- Orifice plates.
- In - line instruments.
- Steam tracing.
- Steam traps.
- Extension stems. Valve operators.
- Bellows, expansion joints and similar specialty items.
- Thermowells (flanged, screwed and weld Ins.).
- Sample coolers.
- Instrument connections (up to and including the first block valve).
- Spring hangers and spring supports.
- Installation of miscellaneous piping and instrumentation supplied by equipment vendor.
- Temporary piping for drying, flushing and hydrostatic testing if necessary.
- Connection of piping to equipment.
- Connection of aboveground piping to underground piping.
- Pipe supports.

This shall include any necessary work to the piping to correct equipment misalignment.

2.6 Fastening of floor supports on concrete will be done with expansion type foundation bolts, if no anchor bolts are provided.

2.7 LSTK CONTRACTOR is responsible for the installation of steam tracing of piping, valves fittings and instruments where required, in accordance with the specifications and drawings. In general steam and condensate headers will be indicated on the piping plans. Lines to the traced will be indicated on P& ID'S and lines lists. Details of steam and condensate headers will be shown on separate drawings. Identification of steam tracers shall be by aluminum tag noting circuit number. Each end of system should be tagged.

A method of identification and tagging of the other various systems shall be established, subject to approval by OWNER and is for account of LSTK CONTRACTOR.

2.8 LSTK CONTRACTOR is responsible for the fabrication and erection of pipe supports, hangers, anchors and guides, as required by the drawings and specifications.

Spring pots and spring hangers, which shall be provided by LSTK CONTRACTOR as will be assembled, installed, adjusted and unlocked by LSTK CONTRACTOR after hydrostatic testing of the line. The required angle iron, will be decided in the field and supplied by LSTK CONTRACTOR.

2.9 LSTK CONTRACTOR shall install and remove all temporary strainers required for WORK defined herein. The removal of these items will be directed by OWNER. OWNER may decide to leave temporary strainers in during commissioning.

2.10 LSTK CONTRACTOR shall be responsible for the fabrication, installation and dismantling of temporary spool pieces and blinds required for control valves, safety valves and in - line instruments during testing and cleaning. Requirements for these shall be minimized. Requirements for these will be prescribed by OWNER.

In general, in-line instruments, safety valves and control valves may be installed for fit-up purposes if available to avoid the use of temporary spool pieces. They shall be removed for flushing and testing and reinstalled as directed by OWNER. In the case of safety valves these must be installed for fit - up, taken down for calibration by LSTK CONTRACTOR, and reinstalled before mechanical completion. All open flanges and valves shall be blinded or plugged off.

2.11 LSTK CONTRACTOR is responsible for the installation and testing of all piping and steam, electrical tracing and all materials including all items necessary to completely close the systems in strict accordance with the established test system procedures and priorities as directed by OWNER.

2.12 **Wrapping & Coating**:- Surface preparations and installation of Wrapping & Coating of the underground piping with Cold tape (Materials for line coating and wrapping shall be of Tape coating system (Polyethylene backed tape with butyl rubber based adhesive system), if required

2.12.1 Protective coating shall consist of a coating system employing Primer, Inner Wrap and Outer Wrap.

2.12.2 The coating system shall be mechanically applied by an approved type of wrapping machine utilizing constant tension brakes except at tie-in welds, repair patches and at other locations where mechanical application is not practicable..

2.12.3 Coating and wrapping materials shall be handled, transported, stored and applied strictly in accordance with the manufacturer's instruction.

2.12.4 Wrapping Coating material is Cold tape type from **Polyken/Denso/Atla** shall be used.

2.13 **Flushing and Cleaning Of Piping Systems**

i) Sections fabricated in LSTK CONTRACTOR'S workshop shall be fitted with plastic end caps to seal pipe ends, and jointing surfaces shall be suitably protected.

These caps shall not be removed until sections are in the course of erection after delivery at SITE and then shall be removed for refuse.

ii) During fabrication and erection the sections shall be inspected or internal cleanliness.

iii) The water which will be used for testing and flushing of the piping system shall be recollected per instruction given by OWNER.

v) Piping systems shall be flushed with suitable water as supplied by LSTK Contractor

unless designated for nitrogen or air testing or otherwise specified by licensor. OWNER'S approval is required before start of flushing.

v) LSTK CONTRACTOR shall supply all equipment, pumps, gauges, etc. required for flushing and testing of the piping systems.

vi) For hydro testing and flushing the piping LSTK CONTRACTOR shall weld and caps and install drain plugs, remove end caps after successful hydro test.

3.0 **HYDRO TESTING**

3.1 Inspection and hydro testing of the piping systems shall be in accordance with the drawings and specifications and in strict witness by OWNER representatives.

3.2 Atmospheric pressure systems shall be:

- Visually inspected that all joints are properly made.
- Filled with water for a 24 hours leakage test under atmospheric conditions.

If any leakage occurs in the system during testing, repairs must be made without extra costs to OWNER.

3.3 LSTK CONTRACTOR shall test all piping systems as per the project test diagrams. Testing is to be witnessed and approved by OWNER and where applicable by the appointed (independent inspection authority) filed inspector. A test schedule by test system shall be prepared by LSTK CONTRACTOR and shall be submitted to OWNER for Approval.

3.4 Testing and completion shall be in accordance with project system priorities.

3.5 All equipment, pumps, gauges, pressure recorders temporary piping and fittings, test gaskets and bolting, required for testing of the piping systems and part of LSTK CONTRACTOR'S supply. Before testing LSTK CONTRACTOR shall calibrate its testing equipment.

3.6 LSTK CONTRACTOR shall supply and install blind flanges when required to enable testing of the lines.

3.7 Inexpensive temporary gaskets supplied by LSTK CONTRACTOR, shall be used instead of permanent gaskets where test blinds are located for hydrostatic testing. On successful completion of a test the permanent gasket shall be installed when the blinds are removed.

3.8 Piping systems shall be tested with suitable water. Extreme care shall be taken that suitable water is used for stainless steel systems. For stainless steel the water must be approved by OWNER and shall have a content of chlorides ≤ 50 mg/L

3.9 The water for testing purposes will be furnished by LSTK CONTRACTOR.

3.10 LSTK CONTRACTOR is to perform the testing in a sequence so as to allow sufficient time for

insulation and/or painting to complete within the time frame of the project schedule.

3.11 A formal system of documentation will be developed by LSTK CONTRACTOR and approved by OWNER for use by LSTK CONTRACTOR to certify this testing phase of the piping erection. This system will also include a section for supplying OWNER'S "But list" comments.

3.12 Erected piping shall be hydrostatically tested in test systems, but not through equipment, control valves etc. except where piping is welded to equipment.

3.13 LSTK CONTRACTOR remains responsible for ensuring that no item of equipment, or instrument, is damaged by the test pressure or the test fluid. Suitability of test fluid to be Approved prior to testing by the OWNER.

3.14 It is emphasized that the installation of temporary strainers prior to testing shall be part of WORK. OWNER shall be contacted concerning installation of temporary strainers.

3.15 When lines are pressure tested, valves at the end of the lines must be covered with a test blank for safety reasons. A record, preferably on the test diagrams, shall be kept by LSTK CONTRACTOR indicating which sections have been completed.

Note : Testing against closed valves in not allowed (spades to be used)

3.16 All material damaged during tests shall be replaced on LSTK CONTRACTOR'S account. All joints broken after testing for installation of strainers, orifice flanges, safety valves, etc. must be remade tightly; labour is for LSTK CONTRACTOR'S account.

3.17 After testing the piping systems, they shall be completely flushed and drained. OWNER will approve when a line is considered flushed and drained by LSTK CONTRACTOR.

3.18 When each section or circuit has been pressure tested and passed, a certificate prepared by LSTK CONTRACTOR on LSTK CONTRACTOR'S furnished forms showing details must be signed by LSTK CONTRACTOR and OWNER, when the test has been completed and the system drained, test blanks must be removed by LSTK CONTRACTOR.

3.19 The following activities by LSTK CONTRACTOR are included for the reinstatement of piping after hydro testing:

- LSTK CONTRACTOR installed temporary testing blinds to be pulled.
- Temporary spool pieces taken out.
- Gaskets renewed, temporary replaced with permanent.
- Flange connection bolts tightened.
- Post hydro punch list items corrected.

- Temporary strainers installed.

- Chemical cleaning performed.

- Supports and hangers checked if in final position.

- Rotating equipment cold alignment checked.

- Reinstallation of control and safety valves and in - line instruments which LSTK CONTRACTOR has removed for hydro-testing.

3.20 Nondestructive testing of welds and systems is to be performed in accordance with standards, codes and specifications prior to perform any hydro-test.

4.0 PIPING MATERIAL IDENTIFICATION AND PAINTING

4.1 All piping materials are supplied by LSTK CONTRACTOR and shall be properly stamped and color-coded to ensure that the correct materials are used as required by the drawings, specifications, codes and regulations.

4.2 All materials will be adequately marked as to its specifications. Should LSTK CONTRACTOR be required to cut same or otherwise render piece(s) to have no marking, LSTK CONTRACTOR'S transfer or replacement of proper identification marking to the pieces involved, must be done according to approved stamping method and to be counter stamped by LSTK CONTRACTOR. Paint alone is unacceptable.

4.3 The governing principle shall be that in the installed piping systems, all components can be identified and their origin and complete specifications can be determined. The method for identification and stamping or tagging of the various components of the system shall be worked out in coordination with OWNER and only be implemented after approval.

LSTK CONTRACTOR shall be held responsible for this requirement as a minimum, and any other requirements of local codes and regulations as to identification and documentation of materials.

4.4 Surface preparation and paint application of piping system by LSTK CONTRACTOR, shall be per paint specification.

4.5 LSTK CONTRACTOR shall assure that no welds are covered by prime coats prior to acceptance of hydro test.

4.6 LSTK CONTRACTOR must ensure that all stamping such as code stamps, registration spool identification, charge numbers etc. shall be visible after paintwork.

5.0 **WELDING**

5.1 All welding shall be carried out according to codes and specifications.

5.2 Welder's qualification

5.2.1 All welders including those with valid qualifications will be required to submit a test conducted by OWNER prior to start of welding.

Welders that have a certificate which is still valid for the type of material and in accordance with ASME IX will not be tested by OWNER.

5.2.2 A current list of qualified welders must be maintained by LSTK CONTRACTOR and a copy furnished to OWNER each time a revision is made.

5.3 Welders' identification stamps shall be provided by LSTK CONTRACTOR. Each weld shall be clearly stamped with welders identification. All welding including tack welding shall be carried out by qualified welders. Unstamped welds shall be-removed and replaced at LSTK CONTRACTOR'S expense.

5.4 Job SITE fabrication shall be carried out under cover where possible.

5.5 Weld spatter shall be knocked off around all welds leaving a smooth clean surface.

5.6 Where openings for branches are cut in run of pipe, all material, which may drop inside the pipe, shall be completely removed before the branch line is welded in place.

6.7 The interior welds of orifice flanges shall be ground smooth.

5.8 **Electrodes, Rods, Wires and Fluxes**

Electrodes shall be stored in the makers' airtight containers until required for use. Electrode heaters shall be used on Job SITE, for low hydrogen types of electrodes.

Electrodes and filler wires to be used at site in this job shall be procured from the approved vendors only. Electrodes and filter wires shall be **D&H, Advani Orlikon or ESAB, Mailam and Bohler group make only**

5.9 **Open Air Welding**

Where welding in the open air is unavoidable, WORK must be discontinued where the quality of the weld may be impaired by weather conditions. Including but not limited to airborne moisture, sand or high winds. After rain the metal surfaces shall be dried. For metal temperature below 5 ^{0}C joints to be preheated.

5.10 **Welding Procedure Qualification**

LSTK CONTRACTOR shall supply welding procedure specifications and qualification in accordance with the rules as set by OWNER.

5.11 Fees for inspection required for welding procedure and welders qualifications, supply of equipment required for the qualification test of welders and welding procedures are for account of LSTK CONTRACTOR.

5.12 **Inspection and Testing**

5.12.1 Inspection of welds shall be in accordance with the instructions of OWNER and/or the requirements of codes and standards.

5.12.2 LSTK CONTRACTOR shall be responsible for the repair of faulty welds and for all the required extra radiography and inspection of the faulty welding work. In case of a faulty weld, 100% radiography, on LSTK CONTRACTOR'S account, shall be done on the weld performed as per code.

OWNER shall have absolute discretion in the selection of the welds, which are to be radio graphed.

5.12.3 LSTK CONTRACTOR shall provide NDE service, acceptable to OWNER.

NDT inspection shall be carried out in accordance with codes for all lines as indicated in the piping specification.

6.0 **STRESS RELIEVING**

6.1 LSTK CONTRACTOR shall provide stress-relieving service acceptable to OWNER. Spool pieces shall be stress relived in an approved furnace equipped with thermostatic control and temperature recorder. Field welds to be stress relieved with electric resistance heaters. Temperature cycles to be monitored with portable temperature recorder.

6.2 Stress relieved welds shall be hardness tested by approved procedure and must meet criteria spelled out in specifications.

7.0 **TRANSPORTATION**

The following various categories of transportation of pipe, pipe fittings and prefabricated pipe spools will be performed by LSTK CONTRACTOR. All categories include loading and unloading materials. Categories will consist of but not limited to:

- From LSTK CONTRACTOR'S warehouse to LSTK CONTRACTOR'S pipe prefab shop.
- From LSTK CONTRACTOR'S pipe prefab shop to LSTK CONTRACTOR'S painting shop.
- From LSTK CONTRACTOR'S pipe prefab or painting shop to LSTK CONTRACTOR'S

storage area or working area located on site or any other location on SITE.

- All transportation required performing nondestructive testing of prefabricated pipe spools.

8.0 LIFTING, LIFTING EQUIPMENT AND GEAR

8.1 Rigging and hoisting shall be executed as per construction specification and local requirements and safety rules, as manufacturer's instructions. If there are stringent one shall prevail.

8.2 Testing And Certification

All LSTK CONTRACTOR furnished cranes, lifting appliances and lifting gear must be properly tested, examined and/or inspected before being used on SITE, and at the intervals specified in the applicable regulations. Copies of the relevant certificates must always be available on SITE for inspection on request by OWNER or other authorities.

8.3 Operation

8.3.1 LSTK CONTRACTOR shall not permit a lifting appliance to be operated otherwise than by a person trained and competent to do so.

8.3.2 LSTK CONTRACTOR shall take express steps to ensure that all personnel employed by LSTK CONTRACTOR are competent and experienced for their assigned tacks.

9.0 DRAWINGS AND DOCUMENTS

LSTK CONTRACTOR shall fill in checklists as required by OWNER.

10.0 MISCELLANEOUS

10.1 LSTK CONTRACTOR shall furnish all field engineering surveying layout, and checking to properly install all above ground piping to meet all requirements of the drawings and specification. OWNER is authorized to reject any WORK already installed, which is not in accordance with drawing and specifications and of adequate quality.

10.2 All costs involved in demolition, removal and replacement of rejected works shall be the responsibility of LSTK CONTRACTOR. All materials equipment or auxiliaries not accepted by OWNER shall be removed immediately from SITE.

10.3 Underground service lines are marked at their installation limits to above ground piping, indicating line size, service and line number.

10.4 During storage, fabrication and erection, care must be taken to ensure that sand, scrap materials, welding rods, items of clothing and other foreign bodies are not allowed to enter piping.

10.5 All connections which are left open by LSTK CONTRACTOR shall be well protected, so that no sand, dirt or any foreign object come into the system.

10.6 In certain instances special bolting torques might be required on critical connections. LSTK CONTRACTOR will arrange WORK in accordance with these requirements.

10.7 Flanged piping connections to vessels or equipment shall be aligned and shall be properly fitted before bolting up. Piping may be heated to bring it into alignment only when approved by OWNER. Extreme care should be exercised to avoid damage. Heating, welding and flame cutting on equipment will not be permitted.

10.8 No cold springing or pre- stressing of piping will be allowed other than indicated on piping drawings, isometrics and manufacturer's instructions (e.g. for expansion joints).

10.9 Flange faces shall be clean and free from foreign matter before assembly. Damaged flange faces may be dressed with a medium cut file only if the damage does not require new facing. This shall be decided by OWNER.

10.10 During erection care shall be taken to remove all dirt, seals, sand and foreign matters from inside the pipe.

10.11 Since LSTK CONTRACTOR is responsible for both the prefabrication and the erection of all the piping, it is LSTK CONTRACTOR'S sole responsibility to ensure that all piping to be installed fits properly prior to lifting. LSTK CONTRACTOR is to check all equipment and underground piping to be piped to, for proper location and orientation. OWNER will not entertain any claims for extra work for :

i. Taking piping down for rework after it is lifted

ii. Re-lifting piping after it is reworked.

10.12 Final hookup of piping to equipment such as pumps and compressors shall be done together with the final alignment of this equipment and shall include checking of dimensions. Piping must fill these flanges without inducing any strain on equipment.

10.13 In all cases, all designated support and hangers should be in unlocked / cold position before final alignment. LSTK CONTRACTOR will be expected to expedite this critical phase of construction.

10.14 Certain small vessels will be considered to be piping items and shall be fabricated as such by LSTK CONTRACTOR.

ANNEXEURE- 7 -2D

EQUIPMENT ERECTION

1.0 **SURVEYING**

1.1 Baseline and base elevation will be furnished to the LSTK CONTRACTOR. LSTK CONTRACTOR will furnish all surveying from this baseline and elevation.

1.2 OWNER shall have the authority at any time to determine in accordance with the drawings or written directives, the correctness or completeness of the lines in use by LSTK CONTRACTOR.

1.3 Any erroneous WORK shall be corrected to OWNER'S satisfaction at LSTK CONTRACTOR'S expense.

2.0 **RIGGING STUDIES AND PLANS**

2.1 LSTK CONTRACTOR shall supply rigging studies and plans as specified.

3.0 **EQUIPMENT HANDLING**

3.1 The handling of all equipment shall include, but not limited to the following activities by LSTK CONTRACTOR:

3.1.1 Submittal to OWNER of detailed rigging studies and plans for lifting, transporting and setting of equipment 4 weeks in advance of work for OWNER to review and approval. Complicated lifts shall be started in the morning and completed the same day.

The transportation plans are to include as a minimum:

Type of equipment to be used to transport each piece.

The planned route of the movement.

The estimated duration of the movement.

The obstructions to the route to be temporarily removed.

3.1.2 Receive, inspect, store, protect and perform preventative maintenance on all equipment in accordance with the specifications and drawings and/or equipment manufacturer’s instructions.

3.1.3 Prepare foundations, pipe sleeves, paving, concrete structures and steel structures for

setting equipment.

3.1.4 Transport form warehouse or point of unloading and install equipment on foundations, paving or structures.

3.1.5 Plumb level and align equipment with coordinates in accordance with the specifications and drawings.

3.1.5.1 **GENERAL**

All of the equipment must be plumbed, leveled and aligned with the coordinates specified on the drawings both in plan and elevation and to the tolerances called out in the specifications, specific manufacturer's instructions or recommended manufacture's practices.

- LSTK CONTRACTOR will be required to verify field conditions and will be responsible for final alignment of mechanical items for this project. LSTK CONTRACTOR will check the anchor bolt locations against the equipment. Any deviation must be reported to OWNER in writing.

- LSTK CONTRACTOR will be required to supply and install shims required for all equipment erection. All cinch anchors required for equipment and supports will be supplied and erected by LSTK CONTRACTOR.

  Prior to the placement of the equipment on a foundation, the surfaces of the foundation shall be cleaned of oil, grease, excess concrete and foreign matters by LSTK CONTRACTOR.

- Prior to setting the equipment on the foundations, the underside of the equipment base plate or supports will be cleaned free of oil, grease and other loose materials by LSTK CONTRACTOR.

- Anchor bolts shall be checked for damage to the thread and the threaded part shall be properly greased.

- Damaged anchor bolts must be replaced by LSTK CONTRACTOR and brought to the attention of OWNER.

- The openings between the anchor bolts and sleeves have to be cleaned of foreign materials to full depth of the opening by LSTK CONTRACTOR.

- All steel wear plates and guide keys shall be coated by CONTRACT with proper lubrication, prior to setting the equipment.

- Equipment shall be set true to line. at correct elevation and in proper orientation as shown and noted on the drawings.

- Maximum allowable setting tolerances shall be in accordance with manufacturer's requirements or with the specifications, whichever is more stringent.

- All equipment, unless otherwise specified, shall be leveled with shims at each anchor bolt (shim on both sides of each anchor bolt) and at intermediate points as required to prevent distortion of the equipment. Shims shall have square cut edges (not trimmed or sheared) and shall be of various thicknesses to minimize the number of shims required. Shims shall be supplied by LSTK CONTRACTOR.

- The equipment shall be set, leveled, aligned and inspected with precision tools (steel straight edge, graduated machinist levels, dial indicators, theodolites, water level instruments, turbine levels, etc.). Setting, leveling and alignment shall be according to manufacturer's recommended tolerances and specifications.

- There may be a number of items not installed by the manufacturer, i.e. seals, packing, lubricators, gauges, miscellaneous piping and tubing, thermometers, etc. that will come separately packed from the equipment itself that must be identified, stored, preferably inside in accordance with project criteria, and finally installed. LSTK CONTRACTOR is responsible for these activities.

- LSTK CONTRACTOR shall remove all temporary shipping supports or erection materials.

- LSTK CONTRACTOR shall do surface preparation for, and apply coating and wrapping on buried vessels before installation.

  Equipment supported on legs or on saddles shall be set to the tolerances specified in specifications of the required elevation measured on the flange of the largest diameter pipe-connecting nozzle.

- For equipment with sliding type supports, LSTK CONTRACTOR will remove dirt, grease or other foreign matter and will coat with graphite grease supplied by LSTK CONTRACTOR on the support.

- The anchor bolt nuts will be placed so as not to restrict the longitudinal movement of the sliding end.

- Vessels, drums, etc. shall be aligned, where applicable and leveled per shown or drawing.

- Shims shall be placed approximately evenly spaced under the support ring of vessels, drums, tanks.

- Towers with two or more pieces shall be assembled and welded at site by LSTK

CONTRACTOR.

- LSTK CONTRACTOR is responsible to check and inspect at these equipments in the vendor's shop.

- All costs are included in the lump sum price.

3.1.5.2 **Rotating Equipment**

- Rotating equipment will be installed in accordance with manufacturer’s instructions.

Align drivers with all rotating equipment.

- LSTK CONTRACTOR shall install all ancillary equipment such as, but not limited to, drivers, guards, harness piping and all other interconnecting piping, casing drains, base plate drains and all necessary supports.

- The measurements for the positioning and leveling of mechanical equipment will be made on the suction flange.

- LSTK CONTRACTOR to install permanent packing, seals lubricating oils, greases and circulated oil systems.

- Services of manufacturer’s technical representative by LSTK CONTRACTOR shall be used to the fullest extent.

- Rotating equipment base plates will be supported for positioning and leveling on shims located as follows.

- For bases with four (4) anchor bolts. one set of shims will be placed adjacent to each anchor bolt.

- For bases with six (6) or more anchor bolts, two (2) sets of shims will be placed adjacent to each anchor bolt, one on each side of the anchor bolt.

- In addition shims shall also be placed directly under those parts of the base plate carrying the greatest weight and shall be placed closely enough to give uniform support.

- When the base plate is level in all directions as indicated by an accurate instrument on the machined pads, the anchor bolt nuts shall be brought down evenly, but not too firmly. The unit is now ready for grouting. After the grout has adequately set, pull the anchor bolt nuts down tight and recheck the base for levelness.

- Release for grouting of base plates must be approved by OWNER.

- After completion of the electric installation to the motor, the direction of rotation of the

motor will be determined. Prior to checking the direction of rotation, the coupling between the motor and the equipment will be disconnected for the test run of motor by LSTK CONTRACTOR.

- Rough aligning of the centrifugal units and their respective drivers shall take place after the equipment has been put on the foundation.

- Coupling alignment

- Dial indicators shall be used and where possible optical alignment equipment.

  Peripheral alignment shall be checked by using one dial reading peripheral differences between coupling halves as they are rotated together.

  Face alignment shall be checked using two dials reading face-to-face differences between coupling halves.

- Tolerances shall be in accordance with manufacturer's instructions with and without pipe work connected.

- Manufacturer's representative shall check that the final alignment of equipment is satisfactory before any running takes place. For small equipment. Where it is agreed by OWNER that the services of a manufacturer's representative are not required, manufacturer's written instructions shall be followed.

- The final checks will be supervised by LSTK CONTRACTOR and the results recorded by LSTK CONTRACTOR and signed by OWNER and LSTK CONTRACTOR.

  Final alignment shall be carried out in two stages.

- After piping is complete with all bolts removed from the flange connections.

- Final alignment with piping assemblies 100% complete and all flanges bolted up to ensure that no unforeseen vertical or horizontal pipe loading is imposed on the unit.

- The final aligning supervised by OWNER to make sure that the detailed instructions furnished by the equipment suppliers are carried out to the full satisfaction.

  LSTK CONTRACTOR to supply qualified personnel in the final alignment activities.

- Prior to putting pumps, etc. into operation, loose equipment such as guards and gauges shall be installed by LSTK CONTRACTOR.

3.1.6 Mount the drivers to the rotating equipment in case of turbines and any large motors that are shipped separately.

3.1.6.1 In case electric motors have to be installed in the field, this shall be done after leveling of base plate, but prior to grouting.
Chrome / nickel shim martial, supplied by LSTK CONTRACTOR shall be used for alignment of drivers and pumps and shall be installed under the entire footing of the driver.

3.1.6.2 Equipment and drivers shall be doweled to bed plate if required by manufacturer's instructions.

3.1.7 Assembly whenever required for the items / package unit like Auxiliary Boilers, Waste Heat Boilers, Air - cooled exchangers, furnaces , compressors ,Turbo generators etc. units as part of the scope of WORK of installation by LSTK CONTRACTOR.

3.1.7.1 Compressor seal oil and lube oil systems and control panels are included in LSTK CONTRACTOR'S installation of compressors.

3.1.7.2 When equipment is delivered in two or more sections for site welding the weld preparation must match accurately on mating sections before assembling.

3.1.7.3 LSTK CONTRACTOR shall assemble and erect items, whether skid mounted or supplied in individual components as specified in the requisition or indicated on drawings in order to make a completed unit.

3.1.7.4 Installation, assembly and alignment of the various components shall be done by LSTK CONTRACTOR.

3.1.7.5 Installation of air - cooled exchangers includes the erection of structural steel on the pipe rack, which will support the tube bundles must be done by LSTK CONTRACTOR.

3.1.7.6 Walkways, platforms, stairs, ladders shall be installed for the items / package unit like Auxiliary Boilers, Waste Heat Boilers, Air - cooled exchangers, furnaces, compressors, Turbo generators etc. by LSTK CONTRACTOR.

3.1.7.7 Drying out systems, refractory and linings is included in LSTK CONTRACTOR scope of work.

3.1.8 Install ladders, platforms, davits, pipe supports and pipe guides in accordance with drawings and specifications.

3.1.9 Open man ways. Inspect. clean and close man ways of all tanks, towers. vessels and other equipment as directed by specification or manufacturer.

3.1.10 Install all trays and vessel internals and support for same shipped loose. in accordance with drawings, specifications and manufacturer's recommended installation instruction.

3.1.11 Under the supervision of OWNER and respective manufacturer’s representative LSTK CONTRACTOR shall load the first loading of chemicals.

a) There will be certain items of equipment such as filters and package equipment that come with cartridges filled with -desiccants, resins, etc. Their items will be installed by LSTK CONTRACTOR if they are shipped separately from the equipment.

b) Installations include the pick-up of these chemicals from the place of storage and transportation to point of installation.

3.1.12 Under the supervision of OWNER, LSTK CONTRACTOR install the first loading of catalysts. Installations include the pick-up of these catalysts from the place of storage and transportation to point of installation.

3.1.13 Touch - up of painting on new equipment after erection.

3.2 LSTK CONTRACTOR shall install grout under all equipment as required.

3.3 Grouting will be as per the specification per the equipment manufacturer's recommendation, whichever is more stringent.

3.4 The following work is included but not limited to LSTK CONTRACTOR'S scope for installation of grouting:

3.4.1 Prepare top surface of base and/or plinth, pockets, sleeves etc., prior to placing grout.

3.4.2 Install grout mortar consisting of one part Portland cement and one part of clean sand and sufficient clean water for workability.

This grout mortar shall be used between steel base plate and concrete foundations.

3.4.3 Wherever non-shrinkage grout is specified on the drawings, the same shall be supplied by LSTK CONTRACTOR and installed in accordance with manufacturer's instructing.

3.5 Install non-shrink grout between reciprocating / rotary equipment base frame including the filling of the equipment steel frame if required, and concrete foundation in accordance with manufacturer specifications and project specifications. Type of non-shrink grout to be approved by OWNER. After grouting, shims used in leveling equipment will not be removed except where removal is specifically required by manufacturer's instructions.

3.6 Unless indicated otherwise on drawings vessels supported on skirts and support rings will be grouted using a stiff mix under the support ring so as to obtain full bearing, Grout will be placed within the area of the skirt the high point of ground at the vertical axis of the tower (or vessel), sloping downward to the support ring with four (4) weep holes under the support ring sufficiently large to ensure drainage.

4.0 MATERIAL HANDLING SYSTEM

4.1 ERECTION & COMMISSIONING

4.1.1 The complete material handling system including its all equipment shall erected at site and commissioned in accordance with the best engineering practice.

4.1.2 Packing, forwarding, transportation, unloading and storage at site, safety and protection of various components at site, insurance etc. shall be the responsibility of the LSTK Contractor / supplier.

4.1.3 All men, material and tools required shall be arranged by the LSTK Contractor at his own cost. The LSTK Contractor shall also arrange for the safe handling, storage, protection and security of his good at site.

4.1.4 The purchaser shall be responsible for supplying his part of material only as covered by the clause pertaining to the work to be excluded from LSTK Contractor's scope of supply.

4.1.5 After erection at site, the belt conveyors and related equipment shall be tested for satisfactory operation for mechanical completion and full-load performance run. The LSTK Contractor shall carry out performance test as per mutually agreed procedure. The details of the procedure shall be submitted by the LSTK Contractor for purchaser's approval.

4.2 MECHANICAL COMPLETION

4.2.1 Mechanical completion shall be considered as achieved when the system is mechanically complete along with the pre-commissioning activities and is ready for feeding. This shall include but not limited to the following :

1. The installation as per FINAL PROPOSAL is complete in all respects in accordance with the drawings, specifications including any approved changes thereto and in accordance with all applicable codes and laws.
2. The machinery, conveyors and all drives are aligned and run or cycled under no-load conditions.
3. The electrical system is installed and tested in accordance with applicable codes and specifications. All wiring is checked for correct hook-up. Motor rotation is checked and power system protective devices are set.
4. Painting is completed to the extent that the incomplete work does not prevent plant start-up and commissioning.
5. Successful completion of no-load test of all the equipment and the complete system.
6. Temporary construction facilities are removed to the extent necessary to permit the plant start-up and commissioning.

4.2.2 The OWNER shall inspect and certify that the LSTK Contractor executed the job in accordance with drawings and specifications.

4.2.3 When the complete belt conveyors and related equipment have been fully erected at site, LSTK CONTRACTOR shall request OWNER for his agreement to start the No-load Test Run. Owner shall, within 72 hours of receipt of such request, issue his agreement or advise LSTK Contractor in writing of any deficiencies noticed in the equipment.

4.2.4 Omissions / rectifications of minor items, if any, not affecting commissioning shall not withhold MECHANICAL COMPLETION as long as the LSTK Contractor agrees to supply / rectify the same within the specified period. The decision of the OWNER is final in this regard.

4.3 COMMISSIONING AND GUARANTEE TEST

4.3.1 After issue of Mechanical completion certificates by Owner, LSTK CONTRACTOR & OWNER shall mutually decide the date of commissioning of the equipment. From the date of commissioning, the equipment shall be gradually brought up to full load or any other load at the discretion of OWNER, and thereafter the equipment shall be run for a minimum period of 5 days. OWNER shall have the right to reduce this period where deemed necessary because of OWNER's difficulties. During this period of 5 days of operation or the reduced period, the system shall run at an average of 90% of rated capacity. If the LSTK CONTRACTOR is not able to bring the load to 90% of the rated capacity as mentioned above within 2 (two) months, OWNER shall, without prejudice to any of his rights under the contract, has the right to take over the equipment and to proceed with modifications / rectifications / additions as he considers necessary at LSTK CONTRACTOR's cost and risk to achieve this sustained load run.

5.0 **PREPARE EQUIPMENT FOR OPERATION**

5.1 Immediately prior to turnover, LSTK CONTRACTOR will make all the equipment ready for operation. This includes, but is not limited to such activities as:

5.1.1 Removal of preservatives and rust preventatives.

5.1.2 Installation of seals or removal of steel covers.

5.1.3 Removal of moisture absorbing materials.

5.1.4 Draining of oil reservoirs and the flushing and filling of the initial charge.

5.1.5 If required by OWNER for the final inspection the opening and closing of man ways of vessels and tanks.

5.1.6 Assisting equipment manufacturer's representatives by final checkout of equipment.

5.1.7 Remove all temporary supports, bracing, or other foreign objects that were installed in vessels rotating equipment or other equipment to prevent damage during shipping, storage, transport and erection.

5.1.8 Conduct all flushing, blowing and chemical cleaning required by the specifications.

5.1.9 Check and run in all rotating equipment, i.e. compressors, pumps.

6.0 Scaffolding Sufficient amount of scaffolding required for good performance of the WORK shall be supplied by LSTK CONTRACTOR.

7.0 **DRAWINGS AND DOCUMENTS**

7.1 LSTK CONTRACTOR will carry out all construction and any required procurement activities directly from the AFC construction drawings and specifications and forming part of the CONTRACT. No additional design work or development e.g. completion of drawings will be required from LSTK CONTRACTOR.

However, the plan type drawings called out to be supplied by LSTK CONTRACTOR in previous subsections of this section are included in LSTK CONTRACTOR'S scope of WORK.

7.2 All of LSTK CONTRACTOR'S drawings, calculations, documents, test reports, and test certificates are to be submitted to OWNER for approval in 6-fold. After receiving approval LSTK CONTRACTOR to submit for final approval all of the above and one (1) soft copy in CF format. LSTK CONTRACTOR drawings receiving "Approved as Noted" stamp may be worked on provided all notes are incorporated. It is understood that OWNER'S approval shall not receive in no way LSTK CONTRACTOR from any of his obligations and further more shall not relieve LSTK CONTRACTOR from his obligations to timely complete the WORK according to approved project schedule by OWNER.

7.3 LSTK CONTRACTOR'S drawings shall be clearly marked with titles, equipment numbers or other item identification.

7.4 Approval of drawings and calculations by OWNER in no way absolves LSTK CONTRACTOR from its responsibility for the accuracy or for the design, construction and timely performance of the WORK.

7.5 LSTK CONTRACTOR shall promptly submit reports of each and every. test or inspection.

7.6 LSTK CONTRACTOR shall submit quality records of the materials, as specified in previous sections and the applicable engineering specifications.

7.7 LSTK CONTRACTOR shall furnish an equipment installation record indicating date of installation and tag number of each piece of equipment.

7.8 LSTK CONTRACTOR shall furnish an equipment maintenance record indicating date and type or maintenance of each piece of equipment during the LSTK CONTRACTOR period.

7.9 LSTK CONTRACTOR shall fill out checklists as required by OWNER.

8.0 **LIFTING, LIFTING EQUIPMENT AND GEAR**

8.1 Rigging and hoisting shall be executed in accordance with construction specification local and governmental requirements and safety manuals, as well as specific equipment manufacturer's instructions. If there are conflicts. the more stringent shall prevail.

8.2 LSTK CONTRACTOR shall only perform the lifts and movements in accordance with approved LSTK CONTRACTOR submitted rigging studies and plans.

8.3 Preferably, equipment will be lifted in accordance with manufacturer's instructions, if include, using lifting trunnions, lifting lugs if provided, or by slings attached to or around the equipment, with adequate protective measures to prevent damage to equipment. No temporary lifting lugs shall be used without the written approval of OWNER.

8.4 No nozzles or other appurtenances not intended for lifting shall be used for attachment of slings.

8.5 Equipment shall be handled with sufficient care to prevent damage. Slings shall have adequate protection to prevent marring the surface of equipment. Where necessary, sling spreaders shall be used to prevent crushing or other damage to the equipment.

8.6 **Testing And Certification**

All LSTK CONTRACTOR furnished cranes, lifting appliances and lifting gear must be properly tested, examined and /or inspected before being used on site and at the intervals specified in the applicable regulations. Copies of the relevant certificates must always be available on site for inspection on request by OWNER or proper authorities.

8.7 **Operation**

8.7.1 LSTK CONTRACTOR shall not permit a lifting appliance to be operated otherwise than by a person trained and competent to do so.

8.7.2 LSTK CONTRACTOR shall take express steps to ensure that all personnel employed by LSTK CONTRACTOR are competent and experienced for their assigned tasks.

9.0 **WELDING**

Welding of or on equipment shall only be permitted with the approval or OWNER.

10.0 **EQUIPMENT PAINTING & INSULATION TOUCH**

Rotating and special equipment to be erected by LSTK CONTRACTOR will be delivered to SITE finished painted. LSTK CONTRACTOR is responsible to apply remedial *I* touch up painting for any damages to paint, or protective coatings on equipment handled by it in connection. With any aspect of this operations such as unloading. transport, handling and **erection as per Annexure mention in ITB Section.**

ANNEXURE- 7 - 2E

ELECTRICAL WORK

1.0 **SCOPE : ELECTRICAL WORK COVERS**

1.1 Installation and erection of the following equipment (items) consists of the preparation for installation, connection, testing and pre-commissioning etc. as per specifications and as per drawings.

1.2 Provision of all tools, equipment and consumables used in the course of the work.

1.3 The installation of the following systems (items) shall consist of the connection, testing and pre-commissioning etc., so that the systems are ready for use as per specifications and as per drawings.

1.4 Transport, store and protect supplied materials to the construction location.

2.0 **ELECTRICAL ITEMS**

2.1 Generators / Motors

2.2 Control panels

2.3 Transformer

Note : Installation of all accessories, tanks, levelling and fixing in place are also considered.

2.4 **Switch Gears**

Note : Bolting together sections where supplied separately and installation of panels, levelling and fixing in place are also considered.

2.5 **Bus Ducting**

Note : Jointing and securing the associated switch boards / transformers are also considered.

2.6 Battery charger, battery sets and UPS unit.

2.7 Cables in trench / conduit / tray / Rack.

Note : Following items are also necessary .

a) Measuring and cutting of cable and protection of cut ends.

b) Identification of cables
c) Fixing of cable to tray / rack

2.8 Cable Glands

2.9 Cable terminations

2.10 Earthing cable in trench / conduit / tape on tray / Rack
2.11 Earth cable tape terminations

2.12 Lightening protection

2.13 Lighting/ fittings / supports

2.14 Earth Rod PRT and cover

2.15 Cable tiles

2.16 Trench marker posts

2.17 Air craft warning

2.18 Underground electrical grounding system

Note : All bellow items are also considered :

a) Pulling of grounding cable in trenches, through culverts, protection sleeves and cable ducts as per grounding cable supplier installation instruction, project specifications and layout and detail drawings.

b) Coil up and clearly designate the final destination of the cable ends, especially if cables have to be continued their routing underground or overhead via cable tray or otherwise to their final destination at a later date.

c) Install, including the provision of the required tools, the required through branch and end connections.

d) Installation of all grounding electrodes including inspection pits as per specification and the layout and detail drawings.

e) Return of the cable drums to the storage area including a clear make up of cable lengthleft on the reels of drums that are not empty.

f) Measure cable resistance for grounding continuity and grounding resistance of ground rods, record data and submit the rest result reports to OWNER prior to commissioning of the installation.

g) Check cables are in proper trenches and ground rods at their location.

h) Perform all test; witnessed by OWNER'S REPRESENTATIVES of the founding installation including the provision of all OWNER approved testing equipment and measuring devices.

2.19 Miscellaneous Electrical equipment

2.20 Earth resistance testing including earth resistance rods for grounding, continuity of grounding, installation resistance testing for electrical cables and HL-POT testing for electrical cables.

3.0 TESTING AND COMMISSIONING

Testing and commissioning consist of the complete testing prior to commissioning, including provision of required testing apparatus and testing documents as requested and as specified in the testing specifications.

- All test results shall be recorded on the test form and submitted to OWNER. Each test record shall include. date of test, ambient temperature, climatic conditions, instruments used with serial numbers, names of test personnel and witnesses, identifications of equipment, ground electrode or circuit tested.

- Testing shall be scheduled at least 24 hours in advance and OWNER is to be notified by LSTK CONTRACTOR. LSTK CONTRACTOR will notify all necessary interested parties including manufacturer's representatives.

  High potential tests shall not be repeated without authorization by OWNER.

4.0 DRAWINGS AND DOCUMENTS

4.1 LSTK CONTRACTOR will carry out all construction and any required erection activities directly from the AFC construction drawings and specifications.

4.2 LSTK CONTRACTOR shall promptly submit reports of each and every test or inspection.

4.3 For more details LSTK CONTRACTOR shall follow **Electrical design philosophy elsewhere mentioned in ITB.**

ANNEXURE- 7 – 2F

INSTRUMENTATION WORK

1.0 **GENERAL**

1.1 Instrumentation symbols and identification of functions shall be based on the current edition of ISA S5.1.

1.2 Specifications for instruments and items of control equipment are shown on data sheets to be issued as they become available.

1.3 All materials and connections for control valves, relief valves, level controllers and similar equipment shall comply with applicable requirements for valves and fittings as noted in the piping specification.

1.4 LSTK CONTRACTOR shall install all shim plates, fixing material such as but not limited to anchors, red heads, etc.

1.5 LSTK CONTRACTOR shall install all instrument equipment tag plates.

2.0 **FIELD INSTRUMENT INSPECTION AND CALIBRATION AND INSTALLATION**

2.1.1 This item covers all activities and supply of all materials to import calibration of instruments. It includes, but is not limited to, the following :

2.1.1 Provision of all tools, equipment and consumables used in the course of the work.

- Calibration of instruments and provision of all necessary test equipment gauges, materials and ancillary items. All necessary testing instruments to be used must be certified by Govt. recognized testing laboratories.

- Check orifice plates and control valves.

- Protection of instruments to maintain cleanliness at all times.

- Mark instrument to indicate status of calibration.

- Return instruments, after calibration and checking to lay-down areas and / or stores including all packaging.

- Pressure and leak test including the provision of all necessary test equipment gauges materials and ancillary items.

Note : The calibration of all instruments within the packages is also the responsibility of LSTK

Contractor.

2.1.2 LSTK CONTRACTOR shall install all instruments as listed in the instrument index and further per the relevant installation specifications, documents and drawings.

2.1.3 Field instrument installation includes, but is not limited to:

Mounting of instruments and related equipment, supports protection boxes, manifolds, junction boxes, nameplates, etc.
Installation of measuring elements (probes, sensors, detectors, etc) including their auxiliaries as required (thermo wells, supports, valves, etc.) unless done by others

Installation of on-line instruments (by piping)

The following is a typical list of on-line instruments:

- Safety blow down valves.
- Control valves (all types)
- Motor - operated valves.
- Safety shut - down valves (including solenoid valves).
- Safety / relief valves.
- Pressure / vacuum relief valves.
- Self - regulating valves.
- Level gauges.
- Level displacer chambers.
- Orifice assemblies.
- Orifice plates.
- Venturies.
- Turbine meters, annubars, magnetic flow meter.
- Positive displacement meters.
- Variable area meters (rotameters)

- Stilling Wells.
- Thermo wells and etc.

- Installation of process connections, impulse lines and capillaries.

- Installation of purge and flushing supply tubing, filter blocks and rotameters.

- Installation of air supply lines.

- Supply and installation of instrument nameplates for field instruments.

2.2 Cable, Supports and Fixing Wire pins, Conduit

LSTK CONTRACTOR shall use for cable installation for indoor and outdoor use the materials such as tubing, cable trays, etc. as called in the specifications.

2.2.1 Cable tray. ladder rack and tubing systems shall be installed to ensure electrical continuity throughout the run and such that water cannot collect or remain in any part of the system.

2.2.2 Pulling of the cables into the trenches, through culverts, protection sleeves and cable ducts as per cable supplier installation instructions and layout drawings, cable lists, trench sections and reel schedules.

2.2.3 Installation of the cable separation tiles, if specified.

2.2.4 Coil up and clearly designate the final destination of the cable ends, especially if cables have to be continued their routing underground or overhead via cable tray or otherwise to their final destination at a later date.

2.2.5 Installation of the sealing shrouds to avoid water ingress after cable cutting.

2.2.6 Installation of the cable markers stamped with cable number by LSTK CONTRACTOR as per cable list.

2.2.7 Installation of cable splicing if required.

2.2.8 Return of the cable drums to the storage area including clear markup of the cable length left on the reels of cable drums that are not empty.

2.2.9 Check if cables are spaced as specified.

2.2.10 Measure cable resistance and cable insulation, record data and submit the test result reports prior to commissioning of installation.

2.2.11 Check whether all cables are installed in the proper trenches.

2.2.12 Perform all tests, witnessed by OWNER of the underground cable installation including the provision of the OWNER'S approved testing equipment and measuring devices.

2.2.13 Record of actual installed cable lengths and location of cable splices.

2.2.14 Where cables required to be installed through or across the edges of tray or other metal work the edge of the lips shall be smoothed. painted and lined with a protective sleeving to avoid cable damage.

2.2.15 Supporting steelwork shall be fabricated and installed by LSTK CONTRACTOR. The material shall be primed in accordance with the painting specification by LSTK CONTRACTOR.

2.2.16 Storage and handling of cable before and during installation shall be carried out with due regard to manufacturer's recommendations. Cable drums shall be rotated only in the direction indicated by drum markings, and open ends of cables are to be effectively sealed immediately after cutting to prevent the ingress of moisture.

2.2.17 At all times, the utmost care shall be exercised to avoid damaging the protective sheathing to cable or of causing excessive bending or twisting which may result in damage to core insulation, sheaths armor and so on.

2.2.18 The bending radius of a cable either during or after installation shall not be less than manufacturer's recommended minimum.

2.2.19 Cables shall be run in continuous unbroken lengths and joints shall not be permitted unless specifically called for in the cable drum-cutting schedule.

2.2.20 Cables installed above ground shall be routed to avoid high-risk areas, e.g. high fire risk areas, and those areas where accidental leakage or spillage may occur and cause damage to cables and supports.

2.2.21 During installation, the ends of cables shall temporarily be protected using compound, tape, heat shrink seals or similar approved methods to avoid damage or entry or moisture until they are permanently terminated.

2.2.22 Pre-cast concrete members should not be drilled for any reason. Fixing shall always be by means of clamping brackets in the most efficient way and in consolation with OWNER.

2.2.23 Under no circumstances shall welding be carried out to any process plant equipment, vessels, pipelines, or structures or to any protected surface unless specifically indicated on the drawings and documentation and then in strict accordance with a procedure subject to Approval of OWNER.

2.2.24 Fixings to the above shall normally be made where brackets and so on, have already been provided or when agreed by the use of purpose built clamps.

2.2.25 On trays horizontal cable runs shall be fastened every 1200 mm, vertical cable runs every 600 mm.

2.2.26 **Grouping**

The cables employed to convey electricity shall be grouped according to the signal kinds. The main group kinds are but not limited to the followings

a) Intrinsically safe signals.
b) Signal cables not intrinsically safe.
c) Instruments power supply cables.
d) Coaxial cables or telephone cables used as serial data buses.

2.2.27 All cable trays, ladders, tubing and supports and fixing material for indoor and outdoor use shall be installed by LSTK CONTRACTOR.

2.2.28 All cables shall always be installed and connected in such a way that no forces can act on terminals. Further, all instrument and power supply cables inside and outside buildings shall be installed in accordance with both cable lists and drawings by LSTK CONTRACTOR.

Carbon steel coated cable stub ups shall be installed by LSTK CONTRACTOR for all cables from sand trenches to 500 mm above ground, in accordance with electrical connection detail drawings.

2.2.29 **Conduit system**

Single pair cables shall be used to connect field mounted instruments to local junction boxes. Single cables shall be armoured type laid in galvanized carbon steel / aluminium pipes with open ends or on closed cable trays. In order not to damage the cable, a plastic annular cap shall cover the pipe end.

Multipair cables shall be used to connect above said local junction boxes to the control room. Multipair cables shall be armoured type and shall run over head in closed cable trays / ladders supported on the pipe racks.

2.2.30 **Wire Pins**

All stranded cable conductors shall be fitted with crimped taper pins, amp (or equivalent) and all screens with lugs. Installation of all amp wire pins and screen lugs by LSTK CONTRACTOR.

Further, in general, all standby conductors shall be wired to terminals.

2.2.31 **Cable Marking**

All instrument cables, conductors and the instrument screen/earth wires shall be tagged on both sides in accordance with the instrument connection list for local and central control

room signals by LSTK CONTRACTOR.

2.2.32 **Cable Entry Sealing**

- **General**

  After installation of all cables and on direction of OWNER, LSTK CONTRACTOR shall seal off all cable entries and passages.

- **Outside walls**

  All cable entries in outside walls and below grade level shall be watertight sealed. Method of sealing shall be supplied by LSTK CONTRACTOR.

- **Separation walls**

  All cable entries in separation walls of buildings shall be sealed with a fire resistant sealing as described hereafter.

- **Control Room Floors**

  All cable and cabinet entries in floors shall be sealed with polyurethane foam.

- **Fire - resistant sealing**

  All fire resistant sealing shall be class H-30.
  Small openings in walls shall be sealed with CSD –F (or equal) in luminescent foam.

  Large openings in walls and between computer floor and cable basement shall be sealed by inserting CSD-F (or equal) in luminescent plates under between and above the cables. The remaining openings shall be sealed with CSD-F (or equal) in luminescent foam.

2.3 **Alarm Systems**

2.3.1 LSTK CONTRACTOR shall install the fire alarm including sensors, cabling, local panels, mimic panels and host system. In accordance with:

- Project engineering specification and codes and standards.

- Cabling between panel and detectors, alarms, switches etc. as described above.

- Installation of all junction / terminal boxes, cable terminations and connections, supporting brackets for cabling as described above.

2.3.2 All work related to the fire and gas system, including overall test / loop check as per specifications and drawings, among which the installation, placing and connection of all

cables of the fire and gas panel located in the control building and panel in the firehouse shall be done by LSTK CONTRACTOR.

2.4 **Analyzers Installation**

LSTK CONTRACTOR shall install all analyzers and sampling conditioning systems in the analyzer house as well as in the field consisting of, but not limited to:

- Installation of all vents and drains from analyzers.
- Installation of calibration gas bottles as well as regulators and connecting tubing, as required.

3.0 **LOCAL PANELS**

LSTK CONTRACTOR shall install local panels, consisting of, but not limited to:

a) Mounting, aligning and fixing to the foundation or steelwork. Uncoil, install and terminate underground cable ends. Install and terminate all aboveground cable to / from panels.

b) Install and connect air supply and air signal piping and tubing to 'from panels.

c) Install cabling and connect alarm horns.

d) Identification / tagging of all equipment, terminals, cables and tubing which is not installed by panel vendor. Tag plates to be installed by LSTK CONTRACTOR.

e) Installation of brackets / supports for cable, etc. and installation material as required to complete the installation.

4.0 **TERMINATION OF CONTROL CABLES FROM THE LV SWITCH ROOM**

The control cables running from the switch room shall be installed and connected in the marshaling cabinet by LSTK CONTRACTOR.

5.0 **CONTROL BUILDING INSTRUMENT INSTALLATION**

5.1 LSTK CONTRACTOR shall install all control building instrumentation in accordance with the relevant installation specifications and drawings.

6.0 **CABINETS AND CONSOLES**

6.1.1 LSTK CONTRACTOR shall install align and anchor all equipment cabinets and consoles in accordance with design drawings and seller's installation instructions.

6.1.2 The false floor shall be completely installed by LSTK CONTRACTOR.

All panels, cabinets, tables, boxes, computers etc. located on the instrument equipment layout shall be place and installed by LSTK CONTRACTOR.

6.1.3 Where cable passage is required according to installation drawings, LSTK CONTRACTOR to indicate locations of holes and passages.

6.1.4 FCS/ESD/PLC cabinets and data base unit:

These groups / cabinets shall be installed in place and bolted together by LSTK CONTRACTOR.

Internal wiring / cabling and / or connections between these groups of cabinets shall be done by LSTK CONTRACTOR in accordance with the instructions of the system vendor's representative.

6.1.5 **FCS Consoles**

The consoles shall be installed in place and bolted together by LSTK CONTRACTOR, including installation of special table with peripherals.

Internal wiring and cabling and/or connections between consoles shall be done by LSTK CONTRACTOR in accordance with the instructions of the system vendor's representative who will be present during these operations.

6.1.6 Communication racks with the same work description as specified elsewhere in Tender documents.

6.1.7 Main processor cabinets (data base units) with the same work description as as specified elsewhere in Tender documents.

6.1.8 **Marshaling Cabinets**

Cabinets shall be installed in place and bolted together by LSTK CONTRACTOR.

Cross wiring between these assembled sections shall be done by LSTK CONTRACTOR.

6.1.9 **Fire Panel Cabinets.**

6.2 **Handling and installation. Termination and Connection of Cabling**

Cables entering instrument room are installed under false floor. These cable shall be handled, cut to length, stripped and after installation of the cabinets be terminated and connected by LSTK CONTRACTOR.

LSTK CONTRACTOR shall leave slack in the cables and provide markings.

6.3 **Installation of System Cables**

LSTK CONTRACTOR shall install, plug in and support all system cables. Cable supporting rail in cabinets is installed by cabinet / console vendors, but in any case LSTK CONTRACTOR is responsible.

- System cable shall be installed by LSTK CONTRACTOR under false floor in auxiliary room. System cables are covered by instrument cable list.

6.4 **Conduits Cable Tray / Trucking. Support Frames and Brackets**

All cable trays, cable trucking, supports / brackets, etc. if required , shall be installed by LSTK CONTRACTOR. For cable tray installation see respective part.

6.5 **Auxiliary Cable Installation and Termination.**

LSTK CONTRACTOR shall install, terminate, support and connect all auxiliary cables.

Auxiliary cables are all cables covered by instrument cable list and instrument cable layout for control room.

LSTK CONTRACTOR shall open / remove and close parts of the false floor as required for cable installation.

6.6 **Communication Cables**

LSTK CONTRACTOR shall install and support communication cables. The connection of the cables in the consoles and cabinets shall be done by LSTK CONTRACTOR, under direct supervision of system vendor. LSTK CONTRACTOR shall open / remove and close parts of the false floor as required for cable installation. Communication cables are listed on instrument cable layout for control room and the system cable list.

6.7 **Power Supply Cabling**

LSTK CONTRACTOR shall install. terminate and connect all power supply cables between power distribution boards and cabinets, consoles, printers and other instrument equipment when listed on the power supply list

6.8 **Earthing System**

LSTK CONTRACTOR shall install and connect the insulated earthing cabling / wiring from the earth buses to the cabinets, consoles and all other instrument equipment.

All cabinets and consoles shall be fitted with earthing bus bars and earthing connection bolts by the vendors and under supervision of LSTK CONTRACTOR.

LSTK CONTRACTOR shall install utility, shield and dedicated earth (clean earth) cabling and connections including tags at both ends.

LSTK CONTRACTOR shall check and test earthing system in accordance with relevant documents.

7.0 LIFTING

7.1 Major instrument equipment shall be rigged from points designated or suitable to accept rigging. When available, LSTK CONTRACTOR shall utilize lugs on equipment.

7.2 When establishing hoisting loads, riggings plans and crane capacities, LSTK CONTRACTOR shall adhere to the requirements and instructions as defined in the specifications and as instructed by OWNER.

8.0 TESTING AND PRECOMMISSIONING (FUNCTION TEST)

8.1 Testing and pre-commissioning consist of the complete testing and pre-commissioning prior to commissioning, including provision of required testing apparatus and testing documents, comprising, but not limited to:

8.1.1 Check for completion and conformance to specifications.

8.1.2 Check the accessibility of all instruments and components for field adjustments, routine maintenance and removal for overhaul, and relocate as necessary.

8.1.3 Perform pressure test on all air sub headers as required by the line specifications.

8.1.4 Clean all instrument air sub headers, transmission tubing and control tubing by blowing with dry, filtered air prior to connection of instrument components

8.1.5 Leak test pneumatic transmission and control tubing, using an approved method acceptable to OWNER

8.1.6 Perform hydrostatic or, where appropriate, pneumatic pressure tests on all instrument process piping, as required by the respective line specifications. Drain and below free of water, as necessary after test.

8.1.7 Check continuity and identification of transmission and control systems for each instrument to ensure proper hookup. Perform megger and continuity tests for instrument electrical wiring. Check correct source of power, polarity and earthing (take into account intrinsically safe technology of this procedure).

8.1.8 Check the bore of the orifice plates and flow direction during and after installation.

8.1.9 Check (on/off valve and) control valves for direction of flow and proper operation, e.g. travel, action with air failure, etc.

8.1.10 Calibrate all instruments (including the instruments in the fire and gas system) and synchronize transmitter and receiver readings for each instrument loop. Check the orifice plates and flow nozzles. Set air pressure regulators.

8.1.11 Install pressure and temperature gauges after line flushing.

8.2 Check fuses, perform voltage checks and energize all electrically powered instruments, alarm and shutdown system, etc. Maintain power supply.

8.3 Set pneumatic and electronic type switches and local control by simulation of input signals.

8.4 Check thermocouples and resistance thermometer circuits from element to measuring instrument by simulation.

8.5 Check and adjust calibration of all other field and panel mounted instruments.

8.6 Complete loop functional test of all instruments, including the instruments in all package units and in the fire and gas system. Functionally test complete control loops alarm and shutdown systems and partial process sequence, etc., to verify capability to measure, operate and stroke final control elements in the direction and manner required by the process application.
All test results shall be recorded and submitted to OWNER. Each test record shall include date of test, ambient temperature, climatic conditions, instruments used with serial numbers, names of test personnel and witnesses, identification of equipment, ground electrode or circuit tested.

Testing shall be scheduled at least 24 hours in advance and OWNER is to be notified by LSTK CONTRACTOR. LSTK CONTRACTOR shall advise OWNER prior to testing, of make, type and accuracy of test equipment used for above-mentioned items. All required test certificates should be of a recent date not exceeding 6 months.

9.0 PAINTING

Surface preparation and application of all required paint layers shall be executed in accordance with paint specifications and related standards.

10.0 WELDING

LSTK CONTRACTOR shall perform welding in accordance with the normal accepted industrial standards.

11.0 MECHANICAL COMPLETION

LSTK CONTRACTOR shall advise OWNER in writing when erection is completed.

Mechanical completion date shall be the date when the activities have been accomplished by LSTK CONTRACTOR as dictated by the construction schedule, which shall be submitted by LSTK CONTRACTOR and approved by OWNER on due time.

12.0 **QUALITY ASSURANCE, QUALITY CONTROL, INSPECTION, CALIBRATION TEST AND MATERIAL CERTIFICATES**

12.1 LSTK CONTRACTOR shall perform quality control, inspect, calibrate required testing, pre-commissioning and supply certificates.

12.2 LSTK CONTRACTOR shall submit reports of each and every test or inspection within three (3) days after actual test or inspection is made.

12.3 Calibration and Testing.

12.3.1 Calibration and testing to be executed by LSTK CONTRACTOR in accordance with respective specifications.

Local instruments such as transmitters, converters, receivers and so on, will be preset by bench testing by LSTK CONTRACTOR in accordance with the specifications before installation on the process, so that no new settings will be necessary for loop acceptance tests.

12.3.2 LSTK CONTRACTOR shall inspect all materials up on receipt for damage and completeness. In case of damage incomplete material, LSTK CONTRACTOR shall modify and immediately inform OWNER.

12.3.3 LSTK CONTRACTOR shall carry out all tests included in this paragraph shall fill out the installation checklists and shall submit all required test certificates and documentation as required.

12.3.4 All tools and test gear necessary to carry out described tests shall be provided by LSTK CONTRACTOR.

12.3.5 Inspection and testing shall be phased with construction and installation in such a manner as to involve the minimum necessary concentration of effort and manpower and the minimum loss of time in reaching the pre-commissioning stage.

12.3.6 All inspection and testing shall be witnessed and approved by OWNER / authorized representative.

12.3.7 LSTK CONTRACTOR shall be responsible for the complete loop continuity check of the field and control room installation, including the parts of the package units, which have been connected by others.

12.3.8 OWNER reserves the rights whenever distinguished package Plant(s)/Unit(s) vendor's representative to be present at site LSTK CONTRACTOR shall be responsible to arrange this WORK.

12.3.9 LSTK CONTRACTOR shall be responsible for the loop continuity checks from the marshaling

cabinets or direct connected cabinet cables in the control room (termination point of underground multi core cable). The loop continuity checks shall be performed on a complete loop, including all parts of the loop as indicated on the instrument loop diagrams (ILD'S).

12.3.10 The communication equipment between field and control room building and/ or other buildings shall be the responsibility of LSTK CONTRACTOR.

12.3.11 Only complete loops shall be accepted, signed by OWNER after all calibration / function checks have been demonstrated successfully completed and recorded.

12.3.12 For all package units and systems supplied by LSTK CONTRACTOR, installed or partly installed and connected by LSTK CONTRACTOR.

LSTK CONTRACTOR shall perform a normal wiring and loop check of signals and supplies to and from these systems.

The following systems apply:

- Analyzer system
- Bentley Nevada system
- Flow metering system
- Fire, smoke and gas detection system
- Tank gauging
- FCS / ESD / PIC system, etc.

For more details LSTK CONTRACTOR shall follow **Electrical design philosophy elsewhere mentioned in ITB.**

13.0 **Miscellaneous**

LSTK CONTRACTOR shall remove all waste and debris from the SITE.

ANNEXURE- 7 - 2G

INSULATION WORK

1.0 **GENERAL**

1.1 **SCOPE**

This standard covers the requirement for supply and application of materials for thermal insulation of equipment, piping and other items.

1.2 **REFERENCE STANDARDS**

The design shall be in accordance with established codes, sound engineering practices and shall conform to the statutory regulations applicable to the country. The main codes, standards and statutory regulations considered as minimum requirements are as follows:- (Latest revision of these shall be followed)

IS 14164	Code of Practice for Industrial Application and finishing of thermal insulation material at temperature -80^{0}C and up to 750^{0}C.
IS 737	Wrought aluminimum and aluminium alloys, sheet, strip
IS 1254	Specification for corrugated aluminum sheet
IS 1322	Bitumen felts for waterproofing and damp proofing
IS 3069	Glossary of terms, symbols and units relating to thermal insulation materials.
IS 8183	Specifications for bonded mineral wool.
IS 9743	Thermal insulation finishing cements
IS 12436	Specification for Preformed Rigid Poly-urethane (PUF) and Poly-isocyanurate (PIR) Foams for Thermal Insulation
IS 13205	Code of practice for the application of polyurethane insulation by the in-situ pouring method.
ASTM C921	Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
ASTM C1029	Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
ASTM C1696-16	Standard Guide for Industrial Thermal Insulation Systems
ASTM C411	Standard Test Method for Hot-Surface Performance of High - Temperature Thermal Insulation
ASTM C450	Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

ASTM C871	Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
ASTM C1338	Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
ASTM C1055	Guide for Heated System Surface Conditions that Produce Contact Burn Injuries
ASTM C1139	Specification for Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board
ASTM D1622	Test Method for Apparent Density of Rigid Cellular Plastics
ASTM C680	Standard Practice for Heat Loss or Gain and Surface Temp.

1.3 **Deviations**:

Should unforeseen difficulties arise to comply with requirements of this standard.

Alternative material and application techniques superior to the requirements of this standard be submitted with complete details for approval of owner.

In case of any conflict / deviations amongst various documents, the order of precedence shall be as follows:

1. Statutory regulations.
2. Job specifications.
3. Engineering design basis.
4. Standard specification.

1.4 **LIMITATIONS**

Temperature Limits.

This standard deals with insulation applied externally on piping equipments etc. as per the table below:-

Maximum Operating Temperature	**Type of Insulation**
60^0C to 750^0C for C.S., A.S. & S.S.	HOT
- 180^0C to 20^0C	COLD

1.5 **THICKNESS DESIGN BASIS**

Thickness calculation method as per procedure given in ASTM C-680

1. **Hot Insulation**

Design Ambient Temperature	:	35ºC
Design Surface Temperature	:	45^0C
Permissible Heat Loss	:	100 kcal./m2 hr.

Permissible Wind Velocity Outside : 1 m/sec
Permissible Wind Velocity Inside : 0.25 m/sec

2. **Cold Insulation**
Design Ambient Temperature : 35ºC
Design Surface Temperature : 2 ºC below ambient/ 0.5 Deg C above the Dew Point
Permissible Heat Gain : 10-12 kcal/m2 hr
Relative Humidity : 85%
Permissible Wind Velocity Outside : 1 m/sec.
Permissible Wind Velocity Inside : 0.25 m/sec.

1.6 GENERAL REQUIREMENTS

1.6.1 Information to be supplied

- Material of construction / dimension of equipments / pipes required to be insulated.
- Temperature
- Location of equipment (Indoor/Outdoor/Elevn.)
- Requirement of removable box type insulation if any
- Special requirements if any regarding type of insulation material and other properties.
- These information shall be supplied in form of insulation schedule.
- Design calculations, drawings and insulation material schedule.
- Material Test certificate's.
- Insulation works execution schedule.
- Detailed procedure for all types of execution works.
- Bill of Quantities, Initial material take-off, final material take off and material requisition.
- QA/QC plan.

1.6.2 STORAGE OF MATERIAL

Insulation material shall at no time be stacked directly on the ground; instead it will be stored at a level higher than ground level. It should not only be covered by tarpaulin but other effective protections against weather are also to be provided. The contractor shall provide a properly covered storage to the satisfaction of engineer-in-charge (Refer IS: 10556).

1.6.3 HYDROSTATIC TEST FOR PIPES

Before taking up insulation job on piping or vessels it shall be ensured that hydrostatic test of the concerned equipment / piping is completed. Where it is felt necessary to take up the insulation job before such testing are performed all welded and mechanical joints shall be left un-insulated for a length of at least 150mm on either side of the joint.

1.6.4 PROTECTION OF INCOMPLETE JOBS

Any part of insulation job which is not provided with final weather proofing will be adequately protected by means of tarpaulins and other aids. After the day's work similar protection should be provided for the partially completed jobs to be continued the next day to avoid any absorption of rain / moisture during the night.

2.0 INSULATION SUPPORTS (CLEATS) TO BE PROVIDED BY EQUIPMENT SUPPLIER

Suitable supports (cleats) in the form of rings, lugs, studs or pins shall be provided on equipment by equipment supplier, however should any additional supports or anchorage be felt necessary for insulation works, the same shall be also considered in LTSK's scope, including all allied work necessary for the same. These will be installed by the contractor free of any extra cost. Owner shall be informed about the same in advance, so also design/drawings shall be updated accordingly.

3.0 MATERIAL REQUIREMENTS

3.1 INSULATION MATERIALS

3.1.1 General

Whenever reference to any Standard is made it is presumed that the latest revision as on date should be considered unless otherwise specified.

3.1.2 Specification and other requirements

Specification and other requirements will be as per below mentioned table:-

Hot Insulation:

For operating temperature Upto 400 deg.C,	Rockwool Mattress of density 120 kg/m3 conforming to IS:8183.
For operating temperature 401-450 deg.C,	Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 451-500 deg.C,	1st layer insulation shall be 25mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 501-550 deg.C	1st layer insulation shall be 50mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.
For operating temperature 551-600 deg.C,	1st layer insulation shall be 75mm Ceramic Fibre Blanket of density 128 kg/m3 conforming to IS :15402 and balance layers with Rockwool Mattress of density 150 kg/m3 conforming to IS:8183.

Bands/Wires for securing insulation shall be of ASTM 8209 Alloy 3003 H16 or 18-737 designation 31000 (old NS3) condition H3 or 18/8 Stainless steel.

For securing cladding on insulation on piping, aluminium band 12mm (min) X 24 SWG thick shall be used. For securing cladding on insulation on equipment, aluminium band 20mm wide X 24 SWG shall be used.

Other insulating materials may be used provided they have the same or better properties and durability aspects.

Insulation thickness of insulating materials shall be based on design calculation of thermal conductivity, insulation class, etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters.

For Valves, Turbines & Compressors Insulation

Prefabricated factory made Ceramic Fibre pad to be used made out of Ceramic Fibre Blanket of density 128 kg/m3 encased in high temperature resistant cloth. The minimum thickness of the pad shall be –

1. 0 Deg.C to 300 Deg.C = 25mm
2. 301 Deg.C to 400 Deg.C = 50mm
3. 401 Deg.C to 500 Deg.C = 75mm

Removable insulation for flanges and valves, like tailor made jackets or pre formed insulation boxes, shall be suitable for quick removal and reinstallation. All tailor made jackets shall fit the actual valve/flange/equipment and secure adequate overlap to incoming insulated pipes.

Technical data sheet of the Ceramic Fibre Pad is as below:

A.	Purpose/Application This Engineering specification is for Fabric jacketed supercera ceramic Fibre insulated flexible reusable covers/pad for application on pipes: pipe fittings, valves, flanges etc vessels & equipments, tubes etc in hot services.				
01	Dimension (mm)	As per drawing/sketch provided by OEM.			
02	Thickness (mm)	25-100			
1.	Specification of Protective jacketed material				
i	Vest Cover	Liner Fibre Glass Fabric			
ii	External Top Cover Fabric (for cold face)	Polymer Coated Fibre Glass fabric Temp. resistance 300 Deg. C, oil & water resistant			
iii	External Bottom Cover fabric (for hot face)	High silica cloth for Temp Resistance up to 900 Deg C			
2.	Specification of insulation Material	Ceramic Fibre Blanket (As per IS 15402)			
i	Classification Temperature	1260 degree Celsius			
ii	Thickness	25 – 100mm			
iii	Bulk Density	128kg/m3			
iv	Shot content on 70 mesh (%)	<30			
v	Tensile strength (KPa)	>40			
vi	Mean Fibre Dia (Micron)	2-4			
vii	Linear Shrinkage (%) At 1200 Deg. C for 24 Hrs	3.5			
viii	Thermal Conductivity (W/mK) Max.	1000C	2000C	3000C	5000C
		0.046	0.072	0.078	0.150
ix	Chemical composition	SiO2%		49-58	
		Al2O3%		41-48	
		ZrO2%		0-7	
		FeO3%		<0.1	
3	Hardware & Non Metal fastening				

i)	Buckle/Draw Stings	Stainless steel (min SS 316), High Temp Braided Chord of fibre glass
ii)	Stic Pins	Stainless Steel (min SS 316), Pins to prevent the insulation from movement inside the cover
iii)	Stitching	Double sewn with Teflon coated Fibre glass wrapped stainless thread. The sewing thread shall not resolve or decompose in typical chemical plant environment.
iv)	Belting	High Temp Fabric same as used in hot face cover
4	Other Properties	
i	Fire Resistance (As per BS 476 Part-4)	Non-Combustible
ii	Chemical Stability/Resistance of Corrosion/water	Good
iv	Shock Resistance	Excellent

Rockwool Insulation shall be of water Repellent Grade and tested as per BS: 2972 for Water Absorption. Maximum water absorption is 0.5 kg/m2 in 48 hours duration.

Precautions must be implemented in the design and fabrication of the insulation jackets to avoid the insulation material from sagging causing reduction of the insulation properties of the jackets.

Cold Insulation:

Insulation material and specifications for cold insulation for operating temperatures up to (-) 180°C and dual temperature (cold/hot) service where, upper temperature limit is 125˚C shall be as given below for all sizes of piping/equipment:

- **Polyurethane Foam**

Preformed pipe section's and radial lags (for higher diameter pipe) of polyurethane foam of self-extinguishing type shall be in accordance with ASTM C591 TYPE-II Grade 2.The physical requirement of bulk density, chloride content, thermal conductivity and PH value of the material shall be as follows:

Temp. Limit Bulk density: Upto (-)180°C & 120°C (max) 35.0 to 39.9kg/m3
Chloride content : 20 ppm (max)
Thermal conductivity : 0.221 mw/cm˚C at mean temp. 10 deg C
PH Value : Neutral.
Closed cell content : 95% (min)

High density polyurethane foam block of bulk density more than 300 Kg/m3 shall be used for supports.

- **Polyurethane Foam Cast-in-Situ**

Cast-in-Situ Polyurethane Foam of density 42±2 kg/m3 conforming to IS: 13205 shall be used. High density polyurethane foam block of bulk density more than 300 Kg/m3 shall be used for supports.
Temp. Limit : Up to (-) 45°C and 120°C (max.)

- **Polyisocynaurate**

Temp. Limit : Up to (-) 180˚C and 125˚C (max.)

Other insulating materials may be used provided they have the same or better properties and durability aspects.

Insulation material specification/ thickness/application mentioned in this document are the minimum requirements. Insulation specification/ thickness/ application shall be based on design calculation of thermal conductivity, insulation class, relevant IS/ ASTM codes etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters. LSTK shall submit detailed material specifications, durability parameters assured, test certificates and application procedure to OWNER/ PMC approval.

3.2 AUXILIARY MATERIALS FOR CLADDING

a) **Aluminium Cladding**

- **Horizontal Vessels**

Aluminium sheet as per IS-737 (designation 31000, condition H3 for flat sheet & 31500/51300, H4 for corrugated sheets)) shall be used for cladding. Insulation on overall piping, vessel and equipment, cladding will be coated on the side in contact with insulation with 3 mil thick polysurlyn film.

Specifications for aluminium Cladding material shall be as follows:

Material	Reference Code / Standard	Thickness	Application
Aluminium sheet with applied moisture barrier of 3 mil thick Polysurlyn coating	IS : 737 / ASTM C-653	22 SWG (0.71mm)	For all piping, tanks, vessels, heat exchanger, flanges, valves, equipments etc. upto 24” outside dia
		20 SWG (0.91mm)	For piping, tanks, vessels, heat exchanger, flanges, valves etc. above 24” outside dia
Removable cover for flanges, valves etc. shall be made out of minimum 18 SWG thickness Aluminium Sheets.			

- Vertical Vessels

Cladding material for vessels with insulation O.D. 900 mm and less shall be same as for pipes. For vessels above 900 mm insulation O.D. 22 SWG corrugated aluminium sheet as per IS-1254 or ribbed aluminium sheet 32 mm x 5 mm deep corrugations may be used.

Aluminium Foil to protect stainless surfaces in Temperature below 0 deg c shall be 0.1 mm (42 SWG) thick per ASTM 8209 alloy 3003 H16 or IS-737 designation 31000 (0IdNS3) condition H3. For securing aluminium foil on stainless steel surface 24 SWG thick x 20mm wide aluminium bands shall be used.

b) **Screws**
Screws used with aluminium sheeting shall be of self tapping type, A No.8x12mm long cadmium plated / SS of high quality at intervals of 150mm.

c) **S-Clips**.
Aluminium, 20x1.5mm or 25mm wide stainless steel banding bent to form a shape of "S" provide a minimum lap of 50mm.

d) **Bands for securing cladding**.
Aluminium of dimensions 12mm width x 0.56 mm thick (24 SWG) for pipes. Stainless Steel bands Type 304, 0.4mm thick x 13mm wide for large dia pipes (above 24") and cylindrical equipment up to outside dia 900mm, 0.5mm thick x 19mm wide for cylindrical equipment above 900mm outside dia meter.

e) **Quick release clips for removable covers**.
Suitable quick release clips will be made as shown in fig. 7 from 20Cm width x 20 SWG aluminium sheet and some fig.7 from 20mm width x 20 SWG aluminium sheet and some suitable rectangular ring.

f) Sealant for cladding joints with Foster 95-44 /TIKI F9544.

g) The vapour barrier mastic shall be Foster 60-38/39 /TIKI M6038/39

h) Adhesive for cold insulation shall be Foster 81-33 /TIKI P8133

i) Vapour Stops at pipe support location shall be Foster 90-66 /TIKI F9066

j) **Rivets**: Aluminium 'POP' blind eye type / Stainless Steel 9.5mm long x 5mm dia meter.

k) Filler material shall be PUF dust or mineral wool mixed with specified adhesive shall be placed lightly so as to fill irregular voids and sealant shall be Foster Foam Seal Sealer 30-45. Glass cloth to be used for vapour barrier reinforcement shall be open weave 10 mesh having glass fibre thickness of 5 mils.

Galvanised steel sheets/ Annealed galvanised steel sheets/ Galvanised colour coated sheet are strictly **PROHIBITED** for use in cladding works. Other cladding materials (except G.I.) may be used provided they have the same or better properties and durability aspects, after prior approval from Owner/PMC.

Cladding material / auxiliary material specification/ thickness/ application mentioned in this document are the minimum requirements. Cladding material/ auxiliary material specification/ thickness/ application shall be based on design calculation of thermal conductivity, insulation class, corrosion aspects, durability, relevant IS/ ASTM codes, etc. Same shall be submitted to the Owner with necessary design calculations, drawings, test certificates and durability parameters.

LSTK shall submit material specifications, durability parameters assured, test certificates and application procedure to OWNER/PMC approval.

4.0 INSPECTION.

4.1 General

All insulation material shall be subject to inspection by owner before application. In case of doubt, Owner's representative will have the liberty to get the material tested by the contractor at any approved test laboratory. Any material not meeting specified requirement will be

rejected and the rejected material shall have to be replaced by the contractor with material of specified type and quality. Insulation found to be improperly installed shall be removed and reinstalled properly by the contractor.

Contractor shall maintain detailed log of various insulation works and same shall be updated on daily basis. QA/QC checks of work done and materials shall be also registered in the daily logs. Owner will have the liberty to check the logs.

4.2 **Inspection**

Inspection of materials and / or installation by owner shall not relieve the contractor of his responsibility to ensure that finished insulation conform to specified requirements and is free from defects, contractor shall correct any defects due to poor workmanship. Contractor shall maintain test certificates and other relevant data from manufacturer.

4.3 **Test for thickness**

Test for thickness shall be carried out after application. Thickness at any point shall not be less than 2mm than the indicated designed thickness and excess thickness up to 115% of the designed thickness is permissible. .

4.4 **Testing for bulk density**

Testing of bulk density of the insulating materials shall be carried out before the application of insulation. This should be within ± 15% of the specified value. Test location shall be selected by owner and its repair shall be done by contractor.

5.0 **APPLICATION**

5.1 **General**

Insulation thickness shall be as per design calculations as specified in the drawings/ insulation schedule/ specification/isometric drawings prepared for equipments/piping.

Contractor shall submit detailed calculations and procedure for different insulation works based on relevant IS / ASTM codes.

5.2 **No. of Layers**

When insulation thickness exceeds 75 mm, the insulation shall be applied in multi-layers with all joints staggered. Each layer will be separately secured with metallic bands/wires.

No. of layers shall be as follows:

Insulation Thickness	**No. of Layers (Min.)**
Up to 75mm	1 Layer
76 to 150 mm	2 Layers
151 and above	3 Layers or more.

5.3 **GENERAL REQUIREMENTS**

5.3.1 **Surface preparation**

- Surface to be insulated shall be cleaned of all dirt. Oil loose scale etc. by wire brushing. Insulation works shall commence only after necessary clearance from QA/QC for painting works as per painting specification. All insulation shall be applied at ambient temperature and both the metal surface and insulation material shall be dry prior to application of insulation.

- The surface for cold insulation shall be then coated with a bitumen emulsion or a mastic coating.

- If the vessel is made of stainless steel, it shall be wire-brushed. with stainless steel wire brush.

5.3.2 **Expansion / contraction joint**

Depending on the type of insulation used the operating temperatures and nature of the material it may be necessary to provide expansion/contraction joints on vessels or pipes to prevent the insulation from rupturing/buckling when the surface expands/contracts. Joints are to be designed as per relevant IS / ASTM codes.

5.3.3 **Filling of Voids**

All voids, irregularities and joints shall be packed with loose insulation material/insulation cement trowelled smooth whichever is applicable.

6.0 **MEASUREMENT OF INSULATION WORK.**

6.1 Measurement of insulation works shall be as per IS: 14164.

7.0 **GUARANTEE**

- There shall be a surface temperature recording as mentioned in the Design Parameter to be performed with the help of Thermography Camera, post the line/ equipment is charged in operating conditions. The same shall be in LSTK's scope and LSTK shall give a detailed report of the same.

-The guarantee test shall be carried out when plant is fully operative.

-The surface temperature, reading shall be taken at six points per pipe line and at each point it shall be taken on all four sides in top, bottom, left side and right side.

-The above reading shall be taken at 2 hours intervals and shall be taken for 18 hours starting from 11 a.m. in the morning.

- Simultaneously ambient temperature shall be taken as per IS: 14164

- A graph shall be plotted between ambient and surface temperature reading

- From this graph the surface temperature against ambient temperature shall be found out

- The ambient and surface temperature shall be measured by the instrument provided by the contractor. The instrument shall be calibrated to the satisfaction of owner/consultant.

- The contractor is required to guarantee the surface temperature of 60ºC (max.) for equipments and piping in case of Hot Insulation. For cold insulation of equipments and piping, the difference between skin temperature and ambient temperature shall not exceed 2 ºC.

- Ambient temperature and surface temperature shall be measured by duly calibrated instruments provided by CONTRACTOR.

- The CONTRACTOR shall undertake immediate replacement of insulation material damaged in transit, storage or application, at no additional cost to Owner.

- LSTK shall produce required number of copies of test certificates as per relevant IS/ASTM Standard. LSTK shall certify/ensure that Test to be done are from NABL approved laboratory, approved by Owner.

- All materials are new and unused and are as per specifications called for in this standard.

- The operating thermal conductivity shall be as specified

- The workmanship shall be in accordance with good practice.

- Other terms & conditions of the guarantee clause shall be as per NIT / purchase order / Commercial documents of ITB.

ANNEXURE- 7 - 2H

PAINTING SPECIFICATION

1.0 GENERAL

1.1 Scope

This specification covers the technical requirements for shop and site application of paint and protective coatings and includes; the surface preparation, priming, application, testing and quality assurance for protective coatings of mechanical equipment, structural steelwork, plate work, tankage, guards, pipe work, handrails and associated metal surfaces, which will be exposed to atmospheric for the Project**.**

1.2 Definitions

C.S	-	Carbon steel and low chrome (1-$^{1}/_{4}$ Cr through 9 Cr) alloys
S.S	-	Stainless steel, such as 304,316, 321, 347,
Non-ferrous		- copper, aluminium and their alloys.
High Alloy	-	Monel, Inconel, Incoloy, Alloy 20, Hastelloy, etc.
DFT	-	Dry Film thickness, the thickness of the dried or curved paint or coating film.

1.3 Safety Regulations

Protective coatings and their application shall comply with all national, state, and local codes and regulations on surface preparation, coating application, storage, handling, safety, and environmental recommendations.

Sand or other materials producing silica dust shall NOT be used for any open-air blasting operations.

1.4 Material Safety Data Sheets

The latest issue of the coating manufacturer's product datasheet, application instructions, and Material safety data Sheets shall be available prior to starting the work and shall be complied with during all preparation and painting / coating operations.

1.5 Materials

All paints and paint materials shall be obtained from the company's approved manufacturer's list. All materials shall be supplied in the manufacturer's containers, durably and legibly marked as follows.

Specification number
Colour reference number
Method of application
Batch number
Date of Manufacture
Shelf life expiry date
Manufacturer's name or recognised trade mark.

2.0 CODE AND STANDARDS:

Without prejudice to the provision of Clause 1.1 above and the detailed specifications of the contract, the following codes & standards shall be followed. Wherever reference to any code is made, it shall correspond to the latest edition of the code.

2.1 Indian Standards:

IS-5: 1994	Colors for ready mixed paints and enamels.
IS-2379: 1990	Color codes for identification of pipe lines.
IS-2629: 1985	Recommended practice for hot-dip galvanizing on iron and steel.
IS-2633: 1986	Methods for testing uniformity of coating of zinc-coated articles.
IS-8629: 1977	Code of practice for protection of iron and steel structures from atmospheric corrosion.
IS:110	Specification for Ready Mixed Paint, Brushing, Grey Filler, for Enamels, for Over Primers
IS:101	Methods of test for ready mixed paints & enamels.

2.2 Other Standards:

2.2.1 Swedish Standard: SIS-05 5900-1967 / ISO-8501-1-1988
(Surface preparations standards for Painting Steel Surface).
This standard contains photographs of the various standards on four different degrees of rusted steel and as such is preferable for inspection purpose by the Engineer-in-charge.

2.2.1 DIN: 53151 Standards for Adhesion test.

2.3 The paint manufacturer's, instructions shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

a) Instructions for storage to avoid exposure as well as extremes of temperature.

b) Surface preparation prior to painting.

c) Mixing and thinning.

d) Application of paints and the recommended limit on time intervals between coats.

3.0 SURFACE PREPARATION

3.1 Metal Surface Preparation

3.1.1 Safety

All work in adjacent areas, which may negatively affect the quality of blast cleaning, and/or impose safety hazards, must be completed or stopped before the blasting operation starts.

3.1.2 Pre-cleaning

Prior to surface preparation all weld spatter shall be removed from the surface, all sharp edges ground down and all surfaces cleaned free of contaminants including chalked paint, dust, grease, oil, chemicals and salt. All shop primed surfaces shall be water washed by means of suitable solvent, by steam cleaning, with an alkaline cleaning agent if necessary or by high-pressure water, to remove contaminants prior to top-coating

3.1.3 Surface Decontamination

Surface decontamination shall be performed prior to paint application when uncoated surface is exposed to a corrosive environment or existing paint work is to be repaired.

Existing coatings shall be removed by abrasive blast cleaning, and then high pressure potable water shall be used to clean steel surfaces.

Prior to application of coatings, the surface shall be chemically checked for the presence of contaminants. A surface contamination analysis test kit shall be used to measure the levels of chlorides, iron salts and pH in accordance with the kit manufacturer's recommendations.

Swabs taken from the steel surface, using cotton wool test swabs soaked in distilled water shall not be less than one swab for every 25m2 of surface area to be painted.
Maximum allowable contaminant levels and pH range is as follows:

Sodium chloride, less than 50 microgram / cm2;

Soluble iron salts, less than 7 microgram / cm2; and

If the results of the contamination test fall outside the acceptable limits, then the wash water process shall be repeated over the entire surface to be painted, until the contaminant test is within the specified levels.

3.1.4 Abrasive Blasting

All C.S. materials shall be abrasive blast cleaned in accordance with Codes (Ref. Clause 2.0). To reduce the possibility of contaminating S.S., blasting is not usually specified. However, for coatings which require a blast-cleaned surface for proper adhesion, S.S. may be blast cleaned using clean aluminium oxide or garnet abrasives (Free from any chloride or Iron / Steel contamination).When hand or power tool cleaning is required on S.S., only S.S. wire-brushes (including 410 S.S.) which have not been previously used on C.S. surfaces may be used.

The surface profile of steel surfaces after blasting shall be of preparation grade Sa 2-1/2 of Swedish Standards SIS-05-5900 (Latest Revision) or better according to ISO 8501-1 and shall be measured using the replica tape method or the comparator method.

The roughness (profile) of blast-cleaned surfaces shall be Medium (G) according to ISO 8503-2: 1988 (appendix 1) unless otherwise specified. Medium defines a surface profile with a maximum peak-to-valley height of 60-100 microns, and G indicates that the surface profile is obtained by grit blasting. For the evaluation of surface roughness Comparator G shall be used.

Abrasive blast cleaning shall NOT be performed when the ambient or the substrate temperatures are less than 3^{o} C above the dew point temperature. The relative humidity should preferably be below 50% during cold weather and shall never be higher than 60% in any case.

Abrasive blast cleaning shall be performed with a clean, sharp grade of abrasive. Grain size shall be suitable for producing the specified roughness. Abrasives shall be free from oil, grease, moisture and salts, and shall contain no more than 50ppm chloride. The use of silica sand, copper slag and other potentially silica containing materials shall not be allowed

The blasting compressor shall be capable of maintaining a minimum air pressure of 7 kPa at the nozzle to obtain the acceptable surface cleanliness and profile.

The blast cleaning air compressor shall be equipped with adequately sized and properly maintained oil and water separators. The air supply shall be checked to ensure no oil and water contamination at the beginning of each work shift.

Blast cleaning abrasive shall be stored in a clean, dry environment at all times. Recycling of used abrasive is prohibited.

After blast cleaning, the surfaces shall be cleaned by washing with clean water (Pressure 7kg/Cm^2 using suitable nozzles. During washing broom corn brushes shall be used to remove foreign matter.

Assessment of the blast cleaned surfaces shall be carried out in accordance with reference code.

Blast cleaned surfaces which show evidence of rust bloom or that have been left uncoated overnight shall be re-cleaned to the specified degree of cleanliness prior to coating.

All grit and dust shall be removed after blasting and before coating application. Removal shall be by a combination of blowing clean with compressed air, followed by a thorough vacuum cleaning with an industrial grade, heavy duty vacuum cleaner.

All cleaned surfaces shall have protection from atmospheric corrosion as per IS8629:1977

3.1.5 Alternate Methods of Surface Preparation

When open air blasting is not permitted on site, or when space limitations or surface configurations preclude blasting, the alternate cleaning methods listed below may be used with prior approval. Alternate cleaning methods shall consider the degree of surface cleanliness and roughness profile required by the specified coating system.

- Vacuum or suction head abrasive blast-cleaning,
- Wet jet abrasive blast-cleaning,

- Compressed-air wet abrasive blast cleaning,
- Pressurized liquid blast-cleaning,
- Power tool cleaning,
- Hand or power tool cleaning,

Hand and/or power tool cleaning shall only be used for spot repair where abrasive blasting is not permitted or is impractical, and on items which could be damaged by abrasive blasting. Power tool cleaning shall not be carried out with tools which polish the surface, e.g. power wire brushes.

The surfaces of equipments and prefabricated piping etc. which are received at site Primerised or with finish paints, depending upon their conditions, shall be touched up and painted at site. For these surfaces sand blasting is not envisaged and these surfaces shall be prepared using power brushes, buffing or scraping, so as to achieve a surface finish to St-3 as per SIS-05-5900 . After wash-up the area to be touched up shall be jointly marked, measured and recorded for payment purposes. The type of system & nos. of coat (primer and/or finish paint) to be applied after touch up, which shall be decided by OWNER/CONSULTANT in writing before taking up the job.

When paint is to be applied on damaged painted surfaces of equipments all loose and flaking paint work should be removed to a firm feathered edge. Rusted spots should be cleaned by one of the methods specified in the clauses 4.4.1 & 4.4.2 above. In case the previous paint work is not compatible to the specified one the entire coating must be removed.

It shall be ensured that sand blasted surface/machine cleaned surface is not contaminated with oil and grease. Water shall also not be allowed to come in contact with sand blasted surface.

4.0 APPLICATION

4.1 General

The final specification of paint systems to be used to suit the exposure conditions of equipment and steelwork, shall be as specified on the scope of work, equipment data sheets or the drawings.

All coatings shall be in accordance with Indian / International Standards, the coating manufacturer's product data sheets and application instructions and the requirements contained in this specification.

4.1.1 General Requirements for Shop Application

All work areas which facilitates shop paint application shall be surface prepared for painting and have the paint system applied before installation.
Equipments assembled at site shall only receive primer coat in the shop and finish coatings will be applied at site.
In all cases, where surfaces will be inaccessible after shop assembly, they shall be prepared and have the paint system applied before assembly is carried out. Drying times between successive coats shall be at least those recommended by the manufacturer.

All known field weld areas shall be given the specified abrasive blast surface preparation but left uncoated for a distance of 50mm from the weld line. Such areas shall be given the appropriate touch-up treatment after installation.

The manufacturer's directions for preparation and application of coatings shall be followed to ensure that the durability of the coating system is not impaired.

The Contractor shall submit the full details of the proposed surface preparation and paint systems prior to the commencement of any surface preparation.

4.1.2 General Requirements for Site Application

Paint shall be stored only in accordance with the manufacturer's instructions.

All materials used for the specific system being applied shall be products supplied by one manufacturer and details of such product shall be submitted for approval before commencement of work.

The contents of cans shall be thoroughly stirred before being poured into paint pots and shall be thinned only in the specified proportions in accordance with the manufacturer's instructions.

Finish coats may be applied by spraying except where any over spray is likely to affect finished surfaces or where spraying constitutes a health hazard to workmen in the other areas. Brush and roller application will require multiple coats to achieve the specified dry film thickness.

Brush application may be used only with the approval of the company.

Roller application shall only be used on relatively large surface areas (i.e. > 50m2) and only if spraying is not an option.

The Contractor shall complete the application of any one type of paint or each coat thereof, before beginning the next coat on that section.

In cases nominated as critical, the application of each coat shall be approved before application of the next coat can proceed, in accordance with ‘hold’ points nominated in the Inspection and Test Plans (ITPs)

All fittings within any given area are to be painted with the same system as the area unless otherwise specified.

Where 2 coat of finish paint are indicated they shall be applied in two different shades to ensure that two coat are applied.

Paint shall not be applied in rain, snow, fog or mist or when the relative humidity is such as to cause condensation on metal surface.

The CONTRACTOR must ensure the availability of a specialist from the paint manufacturer, at SITE during pendency of CONTRACT within his quoted rates to ensure the quality of painting & procedure. Addition of drying agents, pigments or other substances is not allowed unless specifically prescribed or approved by paint manufacturer's specialist.

Name plates/tags attached to the equipments/machineries shall not be painted or removed during painting job. Failing to comply with above, the CONTRACTOR may be required to replace name plates/tags at his cost.

4.1.3 Qualifications and Materials

All surface preparation, coatings application and inspection, shall be carried out by personnel experienced in that particular field. Contractors shall submit the names of subcontractors to be employed for the specific work together with the brand names of coating materials for approval prior to commencement of application.

4.1.4 Handling and Transport

All pipe work, steelwork and equipment that have been finish coated shall be handled with care to preserve the coating in the best practical condition.

Painted materials shall not be handled until the coating has completely cured and dried hard Supports in contact with coated steel during transport and storage shall be covered with a soft material to prevent damage to the coating. Appropriate materials shall be used during transportation between coated steelwork and holding down chains to prevent damage to the coating.

4.2 Application of Coatings

4.2.1 General

The application method and type of equipment to be used shall be suitable for the paint specified and the surface being painted.

Paints and thinners shall be brought to the point of usage in unopened original containers bearing the manufacturer's brand name and colour designation and ready-mixed unless otherwise specified. Two-pack systems shall be mixed at the site of application to the paint manufacturer's recommendations. The mixed amount prepared shall be no more than the amount that can be applied during the stated pot life.

Paint shall be applied so that an even film of uniform thickness, tint and consistency covers the entire surface and is free of pin holes, runs, sags or excessive brush marks. Film finish shall be equal to that of first class brushwork.
Unless it is practical to do so colour shades for primer, intermediate coat and finish coat must be different to identify each coat without any ambiguity

Paint ingredients shall be kept properly mixed during paint application.

Equipment shall be kept clean to ensure dirt, dried paint and other foreign materials are not deposited in the paint film. Any cleaning solvents left in the equipment shall be completely removed before painting.
To ensure the required film thickness is achieved on angles, welds, sharp external edges, nuts and bolts, a coat shall be applied to such items/locations immediately prior to the application of each coating to the whole area.

Care shall be taken to ensure paint application into all joints and crevices.

The contact surfaces between steelwork to be fastened by means of friction grip bolting shall be abrasive blast cleaned and prime coated only, prior to erection.

4.2.2 Atmospheric conditions

Surface preparation and coating shall not be carried out in inclement weather and shall be carried out such that the surface being coated is free of moisture, wind-borne or blast cleaning dust.

Coatings shall not be applied if:

- The relative humidity exceeds 85%.
- The ambient temperature is less than 5^0C (depending on local condition)
- The metal temperature is less than 3^0C above the dew point.
- There is likely hood of an unfavourable change in weather conditions within two hours after painting.

As a general rule, sufficient ventilation, dehumidification and heating capacity to cope with local climatic conditions must be secured before any coating – related work is started.

In any case, humidity, ambient and surface temperature conditions at the time of paint application, and curing and drying time before application of the next coat, shall be in accordance with the paint manufacturer's recommendations. These conditions shall be recorded in the Inspection Test Record (ITR) by the Contractor and be available for review.

4.2.3 Conventional or Airless Spray

Spray equipment shall be equipped with accurate pressure regulators and gauges. Spray gun nozzles and needles shall be those recommended by the paint manufacturer.

Air from the spray gun shall be clean and dry with no traces of oil or moisture.

Coatings shall be wet on contacting the painted surface. Areas of dry spray shall be removed and the correct system re-applied.

4.2.4 Brush Application

The method of "laying-off" shall be suited to the paint specified and shall ensure minimum brush marking.

4.2.5 Roller Application

A uniform method of application shall be adopted when painting large areas. The rolling direction shall minimise paint joint build up. Edges and areas subject to possible roller damage shall be brush-painted prior to rolling.

4.2.6 Thickness of Coatings

The maximum thickness DFT in any one application shall not exceed that specified in Technical specifications/ recommended by the paint manufacturer.

Wet film thickness gauges shall be used to make frequent checks on the applied wet film.
The Contractor shall maintain at the site of painting operations, a dry film thickness tester of an approved type with a valid current calibration.

Coating thickness checks in accordance with reference code shall be performed, and the Contractor shall undertake remedial action if the measured thickness is less than specified.

Build up of each material to required thickness shall be made prior to the application of the subsequent coat; final film build shall be the minimum specified.

4.2.7 Multiple Coat Applications (Except Wet-On-Wet)

Before successive paint coats are applied, intermediate coats shall be inspected for surface contamination. The presence of any grease or oil, shall be removed by a suitable solvent, and any salt and dirt adhering to the surface shall be removed by scrubbing with a solution of non-toxic detergent (except those prescribed by the manufacturer as “wet-on-wet"). Removal of contaminants shall only be performed after an intermediate coat has had sufficient time to cure.

The surface shall then be pressure hosed or dusted down by brush to disturb and remove deposits not apparent on visual inspection.

Coatings shall be applied only under the following conditions:

- The surface has been cleaned and is dry;
- The manufacturer's stated minimum time for re-coat has elapsed;
- The manufacturer's stated maximum time for re-coat has not elapsed. If the maximum time has elapsed then pre-treatment shall be in accordance with the paint manufacturer's recommendations; and

  Damaged areas in preceding coat have been made good in accordance with this Specification.

When multiple coat of finish paint are indicated, they shall be applied in different shades to ensure that multiple coats have been applied.

4.2.8 Protective Coatings for Fasteners

Black and galvanised erection bolts/nuts and galvanised holding down bolts/nuts shall be prepared and painted in accordance with Section 4.4 of this Specification.

Black high tensile bolts/nuts shall be painted after erection to the same paint system specification as the surrounding structural steel.

4.3 Hot Dip Galvanising

All galvanising shall be carried out by the hot dipping process and conform to the requirements of IS-2629:1985 and uniformity of coating shall confirm to IS 2633:1986.

All welding slag shall be removed by chipping, wire brushing, flame cleaning or abrasive blast cleaning where necessary prior to galvanising

For temporary identification, either water-soluble marking paints or detachable metal labels shall be used. For permanent identification, figures/labels shall be heavily punched or embossed by the fabricator.

For galvanised items after pickling, the work shall be inspected and any defects that render the work unsuitable for galvanising shall be repaired. After such repairs, the work shall again be cleaned by pickling.

The coating mass of zinc shall be as specified on equipment data sheets and the Drawings. Galvanised coatings shall be tested by the methods described in referred code.

After galvanising all material shall be cooled to air temperature in such a manner that no embrittlement occurs.

Galvanised coatings shall be smooth, uniform, adherent and free from stains, surface imperfections and inclusions.

All gratings and fixtures including nuts, bolts and washers that are required to be galvanised, shall be hot dipped galvanised and all nut threads shall be re-tapped after galvanising and a lubricant applied on Cold working of galvanised steelwork shall be avoided.

4.4 Damaged or Inaccessible Surfaces

4.4.1 Damaged Paint Surface

Repair of damaged painted surfaces, as well as painting of galvanised and black bolts, and galvanised holding down bolts after erection shall comply with this Clause. The treatment shall be:

- Pre-clean the damaged or unpainted areas in accordance with Section 4.2.1 of this Specification;
  - Disc or hand sand to clean bright metal;
- Inorganic zinc primers subject to mechanical damage or weld etc shall be power tool cleaned
- Feather backs by sandpapering or whip blasting the original coatings surrounding the damaged area over a 50mm distance. A rough surface shall be obtained on epoxy coatings;
  - Clean surface to remove all dust;
- Conduct surface contaminant test in accordance with Section 4.2.2 of this document; and

  Build up a new paint system over the affected area with paints equal to those originally used and having the same dry film thickness for each coat. As an exception, damaged inorganic zinc primers shall be repaired with epoxy organic zinc rich paint and shall be applied within four hours of blast cleaning.

The new coatings shall overlap the original coating over the 50mm prepared distance and shall be colour matched to the specified colour of the original coating.

4.4.2 Damaged Galvanised Surfaces

Damaged areas caused by oxy-cutting, welding or physical impact shall be treated as follows:

- Prepare the surface by removing any weld slag followed by vigorous power wire brushing of the coating surrounding the damaged area over a 50mm distance;
  - Clean surface to remove all dust; and
- Apply two coats of organic zinc-rich primer to a minimum DFT of 100 microns.

The area to be reinstated shall be colour matched to the surrounding finish colour with 40 microns of aluminium paint to the manufacturer's **written instructions.**

4.4.3 Inaccessible Surfaces

Surfaces that will be inaccessible after erection of other elements of the structure, shall be fully painted prior to the installation of the obstructing item.

4.5 Surfaces Not To Be Coated

The following surfaces shall not be blasted or coated unless specifically directed:

Machined surfaces, bearings, seals, grease fittings, adjusting screws and name plates, and identification tags.

- Valve stems;
- Raised faces on pipe and equipment flanges;
- Electrical cabling;
- Instrumentation, gauges and sight glasses;
- Titanium, stainless steel and non-metallic surfaces; and

  Field weld margins, 50mm either side of weld, on tankage and piping, prior welding.

The rear face of piping flanges shall be shop prime coated only. Flange holes for fasteners shall be fully coated.

4.6 Wash-Up

All surface of equipments/prefabricated piping etc. Primerised / painted at Vendor shop and received at site if required shall be washed up as follow:

a) Washing with clean water (Pressure 7 Kg/cm2) using suitable nozzles. During washing, broomcorn brushes shall be used to remove foreign matter.

b) Solvent washing, if required , to remove traces of wash up as per above procedure of all surfaces of equipment, piping, structure etc. completely painted at contractor's shop shall be included in the quoted rates of oil, grease etc. Wash up as per above procedure of all surfaces of equipment, piping, structure etc. completely painted at contractor's shop shall be included in the quoted rates.

4.7 Touch-Up Painting

Prior to the application of any coat, all damage to the previous coat(s) shall be touched-up. Damage to finished work shall be thoroughly cleaned and re-coated.

Surface preparation shall be done as per clause no. 3.0.....

Items supplied with the manufacturer's standard coating system shall be touched-up with the same generic coating system or recoated.

4.8 Paint Storage

The following must be ensured:

a) All paints and painting material shall be stored only in such rooms assigned for the purpose. All necessary precaution shall be taken to prevent fire. The Storage building

shall preferably be separate from adjacent buildings. A sign-board bearing the Words "PAINT STORAGE- NO NAKED LIGHT" shall be clearly displayed outside. The building shall be properly ventilated and shall be adequately protected with fire fighting equipment.

b) Storage shall be far away from heated surface open flames, sparks & well protected from sun rays.

c) Ambient temperature at which paints are stored shall be intimated to paint manufacturer & their advice sought regarding precautions to be taken if any, regarding flammability, explosiveness & toxicity.

d) Maximum allowed storage time for various paint materials shall be clearly indicated on individual containers. Materials which have passed expiry date shall not be used.

e) Paints in non-original containers and/or in containers without seals, shall not be used.

5.0 COATING SYSTEM SELECTION

Coating Systems for Structures Piping and Equipment

The following Table 1 shall be used as a general guide for the selection of a paint system suitable for a particular plant area application. Paint systems specified on equipment data sheets and the Drawings shall take precedence over the general paint system area applications listed in Table 1.

TABLE - 1

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks	
01	Structural Steel work with operating temp. Up to 90^{O} C (Steel structures, Piping support, uninsulated CS piping, flanges, valves, stairways, walkways etc. except grating).	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P2 : ONE coat of two pack zinc rich epoxy Primer meeting SSPC Paint 20 level 1 F1 : One coat of two packs. Polyamide Cured Epoxy. F5 : One coat of two pack aliphatic acrylic polyurethane	P2 : 60 microns F1 : 120 – 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High durability	Total dry film thickness of paint system: 320 microns as per C5 – High durability
02	Uninsulated CS piping, flanges, valves with operating temp. From Above 90^{O} C to 200^{O} C.	Blast cleaning to near white metal grade Sa-2½, of Swedish Standards SIS-05-5900 (Latest)	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F3 : Two coats of single pack special Oleo resinous based heat resistant ready mixed Aluminium Paint.	P1 : 75 microns F3 : 2 x 25 microns for each coat Total - 125 microns.	Total dry film thickness of paint system: 125 microns.	

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks	
03	Uninsulated CS piping, flanges, valves with operating temp. Over 200^{O} C.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F4 : Two coats of Heat Resisting Silicon Aluminium Paint.	P1 : 75 microns F4 : 2 x 25 microns for each coat Total - 50 microns.	Total dry film thickness of paint system: 125 microns.	
04	Insulated CS piping flanges, valves with operating temp up to 90^{O} C	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F8 : One coat of high temperature epoxy phenolic	F8 : 2 x 125 microns	Total dry film thickness of paint system: 250 microns.	
05	Insulated CS piping, flanges, valves with operating temp. From 90^{O} C to 200^{O} C.	Blast cleaning to near white metal grade Sa-2½, of Swedish Standards SIS-05-5900	F8 : Two coats of high temperature epoxy phenolic (novolac)	F8 : 2 x 125 microns	Total dry film thickness of paint system:250 microns	
06	Insulated CS piping, flanges, valves with operating temp. Over 200^{O} C.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F9 : Two coats of Inorganic Co-polymer based coating With an Inert Multipolymer Matrix.	F9 : 2 x 150 microns	Total dry film thickness of paint system: 300 microns.	
07	Uninsulated CS equipment with operating temp. Up to 90^{O} C, to be treated at Manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P2 : ONE coat of two pack zinc rich epoxy Primer meeting SSPC Paint 20 level 1 F1 : One coat of two packs. Polyamide Cured Epoxy. F5 : One coat of two pack aliphatic acrylic polyurethane	P2 : 60 microns F1 : 120 – 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High Durability	Total dry film thickness of paint system: 320 microns as per C5 – High Durability
08	Uninsulated CS equipment with operating temp. From 91^{O} C to 200^{o}C, to be	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1	P1 : 75 microns F3 : 2 x 25 microns	Total dry film thickness of paint system: 125 microns.	

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks
	treated at Manufacturer's shop.	05-5900 (Latest).	F3 : Two coats of single pack special Oleouresinous based heat resistant ready mixed Aluminium Paint.	for each coat	
09	Uninsulated CS equipment with operating temp. Over 200°C, to be treated at Manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F4 : Two coats of Heat Resisting Silicon Aluminium Paint.	P1 : 75 microns F4 : 2 x 25 microns for each coat Total - 50 microns.	Total dry film thickness of paint system: 125 microns.
10	Insulated CS equipment with operating temp. Up to 90° C, to be treated at Manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F8 : Two coats of high temperature epoxy phenolic (novolac)	F8 : 2 x 125 microns	Total dry film thickness of paint system:250 microns
11	Insulated CS equipment with operating temp. From 91° C to 200°C, to be treated at Manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F8 : Two coats of high temperature epoxy phenolic (novolac)	F8 : 2 x 125 microns	Total dry film thickness of paint system:250 microns
12	Insulated CS equipment with operating temp. Over 200°C, to be treated at Manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F9 : Two coats of Inorganic Co-polymer based coating With an Inert Multipolymer Matrix.	F9 : 2 x 150 microns	Total dry film thickness of paint system: 300 microns.
13	Surface of structural steel for furnaces, external surface of furnaces, external surface of flue duct,	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F3 : Two coats of	P1 : 75 microns F3 : 2 x 25 microns for each coat	Total dry film thickness of paint system: 125 microns.

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks	
	metal stacks and similar with operating temp. Up to 200°C. (With exclusion of stair ways, walk ways etc.).		single pack special Oleo resinous based heat resistant ready mixed Aluminium Paint.			
14	For external surfaces of flue ducts, metal stacks, and similar with operating temp. Above 200°C.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F4 : Two coats of Heat Resisting Silicon Aluminium Paint.	P1 : 75 microns F4 : 2 x 25 microns for each coat Total - 50 microns.	Total dry film thickness of paint system: 125 microns.	
15	For surfaces of air cooler heads not galvanized with operating temperature up to 90^0 C, treated at manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P2 : ONE coat of two pack zinc rich epoxy Primer meeting SSPC Paint 20 level 1 F1 : One coat of two packs. Polyamide Cured Epoxy. F5 : One coat of two pack aliphatic acrylic polyurethane	P2 : 60 microns F1 : 120 – 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High Durability	Total dry film thickness of paint system: 320 microns as per C5 – High Durability
		NOTE: All surfaces shall be galvanized at manufacturer's shop with exception of the end header of air cooled heat exchangers that shall be treated as described above at Manufacturer's shop. In case the same surfaces shall not be treated at shop, they shall be treated at site according to environmental and operating conditions.				
16	For surfaces of air cooler heads not galvanized with operating temperature up to 91^0 C TO 200^OC, treated at manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F3 : Two coats of single pack special Oleouresinous based heat resistant ready mixed Aluminium Paint.	P1 : 75 microns F3 : 2 x 25 microns for each coat	Total dry film thickness of paint system: 125 microns.	

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks	
		NOTE: All surfaces shall be galvanized at manufacturer's shop with exception of the end header of air cooled heat exchangers that shall be treated as described above at Manufacturer's shop. In case the same surfaces shall not be treated at shop, they shall be treated at site according to environmental and operating conditions.				
18	STORAGE TANKS					
a)	Acid / Alkali CS Storage Tank (External Surface including all stair ways)	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P2 : ONE coat of two pack zinc rich epoxy Primer meeting SSPC Paint 20 level 1 F1 : One coat of two packs. Polyamide Cured Epoxy. F5 : One coat of two pack aliphatic acrylic polyurethane	P2 : 60 microns F1 : 120 – 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High Durability	Total dry film thickness of paint system: 320 microns as per C5 – High Durability
b)	CS Storage Tanks, Excluding indicated in Sl. No. (a)	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F1 : One coat of two pack Polyamide Cured Epoxy. F5 : Two-pack aliphatic Isocyanate cured acrylic finish paint	P1 : 60 microns F1 : 120 - 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High Durability	Total dry film thickness of paint system: 320 microns as per C5 – High Durability
19	Cold Insulated Carbon Steel and low alloy Steel (1-$^{1}/_{4}$ Cr through 9 Cr) Piping and Equipment. (Upto 60 Deg. C)	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F7 : Two coats of Tar Free Epoxy paint suitably pigmented	F7 : 2 x 125 microns	Total dry film thickness of paint system: 250 microns.	
20	Cold Insulated high alloy Steel piping and Equipment (Upto 200 Deg. C)	Lightly Blast cleaned as per Sa 1.0 Swedish Standards SIS-05-5900	F8 : Two coats of high temperature epoxy phenolic (novolac)	F8 : 2 x 125 microns	Total dry film thickness of paint system:250 microns	

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks	
		(Latest).				
21	DELETED					
22	Surface (CS) with Equipment with temp. Indicating paint from 220°C to 240°C treated at Manufacturer's shop	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F6 : Temperature indicating paint	P1 : 75 microns F6 : 2 x 25 microns for each coat Total - 50 microns.	Total dry film thickness of paint system: 125 microns.	
23	PACKAGE:					
a)	Surface(CS) with operating temperature upto 90°C treated at Manufacturer's shop	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P2 : ONE coat of two pack zinc rich epoxy Primer meeting SSPC Paint 20 level 1 F1 : One coat of two packs. Polyamide Cured Epoxy. F5 : One coat of two pack aliphatic acrylic polyurethane	P2 : 60 microns F1 : 120 – 200 microns F5 : 60 microns	Total dry film thickness of paint system: 240 microns as per C4 – High Durability	Total dry film thickness of paint system: 320 microns as per C5 – High Durability
b)	Surfaces (CS) with operating temperature upto 91^0 C TO 200°C, treated at manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F3 : Two coats of single pack special Oleouresinous based heat resistant ready mixed Aluminium Paint.	P1 : 75 microns F3 : 2 x 25 microns for each coat	Total dry film thickness of paint system: 125 microns.	
c)	Surface (CS) with operating temp. Over 200°C, treated at manufacturer's shop.	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	P1 : One coat of Ethyl Silicate zinc rich with solvent Primer meeting SSPC Paint 20 level 1 F4 : Two coats of Heat Resisting Silicon Aluminium Paint.	P1 : 75 microns F4 : 2 x 25 microns for each coat Total - 50 microns.	Total dry film thickness of paint system: 125 microns.	
d)	Package in	Blast cleaning	F7 : Two coats of Tar	F7 : 2 x	Total dry film	

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks
	Carbon Steel and low Alloy Steel (1-$^{1}/_{4}$ Cr through 9 Cr) with cold insulated surface treated at manufacturer's shop (Upto 60 Deg. C)	to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	Free Epoxy paint suitably pigmented	125 microns	thickness of paint system: 250 microns.
e)	Package in Cold Insulated high alloy Steel. (Upto 200 Deg. C)	Lightly Blast cleaned as per Sa 1.0 Swedish Standards SIS-05-5900 (Latest).	F8 : Two coats of high temperature epoxy phenolic (novolac)	F8 : 2 x 125 microns	Total dry film thickness of paint system:250 microns
f)	DELETED				
24	For internal surface of shell, roof of CS tanks, with operating temp. Upto 110°C	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F2 : Two coats of two pack amine adduct cured Phenolic (Novolac) epoxy (immersion grade)	F2 : 2 x 150 microns for each coat	Total dry film thickness of paint system: 300 microns.
25	For underside (soil side) of the tank bottom (CS) below only of the fixed tanks, bottom & shell shall be treated as follows:	Blast cleaning to near white metal grade 2 ½, of Swedish Standards SIS-05-5900 (Latest).	F7 : Two coats of Tar Free Epoxy paint suitably pigmented OR F8 : Two coats of high temperature epoxy phenolic (novolac)	F7 : 2 x 200 microns OR F8 : 2 x 150 microns	Total dry film thickness of paint system: 400 microns. OR Total dry film thickness of paint system: 300 microns.
26	CS Equipment and associated piping subject to cyclic, intermittent or regeneration operating condition (e.g. Molecular Sieve Driers) subjected to very severe corrosion with	Blast cleaning to near white metal grade 3, of Swedish Standards SIS-05-5900 (Latest).	Primer: One coat of Thermal spray Aluminium paint and sealed with a Silicon Aluminium seal Finish Coat: One coat of Thermal spray Aluminium paint and sealed with a Silicon Aluminium seal.	Primer: 125 microns Finish: 125 microns	Total dry film thickness of paint system 250 microns.

Ref No.	Application	Surface Preparation	Generic Coating System	Minimum DFT	Remarks
	wide operating temperature range.				

NOTES:

Primers

ZINC ETHYL SILICATE PRIMER – P1

The zinc ethyl silicate consists of two packs. One pack contains the ethyl silicate binder with suitable solvents. The other pack contains zinc dust (NOT Paste). Zinc dust shall be ASTM D 520 Type II. They have to be mixed in suitable proportions before application as recommended by manufacturer.

Volume solids	**:**	Min.64% ±2
DFT Range	**:**	50 – 75 microns
Theoretical Spreading Rate	**:**	12.8 – 8.53 sqm/litre
Colour	:	Grey
Application	:	Spray (airless/air)
Drying time (dry to handle)	:	< 45 mins. @ 30 Deg. C and 65% RH
Curing	:	<16 hrs @ 30 Deg. C and 65% RH
% of total metallic zinc in dry film (As per the ASTM D520 – Spherical size)	:	**(SSPC SP 20 Level 1) >85% by wt.**
Specific Gravity	:	**2.5 Kg/Litre min.**
Storage life	:	6 months under sealed conditions

Zinc silicate Material curing shall be checked using ASTM D 4752, minimum Acceptable value is 4.

ZINC RICH EPOXY PRIMER – P2

The zinc rich epoxy consists of two packs. One pack contains the epoxy binder with suitable solvents. The other pack contains zinc dust as per ASTM D520 Type II. They have to be mixed in suitable proportions before application as recommended by manufacturer.

Volume solids	**:**	65% min. ±2
DFT	**:**	50 – 100 microns
Theoretical Spreading Rate	**:**	13 – 6.5 sqm/litre
Colour	:	Grey
Application	:	Airless spray/air spray/brush
Drying time (dry to handle)	:	<10 min. @ 30 Deg C
Hared Dry	:	< 1.5 hrs @ 30 Deg C
% of total metallic zinc in dry film (As per the ASTM D520 – Spherical size)	:	**(SSPC SP 20 Level 2) 81% by wt. min.**
Specific Gravity	:	**2.3 Kg/Litre min.**
Storage life	:	12 months under sealed conditions

Finish Paints

HIGH BUILD EPOXY FINISH – F1

This finish paint is fast drying, high build, Two-pack polyamide cured epoxy resin

Volume solids	:	85% min. ±2
DFT Range	:	100 – 200 microns
Theoretical Spreading Rate	:	7.6 – 3.8 sqm/litre
Colour	:	As per Manufacturer List
Binder	:	Polyamide cured epoxy resin, Lead & Chrome Free
Application	:	Brush or spray
Drying time	:	< 2 hrs @ 30 Deg C
Over coating time	:	< 2 hrs @ 30 Deg C
Storage life	:	24 months under sealed conditions

HIGH BUILD EPOXY FINISH (Immersion Grade) – F2

This finish paint is high build, Two-pack phenolic (novolac) epoxy

Volume solids	:	68% min. ±2
DFT Range	:	100 – 150 microns
Theoretical Spreading Rate	:	6.8 – 4.5 sqm/litre
Colour	:	As per Manufacturer List
Binder	:	Amine adduct cured epoxy resin
Application	:	Brush or spray
Drying time	:	< 1.5 hrs @ 30 Deg C
Over coating time	:	< 6.5 hrs @ 30 Deg C
Storage life	:	24 months under sealed conditions

HEAT RESISTANT ALUMINIUM FINISH PAINT : F3

It is a single pack system based on oleo resinous general purpose aluminium paint with good heat resistance upto 250 Deg. C. and light reflection.

Volume solids	:	25% min. ±2
DFT Range	:	25 microns
Theoretical Spreading Rate	:	10 sqm/litre
Main pigment	:	Aluminium (ASTM 962), Lead & Chrome Free
Colour	:	Metallic Aluminium
Pigment Volume Concentration	:	15 – 20%
Application	:	Brush or spray

Drying time	:	Surface dry <1hr. @ 30 Deg. C
		Hard dry < 3 hrs. @ 30 Deg. C
Storage life	:	24 months under sealed conditions

HEAT RESISTANT SILICON ALUMINIUM FINISH PAINT : F4

It is a single pack system based on ambient curing silicone aluminium pigmented polysiloxane paint with maximum heat resistance of upto 600 Deg. C.

Volume solids	:	25% min. ±2
DFT Range	:	25 microns
Theoretical Spreading Rate	:	10 sqm/litre
Main pigment	:	Aluminium (ASTM 962), Lead & Chrome Free
Colour	:	Metallic Aluminium
Pigment Volume Concentration	:	15 – 20%
Application	:	Brush or spray
Drying time	:	Surface dry < 1hr. at 30 Deg. C
		Hard dry < 3 hrs. at 30 Deg. C
Storage life	:	12 months under sealed conditions

TWO PACK ALIPHATIC ACRYLIC POLYURETHANE FINISH PAINT – F5

It Consists of Acrylic Resin in Part A. Part B consists of an aliphatic poly-isocyanate with appropriate solvents and additives.

Volume solids	:	51% min. ±2
DFT range	:	50 – 100 microns
Theoretical Spreading Rate	:	10.2 – 5.1 sqm/litre
Main pigment	:	Suitable pigments to get the desired colour, **Lead & Chrome Free**
Colour	:	Metallic Aluminium
Binder	:	Shall not contain any binder other than

		acrylic resin; should not contain any **alkyd / acrylate alkyds / esters.**
Application	**:**	Brush or spray
Drying time	**:**	Surface dry < 1hr. @ 30 Deg. C
		Hard dry < 8 hrs. @ 30 Deg. C
ISO 11507/ASTM G 154, QUV A - Accelerated weathering	**:**	**Gloss retention: approx. 80 % and colour change approx. DE 1.2 after 3000 hours exposure**
Storage life	**:**	24 months under sealed conditions

TEMPERATURE INDICATING PAINT : F6

It is a single pack temperature indicating system based on silicone binder. Pigments change colour by heating. The colour change of the coating is permanent. At approximately 200°C, the colour changes from green to blue, above 310°C, the colour changes from blue to greyish white. Maximum service temperature is 400°C.

Volume solids	**:**	40% min.
DFT	**:**	25 microns
Theoretical Spreading Rate	**:**	16 sqm/litre
Main pigment	**:**	As per shade requirement, Lead & Chrome free
Colour	**:**	As per manufacturer
Binder	**:**	Based in silicone Resins
Application	**:**	Brush or spray
Drying time	**:**	Surface dry < 1hr. @ 30 Deg. C
		Hard dry < 4 hrs. @ 30 Deg. C
Storage life	**:**	12 months under sealed conditions

TAR FREE EPOXY – F7 (Coal Tar is Banned Globally being Carcenogic)

A high build two component abrasion resistant, pure epoxy with anti-corrosive properties meant for excellent performance.

Volume solids	**:**	Minimum 72%
DFT Range	**:**	150 – 200
Theoretical Spreading Rate	**:**	4.8 – 3.6 sqm/litre
Application	**:**	By brush or airless spray

Drying time	**:**	Touch Dry within 4 hrs. @ 30 Deg C
		Hard dry < 9 hours @ 30 Deg. C
Storage life	**:**	12 months under sealed conditions

EPOXY PHENOLIC (NOVOLAC) – F8

Two Pack epoxy-phenolic (novolac) cured with amine adduct used as an External coating for the protection of insulated (CUI) equipment.

Volume solids	**:**	68% min.
DFT Range	**:**	100 – 150 microns
Theoretical Spreading Rate	**:**	6.8 – 4.5 sqm/litre
Binder	**:**	Epoxy phenolic (novolac)
Dry Temp. Service	**:**	Min. -196 to max. 205 Deg. C.
Application	**:**	Airless Spray / Brush Touch up
Drying Time	**:**	Surface dry < 1.5hr. @ 30 Deg. C
		Hard dry < 6 hours @ 30 Deg. C
Storage life	**:**	12 months under sealed conditions

INORGANIC CO-POLYMER COATING – F9

MIO pigmented single component inorganic copolymer coating which cures to form an in polymer matrix able to resist temperatures up to 650°C/1202°F and thermal shock/cycling dry or dry/wet service.

Volume solids	**:**	74% min.
DFT Range	**:**	150 microns
Theoretical Spreading Rate	**:**	5 sqm/litre
Binder	**:**	Inorganic copolymer coating
Dry Temp. Service	**:**	Min. -196 to max. 650 Deg. C.
Application	**:**	Airless Spray / Brush Touch up
Drying Time	**:**	Surface dry < 0.5hr. @ 30 Deg. C
		Hard dry < 1.5 hours @ 30 Deg. C
Storage life	**:**	12 months under sealed conditions

6.0 MACHINERY, ELECTRICAL AND INSTRUMENT EQUIPMENT:

6.1 Machinery

Steel surfaces shall be treated with complete paint system at Manufacturer's shop. The paint system shall be according to Manufacturer's Std. However, suitable for operating condition and the environmental condition where the machinery will operate. Where necessary machinery shall be restored at site by Contractor with suitable finish.

6.2 Electrical and Instrument Equipment

Steel surfaces shall be treated with complete paint system at Manufacturer's shop. The paint system shall be according to Manufacturer's Std., however suitable for operating condition and the environmental condition where the electrical and instrument equipment will operate. Where

necessary Electrical and Instrument Equipment shall be restored at site by Contractor with suitable finish.

7.0 COLOURS:

These shall be as required by specification and in particular for:

Description	Colour	Ra1	Correspond. Asian Paint colors to be defined – See Note-2
- Piping with temperature less than 90°C	GREY	7035	
- Piping, hot surface, flue gas ducts and stacks with temperature above 90°C	SMOOTH	ALUMINIUM	"
- Cooling Water Piping	SEA GREEN		"
- Fire fighting Piping	Red	3002	"
- Structures upto 2 MT	BLACK	9005	"
- Structures above 2 MT	GREY	7010	"
- Stair cases – ladders	BLACK	9005	"
- Walkwais	GREY	7010	"
- Handrails assemblies	YELLOW	1004	"
- Equipment	GREY	7035	"
- Hot equipment	SMOOTH	ALUMINIUM	"
- Fire fighting equipment	RED	3002	"
- Valves in general	GREY	7035	"
- Hot valves	SMOOTH	ALUMINIUM	"
- Safety and Fire fighting valves	RED	3002	"
- Valves handwheels	BLACK	9005	
- Electric Rotary Machines	SKY BLUE	5012	
- Electric Static Machines	GREY	7035	
- Machinery (compressors & pumps) with operating temperature less than 90°C	GREY	7035	"
- Machinery (compressors & pumps) with operating temperature above 90°C	SMOOTH	ALUMINIUM	"
FURNACES			
- Cassing and connected steel works	SMOOTH	ALUMINIUM	"
- Steel work not connected to casing	SMOOTH	ALUMINIUM	"
AIR COOLER			
- High Temperature Surfaces (Temp. > 90°C)	SMOOTH	ALUMINIUM	

Description	Colour	Ra1	Correspond. Asian Paint colors to be defined – See Note-2
- Low Temperature surface (Temp. ≤ 90°C)	GREY	7035	"
- Flare ≤ 90°C	GREY	7035	"
- Flare ≥ 90°C)	SMOOTH	ALUMINIUM	"
TANKS			
- Shell of fixed roof	WHITE	9010	"
- Roof of fixed roof tank	WHITE	9010	

NOTE-1: The colours shall be according to IS2379:1990/International STD. RAL or BS, proposed by Contractor or Manufacturer

8.0 PARTICULAR DESCRIPTION

The abrasive Grit Blasting shall be used for surface preparation. **Sand blasting is prohibited due to environmental regulations.**

Primerized surface shall be faultless and shall not have mud-cracking, dripping over thickness and dry sprays.

Blast cleaning and painting shall not be carried out on wet surfaces.
Blast cleaning shall not be done when surfaces temperatures are less than 3°C above dew point, or temperature is below 5°C.

No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after they have been blasted.

The surface preparation of all steel surfaces to be coated shall be free of all mill scale, rust corrosion product, oxides, paint, oil or other foreign matter

Only dry abrasive blasting procedures will be allowed. The compressed air supply used for blasting shall be free of detrimental amounts of water and oil. Adequate separator and traps shall be provided and these shall be kept emptied of water and oil. Any blast cleaning set up without functioning moisture separators shall be removed from blast cleaning areas.
All welded areas and appurtenances shall be given special attention for removal of welding flux in crevices. Welding splatter, slivers, laminations and underlying mill scale exposed during sand blasting shall be removed or repaired.

The blast-cleaned or power brushing surfaces shall be coated with primer within four hours of surface preparation.

No primer or intermediate or finishing coating shall be applied without prior notification to the Company.

The application of the products shall be carried out in strict compliance with the paint manufacturer's recommendation.

The Contractor shall provide suitable protection for all adjacent plants or equipment from airbone during spraying and sand blasting.

9.0 INSPECTION AND TESTING

The inspection and testing requirements outlined in this section shall be performed for shop and site applied coating systems.

Preference shall be given to manufacturers and applicators that are quality certified to ISO 9001: 2000.

Documentation of coating material manufacturers and applicators shall include daily inspection reports, equipment reports, and shall clearly identify and trace materials supply and testing performed on coated items and areas.

Inspection and Test Plans (ITPs), and quality control procedures used for application of coating systems shall form part of the Method Statement and shall be submitted for approval by the Principal prior to commencement of work.

The applicator shall appoint a certified inspector of coatings for inspection and testing of coating systems.

Tests of coated areas and items shall form part of the ITPs.

- Surface Preparation in accordance to Swedish Standard SIS-05-5900 (Latest).
- Blast cleaning profile shall be checked using a suitable profile meter – Acceptable profile shall be 40 - 60 microns.
- Check of time of top coating and drying in accordance with the direction of the paint manufacturer.
- Check of dry film thickness by suitable non-destructive Instrument such as “MIKROTEST”, “DIAMETER” or equivalent.
- Before any coating work is preformed on the site, the contractor shall ensure that any works applied by others is acceptable.

  Any defect that are discovered, are to be notified in writing to the owner before proceeding with the contract work. To ensure the good execution of painting work following test shall be performed:

  - Surface Preparation
  - Surface contaminant tests
  - Surface profile tests
  - Coating thickness tests
  - Tests for cure of coatings
  - Adhesion tests
  - Continuity testing
  - Iron contamination
  - Chloride contamination
  - Dust Contamination

  All Inspection and Test Records (ITRs) shall be submitted with the Manufacturer’s Data Report (MDR) at the conclusion of the job.

  Defective coated areas shall be suitably marked for rectification work to be performed in compliance with this specification.

Access shall be granted for inspection of all paint work, and witnessing of test work. This shall not however relieve the Contractor of their own QA/QC responsibilities.

10.0 ADHESION TEST RESULTS

For all type of primer the Contractor shall guarantee the Classification of Adhesion Test Results as per ASTM D3359. The acceptable Rate Adhesion Test Results shall be for sandblasted and primerized surfaces shall be minimum 3A (or Higher)

For primer plus finishing coat(s) the Contractor shall guarantee the Classification of Adhesion Test Results as per ASTM D 3359. The acceptable Rate Adhesion Test Results shall be for blast cleaned and painted surfaces shall be minimum 3A (or higher).

After test, the surface must be repaired according to the system applied.

11.0 SUBMISSION OF DATA

Contractor shall submit in phase of bid the original technical data sheet and system for all material supplied by him to apply for the permanent works and test report for the paint in compliance to IS101.This material shall be subject to Owner's approval.
The test certificates of zinc silicate shall provide the specific gravity of mixed paint.

12.0 LETTER AND NUMBER INSCRIPTION

Inscriptions letters, as herebelow indicated, shall be made on equipments, piping, storage tanks, machinery etc.

12.1 Geometric forms and dimensions

Letters and numbers dimensions shall be orientatively fixed according to following:

(A – Dimension of side of unitary elements of grid)

a) Storage Tanks A – 60 mm
b) Equipments and piping with O.D. above 600 mm A– 40 mm and
c) Equipments and pipings with O.D. from 300 to 600 mm and for machinery of great dimensions A – 20 mm
d) Equipments and pipings with O.D. less than 300 mm and for machinery with small dimensions A – 10 mm

12.2 Inscription's Colours

Inscriptions shall be Black ENI 901 (RAL 9005) on light base

Inscriptions shall be White ENI 101 (RAL 9010) on dark base

12.3 Spaces and Interspaces

Spaces between words and assemblage of numbers shall have dimensions equal to 2A

Interspaces between letters or numbers shall have dimensions equal to A.

13.0 Colour Band for piping ;-

As a rule minimum width of colour band shall confirm to the following Table:-

Nominal pipe Size	Width L (mm)
3” & below	25
4” NB-6” NB	50
8” NB-12”NB	75
14” OD & above	100

14.0 LIST OF MANUFACTURERS :

1. M/s Berger Paints
2. M/s Jensons & Nickolson
3. M/s Jotun Paints
4. M/s Asian Paints
5. M/s Grauer & Weil (India) Limited
6. M/s Shalimar paints
7. M/s Garware Paints
8. M/s Goodlass Nerolac Paints Ltd
9. M/s.HEMPEL Paints
10. M/s International Paints (Akzo Nobel Brand)
11. M/s Carboline (India) Pvt. Ltd.
12. M/s Mohan Paints

15.0 The contractor shall obtain prior approval from Engineer-In-Charge for the brands of paint material proposed to be used. The contractor shall submit the following details of paint material either at the time of bidding or soon after award of work for approval of paints.

a. Technical data sheet
b. Material safety data sheet
c. Finger printing of paint products as per ISO 20340

16.0 Owner reserves the right to take random samples and get it tested through reputed labs. In case the supplied paint material do not meet the specified performance requirements then suitable action shall be taken against the paint supplier. The decision of Engineer-In Charge shall be final and binding on the Contractor in such cases

17.0 WARRANTY:

Contractor along with Paint Manufacturer jointly shall develop the paint schemes following the system specification.

They shall jointly provide a performance guarantee for a period 5 years as stipulated below,

After 1 years – Corrosion in 3% of total painted area accepted

After 2 years – Corrosion in 6% of total painted area accepted

After 3 years – Corrosion in 9% of total painted area accepted

After 4 years – Corrosion in 12% of total painted area accepted

After 5 years – Corrosion in 15% of total painted area accepted

where spontaneous visible corrosion has broken down the paint film to a degree exceeding “Ri 3” (as defined in ISO 4628/3-2003).

ANNEXURE- 7 - 3

QUALITY CONTROL PROCEDURE AND INSPECTION REQUIREMENTS

1.0 LSTK CONTRACTOR'S QUALITY CONTROL

1.1 LSTK CONTRACTOR shall provide a quality control program manual include specific WORK methods and inspections, which assure quality.

This quality control program manual must be submitted to OWNER for Approval before starting the construction activities.

All installation WORK must be in strict accordance with this approved manual.

1.2 The quality control program shall include as a minimum the following:

- Methods use to control drawings; specifications and CONTRACT correspondence to assure that only the latest revisions are being used in the field.
- Inspection personal name, organization.
- Inspection methods and documentation of inspection (or tests) for shop fabrication, if required, and installation.
- Material control procedures from SITE receiving point, through "over, short and damage inspection" through storage and through installation.
- Positive material identification Procedures for:
- Electrical cable pulling and testing.
- Asphalt placement inspection.
- Handling and storage methods to prevent damage.
- Inspection and testing procedures and reports for civil, structural, piping, electrical, instrument, equipment and all installation WORK.
- Repair.
- Scrap and reject.
- Grouting.
- Welding.
- Welder qualification.
- Receiving all permanent plant material & equipment.
- Rigging.
- Welder's tests.
- Nondestructive examinations to be used.
- Positive material identification. etc.
- Identification of LSTK CONTRACTORS and ensuring their compliance with the manual and WORK required.
- Material certification verification methods.
- Calibration procedures for measurements and test equipment.
- Marking and identification of components in process and complete assemblies.

2.0 Shop fabrication and field installation inspection OWNER'S REPRESENTATIVE to ensure specifications. in the following areas will be performed by full adherence to Receiving and inspection.

- Calibration of test inspection equipment.
- Preventive maintenance and storage protection.
- Internal cleanliness.
- Proper material use and control.
- Nondestructive testing and its results.
- Workmanship.

3.0 OWNER'S REPRESENTATIVE or others as authorized by OWNER are to be permitted access to LSTK CONTRACTOR'S work areas for the purpose of inspection of material, equipment, documentation and other areas as required in LSTK CONTRACTOR'S quality assurance *I* quality control program.

4.0 No concrete will be placed by LSTK CONTRACTOR without an OWNER "Pour Release Form'.

5.0 OWNER'S construction inspections will not relieve. LSTK CONTRACTOR of inspection or other responsibilities.

6.0 For piping all welders test pieces shall be supplied by LSTK CONTRACTOR and fully prepared for welding by LSTK CONTRACTOR.

7.0 LSTK CONTRACTOR shall evidence its familiarity and experience with the execution of the installation of WORK to the requirements of the applicable codes and shall perform its WORK in accordance to these requirements and to instructions issued by OWNER'S REPRESENTATIVE in this regard.

8.0 **CHECK ON QUALITY OF WORK**

8.1 OWNER'S REPRESENTATIVE'S inspector shall have free access to the place where the WORK is performed at all times, in order to check the quality of WORK

8.2 If during inspection *I* check reveals unsatisfactory WORK, LSTK CONTRACTOR shall immediately at LSTK CONTRACTOR'S expense. take such corrective measures as deemed required.

9.0 **CONTROL SYSTEMS**

LSTK CONTRACTOR shall initiate and maintain the following control systems

9.1 **Backfilling**

- Compaction tests.

9.2 **Concrete**

- Design mix and approval record(s).
- Batch plant inspection record.
- Slump test record.
- Compressive test record.
- Pour release record.
- Grouting release record.
- Placement inspection records.
- Concrete curing records.

9.3 **Asphalt**

- Design mix and approval records.
- Batch plan inspection records. Placement inspection records.

9.4 **Piping**
- Weld x-ray file.
- Pipe and fitting certificate file.
- Isometric weld control sheet. Hydrostatic test records.

9.5 **Grounding**

Earth resistance test records.

9.6 **Electrical Cable and Instrument cable**
- Insulation resistance test records.
- Continuity test records.

9.7 **Material certification files**

9.8 **Equipment**
- Weld x-ray file.
- Material certificate files.
- Equipment installation records.
- Equipment maintenance record.
- Hydrostatic test records.
- Grouting release records.
- Alignment records.
- Vibration records.

10. **Requirements for Certification of Materials**

10.1 Mill certification of materials will be required based on the material type, the use and the codes and requirements.

10.2 LSTK CONTRACTOR shall provide:

Type A certification of compliance, for all but not limited to the following materials which LSTK CONTRACTOR is responsible to supply:
- Imported backfill materials.
- Ready mix concrete.
- Asphalt paving materials
- Prefab concrete items, including pre-cast manholes, catch basins, pits, sumps and sleepers.
- Paving stones and tiles.
- Inserted and embedded items, other than rebar, wire mesh and anchor bolts.
- Masonry blocks.
- Steel sliding plates.
- Special grouting materials, i.e. non-shrink type.
- Grouting materials, including grounding loop and branch wire which they are LSTK CONTRACTOR'S supply.

Type "B “certificate, for all but not limited to the following materials, which LSTK CONTRACTOR is responsible to supply:

- Materials to be considered structural or structural grade.
- Reinforcing grade.
- Wires mesh reinforcement fabric.
- Anchor bolts.

10.3 **Definition of Type of Certificates**

Type A (certificate of Compliance):

This is a certificate of compliance, issued by the manufacturing or processing works and

signed by the quality department or persons to carry the responsibility for quality and conformity, stating that the materials) supplied correspond (5) with what was agreed in the purchase order.

Type B (mill Certificate) :
This is a certificate on which the manufacturer's head of quality department confirms that the product supplied corresponds with what has been agreed in the purchase order. Certification shall be on the basis of tests carried out on the material of the product itself, as per purchase order specification. The testing and certification are to be carried out by a testing center which is independent of the production section of the manufacturing works and which has the code-approved facilities. Independence of such testing center should be warranted by LSTK CONTRACTOR.

10.4 LSTK CONTRACTOR will maintain a systematic filing system of all certificates and reports for all tests and inspections carried out by it under the applicable specifications, standards and codes of practice quoted therein.

LSTK CONTRACTOR may use its own format for records but this must be submitted to OWNER'S REPRESENTATIVE for his approval prior to use.

LSTK CONTRACTOR can expect to be audited on a continuous basis.Originals of all documents to be sent to OWNER'S REPRESENTATIVE.

ANNEXURE- 7 – 4

SCHEDULE, PROGRESS EVALUATION AND PROGRESS REPORTING

1.0 GENERAL

1.1 WORK shall start and be completed in the field as indicated on the approved project construction schedule.

LSTK CONTRACTOR shall follow the sequence of construction in executing the WORK as shown in the schedule or as modified by OWNER.

The detailed scheduling of WORK will be supplied by the LSTK CONTRACTOR. WORK shall be conducted in such a manner that other construction activities are not affected.

Once detailed schedule, established and approved by OWNER, LSTK CONTRACTOR commits itself to follow the schedule in detail.

2.0 DETAILED & SCHEDULE

2.1 Detailed construction schedule must cover all construction work, from lowest level up to highest level.

2.2 Activities shown by means of a bar chart must include as a minimum the activities listed in 4.

3.0 PROGRESS REPORTING

LSTK CONTRACTOR shall issue a reporting procedure and a representative sample of all progress reports.

Following schedules and reports must be issued by LSTK CONTRACTOR to OWNER:

Construction schedule. (preliminary and detailed)
Monthly status report.
Weekly progress report.
Monthly construction guide schedule.
Daily manpower reports.

All except detailed construction schedule based on approved project construction schedule.

4.0 CONSTRUCTION SCHEDULE

Within **Two** months after Effective Date, LSTK CONTRACTOR will issue separate graphical "S" curves for the following work activities of total CONTRACT.

Installation of :

- Concrete foundations, pits. manholes. catch basins, trenches and concrete structures.
- Prefabricated concrete items
- Concrete paving and elevated slabs
- Other paving and final surfacing
- Grouting.
- Final road paving.
- Underground piping.
- Underground cable trenches and cables.
- Building erection.
- Structural steel erection.
- Engineering and design of small bore carbon steel piping systems.
- Prefabrication of piping.
- Electrical installation.
- Instrument installation.
- Equipment assembly and elect
- Erection of piping.
- Flushing and cleaning
- Hydro-testing
- Painting
- Insulation.

5.0 INTRODUCTION

The introduction to the monthly status report shall include LSTK CONTRACTOR'S comments on the overall construction schedule with a status update line as attachment, and shall consist of the following items:

- Goals achieved last month.
- Goals for next month.
- Reason for delay, if any. Reason for deviation of original schedule.
- Average manpower by craft, including management and indirect staff.
- LSTK CONTRACTOR'S comments to general situation.

6.0 CONSTRUCTION ACTIVITIES STATUS

This section consists of scheduled versus actual progress curves.

The progress curves are to be commented upon by LSTK CONTRACTOR.

The basis for reporting shall be the construction schedule:

The monthly status shall be reported as a percentage of the total WORK per type of WORK.

7.0 MANPOWER AVAILABILITY / REQUIREMENTS FOR THE MONTH COMING

LSTK CONTRACTOR shall submit its manpower availability requirements for the next month. This section consists also of the scheduled versus the actual manpower curves.

These manpower curves are accompanied by LSTK CONTRACTOR'S comments hereon.

8.0 MAIN CONSTRUCTION EQUIPMENT AVAILABILITY / REQUIREMENTS FOR THE MONTH COMING

LSTK CONTRACTOR shall submit its main construction equipment availability / requirements for the next month. This section consists also of the scheduled versus actual construction equipment requirement curves. These by LSTK CONTRACTOR'S comments hereon.

9.0 WEEKLY PROGRESS REPORT

Progress reporting will be done on a weekly basis by the actually completed work based on details of work such as quantities or piece of equipment as a percentage of the total anticipated work per work activities as defined in item 4.

9.1 Progress will only be reported on the basis of completed activities as per the percentage breakdown of the major steps as follows:

Progress Measurement Parameters

Actual physical progress in the field shall be measured based upon standard percentage of completion of progress stages, that, they are to be prepared by LSTK CONTRACTOR and Approved by OWNER to calculate actual physical progress of the WORK, the exact weight value of each activity from lowest level up to highest level in each category of the WORK shall be specified by LSTK CONTRACTOR and supplied to OWNER.

After OWNER'S Approval this weight value can be used for calculation of actual progress of the WORK

10.0 WEEKLY PROGRESS MEETING

10.1 Weekly Work List

In the weekly progress review meeting LSTK CONTRACTOR shall forecast the WORK it plans to perform during the week by means of a weekly WORK list including its manpower resource allocation as per the activities listed in 4 and 6.

This weekly program shall be in accordance with the construction guide schedules.

10.2 Work Front

LSTK CONTRACTOR shall submit monthly and weekly a total recapitulation Of the total work

front available with estimated manpower requirements, materials and equipment which shall be supplied by LSTK CONTRACTOR.

11.0 MONTHLY CONSTRUCTION GUIDE SCHEDULE

Based on approved overall construction schedule, LSTK CONTRACTOR must issue a monthly construction guide schedule covering a two (2) months period, for each individual activity.

Progress updating of construction guide schedules must be weekly and presented in the weekly progress review meeting at site.

The updated issue will show for each individual activity:

- Percent complete.
- Weight factor complete.

12.0 DAILY MANPOWER REPORTS

LSTK CONTRACTOR shall be furnished daily manpower report as per agreed format.

ANNEXURE- 7 – 5

EXECUTION PLAN

1.0 BIDDER ORGANISATION

1.1 Company Organisation

Bid shall include a description of the organization, its management structure and organization chart of Bidder's company with particular reference to the means whereby the execution of this project will be related to the overall company organization.

The Bidder shall also furnish the name(s) of their partners, associated/ subsidiary companies & their activities, and whether any such associated/ subsidiary company will be involved in the execution of WORK, and if so, their scope thereof.

1.2 Project Organization

Bidder shall give charts of organization, which he intends to use in the execution of the work. Such charts must show lines of authority and communication of senior personals who will be assigned to this work in Bidder's home - office and other offices where WORK shall be performed (if any) and the lines connecting such Project Organization to the Bidder's internal overall organization including partners (if any). The chart shall be supported by a narrative, which shall explain how the proposed organisation will operate and in particular will provide

The name of the location of the office(s) in which the Basic and Detail Engineering Design Packages of the plant shall be carried out.

If any parts of the Basic and Detail Engineering Design Packages are to be carried out in more than one office, then details of the distribution of the jobs between offices and coordination procedure shall also be presented.

A description of the facilities offered to the OWNER'S resident engineers.

2.0 Estimated project and Engineering man-hours

Bidder shall give an estimate of the engineering man-hours and its break down for all activities

3.0 Methods and procedures

Bidder shall summarise the methods and procedures that BIDDER intends to implement during the performance of the WORK. It shall include the proposed procedures such as Engineering, Procurement, construction strategy, WORK Progress Measurement, Pre-commissioning, Commissioning and Performance Test Run of the PLANT, and Training.

BIDDER shall also furnish proposed procedures for the Project management, communication and method and frequency of reporting the progress of the WORK.

The final form for reports, which will be subject to OWNER's Approval, shall include as a minimum the following :

a) Planning and Scheduling

b) Work Progress

c) Safety and Security

NOTES:

a) Sample reporting forms and other key standard forms shall be included.

b) Bidder shall state the extent to which he will be using computerized drafting, etc.

4.0 Job descriptions and personnel resumes

Bidder shall include job descriptions and personnel resumes of his staff nominated to the key positions, including (where applicable) at least the followings, or Bidder's equivalent:

Project director
Process engineering co-ordinator
Construction manager
Process engineer
Project engineering co-ordinator
Senior pre-commissioning engineer
Senior commissioning engineer
Training co-ordinator and instructor.
Construction Engineering Coordinator
Construction Quality Control Engineer
Construction Project Control Engineer
Welding Specialists
Heavy Lift Rigging Specialist
Senior Specialist Engineers
Senior Planning Engineers
Materials Coordinators
Senior Construction Engineers
Senior Pre-commissioning Engineers
Warehousing Officer
Material Planning Engineers

Resumes shall give at least the name, age, nationality, education, professional exception/deviation and previous experience of each assigned personnel. Additionally, one alternative shall be offered for each position. **Bidder shall ensure that personnel to be deployed meet the minimum criteria specified in Annexure-7-6**

Bidder shall confirm that these key personnel will be made available to WORK on the Project as required by the schedule on full time basis.

Bidder shall furnish Summary of its Deployment Schedule Personnel as per **Annexure-7-7.**

Bidder understands that the said proposal represents the minimum deployment and the Bidder acknowledges that the said deployment may have to be augmented with additional number and/or categories, if required, if directed by Engineer-in-Charge in order to complete the work within the completion schedule and quoted lump sum price.

5.0 Construction equipment and machinery

The BIDDER shall furnish details of construction equipment & machinery, testing equipment, tools/tackles, etc., which will be made available by the Bidder at the Site. Bidder shall furnish Summary of such details as per **Annexure-7-8, Annexure-7-9.**

Such list shall, in no way limit the CONTRACTOR's responsibility to arrange & provide any additional construction equipment, tools, tackle, etc., which might be required to execute and complete the WORK as per contractual schedule.

BIDDER shall furnish the procedures and his tools for erection of the Heavy Lift Equipments including tall columns):

6.0 Heavy lifts

BIDDER shall furnish his proposed, site transportation, lifting, along with preliminary rigging schemes and erection procedure for the heavy lifts. Such plans / schemes shall be furnished along with detailed write -up on heavy cranes proposed to be deployed by CONTRACTOR, duly supported by relevant technical literature.

7.0 BIDDER experience & exception/deviation to perform the work

The BIDDER should have experience in the construction of similar Plants. The BIDDER should have successfully executed and completed construction of at least one similar Plant with his own project management and with complete responsibility of construction / erection and pre-commissioning.

The BIDDER shall furnish, as a part of his Tender Documents establishing the BIDDER'S experience and exception/deviation to perform the CONTRACT. Such documentary evidence shall also establish to OWNER's satisfaction that the BIDDER has the necessary financial, technical, project management capabilities and the requisite resources to execute the Work.

Such documentary evidence shall also be furnished for BIDDER'S proposed Subcontractors, if any. The Bidder shall furnish, in a tabular from, a list of jobs of similar type and magnitude executed by them in the past. BIDDER shall also furnish details of their experience in erection of heavy lifts. The Bidder shall furnish documentary evidence, establishing to OWNER satisfaction, that such jobs have been timely and successfully executed by them. The BIDDER shall also furnish the details of their present major commitments.

8.0 QA/QC Program

Bidder shall furnish a summary description of their proposed QA/QC program.

Bidder shall furnish any other technical information / details as per the requirements of ITB.

9.0 Technical assistance

The extent of the Technical Services and Assistance to be rendered by CONTRACTOR for, commissioning and performance test run, etc., is to be proposed

10.0 Training

Bidder shall furnish the following details regarding the Training of OWNER'S personnel:

a) Bidder's organisation set up for Training program.

b) Training facilities available with the Bidder to train the OWNER'S personnel in

- Theory of process, operation, maintenance and manufacturing of products
- Field (on the job) training in process, operation, maintenance and manufacturing of products, to train the personnel on the job.
- Test procedure and other matters.

c) The courses and their duration, number of attendees in each course and location where such courses will be held that the Bidder would recommend OWNER to consider.

d) Bidder's experience of training the personnel for units similar to the subject PLANT.

11.0 Estimate of the number of personnel required for the safe and satisfactory operation of the Plant.

For and on behalf of ……

Stamp & Signature : ……

Name : ……

Designation : ……

Date : ……

ANNEXURE-7-6

Minimum Qualification & Exp. Of Key Supervisory Construction Personnel

SL. NO.	CATEGORY	QUALIFICATION & EXPERIENCE
1	RESIDENT CONSTRUCTION MANAGER / RESIDENT ENGINEER / SITE-IN-CHARGE	Degree in Engg. With minimum 20 years relevant experience in construction should successfully constructed & commissioned at least one process unit in hydrocarbon / fertilizer sector.
2	LEAD DISCIPLINE ENGINEER	Degree in relevant Engg. discipline with minimum 15 years experience in Construction or Diploma in relevant Engg. Discipline with minimum 20 years experience in Construction.
3	LEAD WELDING / NDT ENGINEER	Degree in Mechanical Engg./Metallurgy with minimum 15 years experience in Welding / NDT (Non-Destructive Testing) plus Level-II in RT (Radiographic Testing) or diploma in Mechanical Engg. / Metallurgy with minimum 20 years experience in Welding / NDT plus Level–II in RT.
4	LEAD QA/QC ENGINEER	Degree in Engg. With 15 years Construction Experience of which 5 years should be as QA Manager.
5	LEAD PLANNING ENGINEER	Degree in Engg. With 15 years experience in Planning & Scheduling.
6	LEAD SAFETY OFFICER	Degree / Diploma in Engg. And Diploma in Industrial Safety with min. 10 years relevant experience in Construction Safety.
7	WAREHOUSE-IN-CHARGE / MATERIALS MANAGER	Graduate in Science or Diploma in Engg. / Materials Management with 15 years experience in Warehousing / Stores Management of similar nature.
8	DISCIPLINE SURVEYORS	Degree in relevant Engineering Discipline with minimum 3 years experience in Construction or diploma in relevant Engineering Discipline with minimum 6 years experience in Construction.
9	QUANTITY SURVEYORS	Degree in relevant Engineering Discipline with minimum 3 years experience or diploma in relevant Engineering Discipline with minimum 6 years experience in quantity estimation, field measurement, rate analysis etc. in construction field.

For and on behalf of ……

Stamp & Signature : ……

Name : ……

Designation : ……

Date : ……

ANNEXURE-7-7

Deployment Schedule of Supervisory Personnel

SL. NO.	DESCRITPION	DEPLOYMENT SCHDULE																												
		1	2	3	4	5	6	7	8	9	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35	36	37	TOTAL
1	**PROJECT MANAGEMENT**																													
1.1	PROJECT MANAGER																													
1.2	PLANNING MANAGER																													
1.3	PLANNING ENGINEERS																													
2	**RESIDUAL DESIGN AND DETAILED ENGINEERING**																													
2.1	PROJECT ENGINEERING MANAGER																													
2.2	ENGINEERING COORDINATOR																													
2.3	ENGG. PERSONNEL FOR VARIOUS DISCIPLINE																													
2.3.1	CIVIL STRUCTURAL																													
(i)	ENGINEERS																													
2.3.2	PRESSURE VESSELS																													
2.3.3	MECHANICAL EQPT/ ROTARY EQPT.																													
2.3.4	PIPING																													
(i)	ENGINEERS																													
2.3.5	ELECTRICAL																													

(i)	ENGINEERS																												
2.3.6	INSTRUMENTA-TION																												
(i)	ENGINEERS																												
2.3.7	MISCELL-ANEOUS																												
3	**PROCUREMENT**																												
3.1	PURCHASE																												
3.1.1	PURCHASE MANAGER																												
3.1.2	PURCHASE COORDINATOR																												
3.1.3	PURCHASE OFFICER																												
3.2	INSPECTION																												
3.2.1	INSPECTION MANAGER																												
3.2.2	INSPECTORS																												
3.3	EXPEDITING																												
3.3.1	EXPEDITING COORDINATOR																												
3.3.2	EXPEDITORS																												
3.4	CUSTOM CLEARANCE, IMPORT LICENCE, TRANSPORTA -TION PERSONNEL																												
4	**SITE CONSTRUCTION**																												
4.1	PROJECT MANAGER																												
4.2	CONSTRUC-TION MANAGER																												
4.3	CIVIL STRUCTURAL																												

4.3.I	LEAD ENGINEER																										
4.3.2	SITE ENGINEER																										
4.3.3	SUPERVISORS																										
4.4	MECHANICAL WORKS																										
4.4.1	LEAD ENGINEER																										
4.4.2	SITE ENGINEER																										
4.4.3	SUPERVISORS																										
4.5	PIPING WORK																										
4.5.1	LEAD ENGINEER																										
4.5.2	SITE ENGINEER																										
4.5.3	SUPERVISORS																										
4.6	ELECTRICAL WORK																										
4.6.1	LEAD ENGINEER																										
4.6.2	SITE ENGINEER																										
4.6.3	SUPERVISORS																										
4.7	INSTRUMENTA-TION WORK																										
4.7.1	LEAD ENGINEER																										
4.7.2	SITE ENGINEER																										
4.7.3	SUPERVISORS																										

4.8	QUALITY ASSURANCE/ QUALITY CONTROL																										
4.8.1	QC/QA MANAGER																										
4.8.2	INSPECTOR (CIVIL)																										
4.8.3	INSPECTOR (PIPING)																										
4.8.4	INSPECTOR (MECH EQPT)																										
4.9	SAFETY ENGINEER																										
4.10	SITE ENGINEERING WORKS																										
4.10.1	ENGINEERS																										
4.10.2	SUPERVISORS																										
4.11	COMPUTER ENGINEER																										
4.12	ADMINISTRA – TION MANAGER																										
4.13	MISCELLAN-EOUS																										
4.14	WAREHOUSE PERSONNEL																										
4.15	MATERIAL MANAGER																										
4.16	COMMISSION-ING																										
i)	COMMISSION-ING COORDINATOR																										
ii)	COMM ENGINEER (SHIFT- IN-CHARGE)																										
iii)	CONTROL ROOM COORDINATOR																										

iv)	FIELD SUPERVISOR																											
v)	TECHNICIAN																											

For and on behalf of ……

Stamp & Signature : ……

Name : ……

Designation : ……

Date : ……

ANNEXURE-7-8

Deployment Schedule of Construction Equipment

SL. NO.	DESCRIPTION	CAPA-CITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	..	33	34	35	36	37	TOTAL
1	CRANES																							
1.1	1200 MT																							
1.2	700 MT																							
1.1	500 MT																							
1.2	300 MT																							
1.3	150 MT																							
1.4	75 MT																							
1.5	50 MT																							
1.6	20 MT																							
1.7	15 MT																							
1.8	10 MT																							
1.9	5 MT																							
2	DIESEL GENERATORS																							
2.1	500 KVA																							
2.2	300 KVA/250KV																							
2.3	150 KVA/125KV																							
3	COMPRESSORS																							
3.1	600 CFT																							
3.2	350 CFT																							
4	WELDING M/CS																							
4.1	DIESEL WELDING M/C																							
4.2	DIESEL GENERATOR																							

SL. NO.	DESCRIPTION	CAPA-CITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	..	33	34	35	36	37	TOTAL
4.3	WELDING TRANS FORMERS/RE C-TIFIERS																							
4.4	TIG WELDING M/CS																							
5	GRIT BLASTING M/CS																							
6	SPRAY PAINTING M/CS																							
7	STRESS RELIEVING M/CS																							
8	RADIO-GRAPHY M/CS																							
9	TEST PUMP																							
10	WATER PUMP																							
11	TRANSPORTA-TION EQPT																							
11.1	TRACTOR -TRAILOR																							
11.2	TRUCKS																							
11.3	BUS																							
12	JACKS																							
12.1	MECHANICAL																							
12.2	HYDRAULIC																							
13	CIVIL																							
13.1	EXCAVATORS																							
13.2	DUMPERS																							
13.3	BATCHING PLANT																							

SL. NO.	DESCRIPTION	CAPA-CITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	..	33	34	35	36	37	TOTAL
13.4	CONCRETE PUMP CAR																							
13.5	TRANSIT MIXER																							
13.6	MIXER																							
13.7	VIBRATORS																							
13.8	COMPACTORS																							
13.9	THEODOLITES																							
14.0	OTHERS																							
14.1	INSULATION TESTING EQUIPMENT																							
14.2	SECONDARY INJECTION TESTING KIT																							
14.3	METERS, TOOLS & TACKLES ETC.																							
14.4	CALIBRATION EQUIPMENT																							
14.5	OTHER TOOLS & TACKLES																							
14.6	MULTI METERS CALIBERAT-ORS ETC.																							
14.7	INDUCTION PIPE BENDING PLANTS																							
14.8	METALOGRAPHY																							
14.9	SPECTRO-METERS																							

For and on behalf of :…

Stamp & Signature : ……

Name : ……

Designation : ……

Date : ……

ANNEXURE-7-9

Details Of Equipment Proposed to be used for Tendered Work

I / We, shall use the following MAJOR equipments owned by the tenderer for the work, if awarded to me /us :

Sl. No.	Description	Quantity. (Numbers)	Make	Capacity	Owner	Approximate date when it will be deployed at site	Period of retention at site

For and on behalf of ……

Stamp & Signature : ……

Name : ……

Designation : ……

Date : ……

SECTION – VI - 15.0

SITE WORKING AND SAFETY CONDITIONS

PLANT: **AMMONIA-UREA PLANT BASED ON COAL GASIFICATION**

PROJECT: **INTEGRATED COAL BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)**

TABLE OF CONTENTS

SL. NO.	DESCRIPTION	SHEET NUMBER
1.	SITE LOCATION	
2.	SITE ESTABLISHMENT	
3.	SUPERVISION OF WORK	
4.	INSPECTION	
5.	EMPLOYMENT OF LABOUR	
6.	COMPLETION OF WORK	
7.	WORKING AND SAFETY REGULATIONS	
8.	ELECTRICAL SAFETY REGULATIONS	
9.	REPORTING	
10.	GENERAL SAFETY REQUIREMENTS TO BE OBSERVED DURING SITE FABRICATION AND ERECTION BY THE CONTRACTOR	

1.0 SITE LOCATION

The proposed project will be located within the premises of existing closed coal based Ammonia- urea complex of TALCHER FERTILIZERS LIMITED, Talcher, ANGUL DISTRICT, ODISHA (INDIA).

2.0 SITE ESTABLISHMENT

2.1 The LSTK contractor shall provide all huts, stores, tarpaulins and other covers for the accommodation of his staff, workmen and materials. All materials likely to deteriorate in the open shall be stored under suitable cover.

2.2 The LSTK contractor shall advise the owner within 15 days of the placement of LOI his space requirement which shall include for office, covered storage, open storage, fabrication space, etc. Depending on availability & requirement, space shall be allotted to the contractor for the duration of this contract. He will not be permitted to make use of any other space without the sanction of the Owner. The use of this space shall strictly be made for the execution of this contract only. The sanitary conditions of the ground in or around such structures shall, at all times, be maintained by the contractor in a manner satisfactory to the owner.

2.3 The security of the LSTK contractor's equipment and materials is his own responsibility.

2.4 The LSTK contractor's shall clear away periodically any rubbish, scrap materials, etc. and dump the same in the area indicated by the owner/consultant. All construction material shall be neatly stacked in an orderly manner as directed by the owner and care shall be taken to allow proper access to workmen and easy movement of men, vehicles, cranes and materials.

2.5 The LSTK contractor shall maintain all the drawings carefully mounted on the board of appropriate size and well protected from the ravages of weather termites and other insects.

2.6 The LSTK contractor shall not permit the entry to the site of any person not directly connected/concerned with the work without first having obtained the written permission of owner.

2.7 The LSTK contractor shall submit a list of plant, equipments, tools, tackles, etc. which he will use, to perform the work. The contractor shall submit a list in duplicate of all materials, tools and tackles etc. brought inside the plant site duly signed by owner's security staff as per the rules laid by owner. These tools, etc. shall not be removed from the site till the completion of job. A gate pass must be obtained from the owner in order to remove from site any plant, machinery, tools, materials and equipment.

2.8 All items such as instructions and other pertinent data regarding erection/commissioning and maintenance should be typed and classified for transmittal in a manner approved by the owner.

2.9 All employees of the LSTK contractor shall conform to any rules of conduct, etc. established by owner. Failure to comply with the rules of coduct will be sufficient cause for removal of such person from the site.

2.10 The LSTK contractor will be responsible for providing all plant, tools and tackles, consumables and scaffolding required for the execution of his work as per the best engineering practices.

2.11 The receipt, unloading, movement and storage at site of all the LSTK contractor plant, tools and materials is his responsibility. The receipt, movement & storage of material issued by owner also shall be the responsibility of the Construction Contractor.

2.12 **ELECTRICITY**

Construction power shall be arranged by LSTK contractor as per **Section 14.0 Clause no. 3.0 of this contract.**

2.13 **CONSTRUCTION WATER**

The LSTK contractor shall communicate his water requirements to the Owner within 7 days of the placement of LOI. Construction water shall be arranged by LSTK contractor as per **Section 14.0 Clause no. 3.0 of this contract**

2.14 **FIRST AID**

The LSTK contractor may have access to the Owner's qualified first aid personnel and ambulance, in case of accidents, if available. The contractor will, however provide a first aid post for minor injuries to their staff.

3.0 SUPERVISION OF WORK

3.1 The LSTK contractor shall submit to the Owner resume of his site supervisors for approval prior to commencement of the work. Once approved, the LSTK contractor shall not remove his site supervisors without prior concurrence of the Owner.

3.2 The entire work is to be completed as per the agreed time schedule. The programme of work in details shall be submitted by the LSTK contractor before commencement of work. The detailed programmes prepared by the LSTK contractor shall conform to the targets set forth in the time schedule and will be subject to the approval of the owner. All the work shall be carried out in such a manner that the work of other agencies at site is not hampered due to any action of the LSTK contractor.

4.0 INSPECTION

The work of the LSTK contractor shall be subject to inspection by the Owner at all times.

5.0 EMPLOYMENT OF LABOUR

5.1 The LSTK contractor will be expected to employ on the work only his regular skilled employees with experience of this particular work. The permission of the Owner must be obtained before tradesman is recruited locally for the work. This rule does not apply to unskilled labour. No female labour shall be employed in dark hours/ i.e. hours prohibited under the applicable law. No person below the age of eighteen years shall be employed at any point of time.

5.2 All traveling expenses including provision of all necessary transport to and from site, lodging allowances and other payments to the LSTK contractor employees are his own responsibility.

5.3 The hours of work on LSTK Contractors / Owner and contractor shall adhere to the same.

5.4 All Construction contractors employees shall wear safety helmet and such identification marks as may be provided by LSTK contractor on work site and duly approved by Owner.

5.5 All notices displayed on the site and any instructions issued by the Owner shall be strictly adhered to by the LSTK Contractors and/or his LSTK contractor employees.

5.6 It shall be the responsibility of LSTK contractor to provide suitable accommodation including necessary facilities for their labour and staff.

5.7 LSTK contractor will arrange for Ration Cards and Permits for labour as per statutory provisions for its labour, as necessary.

5.8 The LSTK contractor shall be required to maintain employment records as covered in relevant Acts and produce documentary evidence to the effect that he has discharged his obligations under the Employees Provident Fund Act 1952 for the workmen working at site.

5.9 In case the Owner becomes liable to pay any wages or dues to the labour of the LSTK Contractors or his contractor or any Govt. agency under any of the provision of the Minimum Wages Act, Workmen Compensation Act or any other law due to act of omission of the contractor, the Owner may make such payment and shall recover the sum from Contractor's bills or any other dues.

6.0 COMPLETION OF WORK

Before finally leaving site, all the LSTK contractor store, huts, plant, tools and rubbish shall be removed and the site left clean and tidy. The space allocated by Owner shall be vacated and handed over to the Owner.

7.0 WORKING AND SAFETY REGULATIONS

7.1 The LSTK Contractor shall observe all statutory safety and legal requirements regulations issued by Central and State Governments applicable to the work as well as any local regulations applicable to the site issue by the consultant or any other authority.

7.2 Particular attention is drawn to the following:

a) In case of accident, the Owner shall be informed in writing forthwith. The LSTK Contractor shall strictly follow regulations laid down by Factory Inspector, Govt. and State authorities in this regard.
b) LSTK contractor shall fence his plant, platforms, excavations etc.
c) Compliance with all electricity regulations.
d) Compliance with statutory requirements for inspection and test of all lifting appliances and auxiliary lifting gear.
e) Safety belts proposed to be used, shall be got checked by Fire & Safety Department of LSTK Contractor / OWNER in written before use.
f) Before using the lifting or pulling equipment, LSTK contractor shall carryout load test which shall be witnessed by LSTK Contractor / OWNER.

7.3 Staircase, doors or gangways shall not be obstructed in any way that will interfere with means of access of escape.

7.4 No excavations will be started without the permission of the LSTK Contractor / OWNER, who will inform the LSTK contractor of the position of any pipes or cables known to be buried in the area. All excavations must be effectively railed off at all times, or completely boarded over properly marked during the hours of darkness by red warning lamps, using Flame proof warning lamps in non smoking areas. Debris or material which cannot be immediately removed must be heaped in such a way as to be immediately remove and also to leave adequate passage way. Any finds such as relics or antiques coins or fossils etc. shall be promptly handed over to the Owner.

7.5 The LSTK contractor will notify the Owner of his intention to bring on the site any equipment, such as, space heating or welding apparatus or any container holding liquid or gaseous fuel or other substance which might create a hazard. The Owner will have a right to prohibit the use of such equipment or to prescribe the conditions under which such equipment may be used. The LSTK Contractor will have the right to inspect any construction plant, and to forbid its use if in his opinion it is un-suitable or unsafe. No claim arising there from shall be made by the LSTK Contractor.

The LSTK contractor or any one acting on his instructions will not bring on to the site any radio active substance or any apparatus using such substances or any X ray apparatus until written permission and direction regarding the use of such equipment has been received from the Owner.

The LSTK contractor shall be responsible for the safe storage of the radio graphic sources or those of his Construction contractors.

7.6 The LSTK contractor will meet all requirements, and act on the instructions of the Owner where it is necessary to operate a permit to work system.

7.7 Where it is necessary to provide and/or store petroleum products or petroleum mixtures and explosive, the LSTK contractor shall be responsible for carrying out such provision and/or storage in accordance with the rules and regulation laid down in Petroleum Act 1934, Explosive Act 1948 and Petroleum and Carbide of Calcium Manual Published by the Chief Inspector of Explosive of India. All such storage shall have prior approvals of the Consultant. In case any approval or clearance from

Explosive or any statutory authorities is required, the contractor shall be responsible for obtaining the same.

7.8 The LSTK contractor shall have his own Fire Fighting Extinguishers and Equipment.

7.9 The LSTK contractor shall be responsible for the provision of all safety notices safety equipments including the safety gadgets for his workmen required by both the relevant legislation and such as the Owner may deem necessary.

7.10 While working at heights, safety belts shall necessarily be used.

7.11 "LSTK contractor shall employ a safety officer for safe executing the construction activities of the project who will be responsible for implementing safety requirement contained in the documents.
The safety officer shall possess a recognised degree in engineering discipline preferably, F&S or (Any branch of engineering) and had a post qualification construction experience of minimum two years.
In addition, he/she shall also possess a recognised degree or diploma in industrial safety and preferably have adequate knowledge of the language spoken by majority of the workers at the construction sites.
Contractor shall ensure physical presence of safety personnel at each work location wherever Hot Work permit is required. No work shall be started at site until above safety personnel are physically present at site. The contractor shall submit a safety organogram clearly indicating the lines of responsibility and reporting system and elaborate the responsibilities of safety personnel in the HSE MAUAL/Program. The contractor should furnish Bio-Data/Resume of the safety personnel as above, at least 01 month before the mobilization for PDIL/owner's approval.

7.12 LSTK contractor shall use only steel planks and clamps executing scaffolding. Wooden planks and rope shall not be allowed for this purpose.

7.13 LSTK contractor shall use asbestos cloth to ensure falling of weld spatters down below during above ground welding to ensure safety of electrical cables and personnel and avoiding any fire hazards.

8.0 ELECTRICAL SAFETY REGULATIONS

8.1 In no circumstances will the LSTK contractor interfere with fuse and electrical equipment belonging to the owner or other contractors.

8.2 Before the LSTK contractor connects any electrical appliances to any plug or socket belonging to the other contractor or owner, he will -

i. Satisfy the Owner that the appliance is in good working condition.

ii. Uses of matching sixes plug & does not uses bare wire to insert in socket.

iii. Inform the Owner of the maximum current rating, voltage and phase of appliance.

iv. Obtain permission of the Owner dealing the sockets to which the appliance may be connected.

v. Use distribution board with ELCB for feeding power to hand held tools.

8.3 The Owner will not grant permission to plug in until he is satisfied that-

i. The appliance is in good condition and is fitted with a suitable plug.

ii. The appliance is fitted with a suitable cable having two earth conductors, one of which shall be earthed metal sheath surrounding the cores.

8.4 No electric cable in use by the other LSTK contractor/owner will be distributed without prior permission. No weight of any description be imposed on any such cable and no ladder or similar equipment will rest against or be attached to it. Cables / Wires used shall be in good condition without cuts & in insulation & joints.

8.5 The voltage for all portable equipment e.g. drilling machines, temporary lighting etc. will not exceed 240 volts.

8.6 No work must be carried out on any live equipment. The equipment must be made safe and a “permit to work” issued before any work is carried out.

8.7 LSTK contractor shall employ electrician to maintain his temporary electrical installation.

8.8 Take necessary clearance for working in hazardous area.

9.0 REPORTING

a) The LSTK contractor must report the following information to the Owner in writing daily. Number of men employed, trades-wise,

- Progress achieved;
- Concrete pour card, if any.

b) If during excavation any materials such as but not limited to precious materials or treasure troves etc are found, the same shall be reported to owner immediately and shall be the property of owner.

10.0 GENERAL SAFETY REQUIREMENTS TO BE OBSERVED DURING SITE FABRICATION AND ERECTION BY THE CONSTRUCTION CONTRACTOR

1. Before starting the work, **LSTK contractor** should get safety work permit and should strictly follow instructions written by the concerned authority in work permit. Permit is required for all types of job i.e. Hot, Cold Excavation, Chipping, Grinding etc.

2. Smoking is strictly prohibited inside factory areas.

3. Safety appraisal and equipments shall be provided to workmen as per the nature of work. Welders shall use gloves, goggles, shields etc. during welding, gas cutting etc. All technicians shall use gloves, goggles during

grinding, chipping etc. If any unsafe practice is observed Fire & Safety Sections or the authority issuing the work permit is authorized to stop the work without any prior notice.

4. Temporary fire extinguishers, water hose shall be available near work place and in case of fire, Owner's Fire & Safety Section should be immediately informed by LSTK contractor from nearest available telephone. Project Manager should also be immediately informed.

5. LSTK contractor shall secure necessary insurance of his workmen for the entire duration of works under the contract. Owner is not responsible for any accident/injury caused whatsoever, to any person employed by the Construction Contractor. However, LSTK contractor has to inform Owner's Fire & Safety Section about accident, if any, immediately.

6. Temporary switch boards, cables, wires and electrical equipments should be installed in accordance with standard electrical practice with proper earthing etc. and should have prior approval of LSTK Contractor / Owner electrical engineer. Switch board shall be suitably protected against rainwater. The cable used for welding machine should have flexible tough rubber sheathing.

7. Temporary cables and wires including welding cables should be routed as not to cluster the work areas. Also any possibility of damage to live wires by falling objects should be avoided. Temporary electrical lines for power & lighting shall run overhead or underground so that they should not hinder the movement of men, materials and vehicles.

8. Portable hand lamps being used by construction crew shall be preferably of 24 Volts supply bulb to be protected with safety shields.

9. Earthing for welding shall not be taken through existing structure or equipments due to the very explosive nature of the plant, raw materials, reaction during process and final product. There is every possibility of fire and explosion in the equipment due to electric spark caused by loose earthing connection etc.

10. LSTK contractor should be careful while excavating so that no underground cable or pipe line is damaged. As soon as any brick cover or under ground cables are exposed he should stop the work and inform Construction Manager immediately for necessary action.

11. LSTK contractor should not leave any welding machine etc. running after the work is stopped. Before leaving the work place, Contractor should ensure that welding sets are disconnected from welding socket outlet.

12. All work areas shall be kept reasonably clear and clean for easy movement of men & material. Also all approach roads shall be free from obstacles for easy movement of cranes, vehicles, fork-lifts, trollies etc. and all debris shall be periodically removed.

13. All temporary structure and supports for erection purpose such as scaffolding, ladders, walkways, platform, shuttering etc. shall be sufficiently

strong for safe use and to prevent collapse & accidental fall of workman. Same shall be removed immediately after the work is completed.

14. All workmen working at unsafe elevation during the construction activity such as concreting, plastering, welding, erection work, painting, insulation etc. shall be safe and sufficient passage and should be properly instructed to take necessary safety precautions and observe safe practice to prevent accidental fall. Safety belts and helmets shall be used wherever necessary.

15. All supervisors, welders, electricians, technicians, riggers, engaged in the work shall be adequately skilled, experienced and acquainted with standard rules, regulation & practices of the work.

16. All open trenches, pits and other excavation carried shall be barricaded out by Construction Contractor, to avoid accident.

17. All lifting tools, tackles & accessories shall be in good working condition and of suitable capacity for the purpose for which they are used. All certificates/permits/licenses etc. required under any law or regulation for the same shall be available and valid during the entire period of the execution of the work under this WO/Contract.

18. LSTK contractor shall not use any structure or equipments erected or under erection for fastening, lifting or flying tackle guy-ropes etc. which may impose such loads for which structure or equipments are not designed to carry. However, LSTK contractor has to get prior approval from Construction Manager of Owner before using beams, permanent structure for the above purpose.

19. When work is carried out at high elevations, it is the responsibility of the LSTK contractor to ensure that tools and materials are not left in a position where they can fall on peoples moving /working below. Where necessary, places below should be cordoned off and caution boards be provided by contractor. Also, LSTK contractor should not cut existing hand railing/structure.

20. Contractor's men must not tamper with any machines, switches, valve or equipment not connected with their work. Welding holders should not be tested on running pipe lines.

21. Nylon rope should not be used for scaffolding where hot line is running near by, because there is every possibility of wire rope catching the fire. Also, no scaffolding is to be made on hot as well as insulated lines.

22. Necessary sign boards clearly indicating "RADIOGRAPHY HAZARDS" on all the four sides of the cordoned area surrounding radiography source will have to be displayed by Construction Contractor. Surrounding area will be cordoned with the help of manila rope and his personnel will be kept for watching/guard on all the four sides to prevent entry of personnel till the radiography work is completed. Construction Contractor's personnel should be able to communicate clearly/properly to stop entry of unauthorized personnel within the area cordoned for the radiography work.

Refuse Disposal

23. Refuse must be removed daily to prevent accumulation. Materials liable to cause persons to slip or trip and fall should be cleared immediately.

24. Refuse removal teams working after work hour should be organized where normal cleaning can not cope with the build up of waste materials.

25. Projecting nails should be removed or bent over.

Personal Protective Equipments

26. Helmets should be provided for all who are exposed to the dangers of falling material or structures they might strike against.

27. Suitable eye protection should be provided for all who are exposed to flying particles, harmful glare and dangerous substances.

28. In the handling of rough objects, gloves should be provided and used.

29. Safety footwear should be provided to all who are exposed to foot injury, should be good fitting and comfortable to wear.

30. Safety belts should be provided where other means are not practicable. Both the anchorage points and lifelines provided for attaching safety belts should be of adequate strength. The umbilical line should be fixed in such a way that user's freefall will not exceed 1 metre.

31. Catch net should be used where persons are liable to fall and these should be securely supported at a level as near as possible to the working level.

32. Noise defenders should be provided for work area where the noise level exceeds 85 dBA.

33. Respiratory protection should be provided by employers and used by workers where the dust level remains high and where control at source is not practicable.

Inspection & Record Keeping

34. Where defects render the scaffolds unsafe, they should be rectified immediately. Where this is not practicable, a sign should be put warning against using it.

Winches

35. Adequate foundations should be provided for winches.

Lifting Gear

36. All lifting gear and slinging should be tested before use and thereafter inspected regularly by competent engineers. Workers should also check the lifting gear visually before using them.

37. Each piece of lifting gear should bear its safe working load, its identification number and its last inspection date. It could in addition be colour coded according to due date of inspection.

38. Wire ropes should be preserved against rusting, kinking, fraying, birdcaging and heat damage. Defective wires should be destroyed to prevent recycling.

Concrete Mixers

39. Moving parts which are liable to become nip points, such as gears, chains and rollers should be guarded.

40. Where concrete mixers are driven by internal combustion engineers, exhaust points should be located away from the workers' work station so as to eliminate their exposure to obnoxious fumes.

Electrical Components

41. All components and conductors used must be in good condition.

42. Proper junction boxes and distribution boards from which electric power could be tapped should be provided at every floor level.

Demolition: General Provisions

43. Uncontrolled collapse of walls or other structures under demolition should be prevented.

44. The throwing of materials over the sides of the buildings should not be permitted.

Waste Handling

45. Where demolition is carried out near public areas:

    a) Hoardings slopping inwards should be erected around the building.
    b) Protective nettings should be hung around the building to prevent materials falling outside the periphery shelter
    c) asbestos

    Where asbestos materials are present, appropriate dust control and respiratory protection approved by the local authority must be used.

Excavation: General Provisions

46. Test for toxic gases should be carried out where their presence is suspected.

47. Exposure of shorings to vibration such as that produced by engines or vehicular traffic should be kept to a minimum.

General – Ventilation, Fire Protection/Fighting

48. Where flammable gas concentration could reach explosive levels, it may be necessary to provide intrinsically safe electrical equipments.

49. Adequate lighting and emergency lighting should be provided.

50. Adequate evacuation stairways should be provided for rapid evacuation in case of an emergency.

First Aid

51. Sufficient First Aid Boxes containing simple dressings and supplies should be provided on the site under the control of the foreman.

Awareness

52. The contractor shall brief the visitor about HSE precautions which are required to be taken before proceeding to site and make necessary arrangement to issue appropriate PPE's like HELMET, Safety shoes etc. to the visitors.
The contractor shall promote and develop consciousness about Health, safety and environment among all personnel working for the contractor. Regular awareness programmes and fabrication shop/work site meeting at least on fortnightly basis shall be arranged on HSE activities to cover hazards involved in various operations during construction phase. During the awareness program, step shall be taken by the contractor to motivate & encourage the workmen and supervisory staff by issuing/awarding them the tokens/gifts/mementos/ Monitory incentives.
A verbal warning shall be given to the workers during the first HSE violations. A written warning shall be issued on second violations and thereafter for the third volitions; the services of worker shall be terminated. For all these violations, a penalties' shall be imposed, separately on the contractor. Records of warning for each worker shall be kept in the records**.**

16.0 GUARANTEES:

Bidder shall carry out performance guarantee test run within 6 months from the date of successful commissioning. The test run shall commence when the unit is operating under stable conditions & shall be conducted for a period of not less than 72 consecutive hours or less, as per mutual agreement between Owner and Vendor.

16.1 Workmanship Guarantee:

The bidder shall guarantee all components of the Flare stack including K.O. drum against faulty design, improper material of construction and poor workmanship in addition to plant trial runs. Approval by PDIL/Owner for design calculation and detailed shop drawing, will not in any way absolve the Bidders from his responsibility. Should any repair or replacement be necessary owing to any type of failure on account of faulty design and poor workmanship of the item, the bidder shall be bound to replace the same either in part or whole without any time & cost implication to the purchaser. Repaired or replaced part shall also be covered by same guarantee as in case of main supply.

16.2 PLANT TRAIL RUNS:

Bidders shall conduct successful plant trial runs for a continuous period of 72 hours or less, as per mutual agreement between Owner and Vendor after completion of the plant.

Performance Guarantee parameters/Plant acceptability criteria:

The procedure of performance testing shall be submitted for Owner's review and shall be mutually agreed between the Owner and the contractor.

Contractor shall guarantee the following during performance testing of the Flare system:

a) **Pressure drop through entire flare stack system** including (Flare tip, Molecular seal, Stack pipe, K.O. Drum / etc.)

b) Calculated **radiation intensity** shall be as per NIT. Contractor shall furnish the graph for flow rate Vs radiation level at sterile radius and at stack base and provide the same along with PGTR procedure document. During PG demonstration, Radiation levels corresponding to the flow rate available at the time of PG testing shall be demonstrated by contractor.

c) Guaranteed level of smokeless flaring to be ensured.

d) Flame stability under all conditions

e) Utility consumption (shall be furnished by contractor):

   i. Consumption of Fuel gas (Kg/hr) for continuous burning of pilot burners.

   ii. Consumption of purge gas (per hour) for continuous purging of molecular seal

   iii. Nitrogen for Flare stack purging

Fuel gas required for each pilot burner and as total consumption per hour. The same is to be demonstrated at site. Contractor shall furnish the flow rate of fuel gas & Nitrogen gas for demonstration purpose.

f) Noise level at Flare stack base at maximum relief & continuous conditions, at specified locations. Design flare load: 85 dBA at flare stack base in all directions, 70 dBA at sterile radius. Flare contractor shall furnish the graph for flow rate Vs Noise level at sterile radius & stack base and provide the same along with PGTR procedure document. During PG demonstration, Noise level (as per above mentioned graphs) corresponding to the flow rate available at the time of PG testing shall be demonstrated by contractor.

g) NO_x Content.

h) Consumption of utilities such as service water, LP steam, instrument air, nitrogen, etc.

i) Utilities requirement including electric power consumption during ignition of flare.

j) The design lifetime for the flare (Bidder's scope) shall be minimum twenty five years.

17.0 TIME SCHEDULE:

The time schedule for supply of the complete package of flare stack is 15 months.

Bidders shall furnish activity schedule in form of master network in Prima Vera identifying major activities in various areas like Basic Design, Engineering, and Procurement of materials, bought out items, Manufacture of equipment, Delivery and construction/erection & Commissioning activities. The schedule should conform to the time period as mentioned. Master network, Engineering drawings and Data submission schedule shall be discussed and finalized before issue of Letter of Intent (LOI). After award of contract, the bidder shall plan sequence of work of manufacture and erection to meet the plant commissioning dates and shall ensure that all work/manufacture, shop testing and shipment of equipment is in accordance with required construction/execution sequence. All the dates shall be finalized during the Basic Review Meeting.

Within fifteen days after the award of Letter of Intent (LOI), bidder shall submit for review and approval a detailed network schedule based on the master network as mutually agreed upon, showing logic and duration of activities in following major areas:

- Design, detailed engineering, procurement, manufacture, shop, inspection, testing, dispatch/ shipment and receipt at site, construction & erection, commissioning etc.

The bidder shall, within fifteen days of award of letter of intent, submit the scheme for calculations of percentage progress for schedule and actual, for review and approval of Owner/ PDIL.

SECTION – VI 18.0

DRAWINGS & DOCUMENTS

PLANT: FLARE SYSTEM

PROJECT: INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL, DISTRICT- ODISHA, INDIA

			POST ORDER		
Sl. No	**Description**	**With Bid (Y/N)**	**For Review/ Approval**	**For Information**	**Final/ Approved/ As-built**
	PROCESS				
1	Technical-Check List	Y			
2	Data Sheets - Flare Stack Components	Y	Y		Y
3	Process description	Y	Y		Y
4	P&ID for flare System(s)	N	Y		Y
5	Schematic/ PFD	Y	Y		Y
6	Process Calculation of Pressure drop and Steam /Air quantity for smokeless flaring	Y	Y		Y
7	Operation & control narrative	N	Y		Y
9	Process Calculation of Tip exit velocity	N	Y		Y
10	Noise and Radiation Data & Calculation	N	Y		Y
11	Noise maps	N	Y		Y
12	Utility consumption requirements	Y	Y		Y
13	Performance Guarantee Test Procedure as applicable	N	Y		Y
14	Installation, operation & maintenance manuals containing all certified drawings & documents	N		Y	Y
15	G. A. Drawing of Flare components	N	Y		Y
16	As Built Drawings	N		Y	

17	NG Consumption	Y	Y		Y
18	Radiation Intensity Graph	Y	Y		Y
19	Pressure Drop across KOD, Riser, Molecular seal, Flare tip & Piping	Y	Y		Y

Sl.No	Description	With bid Y/N	For Review/ Approval	For Information	Final/ Approved/ As-built
A.	**CIVIL**				
1	Standards for steel structures	N	Y	-	-
2	Standards for concrete construction	N	Y	-	-
3	Architectural drawings	N	Y	-	Y
4	Overall General arrangement drawing	N	Y	-	Y
5	Design calculations, design analysis for Steel/RCC structures including foundations, and super structure	N	Y	-	Y
6	Foundation layout and detail engg. Drawings	N	Y	-	Y
7	Structural layout & detail engg. drawings of super structure -Structural Sectional drawings, platforms, Ladders, Walkways & Staircases	N	Y	-	Y
8	Fabrication & bar bending schedule	N	N	-	Y
9	Finishing schedule	N	Y	-	Y

VENDOR DATA REQUIREMENTS:

The following drawings/documents marked "Y" shall be furnished by the bidder.

VESSEL					
Sl. No.	**Name of Document**	**With Bid**	**Post Order**		
		Y/N	**For review/ Approval**	**For information**	**Final / approved/ As-built**
1.0	PURCHASE REQUISITION	**N**		Y	Y
2.0	MECHANICAL DATA SHEET OF EQUIPMENT	N	Y	-	Y
2.1	GENERAL ARRANGEMENT DRAWINGS INDICATING DESIGN DATA , FABRICATED EQUIPMENT WEIGHT, GENERAL NOTES, NOZZLE SCHEDULE, DETAILS OF SHELL, HEADS SUPPORTING ARRANGEMENT , MAIN WELD SEAMS ,NOZZLE ORIENTATION PLAN ETC	N	Y	-	Y
3.0	DETAIL OF NOZZLES, MANHOLES,ACCESSORIES ETC.	N	-	Y	Y
4.0	DETAIL OF INTERNALS SUCH AS TRAY,TRAY SUPPORT RING, BOLTING BARS ETC.	N	-	Y	Y
5.0	DETAIL OF DEMISTER	N	Y	-	Y
6.0	MECHANICAL DESIGN CALCULATIONS COMPLYING WITH THE SPECIFICATIONS AND CODES.	N	Y	-	Y
7.0	DETAIL OF PACKING SUPPORT,DEMISTER SUPPORT, GRATING & GRATING SUPPORT	N	Y	-	Y
8.0	DETAIL OF INTERNAL DISTRIBUTOR	N	Y	-	Y
9.0	DETAIL OF EXTERNAL CLIPS SUCH AS LADDER, PLATEFORM,PIPE SUPPORT	N	-	Y	Y
10.0	DETAIL OF INSULATION ,FIREPROOFING	N	-	Y	Y
11.0	DETAIL OF PIPE DAVIT	N	-	Y	Y
12.0	DETAIL OF LIFTING LUG, TAILING LUG & TRUNION ETC. INCLUDING DESIGN CALCULATION	N	-	Y	Y
13.0	SHELL DEVELOPMENT DRAWINGS INCORPORATING ALL ATTACHEMENTS AMD WELD SEAMS	N	-	Y	Y

14.0	ALL FINAL AS- BUILT SHOP DRGS. & DESIGN CALCULATIONS	N	-	Y	Y
15.0	DATA FOLDER AS PER SPECIFICATION	N	-	Y	Y
16.0	MATERIALS TEST CERTIFICATES (**)	N	-	-	Y
17.0	QAP & INSPECTION AND TEST PLAN (**)	N	Y	-	Y
18.0	WELDING PRCEDURE AND QUALIFICATION TEST REPORTS (**)	N	-	Y	Y
19.0	DESTRUCTIVE AND NON DESTRUCTIVE PROCEDURE & TEST REPORTS (**)	N	-	-	Y
20.0	HEAT TREATMENT PROCEDURE AND TIME TEMPRATURE CHARTS (**)	N	-	Y	Y
21.0	RADIOGRAPHIC EXAMINATION REPORTS & FILMS (**)	N	-	-	Y

VESSEL					
Sl. No.	**Name of Document**	**With Bid**	**Post Order**		
		Y/N	**For Review/ approval**	**For information**	**Final / approved/ As-built**
22.0	COMPLETION CERTIFICATES (INCLUDING INSPECTION CERTIFICATE, HYDROSTATIC TEST CERTIFICATE , LOCAL CODE REQUIREMENTS)	N	-	-	Y
23.0	PACKING AND FORWARDING INSTRUCTION (**)	N	-	-	**Y**
24.0	TRANSPORTATION DRAWING SHOWING OVERALL DIMENSION, C.G. WEIGHT AND HANDLING INSTRUCTIONS DULY APPROVED BY APPROPRIATE AUTHORITY	N	-	Y	**Y**
25.0	FINAL CIVIL LOAD DATA INCLUDING DETAILS OF FOUNDATION/ANCHOR BOLTS	N	-	Y	**Y**
26.0	LIST OF SPARE PARTS AND DETAILS	N	Y	-	**Y**
	Note: (**) are to be approved by authorized Third Party Inspection Agency and Statutory authorities as applicable.				

LEGEND: Y – Yes, N – No

Notes :

1. Final documentations shall be supplied in hard copies as well as soft copes in CD Formats. Applicable Software are MS Office 2000, Word, Access, and Excel.
2. Document marked as (**) are to be approved by authorized Third Party Inspection Agency and Statutory authorities as applicable.
3. Final documentation shall be supplied in hard copies (6 prints) and soft (two CDs/DVDs) in addition to Submission through email
4. All drawing & documents shall be submitted in A2/A3 or A4 paper size .Documents in higher paper size shall be submitted in exceptional circumstances or as indicated in MR/Tender.
5. Bill of material (showing part no. MOC, Size, quantity, weight of each part) shall form part of the respective drawing.
6. The Purchase Requisition for static equipment shall be submitted only for Record purpose and same shall not be reviewed by PMC/Owner. The onus of complying tender requirement lies with the Contractor. Any comment on vendor document during detail engineering to meet tender requirement shall be complied by the contractor without any cost or schedule implication to Owner/PMC.

LIST OF DRAWINGS & DOCUMENTS:

Sl. No.	Description	With Bid (Y/N)	For Review/ Approval	For Information	Final/ Approved / As-built
	PIPING				
1.0	Equipment layout drawing	Y	Y	-	Y
2.0	Piping Layout drawing	N	Y	Y	Y
3.0	Design data:				
3.1	Design basis	N	Y	-	Y
3.2	Piping material specification	N	Y	-	Y
3.3	Valve material specification(Valve Data Sheet)	N	Y	-	Y
4.0	Material Take-offs (Linewise & consolidated BOQ)	N	-	Y	Y
5.0	Material Requisitions schedule	N	-	Y	Y

6.0	Quality control plan/Inspection test plan	N	-	Y	Y
7.0	Vendor Drawings(Valves, Strainers, Traps etc)	N	Y	Y	Y
8.0	Issued for construction (IFC) Drawing				
8.1	Piping GA drawings	N	-	Y	Y
8.2	Isometrics	N	-	Y	Y
8.3	Piping supports, operating platforms drg.	N	-	Y	Y
9.0	Design calculation / Documents.	N	-	Y	Y
10.0	Flexibility Analysis of Piping	N	Y	-	Y
11.0	Support and load data	N	-	Y	Y
12.0	All inspection, testing & NDT Records.	N	-	Y	Y
13.0	As Built Drgs/Docs/MTCs	N	-	-	Y
14.0	3D model	N	Y	Y	Y

Sl.No	Description	With Bid (Y/N)	For Review/ Approval	For Information	Final/ Approved/ As-built
	INSTRUMENTATION				
1	Drawing & document schedule		Y		Y
2	Instrument Index			Y	
3	Instrument sizing calculations (control vales, safety valves & flow elements)			Y	
4	Utility requirements			Y	
5	Level sketches			Y	

6	Material Requisition		Y		Y
7	Purchase Requisition			Y	
8	Vendor Drawings			Y	
9	Functional Schematic			Y	
10	Logic Diagrams as per ISA 75.2			Y	
11	Instrument loop drawings			Y	
12	Control room layout		Y		Y
13	Layout of equipment inside control room		Y		Y
14	Power supply distribution		Y		Y
15	Wiring diagram for panels			Y	
16	Configuration diagram		Y		Y
17	I/O assignment		Y		Y
18	DCS/PLC graphics, report/log formats & other DCS/PLC docs.		Y		Y
19	Instrument duct / tray layout			Y	
20	Instrument cable schedule			Y	
21	Instrument location plans			Y	
22	Instrument installation drawings			Y	
23	Bill of material for installation items			Y	
24	Spare part list for :				
	a. Mandatory Spares			Y	

	b. Start up & commissioning			Y	
25	Inspection & test procedures			Y	
26	Complete catalogues with part list for all vendor supplied instruments, control etc.			Y	
27	Installation, operation & maintenance manuals			Y	
28	As Built Drawings			Y	
29	System Architecture	Y			Y
30	Instrument Control Philosophy	Y			Y

S. No	Description	With Bid (Y/N)	For Review/ Approval	For Information	Final/ Approved/ As-built
	ELECTRICAL				
1.0	Cable schedule.	N	Y	-	Y
2.0	Cable rack/trench/pipe layout.	N	Y	-	Y
3.0	Dimensional Drawing Showing the Mounting Details & General Arrangement of i) Aviation light ii) Junction Boxes	N	Y	-	Y
4.0	Interconnection & Terminal connection diagram	N	-	Y	Y
5.0	Earthing and lightning protection layout	N	Y	-	Y
6.0	Lighting layout and Distribution diagram	N	Y	-	Y

7.0	Catalogues for all bought out items	N	-	Y	Y
8.0	Bill of Materials covering all electrical equipment and installation materials	N	-	Y	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in pen drive shall be submitted as final documents prior to dispatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N – No

SECTION- VI: TECHNICAL

SECTION VI- 19.0

SPARE PARTS

TECHNICAL SPECIFICATION

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL GASIFICATION BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

1.0 SPARES PARTS FOR ERECTION & COMMISSIONING:

Contractor shall supply free of cost (Include in the scope) spare parts and Consumables (except raw materials and Utilities supplied by others) required during Pre-commissioning & Commissioning of the plants till the plant is handed over to the Owner after Performance Test.

2.0 Mandatory Spares

Contractor shall supply spare parts (along with the equipment) as per list of Mandatory Spares detailed below:

2.1 STATIC EQUIPMENT:

S.no	Spare Items	Quantities
1.0	**Pressure Vessels ,Filter e.t.c**	
1.1	Gaskets (for all nozzle connections with blind flange)	200 %
1.2	Bolts (for each nozzles with blind/companion flanges)	10% (minimum 2 numbers)
1.3	Gaskets (For each girth flange)	200 %
1.4	Bolts(for each Girth Flange)	10% (minimum 2 numbers)
1.5	Bolting for internal flange	10 % (Minimum 2 numbers)
1.6	Gasket for internal flange	200 %
1.7	Spare for internals Bolts Clamps Washer Bubble Caps / valve	 10% (Minimum 2 numbers) 2 % excess, min. 5 piece 20 % excess, min. 3 piece 10%
1..8	Sight/light glass assembly complete with bolting and gasket	300% of each installed glass
1.9	Filter Cartridge/Elements	200%

Notes:

1) Quantities shown are for each equipment.
2) The parts listed are the principal parts only. Other parts shall be considered for recommendation in quantities consistent with the above table.
3) All special tools and tackles required for maintenance for critical items shall be supplied along with equipment.
4) Spare parts shall be identical in all respects to the parts fitted on the main equipment, including dimensions, material of construction, testing & heat treatment.
5) Prices of Mandatory Spares shall be included in the quoted price. The mandatory spares shall be supplied to Owner. These spares shall not be used during construction, erection or Commissioning.
6) The Bidder shall quote for all the mandatory spares as defined above & as applicable to the proposed design of the equipment. In case, any spare which is listed above but not applicable due to specific construction/design of the equipment, the same shall be highlighted as `Not Applicable' against that spare supported with proper technical explanation.

3.0 VENDOR'S RECOMMENDED SPARE PARTS:

Contractor shall submit list of recommended spare parts of specialised items not covered under Mandatory spares, along with itemised price. Owner will review and decide the recommended spares required for the project.

Piping Items:

Following mandatory spares are to be supplied by bidder for the Piping items:

Sl. No.	Part Description	Size Range (NB)	Quantity Required (% of as built)	Remark
1	Pipes & Fittings	≤1.5"	5%	min. qty. 6 mtr. / 1 No.
2	Pipes & Fittings	≥ 2"	2%	min. qty. 6 mtr. /1 No.
3	Flanges	≤6"	5%	min. qty. 1 No.
4	Flanges	8" to 36"	2%	min. qty. 1 No.
5	Valves	≤14"	5%	min. qty. 1 No.
6	Valves	≥16" with rating ≥900#		Note-5
7	Bolts, Nuts & Gaskets		10%	min. qty. 1 No.
8	Traps		2%	min. qty. 1 No.
9	Expansion Bellow		10%	min. qty. 1 No.
10	Strainer element		10%	min. qty. 1 No.(Note-6)
11	Complete Gear Box for gear operated Valves		5%	min. qty. 1 No.
12	Seal ring for the Pressure seal type valves		5%	min. qty. 10 Nos.
13	Hose assembly		50%	min. qty. 10 Nos.
14	Bolt torque wrenches (Manual)		1 set	min. qty. 1 set (Note-7)
15	Bolt torque wrenches (Hydraulic)		1 set	min. qty. 1 set (Note-7)

Note (Piping items):

1. Percent of quantity required as mandatory spares is for each and every item/size/rating/thickness/material consumed in as built.
2. No substitution in size, rating and material is allowed.
3. Pipe length in meter and other items in No. or Set shall be supplied.
4. Fractional part of quantity shall be converted into nearest upward whole part.
5. For rating ≥900# and sizes ≥16", minimum one qty. valve spare shall be supplied for each size, rating & material.
6. Percent of quantity required as mandatory spares for strainer element is for each and every Strainer/size/rating/material consumed in as built.
7. Quantity shall be supplied irrespective of as built/installed.

SPARE PARTS

A. SPARES PARTS FOR COMMISSIONING:

Contractor shall supply free of cost spare parts and consumables required during Pre-commissioning & Commissioning of the plants until the plant is handed over to the Owner after Performance Test.

B. MANDATORY SPARE PARTS FOR TWO YEARS OPERATION OF FIRE FIGHTING SYSTEM

Contractor shall supply mandatory spares for Fire Fighting Package as listed below. The attached list of parts is minimum requirement for the fire fighting package system. Vendor may offer and supply spares quantity based on his past experience for smooth 02 Years operation of Fire Fighting system.

C. VENDOR'S RECOMMENDED SPARE PARTS

Contractor shall submit list of recommended spare parts of specialised items not covered mandatory spares, along with itemised price. Owner will review and decide the recommended spares required for the project. However, these spares shall not be considered in Price evaluation.

1.0 FIRE FIGHTING SYSTEM :

Following mandatory spares are to be supplied by bidder :

Sl. No.	Part Description	Size Range	Quantity Required (% or part or fraction of as built quantity)	Remark
1	Hose box, RRL hose (63mm) with couplings, jet nozzle with branch pipe, hydrant valve, landing valve		5%	min. qty. 1 No.
2	Hose reel with valve, nozzle, drum & mountings		5%	min. qty. 1 No.
3	Monitor (Per type & capacity)		10%	min. qty. 1 No.
4	Portable fire extinguisher per type & capacity (upto 10 kg)		10%	min. qty. 1 No.
5	Wheel mounted fire extinguisher per type & capacity (greater than 10 kg)		10%	min. qty. 1 No.
6	Spray / sprinkler head per size, rating & material		10%	min. qty. 1 No.

Notes:

1. Quantity required for mandatory spares is, as applicable, for each and every item/capacity/size/rating/thickness/material consumed in as built.
2. No substitution in size, rating and material is allowed.
3. Pipe length in meter and other items in No. or Set shall be supplied.
4. Fractional part of quantity shall be converted into nearest upward whole part.

1.0 SPARES PARTS FOR COMMISSIONING:

LSTK Contractor shall supply free of cost spare parts and consumables required during Pre-commissioning & Commissioning of the plants until the plant is handed over to the Owner after Performance Test.

2.0 MANDATORY SPARE PARTS

LSTK Contractor shall supply mandatory spare parts as per list of spares as detailed below:

2.1 Instrumentation Items:

1) Set means complete replacement of particular part in one machine.
2) Wherever "Each Type" is specified, it means "of the Type/make/model/size/rating and exactly replaceable"
3) Wherever "% qty." is specified, Bidder to quote in next higher rounded figure
4) Out of % age spares and minimum qty specified against each item - higher of the two shall be supplied.

Sl. No.	DESCRIPTION	QUANTITY
1.0	**Field instruments**	
	Pressure Gauges, Differential Pressure Gauge, Draft Gauges, Field Indicators, RTD/T/C with Thermowells, welded thermowell, Skin Thermocuple Sets, Speed Probes with Cables and Fixing Screws and Bolts, Vibration Probes, with Cables (including extension cable) and Fixing Screws and Bolts, Speed Transmitter with Cables and Fixing Screws and Bolts, Proximeters of diff. model and Fixing Screws and Bolts, Gas Sensors with Cables and Fixing Screws and Bolts	10% of each type of instruments, subject to minimum 2 nos. of each type
	Pressure Switches, DP Switches, Purge Rotameters	10% of each type of instruments, subject to minimum 2 nos of each type
	Special thermocouples (like reactors) /multipoint thermocouples,	10% of each length subject to minimum 1 number of each type.
	Skin Type Thermocouple-	10% of total subject to minimum 1 number Complete Set of each type.
	Float and micro switch assembly for level switch	10% of each length subject to minimum 1 number of each type.
	Transmitters for Flow, Pressure, Temperature, Level, Diff. Pressure application, Remote Seal Transmitter, Transmitter for LEL/GAS Detector	10% of each type of instruments, subject to minimum 2 nos of each type

	System including Sensors .	
	Hydra Step	1 no. Electronic unit or 10% subject to minimum. 20% or Min 3 Nos of Sensor Probes
	Mass flow meter & Mag Flow meter	A) Power fuses 6 nos per set B) Sensor assembly-10% min 1 no C) 10% or minimum one number complete electronic head unit
	Vortex Flow Meter	A) One sensing probe ,one set of gasket and Packing for each type and Size B) 10% or minimum one number complete electronic head unit
	Ultrasonic Flow meter	A) 1 pair probe for each instrument B) 1 number electronic card of each type C) 2 numbers fuses of all Types.
	Glass tube Rota meters	20% or min 2 Nos of glass tubes of each size/rating /make.
	Variable Area Metal tube Flow meter (Rota meters)	10% or minimum one no. float & set of Packing for each type, size, rating and material
	Averaging Pitot Tube	Set of Gasket, O-ring, Packing for Retract Mechanism and one no. Needle Valve with each Pitot Tube.
	Flame scanners and optical pyrometer a) Electronics b) Detectors / sensors or spares with limited life	a)10% subject to minimum 1 No. of each type. b)As required for 1 year operation or Min 2 Nos Complete flame scanner
2.0	Displacer type Level Transmitters	A) 10% of each type of instruments head with Torque Tube Assembly and Transmitter, subject to minimum 2 nos of each type. 1 No of float of each type. B) 10% Electronic cards and Display module – Minimum 1 no. of each type
2.1a	Ultrasonic / Guided Wave Radar Type – Level	A) 10% complete Instrument –

	Instrument	Minimum 1 No. of each Type / Range / Material B) 10% Electronic – module / Cards /Display module – Minimum 1 no. of each type
2.2	Level gauge- Transparent / Reflex Type	20% subject to minimum 10 numbers of glass along with pair of Gaskets and glands sets for I/V valves of each type, size (Cushion & Wet Gaskets), whichever is higher.
2.2.1	Level Gauge- Magnetic Type	10% subject to minimum 1 set of Float, Magnet/ball follower-ring gaskets of each type.
3.0	**Control Valve, Shut Down, On-Off, Butterfly, Ball Valves, Gate Valves, Angle Valves, PCV, MOV, Safety Valve Spares**	
3.1	Soft part / actuator spares, including actuator diaphragm, actuator seal kit and spring sets, for each type of actuator	20% of each type of instruments, subject to minimum 1 no. of each type
3.2	Trim Set	Trim set consisting of seat ring / seal ring, plug with stem, cage (wherever applicable), packing material for each make, type , size, reassure rating valve to be provided as spare
3.3	Complete Actuator with Hand Wheel assembly	one complete Actuator for each type and size
3.4	Complete Spare Control Valve for Antisurge Control Valve	One No
3.5	Gland packing, O rings, Packing and Bonnet gasket, seat gasket	100 % for each valve. i.e. one set for each tag.
3.6	Greases and grease guns	5 sets of each type of grease and 1 grease gun of each type
3.7	Solenoid valves	10% of each type of instruments, subject to minimum 2 nos of each type
3.8	Proximity switches including enclosure	10% of each type of instruments, including enclosure- subject to minimum 2 nos of each type
3.9	SMART Positioners	10% of each type of instruments, subject to minimum 2 nos of each type
3.11	Other accessories: Quick Exhaust relay, Volume Boosters, Air Filter regulators, position Transmitters, change over relay, NRV, Pilot valves.	10% of each type of instruments, subject to minimum 3 nos of each type.

		Air filter regulator shall be minimum 20%.
3.12	PRDS & De-super heater unit	a)Same as those of Control Valves
		b) Gaskets for valve and connections per unit (if such gaskets, are special and supplied by PRDS/De-Super heater vendor
3.13	For PCV Repair kit consisting of (orifice, plug, spring, gasket, diaphragm, spring, O-ring for each valve.	20% or minimum 1 no. in each type
3.14	HHT loaded with latest HART configurator software (Emerson make)	1 no. minimum
3.15	Safety Valve:	Set of each type/ size. 1 Set comprising of 1 upper adjusting ring, 1 lower adjusting ring, 1 disk, 1 Nozzle, 1 stem & 1 Gasket set
		20% of each size and rating of Discs, Nozzles, bellows, springs etc. Additionally Minimum 2 Nos of Complete PSV for critical application (Very high pressure PSV's e.g Boiler drum application etc.)
4.0	**DCS, ESD, F&G PLC, Storage PLC, Analyser PLC, Any other Control and PLC system.**	
4.1	CPU	10% or minimum 1 no. each type.
4.1a	Communication cards, Processor cards (Controller) ,FTA cards	2 nos of each type of cards.
4.2	System Pre-fab cables, I/O Card cables, communication bus cables.	10% or min. 5 sets of each type with all connectors, plugs,
4.3	Racks, Backplane units	2 Nos each type
4.4	Local Panel, Hardwire console & annunciator All items like Push buttons, indicators, hand switches lamps, relays selector switches, IS type indicators / Annunciators, holders etc. mounted in the local panel	10% or minimum 2 no. each type.
4.5	HDD unit	2 set of each type (normal as well as Raid-5) with all connectors, plugs.
4.6	Various Keyboards (including operator keyboard) /mouse	2 nos. of keyboard each type and 5 Nos. of mouse.
4.7	Relays	5% of each type of relays, including relevant terminal modules/sockets minimum 5 nos of each type

4.8	Pushbuttons, Lamps, Selector switches	10% of each type , including relevant terminal modules/accessories as a complete set
4.10	All type of system/PDB/Marshalling cabinet /console filters	100%
4.11	All type of system/PDB/Marshalling cabinet/console fan	2 Nos of each type including relevant terminal modules/pre-fab system cables.
4.12	All type of system/PDB/Marshalling cabinet/console Tube light	2 Nos of each type.
4.13	All type of various PDBs Voltmeters	2 Nos of each type.
4.14	I/O Cards	20% of each type of card, including relevant terminal modules/pre-fab system cables, etc., subject to minimum of 5 nos. each
4.15	Various System Battery, Terminators	1 no. of each type
4.16	All system Fuses and various glass fuses	100% for imported fuses
4.17	All PDB fuses, like HRC, GSA Fuses	100% of total qty. of each type
4.18	MCBs	5 Nos. of each type
4.19	Terminal Blocks	Spare Terminal Blocks along with DIN rail – 100 nos each type
4.20a	Cables for wiring inside Marshalling Racks of DCS of relevant size	100 mtr of each color and size
4.20b	Cables for wiring inside Marshalling Racks of ESD of relevant size	100 mtr of each color and size
4.21	24 V DC Bulk Power Supply modules	Min. 2 nos of each type
4.22	System DC Power supply for DCS	Min. 2 nos of each type
4.23	System DC Power supply for ESD	Min. 2 nos of each type
4.23 a	Diode-o ring modules	10% or minimum 1 no. each type.
4.24	Safety barriers, active isolators, signal convertors, trip amplifiers, signal multipliers	10% of each type of instruments, subject to minimum 5 nos of each type
4.25	Hubs, Bus units, Switches, Routers	20% or Min 1 nos of each type
4.26	OPC / Modbus interface Cards	1 No each along with connectors / cables
4.27	DCS operator and engineering subsystem	
	Communication card Operator Station communication bus	1 No.
	Communication card for Engineering Station communication bus	1 No.
	Motherboard for Operator Workstation	1 No.
	Motherboard for Engineering Workstation	1 No.

	SMPS	1 No.
4.28	PLC operator and engineering subsystem	
	Communication card for PLC programming Station communication bus	1 No.
	Communication card for PLC SOE Station communication bus	1 No.
	Communication card for PLC Operating Station communication bus	1 No.
5.0	**Special control system modules** a) WoodWard Digital Governor, b) WoodWard PROTECH 2oo3/Braun Speed Trip unit, Speed Probes c) Any other Control system module associated with Speed trip and Monitoring system. d) Voith Make E/H Converters.	1 no. of each (Controller, IOs ,cables, barriers Complete unit). Speed Probe - 2 nos of Speed Governing, 2 nos for Over speed Trip. • 1 no of each electronics & sensor • 1 no I/H converter complete set.
6.0	**Bentley Nevada 3500 Series Vibration Monitoring System Spares**	
6.1	Central Rack cards : Power supply card, Vibration/Thrust Monitoring card, Axial displacement card, Speed monitor card, Key phasor module, Relay module, Display Unit., transducers and transmitters	20% of each type of cards, subject to minimum 2 nos of each type
6.2	Vibration probes with leads, axial displacement probes with leads, Bearing thermo elements, speed probes with leads, I/H converter, E/H Convertor, trip solenoid valves, transducers, barriers for vibration probes/ Proximeter.	10% or minimum 1 no. of each type. Proximeter 20%
7.0	**Consumables for DCS**	
7.1	Printer papers A3, A4 size	A3- 10 Rims, A4- 50 Rims
7.2	Laser Cartridges (Black and Color)	For 6 month usage, min. 2 sets for each printer
7.3	DATs of HP/ 3-M	25 nos. each
7.4	CDs of HP/Samsung	200 with individual casing
7.5	DVDs of HP/Samsung	200 with individual casing
8.0	**GC Spares**	
a	Set of Filters	1 set
b	Detector Assembly	1 set
c	PCB assembly Power Supply	2 nos.
d	PCB assembly Digital temp control	2 nos each type
e	Pressure Regulator	1 no
f	Thermocouple Assembly	1 no
g	Sol Valve	1 no
h	Backplane Assembly	1 no

i	PCB Assembly	1 no
j	Ignitor Assembly	1 no
k	Pressure Sensor	1 no
l	Filament Kit	2 nos
m	Set of Fuses	1 no
n	Set of Fittings	1 no
o	Pressure Gauge	1 no
p	Temperature gauge	1 no
q	Sample flow meter	1 no
r	Bypass flow meter	1 no
9.0	**Gas Analyzer Spares applicable for all Gas Analyzers / MassSpectrometer**	
a	Sample Flow Meter	1 no
b	By pass Flow meter	1 no
c	Solenoid Valve	1 no
d	Communication board	1 no of each type
e	Display Unit	1 no each type
f	CPU Board	1 no each type
g	Sensor Electronic	1 no each type
h	Modulation Unit	1 no each type
i	Sample Cell	1 no
j	Sensor	1 no each type
k	O Ring	3 sets
l	Thermal fusses	2 sets
m	Heating cartridge	1 set
n	Thermal trip	2 set
o	Analogue module	1 set each type
p	Filter membrane (pack of 25)	1 set
q	Fuse	1 set each type
10.0	**pH / Conductivity Analyzer**	2 (Two) Complete Analyzer complete with sensor, cables, transmitters etc of each type
11.0	**Silica Analyzer/Sodium/chlorine/ moisture /Turbidity /density/O2/CO/NOx/SPM Spares**	
a	Sensor board	1 no.
b	Sensor and Detector	1 no each type
c	Rotameter (if applicable)	1 no.
d	Pressure Control Valve (if applicable)	1 no.
e	Fuses	5. sets.
f	Electronic card	1 no. each type
g	Other Aux. Cards	1 each
h	Probe	1 no. each type
i	Filters, O-rings, Gaskets	2 sets
j	Consumable Kit	2 sets
12.0	**Sample Conditioning system applicable for all**	

	analyzers / Mass spectrometer	
a	Complete sample kit for sample pumps inclusive of 'O' rings, Seal ring, Diaphragm	1 set
b	Solenoid valve for, more than one stream application	1 no
c	Flow switch	1 no
d	Vaporization system if required, which includes vaporizer, thermostat, electrical tracing cable and heater	1 set
e	Cooling system if required, which includes one cooler, flow conditioning system	1 set
f	Sample handling system fitting, valves, pressure gauges, regulators, solenoid valves, flow meters / flow switches and other components, etc	10% or minimum 1 no. of each type
g	Consumables like filters, membranes, reagents, cal. Gas, carriers	For 1 year of continuous operation
13.0	**Flame Scanner**	Two complete instrument of each type
13A	**Ignition System**	
1.	Ignition Transformer	1 no
2.	Trip Amplifier	1 no
3.	Solenoid Operated Valve	1 no
4.	PCV	1 no
5.	Push Buttons	1 Set
6.	Auto Manual Switch	1 Set
7.	Pilot Burner	1 no
8.	Pressure Gauges for each range	1 no + 1 Set
14.0	**Ferruling machine**	1 no along with printer ribbon and sleeves size of 5.0 mm2 and 3.5 mm2 100 meter each
	Other Items	
15.0	**Snubber, Syphon, Gauge Saver**	10% (subject to minimum of 2) of each item used, whichever is higher
16.0	**Loop powered indicators**	10% (subject to minimum of 2) of Loop powered indicators used, whichever is higher
17.0	**Panel mounted instruments**	10% or minimum one no. whichever is higher
25.0	**Tools**	
25.1	Technician's Tool Kit Set including screw drivers, slide wrench, O & D Spanners Kits	10 nos
25.2	Crimping Tool for RJ-45 Connector, Tapria	5 nos
25.3	Crimping Tool 0.5 to 4.0 mm2 wire, Tapria	5 nos

25.4	Crimping Tool BNC connector for Bentely Neveda	2 nos
25.5	Torque Wrench (Adjustable)	2 nos
25.6	Insulation Remover	5 nos
25.7	IC Puller	2 nos of each type
25.8	Logic probe	2 nos.
25.9	Screw driver kit (Taparia make)	5 set
25.10	Allen Key Set (1mm to 8 mm)	5 set
25.11	Lamp puller	3 nos.
25.12	Torches (LED) handheld	10 nos
25.13	Torches (Head Lamp)	10 nos
25.14	Battery charger alongwith 1 set of batteries	2 nos of each type
26.0	CCTV camera, camera station, lens with zoom, Pan & Tilt Unit, Receiver Unit, electronic unit, , power supply, etc.	10% or minimum one of each type of module.
27.0	EPABX Unit, Electronic Card each type	10% or minimum one of each type of module.
28.0	Gas Detector system a) Transmitter assembly (including field display) b) Sensors	10% subject to minimum 1 No. of each type. 20% subject to minimum 2 No. of each type
29.0	Smoke Detectors , MCP, Sounders, Hooters	10% or minimum one of each type of module.
30.0	Pressure Relief Valves/Thermal Relief Valves/ Vacuum Relief Valves / Low Pressure Relief Valves / Pilot Operated Valves	10% of minimum one of each type & size for nozzle, disc insert, guide whichever is higher
30.0a	Rupture Disc	2 spare disc for each Tag.
31.0	MOVs Main PCB of each type Local / Remote / off Selector Switch each type Open / close / stop Selector Switch each type	 1 Nos 1 Nos 1 Nos
31.0	**Installation Material**	
31.1	Instrument valves and	10% subject to minimum 1 no. of each type.
31.1.1	Valve manifolds	10% subject to minimum 3 no. of each type.
31.2	Tube fittings	10% subject to minimum 10 no. of each type.
31.3	Tubes	10% of the total length of each type
31.4	Cables	10% of the total length of each type
31.5	Junction boxes and cable glands	10% subject to minimum 1 no. of each type

SECTION- VI: TECHNICAL

SECTION VI- 20.0

VENDOR LIST

TECHNICAL SPECIFICATION

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL GASIFICATION BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

VENDOR LIST:

Contractor/Bidder shall select sub vendors from the vendor list as specified below. However, if, bidder is the manufacturer of any item, it shall be acceptable subject to furnishing of proven track record/credential by bidder for similar or comparable plant design capacity and approval of owner/consultant during detail engineering stage. Bidder shall ensure that sub vendor for the specified item has supplied item for the specified service & the supplied item is in satisfactory service since last 3 years as on date of offer.

Any equipment/item for which vendor list is not enclosed; Contractor/Bidder shall furnish a list of proposed vendors along-with their references for supply for the specified services of similar type of equipment. However, all proposed additional sub-vendors shall have proven track record/credential and shall be subjected to owners / consultant approval during detail engineering.

STATIC EQUIPMENTS:

S.NO	ITEM DESCRIPTION	COUNTRY
VESSELS IN CS/AS/SS PRESSURE UPTO 10 Kg/cm2g		
1	AERO ENGINEERS	INDIA
2	AIRFRIGE INDUSTRIES	INDIA
3	ARTSON ENGINEERING LIMITED	INDIA
4	B H P V	INDIA
5	BHARAT HEAVY ELECTRICALS LTD.	INDIA
6	FABTECH PROJECTS & ENGINNERS LTD. (For CS Only)	INDIA
7	FLOWLINK INDUSTRIES PVT. LTD. (CS/SS Except Urea Service)	INDIA
8	FURNACE FABRICA (INDIA) LTD. (CS/SS)	INDIA
9	G R ENGINEERING PRIVATE LIMITED	INDIA
10	GANSONS LTD.	INDIA
11	GEMINI ENGI-FAB PVT. LTD. (Excluding AS Mati)	INDIA
12	GHANSHYAM STEEL WORKS LTD. (CS/SS)	INDIA
13	GMM PFAUDLER LIMITED	INDIA
14	GODREJ & BOYCE MFG. CO. LTD	INDIA
15	GRAND PRIX ENGINEERING PVT. LTD. (upto 4m D x 6m L x80mm Thk)	INDIA
16	GRASIM INDUSTRIES	INDIA
17	HEATEX INDIAN CORPORATION	INDIA
18	HINDUSTAN DORR-OLIVER LTD.	INDIA
19	ICEM ENGG. CO. LTD.	INDIA
20	INDIA TUBE MILLS & METAL INDUSTRIES LTD. (For CS/SS only)	INDIA
21	INDUS PROJECTS LTD (FORMERLY INDUS ENGG)	INDIA
22	ISHAN EQUIPMENTS PVT. LTD. (CS/SS only)	INDIA
23	KINETICS TECHNOLOGY INDIA LTD.	INDIA
24	LARSEN & TOUBRO LTD.	INDIA
25	LLOYDS STEEL INDUSTRIES LIMITD	INDIA
26	LOYAL EQUIPMENTS PVT. LTD. CS/SS and Non IBR only)	INDIA

27	MARS DESIGN PVT. LTD.	INDIA
28	MISTRY PRABHUDAS MANJI ENGG. PVT. LTD.	INDIA
29	MOD FABRICATORS	INDIA
30	MULTI-MAX ENGINEERING WORKS PVT. LTD. (CS and SS Material only)	INDIA
31	NAVA BHARAT FERRO ALLOYS LTD	INDIA
32	NEW FIELD INDUSTRIAL EQUIPMENT PVT. LTD. CS/SS Only)	INDIA
33	NIVITA ENGINEERING WORKS	INDIA
34	NOVATECH PROJECTS INDIA (P) LTD. (CS and SS material only)	INDIA
35	ORIENTAL MANUFACTURERS PRIVATE LIMITED (CS/SS only)	INDIA
36	PATELS AIRTEM (INDIA LIMITED	INDIA
37	PRECISION EQUIPMENTS (CHANNAI) PVT LTD	INDIA
38	PROJECT TECHNOLOGISTS PVT. LTD.	INDIA
39	R.D. ENGINEERS (INDIA) PVT. LTD.	INDIA
40	RAJ ENGG. CO.	INDIA
41	RELIANCE FABRICATIONS PVT. LTD.	INDIA
42	REYNOLDS CHEMEQUIP PRIVATE LIMITED (CS/SS)	INDIA
43	SHRENO LTD. (UNIT 2)	INDIA
44	TAS ENGINEERING CO. (P) LIMITED	INDIA
45	TATA CHEMICALS LTD	INDIA
46	THE ANUP ENGINEERING LIMITED	INDIA
47	ISGEC HEAVY ENGINEERING LIMITED	INDIA
48	TITANIUM EQUIPMENT AND ANODE MFG. CO. LTD.	INDIA
49	TRIVENI STRUCTURALS LTD.	INDIA
50	UNITOP ENGINEERS PVT. LTD. (Max. Shell Dia 4.65, Water vol. 140m3)	INDIA
51	HYOSUNG CORPORATION (CS/SS/LAS only)	KOREA
52	APPARATEBAU SCHWEISS TECHNIK GMBH	AUSTRIA
53	SCHOELLER-BLECKMANN NITEC GMBH	AUSTRIA
54	OLMI SPA	ITALY
55	JAPAN STEEL WORKS LTD	JAPAN
56	DOOSAN MECATEC CO. LTD.	KOREA
57	HANJUNG DCM CO. LTD.	KOREA
58	HUNDAI HEAVY INDUSTRIES	KOREA
59	KOREA HEAVY INDUSTRIES & CONSTN. CO. LTD	KOREA
60	CHEM PROCESS SYETEM PVT. LTD. (CS/SS ONLY)	INDIA
61	COPERION IDEAL PVT. LTD.(CS,SS ND LOW ALLOY STEEL ONLY)	INDIA
62	ESSAR HEAHY ENGINEERING SERVICES	INDIA
63	PHILS HEAVY ENGINEERIG PVT. LTD.	INDIA
64	PRAJ INDUSTRIES LIMITED	INDIA
65	SPETECH PLANT EQUIPMENT PVT. LTD. (CS ONLY)	INDIA
66	TECHNO PROCESS EQUIPMENT (I) LTD.	INDIA
67	UNIVERSAL HEAT EXCHANGER LIMITED (CS/SS/LTCS only)	INDIA
68	VIJAY TANKS & VESSELS LIMITED	INDIA
69	VIJAY TANKS & VESSELS LIMITED (KANDLA) (CS/ SS ONLY)	INDIA
70	CRYOSTAR TANKS & VESSEL PVT. LTD.(CS ONLY)	INDIA
71	BTL EPC LIMITED (CS ONLY)	INDIA

72	THE KCP LIMITED	INDIA
73	SUNGJIN GEOTECH CO. LTD. (CS and SS only)	KOREA
74	TECKSON STEEL INDUSTRIES (SS & CS ONLY)	INDIA
75	ATV PROJECTS INDIA LIMITED (CS ONLY)	INDIA
76	PRECEISION GASIFICATION SERVICES PRIVATE LIMITED (NON IBR)	INDIA
VESSELS IN CS/AS/SS PRESSURE 11 TO 60 Kg/cm2g		
1	ALTECH INFRASTRUCTURE (INDIA) PVT. LTD. (Upto 20 Kg/cm2(g)CS Material)	INDIA
2	ARIEN NEW DELHI PRIVATE LIMITED (CS/SS UP TO 11 to 30 kg/cm2(g))	INDIA
3	B H P V	INDIA
4	BHARAT HEAVY ELECTRICALS LTD.	INDIA
5	EXPO GAS CONTAINERS LTD. (CS Only, For SS Material Upto 30 Kg/sq cm (g))	INDIA
6	FABTECH PROJECTS & ENGINNERS LTD. (For CS Only)	INDIA
7	FURNACE FABRICA (INDIA) LTD. (CS/SS UP TO 11 to 30 kg/cm2(g))	INDIA
8	G R ENGINEERING PRIVATE LIMITED	INDIA
9	GANSONS LTD.	INDIA
10	GHANSHYAM STEEL WORKS LTD (CS/SS)	INDIA
11	GODREJ & BOYCE MFG. CO. LTD	INDIA
12	GRAND PRIX ENGINEERING PVT. LTD.	INDIA
13	GRASIM INDUSTRIES (upto 30Kg/cm2g)	INDIA
14	HEATEX INDIAN CORPORATION	INDIA
15	HINDUSTAN DORR-OLIVER LTD. (CS/SS Only)	INDIA
16	INDIA TUBE MILLS & METAL INDUSTRIES LTD. (For CS/SS only upto 30 Kg/cm2g)	INDIA
17	INDUS PROJECTS LTD (FORMERLY INDUS ENGG)	INDIA
18	ISHAN EQUIPMENTS PVT. LTD. (CS/SS Upto 30 Kg/Cm2(g) only)	INDIA
19	KAVERI ENGG. INDUSTRIES LTD.,	INDIA
20	LARSEN & TOUBRO LTD	INDIA
21	LLOYDS STEEL INDUSTRIES LIMITED	INDIA
22	LOYAL EQUIPMENTS PVT. LTD. (Upto 11-30 Kg/cm2, CS/SS and Non IBR only.)	INDIA
23	MULTI-MAX ENGINEERING WORKS PVT. LTD. (Up to 30 Kg/cm2g (CS and SS Materials only)	INDIA
24	NEW FIELD INDUSTRIAL EQUIPMENT PVT. LTD. (Upto 30 Kg/cm2g (CS/SS Only)	INDIA
25	ORIENTAL MANUFACTURERS PRIVATE LIMITED (CS/SS only)	INDIA
26	PATELS AIRTEMP (INDIA LIMITED (CS & SS only)	INDIA
27	PRECISION EQUIPMENTS (CHENNAI) PVT. LTD (upto 44 Kg/cm2g)	INDIA
28	RAJ ENGG. CO. (up to 30kg/cm 2 (g) CS/SS/AS (P3 & P4 only)	INDIA
29	THE ANUP ENGINEERING LIMITED	INDIA
30	BTL EPC LIMITED (up to 36 kg/cm2 (CS Only))	INDIA
31	THE INDIAN SUGAR & GENERAL ENGG. CORPN. (ISGEC), DAHEJ (Except Urea Plant Critical Equipment)	INDIA
32	ISGEC HEAVY ENGINEERING LIMITED	INDIA
33	HYOSUNG CORPORATION (CS/SS/LAS only)	KOREA
34	SCHOELLER-BLECKMANN NITEC GMBH	AUSTRIA

35	BORSING GmbH	GERMANY
36	BELLELI S.P.A	ITALY
37	FBM HUDSON ITALIANA S.p.A	ITALY
38	GE POWER (NUOVO PIGNONE SPA)	ITALY
39	ROLLE S.P.A. (11 TO 60 kg/cm2 pr.)	ITALY
40	WALTER TOSTO SpA	ITALY
41	HITACHI ZOSEN	JAPAN
42	KOBE STEEL LIMITED	JAPAN
43	MITSUBISHI HEAVY INDUSTRIES LTD.	JAPAN
44	MITSUI ENGINEERING & SHIPBUILDING CO. LTD	JAPAN
45	DOOSAN MECATEC CO. LTD.	KOREA
46	HANJUNG DCM CO. LTD.	KOREA
47	HANTECH LIMITED	KOREA
48	KOREA HEAVY INDUSTRIES & CONSTN. CO. LTD	KOREA
49	MECANICA DE LA PENA S.A.	SPAIN
50	BEAIRD INDUSTERIES LOUISIANA	U.S.A
51	CHEM PROCESS SYSTEM PVT. LTD. (CS/SS upto 30 kg/cm^2g only)	INDIA
52	CICB-CHEMICON PVT. LTD. (upto 30 kg/cm^2 only (CS only))	INDIA
53	ESSAR HEAVY ENGINEERING SERVICES	INDIA
54	FAB-TECH WORKS & CONSTRUCTIONS PRIVATE LIMITED	INDIA
55	GMM PFAULER LIMITED (CS/SS only)	INDIA
56	INDCON PROJECTS & EQUIPMENT LIMITED (for CS/LTCS/SS only upto 30 kg/cm^2g)	INDIA
57	MEENAKSHI ASSOCIATED (P) LTD. (CS/LTCS/SS upto 30 kg/cm^2g)	INDIA
58	NUBERG ENGINEERING LIMITED (CS/SS upto 30 kg/cm^2g)	INDIA
59	PHILS HEAVY ENGINEERING PVT. LTD. (upto 30 kg/cm^2g)	INDIA
60	R.D. ENGINEERS (INDIA) PVT. LTD. (upto 30 kg/cm^2g)	INDIA
61	RELIANCE FABRICATIONS PVT. LTD. (CS/SS upto 30 kg/cm^2g)	INDIA
62	SPETECH PLANT EQUIPMENT PVT. LTD. (CS upto 30 kg/cm^2g)	INDIA
63	TECHNO PROCESS EQUIPMENTS (I) LTD.	INDIA
64	NEWTON ENGINEERING AND CHEMICAL LTD.(upto 36 kg/cm^2g) (CS/SS ONLY)	INDIA
65	UNIQUE CHEMOPLANT EQUIPMENTS (CS/SS only upto 30 kg/cm^2g)	INDIA
66	UNIVERSAL HEAT EXCHANGERS LIMITED (CS/SS/LTCS upto 30 kg/cm^2g)	INDIA
67	VIJYA TANKS & VESSELS LIMITED (Upto 37 kg/cm^2g only)	INDIA
68	VIJYA TANKS & VESSELS LIMITED (KANDLA)(CS/SS upto 30 kg/cm^2g only)	INDIA
69	AERO ENGINEERS (CS only)	INDIA
70	AVADH INDUSTRIES (Upto 34 kg/cm2g), CS only	INDIA
71	GEMINI ENGI-FAB PVT. LTD. (Upto 40 Kg/cm2g)	INDIA
72	JINDAL STEEL & POWER LTD. (MACHINERY DIVISION) (CS only)	INDIA
73	PRAJ INDUSTRIES LIMITED (CS/SS ONLY)	INDIA
74	TECHNOPROCESS EQUIPMENT INDIA PVT.LTD (NON IBR)	INDIA
75	THE KCP LIMITED	INDIA
76	ALPEC CO. LTD. (CS & AS only)	KOREA

77	SUNGJIN GEOTEC CO., LTD. (CS and SS only)	KOREA
VESSELS IN CS/AS/SS PRESSURE ABOVE 60Kg/cm2g		
1	B H P V	INDIA
2	BHARAT HEAVY ELECTRICALS LTD.	INDIA
3	G R ENGINEERING PRIVATE LIMITED	INDIA
4	GODREJ & BOYCE MFG CO. LTD.	INDIA
5	LARSAN & TOUBRO LTD.	INDIA
6	THE INDIAN SUGAR & GENERAL ENGG. CORPN. (ISGEC), DAHEJ (Except Urea Plant Critical Equipment)	INDIA
7	ISGEC HEAVY ENGINEEERING LIMITED.(Except Urea Plant Critical Equipment)	INDIA
8	HYOSUNG CORPORATION (CS/SS/LAS only)	KOREA
9	BORSIG GmbH (upto 1500 Deg. C & upto 35000KPa)	GERMANY
10	FERROSTAAL AKTIENGES ELLSCHAFTG	GERMANY
11	KRUPP INDUSTRIES-TECHNIK	GERMANY
12	THYSSEN RHEINSTAHL TECHNIK GMBH	GERMANY
13	ACCIAI SPECIALI TERNI	ITALY
14	ATB ACCIAIERIA E TUBIFICIO DI BRESCIA SP	ITALY
15	BELLELI S.P.A	ITALY
16	FBM HUDSON ITALIANA S.p.A	ITALY
17	GE POWER (NUOVO PIGNONE SPA)	ITALY
18	OLMI SPA	ITALY
19	WALTER TOSTO SpA	ITALY
20	KAWASAKI HEAVY INDUSTRIES LTD.	JAPAN
21	KOBE STEEL LIMITED	JAPAN
22	MITSUBISHI HEAVY INDUSTRIES LTD.	JAPAN
23	SUMISHO MACHINERY TRADE CORPORATION	JAPAN
24	DOOSAN MECATEC CO. LTD.	KOREA
25	HANJUNG DCM CO. LTD.	KOREA
26	HUNDAI HEAVY INDUSTRIES	KOREA
27	KOREA HEAVY INDUSTRIES & CONSTN. CO. LTD	KOREA
28	ALPEC CO. LTD. (CS & SS ONLY)	KOREA
29	SCHOELLER-BLECKMANN NITEC GMBH	AUSTRIA
30	HINDUSTAN DORR-OLIVER LTD. (CS/SS/LAS/LTCS only)	INDIA
31	SUNGJIN GEOTEC CO. LTD. (CS and SS only)	KOREA
32	GRAND PRIX ENGINEERING PVT. LTD. (CS Only)	INDIA
33.	PATELS AIRTEMP (INDIA LIMITED (CS only)	INDIA
34.	PRAJ INDUSTRIES LIMITED (CS and SS only)	INDIA
35.	TECHNO PROCESS EQUIPMENTS (INDIA) PVT. LTD. (NON IBR ONLY)	INDIA
36.	THE ANUP ENGINEERING LIMITED	INDIA
37.	ISGEC HITACHI ZOSEN LIMITED	INDIA

MECHANICAL – PIPING

	CS PIPES IS-1239 (BLACK & GI)	
1	AMBICA TUBES CO.	INDIA
2	ANIL METAL CORPORATION	INDIA
3	CHETAN STEELS (Upto 6")	INDIA
4	DADU PIPES (P) LIMITED (½" to 6")	INDIA
5	GOOD LUCK STEEL TUBES LTD. (15 mm to 150 mm dia)	INDIA
6	GUJRAT STEEL TUBES LTD.	INDIA
7	HI-TECH PIPES LTD. (ERW MS / GI Pipes:½" NB to 6" NB, (Thickness 2.2 mm to 6.0 mm))	INDIA
8	INDIAN TUBE CO. (TATA DIV. OF TUBES & PIPES) (For >200M)	INDIA
9	INDUS TUBES LIMITED (½" to 6")	INDIA
10	JAY LAKSHMI STEEL & ENGINEERING CO.	INDIA
11	JINDAL PIPES LTD. (1/2" to 4")	INDIA
12	JOTINDRA STEEL & TUBES LTD. (½" to 6")	INDIA
13	KALPESH TUBE(INDIA), (TRADER) (upto a max order value Rs.25.0 lakh)	INDIA
14	MUKAT PIPES LTD	INDIA
15	NAVRATAN PIPE AND PROFILE LTD. (Upto 6")	INDIA
16	P.K.FORGE & FITTING INDUSTRIES	INDIA
17	SAGAR STEEL CORPORATION (TRADER)	INDIA
18	SANGHVI METALS (TRADER)	INDIA
19	SURINDRA ENGINEERING CO. PVT. LTD.	INDIA
20	SURYA ROSHNI LTD. (15mm to 150mm)	INDIA
21	THE BENGAL MILL STORES SUPPLY CO.(TRADER)	INDIA
22	WELSPUN GUJARAT STAHL ROHREN LIMITED (ANJAR) (Upto 6")	INDIA
23	ZENITH LIMITED	INDIA
	CS WELDED PIPES IS-3589	
1	ANIL METAL CORPORATION	INDIA
2	DADU PIPES (P) LIMITED (6" to 12" (Thickness up to 9.5 mm))	INDIA
3	EVERGREEN HARDWARE STORES	INDIA
4	GOOD LUCK STEEL TUBES LTD. (Upto 150mm dia, 8 mm thick.)	INDIA
5	GUJRAT STEEL TUBES LTD.	INDIA
6	HEAVY METAL & TUBES LIMITED	INDIA
7	HI-TECH PIPES LTD. (ERW MS / GI Pipes: 6" NB OD to 12", (Thickness 2.6 mm to 8.0 mm))	INDIA
8	INDUS TUBES LIMITED (6" to 12")	INDIA
9	JAY LAKSHMI STEEL & ENGINEERING CO.	INDIA
10	JINDAL PIPES LTD. (8" to 14")	INDIA
11	JOTINDRA STEEL & TUBES LTD. (6" to 14")	INDIA

12	KALPESH TUBE(INDIA), (TRADER)	INDIA
13	LALIT PIPES & PIPES LIMITED (16" to 64", thickness upto 20mm)	INDIA
14	MUKAT PIPES LTD	INDIA
15	NAVRATAN PIPE AND PROFILE LTD. (Upto 10")	INDIA
16	P.K.FORGE & FITTING INDUSTRIES	INDIA
17	PRATIBHA INDUSTRIES LTD., (16" NB to 24" NB, Wall Thickness: 6 mm to 20 mm)	INDIA
18	RATNAMANI METALS & TUBES LIMITED	INDIA
19	SAGAR STEEL CORPORATION (TRADER)	INDIA
20	SANGHVI METALS (TRADER)	INDIA
21	SAW PIPES	INDIA
22	SHRI RAM METALS	INDIA
23	STEEL AUTHORITY OF INDIA LTD.	INDIA
24	SURINDRA ENGINEERING CO. PVT. LTD.	INDIA
25	SURYA ROSHNI LTD. (6" to 16" ,(150mm to 400mm))	INDIA
26	THE BENGAL MILL STORES SUPPLY CO.(TRADER)	INDIA
27	WELSPUN GUJARAT STAHL ROHREN LIMITED (DAHEJ) (Upto 72" (50 mm thk.))	INDIA
28	WELSPUN GUJARAT STAHL ROHREN LIMITED (ANJAR) (Upto 100" (30 mm thk.))	INDIA
	CS WELDED PIPES TO API 5L SPIRAL/ LONG. WELDED	
1	HEAVY METAL PIPE CENTRE (UPTO 24" (Upto SCHXXS) (PDIL approved Manufacturer's Make only)	INDIA
2	JINDAL PIPES LTD. (2" TO 14")	INDIA
3	JOTINDRA STEEL & TUBES LTD. (½" TO 14")	INDIA
4	KALPESH TUBE(INDIA), (TRADER)	INDIA
5	LALIT PIPES & PIPES LTD. (16" to 64" thickness upto 20mm)	INDIA
6	MUKAT PIPES LTD.	INDIA
7	P.K.FORGE & FITTING INDUSTRIES	INDIA
8	PRATIBHA INDUSTRIES LTD. (16" to 24" thickness 6mm to 14.27mm)	INDIA
9	RATNAMANI METALS & TUBES LTD.	INDIA
10	SAGAR STEEL CORPORATION (TRADER)	INDIA
11	STEEL AUTHORITY OF INDIA LTD.	INDIA
12	SURINDRA ENGINEERING CO. PVT. LTD.	INDIA
13	SURYA ROSHINI LTD (GR. A, 3" TO 4", GR. B, 6" TO 14")	INDIA
14	THE BENGAL MILL STORES SUPPLY CO.(TRADER)	INDIA
15	WELSPUN GUJARAT STAHL ROHREN LIMITED (DAHEJ) (upto 72" (50 MM THK))	INDIA
16	WELSPUN GUJARAT STAHL ROHREN LIMITED (ANJAR) (upto 100" (30 MM THK.))	INDIA

17	ETS TROUVAY & CAUVIN	FRANCE
18	PHOCEENNE	FRANCE
19	MANNESMANN HANDEL AG	GERMANY
20	THYSSEN-KRUPP STAHLUNION GMBH	GERMANY
21	DALMINE SPA	ITALY
22	RACCORTUBI SRL	ITALY
23	KOSEI SANGYO LTD	JAPAN
24	MARUBENI ITOCHU STEEL	JAPAN
25	MITSUBISHI CORPORATION	JAPAN
26	NIPPON KOKAN	JAPAN
27	NIPPON STEEL CORPORATION	JAPAN
28	NISHITANI & CO. LTD.	JAPAN
29	NISSHO IWAI CORPORATION	JAPAN
30	OKURA & CO. LTD.	JAPAN
31	SOJITZ CORPORATION	JAPAN
32	SUMITOMO METAL INDUSTRIES LTD.	JAPAN
33	HYUNDAI CORPORATION	KOREA
34	BRITISH STEEL CORPORATION	U.K.
35	CORUS TUBES LIMITED	U.K.
36	SAW PIPES USA, INC	U.S.A
	CS/AS/ LTCS SEAMLESS PIPES	
1	ANAND SEAMLESS TUBES PVT. LTD. (CS Seamless Pipes upto 2”)	INDIA
2	BHEL (VALVES DIVISION)	INDIA
3	CHETAN STEELS (Upto 12”, SCH80)	INDIA
4	HEAVY METAL & TUBES LIMITED (upto 8”, thickness upto 18.26mm)	INDIA
5	HEAVY METAL PIPE CENTRE (UPTO 24" (upto SCHXXS) (PDIL approved Manufacturer’s make only))	INDIA
6	INDIAN TUBE CO. (TATA DEV. OF TUBES & PIPES)	INDIA
7	ISMT LIMITED	INDIA
8	JAY LAKSHMI STEELS & ENGINEERING CO.	INDIA
9	JINDAL SAW LTD.	INDIA
10	MAHARASHTRA SEAMLESS LTD.	INDIA
11	P.K.FORGE & FITTING INDUSTRIES	INDIA
12	RATNADEEP METAL & TUBES PVT. LTD. (<=168.3MM OD)	INDIA
13	SAINEST TUBES PVT. LTD. (½ “ NB TO 3” upto SCH. 160 (ASTM A 106 GR. B, A333 GR. 1 & 6 & A335 GR. P11))	INDIA
14	ETS TROUVAY & CAUVIN	FRANCE
15	PHOCEENNE	FRANCE

16	HORST KURVERS GMBH	GERMANY
17	MANNESMANN HANDEL AG	GERMANY
18	DALMINE SPA	ITALY
19	GAM RACCORDI S.P.A	ITALY
20	IBF SEAMLESS PIPES SPA	ITALY
21	RACCORTUBI SRL	ITALY
22	MARUBENI ITOCHU STEEL	JAPAN
23	MITSUBISHI CORPORATION	JAPAN
24	NIPPON STEEL CORPORATION	JAPAN
25	NISHITANI & CO. LTD.	JAPAN
26	NISSHO IWAI CORPORATION	JAPAN
27	OKURA & CO. LTD.	JAPAN
28	SOJITZ CORPORATION	JAPAN
29	SUMITOMO METAL INDUSTRIES LTD.	JAPAN
30	HYUNDAI CORPORATION	KOREA
31	AB SANDVIK STEEL	SWEDEN
32	BRITISH STEEL CORPORATION	U.K.
33	CORUS TUBES LIMITED	U.K.
34	VOMAL INTERNATIONAL LIMITED	U.K.
	SS SEAMLESS/ WELDED PIPES	
1	APEX TUBES PVT LIMITED (SEAMLESS upto 8" (SCH. 80S) & WELDED upto 48" (SCH160))	INDIA
2	BHANDARI FOILS & TUBES LIMITED (SEAMLESS upto 4" (SCH. 80) & WELDED UPTO 20" (THK. <= 8MM))	INDIA
3	CHETAN STEELS (upto 6” SCH. 40)	INDIA
4	CHOKSI TUBE COMPANY LTD.	INDIA
5	DIVINE TUBES PVT. LTD. (UPTO 8”)	INDIA
6	HEAVY METAL & TUBES LIMITED (UPTO 8" (THICKNESS UPTO 18.26 MM))	INDIA
7	HEAVY METAL PIPE CENTRE (UPTO 8" (upto SCH80S) (PDIL APPROVED MANUFACTURER'S MAKE ONLY))	INDIA
8	JAY LAKSHMI STEEL & ENGINEERING CO.	INDIA
9	JINDAL SAW LTD.	INDIA
10	KRYSTAL STEEL MANUFACTURING PVT. LTD. (upto 2" (MATERIAL UPTO GRADE SS 321))	INDIA
11	MARDALE PIPES PLUS LTD.	INDIA
12	MODERN TUBE INDUSTRIES LTD. (upto 2" (upto SS Grade 321))	INDIA
13	NUCLEAR FUEL COMPLEX	INDIA
14	P.K.FORGE & FITTING INDUSTRIES	INDIA

15	PRAKASH STEELAGE LTD. (Seamless: upto 12” & Welded: upto 24”)	INDIA
16	QUALITY STAINLESS PVT. LTD. (Seamless: upto 6”(SCH40S), Welded: upto 20”(SCH40S)(UPTO SS GRADE 316L))	INDIA
17	RATNADEEP METAL & TUBES PVT. LTD. (SMLS<=168.3MM O.D., WELDED <=50.8MM O.D.)	INDIA
18	RATNAMANI METALS & TUBES LTD.	INDIA
19	REMI EDELSTAHL TUBULARS LTD. (RAJENDRA MECHANICAL INDUSTRIES (Welded Upto 48” seamless upto 8” (Thk: upto 12.7mm))	INDIA
20	SANDVIK ASIA PVT. LTD. (¾" TO 2" (THK: UPTO 8.74 MM))	INDIA
21	SANGHVI METALS (TRADER)	INDIA
22	SCORODITE STAINLESS (INDIA) PVT. LTD. (Seamless UPTO 16"NB, Welding upto 36”)	INDIA
23	SUBHLAXMI METALS & TUBES PVT. LTD. (SS Seamless: ¾”NB to 2”NB; Thk:1.2mm to 8mm, L upto 14mtr; SS Welded ¾” NB to 8”NB; Thk:1.2 mm to 8mm Lupto 14mtr (Material: SS 304, SS304L, SS316, SS316L, SS321, SS347, SS347H))	INDIA
24	SURAJ LIMITED (SURAJ STAINLESS LIMITED)	INDIA
25	THE BENGAL MILL STORES SUPPLY CO.(TRADER)	INDIA
26	WELSPUN SPECIALITY SOLUTIONS LIMITED (UPTO 4”(ONLY FOR SEAMLESS PIPES))	INDIA
27	ZHEJIANG JIULI STAINLESS STEEL PIPE CO. LTD.	CHINA
28	ETS TROUVAY & CAUVIN	FRANCE
29	PHOCEENNE	FRANCE
30	H. BUTTING GMBH & CO. (SEAMLESS : UPTO 30" (UPTO 16MM THK) & WELDED: UPTO 72" (UPTO 64MM)	GERMANY
31	HORST KURVERS GMBH	GERMANY
32	MANNESMANN HANDEL AG	GERMANY
33	THYSSEN-KRUPP STAHLUNION GMBH	GERMANY
34	DALMINE SPA	ITALY
35	GAM RACCORDI S.P.A (THICKNESS 2” TO 24”)	ITALY
36	IBF SEAMLESS PIPES SPA	ITALY
37	RACCORTUBI SRL	ITALY
38	MARUBENI ITOCHU STEEL	JAPAN
39	MITSUBISHI CORPORATION	JAPAN
40	NIPPON STEEL CORPORATION	JAPAN
41	NISHITANI & CO. LTD.	JAPAN
42	NISSHO IWAI CORPORATION	JAPAN
43	OKURA & CO. LTD.	JAPAN
44	SOJITZ CORPORATION	JAPAN
45	SUMITOMO METAL INDUSTRIES LTD.	JAPAN

46	HYUNDAI CORPORATION	KOREA
47	T.T.I. – TUBACEX TUBOS INOXIDABLES, S.A. (Upto 10”)	SPAIN
48	AB SANDVIK STEEL	SWEDEN
49	SOSTA BV (UPTO 72" (THICKNESS UPTO 25.4 MM))	NETHERLANDS
50	VOMAL INTERNATIONAL LIMITED	U.K.
51	CORUS TUBES LIMITED	U.K.
52	BRITISH STEEL CORPORATION	U.K.
	SS SEAMLESS TUBES	
1	ANIL METAL CORPORATION	INDIA
2	APEX TUBES PVT. LIMITED (UPTO 50.8 MM OD (THICKNESS UPTO 4.00 MM))	INDIA
3	BHANDARI FOILS & TUBES LIMITED (UPTO 50MM OD)	INDIA
4	DIVINE TUBES PVT. LTD. (UPTO 3”)	INDIA
5	HEAVY METAL & TUBES LIMITED (UPTO 8" (THICKNESS UPTO 18.26 MM))	INDIA
6	KRYSTAL STEEL MANUFACTURING PVT. LTD. (UPTO 50.8 MM OD (MATERIAL UPTO GRADE SS 321))	INDIA
7	MODERN TUBE INDUSTRIES LIMITED (UPTO 50.80 MM OD (UPTO SS GRADE 321))	INDIA
8	PRAKASH STEELAGE LTD. (114.3 mm OD, Thickness upto 6 mm)	INDIA
9	RATNAMANI METALS & TUBES LTD.	INDIA
10	SANDVIK ASIA PVT. LTD. (OD UPTO 60.33 (THK: UPTO 8.74 MM))	INDIA
11	SCORODITE STAINLESS (INDIA) PVT.LTD. (19.05 mm OD TO 50.80mm OD, Thickness upto 3mm)	INDIA
12	SURAJ LIMITED (SURAJ STAINLESS LIMITED)	INDIA
13	WELSPUN SPECIALITY SOLUTIONS LIMITED (UPTO 114.3mm OD)	INDIA
14	T.T.I.-TUBACEX TUBOS INOXIDABLES, S.A.(Upto 250.0mm OD)	SPAIN
	SS PIPES UREA GRADE	
1	KEY-TECH ENGINEERING COMPANY (UPTO 8”)	INDIA
2	BHDT GMBH	AUSTRIA
3	SCHOELLER-BLECKMANN NITEC GMBH	AUSTRIA
4	ETS TROUVAY & CAUVIN	FRANCE
5	PHOCEENNE	FRANCE
6	HORST KURVERS GmbH	GERMANY
7	MANNESMANN HANDEL AG	GERMANY
8	THYSSEN-KRUPP STAHLUNION GmbH	GERMANY
9	DALMINE SPA	ITALY
10	IBF SEAMLESS PIPES Spa	ITALY
11	MARUBENI ITOCHU STEEL	JAPAN

12	MITSUBISHI CORPORATION	JAPAN
13	NIPPON STEEL CORPORATION	JAPAN
14	NISHITANI & CO. LTD.	JAPAN
15	NISSHO IWAI CORPORATION	JAPAN
16	OKURA & CO. LTD.	JAPAN
17	SOJITZ CORPORATION	JAPAN
18.	SUMITOMO METAL INDUSTRIES LTD.	JAPAN
19	HYUNDAI CORPORATION	KOREA
20	T.T.I- TUBACEX TUBOS INOXIDABLES, S.A. (Upto 10”)	SPAIN
21	AB SANDVIK STEEL	SWEDEN
22	BRITISH STEEL CORPORATION	U.K
23	CORUS TUBES LIMITED	U.K
24	VOMAL INTERNATIONAL LIMITED	U.K
	HDPE/MDPE PIPES & PIPE FITTINGS	
1	ASTRAL	INDIA
2	AQUAGUARD PLASTICS & POLYMERS	INDIA
3	CLIMAX SYNTHETICS	INDIA
4	FIBRO PLASTICHEM (I) PVT. LTD.	INDIA
5	NATIONAL ORG CHEMICAL INDIA LTD.	INDIA
6	PARTH POLY VALVES PVT. LTD. (3/4” TO 8”(150#))	INDIA
7	PENNWALT AGRU PLASTICS LTD. (UPTO 250MM DIA)	INDIA
8	RELIANCE INDUSTRIES “RELPIPE”	INDIA
9	SONAL ENGG. PLASTIC FABRICATOR	INDIA
	SS WLEDED TUBES	
1	APEX TUBES PVT. LTD. (Upto 102mm OD (Thickness Upto 4.00mm)	INDIA
2	DIVINE TUBES PVT. LTD (Upto 4”)	INDIA
3	KRYSTAL STEEL MANUFACTURING PVT. LTD (Upto 50.8 OD- (Material upto Gr. SS321))	INDIA
4	MAXIM TUBES COMPANY PVT. LTD (6mm to 114.3mm (0.5mm to 4.5mm thk))	INDIA
5	MODERN TUBE INDUSTRIES LTD (Upto 50.80 OD(UPTO SS321 Grade))	INDIA
6	PRAKASH STEELAGE LIMITED (114.3mm OD, thickness upto 6mm)	INDIA
7	QUALITY STAINLESS PVT. LTD (Upto 4”OD(upto 4.0mm thk)upto Grade SS316L))	INDIA
8	REMI EDELSTAHL TUBULARS LTD. (RAJENDRA MECHANICAL INDUSTRIES(50.8mm OD))	INDIA
9	SCODA TUBES LTD. (9.52 mm OD to 50.8mm OD)	INDIA
10	SCORODITE STAINLESS (INDIA) PVT. LTD. (19.05 mm OD to 50.80mm OD, thk upto 3mm)	INDIA

11	STEAMLINE INDUSTRIES LTD. (6.00mm OD to 50.8mm OD)	INDIA
12	SUNRISE STAINLESS PVT. LTD (Upto 4” OD Thickness upto 6mm)	INDIA
13	SURAJ LIMITED (SURAJ STAINLESS LIMITED)	INDIA
14	WELSPUN SPECIALITY SOLUTIONS LIMITED (Upto 50.8mm OD)	INDIA
	FITTINGS: CS/AS/SS SEAMLESS & FORGED	
1	AMFORGE INDUSTRIES (Upto 24”)	INDIA
2	ANIL METAL CORPORATION	INDIA
3	CHETAN STEELS (UPTO 6” SCH. 80)	INDIA
4	COMMERCIAL SUPPLYING AGENCY	INDIA
5	CSA FITTINGS (Forged ½” to 2”-(Upto 9000#) & Seamless: 2” to 8” (upto SCHXXS))	INDIA
6	EBY FASTENERS	INDIA
7	EBY INDUSTRIES	INDIA
8	FIT-TECH INDUSTRIES (Upto 24”)	INDIA
9	FLASH FORGE(P) LTD.(Forged upto 4” (upto 9000#) & Seamless up to 42”)	INDIA
10	GUJARAT INFRAPIPES PVT. LTD.	INDIA
11	JAY LAKSHMI STEELS & ENGINEERING CO.	INDIA
12	KALPESH TUBE(INDIA),(TRADER) (UPTO A MAX ORDER VALUE RS.25.0 LAKH)	INDIA
13	M.S FITTINGS MANUFACTURING CO. PVT LTD.	INDIA
14	MARDALE PIPES PLUS LTD.	INDIA
15	NAVKAR FORGINGS & FITTINGS PVT. LTD (Forged 3”(UPTO 6000#) & Seamless(Upto 16” SCH XXS))	INDIA
16	NL HAZRA (upto SCH80)	INDIA
17	P.K TUBES & FITTINGS PVT. LTD. (Forged upto 1 ½” & Seamless upto 24” (SCH160))	INDIA
18	P.K FORGE & FITTING INDUSTRIES	INDIA
19	PARAS FITTINGS PVT. LTD. (Forged: CS ½” to 2” & CS Seamless: 2” to 8”(upto SCHXXS))	INDIA
20	PARMAR TECHNO FORGE (Elbow- ½” to 12”; Tee- ½” to 8”; Reducer (conc & eccn)- ½” to 12” , Cap ½” to 18” (CS&SS))	INDIA
21	PERFECT MARKETTING PVT. LTD.	INDIA
22	PETROCHEM INDUSTRIES (Seamless: Upto 16" (All Fittings) & upto 36" (Only caps) SCH : XXS /80S, Forged: upto 3”-6000#)	INDIA
23	RAJENDRA FORGE INDUSTRIES (CS: UPTO 12" SCH 40 & SS: 6" SCH 40S)	INDIA
24	S & G ENGINEERS (P) LTD.	INDIA
25	SAGAR STEEL CORPORATION (TRADER)	INDIA
26	SANGHVI METALS (TRADER)	INDIA
27	SAWAN ENGINEERS PVT LTD (Upto 36” (SCH160))	INDIA

28	SHIVANANDA PIPE FITTINGS LTD.,	INDIA
29	STEWARTS AND LLOYDS OF INDIA LIMITED	INDIA
30	TEEKAY TUBES PRIVATE LIMITED	INDIA
31	THE BENGAL MILL STORES SUPPLY CO.(TRADER)	INDIA
32	TOPAZ PIPING INDUSTRIES (2” to 36” (SCH 10 to Sch160))	INDIA
33	TUBE BEND (CALCUTTA) PVT. LTD. (CS FITTINGS ONLY)	INDIA
34	TUBE PRODUCTS INCORPORATE	INDIA
35	ZOLOTO INDUSTRIES (15mm to 150mm (only CS Galv.))	INDIA
36	PETROL RACCORD S.P.A. (Seamless: 1” to 42” (Elbows) & 1” to 56” Tee/Reducer/Caps))	ITALY
37	ETS TROUVAY & CAUVIN	FRANCE
38	PHOCEENNE	FRANCE
39	VALLOUREC	FRANCE
40	SEIKMANN ANLAGEN-TECHNIK GMBH.	GERMANY
41	TPS-TECHNITUBE ROHRENWERKE GMBH	GERMANY
42	HORST KURVERS GMBH	GERMANY
43	MANNESMANN HANDEL AG	GERMANY
44	DALMINE SPA	ITALY
45	GAM RACCORDI S.P.A	ITALY
46	IBF SEAMLESS PIPES SPA	ITALY
47	IND MECCANICA BASSI LUIGI & C. SPA	ITALY
48	MANTOVANI SPA	ITALY
49	RACCORTUBI SRL	ITALY
58	TECHNO FORGE SPA	ITALY
51	MARUBENI ITOCHU STEEL	JAPAN
52	NIPPON KOKAN	JAPAN
53	NISHITANI & CO. LTD.	JAPAN
54	NISSHO IWAI CORPORATION	JAPAN
55	OKURA & CO. LTD.	JAPAN
56	SOJITZ CORPORATION	JAPAN
57	SUMITOMO METAL INDUSTRIES LTD.	JAPAN
58	HAITIMA CORPORATION	TAIWAN
59	BRITISH STEEL CORPORATION	U.K.
60	CORUS TUBES LIMITED	U.K.
61	EUROTUBE LIMITED	U.K.
62	VOMAL INTERNATIONAL LIMITED	U.K.
63	BONNEY FORGE	U.S.A.

	FITTINGS: SS UREA GRADE	
1	KEY-TECH ENGINEERING COMPANY (Upto 8”)	INDIA
2	PETROL RACCORD S.P.A (Size upto 14”)	ITALY
3	BHDT GMBH	AUSTRIA
4	ETS TROUVAY & CAUVIN	FRANCE
5	PHOCEENNE	FRANCE
6	VALLOUREC	FRANCE
7	HORST KURVERS GmbH	GERMANY
8	MANNESMANN HANDEL AG	GERMANY
9	SEIKMANN ANLAGEN-TECHNIK GMPH	GERMANY
10	TPS-TECHNITUBE ROHRENWERKE GMBH	GERMANY
11	DALMINE SPA	ITALY
12	IBF SEAMLESS PIPES Spa	ITALY
13	IND MECCANICA BASSI LUIGI & C.SPA	ITALY
14	RACCORTUBI SRL	ITALY
15	TECHNO FORGE SPA	ITALY
16	MARUBENI ITOCHU STEEL	JAPAN
17	NIPPON KOKAN	JAPAN
18	NISHITANI & CO. LTD	JAPAN
19	NISSHO IWAI CORPORATION	JAPAN
20	OKURA & CO. LTD	JAPAN
21	SOJITZ CORPORATION	JAPAN
22	SUMITOMO METAL INDUSTRIES LTD.	JAPAN
23	AVESTA CANDVITE TUBE AD	SWEDEN
24	HELENS ENERGY	SWEDEN
25	BRITISH STEEL CORPORATION	U.K
26	CORUS TUBES LTD	U.K
27	EUROTUBE LTD	U.K
28	VOMAL INTERNATIONAL LTD	U.K
	FRP/PVC PIPE AND PIPE FITTINGS	
1	ASTRAL POLYTECHNIK PVT. LTD. (1/2” to 12” Size)	INDIA
2	GANDHI AND ASSOCIATES	INDIA
3	SONAL ENGG. PLASTIC FABRICATOR	INDIA
	CAST IRON FITTINGS & PIPES	
1	CRAWLEY & RAY (F&E) PVT. LTD	INDIA
2	IISCO LTD	INDIA
3	KESORAM SPUN PIPES & FOUNDRIES	INDIA

4	SAYAJI IRON & ENGG. CO (P) LIMITED	INDIA
5	SHAKTI CAST (P) LTD	INDIA
6	SHALIMAR WORKS LTD	INDIA
7	SHIVA ENGINEERING WORKS	INDIA
8	VISVESARAYA IRON & STEEL LTD.	INDIA
	FORGED FLANGES	
1	AJAY FORGING PVT. LTD	INDIA
2	AMFORGE INDUSTRIES(Upto 24”(upto1500#) & Upto 12”(FOR 2500#)	INDIA
3	ANANDMAYEE FORGINGS PVT. LTD.	INDIA
4	C D ENGINEERING	INDIA
5	CHANDAN STEELS LIMITED (ONLY SS Flanges- Upto36”-150#, Upto24”-300#, Upto20”-600#, Upto16”-900#, Upto12”-1500#, Upto8”-2500#)	INDIA
6	CHETAN STEELS (UPTO 6”, 150#)	INDIA
7	CHW FORGE PVT. LTD. (FORMELY CHAUDHARY HAMMER WORKS)	INDIA
8	ECHJAY INDUSTRIES LTD	INDIA
9	FERROUS ALLOYS FORGING PVT. LTD	INDIA
10	GOLDEN IRON & STEEL WORKS	INDIA
11	GOOD LUCK ENGINEERING CO. (½"-12" (UPTO 2500#), 14"-16" (UPTO 900#), 18"-32" (UPTO 600#), 34"-48" (UPTO 300#),	INDIA
12	J.K FORGINGS (1/2” to 60” ANSI B 16.5, Class 150 to 2500)	INDIA
13	KUNJ FORGINGS PVT. LTD. (upto 60” (upto 300#) & upto 12” (upto 2500#))	INDIA
14	MAHESH INDUSTRIES (1/2” to 8”NB,Rating-150#,SWRF,SORF & BLRF material: ASTM A105 only; 2”NB to 4”NB, Rating- 150# WNRF FLANGES, Material-A105 only)	INDIA
15	METAL FORGINGS PVT. LTD. (Upto86”-150#; 60”-300# TO 600#; 48”-900# ; 24”-1500#; 12”-2500#)	
16	P.K TUBES & FITTINGS PVT. LTD. (Upto 24”(upto1500#) & Upto 12”(upto2500#) Spectacle Blind and Spacer & Blinds only)	INDIA
17	PARAMOUNT FORGE (CS,AS & SS : ½” TO 42” (UPTO 600#), ½” TO 24” (UPTO 900#), ½ “ TO 16” (UPTO 1500#), ½” TO 12” (UPTO 2500#)).	INDIA
18	PERFECT MARKETING (P) LTD.	INDIA
19	PUNJAB STEEL	INDIA
20	R D FORGE (A UNIT OF R D CHEMICALS PVT LTD) (1/2” to 54” (150#), ½” to 40”-300#, ½” to 42”- 600#,1/2” to 20”-900#, 1/2” to 20”-1500#, ½” to 12” -2500# (CS, AS & SS))	INDIA
21	RAJENDRA FORGE INDUSTRIES (CS & SS : UPTO 12", 300#)	INDIA
22	S & G ENGINEERS (P) LTD.	INDIA
23	SANGHVI FORGINGS & ENGINEERING LTD (Upto 42” (upto 300#), 36” (600#), 24” (upto 1500#) & 12” (2500#))	INDIA
24	SANGHVI METALS (TRADER)	INDIA

25	SAWAN ENGINEERS PVT LIMITED	INDIA
26	TECHNO FORGE LTD. (UPTO 42" (UPTO 300#), UPTO 24" (600#), UPTO 20" (900#), UPTO 16" (1500#), upto 12" (2500#))	INDIA
27	TUBE BEND (CALCUTTA) PVT LTD	INDIA
28	ETS TROUVAY & CAUVIN	FRANCE
29	PHOCEENNE	FRANCE
30	HORST KURVERS GMBH	GERMANY
31	I.S. INTERNATIONAL	ITALY
32	MANTOVANI SPA	ITALY
33	OFFICINE NICOLA GALPERTI & FIGLIO S.P.A	ITALY
34	RACCORTUBI SRL	ITALY
35	NICHINAN SANGYO CO. LTD.,	JAPAN
36	NISHITANI & CO. LTD.	JAPAN
37	SOJITZ CORPORATION	JAPAN
38	VOMAL INTERNATIONAL LIMITED	U.K.
	PLATE RING FLANGES	
1	FABWELL ENGINEERS	INDIA
2	MAHESH INDUSTRIES (1/2" TO 16"NB -150# &300# SWRF, SORF & BLRF, Material: MS Plate Flanges of IS 2062 Grade)	INDIA
3	MOD FABRICATORS	INDIA
4	P K TUBES & FITTINGS PVT. LTD (Upto 48"- (Spectacle Blinds and Spacer & Blind only))	INDIA
5	PARAMOUNT FORGE (CS & SS: ½" to 84")	INDIA
6	PERFECT MARKETING (P) LTD	INDIA
7	R SQUARE ENGINEERS	INDIA
8	SANGHVI METALS (TRADER)	INDIA
	FITTINGS: CS/AS/SS WELDED	
1	PARAS ENGINEERING WORKS (8" to 36" NB- SCH 5 to SCH XXS- (CS&SS))	INDIA
2	CHETAN STEELS (Upto 10" SCH80)	INDIA
3	FIT- TECH INDUSTRIES (Upto 48")	INDIA
4	FLASH FORGE (P) LTD. (Upto 42")	INDIA
5	NAVKAR FORGING & FITTINGS PVT. LTD (Upto24"- (SCH XXS, Material: CS only))	INDIA
6	P K TUBES & FITTINGS PVT. LTD (Upto 48"- (SCH160))	INDIA
7	PETROCHEM INDUSTRIES (6" to 36" (all Fittings) & 6" to 56" (Only Conc/Ecc. Reducers) SCH :XXS/80S)	INDIA
8	RAJENDRA FORGE INDUSTRIES (CS & SS: Upto 12", SCH40)	INDIA
9	SAWAN ENGINEERS PVT. LIMITED (Upto 52" (SCH160))	INDIA
10	TOPAZ PIPING INDUSTRIES (8" to 48" (SCH 10 to SCH160))	INDIA

11	PETROL RACCORD S.P.A (4”-56” (Tees/Reducers/Elbows))	ITALY
12	TK CORPORATION	KOREA
	PIPE COATING	
1	PRATIBHA INDUSTRIES LTD, (External Coating 4” to 24” Pipe OD)	INDIA
2	WELSPUN GUJARAT STAHL ROHREN LIMITED (DAHEJ) (4” to 64” for external coating & 16” to 64” for internal coating)	INDIA
	GATE/ GLOBE/ CHECK VALVES CS/SS/AS < 900 LBS	
1	AV VALVES LTD. (CAST UPTO 42”(150#), 28” (300#), 24” (600#) & FORGE UPTO 2” (800#))	INDIA
2	ADVANCE VALVES (2”-80”(Upto 600#) Dual Plate Check Valves only))	INDIA
3	ASSOCIATED TOOLINGS (I) PVT. LTD. (1/2” to 2”, upto 800#)	INDIA
4	AUDCO INDIA LIMITED (L&T VALVES DIVN.)	INDIA
5	AUTOCAP INDUSTRIES (1/2” to 2”, 800# (only CS & SS))	INDIA
6	BELL- O-SEAL VALVES LTD. (FOR ZERO LEAKAGE, HAZARDOUS FLUIDS.)	INDIA
7	BHEL (VALVES DIVISION)	INDIA
8	BRIGHTECH VALVES AND CONTROLS PVT. LTD. (Upto 8” x 300# for CS, AS & SS Material)	INDIA
9	CHEMTECH INDUSTRIAL VALVES PVT. LTD.	INDIA
10	CHEMTROLS SAMIL (INDIA) PVT. LTD (Upto 12”-150# -Dual Plate Check Valve only)	INDIA
11	CRAWLEY & RAY (FOUNDERS & ENGINEERS) PVT. LTD. (<=300#, (only CS))	INDIA
12	DATRE CORPORATION LTD. (Upto 300#, 2”-8” (Gate), 2”- 6” (Globe & Check))	INDIA
13	DEWRANCE MACNEILL & CO. LTD.	INDIA
14	ECONO VALVES PVT. LTD.	INDIA
15	EXPERT ENGINEERING ENTERPRISES (Forged upto 2”-800#, Gate & Globe Valve: upto12”-150# & 300#, Check Valve upto 32”-150# & 300#)	INDIA
16	FLOCON SYSTEMS PVT. LTD. (CS upto 6” 150#)	INDIA
17	FLOVEL VALVES PVT. LTD.(SINGLE DISC, DUAL PLATE & NOZZLE CHECK VALVES ONLY: UPTO 48”(150#) & 24 (UPTO 600#))	INDIA
18	FLUIDTECH EQUIPMENT PVT. LTD. (CAST # (CS & SS): 2” to 12” 150# & 2“ to 8” 300# AND FORGED (CS AND SS) ½” TO 2” (800#)	INDIA
19	FORWARD ALLOYS & CASTINGS (UPTO 14”)	INDIA
20	GURU INDUSTRIAL VALVES PVT. LTD. (Cast CS only: upto 24”(150#), 20”(300#), 10” (600#) & Forged : upto 2” (800#)	INDIA
21	HAWA ENGINEERS LTD. (Gate Valves: upto 40”(150#), upto 26” (300#), upto 24” (600#), upto 2” (800#); Globe Valves: upto 20”(150#), upto 16” (300#), upto 12” (600#), upto 2” (800#), Check Valves: upto 36”(150#), upto 24” (300#), upto 16” (600#), upto 2” (800#) (Dual Plate: 36” (150#)	INDIA

22	HAWA VALVES INDIA PVT. LTD. (CS upto 6", 150#)	INDIA
23	HI-TECH VALVES PVT. LTD. (CS,<=800#, SIZE ½"–2", <=300# FOR SIZE 2"-6")	INDIA
24	INTERVALVE POONAWALLA LTD. (CAST UPTO 24" (UPTO 300#) & UPTO 12" 600# , FORGED UPTO 2" (800#))	INDIA
25	JC VALVES & CONTROLS INDIA PVT. LTD. (CAST UPTO 48" (150#) & 24"(UPTO 600#) & FORGED UPTO 2" (800#))	INDIA
26	KIRLOSKAR BROTHERS LTD.(CS UPTO 12" size, 300#)	INDIA
27	KSB PUMPS LIMITED (VALVES DIVN)	INDIA
28	LARSEN & TOUBRO LIMITED (1/2" TO 24")	INDIA
29	LEADER VALVES LTD. (Casting<=20" upto 600#, & 30"-150#, Forging<=2" upto 800#)	INDIA
30	M.H. VALVES PVT. LTD. (1/2" to 1 1/2"-800#, 2" to 6"-600#)	INDIA
31	MICON ENGINEERS (HUBLI) [PVT. LTD.(Cast: Upto 12" (150# & 300#), 6" (600#) & Forged: upto 2" (800#))	INDIA
32	MICROFINISH VALVES LTD.	INDIA
33	NEOSEAL ENGINEERING PRIVATE LTD (Upto 24" rating upto 600#)	INDIA
34	NITON VALVES INDUSTRIES PVT. LTD. (Forging upto 800#, <=1.5" size)	INDIA
35	NSSL LTD. (Cast: UPTO 80" (150#), 56" (UPTO 600#) & FORGED UPTO 2" (800 #))	INDIA
36	OSWAL INDUSTRIES LTD. (UPTO 48" (150#), 32" (300#) & 24" (600#)	INDIA
37	S & M INDUSTRIAL VALVES LTD. (CS Gate & Globe Valves 2" – 24" <=300#)	INDIA
38	SHALIMAR VALVES PVT. LTD. (Cast Upto 24" (Upto 600#), Forged: ½" to 1 ½" (800#))	INDIA
39	SHREERAJ INDUSTRIES (CS upto 150#)	INDIA
40	STEEL STRONG VALVES (I) PVT. LTD. (Upto 42")	INDIA
41	VENUS PUMP & ENGINEERING WORKS.	INDIA
42	VIBA FLUID CONTROL	INDIA
43	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Cast UPTO 36" (150#); 24" (300#); 12" (600#) & Forged: Upto 2" (800#))	INDIA
44	ZED VALVES CO. PVT. LTD. (Upto 14" (600#))	INDIA
45	ZOLOTO INDUSTRIES. (40 MM TO 200 MM(ONLY CS & SS))	INDIA
46	VELAN INC. (UPTO 48" , Rating upto 600#)	CANADA
47	BOTELI VALVE GROUP CO. LTD.(Cast Upto 56" (150#), 36" (300#), 24" (600#) & Forged: Upto2" (800#))	CHINA
48	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
49	PEMTO VALVE	GERMANY
50	CESARE BONETTI SPA (Cast Upto 42" (Upto 300#), 24" (600#) Forged: upto 1 ½" (800#))	ITALY
51	FASANI S.P.A.	ITALY

52	FRIULCO SPA (UPTO 48" (150#), 32" (Upto 600#)	ITALY
53	GTC ITALIA, S.R.L.	ITALY
54	MANTOVANI SpA	ITALY
55	OMB S.P.A.	ITALY
56	PETROL VALVES S.R.L.	ITALY
57	MATSURA H. P MACHINE WORKS CO.LTD.	JAPAN
58	NISHITANI & CO. LTD.	JAPAN
59	SOJITZ CORPORATION	JAPAN
60	REDPOINT ALLOYS BV	NETHERLAND
61	BABCOCK BORSIG ESPANA , S.A	SPAIN
62	POYAM VALVES (AMPO S.CCP.) (Size upto 60” (Rating upto 800#)	SPAIN
63	WALTHAN & WEIR	SPAIN
64	SUFA LIMITED	U.A.E.
65	BEL VALVES	U.K.
	GATE/ GLOBE/ CHECK VALVES CS/SS/AS >=900 LBS	
1	A V VALVES LIMITED (Cast Upto 24” (900# & 1500#), 8” (2500#) Forged: Upto 2” (2500#))	INDIA
2	ADVANCE VALVES (2”-36” (900#) 2”-24” (1500#), 2”-12(2500#) DUAL PLATE CHECK VALVES ONLY)	INDIA
3	ASSOCIATED TOOLINGS (I) PVT. LTD. (½” TO 2” (RATING :900# & 1500#))	INDIA
4	AUDCO INDIA LIMITED (L&T VALVES DIVN.)	INDIA
5	BHEL (VALVES DIVISION)	INDIA
6	FLOVEL VALVES PVT. LTD. (Dual Plate Check Valves only: Upto 24” (900#))	INDIA
7	HAWA ENGINEERS LTD. (Gate Valves: upto 20”(900#), upto 10” (1500# & 2500#); Globe Valves: upto 8”(900# & 1500#), upto 1” (2500#); Check Valves: upto 10”(900#), upto 6” (1500#), upto 1” (2500#)	INDIA
8	INTERVALVE POONAWALLA LTD.(Forged: Upto 2” (1500#))	INDIA
9	JC VALVES & CONTROLS INDIA PVT. LTD. (CAST UPTO 12” (1500#),10” (2500#) & FORGED UPTO 2” (2500#))	INDIA
10	KSB PUMPS LIMITED (VALVES DIVN)	INDIA
11	LARSEN & TOUBRO LIMITED (1/2" TO 2")	INDIA
12	LEADER VALVES LIMITED (Casting<=12” upto2500#, Forging <=2” upto 2500#)	INDIA
13	METROPOLITAN INDUSTRIES (SIZE=200mm, rating=2500 lb)	INDIA
14	MICON ENGINEERS (HUBLI) PVT. LTD. (FORGED: UPTO 2" (1500#))	INDIA
15	NEOSEAL ENGINEERING PVT. LTD. (Upto24”- rating upto 2500#)	INDIA
16	NSSL LIMITED. (CAST: Upto 36"(900#), 24” (upto 2500#) & FORGED: Upto 2” (Upto 2500#))	INDIA

17	OSWAL INDUSTRIES LTD. (Upto 12” (900# & 1500#))	INDIA
18	SHALIMAR VALVES PVT.LTD.(CAST: UPTO 20"(900#), FORGED: ½" TO 1 ½" (1500#))	INDIA
19	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Cast UPTO 12" (upto 2500#) & Forged: Upto 2” (1500#), 1” (2500#))	INDIA
20	VELAN INC. (UPTO 24” (Rating upto 2500#))	CANADA
21	BOTELI VALVE GROUP CO. LTD.(Cast Upto 16” (Upto 1500#), 12” (2500#) & Forged: Upto 2” (1500# & 2500#))	CHINA
22	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
23	BFE BONNEY FORGE VALVE LICENSEE	ITALY
24	CESARE BONETTI SPA (Upto 24” (Upto 2500#)	ITALY
25	FASANI S.P.A.	ITALY
26	FRIULCO SPA (UPTO 32" (900#); 24" (1500#); 14" (2500#))	ITALY
27	GTC ITALIA S.R.L.	ITALY
28	OMB S.P.A.	ITALY
29	PETROL VALVES S.R.L.	ITALY
30	VALVITALIA SPA	ITALY
31	MATSURA H. P MACHINE WORKS CO.LTD.	JAPAN
32	NISHITANI & CO. LTD.	JAPAN
33	BABCOCK BORSIG ESPANA, S.A.	SPAIN
34	POYAM VALVES, (AMPO S. COOP.) (SIZE UPTO 30" (RATING UPTO 2500#))	SPAIN
35	SUFA LIMITED	U.A.E.
36	BEL VALVES	U.K.
	BALL VALVES (SOFT SEATED)	
1	A V VALVES LIMITED (Upto 12” (Upto 600#))	INDIA
2	AIRA EURO AUTOMATION PVT. LTD. (Upto 6”, Rating 150# & 300#),	INDIA
3	AQUA VALVES PVT. LTD.	INDIA
4	BRIGHTECH VALVES & CONTROLS PVT. LTD. (4” x 150# for CS, AS & SS material)	INDIA
5	CHEMTECH INDUSTRIAL VALVES PVT. LTD.	INDIA
6	CRAWLEY & RAY (FOUNDER & ENGINEERS) PVT. LTD. (DN25)	INDIA
7	DELVAL FLOW CONTROLS PVT. LTD. (Upto 12” (Upto 900#))	INDIA
8	FLOCON SYSTEMS PVT. LTD. (CS upto 6”, 150#)	INDIA
9	FLOW CONTROL	INDIA
10	FLOWCHEM INDUSTRIES (UPTO 300# and upto 10”)	INDIA
11	FLUIDTECH EQUIPMENT PVT. LTD(UPTO 4” (300#))	INDIA
12	FORWARD ALLOYS AND CASTINGS (Upto 900#)	INDIA
13	GURU INDUSTRIAL VALVES PVT. LTD. (Cast CS only: Upto 12” (Upto	INDIA

	300#), 4" (Upto 900#) & Forged: Upto 2" (800#))	
14	HAWA ENGINEERS LTD. (Upto 16" (150# & 300#), Upto 12" (600# & 900#))	INDIA
15	INTERVALVE POONAWALLA LTD. (Forged: Upto 2" (800#), Cast: Upto 12" (Upto 300#))	INDIA
16	JC VALVES & CONTROLS INDIA PVT. LTD. (CAST UPTO 28" (upto 600#),12" (900#, 1500#) & 10"(2500#))	INDIA
17	KSB PUMPS LTD. (VALVES DIVN.) (CS upto 100DN, 20 bar)	INDIA
18	LEADER VALVES LTD. (Casting <=6" upto 600# & forging <=2" upto 800#)	INDIA
19	MEVADA ENGINEERING WORKS PVT. LTD., MUMBAI (Upto 2"(800#), (Forged), UPTO 14"(300#), Material: CS/AS/SS	INDIA
20	MICON ENGINEERS (HUBLI) PVT. LTD. (Cast: Upto 6" (150# & 300#) & Forged: Upto 2" (800#)	INDIA
21	MICROFINISH VALVES (P) LTD.	INDIA
22	NEOSEAL ENGINEERING PVT. LTD (Upto 12" rating upto 600# and Upto 8" upto 2500#)	INDIA
23	NSSL LTD. (Upto 12" (150# & 300#))	INDIA
24	OSWAL INDUSTRIES LTD. (Upto 24" (150#, 300# & 600#))	INDIA
25	SHALIMAR VALVES PVT. LTD. (Upto 18" (600#) Material: CS/AS/SS)	INDIA
26	VIBA FLUID CONTROL (Upto 300#)	INDIA
27	VIRGO ENGINEERS LTD. (Upto 16" (upto 600#))	INDIA
28	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Cast: Upto 30" (150# & 300#), 20" (600#), 16" (900#), 12" (1500#) & Forged: Upto 2" (800#))	INDIA
29	XOMOX SANMAR LTD.(FISHER XOMOX)	INDIA
30	BHDT GMBH	AUSTRIA
31	BOTELI VALVE GROUP CO. LTD. (Upto 32" (150# & 300#), 30" (600#), 24" (900#)	CHINA
32	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
33	VELAN INC.(UPTO 16", 600#)	CANADA
34	ETS TROUVAY & CAUVIN	FRANCE
35	PERRIN GMBH (SIZE UPTO 24", RATING UPTO 2500#)	GERMANY
36	CESARE BONETTI SPA (Cast: Upto 4" (150#) & Forged: Upto 1" (800#) Floating only)	ITALY
37	FRIULCO SPA (UPTO 48" (150# & 300#); 20" (upto 1500#); 12" (2500#))	ITALY
38	GTC ITALIA S.R.L	ITALY
39	MANTOVANUI SPA	ITALY
40	PETROL VALVES S.R.L	ITALY
41	PIBIVESSE SRL (UPTO 48" , 600#)	ITALY
42	METSO AUTOMATION	SINGAPORE

43	POYAM VALVES (AMPO S. COOP.) (Size upto 42” (Rating upto 2500#))	SPAIN
44	HATIMA CORPORATION	TAIWAN
	BALL VALVES (METAL SEATED)	
1	AIRA EURO AUTOMATION PVT. LTD. (Upto 6”, Rating 150# & 300#),	INDIA
2	BRIGHTECH VALVES & CONTROLS PVT. LTD. (4” x 150# for CS, AS & SS material)	INDIA
3	DELVAL FLOW CONTROLS PVT. LTD. (Upto 12” (Upto 900#))	INDIA
4	GURU INDUSTRIAL VALVES PVT. LTD. (Cast CS only: Upto 12” (Upto 300#), 4” (Upto 900#) & Forged: Upto 2” (800#))	INDIA
5	HAWA ENGINEERS LTD. (Upto 16" (150# & 300#), Upto 12" (600# & 900#))	INDIA
6	INTERVALVE POONAWALLA LTD.(UPTO 12” , 150#).	INDIA
7	JC VALVES & CONTROLS INDIA PVT. LTD. (UPTO 28” (upto 600#),12” (upto 1500#), 10” (2500#))	INDIA
8	MICON ENGINEERS (HUBLI) PVT. LTD. (Cast: Upto 6” (150# & 300#) & Forged: Upto 2” (800#)	INDIA
9	MICROFINISH VALVES PVT LTD.	INDIA
10	NEOSEAL ENGINEERING PVT. LTD (Upto 12” rating upto 600#)	
11	NSSL LIMITED (Upto 12" NB, (150# & 300#))	INDIA
12	OSWAL INDUSTRIES LTD. (UPTO 24" (150#, 300#, & 600#))	INDIA
13	VIRGO ENGINEERS LTD. (UPTO16" (UPTO 600#))	INDIA
14	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Cast: Upto 30" (150# & 300#); 20" (600#), 16” (900#), 12” (1500#) & Forged: Upto 2” (800#)	INDIA
15	VELAN INC. (SIZE UPTO 16" (Rating Upto 600#))	CANADA
16	BOTELI VALVE GROUP CO. LTD. (Upto 32” (150# & 300#), 30” (600#), 24” (900#)	CHINA
17	PERRIN GMBH (SIZE UPTO 24" (RATING UPTO 2500#))	GERMANY
18	ALFA VALVOLE SRL	ITALY
19	CESARE BONETTI SPA (UPTO 24" (150#) & 4" (UPTO 1500#) TRUNNION MOUNTED ONLY)	ITALY
20	FRIULCO SPA (UPTO 48" (150# & 300#); 20" (UPTO 1500#); 12" (2500#))	ITALY
21	GE POWER (NUOVO PIGNONE SPA)	ITALY
22	GTC ITALIA, S.R.L.	ITALY
23	PETROL VALVES S.R.L	ITALY
24	PIBIVIESSE SRL(UPTO 48”, 600#)	ITALY
25	VALVITALIA SPA	ITALY
26	RED POINT ALLOYS BV	NETHERLAND
27	METSO AUTOMATION	SINGAPORE
28	ORBIT VALVES PLC	SINGAPORE
29	POYAM VALVES, (AMPO S. COOP.) (SIZE UPTO 42" (RATING UPTO	SPAIN

	2500#))	
	BUTTERFLY VALVES	
1	A V VALVES LIMITED (UPTO 48" (150#))	INDIA
2	ADVANCE VALVES (2"-120"(UPTO150#), 2"-80"(UPTO 900#))	INDIA
3	AIRA EURO AUTOMATION PVT. LTD. (Upto 48", Rating: upto 300#)	INDIA
4	AUDCO INDIA LIMITED (L&T VALVES DIVN.)	INDIA
5	BDK PROCESS CONTROL PVT LTD. (UPTO 1600MM)	INDIA
6	CHEMTECH INDUSTRIAL VALVES PVT LTD	INDIA
7	CRAWLEY & RAY (FOUNDER & ENGINEERS) PVT. LTD. (40mm-1000mm)	INDIA
8	DELVAL FLOW CONTROLS PVT. LTD. (Upto 24" (Upto 300#))	INDIA
9	FLOCON SYSTEMS PVT. LTD. (CS upto 12", 150#)	INDIA
10	FLUIDTECH EQUIPMENT PVT. LTD. (CS upto 12" (300#))	INDIA
11	FOURESS ENGINEERING (I) LTD.	INDIA
12	HAWA ENGINEERS LTD. (2" to 48"(PN10/PN16/150#/300#))	INDIA
13	HAWA VALVES INDIA PVT. LTD. (CS UPTO 6", 150#)	INDIA
14	HI-TECH BUTTERFLY VALVES INDIA PVT. LTD (<300#,<30"(TEFLON/RUBBER) ,<72"(METAL))	INDIA
15	INSTRUMENTATION LTD. (PALAKKAD)	INDIA
16	INTERVALVE POONAWALLA LTD. (Upto 72" (150#) & Upto 16" (300#))	INDIA
17	JC VALVES & CONTROLS INDIA PVT. LTD. (Upto 20" (150#) & 10" (300#))	INDIA
18	L&T LTD (1/2" TO 24")	INDIA
19	LEADER VALVES LTD.(upto 16"- 150#)	INDIA
20	MATHER & PLATT (INDIA) LTD. A SUBSIDIARY OF WILO SE GERMAN (UPTO DN1600,PN10, Double flange type)	INDIA
21	METROPOLITAN INDUSTRIES (SIZE=2000mm)	INDIA
22	MICON ENGINEERS (HUBLI) PVT. LTD.(Upto 24" (PN10 & PN16))	INDIA
23	VENUS PUMP & ENGINEERING WORKS (upto 600NB, 150#)	INDIA
24	VIRGO ENGINEERS LTD. ((Triple offset only): 3" to 24", Upto 600# (CS/SS))	INDIA
25	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Upto 56" (Upto 150#), 24" (300#))	INDIA
26	XOMOX SANMAR LIMITED (FISHER XOMOX)	INDIA
27	TOMOE VALVE CO. LTD. (Upto 48"(150# & 300#), Upto 24"(600#, 900# & 1500#))	JAPAN
28	BHDT GMBH	AUSTRIA
29	VELAN INC. (Size upto 48"(Rating upto 600#)	CANADA
30	BOTELI VALVE GROUP CO. LTD. (Upto 36" (150# & 300#)	CHINA
31	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
32	GRISS SAPAG INDUSTRIAL VALVES	FRANCE

33	ADAMS ARMATUREN	GERMANY
34	GTC ITALIA, S.R.L.	ITALY
35	HAITIMA CORPORATION	TAIWAN
36	LEEDS VALVE LTD	U.K
37	WEIR VALVES & CONTROLS DIVISION.	U.K
38	CURTIS WRIGHT FLOW CONTROL CORPOARATION	U.S.A.
39	EMERSON PROCESS MGT	U.S.A.
40	LEAR SIEGLER MEAS. CTRLS. CORP	U.S.A.
41	SPX VALVES & CONTROLS (COPES-VULCAN LTD)	U.S.A.
42	TYCO INTERNATIONAL INC.,U.S.A.	U.S.A.
43	XOMOS (CRANE CO.)	U.S.A.
	BLOWDOWN VALVES	
1	VELAN INC.(SIZE UPTO 2”(RATING UPTO 1500#)	CANADA
2	GESTRA AG	GERMANY
3	CEASRE BONETTI SPA(UPTO 3”(UPTO 2500#))	ITALY
4	TYCO INTERNATIONAL INC, U.S.A.	U.S.A.
	SAMPLING VALVES/ NEEDLE VALVES	
1	ASSOCIATED TOOLINGS (I) PVT. LTD. (1/2” to 11/2”, Rating: 800#)	INDIA
2	CHEMTECH INDUSTRIAL VALVES PVT LTD	INDIA
3	EXCELSIOR ENGG WORKS	INDIA
4	EXPERT ENGINEERING ENTERPRISES(UPTO 12”-150# & 300#)	INDIA
5	LEADER VALVES LIMITED(SIZE<=1 ½”-800#)	INDIA
6	TECNOMATIC (INDIA) PVT LTD.	INDIA
7	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (UPTO 50MM SIZE (upto 2500#))	INDIA
	PLUG VALVES (NON LUBRICATED)	
1	A V VALVES LIMITED (UPTO 20"(150#)(CS&SS))	INDIA
2	AUDCO INDIA LTD (L&T VALVES DIVN.)	INDIA
3	AZ ARMATUREN GMBH (1/2” TO 20”(150#, 300# & 600#), Matl. CS, AS &SS)	INDIA
4	BDK PROCESS CONTROL PVT LTD.	INDIA
5	CHEMTECH INDUSTRIAL VALVES PVT LTD	INDIA
6	CHEMTROLS SAMIL (INDIA) PVT LTD (Upto 12”-150# & 300#))	INDIA
7	CRAWLEY & RAY (FOUNDERS & ENGINEERS) PVT. LTD (DN 200)	INDIA
8	FLUIDTECH EQUIPMENT PVT. LTD. (Upto 4” (300#))	INDIA
9	GURU INDUSTRIAL VALVES PVT. LTD. (Cast CS only: Upto 12” (Upto 300#), Upto 4” (Upto 900#)) & Forged: Upto 2” (800#))	INDIA
10	HAWA ENGINEERS LTD. (1/2” TO 8” (150#))	INDIA

11	JC VALVES & CONTROLS INDIA PVT. LTD. (Upto 12" (Upto 300#))	INDIA
12	LARSON & TOUBRO LTD (1/2" TO 24")	INDIA
13	LEADER VALVES LIMITED (Upto 6" (Upto 300#))	INDIA
14	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (UPTO 16"(150#), 12" (300#), 3" (600#))	INDIA
15	XOMOX SANMAR LIMITED (FISHER XOMOX)	INDIA
16	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
17	O.M.S. SALERI DI SALERI P & FIGLI S.M.C.	ITALY
18	POYAM VALVES, (AMPO S. COOP.) (UPTO 30" (UPTO 900#) FOR LIFT PLUG VALVES ONLY.)	SPAIN
	PLUG VALVES (LUBRICATED)	
1	A V VALVES LIMITED (Upto 20"-150# CS & SS)	INDIA
2	AUDCO INDIA LTD (L&T VALVES DIVISION)	INDIA
3	BDK PROCESS CONTROLS PVT. LTD	INDIA
4	ECONO VALVES PVT. LTD (<=8" (150 - 300#), <= 1 ½" (<=800#))	INDIA
5	FLUIDTECH EQUIPMENT PVT. LTD (Upto 4"-300#)	INDIA
6	GURU INDUSTRIAL VALVES PVT. LTD (Cast CS only: Upto 12"-300#, 4" Upto 900# & Forged: upto 2"-800#)	INDIA
7	HAWA ENGINEERS LTD. (1/2" TO 8" -150#)	INDIA
8	JC VALVES & CONTROLS INDIAN PVT. LTD (Upto 12"-300#)	INDIA
9	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT.LTD)Upto 8"-125#	INDIA
10	ZHEJIANG JIEHUA VALVES CO. LTD	CHINA
11	DELTA VALVES EUROPE	ITALY
12	O.M.S SALERI DI SALERI P & FIGLI S.M.C	ITALY
13	BABCOCK BORSIG ESPANA, S.A	SPAIN
	DIAPHRAGM VALVES/RUBBER LINED CHECK VALVES	
1	A V VALVES LIMITED (Upto 12"-125#)	INDIA
2	AKAY INDUSTRIES PVT LTD	INDIA
3	BDK PROCESS CONTROLS PVT. LTD. (Upto 150#, 6 mm to 350mm)	INDIA
4	CHEMTECH INDUSTRIAL VALVES PVT. LTD	INDIA
5	CRAWLEY & RAY (FOUNDERS & ENGINEERS) PVT. LTD (25NB to 200NB)	INDIA
6	HAWA ENGINEERS LTD (1/2" to 8" –PN10)	INDIA
7	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT LTD)(UPTO 14"(PN16))	INDIA
	CAST IRON VALVES	
1	A V VALVES LTD. (Upto 48" (125#))	INDIA
2	CRAWLEY & RAY (F&E) PVT. LTD. (BUTTERFLY)	INDIA
3	FLUIDTECH EQUIPMENT PVT. LTD. (Upto 24" (PN 1.0 & PN 1.6))	INDIA

4	GEETA ENGINEERING WORKS	INDIA
5	KIRLOSKAR BROTHERS LIMITED (Sluice, gate, butterfly valves PN1.0 & PN1.6)	INDIA
6	LEADER VALVES LTD. (size<=24" upto PN16 rating)	INDIA
7	S & M INDUSTRIAL VALVES LIMITED (ONLY GATE & GLOBE VALVES, 50mm-600mm, 125#)	INDIA
8	VENUS PUMPS & ENFINEERING WORKS (sluice<900mm, Diaphragm<300mm, stop<500mm)	INDIA
9	WEIR BDK VALVES (A UNIT OF WEIR INDIA PVT. LTD.) (Upto 12" (PN6))	INDIA
	PVC/CPVC VALVES	
1	ASTRAL POLYTECHNIK PVT. LTD (Size ½"-6", BUTTERFLY VALVE Upto 24")	INDIA
2	S & M INDUSTRIAL VALVES LTD. (32mm-80mm)	INDIA
	FLAT GASKETS/ RUBBER GASKET	
1	FERROLITE JOININGS (P) LTD.	INDIA
2	GASKETS (INDIA) PVT. LTD	INDIA
3	GOODRICH GASKET PVT. LTD. (UPTO 24")	INDIA
4	HINDUSTAN ASBESTOS & ALLIED PRODUCTS	INDIA
5	HINDUSTAN COMPOSITE LTD.	INDIA
6	HINDUSTAN FERREDO LTD.	INDIA
7	IGP ENGINEERS LIMITED	INDIA
8	MADRAS INDUSTRIAL PRODUCTS(UPTO 48")	INDIA
9	MECHANICAL PACKING INDUSTRIES LTD.	INDIA
10	NEOSEAL ENGINEERING PVT. LTD (Upto 80" 150#- Only rubber gasket)	INDIA
11	PACKING & JOINTINGS (P) LTD.	INDIA
12	PERFECT MARKETING (P) LTD,	INDIA
13	PRASHANT ENGG STORES	INDIA
14	REINZ TALBROS PVT. LTD.	INDIA
15	SPIRALSEAL GASKETS PVT. LTD. (CAF & Teflon)	INDIA
16	STARFLEX SEALING INDIA PVT. LTD.	INDIA
17	THE BENGAL MILL STORES SUPPLY CO. (TRADER)	INDIA
18	UNIQUE INDUSTRIAL PACKINGS PVT. LTD.	INDIA
	SPIRALLY WOUND GASKETS	
1	GASKETS (INDIA) PVT. LTD	INDIA
2	GOODRICH GASKET PVT. LTD. (upto 24")	INDIA
3	IGP ENGINEERS LIMITED(10 TO 3550MM, 150#-2500# FOR EXCH GSKT)	INDIA
4	MADRAS INDUSTRIAL PRODUCTS(UPTO 52")	INDIA
5	NEOSEAL ENGINEERING PVT. LTD (Upto 84" 150#- AND 30" UPTO600#)	INDIA

6	PACKINGS & JOINTINGS PVT. LTD	INDIA
7	PERFECT MARKETING (P) LTD,	INDIA
8	PRASHANT ENGG STORES	INDIA
9	SPIRASEAL GASKETS PVT. LTD.(SS UPTO 12” & 150#)	INDIA
10	STARFLEX SEALING INDIA PVT. LTD.	INDIA
11	THE BENGAL MILL STORES SUPPLY CO. (TRADER)	INDIA
12	UNIQUE INDUSTRIAL PACKINGS PVT.LTD. (UPTO 42"(600#) & UPTO 24" (2500#))	INDIA
13	ZHEJIANG JIEHUA VALVE CO. LTD.	CHINA
	LENS GASKETS & RING JOINT (METALLIC)	
1	GASKETS (INDIA) PVT. LTD	INDIA
2	GOODRICH GASKET PVT. LTD. (0.5” to 24”)	INDIA
3	IGP ENGINEERS LTD. (150# to 2500#)	INDIA
4	MADRAS INDUSTRIAL PRODUCT	INDIA
5	METROPOLITAN INDUSTRIES (3mm thk, 300#)	INDIA
6	NEOSEAL ENGINEERING PVT. LTD. (Upto 30”, Upto 900# AND Upto 20”- upto 2500#)	INDIA
7	PACKINGS & JOINTINGS PVT. LTD.	INDIA
8	PRASHANT ENGG STORES	INDIA
9	SPIRASEAL GASKET PVT. LTD	INDIA
10	STARFLEX SEALING INDIA PVT. LTD	INDIA
11	UNIQUE INDUSTRIAL PACKINGS PVT. LTD (Ring Joint Gasket only, Upto 16”-1500#)	INDIA
12	BHDT GMBH	AUSTRIA
13	MANTOVANI SPA	ITALY
	EXPANSION JOINTS & BELLOWS	
1	CORI ENGINEERS PVT. LTD. (For Rubber)	INDIA
2	D.WREN & CO. (For Rubber & Fabric)	INDIA
3	FLEXATHERM EXPANLLOW PVT. LTD. (Circular: Upto 240”, Rectangular No bar for size, (Upto 600#))	INDIA
4	FLEXICAN BELLOWS & HOSES PVT. LTD	INDIA
5	FLUIDYNE ENGINEERS (I) PVT. LTD(METALLIC BELLOWS UPTO 800mm DIA)	INDIA
6	KELD ELLENTOFT INDIA PVT. LTD (For Fabric)	INDIA
7	LONESTAR INDUSTRIES	INDIA
8	MB METALLIC BELLOWS PVT. LTD	INDIA
9	PRASHANT ENGG. STORES	INDIA
10	STANDARD PRECISION BELLOWS	INDIA

11	TUBOFLEX	GERMANY
12	FLEXIDER S.P.A.	ITALY
	STRAINERS (PERMANENT INCLUDING Y-TYPE)	
1	CHEMTECH INDUSTRIAL VALVES PVT. LTD	INDIA
2	FLAIR STRAINERS & FILTERS (SIZE UPTO 42" (RATING UPTO 1500#))	INDIA
3	GRAND PRIX ENGINEERING PVT. LTD. (UPTO 60" PIPELINE, UPTO ANSI 1500#)	INDIA
4	GREAVES LIMITED	INDIA
5	GUJARAT OTOFILT	INDIA
6	HAWA ENGINEERS LTD. (1/2” to 24”(150# / 300# / PN10 / PN40))	INDIA
7	KWIKFLO FILTERS PVT. LTD.	INDIA
8	LEADER VALVES LTD. (upto 300# & upto 12” size)	INDIA
9	MOD FABRICATORS	INDIA
10	MULTITEX FILTERATION ENGINEERS LTD	INDIA
11	ZOLOTO INDUSTRIES (15MM TO 100MM)	INDIA
12	BOTELI VALVE GROUP CO. LTD. (Y - TYPE ONLY: 14" (150#) & 3" (300# & 600#))	CHINA
	STEAM TRAPS	
1	GREAVES LTD.	INDIA
2	MOD FABRICATORS (for Drip Rings)	INDIA
3	PENNANT ENGINEERING PVT. LTD.	INDIA
4	VIRGO ENGINEERS LTD. (1/2” to 4” (upto 600#) (CS/SS))	INDIA
5	YARWAY CORPORATION	INDIA
6	ZOLOTO INDUSTRIES (15 mm to 25 mm)	INDIA
7	GESTRA AG	GERMANY
8	ARMSTRONG INTERNATIONAL INC.	U.S.A
9	OGONTZ CORPORATION	U.S.A
10	TYCO INTERNATIONAL INC.,U.S.A.	U.S.A
	SPRING SUPPORTS	
1	PIPE SUPPORTS CO. (Upto 14MT)	
2	MYRICS PIPING SYSTEM PVT.LTD.	INDIA
3	PIPE SUPPORTS INDIA PVT. LTD.	INDIA
4	PIPING & ENERGY PRODUCTS (P) LTD.	INDIA
5	SARATHI ENGG. ENTERPRISES PVT. LTD.	INDIA
6	SPRING SUPPORTS MFG. CO.	INDIA
7	FLEXIDER S.P.A.	ITALY
	FLAME ARRESTORS	
1	AIROIL FLAREGAS (INDIA) PVT. LIMITED	INDIA

2	EMFA INDUSTRIES	INDIA
3	M.H. VALVES PVT. LTD (1/2"-1.5" :800#, 2"-6" :600#)	INDIA
4	NIRMAL INDUSTRIAL CONTROLS PVT. LTD (1/2" TO 8", RATING:150#)	INDIA
5	PETROL SERVICE INDIA PVT. LTD.	INDIA
6	L & J TECHNOLOGIES	U.S.A.
	SPRAY NOZZLE ASSEMBLY	
1	CHEMTROLS SAMIL (INDIA) PVT. LTD.	INDIA
	FASTENERS	
1	AEP COMPANY	INDIA
2	CAPITAL INDUSTRIES	INDIA
3	CONSOLE ENGG. & FASTNERS INDUSTRIES	INDIA
4	EBY FASTNERS	INDIA
5	FIT TIGHT NUTS & BOLTS LTD.	INDIA
6	FIX FIT FASTENERS MFG. PVT. LTD.	INDIA
7	HEM INDUSTRIES (Upto 4")	
8	INDUSTRIAL ENGINEERING CORPORATION (SIZE UPTO 4" (M100))	INDIA
9	MEGA ENGINEERING PRIVATE LIMITED (½" TO 3" MATERIAL: CS/AS/SS)	INDIA
10	METRO MECHANICAL PVT.LTD.	INDIA
11	NAGBHUSHANAM INDUSTRIES	INDIA
12	NIREKA ENGG. CO. PVT. LTD.	INDIA
13	PACIFIC FORGING & FASTENERS PVT. LTD. (M 10 TO M125)	INDIA
14	PERFECT MARKETING (P) LTD,	INDIA
15	PIONEER NUTS & BOLTS PVT. LTD. (1/4" TO 4" DIA)	INDIA
16	PRECISION AUTO ENGINEERS	INDIA
17	PRECISION ENGINEERING INDUSTRIES	INDIA
18	PTD FASTNERS PVT. LTD.	INDIA
19	SANGHVI METALS (TRADER)	INDIA
20	SUNDARAM FASTENERS LIMITED	INDIA
21	UDHERA FASTENERS	INDIA
	FIRE FIGHTING SYSTEM	
1	AGNICE FIRE PROTECTION LTD.	INDIA
2	BHARTIYA CACCIALANZA FIRE SYSTEMS LTD	INDIA
3	BLUE STAR LTD.	INDIA
4	DE'S TECHNICO	INDIA
5	DE'S TECHNICO PVT. LTD.	INDIA
6	FUTECH CONSULTANTS PVT. LTD.	INDIA
7	GENERAL MECHANICAL WORKS	INDIA

8	HD FIRE PROTECTION COMPANY	INDIA
9	LAL ENTERPRISES	INDIA
10	MATHER & PLATT (INDIA) LTD. (A Subsidiary of WILO SE German)	INDIA
11	MX SYSTEMS INTERNATIONAL PVT. LTD.	INDIA
12	NEWFIRE ENGINEERS SERVICES	INDIA
13	PRAGATI ENGG. (PVT.) LTD.	INDIA
14	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
15	RADIANT FIRE PROTECTION ENGINEERS	INDIA
16	STEELAGE INDUSTRIES LTD.	INDIA
17	TECHNOFAB ENGG.	INDIA
18	TRI-PARULEX FIRE PROTECTION SYSTEMS	INDIA
19	UNITECH MACHINES LTD	INDIA
20	VIJAY FIRE PROTECTION SYSTEM LTD.	INDIA
	HOSE PIPE (METALLIC) & CAM LOCK COUPLING	
1	AEROFLEX INDUSTRIES LIMITED (Size 6mm to 250mm dia. (SS Corrg. Flex. Hose with Braid, Braid & Assembly)	INDIA
2	CHHATARIA RUBBER CHEMICALS INDUSTRIES	INDIA
3	D. WREN & CO.	INDIA
4	FLEXATHERM EXPANLLOW PVT. LTD. (1/2” to 6”)	INDIA
5	GAYATRI INDUSTRIES	INDIA
6	GAYATRI INDUSTRIAL CORPORATION (UPTO 6” ID)	INDIA
7	HELIFEX HYDRAULICS & ENGG CO. LTD.	INDIA
8	SENIOR INDIA PVT. LTD.	INDIA
	HOSE PIPE (NON-METALLIC) & CAM LOCK COUPLING	
1	CHHATARIA RUBBER CHEMICALS INDUSTRIES	INDIA
2	D. WREN & CO.	INDIA
3	GAYATRI INDUSTRIES	INDIA
4	GAYATRI INDUSTRIAL CORPORATION (UPTO 8” ID)	INDIA
5	HELIFEX HYDRAULICS & ENGG CO. LTD.	INDIA
6	PADMINI INDUSTRIES LIMITED	INDIA
7	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
8	SENIOR INDIA PVT. LTD.	INDIA
	FIRE WATER PUMPS	
1	BEST & CROMPTON ENGG. CO.	INDIA
2	GREAVES COTTON & CO. LTD.	INDIA
3	JAYANT ENGINEERING & MARKETING (P) LTD.	INDIA
4	KIRLOSKAR BROTHERS LIMITED	INDIA
5	MATHER & PLATT INDIA LTD. (A Subsidiary of WILO SE German)	INDIA

	PORTABLE FIRE EXTINGUISHERS & FIRE FIGHTING CHEMICALS	
1	CEASEFIRE INDUSTRIES LTD	INDIA
2	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
3	UNITECH MACHINES LTD.	INDIA
4	ZENITH FIRE SEVICES INDIA PVT. LTD	INDIA
	SMOKE / GAS DETECTOR	
1	CEASEFIRE INDUSTRIES LTD	INDIA
2	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
3	UNITECH MACHINES LTD.	INDIA
4	ZENITH FIRE SEVICES INDIA PVT. LTD	INDIA
	FIRE FIGHTING EQUIPMENTS	
1	DE'S TECHNICO PVT. LTD. (Deluge Valve and Sprinklers only.)	INDIA
2	HD FIRE PROTECT PVT. LTD.	INDIA
3	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
4	VENUS PUMP & ENGG. WORKS	INDIA
5	WINCO VALVES PVT. LTD. (Equipments for Fire Hydrant System)	INDIA
6	ZENITH FIRE SEVICES INDIA PVT. LTD	INDIA
	MARINE LOADING ARM	
1	LLOYDS STEELS INDUSTRIES LIMITED (8” TO 20”)	INDIA
	TRUCK/WAGON LOADING ARM	
1	LLOYDS STEELS INDUSTRIES LIMITED (2” TO 4”)	INDIA
2	WOODFIELD SYSTEMS INTERNATIONAL PVT LTD (upto SIZE: CORE-4”/ JACKET-6”)	INDIA

NOTE(Piping vendor list):

1. Make of the items not indicated and any other make for the specified item shall be subject to owner’s / consultant’s approval.

2. Any item for which vendor list is not enclosed; bidder has to furnish a list of their proposed vendors along with their references for supply of similar type of items with their proven track record. Vendor for these items shall be finalized during execution/detail engineering stage.

3. Any addition to vendor list of listed item shall be reviewed and approved by Owner/PMC, subject to submission of proper justification/reason and back-up credentials with proven & reliable record of performance for similar items on case to case basis.

4. In case of trader/stockist, make of items shall be as per approved vendor list.

1.0	**VENDOR LIST – FIRE FIGHTING SYSTEM**	
1	AGNICE FIRE PROTECTION LTD.	INDIA
2	BHARTIYA CACCIALANZA FIRE SYSTEMS LTD	INDIA

3	BLUE STAR LTD.	INDIA
4	DE'S TECHNICO	INDIA
5	DE'S TECHNICO PVT. LTD.	INDIA
6	FUTECH CONSULTANTS PVT. LTD.	INDIA
7	GENERAL MECHANICAL WORKS	INDIA
8	HD FIRE PROTECTION COMPANY	INDIA
9	LAL ENTERPRISES	INDIA
10	MATHER & PLATT (INDIA) LTD. (A Subsidiary of WILO SE German)	INDIA
11	MX SYSTEMS INTERNATIONAL PVT. LTD.	INDIA
12	NEWFIRE ENGINEERS SERVICES	INDIA
13	PRAGATI ENGG. (PVT.) LTD.	INDIA
14	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
15	RADIANT FIRE PROTECTION ENGINEERS	INDIA
16	STEELAGE INDUSTRIES LTD.	INDIA
17	TECHNOFAB ENGG.	INDIA
18	TRI-PARULEX FIRE PROTECTION SYSTEMS	INDIA
19	UNITECH MACHINES LTD	INDIA
20	VIJAY FIRE PROTECTION SYSTEM LTD.	INDIA
2.0	**HOSE PIPE (METALLIC) & CAM LOCK COUPLING**	
1	AEROFLEX INDUSTRIES LIMITED (Size 6mm to 250mm dia. (SS Corrg. Flex. Hose with Braid, Braid & Assembly)	INDIA
2	CHHATARIA RUBBER CHEMICALS INDUSTRIES	INDIA
3	D. WREN & CO.	INDIA
4	FLEXATHERM EXPANLLOW PVT. LTD. (1/2” to 6”)	INDIA
5	GAYATRI INDUSTRIES	INDIA
6	GAYATRI INDUSTRIAL CORPORATION (UPTO 6” ID)	INDIA
7	HELIFEX HYDRAULICS & ENGG CO. LTD.	INDIA
8	NEW AGE FIRE FIGHTING CO.LTD.	INDIA
9	SENIOR INDIA PVT. LTD.	INDIA
3.0	**HOSE PIPE (NON-METALLIC) & CAM LOCK COUPLING**	
1	CHHATARIA RUBBER CHEMICALS INDUSTRIES	INDIA
2	D. WREN & CO.	INDIA
3	GAYATRI INDUSTRIES	INDIA
4	GAYATRI INDUSTRIAL CORPORATION (UPTO 8” ID)	INDIA
5	HELIFEX HYDRAULICS & ENGG CO. LTD.	INDIA
6	PADMINI INDUSTRIES LIMITED	INDIA
7	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
8	SENIOR INDIA PVT. LTD.	INDIA
4.0	**HYDRANT VALVE /LANDING VALVE**	

1	MINIMAX	INDIA
2	NEW AGE FIRE FIGHTING CO.LTD.	INDIA
3	SHAH BHOGILAL JETHALAL & BROTHERS	INDIA
4	SAFEX	INDIA
5.0	**WATER CUM FOAM MONITOR**	
1	HD FIRE	INDIA
2	FIRETECH EQUIPMENTS & SYSTEMS PVT. LTD.	INDIA
3	NEW AGE FIRE FIGHTING CO.LTD.	INDIA
4	SHAH BHOGILAL JETHALAL & BROTHERS	INDIA
6.0	**HOSE REEL**	
1	MINIMAX	INDIA
2	NEW AGE FIRE FIGHTING CO.LTD.	INDIA
3	SHAH BHOGILAL JETHALAL & BROTHERS	INDIA
7.0	**UNIVERSAL TRIPPLE PURPOSE NOZZLE / AIR RELEASE VALVE / HOSE BOX**	
1	MINIMAX	INDIA
2	NEW AGE FIRE FIGHTING CO.LTD.	INDIA
3	SHAH BHOGILAL JETHALAL & BROTHERS	INDIA
8.0	**SPRAY NOZZLE / WATER CURTAIN NOZZLE/QBD**	
1	HD FIRE	INDIA
2	NEW AGE	INDIA
3	SHAH BHOGILAL JETHALAL & BROTHERS	INDIA
4	TYCO SAFETY PRODUCTS	INDIA
5	VIKING	INDIA
9.0	**PORTABLE FIRE EXTINGUISHERS & FIRE FIGHTING CHEMICALS**	
1	CEASEFIRE INDUSTRIES LTD.	INDIA
2	KANADIA FYR FYTER (MAKE- KANEX)	INDIA
3	MINIMAX	INDIA
4	PYROTEK INDUSTRIES (INDJA) PVT. LTD.	INDIA
5	SAFEX FIRE	INDIA
6	SUPREMEX EQUIPMENTS	INDIA
7	UNITECH MACHINES LTD.	INDIA
8	ZENITH FIRE SEVICES INDIA PVT. LTD	INDIA
10.0	**DELUGE VALVE**	
1	DARLING MUESCO (I) PVT.LTD	INDIA
2	HD FIRE	INDIA
3	TYCO SAFETY PRODUCTS	INDIA
4	VIKING	INDIA
11.0	**CLEAN AGENT SYSTEM**	
1	HONEYWELL	INDIA

2	GUNNEBO INDIA PVT. LTD	INDIA
3	MX SYSTEMS INTERNATIONAL PVT. LTD.	INDIA
4	NOHMI BOSAI INDIA PVT. LTD.	INDIA
5	SEVO SYSTEMS	INDIA
6	SIEMENS	INDIA
7	ROTAREX ENGG INDIA PVT. LTD.	INDIA
8	UTC FIRE & SECURITY INDIA LTD.	INDIA
12.0	**PERSONNEL PROTECTION EQUIPMENT(SAFETY EQUIPMENTS)**	
1	VIJAY SABRE SAFETY PVT. LTD.	INDIA
2	SURE SAFETY INDIA LTD.	INDIA
3	DRAGER	INDIA
13.0	**SAFETY SHOWER**	
1	UNICARE	INDIA
2	SURE SAFETY INDIA LTD.	INDIA
14.0	**FIRE FIGHTING EQUIPMENTS**	
1	DE'S TECHNICO PVT. LTD.	INDIA
2	HD FIRE PROTECT PVT. LTD.	INDIA
3	PYROTEK INDUSTRIES (INDIA) PVT. LTD.	INDIA
4	VENUS PUMP & ENGG. WORKS	INDIA
5	WINCO VALVES PVT. LTD.	INDIA
6	ZENITH FIRE SEVICES INDIA PVT. LTD	INDIA
Note:	Fire fighting equipments shall include hydrant post, hydrant valve, deluge valve, monitor, foam tank/can, safety equipment, personnel protection equipment, foam chamber, deflector, fire extinguisher, spray & sprinkler	

INSTRUMENTATION:

Sl.No	Vendor's Name	Country
Gas Analysers (IR, Thermal Conductivity, Paramagnetic)		
1.	ABB Ltd (BU – Analytical &Adv)	India
2.	Chemtrols Industries Limited (Maihak Make)	India
3.	Emerson Process Management (I) Pvt. Ltd	India
4.	Endress+ Hauser (India) pvt. Ltd.	India
5	Yokagawa	India
6	Ametek ,INC	U.S.A
7	Emerson Process Mgt Singapore Ltd.	Singapore
8	MaihakAktiengesellschraft	Germany
9	M.S.A International	U.S.A
10	Siemens AG	Germany
Sodium Analyser		
1.	ABB	
2.	HACH	
3.	THERMOFISHER	
4.	WALTRON	

5.	AWA	
Chlorine Analyser		
1.	ABB	INDIA
2.	HACH	FRANCE
3.	KROHNE	U.K
4.	E&H	
5	WALTRON	
6	THERMOFISHER	
Turbidity Analyser		
1.	HACH	
2.	YOKOGAWA	JAPAN
SDI Analyser		
1.	RODI	USA
pH, conductivity & ORP Analyser		
1.	ABB India Limited	India
2.	BELA INSTRUMENTS (For Knick, GmbH make), Mumbai(For ConductivityAnalyser)	India
3	Chemtrols Industries Limited	India
4	Emerson Process Management (I) Pvt. Ltd	India
5	Endress+ Hauser (India) pvt. Ltd. (Liquid Analyser)	India
6	Forbes polymetron Pvt. Ltd.	India
7	POTENCE CONTROLS (for GLI International make), Mumbai.(For ConductivityAnalyser)	India
8	Yokogawa India Ltd.	India
9	Emerson Process Mgt Singapore Ltd.	Singapore
10	Foxbro Far East PTE Ltd.	Singapore
11	Hach Company	U.S.A
12	Yokogawa Electric Corporation	Japan
13	Zellweger SA	France
Trace Analyser/ Ion Selective		
1.	ABB India Limited	India
2	Chemtrols Industries Limited	India
3	Forbes PolymetronPvt. Ltd	India
4	Bran &Luebbe Ltd	U.K
5	Hach company	U.S.A
6	Zellweger SA	France
PC / SERVERS		
1.	DELL	INDIA
Fire alarm System		
1.	HONEYWELL	INDIA
2	SIEMENS	INDIA
SO_X/ NO_X Analyser		
1.	ABB India Ltd.	India
2.	Chemtrols Industries Limited	India
3.	Emerson Process Management (I) Pvt. Ltd	India
4.	Yokogawa India Ltd.	India
5.	Emerson Process Management Singapore Ltd	Singapore
6.	Horiba Ltd.	Japan
7.	Lear Siegler Meas. Controls Corp.	U.S.A
8.	M.S.A International	U.S.A
9.	Sick AG	Germany
10.	Siemens AG	Germany

11.	Thermo Environment Instruments Inc	U.S.A
12	Yokogawa Electric Corporation	Japan
Mass Spectrometer		
1.	ABB India Ltd.	India
2.	Orbital Science Corporation	U.S.A
3.	VG Gas Analysis Systems	U.K.
Gas Chromatograph		
1.	ABB India Limited	India
2.	Emerson Process Management (I) Pvt. Ltd.	India
3	Applied Automation Inc	Singapore
4	ABB Process Analytics	U.K
5.	Foxbaro Far East Pte Ltd	Singapore
6.	Siemens	Germany
7	Yokogawa India Ltd.	India
Flue Gas Analyser (ZrO_2 type)		
1.	ABB Ltd (BU – Analytical &Adv)	India
2.	Chemtrol (For MAIHAK Only)	India
3.	Emerson Process Management (I) Pvt. Ltd	India
4.	Endress+Hauser	India
5	Yokogawa India Ltd.	India
6	Ametek Inc	U.S.A
7.	GE Panametrics	Ireland
H_2S/ Total Sulphur Analysers		
1.	ABB India Ltd.	India
2.	Barton Instrument Systems Limited	U.K
System House Analysers		
1.	ABB Ltd (BU – Analytical &Adv)	India
2.	Adage Automation Pvt. Ltd.	India
3.	Analyser Instrument Co.Pvt. Ltd.	India
4.	Chemtrols Industries Limited	India
5.	Emerson Process Management (I) Pvt. Ltd	India
6.	Yokogawa India Ltd.	India
7.	Intech	Italy
Density Analysers		
1.	Chemtrols Industries Limited	India
2.	Emerson Process Management (I) Pvt. Ltd (coriolis type)	India
3.	Bopp & Reuther MesstechnikGmbh (coriolis type)	Germany
4	Solartron Mobrey	U.K
Moisture Analysers		
1.	Chemtrols Industries Limited	India
2.	AmetekInc	U.S.A
3	GE Panametrics	Italy
Gas & Fire Detection System		
1.	Andrew Yule & Company Ltd. (Fire)	India
2.	Chemtrols Industries Limited	India
3.	Honeywell Automation India Limited (Gas)	India
4.	J B Boda And Brothers Pvt. Ltd. (Gas Make-International Sensor Technology)	India
5.	Pollution Protection System Mumbai Pvt Ltd (Gas)	India
6.	General Monitors (Gas)	U.K
7	Teledyne Fluid Systems (Gas)	Thailand

Air Quality Monitoring System		
1	Chemtrol Industries Ltd.	India
Sample Handling System		
1.	Analyser Instrument Co.Pvt. Ltd.	India
Flow Element: Orifice/ Venturi/ Flow Nozzle		
1.	Baliga Lighting (only Orifice)	India
2.	Chemtrol Industries Ltd.	India
3.	Delta Engineering, Pune	India
4.	Eureka Industrial Equipments Pvt. Ltd.	India
5	FORBES MARSHALL	India
6	Flowtech Instruments (Orifice/Venturi)	India
7	General Instruments Consortium	India
8.	Instrumentation Ltd.	India
9.	Micro Precision Products Private Ltd.	India
10.	Micro India Flow Elements Pvt. Ltd.	India
11	Minco(India) Flow Instruments Pvt. Ltd.	India
12	Unicontrols Instrument Pvt. Ltd.	India
13	Bopp & Reuther Messtechnik GMBH	Geramny
14	Daniel Measurement & Control	USA
15	ISA Controls Limited	U.K
16	Technomatic SPA	Italy
Pitot Tube/ Annubar		
1.	ABB India Limited	India
2.	Control Engineers	India
3.	Emerson Process Management (I) Pvt. Ltd.	India
4	Micro Precision Products Private Ltd.	India
5.	Unicontrols Instruments Pvt. Ltd.	India
6.	Daniel Measurement & Control	U.S.A
7.	ISA Controls Limited	U.K
8	Technomatic Spa	Italy
Rotameters		
1.	ABB india Ltd.	India
2.	Chemtrols Industries Ltd.	India
3.	Delta Control	India
4.	Eureka Industrial Equipments Pvt. Ltd.	India
5	Flowtech Instruments services	India
6.	Instrumentation Engineers Pvt. Ltd.	India
7.	Krohne Marshall Pvt. Ltd.	India
8.	Placka Instruments & Controls Pvt. Ltd. (Purge Rotameter Only)	India
9.	Rota Instrumentation	India
10	Yokogawa	India
11	Rota Yokogawa Gmbh& Co. Kg	Germany
12	Tokyo Keiso Co.Ltd.	Japan
13	Azbil Corporation	Japan
14	Emerson Process Mgt	U.S.A
15	Krohne	Germany
Mass Flow Meter (Coriolis Type)		
1.	ABB India Limited	India
2	Chemtrol Industries Ltd	India
3.	Emerson Process Management (I) Pvt. Ltd.	India
5	Endress + Hauser	India
6.	SIEMENS Ltd.	India

7.	Yokogawa	India
8.	Bopp & Reuther Messtechik GMBH	Germany
7	Krohne	Germany
8	Schlumberger resource management Ltd.	U.S.A
Turbine Flowmeter		
1.	ABB India Ltd.	India
2.	Chemtrol Industries Ltd	India
3.	Krohne	India
4.	Yokogawa	India
5.	Azbil Corporation	Japan
6.	Bopp & Reuther Messtechnik Gmbh	Germany
7.	Barton Instrument System Ltd.	U.K.
8.	Emerson Process Mgt	U.K.
9.	Emerson Process Mgt.	U.S.A
10.	Instromet International N.V.	Holland
11.	Itochu Corporation	Japan
12.	Oval Asea Pacific Pte Ltd.	Singapore
13.	Rockwell International Corporation	U.S.A
Vortex meter		
1.	ABB India Ltd.	India
2.	Emerson Process Management (I) Pvt. Ltd.	India
3.	Krohne Marshall Pvt. Ltd.	India
4	Siemens Ltd.	India
5.	Yokogawa Limited	India
6	Bopp & Reuther MesstechnikGmbh	Germany
7.	Endress + Hauser	Germany
8..	Itochu Corporation	Japan
9.	Krohne	Germany
10.	Schlumberger resource management Ltd.	U.S.A
PD Meter		
1.	Chemtrols Industries Ltd.	India
2.	Rock Flow Meters (i) Pvt. Ltd.	India
3.	Bopp & Reuther MesstechnikGmbh	Germany
4.	Emerson Process Managment	U.S.A
5.	Oval Asea Pacific Pte Ltd.	Singapore
6.	Schlumberger resource management Ltd.	U.S.A
Magnetic Flow meter		
1.	ABB India Ltd.	India
2.	Chemtrol Industries Ltd	India
3.	Emerson Process Management (I) Pvt. Ltd.	India
4.	Endress + Hauser (India) Pvt. Ltd.	India
5.	Krohne Marshall Pvt. Ltd.	India
6	Siemens Ltd.	India
7	SBEM Pvt. Ltd.	India
8	Yokogawa	India
9.	Azbil Corporation	Japan
10.	Bopp & Reuther MesstechnikGmbh	Germany
11	Krohne	Germany
Insertion Type Flow Meter		
1	Emerson Process Management (I) Pvt. Ltd.	India
2	Siemens Ltd.	India
Ultrasonic Flow Meter		

1	Chemtrol Industries Ltd	India
2.	Endress + Hauser (India) Pvt. Ltd.	India
3.	Emerson Process Management	India
4	Siemens Ltd.	India
5	Yokogawa	india
Orifice Meter		
1	Chemtrol Industries Ltd	India
Metering Skid		
1.	Chemtrol Industries Ltd.	India
Pressure Gauges		
1.	Ashcroft India(P) Ltd. (standard normal type)	India
2.	A.N. Instruments Pvt. Ltd.	India
3.	Baumer Technologies India Pvt . Ltd	India
4.	Forbes Marshall	India
5.	General Instruments Consortium,	India
6.	H.Guru Industries	India
7.	Peejee Engg. Works	India
8.	Precision Industries Ltd. (standard normal type)	India
9.	Premium Instrument & Controls Ltd.	India
10.	Manometer (India) Pvt. Ltd.	India
11.	Walchand Nagar Industries Ltd.	India
12.	Wika	India
13.	Budenberg Gauge Co. Ltd	U.K
14.	Dresser Europe S.A	Germany
15.	Nagano keiki Seisakusho	Japan
16.	Rueger Sa	Switzerland
17	Spriano Spa	Italy
18	WikaAlexenderWiegardGmbh& Co.	Germany
Local D/P Indicators		
1.	Precision Mass Products Pvt. Ltd	India
2.	Switzer Instrument Co.	India
3	Wika	India
4	Barton Instrument Systems Limited	U.K
5	Delta Controls Ltd.	U.K
Pressure & D/P Transmitters		
1.	ABB India Ltd.	India
2.	Emerson Process Management (I) Pvt. Ltd.	India
3.	Endress + Hauser (India) Pvt.Ltd.	India
4.	Honeywell Automation India Limited	India
5	Siemens Ltd.	India
6.	Yokogawa Limited	India
7.	Azbil Corporation	Japan
8.	Emerson Process Mgt Singapore Ltd	Singapore
9.	Honeywell Inc.	U.S.A
10	Moore Products Company	U.S.A
11	Siemens Ag, Germany	Germany
12	Smar Singapore Pte. Ltd.	Singapore
13	VEGA Grieshaber KG	Germany
14	Yokogawa Electric Corporation	Japan
Pressure & D/P Switches Including Vol. Seal		
1.	Endress + Hauser(India) Pvt. Ltd.	India
2.	Indfos Industries Ltd. (Except Vol.Seal)	India

3.	Kaustubha Udyog (Except Vol.Seal)	India
4.	Precision Mass Products Pvt. Ltd	India
5.	Switzer Instrument Co. (Except Vol.Seal)	India
6.	Azbil Corporation	Japan
7	Delta Controls Ltd.	U.K
8	Nagano Keiki Seisakusho	Japan
9	SOR Inc.	U.S.A
10	United Electric Controls Co.	U.S.A
Transparent/ Reflex / Bicolor Mag.Level Gauges		
1.	ABB India Ltd.	India
2.	Bliss Anand Private Ltd.	India
3.	Chemtrols Samil(India) Pvt Ltd.	India
4.	Flowtech Instruments services	India
5.	LEVCON INSTRUMENTS PVT. LTD.	INDIA
6	Nisan Scientific Process Equipments Pvt. Ltd	India
7.	Pune Techtrol Pvt. Ltd. (=<300#)	India
8	Technomatic (India) Pvt. Ltd.	India
9.	V-Automat Instruments Pvt. Ltd. (upto 300#)	India
10	Clark-Reliance Corp.	U.S.A
11	CesareBonetti	Italy
12	Jerugson Gauge & Valve Co.	U.S.A
13	Nihon Klingage Co. Ltd.	Japan
14	Richard Klinger Ag	Austria
15	Technomatic Spa	Italy
Level Switches (Float & Displacer Type)		
1.	ABB India Ltd.	India
2.	Bliss Anand Private Ltd.	India
3.	Chemtrols Samil(India) Pvt Ltd.	India
4.	Pune Techtrol Pvt. Ltd.	India
5.	SBEM Pvt. Ltd.	India
6.	Siemens Ltd.	India
7.	V.Automat & Instruments (P) Ltd.	India
8.	ISA Controls Limited	U.K.
9	KDG. MOBREY Ltd.	U.K.
10	Magnetrol International N.V	Belgium
11	SOR Inc.	U.S.A
12.	Vega Grieshaber KG	Germany
Displacer Type Level Transmitters		
1.	Chemtrols Industries Limited (Eckdart Make Electronics)	India
2.	Dresser Valve India Pvt Ltd (Rating <= 600#)	India
3.	Dresser Masoneilan	France
4.	Foxboro EckardtGmbh	Germany
5.	Magnetrol International N.V. (Lvdt)	Belgium
6.	Parcol Spa (Pneumatic Transmission Only)	Italy
Tank Level Instruments		
1.	ABB India Limited	India
2.	Emerson Process Management (i) Pvt. Ltd.	India
3.	Pune Techtrol Pvt. Ltd.	India
4.	Siemens Ltd. (Radar level Transmitter, guided wave Radar)	India
5.	SBEM Pvt. Ltd.	India
6	EnrafSingaporePte. Ltd.	Singapore
7.	Endress + Hauser Gmbh& Co., (Non-Contact & Servo)	Germany

8.	Krohne (Non-Contact Type)	Germany
9.	L& J Technologies	U.S.A
10.	Toyo Keiso Co. Ltd.	Japan
Ultrasonic Level Transmitter		
1.	Forbes Marshell	India
2.	Siemens Ltd.	India
3	Vega Grieshaber KG	Germany
Tank Farm Management		
1.	Endress + Hauser (India) Pvt. Ltd. (Servo,Radar)	India
Guided wave Rdar		
1.	Endress + Hauser (India) Pvt. Ltd	India
2.	Forbes Marshell	India
3	Magnetrol	India
4	Vega Grieshaber KG	Germany
Temperature Elements (Thermocouple, Rtd)		
1.	Altop Industries Ltd.	India
2.	ABB India Ltd.	India
3.	Detriv Instrumentation & Electronics Ltd.	India
4.	Electrical & Electronics Ltd.	India
5.	Eleind Engineering Pvt. Ltd.	India
6.	Endress + Hauser (India) Pvt. Ltd.	India
7..	Exotherms Instruments	India
8.	General Instruments Consortium	India
9.	Goa Instruments Industries Ltd.	India
10.	Industrial Instrumentation	India
11.	Precision Mass Products Pvt. Ltd.	India
12.	Pyro Electric Instruments Goa Pvt. Ltd.	India
13.	Tempsens Instruments (I) Pvt. Ltd.	India
14	Thermal Instruments India Pvt. Ltd.	India
15	Unicontrols Instruments Pvt. Ltd.	India
16	Azbil Corporation	Japan
17	Okazaki Manufacturing Co.	Japan
18	Sensycon	Germany
19	Thermo Electric Co.Ltd.	Holland
20	W.C.Heraeus GMBH	Germany
Bimetallic Thermometer		
1.	A N Instruments Pvt. Ltd.	India
2.	Ashcroft India(P) Ltd.	India
3.	Baumer Technologies India Pvt. Ltd.	India
4.	General Instruments Consortium	India
5.	Goa Instruments Industries Ltd	India
6.	H.Guru Industries	India
7	Krohne Marshall Pvt. Ltd.	India
8	Precision Mass Products Pvt. Ltd.	India
9	Nagano Keiki Seisakusho	Japan
10	Rueger SA	Swizerland
11	Technomatic SPA	Italy
12	Trend Instrument Inc.	U.S.A
Vibration Fork type Level Switches		
1.	ABB India Ltd.	India
2.	Protocontrol Instruments (I) Pvt. Ltd. (non-critical)	India
3.	Endress + Hauser	Germany

4.	SOR Inc.	U.S.A
Dial Thermometer (Hg In Steel/Glass)		
1.	A N Instruments Pvt. Ltd.	India
2.	Ashcroft India(P) Ltd.	India
3.	Baumer Technologies India Pvt. Ltd.	India
4.	General Instruments Consortium,	India
5.	Goa Instruments Industries Ltd	India
6.	H.Guru Industries	India
7.	Precision Mass Products Pvt. Ltd	India
8.	Pejee Engg Works	India
9.	Walchand Nagar Industries Ltd.	India
Radiation Pyrometer		
1.	Tempsens Instruments Pvt. Ltd.	India
2.	C.C.R Technico	Italy
3.	Chino Corpn.	Japan
4.	Land Infrared	U.K.
5.	Siemens AG	Germany
6.	Wahal Instruments	U.S.A
Temperature Transmitters		
1.	ABB India Limited	India
2.	Emerson Process	India
3.	Endress+ Hauser (India) Pvt. Ltd.	India
4.	Siemens Ltd.	India
5	Yokogawa	India
Gate/Plug Valves		
1.	Audco India Limited(L&T Valves Divn.)	India
2.	BHEL(Valves Division)	India
3.	Chemtrols Engineering Limited (Plug Valves)	India
4.	Flowserve India Control Pvt. Ltd.(Plug Valve upto 12”300# upto 6” 600#)	India
5.	Ksb Pumps Limited (Valves Divn)	India
6	NU Tech Controls (MOV Gate :1/2” to 8” 2500#, 10” to 14”,300#)	India
7.	Samsons Contols Pvt. Ltd. (Upto 34”, 300#)	India
8.	Valve Tech Industries (Mov -8” upto 2500#)	India
9.	Velan Inc.	Canada
10	Weir Bdk Vlaves	India
11	Bel Valves	Japan
12	CesareBonetti	Italy
13	Fasani S.P.A	Italy
14	MalbranqueS.A.	France
15	Matsura H. P Machine works co. Ltd.	Japan
16	Petrol Valves S.R.L	Italy
Globe / Angle Valves		
1.	AST S.P.A (Upto 8”900#)	India
2	Chemtrol Industries Ltd.	India
3	Circor Flow Technologies India Pvt. Ltd.	India
4	Dresser Valve India Pvt. Ltd.(Rating =<600#,size ¾” to 6”)	India
	Emerson Process Management India Ltd	India
5	Emet Controls Pvt. Ltd.(Globe Valve up to 4”,300# angle valve upto 1-1/2”,2500#)	India
6	Flowserve india control pvt. Ltd. (globe valve upto 30” 600# upto 24” 900#, upto 16” 2500# upto 4” 4500#)	India

7	Koso fluids controls pvt. Ltd. (globe valves: upto 8" 2500# 10 to 18" 300# angle valves upto 8" 300#)	India
8	Instrumentation Ltd. (Palakkad)	India
9.	Mil Controls Limited	India
10.	NU Tech Controls	India
11	Pneucon valves Pvt. Ltd. (upto 6" 300#) noncritical)	India
12	Samson Control Pvt Ltd(upto 6'' &=<600#)	India
13	Tecnik valves pvt Ltd. (air & water service upto 4" 150#)	India
14	Valve-Tech Inducstries (non-critical)	India
15	Azbil Corporation (=< 2500#)	Japan
16	Arca Regler GMBH	Germany
17	Dresser Masoneilan	France
18	Flowserve (=<2500#)	U.S.A
19.	Fisher Xomox (=< 2500#)	Singapore
20.	Parcol Spa	Italy
21	Nippon Fisher Co. Ltd. (=<2500#)	Japan
22	Severn Glocon (1 to 12" 600#)	U.K.
Ball Valves		
1.	Tyco Valves & Controls (I) Ltd (=< 150 #)	India
2.	Virgo Engineers Ltd. (=<600# With Maccair Actuators)	India
3.	Anand teknow aids engineering india limited (upto 6",600# (ON-OFF)	India
4.	Bray Controls India Pvt. Ltd.(upto 4",300#)	India
5.	Emerson	India
6	EMET controls pvt. Ltd.(upto 8",150# for air service)	India
7	Fisher Xomox Sanmar	India
8	Flowserve India controls Pvt. Ltd. (upto 16" 600#)	India
9	Intervalve ponnawalla limited (uptp 10",150#)	India
10	Koso Fluid Controls pvt. Ltd. (upto 8 " ,2500# ,10" to 18" 900#)	India
11	NU Tech Controls (14",600# for non-critical purpose)	India
12	Pentair Valves and controls India Pvt. Ltd. (<=150#)	India
13	Pneucon valves pvt. Ltd. (upto 6",150# non-critical)	India
14	Samson Control Pvt Ltd(upto 24'' &=<1500#)	India
15	Valve tech industries ltd. (18",150# non critical)	India
16	Weir Bdk Vlaves (upto 16",150#)	India
17	G.T.C. Italia S.R.L(=<300#)	Italy
18	Metso Automation (=<2500#)	Singapore
19	Orbit Valves PLC (=<2500#)	Singapore
20	Petrol Valves S.R.L	Italy
21	PERRIN Gmbh (size ½" to 12",& rating 150# to 2500#,size 14"to 18", rating 150# to 1500# ,size 20"to 24" rating 150# & 300#)	Germany
22	Pibiviesse S.P.A. (Rating Upto 2500 #)	Italy
23	Rotex manufacturers & Engineers Pvt. Ltd. (upto 6" 600#, 6" to 10" 150#)	India
24	Velan Inc. (ball valves on/off size: ¼" to 6" (rating upto 2500#) size 8"to 16" (rating upto 900#) size 18" to 30 " (rating upto 300#)	Canada
Butterfly Valves		
1	Advance valves pvt. Ltd.(size 2"to 24" upto 600#)	India
2	Bray controls india pvt. Ltd. (upto 300#)	India
3	Dresser Masonelian Valves	India
4	Emet controls pvt. Ltd. (upto 4",900#, 6",150# to 16",150# double eccentric)	India

5	Flowserve india control pvt. Ltd. (upto 30",300# upto 12" 600#)	India
6	Fisher	India
7	Intervalve ponnawaala ltd. (2" to 48",150#)	India
8	Instrumentation Ltd. (Palakkad) (=< 300#)	India
9	Koso fluid controls (pvt.) ltd. (=< 150#)	India
10	Nu tech controls (16",300# for non-critical services)	India
11.	Pneucon valves pvt. Ltd. (upto 8",150# non critical)	India
12.	Samson controls pvt. Ltd.	India
13	Tyco Valves & Controls (I) Ltd (=< 150 #)	India
14	Valve tech industries (non-critical services)	India
15	Virgo Engineers Ltd. (=<300#)	India
16	Weird BDK valves (upto 16",300#0	India
17	Bray Controls(=<300#)	U.S.A
18	Keystone (Upto 2500#)	Singapore
19	Leeds valve ltd.	UK
20	Korea Unicom Valve Co. Ltd.	Korea
21	Parcol Spa (=< 2500# Urea Service Also)	Italy
22	Pentair Valves and controls India Pvt. Ltd. (<=150#)	
23	Metso Automation (Upto 2500#)	Singapore
24	Orton S.r.l. (upto 2500#)	
PRDS & SPRAY NOZZLE,VENT VALVES upto 2500#		
1.	ARCA (Forbes Marshal) (Mech. Spray nozzle type desuperheater only)	India
2.	Chemtrols Industries Ltd. (PRDS Combine &Split)	India
3.	Circor Flow Technolgies India Pvt. Ltd. (1" to 20",upto 150#, 1 to 10" upto 1500#, 1"to 8",upto 2500#)	India
4	Control components INC	India
5	FisherControls	India
6.	Samson Controls Pvt. Ltd. (upto 6",150#)	India
7.	CCI Valve Technology AB	Sweden
8	SPX Valves & Controls (COPES-VULCAN LTD.)	U.S.A
Electric Actuator		
1.	Biffi Italia S.R.L	Italy
2.	Limitorque, U.S.A	U.S.A
3.	Rotork Control (Deutschland) Gmbh	Germany
4.	Auma, Usa	U.S.A
Air Filter cum Pressure Regulator		
1.	ABB India Limited	India
2.	Divya Control Elements Pvt. Ltd.	India
3.	Dresser	India
4.	Emerson Process Managenment	india
5.	Mil Controls Limited	India
6.	Placka Instruments & Controls Pvt. Ltd.	India
7.	Shavo Norgren(India) Pvt Ltd.	India
8.	Schrader Duncan Ltd. (1/4" to 2" port size)	India
Valve Actuator (Pneumatic/Rotary)		
1.	Bray Control India Pvt. Ltd.	India
2.	EL-O-Matic India Pvt. Ltd.	India
3	Rotex Manufacturers & Engineers Pvt Ltd	India
4	Schrader Ducan Ltd.	India
Self actuated pressure control valve		
1	FisherControls	India

2	Nirmal Industrial controls private limited (size ½" to 6 " & rating : < =300#)	India
3	Nu tech Controls (upto 10",600#)	India
4	Pneucon Valves Pvt.Ltd. (upto 4",150#)	India
5	Samsons Controls Pvt. Ltd. (upto 2",150#)	India
Electropneumatic Positioner		
1.	FisherControls	India
2	Siemens Ltd.	India
Desuperheaters		
1.	Circor Flow Technologies India Pvt. Ltd (upto 24",300# upto 28",150#, multinozzle 3" to 4",upto 2500#)	India
2.	Chemtrols	India
3	CCI	India
4	EMET Controls Pvt. Ltd.(Desuperheating Control Valves 1-1/2", 600# * 3",2500#)	India
5	Fisher	India
6	Tyco	India
Pressure reducing Station		
1.	Circor Flow Technologies India Pvt. Ltd (1" to 20",upto 150# ,1 "to 10", upto1500#,1"to 8 " upto 2500#))	India
Pressure Regulator		
1.	Chemtrol Industries Ltd.	India
Safety Valves & Thermal Relief Valves Upto 2500#		
1.	AST S.P.A	India
2.	Bliss anand private limited (8" * 10" 300#, 6" * 8 " 600# ,4 * 6" 1500#)	India
3.	FaingerLeser Valves (P) Ltd. (Upto 600#, ½" To 6")	India
4.	Instrumentation Ltd. (Palakkad)	India
5.	Keystone	India
6	Pentair Sanmar Ltd.	India
7	Nu tech controls (upto 2",300# * 3",150#)	India
8	Valve Tech Industries	India
9	Weir Bdk Valves	India
10	BOPP & Reuther Messtechnic GMBH	Germany
11	Crossby valve & Engg. Company Ltd.	U.K
12	Dresser Industries Incorporated	U.S.A
13	Dresser Valve & Controls	Canada
14	Farris	U.K
15	Itochu Corporation	Japan
16	Parcol Spa (For Urea Service Also)	Italy
17	Sapag Gec Alsthom	France
18	Tai Milano S.P.A	Italy
19	Teledyne Fluid Systems	Thailand
Vaccum Breakers		
1.	Fainger Engineering	India
2.	Potego India Pvt. Ltd.	India
3.	Braunschweiger Flammenfilter	
4.	Itochu Corporation	Japan
5.	Parcol Spa	Italy
6.	Safety Systems UK Ltd.	U.K
7.	Tai Milano S.P.A	Italy
8.	Whessoe Varec Limited	U.K

Rupture Discs		
1.	Bs&B Safety Systems (India) Limited	India
2.	Fainger Engineering	India
3.	Tyco Sanmar	India
4.	Continental Controls Inc.	U.S.A
5.	Fike Europe	Belgium
6.	Sapag GEC Alsthom	France
7.	Teledyne Fluid Systems	Thailand
Pilot relief valves		
1.	AST S.P.A (inlet size upto 3", upto 1500#, outlet size upto 4", upto 300#,inlet size upto 4",upto 300# ,inlet size upto 6", upto 150#,outlet size upto 8", upto 150#)	India
2.	Bliss Anand Private Limited (Size 1"* 2" 2500#)	India
Low pressure relief valve		
1.	Protego India Pvt. Ltd. (less than 1 BAR with flame arrestor)	India
Flame arrestor		
1.	Protego India Pvt. Ltd	India
Control Panel		
1.	Electronics corporation of india ltd.	India
2.	Ex protecta	India
3.	Hulasi metals pvt. Ltd.	India
4.	Industrial control appliances (p) ltd.	India
5.	Jaisun & hutchisun control ltd.	India
6.	Prima automation (india) pvt. Ltd.	India
7.	Pyrotech electronics pvt. Ltd.	India
8	Tan swa technologies INC	India
9	United electric co (delhi) pvt. Ltd,	India
10	Yokogawa india limited	India
11	Instromet international N.V.	Holland
Programable Logic Controller- Package		
1.	ABB India Limited	India
2.	Emerson Process Management (I) Pvt. Ltd.	India
3.	Ge Fanuc Systems Prvitate Limited	India
4.	Honeywell Automation India Limited	India
5.	Rockwell Automation India Ltd.	India
6	Siemens Ltd.,	India
7.	Yokogawa	India
8	GE fanuc automation north America INC (fault tolerant TMR)	U.S.A
9	Hima paul Hiildebrandt Gmbh +Co KG (fail safe)	Germany
10	Marconi italiana (non fail safe)	Italy
11.	Omron corporation (Relay)	Japan
12	RTP Control system	U.S.A /India
13	Triconex (fault tolerant TMR)	Singapore
14	Triconex (Schenider)	Singapore
Distributed Control System		
1.	ABB India Limited	India
2.	Emerson process management India Pvt. ltd.	India
3.	Foxboro	India/Intl.
4.	Honeywell Automation India Limited	India
5.	Siemens Ltd.	India
6	Yokogawa Limited	India

7	Bailey controls company	U.S.A
8	Emerson process management Singapore ltd.	Singapore
9	Honeywell Inc.	U.S.A
10	Invensys	Holland
11	Siemens AG	Germany
12	Yokogawa Electric Corporation	Japan
ESD SHUT- DOWN SYSTEM		
1	HONEYWELL	
2	HIMA CONTROLS	
3	PAUL HILDEBRANDT (HIMA)	
4	RTP Control system	
5	Rockwell automation pvt. Ltd.	
6	SIEMENS AG	
7	TRICONEX / IMPROTEC	
8	YOKOGAWA	
Multiplexer / Remote I/O		
1.	Mtl Instrument Limited	India
2.	Pepperl + Fuch	India
3.	M.system Co. Ltd. (Remote I/O; Model No.R3)	Japan
4	M.T.L., U.K.	U.K
5	Pepperl + Fuchs Pte Ltd.	Singapore
6	Stahl-Und Apparatebau Hans LefferGmbh	Germany
Receiver Instruments (Indicator,Controller,Recorder)		
1.	ABB India Limited	India
2.	Chino-Laxsons (India) Limited (Only Recorder)	India
3.	Eurotherm Del India Limited	India
4.	Honeywell Automation India Limited	India
5.	Masibus Automation & Instrumenation Pvt.Ltd. (Receiver Instruments except recorder)	India
6.	Moore Controls Ltd.	India
7.	Yokogawa Limited	India
8	ChinoCorpn.	Japan
9.	Heraeus Electro-Nite International N.V.	Japan
10.	Honeywell Inc.	U.S.A
11	Siemens Ag, Germany	Germany
12	Yokogawa Electric Corporation	Japan
Alarm Annunciator		
1.	Industrial Instruments & Controls	India
2.	Shree Electronics	India
3.	M.T.L., U.K.	U.K
4.	Rochester Instrument Systems Ltd.	U.K
5.	Riley Panalarm	U.S.A
6.	Ronan Engg. Co.	U.S.A
Temperature Scanner		
1.	Industrial Instrumentation	India
2.	Protocontrol Instruments (I) Pvt. Ltd.	India
Cctv / Access System		
1.	Honeywell Automation India Limited	India
2.	Yokogawa Limited	India
Miscellenous Items (Rtu / ScadaEtc)		
1	ABB India Limited	India
2.	Rockwell Automation India Pvt. Ltd.	India

3.	Siemens Ltd. (Simatic WINcc)	India
Energy meter		
1.	M.system co. Ltd.(Model No. 53U)	India
Surge Protection Devices		
1.	Phoenix Contact (India) Pvt. Ltd.	India
Wiring Ducts		
1.	Trinity touch Pvt.Ltd.	India
DIN Rail		
1.	Trinity touch Pvt.Ltd.	India
Interface Module		
1.	Trinity touch Pvt.Ltd.	India
Cable connector		
1.	Phoenix contact (India) Pvt. Ltd.	India
Advance Process Control System		
1.	Yokogawa India Limited	India
Speed Indicator		
1.	Bentley NevedaLlc	U.S.A
2.	Jacquet	Switzerland
3.	Pepperl + Fuch	Germany
4.	Pepperl + Fuchs Pte Ltd.	Singapore
5.	Shinkawa Electric Co.	Japan
Burner Management System		
1.	Siemens (TMR/QMR)	
2.	Triconex (TMR/QMR)	
3.	Honeywell (TMR/QMR)	
4.	Yokogawa (TMR/QMR)	
5.	Rockwell Automation Pvt. Ltd. (TMR/QMR)	
Instrument Power & Control Cables		
1.	Associated Cables Ltd.	India
2.	Associated Flexibles & Wires Pvt. Ltd.	India
3.	Cords Cable Industries Ltd.	India
4.	Delton Cables Ltd	India
5.	Insucon Cables & Conductors (P) Ltd. (For Smaller Non-Critical Projects)	India
6.	J K Cables Limited	India
7.	Kei Industries Limited	India
8.	Leoni cable solutions	India
9.	Paramount Cable Corporation	India
10.	T C Communications Pvt Ltd	India
11.	Thermo Cables Limited	India
12.	Toshniwal Cables	India
13	Udey Pyro Cables Pvt Ltd	India
Extension & Compensating Cables		
1.	Associated Cables Ltd.	India
2.	Associated Flexibles & Wires Pvt. Ltd.	India
3.	Cords Cable Industries Ltd.	India
4.	Delton Cables Ltd	India
5.	General Instruments Consortium,	India
6.	J K Cables Limited	India
7.	Kei Industries Limited	India
8.	Paramount Cable Corporation	India

9.	ThermopadsPvt. Ltd.	India
10.	Toshniwal Cables	India
Cable Trays & Accessories (Al./Gi)		
1.	D-Y Engineers	India
2.	Globe Electrical Industries	India
3.	HOPPES	India
4.	Indiana Engg Works Pvt Ltd	India
5.	Metalite Industries	India
6.	Parekh Engineering Company	India
7	Sadhana Engineering Corporation	India
8	Steelite Engineering Limited	India
Multi Transit Inlet System		
1.	Hawke International	U.K
2.	MctBrattbergAktiebolag	Sweden
3.	RoxtecAb	Sweden
Junction Box & Cable Gland		
1.	Baliga Lighting Equipments Limited	India
2.	Ceag Flameproof Control Gears Pvt.Ltd.	India
3.	Ex-protecta	India
4.	Flameproof EquipmentsPvt. Ltd.	India
5.	Flexpro Electicals Pvt. Ltd.	India
6.	TAN SWA technologies Inc (Junction Box)	India
7.	Trinity Touch Pvt. Ltd. (Only cable Glands upto size 25M)	India
8	Stahl-Und Apparatebau Hans LefferGmbh	Germany
CS Seamless Pipes –As per Piping list		
1	Indian tube Co.(Tata Div of tubes & pipes)	India
2	ISMT limited	India
3	Maharasthra seamless limited	India
4	Dalmine SPA	Italy
5	ETS Trouvay & Cauvin	France
6	Horst kurvers Gmbh	Geramny
7	Hyundai Corporation	Korea
8	IBF seamless pipes SPA	Italy
9	Mannesmann Hnadel AG	Geramny
10	Marubeni Itochu Steel	Japan
11	Nippon steel corporation	Japan
12	Nissho IWAI Corporation	Japan
13	Okura & Co. Ltd.	Japan
14	Sojitz Corporation	Japan
15	Sumitomo metal industries Ltd.	Japan
16	Phoceenne	France
17	Vomal International Limited	UK
SS Seamless Pipes-As per piping list		
1	Choksi tube company limited	India
2	Maxim tubes company pvt. Ltd.	India
3	Nuclear fuel complex	India
4	Ratnamani metals & tubes limited	India
5	Remi edelstahl tubular ltd.	India
6	Dalmine SPA	Italy
7	Phoceenne	France
8	TPS technitube Rohrenwerke	Germany
9	T.T.I tubecex tubos inoxidables S.A. (1/2” NB SS pipe)	Spain

SS Tubes		
1.	Choksi Tube Company Ltd.	India
2.	Matim Tubes Company Pvt. Ltd.	India
3.	Nuclear Fuel Complex	India
4.	Ratnamani Metals & Tubes Limited	India
5.	Sandvik	India
6	Itochu Corporation (Rep.KubotaCorpn.)	Japan
7.	Nishitani& Co. Ltd.	Japan
8	Sumitomo Metal Industries Ltd.	Japan
Pipe Fittings		
1.	Eby industries	India
2.	Excel hydropneumatics pvt. Ltd.	India
3.	Micro precision products pvt. Ltd.	India
4	Precision engineering industries	India
5	Tecnomatic (india) pvt. Ltd.	India
6	Wesmec engineering pvt. Ltd.	India
7	Celleir	France
8	Cesare bonetti SPA	Italy
9	Dewrance & Co. Ltd.	U.K.
10	Hopkinsons Ltd.	U.K.
11	Siemens AG PGI	germany
12	Sumitomo metal industries ltd.	Japan
13	Thysen krupp stahlunion Gmbh	germany
14	Tecnomatic SPA	Italy
Instrument Miniature Valves		
1.	Audco India Limited(L&T Valves Divn.)	India
2.	Aura Inc	India
3.	Bhel (valves division)	India
4.	Chemtrol Industries Ltd	India
5.	Chemtrols Samil(India) Pvt Ltd	India
6.	Comfit & Valves Pvt. Ltd.	India
7.	Excel Hydro-Pneumatics Pvt Ltd,	India
8.	Excelsior Engg Works	India
9.	Hyd- Air Engineering works Lonavla	India
10.	Ksb Pumps Limited (Valves Divn)	India
11	Panam Engineers	India
12	Tecnomatic (India) Pvt. Ltd.	India
13	Anderson Greenwood & Co.	U.S.A
14	BFE boneey forge valve License	Italy
15	Celleir S.A.	France
16	Crane Company International Sales	U.S.A
17	Dewrance & Co. Ltd.	U.K.
18	Euromisure Cremona	Italy
19	Hopkinsons Ltd.	U.K.
20	Kosei Sanyog Ltd.	Japan
21	Swagelok company/creximco	U.S.A
22	Sumitomo metal industries ltd.	Japan
23	Technomatic SPA	Italy
24	Velan engineering Co. Limited	U.K.
25	Wesmec engineering pvt. Ltd	India
Purge rotameter		
1	Eureka industrial equipments Pvt. Ltd.	India

2	Instrumentation engineers pvt. Ltd.	India
3	Placka instruments & engineers pvt. ltd	India
AIR HEADER/ADPOT		
1	Wesmec engineering pvt. Ltd.	India
Condensate pot		
1	HYDROPNEUMATICS	India
2	MICRO-PRECISION PRODUCTS	India
3	TECHNOMATIC (I) P. LTD.	India
4	Wesmec engineering pvt. Ltd.	India
Valve manifolds		
1	Comfit & Valves Pvt. Ltd.	India
2	EXCEL HYDROPNEUMATICS PVT. LTD.	India
3	HYDER	India
4	INSTRUMENTATION LTD.	India
5	MICRO PRECISION	India
6	NORDIVAL (SWAGELOC)	
7	PARKER	India
8	TECHNOMATIC	India
9	Wesmec engineering pvt. Ltd.	India
Calibration equipment & services		
1	Tempsens instruments (i) pvt. Ltd.	India
2	Fluke	Singapore
3	Omega Engineering	US
Enclosures		
1	Trinity touch pvt. Ltd. (weatherproof size 80 * 80 mm)	India
Instrument contractor for inst. Construction /erection works		
1	Blue star	India
2	Bells control ltd.	India
3	Godrej & Boyce mfg. co. ltd	India
4.	ICB Contractor Pvt. Ltd.	India
5.	Jasubhai Industries	India
6.	Koso india pvt. Ltd. (kent introl control valve divn.)	India
7.	L&T (construction contracts Divn.)	India
8.	Miraj instrumentation service (upto 0.5 crores)	India
9.	Narayan engineering (< Rs. 5 lacs (small project))	India
10.	Pace process control pvt. Ltd.	India
11	Peron engg. Construction ltd.	India
12.	Protect control pvt. Ltd.	India
13	Technimont ICB ltd.	India

ELECTRICAL:

Wall Mounting Type Distribution Boards		
1.	Anand Power Limited	India
2.	Associated Switchgears & Projects Ltd.	India
3.	C & S Electric Ltd	India
4.	Cosmic Power Systems Pvt. Ltd.	India
5.	Elecmech Corporation	India
6.	GE Power Controls India Pvt. Ltd.	India

7.	Intrelec	India
8.	Larsen & Toubro Ltd.(El.Products Divn)	India
9.	Lotus Powergear Pvt Ltd	India
10.	Siemens Ltd.	India
11.	Spaceage Switchgears Limited	India
12.	Tricolite Electrical Industries Pvt. Ltd.	India
13.	Trident Switchgears Pvt. Ltd. (Upto 3200 A)	India
14.	United Electric Co. (Delhi) Pvt. Ltd	India
15.	Venus Controls & Switchgear (P) Ltd.	India
16.	Schneider	India
MCB / ELCB / RCBO		
1.	GE Power Controls India Pvt. Ltd.	India
2.	Havells India Ltd.	India
3.	Indo Asian Fusegear Ltd	India
4.	Legrand India Ltd	India
5.	S & S Power Switchgear Ltd	India
6.	Siemens Ltd.	India
7.	Standard Electricals Limited	India
8.	ABB	India
9.	Schneider Electric	India
Low Voltage Industrial Switches/Isolators		
1.	Asea Brown Boveri Ltd.	India
2.	GE Power Controls India Pvt. Ltd.	India
3.	Havells India Ltd.	India
4.	Kaycee Industries Ltd	India
5.	Larsen & Toubro Ltd.(El.Products Divn)	India
6.	Siemens Ltd.	India
7.	Schneider Electric	India
Industrial Type Sw. Socket & Plug		
1.	Baliga Lighting Equipments Limited	India
2.	Chloride Power Systems and Solutions Ltd. (formerly CALDYNE)	India
3.	Crompton Greaves Ltd	India
4.	Cyclo Electric Devices & Services Co.	India
5.	Ex-protecta	India
6.	FCG Flameproof Control Gears Pvt. Ltd. (Formerly CEAG Flame	India
7.	FCG Power Industries Ltd	India
8.	Flameproof Equipments Pvt. Ltd.	India
9.	Legrand India Ltd	India

10.	Legrand S.A.	France
11.	BBC-Brown Boveri & Cie AG	Germany
12.	R Stahl Schaltgerate Gmbh	Germany
13.	Weidmuller Ltd.	Germany
14.	CORTEM S.p.A.	Italy
Air Obstruction Lights (Neon Type)		
1.	Bajaj Electricals Limited	India
2.	Elecab Poysha	India
3.	Wipro Lighting	India
Lighting Poles		
1.	Bharti Exports	India
2.	Metalite Industries	India
3.	Premier Power Products (Calcutta) Pvt. Ltd.	India
4.	Sadhana Engineering Corporation	India
5.	Surya Roshni Ltd.	India
Explosion Proof Lighting Fixtures		
1.	Baliga Lighting Equipments Limited	India
2.	Crompton Greaves Ltd	India
3.	Ex-Protecta	
4.	FCG Flameproof Control Gears Pvt. Ltd. (Formerly CEAG Flame)	India
5.	FCG Power Industries Ltd	India
6.	Flameproof Equipments Pvt. Ltd.	India
7.	Flexpro Electricals Pvt. Ltd.	India
LT Power Cables		
1.	Cable Corpn. of India Limited	India
2.	Cords Cable Industries Ltd	India
3.	Delton Cables Ltd	India
4.	Finolex Cables Ltd	India
5.	KEC International Ltd. (Formerly RPG Cables Limited	India
6.	KEI Industries Limited	India
7.	Plaza Cable Industries Limited	India
8.	Ravin Cables Limited	India
9.	Torrent Cables Ltd	India
10.	Universal Cables Ltd.	India
11.	Polycab	India
LT Control Cables (1.1 kV)		
1.	Cable Corpn. of India Limited	India
2.	Cords Cable Industries Ltd	India
3.	Delton Cables Ltd	India
4.	Finolex Cables Ltd	India

5.	KEC International Ltd. (Formerly RPG Cables Limited	India
6.	KEI Industries Limited	India
7.	Plaza Cable Industries Limited	India
8.	Radiant Cables Pvt. Limited	
9.	Ravin Cables Limited	India
10.	Torrent Cables Ltd	India
11.	Universal Cables Ltd.	India
12.	Miracle cables	India
13.	Polycab	India
Cables For Earthing		
1.	Advance Cable Technologies (P) Ltd.	India
2.	Delton Cables Ltd	India
3.	Finolex Cables Ltd	India
4.	Gupta Electric & Machinery Stores (GEMSCAB)	India
5.	J K Cables Limited	India
6.	Netco Cable Industries (Pvt.) Ltd.	India
7.	Prestige Cable Industries	India
8.	Shyam Cables Industries	India
9.	Special Cables Pvt. Ltd.	India
10.	T C Communication Pvt Ltd	India
11.	Universal Cables Ltd.	India
Cable Jointing Kits		
1.	Raychem RPG Ltd.	India
Pre-Fabricated Al-Cable Trays		
1.	Globe Electrical Industries	India
2.	Hindustan Vidyut Products	India
3.	Indiana Engg Works Pvt Ltd	India
4.	Indmark Formtech Pvt. Ltd.	India
5.	Jamna Metal Company	India
6.	Kanade Anand Udyog Pvt. Ltd.	India
7.	Maheshwari Electrical Mfrs. (P) Ltd.	India
8.	Metalite Industries	India
9.	Parekh Engineering Company	India
10.	Premier Power Products (Calcutta) Pvt. Ltd.	India
11.	Rukmani Electricals & Components Pvt Ltd	India
12.	Sadhana Engineering Corporation	India
13.	Sree Atreya Enterprises	India
14.	Stealite Engg Co	India
Pre-Fabricated G.I. Cable Trays		
1.	Globe Electrical Industries	India

2.	Indiana Engg Works Pvt Ltd	India
3.	Indmark Formtech Pvt. Ltd.	India
4.	Jamna Metal Company	India
5.	Kanade Anand Udyog Pvt. Ltd.	India
6.	Maheshwari Electrical Mfrs. (P) Ltd.	India
7.	Metalite Industries	India
8.	Parekh Engineering Company	India
9.	Premier Power Products (Calcutta) Pvt. Ltd.	India
10.	Rukmani Electricals & Components Pvt Ltd	India
11.	Sadhana Engineering Corporation	India
12.	Slotco Steel products Pvt. Ltd.	
13.	Sree Atreya Enterprises	India
14.	Stealite Engg Co	India
Flameproof Items (Switch, Switch Socket, Plugs, Isolators, Junction Box, Local Control Station, Distribution Board)		
1.	Baliga Lighting Equipments Ltd.	India
2.	Ex-Protecta	India
3.	FCG Flameproof Control Gears Pvt. Ltd.(Formerly CEAG Flame)	India
4.	FCG Power Industries Ltd	India
5.	Flameproof Equipments Pvt. Ltd.	India
6.	Flexpro Electricals Pvt. Ltd.	India
7.	Legrand S.A.	France
8.	AEG Telefunken AG	Germany
9.	BBC-Brown Boveri & CIE AG	Germany
10.	R Stahl Schaltgerate GMBH	Germany
11.	Siemens AG, Germany	Germany
12.	Weidmuller Ltd.	Germany
13.	Cortem S.p.A.	Italy
14.	Fuji Electric Systems Co. Ltd.	Japan
15.	Togami Electric Mfg. Company	Japan
16.	Toshiba Corporation	Japan
17.	Asea Brown Boveri	Sweden
18.	Crouse-Hinds (Europe) Ltd.	U.K.
19.	GEC Industrial Control Ltd.	U.K.
20.	M&C Switchgear	U.K.
Earthing & Lightning Protection Material – (Al) Wire/Strip		
1.	Anand Electric Trading Co.	India
2.	C & S Electric Ltd.	India
3.	Indmark Formtech Pvt. Ltd.	India
4.	Jayant Metal Mfg. Co.	India

5.	Premier Power Products (Calcutta) Pvt. Ltd.	India
6.	Jamna Metal Company	India
7.	Mahavir Industrial Corporation	India
8.	Metropolitan Industries	India
9.	Sai Galvanisers & Fabricators Pvt Ltd	India
Earthing & Lightning Protection Material – (GI) Wire/Strip		
1.	Indmark Formtech Pvt. Ltd.	India
2.	Premier Power Products (Calcutta) Pvt. Ltd.	India
3.	Jamna Metal Co.	India
4.	Mahavir Industrial Corporation	India
5.	Metropolitan Industries	India
6.	Sai Galvanisers & Fabricators Pvt Ltd	India
7.	Metalite Industries	India
8.	Rukmani Electricals & Components Pvt Ltd	India
9.	Sadhana Engineering Corporation	India
10.	Stealite Engg Co	India
GI Pipes & Conduits		
1.	Bharti Exports	India
2.	Indian Tube Co. (Tata Div. of Tubes & Pipes)	India
3.	Jindal Pipes Ltd.	India
4.	Meghjyot Enterprises	India
5.	Rukmani Electricals & Components Pvt Ltd	India
6.	Steelcraft	India
Industrial Cable Gland		
1.	Baliga Lighting Equipments Limited	India
2.	Comet Brass Products	India
3.	Comet Industries	India
4.	Dowell's Electricals	India
5.	Electromac Industries	India
6.	FCG Flameproof Control Gears Pvt. Ltd. (Formerly CEAG Flame	India
7.	Gland-Mech. Industries	India
8.	Industrial products Equipment	India
9.	Power Engg Co	India
10.	Quality & Precision Indl. Equipment	India
11.	S J Metal Industries (Jainson)	India
Cable Lugs		
1.	Dowell's Electricals	India
2.	Forward Engg Industries	India
3.	KSE Electrical Pvt. Ltd.	India
4.	MG Electrica	Indai
5.	Power Engg Co	India
6.	S J Metal Industries (Jainson)	India

7.	Usha Martin Industries Ltd. (Ismal Divn)	India
Flameproof Cable Gland		
1.	Baliga Lighting Equipments Limited	India
2.	Comet Brass Products	India
3.	Comet Industries	India
4.	Dowell's Electricals	India
5.	Electromac Industries	India
6.	Ex-Protecta	
7.	FCG Flameproof Control Gears Pvt. Ltd. (Formerly CEAG Flame)	India
8.	FCG Power Industries Ltd	India
9.	Flameproof Equipments Pvt. Ltd.	India
10.	Flexpro Electricals Pvt. Ltd.	India
11.	Industrial Products Equipment	India
12.	Kaysons Techno Equipments Pvt. Ltd.	India
13.	Power Engg Co	India
14.	Prompt Engineering Works	India
15.	Sudhir Switchgears Pvt. Ltd.	India
Fuse		
1.	Larsen & Toubro Ltd. (El. Products Divn.)	India
2.	Siemens Ltd.	India
3.	Alstom Power	India
4.	Havells India Ltd.	India
5.	GE	India
6.	Bussman	India
Contactor / Relay		
1.	Larsen & Toubro Ltd. (El. Products Divn.)	India
2.	Siemens Ltd.	India
Timer		
1.	ABB India Limited	India
2.	Alstom Power	India
3.	Bhartia Cutler Hammer	India
4.	Siemens Ltd	India
Control Switches		
1.	Alstom Power	India
2.	Siemens Ltd.	India
3.	Kaycee	India
4.	Larsen & Toubro Ltd. (El. Products Divn.)	India
Push Buttons		
1.	Alstom Power	India
2.	Larsen & Toubro Ltd. (El. Products Divn.)	India
3.	Siemens Ltd.	India
4.	Tecnik	India
5.	Tulsi	India

Signal Lamps		
1.	Alstom Power	India
2.	Binoy	India
3.	Larsen & Toubro Ltd. (El. Products Divn.)	India
4.	Siemens Ltd.	India
Terminal Blocks		
1.	Connectwell	India
2.	Elmex	India
3.	Larsen & Toubro Ltd. (El. Products Divn.)	India
4.	Siemens Ltd.	India

CIVIL DEPT. VENDOR LIST

SL. NO.	ITEM	NAME
1.0	**FLOOR FINISHING**	
1.1	CEMENT TILES (FLOOR/WALL)	a) EUROCON b) ALTRA TILE PVT. LTD. c) DAZZLE
1.2	TERRAZZO TILES	a) NITCO b) HINDUSTAN TILES
1.3	CERAMIC TILES	a) SPARTEK CERAMICS b) BELL CERAMICS c) SOMANY CERAMICS d) H&R JOHNSON CERAMICS e) KAJARIA CERAMICS f) ORIENT CERAMICS
1.4	HEAVY DUTY FLOOR TILES	a) BHARAT TILES b) RESTILE CERAMICS c) PELICAN CERAMIC INDUS. d) DIAMOND REGINA e) SONA TILES
1.5	INDUSTRIAL FLOOR HARDENER ADMIXTURE	a) SAMKOCK CHEMICALS (P) LTD. b) STRUCTURAL WATER PROOFING CO. (P) LTD.
1.6	PVC ROLLS	a) PREMIER VINYL b) ARMSRONG INARCO c) PREMIER POLYFILM
1.7	PVC TILES	a) BHOR INDUSTRIES b) ARMSTRONG c) SHYAM VINYLES
1.8	PVC TILES/ROLL ANTISTATIC	a) PREMIER VINYL b) PREMIER POLYFILM c) ARMSTRONG
1.9	ACID RESISTANT TILES(BATTERY ROOM)	a) H&R JOHNSON OR APPROVED EQUIV.
1.10	MOSSAIC TILE	a) ITALIA b) SPECIFIC GLASS MUSSAIC INDIA LTD.
2.0	WOOD WORK	
2.1	FLUSH DOOR	a) SITAPUR PLYWOOD b) WOODCRAFT PRODUCTS c) KITPLY PRODUCTS
2.2	PLY WOOD/BLOCK BOARD	a) WOODCRAFT PRODUCTS b) KITPLY PRODUCTS c) GREEN PLY
2.3	PARTICLE BOARD (EXTRA GRADE)	a) BHUTAN BOARD b) BEST BOARD c) NOVAPAN INDIA LTD. d) THE BOMBAY BURMAN TRACING CORPN. LTD.
2.4	MDF BOARD/MD PARTICLE BOARD (EXTRA GRADE) VENEEREED/LAMINATED	a) NUCHEM LTD. b) MANGALAM TIMBER PRODUCTS LTD. c) WESTERN BIO SYSTEMS LTD.
2.5	DECORATIVE LAMINATES	a) THE BOMBAY BURMAN TRADING CORPN. LTD. b) GREENPLY INDUS. LTD. c) BAKELITE HYLAM LTD. d) RAMMICA INDUSTRIES

2.6	MARINE PLYWOOD	a) INDIAN PLYWOOD MFG. CO. LTD. b) SWASTIC PLYWOOD
2.7.0	DOORS & WINDOWS FITTINGS	
2.7.1	MORTICE LOCKS WITH HANDLES	a) GODREJ & BOYCE b) EVERITE AGENCIES (P) LTD. c) GOLDEN INDUSTRIES
2.7.2	CYLINDRICAL PIN TUMBLER LOCK WITH KNOBS	a) SECURE INDUSTRIES b) GOLDEN INDUSTRIES c) GODREJ & BOYCE
2.7.3	HYDRAULIC DOOR CLOSER (OVER HEAD/ FLOOR)	a) DOORKING INDUSTRIES b) EVERRITE AGENCIES (P) LTD. c) HARDWYN
2.7.4	MISC. DOOR FITTINGS HINGES, TOWER BOLTS, LATCHES, SOPPER, STAYS, ALDROPS ETC.	a) EVERITE AGENCIES (P) LTD. b) EBCO DINSUTRIES c) ECIE (P) LTD. d) NU-LITE INDUSTRIES e) HARDWYN
2.7.5	THREE WAY BOLTING LOCKING DEVICE HANDLE	a) SRIMA SALES & SERVICES b) DHIMAN INDUSTRIES
2.7.6	PANIC BAR LATCH (FOR EMERGENCY DOOR)	a) SRIMA SALES & SERVICES OR APPROVED EQUIV.
2.7.7	UPVC WINDOWS	a) FENESTA b) ENCRAFT c) WINDOW MAGIC
2.7.8	FASTENERS	a) HILTI INDIA PVT. LTD. b) FISCHER
3.0	STEEL/ ALUMINIUM DOORS, WINDOWS & VENTILATOR	
3.1	PRESSED STEEL DOORS WINDOWS & SECTION DOORS WINDOWS/ROLLING SHUTTER	a) RAYMUS ENGINEERS b) DHIMAN STEEL c) RDG ENGINEERING d) SUPER STEEL WINDOW CO.
3.2	ALMUNIUM / DOORS/ WINDOWS SECTIONS	a) JINDAL ALUMINIUM LTD. b) HINDALCO INDUSTRIES c) INDAL
3.3	FIRE-PROOF DOORS(APPROVED)	a) NAVAIR INTERNATIONAL b) RDG ENGINEERING
3.4	PVC DOORS / WINDOWS	a) SINTEX Or APPVD EQUIV.
3.5	PVC WATER TANKS	a) SINTEX Or APPVD EQUIV.
4.0	PLASTERING	
4.1	WATERPROOFING/ COMPOUND IN CEMENT PLASTER	a) STRUCTURAL WATER PROOFING CO. (P) LTD. b) PIDILITE INDUSTRIES
5.0	ROOF TREATMENT (WATER PROOFING)	
5.1	BRICK BAT COBA	a) INDIA WATER PROOFING CO. b) OVERSEAS WATERPROOFING CORPN.
5.2	ACRYLIC BASED CEMENTATIOUS PRIMER COATING FOR ROOF WATERPROOFING	a) STRUCTURAL WATER PROOFING CO. (P) LTD. b) SIKA QUALCRETE LTD.
5.3	APP MODIFIED POLYMERIC WASTER PROOFING MEMBRANE	a) PIDILITE INDUSTRIES LTD. b) STP TEXAS LTD. c) BITUMET CO. LTD.
5.4	POLYURETHANE COATING	a) AMCHEM PRODUCTS PVT. LTD b) CIPY POLYURETHANE COATING c) EZECOAT by M/s INDUSTRIAL PRODUCTS

		d) M/s SLP INDUSTRIES LTD. e) M/s SHIVALIX AGRO-POLY PRODUCTS
6.0	PAINTING WORKS	
6.1	PLASTIC EMULSION (INTERIOR/EXTERIOR)	a) ICI INDIA LTD. b) BERGER PAINTS LTD. c) ASIAN PAINTS LTD. d) SHALIMAR PAINTS e) KANSAI NEROLAC PAINTS LTD.
6.2	DRY OILBOUND DISTEMBER	a) ASIAN PAINTS LTD. b) KANSAI NEROLAC PAINTS LTD.
6.3	INDUSTRIAL / EXPOXY/ SYNTHETIC ENAMEL PAINTS	a) ICI/AKZO NOBEL INDIA b) BERGER PAINTS LTD. c) ASIAN PAINTS LTD. d) SHALIMAR PAINTS e) INTERNATIONAL MARINE COATINGS PVT. LTD. f) KANSAI NEROLAC PAINTS LTD. g) BOMBAY PAINT
6.4	WATERPROOF CEMENT PAINT	a) KILLICK NIXON LTD. b) RAJDOOT PAINTS
6.5	WOOD MELAMINE POLISH	a) ASIAN PAINTS b) SHALIMAR PAINTS
6.6	WASTERPROOFING TRANSPARENT EXTERIOR WALL COATING (OVER PAINTED SURFACE)	a) PIDILITE INDUSTRIES b) INDUSTRIAL PROD. MFG c) STRUCTURAL WATER-PROOFING CO.(P) LTD.
6.7	FIRE PROOF COATING	a) NAVAIR INTERNATIONAL OR APPVD. EQUIV.
7.0	ROOFING SHEETS & ACCESSORIES	
7.1	ASBESTOS SHEETS	a) ETERNIT EVEREST LTD. b) CHARMINAR INDUSTRIES
7.2	C.G.I. SHEETS	a) ISPAT INDUSTRIES LTD. b) STEEL AUTHORITY OF INDIA c) TATA STEEL
7.3	PRECOATED G.I. PROFILE SHEETS FOR ROOFING & WALL CLADDING	a) ISPAT INDUSTRIES LTD. b) SHREE PRECOATED STEELS LTD. c) INTERARCH BUILDING PRODUCTS (P) LTD. d) HARDCASTLE & WAUD MFG. CO. LTD. e) LLOYD INSULATION (I) LTD. f) SHIV SHAKTI FIBER UDYOG
7.4	ALUMINIUM SHEET (PLAIN/PROFILE)	a) INDIAN ALUMINIUM CO. LTD. Or APPROVED EQUIVALENT
7.5	FIBRE GLASS SHEETS & PANELS (MACHINE MOULDED)	a) SIMBA FRP (P) LTD. b) GE INDIA c) SHIV SHAKTI FIBER UDYOG
7.6	PROOFING J/L HOOKS, BOLTS & OTHER ACCESSORIES (POLYMER COATED)	a) KATALIST CONSULTANT (P) LTD. b) ADVANCED MACHINE
8.0	SANITARY PLUMBING FITTINGS & FIXTURES	
8.1	SANITARY FITTINGS (W.C. WASH BASIN, URINAL ETC.)	a) HINDUSTAN SANITARY WARE & INDUS. LTD. b) PARRYWARE SANITARY WARE c) MADHUSUDAN CERAMICS d) NYCER CERAMICS

8.2	PLUMBING FITTINGS & FIXTURES	a) GEM b) PARKO c) KINGSTON
8.3	GLASS/MIRROR (SHEET/ FLOAT/ TOUGHENED/ LAMINATION	a) GUJARAT GUARDIAN LTD. b) SAINT GOBAIN c) ASAHI FLOAT
8.4	GI PIPES	a) JINDAL b) SURYA c) PRAKASH d) SWASTIK
9.0	**FLASE CEILING, FLASE FLOORING & UNDERDECK INSULATION**	
9.1	FLASE CEILING / WALL CLADDING (ALUMINIUM STRIP/ TRAY TYPE)	a) INTERARCH BUILDING PRODUCTS (P) LTD. b) HUNTER DOUGLAS c) MASCOT OVERSEAS
9.2	FALSE FLOORING	a) MULTI INTERIORS PVT. LTD. b) BESTLOCK SYSTEM & CONCEPTS c) LLOYD INDUSULATION (I) LTD. d) UNITED INSULATION e) A.R. & BROTHERS
9.3	UNDERDECK/WALL HEAT INSULATION	a) BAKELITE HYLAM LTD. b) U.P. TWIGA F.G. LTD. c) LLOYD INDULATION (I) LTD.
9.4	OVERDECK HEAT INSULATION	a) LLOYD INSULATION (I) LTD. b) BEST PLASTRONICS LTD.
9.5	GYPSUM BOARD TILES (FIBRE GLASS REINFORCED)	a) INTERARCH BUILDING PRODUCTS (P) LTD. b) INDIA GYPSUM LTD.
10.0	SPECIALITY PRODUCTS (CEMENT ADDITIVES/ ADMIXTURES/CORROSIO N INHIBITORS/ SURFACE TREATMENT/ GROUT & ANCHORS/SEALING/ COASTING	a) FOSROC b) SIKA c) MYK Arment Pvt Ltd d) JAY CHEMICALS INDUSTRIES PVT LTD (K2)
10.1	EPOXY FLOOR COATING (BATTERY ROOM)	a) FOSROC b) SIKA c) FAIRMATE d) MYK Arment Pvt Ltd e) JAY CHEMICALS INDUSTRIES PVT LTD (K2)
11.0	**MISCELLANEOUS ITEMS**	
11.1	WOOD PRESERVATIVE	a) ASCU HICKSON LTD.
11.2	WALL SURFACE TEXTURED COATING	a) UNITILE b) SPECTRUM PAINTS c) BAKELITE HYLAM
11.3	PVC PLUMBING FITTINGS	a) PRAYAG POLYMERS (P) LTD.
11.4	REINFORCED FIBRE GLASS WATERPROOFING FELT	a) FGP LTD. b) U.P. TWIGA F.G. LTD.
11.5	ANTI TERMITE TREATMENT	a) PCI Or APPRVD EQUIV.
11.6	MATERIAL TEST HOUSE	a) SHRIRAM TEST HOUSE b) SPECTRO ANALYTICAL LABS c) BHARAT TEST HOUSE
12.0	**CEMENT**	a) ACC b) J K CEMENT c) BINANI CEMENT

		d) JP CEMENT e) GUJARAT AMBUJA f) ULTRA TECH CEMENT g) BIRLA CORPN. LTD. h) GRASIM i) SHREE
12.1	SULPHUR RESISTANT CEMENT	a) SAURASHTRA CEMENT LTD. b) SHREE DIGVIJAY CEMENT
13.0	RCC DESIGN MIX	a) IIT DELHI b) SHRIRAM TEST HOUSE
15.0	FIRE PROOFING MATERIAL	a) CAFCO b) CARBOLINE
16.0	STRUCTURAL STEEL / CS PLATE	a) SAIL b) TATA STEEL c) RINL d) JINDAL e) ESSAR f) ISPAT INDUSTRIES g) JINDAL STEEL & POWER LTD.
16.1	MS PIPES (HAND RAIL APPLICATION)	a) HITEX b) ASHWANI STEELS c) SURYA d) PRAKASH e) VIKRANT ISPAT UDYOG
17.0	TMT BAR / REBAR	a) SAIL b) TATA STEEL c) RINL d) SHYAM STEEL INDRUSTRIES LIMITED e) ELECTROSTEEL STEELS LTD. f) SHRI RATHI STEEL LTD. g) SRMB SRIJAN PRIVATE LIMITED h) JINDAL STEEL & POWER LTD. i) SHRI BAJRANG POWER & ISPAT Ltd (GOEL TMT)
18.0	GRATINGS/HANDRAILS	a) INDIANA GRATINGS b) WESTCOAST ENGINEERING c) GREATWELD GRATING d) KANADE ANAND UDYOG
19.0	WELDING ELECTRODE	a) ADOR b) ESAB c) D & H d) HANOVAR e) Bohler group f) Mailam g) Advani Orlikon

GENERAL NOTES:

i. Only 'First' Quality materials shall be used.

ii. Bidder shall select sub vendors from the vendor list as specified below. Bidder shall ensure that sub vendor for the specified item has supplied item for the specified service & the supplied item is in satisfactory service since last 3 years as on date of offer. Vendor shall have well proven record for the specified services and shall be subjected to owner/consultant approval.

iii. OWNER / CONSULTANT reserve the right to choose any of the approved make / vendor as per this list. Make of the item not indicated and any other make for the specified item shall be subject to owner's / consultant's approval.

iv. Specifications of manufacturer's items shall be checked against tender item / specifications before selecting any product or brand name. In case of any discrepancy, tender item / specifications shall prevail, and any such brand of item shall not be used which is not conforming to tender specifications even if it is listed in this vendor list.

v. In case of non-availability of any material among approved vendors / makes in a particular site / region, alternate vendor / make conforming to IS / BS etc. shall be used subject to approval of Vendor (Material and Price) by Owner / Consultant site team and subsequently by Head office.

vi. Contractor shall get the material sample approved by EIC as per the Vendor list before procurement.

21.0 APPLICABLE CODES & STANDARDS:

It is the primary responsibility of the Bidder to design & construct all electrical & instrumentation items of the flare stack, in accordance with the latest industry standard & codes, including all supplements and addendums issued at time of the order.

22.0 THIRD PARTY INSPECTION:

Inspection shall be carried out by any of the approved agencies i.e. LLOYD/BV/DNV/TUV.

23.0 LIST OF REFERENCES:

Bidder shall submit a list of references for executing similar jobs of similar capacity which have been working satisfactorily for the last three years. Feedback report for the same shall be furnished along with offer.

ELECTRICAL SPECIFICATION

PLANT : SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM

PROJECT : INTEGRATED COAL BASED FERTILISER COMPLEX, AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	Scope
2.0	Basis of Design
3.0	Area Classification
4.0	System Details and Utilization Voltages
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6.0	Equipment Specification
7.0	Cabling
8.0	Illumination System
9.0	Earthing and Lightning Protection
10.0	Structure
11.0	Testing & Inspection
12.0	Documentation
13.0	Vendor List
14.0	Installation, Testing and Commissioning
15.0	Coordination with Other Contractors
Annexure-I	Illumination Levels

LIST OF ATTACHMENTS

Technical Specification No.	Description
PC183-TS-0808	Sheet Steel Distribution Boards
PC183-TS-0809	Lighting Sub Distribution Boards
PC183-TS-0811	Interlocking Switch Socket and Plug
PC183-TS-0815	Cables
PC183-TS-0816	Prefabricated Ladder Type Cable Racks
PC183-TS-0818	Junction Boxes
PC183-TS-0843	Electrical Erection, Testing & Commissioning

Electrical Sketches	Description
PC183-PDS:E 510	Details of Concrete Cable Trench
PC183-PDS:E 511	Cable Rack Arrangement in Trenches
PC183-PDS:E 516	Typical Arrangement of Cables buried in slit
PC183-PDS:E 530	Pre-Fabricated Cable Tray Straight Run
PC183-PDS:E 531	Pre-Fabricated Cable Tray Horizontal Tee
PC183-PDS:E 532	Pre-Fabricated Cable Tray Horizontal Cross
PC183-PDS:E 533	Pre-Fabricated Cable Tray 90° Horizontal Bends
PC183-PDS:E 534	Pre-Fabricated Cable Tray 90° Vertical Bend Bending Rad. 1000 mm
PC183-PDS:E 535	Pre-Fabricated Cable Tray 90° Vertical Bend Bending Radius 600 mm
PC183-PDS:E 536	Pre-Fabricated Cable Tray Coupling Arrangement
PC183-PDS:E 537	Pre-Fabricated Cable Tray Fixing Arrangement
PC183-PDS:E 538	Pre-Fabricated Cable Tray Reducing Coupler Plate
PC183-PDS:E 1201	Typical Arrangement of Chemical Earthing
PC183-PDS:E 601	General Notes on Earthing and Lightning Protection
PC183-PDS:E 602	Earthing Conductor Details
PC183-PDS:E 603	Arrangement of Connections of Earth Conductors
PC183-PDS:E 606	Typical Arrangement of Earthing for Motor and Start Stop Push Button
PC183-PDS:E 611	GI/Al Accessories for Earth Electrode
PC183-PDS:E 615	GI Earth Bus
PC183-PDS:E 617	Typical Arrangement for Neutral and Equipment Earthing

1.0 SCOPE

1.1 The scope includes work/service for the complete design, engineering, manufacture, testing at works, supply of all electrical equipment, dispatch, storage, handling, erection, testing at site and commissioning of complete electrical system required for 'Flare System'.

Although every item of supply and/or installation might not have been described, the LSTK Contractor shall supply anything and everything to complete the project.

1.2 This specification shall be read in conjunction with all drawing and documents attached and other relevant reference as specified therein.

1.3 The scope of work/services of LSTK Contractor shall comprise complete electrics of the Flare System. The scope of work/services shall broadly comprise but not limited to the following:

1.3.1 Manufacture, testing at works, getting inspected by owner and/or their consultant/third party, packing, transportation and delivery to site in well packed condition, insurance during transit and till commissioning & handing over, storing at site as per recommendation of manufacturer/supplier/direction of supervising engineer of Owner/Consultant until required for erection, transportation to work place. Erection, testing & commissioning, handing over of complete electrical system of 'Flare System' (hereinafter referred as Plant in short) comprising, but not limited to:

a. Switchgears:
   - Local control Panels, Switch Sockets.

b. All Cables viz
   - Power Cables
   - Control Cables
   - Earthing Cable
   - Signal cables
   - Any other cables

c. Erection/installation & all sundry materials for installation, testing & commissioning of equipment/panels/fittings/cables (including jointing & termination of cables) comprising (but not limited to) following:
   - Foundations
   - Brackets, support structures, erection materials & accessories, as required.
   - Cable trays, racks, pipes, ducts, cable channels etc as required.
   - Testing checking kits/instruments

d. Aviation lighting

e. Earthing of equipment & structures.

f. Protection against lightning.

g. Cable trench/Cable tray with supporting structure.

h. The scope shall also include the erection, testing, commissioning of above equipments.

   The contractor shall clear the site after commissioning of the equipments/system and obtain the Site Clearance Certificate from owner's Engineer-in-charge

i. Any and all other Materials, Equipment and Services so as to make a totally integrated and functional system together with all accessories and associated equipment, ensuring

safety, maintainability and reliability in compliance with all applicable codes, standards, guidelines, statutory regulations and safety requirements in force.

j. Any other equipment, not specified, but required for safe, proper, trouble free and efficient operation of the system

k. LSTK Contractor shall consider any other requirement which is not covered in this NIT, but required for successful operation of the plant.

l. Tools & Tackles.

1.4 Owner will provide UPS power supply 2 nos. feeders at 240V and 1 Nos. feeder at 115V from nearby control room and further distribution shall be in LSTK Contractor's scope.

Power for Lighting and other Electrical Loads shall be tapped from Switchboards located at Cooling Tower MCC Room. Bidder shall indicate details of loads in Technical Bid itself, so that suitable feeders can be considered at Owner's Switchboards at Cooling Tower MCC Room.

1.5 The bidder shall offer the best and proven most suitable type of energy efficient equipments manufactured by well known reputed manufacturers having proven performance track record of minimum 2 years, as per vendor list appended in this bid package. However, for the sake of standardization of the electrical equipment and material used for the electrical installation, the LSTK Contractor shall supply all items of a particular type or make for whole plant of the same manufacturing company for ease of maintenance and less spares inventory.

1.6 1 No. 415 V Feeder (32 A) at existing Substation near 132 KV Switchyard shall be made available. Tapping of Construction Power (on chargeable basis) from this feeder (including supply & erection of all required materials like structural supports for cable tray, cable trays, power cables, control cables, protection & metering, cable termination etc. as well as underground cabling work) and further distribution shall be in LSTK Contractor's scope.

Bidder shall ensure that the minimum power factor of 0.9 shall be maintained at their end by providing suitable power factor improvement devices.

LSTK contractor shall have to distribute construction power with adequately rated distribution and sub distribution boards/feeder pillars, power supply cables and other associated materials for feeding loads to carry out construction and fabrication activities at his own cost.

Bidder shall indicate details of construction power in the bid with month-wise breakup for the entire duration of project.

However during non availability of construction power, LSTK contractor shall have to arrange emergency power, if required, through DG set at their own cost.

1.7 Contractor shall provide adequate area lighting at site of construction, fabrication yards, storage yard and office etc. by means of suitable lighting fixture, lighting masts, flood lighting poles etc. which are to be supplied and maintained by the contractor as per safety aspect.

1.8 In case of any discrepancies between Design Philosophy – Electrical and Technical Specification of equipment/item/work in respect of description of equipment/item/work, the details indicated in the Design Philosophy – Electrical shall prevail.

1.9 All electrical equipments installed in the areas classified as hazardous shall be certified for such use by a recognized certifying authority such as CIMFR Dhanbad/PESO, Nagpur etc.

2.0 BASIS OF DESIGN

2.1 Statutory requirement Codes and Standards

2.1.1 The design, installation, testing & commissioning shall conform to compliance of following statutory requirements :

- Indian Electricity Act
- Indian Electricity Rules

- The Indian Factories Act
- The Indian Explosives Act.
- Statutory requirement of Govt of Odisha and Govt. of India.
- Guidelines, instructions, directions issued by Pollution control Boards of state as well as central government. Guidelines, instructions, directions issued by Chief Controller of Explosives (CCoE), CPCB, CMRI, DGMS, CEA etc.
- Guidelines of Tariff Advisory Committee
- Guidelines of Insurance Companies Association.
- International Civil Aviation Organization (ICAO) Standards/Norms/Guidelines
- Any other applicable Rules/Acts/Regulations.

The design, installation, testing & commissioning shall be in accordance with established codes, good engineering practices and latest versions of following documents valid/ applicable on the date of acceptance of bid. The stipulations in these documents shall be considered as minimum requirements:

- Indian Standard Specification or equivalent IEC Standards
- Publications of IEEE
- API Standards
- National Electrical Safety Code (NESC)
- Standards of Underwrites Laboratory (UL)
- American Society for Testing Material (ASTM)
- American National Standards Institute (ANSI)
- Other International Standards

LSTK contractor shall be responsible for obtaining necessary statutory approvals from all the statutory bodies/authorities e.g. Electrical Inspectorate, PESO (earlier CCoE) as applicable before commissioning of electrical facilities. The CEA clearance for electrical equipment and components thereof shall be obtained by the contractor.

LSTK Contractor shall carry out all modifications/alterations required by all statutory bodies. However, necessary statutory fee shall be deposited by the Owner.

2.2 In case of any conflict/deviation amongst various documents the order of precedence shall be as follows:

- Statutory rules/regulation
- Design Philosophy
- Data sheets
- Technical specification/Installation Standards etc.
- Applicable IS/IES standards

In case of contradiction/conflict among documents and statutory requirement, LSTK Contractor shall refer to Owner for clarification. However, most stringent specification shall be followed with Owner's approval. Owner decision shall be considered as final.

2.3 **Site Conditions**

The equipment shall be designed for the following site conditions:-

- Minimum ambient Temperature 1 deg.C
- Maximum ambient Temperature 46 deg.C
- Design Reference Temperature 50 deg.C
- Relative Humidity 100%
- Altitude above mean sea level Lower than 1000 Mtrs.

- Atmospheric pollution — Dusty due to presence of Coal Dust & Urea Dust and corrosive due to presence vapours of Ammonia.

3.0 AREA CLASSIFICATION

3.1 The hazardous zones within the project area shall be classified according to the requirement of IS/IEC. PESO approved Hazardous Area Classification Drawing shall be submitted during detailed engineering.

3.2 All electrical equipments installed in the areas classified as hazardous shall be certified for such use by a recognized international certifying authority such as CIMFR earlier CMRI, Dhanbad. The item shall in addition bear the valid certification from PESO (earlier CCoE) and also the manufacturer shall hold a valid Bureau of Indian Standards (BIS) license.

For those items where overseas OEM vendor will supply the electrical equipment certificate from international authority can be accepted but the certification shall be approved by PESO (earlier CCoE), Nagpur India.

3.3 The electrical equipment for hazardous areas shall be selected as per IS-5571 and petroleum rules and Gas group shall be selected based on the approved hazardous area classification drawing. The minimum requirement is summarized below:

Equipment	Zone-1	Zone-2
Plug & Socket	Ex-d	Ex-d
Lighting fitting	Ex-d	Ex-d
Control Gear Box	Ex-d	Ex-d
Junction Boxes	Ex-d	Ex-d
Lighting Panel/Power Panel	Ex-d	Ex-d

4.0 SYSTEM DETAILS AND UTILIZATION VOLTAGES

4.1 The various voltage levels for in plant power distribution shall be as follows:

A. Distribution Equipment	a) 415V±10%, 3 Ph, 4 W/240V ± 10%, 1 Ph, 2W, 50 Hz ± 5% solidly grounded neutral.
Combined variation in voltage & frequency	± 10%
Control Supply	AC 240V ± 10%, 50 Hz ± 5%, 1Ph, 2W
- Instrumentation and Automation, DCS & Auxiliaries	AC 115 V ± 10%, 50 Hz ± 3% 1Ph, 2W – Instrumentation UPS located at Control Room
- Lighting	415V/240V AC
- Power Sockets/Receptacle	415V, 3 Ph AC/240V, 1 Ph AC

5.0 POWER SUPPLY AND DISTRIBUTION.

5.1 Owner will provide UPS power supply 2 nos. feeders at 240V and 1 Nos. feeder at 115V from nearby control room and further distribution shall be in LSTK Contractor's scope.

Power for Lighting and other Electrical Loads shall be tapped from Switchboards located at Cooling Tower MCC Room. Bidder shall indicate details of loads in Technical Bid itself, so that suitable feeders can be considered at Owner's Switchboards at Cooling Tower MCC Room.

5.1.1 Tapping of power supply from owner's feeder (including supply of all required material), structural supports for cable tray, cable trays, cables, cable termination etc. shall be in LSTK Contractor's scope. Further distribution to equipment through proper type and size of cables, their supply, erection, testing and commissioning etc. shall be in LSTK Contractor's scope.

5.2 **Instrumentation Power**

5.2.1 The power supply for instrument shall be 115V, 1Ph from UPS System.

6.0 **EQUIPMENT SPECIFICATION**

6.1 **General Features**

6.1.1. The equipment shall be suitable for tropical climate conditions and corrosive and saline atmosphere.

All electrical equipment accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Fine mesh screen of corrosion resistant material shall be furnish on all ventilating openings to prevent entry of insects.

6.1.2. The equipment to be installed in outdoor plant area shall have IP 65 enclosure.

6.1.3. All the electrical equipment shall be provided with rolled aluminium/stainless steel heavy duty double compression type cable glands and crimping lugs for the cable terminations

6.1.4. The outside surface of all equipment shall be painted after suitable pre-treatment by the application of two coats of anti-rust and corrosion resisting epoxy based paints.

6.2 **Switchboards**

6.2.1 Distribution Board/Local Control Panel/Power Panel shall be of dust, vermin and weatherproof construction fabricated out of 2mm thick CRCA conforming to IP65. The enclosure shall be suitable for mounting on wall/structure. 4 nos. holes suitable for 12mm bolts shall be provided outside the enclosure for fixing the Distribution Board.

6.2.2 The cut out on the enclosure shall be lined with gaskets. The external cover shall be flushed with the main cover. Continuous neoprene gasket shall be provided to make the board completely dust and weatherproof.

6.2.3 The miniature circuit breakers shall be so mounted inside the enclosure that their operating knobs project outside for easy operation. The cut-out for the knobs on the enclosure shall be lined with gasket for dustproofness. For further protection against ingress of dust, the portion where the knobs have protruded out shall be provided with another external front cover, internally hinged at the top, gravity operated and with a knurled knob at the bottom. The external cover shall be flushed with the main cover. Continuous neoprene gasket shall be provided to make the board completely dust and weather proof.

6.2.4 All external hard ware of diameter less than 8mm shall be of stainless steel and those of diameter 8mm and above shall be of mild steel zinc passivated.

6.2.5 The Distribution Boards/Local Control Panel/Power Panel shall have top/bottom entry arrangement for outgoing cables and bottom entry for incoming cable provided with double compression type rolled aluminium cable glands suitable for 1.1 KV XLPE-A-FRLS PVC outer-sheathed cables.

6.2.6 The internal wiring shall be carried out by means of single core XLPE/PVC insulated 2.5 sq.mm stranded copper conductor cables.

6.2.7 Individual earth terminals shall be provided for the earth conductor of the outgoing cables beside the phase and neutral terminals.

6.2.8 Suitable label inscription consisting of black Perspex with engraving for the board and circuit nos. of all outgoing feeders shall be provided. The label inscription of the board shall contain description and code no. as indicated in specification sheet. The circuit nos. of outgoing feeders shall be serially indicated as 1L, 2L..... 17L, 18L, as applicable.

6.2.9 The Distribution Boards shall be provided with two external earthing terminals.

6.2.10 The board shall be complete with terminal block, cable glands, cable lugs and other accessories as required.

6.2.11 Lighting Sub Distribution Boards

The Distribution Boards shall be single front, non-draw out wall mounted type.

6.2.12 UPS Distribution Boards

The UPS Distribution Boards shall be single front, floor/wall mounted non-drawout type for supply of 115 V AC/240 V AC.

6.3 MINIATURE CIRCUIT BREAKERS (MCB)

6.3.1 MCBs shall have silver tungsten contact rewirable connections suitable for flush and surface mounting and shall be suitable for mounting on Din-Rail. MCB and distribution boards shall be as per approved make of list.

6.3.2 All MCBs shall be ISI marked.

6.3.3 All wiring connections required to be made with MCBs shall be carried out by providing necessary thimbles/lugs duly crimped.

6.3.4 MCBs shall be hand operated, air break, quick make, quick break type conforming to applicable standards.

a) The MCB shall be provided with overload/short-circuit protective device for protection under overload and short circuit conditions. The switch action shall be trip free to inhibit closing under fault conditions. All brass parts shall be electroplated and all steel parts cadmium plated and all contacts silver plated. The minimum breaking capacity of MCBs shall be 10 KA r.m.s at 415V/220V AC.

b) Miniature circuit breakers shall be SP/DP/TP or 4P and of the current rating all as specified elsewhere or approved. Each miniature circuit breaker shall be provided with spring-washer at each cable termination. All MCBs shall be in accordance with the relevant standards.

c) The instantaneous magnetic tripping of the MCBs shall be in accordance with the latest edition of the I.E. Regulations. The magnetic tripping of miniature circuit breaker supplying socket outlets shall be 2.7 to 4 times their rated current. The magnetic tripping of the miniature circuit breakers supplying lighting circuits shall be 7 to 10 times their rated current.

6.4 INTERLOCKED TYPE SWITCH SOCKET & PLUG

6.4.1 Interlocked type switch socket shall be of the types as specified in specification sheet.

6.4.2 These shall be complete with heavy duty air break switches, HRC fuses, sockets & plugs. These shall be fully wired and shall be complete with cable glands, lugs, terminals etc. for external connection.

6.4.3 The switch socket shall be heavy duty industrial type. The interlocking arrangement shall be such that it is not possible to insert or withdraw the plug with the switch in ‘ON’ position. Switch socket shall also conform to specification sheet.

6.4.4 The enclosure of switch sockets and plugs shall be dust and hose proof in weatherproof execution and of Cast Aluminium Alloy 4600, suitable for fixing on wall/structure. A rain-hood shall be offered as an additional protection. Rain hood shall be of the same material as of the main enclosure. Suitable arrangement for looping of cables from one switch socket to the other shall be provided. Necessary terminals, cable glands and lugs for looping shall be provided.

6.4.5 Also one no. threaded plug for each switch socket shall be supplied loose.

6.4.6 The Air break switches shall be quick make, quick break rotary type and of utilization category

6.4.7 AC-23. Switches shall be hand operated from outside the cover. The switch handle shall remain fixed to the front cover while removing the front cover.

6.4.8 The sockets shall be provided with link type HRC fuses. The fuses shall be capable of withstanding a short circuit current of 50 KA and shall be delayed action type. These shall be mounted on a shrouded base.

6.4.9 The socket outlet shall be located in the lower part of the enclosure and shall be provided with a threaded aluminium cover attached to the body with SS chain, to protect the socket after extraction of the plug. Spring loaded automatic shutter shall not be acceptable.

6.4.10 The plugs shall be so constructed that these can be easily fitted in to the socket outlets and shall be provided with knurled knob arrangement for screwing on the body of the socket so that it can be securely fixed on the top. The plug base and cover shall be firmly secured to each other and shall be sufficiently robust in construction to withstand normal usage. The plug and socket contacts shall be self-aligning type with best electrical continuity.

6.4.11 The plug shall be provided with cable entry suitable for receiving TRS flexible heavy duty copper conductor cable of specified size. The arrangement shall be such that the conductors are relieved from strain including twisting where they are connected to the terminals and that the outer surface of the cable at the place of entry is not damaged.

6.4.12 2 Nos. of inter-locked type 63A, 415V, 3 Ph and 1 No. 16A, 240V, 1 Ph switch sockets shall be provided as per hazardous area classification near Flare Area.

7.0 CABLING

7.1 Cables

7.1.1 All LV power and control cables shall be supplied and laid by the contractor. Terminations at switchgear end and at the equipment end shall be in contractor's scope. Supporting and laying of these cables shall also be in contractor's scope. Termination of LV cables shall be in contractor's scope.

7.1.2 All LV power cables shall be with stranded aluminium/copper conductor with XLPE insulation, PVC inner sheathed FRLS type, armoured, PVC outer sheathed FRLS type and construction as per IS: 7098 (Part 1). Power cables with conductor size upto and including 16 sq. mm shall be with copper conductor, conductor size 35 sq. mm and above shall be aluminium conductor.

Single core LV Power cable shall be of aluminium conductor. The construction of same shall be as per above.

7.1.3 All control cables shall be with 2.5 sq. mm, stranded copper conductor with XLPE insulation, PVC inner sheathed FRLS type, armoured, PVC outer sheathed FRLS type and construction as per IS: 7098 (Part 1). Control cables shall be twisted pair or shielded wherever electro-magnetic/electrostatic interference is anticipated.

7.1.4 All control cables shall have 20% spare cores. All cores shall be identified with numerical core numbers printed on core in addition to colour coding.

7.1.5 All cables shall be armoured and shall have extruded inner and outer sheath.

7.1.6 All LV power & control cable shall be suitable for earthed and unearthed system.

7.1.7 Cables connected in parallel shall be of the same type, cross section and terminations.

7.1.8 All power and control cables shall be in continuous lengths (except for very long feeders) without any joints. The cables used for lighting and wires in conduits shall have appropriate junction boxes with adequately sized terminals. Cable joints in hazardous areas shall not be permitted.

7.1.9 The maximum voltage drops in various sections of the electrical system shall be within limits stated in the following table:

Sl. No.	System Element	Maximum Permissible Voltage Drop
i)	Cable between PMCC and MCC or auxiliary switchboard i) MCC/Auxiliary Switchboard near PMCC ii) MCC/Auxiliary Switchboard situated remote from PMCC	 0.5% 2 to 2.5%
ii)	Cable between Auxiliary Switchboard/MLDB and Lighting Panel/Power Panel	1 to 1.5% (Note-2)
iii)	Circuit between lighting panels and lighting points	4% (Note-2)
iv)	UPS outgoing circuit	5% (Note-1)

Note-1

Minimum voltage available across any instrument in the field/control room/satellite rack room shall be as per instrumentation design basis. Distribution system for instrumentation supplies shall be designed accordingly. In case of any conflict between electrical equipment specification sheet and instrumentation design basis report, the latter shall govern regarding instrumentation power supplies.

Note-2

In case of difficulty in achieving specified voltage drops in cables up to lighting panel, 5% drop from Auxiliary Switchboard/MLDB up to lighting points may be permitted.

7.1.10 The minimum size of power cables shall be 2.5 sq. mm (Cu).

7.1.11 The control cables shall be 2.5 sq. mm (Cu). However, wiring in the panel/switch boards may be by means of 1.5 sq. mm (Cu) cables except for CT wiring which shall be 2.5 sq. mm. All the control and power wiring shall be carried by using FRLS wires only.

7.2 Cable Laying

7.2.1 The cables shall generally be laid on overhead racks. Pipe racks where available, shall be used to support the cable racks.

LV power and control cable shall be laid on cable tray in touching formation in single layer.

LV Power and Control cable shall be on separate trays. Instrument and electrical cable trays shall be separate.

Cables shall be clamped properly on the cable rack in such a way that position and layout of a particular cable shall not change throughout the rack so that it can be easily traced during maintenance jobs.

7.2.2 The cable racks shall be ladder type, pre-fabricated from suitable hot dip galvanized steel/heavy duty FRP material. Cable racks around cooling tower areas shall be of heavy duty FRP (fire retardant and UV stabilized) material. Maximum cable tray size shall be 600mm wide. Maximum supporting span shall be 2 Mtrs. as per PDS Doc. No. PDS: E 530 attached with the NIT. Cable trays shall be designed considering 25% margin for future use.

All cable racks must be provided with GI flat strip of size 75mm X12 mm as running earth all along the tray.

7.2.3 Bimetallic lugs shall be provided, as required.

8.0 ILLUMINATION SYSTEM

8.1 General

8.1.1 LED type lighting shall be provided.

8.1.2 LED shall conform to the following types and standards:-

Product Type	Safety Standard	Performance Standard
Self ballasted LED lamps for general lighting services > 50 V	IEC 62560 Latest Edition	IEC 62612/PAS Publicly available specification
Control gear for LED modules	IEC 61347-2-13 Latest Edition	IEC 62384 Latest Edition
LED modules for general lighting	IEC 62031 Latest Edition	IEC/PAS 62717 Latest Edition
LED luminaries	IEC 60598-1 Latest Edition	IEC/PAS 62722-2-1 Latest Edition Luminaries performance – Part 2-1: particular requirements for LED
LEDs and LED modules	IEC TS 62504 Terms and Definitions for LEDs and LED modules in general lighting.	

Maintenance factor for indoor lighting shall be considered as 0.7 and for Outdoor lighting 0.6.

The colour rendering index shall not be less than 90%.

The LED lights shall work satisfactorily at the design temperature of 50 Degree Celsius.

All the LED fittings shall be selected in accordance with Hazardous Area Classification.

The life assessment of LEDs shall include control gears/ driver as well.

8.1.3 The specified illumination level shall be maintained after considering maintenance factor 0.5 and utilisation factor as per manufacturer catalogues for type of fixture.

8.1.4 Aviation lights shall be provided. Aviation Lighting shall be in accordance with International Civil Aviation Organization (ICAO) Publication Annexure 14 and to Indian Standards, together with the approval of local aviation authority.

LED type Low Intensity Aviation Obstruction Light suitable for 240V, 50 Hz supply. It shall be covered under Indian patent act (Govt of India) No. 188995. Degree of protection shall be IP-65.

The illumination intensity of aviation lights and mounting height shall be considered based on vicinity of civilian air terminal within 1 kM radius. Aviation lights at each location shall be fed from two separate feeders. Incase aviation lights are not switched ON for any reason, whatsoever, a signal shall be sent to control room which will sound buzzer and also result in flashing of red light. On acknowledgement, buzzer shall stop but flasher will continue unless aviation lights are turned ON.

The fixtures shall have body of corrosion resistant aluminium alloy casting and shall be suitable for outdoor use and mounting on 40 mm NB G.I. pipe. Necessary electrical threading shall be tapped in the fixture for mounting.

8.1.5 Power factor of complete fitting shall be 0.95 min. at 230 V.

8.1.6 Lights from LED's shall be soothing to eye and without any bright spots on the floor/objects illuminated by the luminaries.

8.1.7 The driver shall be mounted internally and be replaceable with the aid of commonly available hand tools.

8.1.8 The LED module or array shall be designed in such a way that the failure of one LED shall not affect additional LED's.

8.1.9 Life expectancy of LED Luminaries shall be minimum of 50000 hrs with greater than 70% of rated lumen output.

8.1.10 Min. efficiency of LED driver: The minimum efficiency of LED driver shall be 85% for driver power output rating <=40W and 87% for driver power output rating> 40W.

8.1.11 Short circuit protection /Open load protection shall be required for LED fixtures.

8.1.12 Surge Protection for minimum 2kV for indoor and minimum 3kV for Outdoor LED systems shall be provided. However, if a site is prone to lightning and surges 10kV surge protection shall be required. In case of outdoor luminaires, the Surge Protection Device (SPD) should be series type with fail safe.

8.1.13 Color temperature of LED Luminaries: 5700K

8.1.14 Cover type for outdoor type fittings shall be Toughened glass or UV stabilized polycarbonate whereas, for indoor and non-weather proof items, UV stabilized Poly Carbonate can be used.

8.1.15 For lighting fixtures and 16 Amp plug socket circuits, 3 core 2.5 sq. mm (Cu) cable shall be used.

8.2 JUNCTION BOXES

Junction Boxes shall be FLP type made of cast aluminium enclosure having IP 65 degree of protection and adequately sized, with terminal blocks, cable lugs and cable glands as required.

The cabling between this junction box and aviation light shall be in bidder's scope of work.

9.0 EARTHING AND LIGHTNING PROTECTION

9.1 Earthing

9.1.1 Complete earthing installation shall be done as per IS: 3043, IEEE-80, IE Rules and IEC recommendations. The earthing system shall be designed to:

(a) Provide a permanent & continuous path from equipment and conductor enclosures to earth from circuits for flow of fault current.

(b) Provide sufficient current carrying capacity to conduct safely any current liable to be imposed on it.

(c) Provide sufficient low resistance to earth to limit the potential between metalwork and earth within safe limits.

(d) Provide equal distribution of potential and minimum potential difference for safety of personnel.

(e) Ensure sufficient current in case of fault to facilitate the operation of relays, over current devices, fuses etc. provided in the circuit.

9.1.2 Common underground earthing grid shall be provided covering plants which is further connected to overall Earthing Grid. The overall earth resistance (dry) shall be limited to 1 ohm.

9.1.3 Earthing rings shall be provided around plants which in turn shall be connected to the common earthing grid. Minimum size of main grid shall be 75mm×12mm.

Anti-corrosive bituminous paint shall be provided at each joint of earth flat after necessary finishing and priming treatment.

9.1.4 Earthing grid/ring shall comprise of buried GI earth strips and GI pipes/electrodes.

9.1.5 Chemical earth pits shall be considered instead of conventional earth pits in view of faster dissipation of lightning surges and fault currents, easy installation and maintenance free feature. Enhanced high quality UL certified 17.2 mm copper bonded (250 micron) earthing electrode/rod along with 22.6 KG graphite based (non-bentonite) as a ground enhancing material with stainless steel clamp for connecting copper bonded rod with horizontal flat strip shall be used.

9.1.6 Backfill shall be permanent and maintenance free. (No re-charging with salts or any other chemicals) and shall maintain its earth resistance with time. Backfill shall confirm IEEE 80-2000 Clause No.14.5 (d). Backfill in its set form shall have a resistivity of not more than 0.12 ohm-m. Backfill shall comply the requirements and all applicable tests as per Part-7 of IEC 62561.

9.1.7 Earthing grid/ring shall comprise of buried GI earth strips and GI pipes/electrodes.

9.1.8 Separate earth electrodes shall be provided for system neutral earthing. For equipment earthing, minimum two numbers of electrodes shall be provided around each plant/section. However, all these earth electrodes shall be interconnected.

9.1.9 Inter-connecting pits having an earth bus in an enclosed brick chamber without earth electrode shall be provided in the common underground earthing grid for convenience of taking earth conductors inside the plants.

9.1.10 As far as possible, the reinforcement rods inside concrete column shall be connected to the earthing grid/ring to reduce the overall earth resistance.

9.1.11 Individual electrical equipment shall be earthed by GI strip/GI wire/Cu/Al cable. Earth buses shall be provided in plants for earthing groups of electrical/non-electrical equipment to earthing grid/rings.

9.1.12 All equipment rated above 250 V shall have two external earth connections and those rated up to 250 V shall have one external earth connection. However, for lighting fixtures, earthing shall be done through 3rd core of the cable in safe as well as in hazardous area.

9.1.13 Flameproof equipment, in addition, shall have one internal earth connection. This means that 4 core cables to be used for all the flameproof equipments and 3.5 core cables to be used for all flameproof motors located at hazardous area.

9.1.14 All steel structures, tanks, vessels, pipes, pipe joints, valves etc. shall be earthed against static charge accumulation by 50x6 mm GI strip. The no. of earth connections shall be as follows:

Equipment having diameter	Hazardous area	Non hazardous area
30 M	2	2
More than 30 M	3	2

9.1.15 For all equipment in hazardous area, in addition to external earthing one internal earthing shall be provided.

9.1.16 Minimum sizes of earth conductors to be used shall be as given below.

Sl.No.	Equipment	GI conductor size	Al conductor Size
1.	All minor equipment rated 250V & above.	10 SWG	6 sq. mm
2.	Earth Grid	75mm x 12 mm.	-

Vendor to calculate the actual size. However, higher size of calculated one or above-mentioned size shall be provided.

All GI conductors shall meet the galvanizing requirement as per IS.

9.1.17 The main ground grid shall be buried in earth at a minimum depth of 1000 mm below finished grade level unless stated otherwise.

9.2 Lightning Protection

9.2.1 All structure shall be protected against lightning strokes by suitable lightning protection system to be designed and installed as per IS/IEC-62305.

9.2.2 The number of down conductors shall be minimum two.

9.2.3 Bare metallic structures shall not have any air termination rods at the top. The earth connections shall be welded to the bottom of structure at 300 mm above floor level. However, tall metallic columns with insulation at top shall be provided with air termination rods. Separate earth electrodes shall be provided for each down conductor of lightning protection. However, these shall be inter-connected with the other electrodes in main grid.

9.2.4 Air Terminal

The vertical air terminal rods shall be installed at the roof of buildings to protect from lightning strokes.

The vertical air terminal shall be made of 20 mm dia galvanized steel rod. The size shall be decided based on the Lightning Adequacy Calculation. The projected length of the rod shall be as required to protect the object (on which the rod is fixed) from lightning stroke.

The air terminal rod shall be properly fixed on the top of the building/structure to withstand very high wind pressure. In case the air terminal rod is embedded at the top of roof of building: the portion embedded inside the concrete shall not touch the reinforcement bars and shall be duly insulated from them.

All the vertical air terminal rods shall be electrically connected together by means of horizontal conductors of size 50 x 6 mm galvanized steel flats.

The shielding angle for one vertical air termination shall be 45 degrees. For more than one rod, shielding angle between the rods shall be taken as 60 degrees.

Horizontal air termination (i.e. G.S. Flat conductor) shall be so laid that no part of the rod will be more than nine (9) metres from the nearest roof conductor.

9.2.5 Shielding Masts

The shielding mast for lightning protection shall be installed at the top of steel columns cap plates of power house main building.

The shielding mast shall be made of galvanized steel pipe and the height of the same shall be decided considering the zones to be protected.

Each shielding mast shall be connected to grounding grid by a down conductor 50 x 6 mm. Galvanized steel flat run along the building column. In addition all power house building columns joints shall be electrically bonded.

9.2.6 Down Conductors

The down conductors shall be 50 x 6 mm galvanized steel flats. The connection between each down conductor and earth electrode shall be made via test link located at approximately 1500 mm above ground level.

10.0 MOUNTING STRUCTURES

Switch sockets, cable trays, DBs etc. shall be mounted/supported on suitable structure fabricated out of standard sections of mild steel, i.e. channels, angels, flats etc. conforming to IS: 2066.

11.0 TESTING & INSPECTION

11.1 Testing of all electrical equipments shall be done in accordance with relevant IEC/BIS codes in presence of owner’s representative at manufacturer's works before despatch/at site before installation. All such tests shall be arranged by the contractor and testing charges, if any, shall be borne by the contractor.

11.2 The LSTK Contractor shall submit the certificates of type tests performed on identical equipment as evidence of the compliance of the equipment with the type tests.

11.3 The LSTK Contractor shall submit the certificates of routine and acceptance tests conducted on the purchased equipments.

11.4 All the routine/acceptance tests shall be performed at the manufacturer's works in the presence of owner's representative.

11.5 Electrical installation work shall be subjected to inspection by owner/his authorized representative, statutory bodies like Electrical Inspector, Factory Inspector and where applicable by equipment supplier's engineer. The contractor shall carry out without extra cost to owner rectifications/modifications desired by the above authorities to make the installation conforming to I.E. Rules etc.

11.6 The owner may reject any portion of the work considered defective or of poor workmanship and the contractor shall make good these defects without extra cost to owner.

12.0 DOCUMENTATION

12.1 The LSTK Contractor shall submit the documents for electrical equipments (MS-word, MS-excel and AutoCAD) as per the drawing and documentation schedule as given in this bid package.

12.2 LSTK Contractor shall ensure that following shall be mentioned in each sheet of drawings/ documents in the order mentioned below:

(a) Logo and Name of the client

(b) Logo and Name of the consultant

(c) Logo and Name of the contractor (LSTK Contractor)

(d) Logo and Name of the Manufacturer on the drawings prepared by manufacturer, if applicable

(e) Name of the Project for which drawings are applicable

(f) Title of the drawing (Title shall indicate the details shown in the drawing)

(g) Drawing/document number with sheet number and number of total sheets in the drawing (Drawings having different title shall be assigned different drawing number)

(h) All sheets of each drawing shall bear same title, same document number and same revision number

12.3 At the time of handing over of the installation, LSTK Contractor shall supply as built drawings taking into consideration the actual execution carried out at site.

12.4 Erection, testing/checking (inclusive of calibration check) prior to energisation/after energisation and commissioning Manuals shall be in bound book format and shall give step by step procedure for:

(a) Storage, Handling and Erection

(b) Checking/testing after erection and before energisation.

(c) Pre-commissioning tests/checks and cold trials

(d) Commissioning

(e) Drawings relevant for erection, operation, maintenance and repair of the equipment.

(f) List of instruments/testing kits/sets, measuring instruments etc. required for testing/ checking with specification, ratings, ranges etc.

12.5 The details of equipment layout and cable routing will be designed by the LSTK Contractor during detail engineering stage and these shall be subject to approval by Owner/Consultant. Changes as required to achieve a neat layout with adequate working space all around, for better aesthetics as well as to meet statutory regulation and codes shall be done without any time and cost implication.

13.0 VENDOR LIST

13.1 Make of all electrical equipment shall be as per Section 15.0: Vendor List attached with this bid package.

13.2 Any other vendor shall be subject to Owner/Consultant's approval.

13.3 Bidder shall indicate the make of all the equipments in their offer.

13.4 Any other item for which vendors are not mentioned in NIT, LSTK Contractor shall furnish list of proven suppliers with PTR subject to Owner's/Consultant's approval during detailed engineering. Document (PTR) shall be in English language only.

14.0 INSTALLATION, TESTING AND COMMISSIONING

14.1 The LSTK Contractor shall undertake installation of all electrical equipment in accordance with latest code of practices, in conformity with recommendation of the respective equipment manufacturers, drawings approved by the owner or owner's representative, direction of engineer-in-charge, statutory regulations and to the entire satisfaction of the owner.

14.2 The LSTK Contractor shall arrange all the necessary erection tools and tackles, testing and measuring instruments and shall supply the required erection materials including structural steel.

14.3 LSTK Contractor shall furnish field inspection and test data sheets for all equipments for owner's approval.

14.4 The LSTK Contractor shall obtain the necessary certificate of compliance/completion certificate with test results from statutory authorities as required. All necessary drawings and test certificates as required by them shall be furnished by the vendor.

14.5 The erection work shall be supervised by competent supervisors holding relevant supervisory license from the Government.

14.6 Cable Installation

14.6.1 General

(a) All Cables to be laid in overhead cable tray only. Cable Tray for HV, LV and Control cable should be separate. Underground cable to be avoided, Cables to be laid on racks in underground concrete cable trenches inside the plant only where overhead structure is not possible. Cables may be laid in ground (slit with HDPE conduit) where number of cables to be laid are less and do not justify use of concrete cable trenches.

(b) All the cable tray structures shall be painted with two coats of primer and two coats of final paint after necessary surface preparation.

(c) Cable OD 40 mm and above shall be clamped individually.

(d) Cables shall be clamped only after the cables are neatly arranged, dressed tailored and kept in position. Support of cables on edges of cable trays/structural steelwork shall be avoided.

(e) LV power and control cable shall be laid on cable tray in touching formation in single layer.

(f) All the cable tray network shall be earthed by a continuous earth strip.

14.6.2 Cable laying in Trench/on Racks/Trays/Cleated on Wall/Structure. For proper support, access and neatness of appearance of installation; cables shall be laid on racks or cable trays or cleated on wall and/or structure taking following into consideration:

(a) Cable racks/trays shall be 250 mm apart.

(b) Ladder type FRP cable trays shall be used for laying power & control cables.

(c) Coaxial cables for data transfer from/to microprocessor based equipments shall be laid in HDPE conduits with pull boxes fixed to cable supporting racks.

(d) Top tray shall be used/left vacant for communication, signaling and fire alarm cables.

(e) Cables shall be laid in separate trays according to voltage and noise classification. Fire proof partition shall be provided between HV and LV cables.

(f) Power, control and lighting cables shall be laid in separate cable trays.

(g) Large size cables shall be clamped individually. Small size cables may be bunched together provided that in any bunch all cables have sheath of same material.

(h) Cables in trays shall be clamped at not more than every 1500 mm for horizontal run and 800 mm for vertical run and near bends.

(i) Cable racks/trays shall be planned in such a way so that at least 20% or one rack/ tray (whichever is more) can be added in future and at least 20% free space shall be left in each cable tray for cable laying in future.

(j) Support to cable trays shall be provided at intervals as required for proper support but at interval not more than 1000 mm.

(k) Support to trays shall also be provided at each joint of tray irrespective of it's distance from adjacent support.

(l) FRP trays shall be fixed using nuts and bolts as welding will not be permitted.

14.6.3 Cable laying in conduits

(a) Cables shall be laid in GI conduits while laying on or crossing floors/wall/railway lines/ roads.

(b) While laying on floor or wall or crossing roads conduits shall be embedded in concrete/wall.

(c) When laid on floor the top cover shall be minimum 10 mm.

(d) At rail/road crossings, the conduits shall be laid not less than 1 meter below top surface of the road.

(e) Mechanical protection by G.I. Pipe shall be provided to all cables up to 1200 mm from ground/floor level.

(f) Minimum diameter of G.I. pipes used for laying/protection of cables shall be 1.6 times the cable diameter.

(g) Only one cable shall be laid in one conduit.

(h) Conduit shall be sealed after cable laying.

(i) Standard bends or fabricated bends shall not be used. wherever required, conduits shall be bent using bending machine. Bending radius shall not be less than 10 times the diameter of conduit.

(j) Jointing of the conduits shall be done using sockets which may be welded from top to avoid ingress of water.

(k) Ends of conduits shall be made smooth to avoid damage to cables.

14.6.4 Cable Jointing

(a) Joints in cable length less than standard drum length shall not be allowed.

(b) Joints, if unavoidable, shall be made at most suitable places.

(c) Joints shall not be made at passageways or under rail/road crossings and in hazardous area.

(d) Joints shall be segregated by not less than 2 meters so as to reduce the possibility of one joint failure affecting the other.

(e) Individual cores in cables shall always be joined number to number or colour to colour of the insulation over the conductors.

(f) Continuity and current carrying capacity for earth conductor and/or armour shall be provided.

(g) Cable jointing shall be done by joiners who possess certificate of competency for carrying out particular joint.

(h) Minimum 2 meters cable loops shall be kept near each joint.

(i) Cable joints shall be restricted in hazardous area.

14.6.5 Cable Termination

(a) Double compression heavy duty industrial type glands/heat shrinkable termination kits and bi-metallic/copper lugs shall be used for termination of cables.

(b) Paint of the gland plate at the contact point of gland shall be removed for proper contact.

(c) Cable glands/termination kits shall be earthed.

(d) Cables to individual cubicles shall be neatly laid out and supported.

(e) Cables shall be clamped at a distance of 400 mm from gland/ termination.

(f) Conductors of control cables shall be neatly arranged in compact group. The entire group shall be placed and tied with nylon straps.

(g) Spare cores shall be terminated with sufficient length to permit future connection to the terminal block associated with control cables.

14.6.6 Identification

(a) Cable tags shall be made of non-corrodible material, preferably SS.

(b) Voltage, cable number etc. shall be engraved on each tag.

(c) Cable tags shall be tied to each cable at

(i) All termination (outside as well inside panel/box)

(ii) All bends

(iii) All points before and after which their route cannot be easily identified.

(iv) Entry and exit from conduits.

(v) All joints

(vi) Every 15 meter for straight run.

15.0 COORDINATION WITH OTHER CONTRACTORS

15.1 LSTK Contractor shall coordinate with Owner's other Contractors and shall freely exchange all technical information required for this purpose.

15.2 All civil works connected with electrical installation shall be under the LSTK Contractor's scope.

ANNEXURE-I

ILLUMINATION LEVELS

Average illumination levels (Mean Lux) for various areas shall be as follows:

Sl. No.	AREA	LUX
1.0	**PLANT**	
1.1	Operating platforms	100
1.2	Non-operating platform/ general process areas & walk ways	50
1.3	Pipe rack	100
1.4	Area near large rotating equipment/plant	200
2.0	**STAIR CASES**	
2.1	Safe areas	100
2.2	Hazardous areas	100
3.0	**PANIC LIGHTING**	10

SPECIFICATION SHEET
DISTRIBUTION BOARDS

PROJECT: Coal Based Fertilizer Plant		PLANT: Flare System	
ISSUED FOR : PROPOSAL ☐ ENQUIRY ☒		ORDER ☐	FINAL ☐
GENERAL		**AMBIENT CONDITION**	
Ref. Stds. : IS/IEC		Temp.- Max/Min/Design ref.: 46/1/50°C	
Encl. Docs. :		Max Relative Humidity ≤ 100% Alt. above sea : <1000 M	
Vendor :		Atmos Polluti	Dusts : Coal Dust & Urea Dust Vapour : Ammonia & Highly Corrosive
Vendor Ref. No. :		Area	Safe ☐ Hazardous - ☒
Sample Reqd. :		Hazar Area	Zone : Encl. Gr. : Temp. Class :
		Location :	Indoor ☒ Outdoor ☒

LOCATION :	Indoor ☒	Outdoor ☒	
TESTS:	Routine ☒	Type ☐	Others ☐

BASIC DATA

TAG NO.	Item No.		
	Description		Sheet Steel Distribution Board
	Code No.		
REFERENCE DRAWINGS	Single Line Diagram		
	Feeder Details		
	Scheme Diagrams		
SYSTEM DETAILS	Nominal Voltage with Variation		
	Rated Frequency with Variation		
	Combined V & F Variation		
	No. of Phases & Wires		
	Insulation Level		
	Fault Level		
	Earthing Mode		Solidly Earthed
BUS BARS	Material of Construction		
	Bare/Insulated		Insulated
	Type of Insulation		PVC
EXECUTION	Single Front/Double Front		
	Drawout/Non Drawout :		Non Draw out
	CABLE ENTRY	Top	
		Bottom	Bottom
MISC. DATA	Dummy Panel Reqd. (Yes/No)		
	Width of Dummy Panel		
	No. of Dummy Panel		
	PAINTING	Type	Epoxy based
		Shade	Shade 631 of IS: 5
	Spares Parts Reqd. for a Period of		2 Years operation and maintenance

Notes:
All unfilled data shall be filled by the Contractor. Completely filled in Specification Sheet duly stamped & signed by the LSTK Contractor shall be submitted after award of order for owner/consultant approval before commencement of manufacturing in line with NIT/Contract.

TECHNICAL PARTICULARS
DISTRIBUTION BOARDS

PROJECT: Coal Based Fertilizer Plant		PLANT: Flare System
ISSUED FOR : PROPOSAL ☐	ENQUIRY ☒	ORDER ☐ FINAL ☐
GENERAL		
Make/Maker's Type :		
Ref. Standards		
Rated Operational Voltage with ± %		
Rated Insulation Voltage		
Rated Current		
Short Circuit Rating		
Degree of Protection of Enclosure		
Service Condition : Indoor/Outdoor		
EXECUTION	Drawout/Non Drawout	
	Single Front/Double Front	
	Cable Entry Top/Bottom	
MAX. NOS. OF FDRS IN ONE PANEL	Motor Starters	
	Switch Fuse	
SHEET STEEL TYPE/THICKNESS	Load Bearing Member	
	Non Load Bearing Member	
	Base Channel	
Material of Gaskets		
Material of External Hardware ≤ 8 mm/> 8 mm		
Operating Height : Max./Min.		
PAINTING	Method of Pre-treatment	
	Type	
	Thickness of Paint	
	Finishing Shade	
Dimensions : L X B X H/Dim. Drg. Ref. No.		
Shipping Dimensions of Largest Package		
Weight : Static/Dynamic		
Heat Dissipation		
Space Heater Rating of Each Panel		
BUS - BARS		
Material		
SIZE	HBB : Phase/Neutral	
	VBB : Phase/Neutral	
	Ground	
	Calculation Attached	
MINIMUM CLEARANCE BETWEEN	Live Parts	
	Live & accidentally dangerous parts	
Minimum Creepage Distance		
CURRENT RATING	Continuous	
	Short Time for 3 secs.	
Temp. Rise for : Cont. Load/Short Time Current		
SUPPORT	Material	
	BIL	
	Arrangement :Separate/Common	
Material of Bus Bar Insulation		
Shrouding Material for Joints		
No. & Type of Bolts per Joint		
COMPONENT DETAILS		
SWITCHES	Make/Maker's Type	
	Ref. Standard	
	Type of Switch	
	Rated Voltage	
	Utilisation Category	
	Rated Operational Current	
	Short Time Withstand Current	
	No. of Poles/Breaks	

	Type Test Certificate Ref. No.		
COMPONENT DETAILS			
FUSES	Make/Maker's Type		
	Ref. Standard		
	Type of HRC Fuse		
	Rated Voltage/Current		
	Category of Duty		
	Prospective Breaking Current		
	Current Time Curve showing Pre-Arcing & total I^2t Values	Ref. No.	
		Attached	
CONTACTORS	Make/Maker's Type		
	Ref. Standard		
	Rated Operational Voltage		
	Utilisation Category		
	Rated Duty		
	Rated Thermal Current		
	Operating Voltage Of Coil	Pick Up Max./Min.	
		Drop Off Max./Min.	
	Coil Consumption : Pick Up/Hold On		
CURRENT TRANSFORMERS	Make/Maker's Type		
	Ref. Standard		
	Rated Primary Current		
	Ratio		
	Rated Burden		
	Accuracy Class		
INSTRUMENTS & METERS	Make/Maker's Type		
	Ref. Standard		
	Operating Principle		
	Scale Range		
	Accuracy		
	Size		
	Type of Mounting		
CONTROL SWITCHES	Make/Maker's Type		
	Ref. Standard		
	Contact Rating		
	Utilisation Category		
PUSH BUTTONS	Make/Maker's Type		
	Ref. Standard		
	Contact Rating		
	Utilisation Category		
SIGNAL LAMPS	Make/Maker's Type		
	Ref. Standard		
	Rated Voltage/Watts		
	Rating of Safety Resistor		
	Type of Lamp Holder		
	Type of Globe		
MCCB	Make/Maker's Type		
	Ref. Standard		
	Current Rating		
	Breaking Capacity		
	Setting Range of Thermal Release		
	Setting Range of Magnetic Release		
MCB	Make/Maker's Type		
	Ref. Standard		
	Rated Current		
	Breaking Capacity		
CABLE GLANDS	Material		
	Type		
TERMINAL BLOCKS	Make		
	Type		
	Current Rating		

SPECIFICATION SHEET
SWITCH SOCKET & PLUG

PROJECT: Coal Based Fertilizer Plant — PLANT: Flare System

ISSUED FOR : PROPOSAL ☐ ENQUIRY ☒ ORDER ☐ FINAL ☐

GENERAL		**AMBIENT CONDITION**	
Ref. Stds. : IS/IEC		Temp.- Max/Min/Design ref.: 46/1/50°C	
Encl. Docs. :		Max Relative Humidity ≤ 100% Alt. above sea : <1000 M	
Vendor :		Atmospheric Pollution	Dusts : Coal Dust & Urea Dust
Vendor Ref. No. :			Vapour : Ammonia & Highly Corrosive
Sample Reqd. :		Area	Safe ☐ Hazardous - ☒
		Hazardous Area Class	Zone : Encl. Gr. :
			Temp. Class :
		Location :	Indoor ☒ Outdoor ☒

TESTS TO BE WITNESSED : Routine ☒ Type ☐ Others ☐

BASIC DATA

Item No.		
Quantity		
Rated Voltage & Frequency		415V/240V± 10%, 50 Hz± 5%,
Rated Current		63A/15A
No. of Phases & Pins		3 Ph/1 Ph, 3 Pin
Degree of Protection		IP55
Addl. Degree of Protection		--
Cable Size	Supply	
	Plug	--
Period for which Spares required		2 Years

All unfilled data shall be filled in by the bidder.

TECHNICAL PARTICULARS

- (**Note:** Completely filled in Technical Particulars Sheet shall be furnished after award of order for owner/consultant approval before commencement of manufacturing in line with NIT/Contract.

General	Make & Maker's Type		
	Material & Thickness of Enclosure		
	Gasketing Materials		
	Material of Ext. Hardwares < 8mm/> 8mm		
	Cable glands Type & Material		
	Painting	Pre treatment	
		Shade	
	Dimensional Drawing Reference No.		
	Weight of Switch Socket/Plug		
Switch	Make & Maker's Type		
	Reference Standards		
	Rated Current		
	Utilisation Category		
Fuse	Make & Maker's Type		
	Reference Standards		
	Rated Current		
Socket	Make & Maker's Type		
	Reference Standards		
	Rated Current		
Plug	Make & Maker's Type		
	Reference Standards		
	Rated Current		

NOTE:
- Completely filled in Technical Particulars Sheet shall be furnished after award of order for owner/consultant approval before commencement of manufacturing in line with NIT/Contract.

SPECIFICATION SHEET
POWER & CONTROL CABLES

PROJECT: Coal Based Fertilizer Plant			PLANT: Flare System	
ISSUED FOR : PROPOSAL ☐	ENQUIRY ☒	ORDER ☐	FINAL ☐	
GENERAL		**AMBIENT CONDITION**		
Encl. Docs. :		Temp. Max./Min./Design Ref. 46/1/50°C		
Vendor :		Relative Humidity: 100 %	Alt. above Sea Level < 1000M	
Vendor Ref. No. :		**Atmospheric Pollution**	Dusts : Coal Dust & Urea Dust	
			Vapour : Ammonia & Highly Corrosive	
TESTS TO BE WITNESSED: Routine ☒	Type ☐	Acceptance ☒	Others ☐	
Type Tests Certificate of Similar Cable : Required ☒		Not required ☐		

BASIC DATA				
Item No.				
Ref. Stds.		IS:7098 (PART-1)	IS:7098 (PART-1)	IS:7098 (PART-1)
Voltage Grade		1.1 KV POWER CABLE	1.1 KV CONTROL CABLE	1.1 KV EARTHING CABLE
System Earthing		NEUTRAL SOLIDLY EARTHED	NEUTRAL SOLIDLY EARTHED	NEUTRAL SOLIDLY EARTHED
Type of Cable		POWER	CONTROL	EARTHING
CONDUCTOR	Material	ALUMINIUM/COPPER	COPPER	ALUMINIUM/COPPER
	Construction	STRANDED	STRANDED	STRANDED
Insulation Type		XLPE EXTRUDED	XLPE EXTRUDED	XLPE EXTRUDED
Inner Sheath Type		EXTRUDED PVC (ST2)	EXTRUDED PVC (ST2)	--
CONDUCTOR SCREEN	Required	--	--	--
	Not Required	--	--	--
Material of Conductor Screen		--	--	--
ARMOURING	Required	YES	YES	--
	Material	GALVANISED STEEL	GALVANISED STEEL WIRE	--
	No. of Layers	SINGLE	SINGLE	--
Outer Sheath Type		EXTRUDED FRLS PVC TYPE-ST2	EXTRUDED FRLS PVC TYPE-ST2	EXTRUDED FRLS PVC TYPE-ST2
Special Requirements		--	--	--
Drum Material		WOOD	WOOD	WOOD

TECHNICAL PARTICULARS
CABLES

PROJECT: Coal Based Fertilizer Plant		PLANT: Flare System
ISSUED FOR : PROPOSAL ☐ ENQUIRY ☒ ORDER ☐ FINAL ☐		
GENERAL		
Make		
Ref. Standard		
Item No.		
Voltage Grade		
Suitable For Earthed/Unearthed System		
No. of Cores & Size of Conductor		
CONSTRUCTIONAL DETAILS		
CONDUCTOR	Material	
	Construction	
	No. & Dia of wires per Core	
CONDUCTOR SCREEN	Material	
	Thickness	
INSULATION	Material	
	Thickness	
	Core Identification Method	
INSULATION SCREEN	Material	
	Thickness	
INNER SHEATH	Type & Material	
	Thickness	
ARMOURING	Type & Material	
	Dia of Wire/Strip Thickness	
OUTER SHEATH	Material	
	Thickness	
ELECTRICAL DATA		
CONTINUOUS CURRENT RATING WHEN LAID IN	Ground At 30^0 C	
	Air At 40^0 C	
Short Circuit Current For 1 sec.		
CONDUCTOR TEMP.	Continuous	
	Short Time	
Resistance At Operating Temp. (Ohm/KM)		
Reactance At 50 C/S (Ohm/KM)		
Capacitance (F/Km)		
Insulation Resistance		
Polarisation Index		
DERATING FACTOR CHART ATTACHED FOR	Temperature	
	Grouping	
	Exposure to Sun	
MECHANICAL DATA		
DIAMETER WITH TOLERANCE	Over Inner Sheath	
	Over Armour	
	Overall	
Weight Of Cables Per KM		
Minimum Bending Radius		
Maximum Pulling Tension		
Standard Drum Length		
Tolerance On Drum Length		

Note:

- Completely filled in Technical Particulars Sheet for each type & size of cable shall be furnished after award of order for owner/consultant approval before commencement of manufacturing in line with NIT/Contract.

TECHNICAL SPECIFICATION

SHEET STEEL DISTRIBUTION BOARDS

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	SERVICE CONDITIONS
4.0	OPERATING REQUIREMENTS
5.0	DESIGN AND CONSTRUCTIONAL FEATURES
6.0	COMPONENT DETAILS
7.0	ACCESSORIES
8.0	PAINTING
9.0	TESTS AND INSPECTION
10.0	DRAWINGS AND DOCUMENTS
11.0	SPARES
12.0	PACKING
ANNEXURE - I	DOCUMENTATION FOR SHEET STEEL DISTRIBUTION BOARDS

1.0 SCOPE

1.1 This standard covers the technical requirements of design, manufacture, testing at works and delivery in well-packed condition of Sheet Steel Distribution Boards.

1.2 This standard shall be read in conjunction with relevant part of Design Philosophy – Electrical.

2.0 STANDARDS TO BE FOLLOWED

2.1 The design, manufacture and testing of the equipment shall comply with the latest issue of the following Indian Standards, unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

IS: 8623	-	Specification for low voltage switchgear and control gear assemblies.
IS/IEC:60947	-	Specification for Low-voltage Switchgear and Control gear
IS: 5578	-	Guide for marking of insulated conductors.
IS: 11353	-	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS: 10118	-	Code of practice for selection, installation and maintenance of switchgear and control gear.

Various components housed in the distribution board shall conform to the Indian Standard Specification as mentioned against the component details.

2.2 The design and operational features of the equipment offered shall also comply with the provisions of the latest issue of the Indian Electricity Rules and other Statutory Acts and Regulations. The supplier shall, wherever necessary, make suitable modifications in the equipment to comply with the above.

2.3 Wherever any requirement, laid down in this standard, differs from that in Indian Standard Specification the requirement specified herein shall prevail.

3.0 SERVICE CONDITIONS

3.1 **Ambient Conditions**

These shall be as indicated in Design Philosophy – Electrical.

3.2 **System Details**

These shall be as indicated in Design Philosophy – Electrical.

4.0 OPERATING REQUIREMENTS

The distribution board shall be suitable for operating at the specified rating continuously with the specified voltage and frequency variations under the ambient conditions, without exceeding the permissible temperature rise and without any detrimental effect on any part.

5.0 DESIGN AND CONSTRUCTIONAL FEATURES

5.1 **General**

5.1.1 The distribution board shall consist of an assembly of a series of floor mounting, identical, metal clad, dead front type panels of unitized design. The panels shall be placed side by side to form a compact assembly and shall be extensible on either side.

5.1.2 The complete assembly shall be dust, damp and vermin proof having minimum degree of protection equivalent to IP-52 as per IS/IEC:60947.

5.1.3 The frame work of the cubicles shall be of bolted/welded construction. The minimum thickness of steel shall be 2 mm for load bearing members, 1.6 mm for non-load bearing

members and 3 mm for base channel. The doors and covers shall be fabricated from cold rolled sheet steel. Suitable reinforcement, wherever necessary, shall be provided.

5.1.4 The door hinges shall be concealed type.

5.1.5 All external hardware shall be cadmium plated/zinc passivated. The hardware for fixing the removable parts shall be provided with retaining devices.

5.1.6 The doors and the removable covers shall be provided with non-deteriorating neoprene gaskets. Gaskets without any discontinuity shall be preferred. Gaskets shall be held in position in groove of shaped sheet steel work or these shall be of U type. Adhesive cement, if used, shall be of good quality so that the gaskets do not come off during service.

5.1.7 All the components shall be accessible for inspection and maintenance without the necessity for removal of the adjacent ones. In case of single front design all components shall be accessible from the front for maintenance and back opening doors/ openable covers for maintenance shall not be acceptable.

5.1.8 The layout of the components inside a module shall be liberal to facilitate maintenance and the interconnection of wiring between the components shall not be subjected to any undue stress at the bends.

5.1.9 Mounting height of components requiring operation and observation shall not be lower than 300 mm and higher than 1800 mm.

5.1.10 Inter panel barriers shall be provided.

5.1.11 Adequate arrangement for earthing shall be provided to safeguard the operator or other personnel from electric hazards under all conditions of operation.

5.2 Panel Arrangement

5.2.1 The distribution board shall be non-drawout type in single front configuration.

5.2.2 Each Panel shall have its horizontal bus-bar chamber running on the top with multi-tier module units in the centre and having vertical bus-bar chamber and cable alley on either side.

5.2.3 The modules shall be enclosed on all sides and shall be so arranged that larger ones are placed at the bottom portion of the panel. Fixed type modules shall be at least 300 mm from the base channel.

5.2.4 The number of modules in the panel shall not exceed six for motor starter feeders and eight for switch fuse/MCB/MCCB feeders. The minimum size of module shall be 300 mm and 200 mm for starter and switch fuse feeders. The incomer and bus coupler module sizes for ratings up to 400 A shall be half the panel size. For higher ratings they shall be housed in single panel.

5.2.5 The module door shall be so interlocked that it shall not be possible to open the door with switch in closed position. Defeat interlock facility shall be provided.

5.2.6 The relay, meters, switches and lamps shall be flush mounted. All components of one module shall be mounted on the same module on a rigid sheet steel chassis. A 20 mm dia. rotating knob on the door shall be provided for closing and opening.

5.3 Bus Bars and Connections

5.3.1 The bus-bar shall be suitable for the supply system. The bus-bar and connections shall be made of electrolytic copper or high conductivity aluminium alloy conforming to Grade E91E of IS: 5082.

5.3.2 The bus-bar shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding the temperature of 90ºC. The bus-bars shall also be designed to withstand the system fault current for 1 second without

exceeding the temperature of 200ºC for bare aluminium and 250ºC for bare copper. The minimum acceptable size of bus-bars shall be 250 sq. mm (Al). Calculation for the bus-bar sizing shall be furnished along with the offer.

5.3.3 In case of double front arrangement of distribution boards, different sets of vertical bus-bars shall be provided. The vertical bus-bars shall be PVC sleeved or shrouded by insulating barriers which shall have cut-outs to permit entry of power wires. It shall be possible to remove the shroud for inspection and maintenance. Neutral-bars shall be provided in this chamber.

5.3.4 Horizontal bus-bars shall be of same cross-section through out. Stepped bus-bars shall not be acceptable.

5.3.5 All bus-bars shall be arranged and colours coded according to IS: 5578/11353.

5.3.6 The horizontal bus-bar shall run in a separate bus chamber located at the top shall have separate screwed cover for inspection purpose.

5.3.7 The bus-bars shall be rigidly supported at equal intervals to withstand maximum short circuit stresses. The supports shall be of moulded construction with built in anti tracking barriers. The support material shall be of fibre glass reinforced thermosetting plastic.

5.3.8 All joints shall be suitably treated to avoid oxidation of contact surfaces and bimetallic corrosion. A minimum of two bolts with spring washers shall be used for horizontal bus-bar joints.

5.3.9 Horizontal bus bars shall be insulated with heat shrinkable PVC sleeves of reputed makes. Insulating shrouds shall be provided for all joints of insulated bus-bars.

5.4 Clearance and Creepage Distances

5.4.1 The clearance and creepage distances shall not be lower than the values specified below :

i)	Minimum clearance between two live conductors	--	20 mm
ii)	Minimum clearance between live part and accidentally dangerous part	--	20 mm
iii)	Minimum creepage distance	--	28 mm

5.4.2 The clearances and the creepage, as specified above, shall definitely be maintained in the bus-bar system. Provision of bus-bar insulations, separator or barriers shall not be considered to reduce the clearance from the values specified above.

5.4.3 At the termination points in the equipment, e.g. switches, contactors, thermal relays, etc. it is realized that above clearance shall not always be possible to be maintained. All such points where above clearance are not possible to be maintained shall, therefore, be insulated or taped.

5.5 Insulation

5.5.1 The insulation used shall be non-hygroscopic and shall be of porcelain, Epoxy- resins or fibre glass moulded with plastic. It shall be of adequate electrical and mechanical strength to give trouble free service during normal operation and short circuit conditions.

5.5.2 The insulation shall be treated suitably to withstand the tropical conditions and atmospheric pollution.

5.6 Power Wiring

5.6.1 The connections from bus-bar including neutral to individual units on the modules shall consist of PVC insulated flexible copper cable or tapped copper strip.

5.6.2 The power wiring size shall be decided based on the rating of the switch, after using a rating factor of not more than 50% over the current rating in free air. In any case the minimum size of power wiring shall not be less than 4 sq. mm copper.

5.6.3 The size of connection from incomer to horizontal bus-bar and from horizontal bus-bar to bus coupler shall not be less than the size adopted for horizontal bus-bar.

5.7 **Control Wiring**

5.7.1 The switch board shall be completely factory wired and ready for external connections.

5.7.2 The wiring shall be carried out with flexible stranded PVC insulated copper conductor cables of 1100 Volt grade. The size of wires shall be as follows:

C.T. Circuit	--	2.5 sq. mm
V.T. and Control Circuits	--	1.5 sq. mm

5.7.3 All wiring shall be provided with dependent both end marking as per IS: 5578. Numbered ferrules, reading from the terminals outwards, shall be provided at both ends of all wiring for easy identification. These shall be interlocking type plastic ferrules.

5.7.4 Control wiring circuits, fed from a supply common to a number of feeders, shall be so protected that failure of a circuit in one feeder does not affect the operation of the other feeders.

5.7.5 The wiring to the equipment mounted on the doors shall be carried out with flexible multi strand copper conductor cable and supported so that opening of the door, there is no undue strain on wire leads.

5.7.6 The control cables shall be neatly arranged and properly supported.

5.8 **External Cable Termination**

5.8.1 All power and control cables shall enter the distribution board from the bottom. Sufficient space shall be provided for ease of connection and termination of cables.

5.8.2 All cables shall be of 1.1 KV grade PVC insulated armoured and PVC sheathed except for single core cable which shall be unarmoured. The number and sizes of cable shall be as indicated in Feeder details.

5.8.3 Compression type cable glands along with the cable lugs as required shall be provided for termination of cables.

5.8.4 The cable glands shall be of rolled Aluminium heavy duty double compression type and shall be mounted on a removable gland plate, provided at a minimum height of 75 mm from the bottom of the distribution board. Two numbers spare knockouts of size 20 mm shall also be provided on the gland plates for future use.

5.8.5 For all power cables crimped type aluminium lugs for aluminium cables and tinned copper lugs for copper cables shall be provided.

5.8.6 The terminal blocks shall be pressure clamp type up to 35 sq. mm cable and bolted lug type for higher sizes of cables. These shall be protected type and rated for 1100 Volts service. The minimum current rating of terminal block shall be 16 Amp. The construction shall be such that after the connection of cables by means of lugs, necessary clearance and creepage distance are available.

5.8.7 Where more than two cables in parallel are required to be terminated, a system of bus links shall be provided with adequate clearance and spacing.

5.8.8 Suitable clamps to support the vertical run of cables shall be provided.

5.8.9 The terminal block shall be grouped according to circuit functions and suitably numbered. 20% extra terminals shall be provided in the terminal block.

5.8.10 For power connections, suitable marking on the terminals shall be provided to identify the phases.

5.9 **Feeder Details**

5.9.1 The requirements of incomer, bus coupler and outgoing feeders shall be as indicated in the single line diagram, feeder details and corresponding schematic diagram.

5.9.2 The bus coupler shall be so located that it is possible to maintain half of the bus-bars while the other half is still alive. Complete segregation of bus-bar connections to bus coupler shall be provided.

5.9.3 Castle key type mechanical interlocks shall be provided between incomers and bus section modules to avoid paralleling of incomers. In addition padlocking facilities shall be provided in OFF position.

5.9.4 Single phase loads shall be distributed as far as possible on all the three phases.

6.0 COMPONENT DETAILS

The components shall conform to type of co-ordination C as per IS/IEC:60947. Makes of all components shall be subject to owner's / consultant's approval

6.1 **Moulded Case Circuit Breakers**

6.1.1 The circuit breaker shall conform to IS/IEC:60947 and shall be of P2 category having rupturing capacity as per system requirement.

6.1.2 The circuit breaker shall be provided with spring assisted quick make quick break type manually operated trip free mechanism, mechanical ON/OFF position indicators, thermal tripping devices of inverse characteristics, instantaneous short circuit tripping devices and necessary auxiliary and alarm switches. The MCCB cubicle shall be provided with service, test and isolated position and automatic safety shutter.

6.1.3 The thermal and short circuit tripping device shall be adjustable type.

6.1.4 When used for motor circuit shunt trip devices shall be provided and the let through power of controlling MCCB shall be lower than the respective contactor.

6.1.5 In addition, under voltage trip shall be provided, if specified.

6.2 **Switches**

6.2.1 The switches shall be Motor duty type AC23 category and shall comply with the requirements laid down in IS/IEC:60947. Switches up to 63 Amps shall be rotary type and those of 100 Amp and above shall be link type.

6.2.2 'ON' and 'OFF' positions of the switches shall be indicated on the panel. Provision shall be made to lock the switch in the 'OFF' position.

6.2.3 The fixed contacts shall be shrouded and the contacts shall be silver plated.

6.2.4 Two Pole switches shall also isolate the neutral circuit along with phase circuit.
4 Pole / 2 Pole switches shall be used for 3 Phase/1 Phase circuits respectively.

6.3 **Fuses**

The fuses shall be of non-deteriorating HRC cartridge link type and conform to IS: 13703. They shall be suitable for the load and the service required in the circuit.

6.4 **Air Break Contactors**

6.4.1 The Air Break Contactor shall be of AC3 category unless otherwise specified, conforming to IS/IEC:60947 and flapper type. Gravity operated contactors are not acceptable.

6.4.2 The dropout voltage shall not exceed 65% of rated voltage.

6.4.3 Each contactor shall be provided with auxiliary contacts as required. The rating of the auxiliary contacts shall be 5 Amps. AC or 1 Amp DC at the specified control voltages. The spare auxiliary contacts shall also be wired terminal block.

6.5 **Bimetal Thermal Overload Relays**

6.5.1 The contactor shall be provided with three pole bimetal thermal overload relays unless otherwise specified. The bimetal relays shall be of suitable range, ambient temperature compensated and shall be separate mounting type. They shall be adjustable through graduated scale and shall be provided with changeover contact.

6.5.2 Bimetal relays shall conform to IS: 3231 and shall have built in single phasing preventor.

6.5.3 The bimetal relays shall be provided with a manual reset device resetable after opening the cubicle door. Auto reset thermal relays are not acceptable.

6.6 **Current Transformers**

6.6.1 The current transformers shall conform to IS: 2705.

6.6.2 Current Transformers shall be Class-F insulated and vacuum impregnated. The Current Transformers shall be rigidly mounted and shall be easily accessible for maintenance and testing.

6.6.3 The Current Transformers shall be of 7.5 VA output. The output shall be adequate for the instrument and metering duties involved with sufficient margin. The Current Transformers shall have the accuracy Class-1 for the metering duty.

6.6.4 All the Current Transformers shall be provided with terminals and shorting links. One of the terminals of C.T. shall be earthed. The polarity of the C.T. shall be clearly marked.

6.6.5 The C.T.s shall be capable of withstanding momentary open-circuit on the secondary side without injurious effects.

6.7 **Instruments and Meters**

6.7.1 All instruments shall be flush mounting type with square face and shall be tropicalized and dust tight.

6.7.2 The size of the instruments shall be 96 mm x 96 mm for full and half size modules and 72 mm x 72 mm for lower size modules.

6.7.3 Dials shall be parallax free with scale marked in black on white background and shall be suitable for direct reading.

6.7.4 Zero adjusters shall be provided for operation from the front of the cases.

6.7.5 All ammeters and voltmeters shall have 0 - 240º scale moving iron spring controlled type and of Class 1.5 accuracy as per IS: 1248. The scale range of the ammeter and voltmeter shall be as indicated in the feeder details.

6.7.6 In case of motor feeders, the ammeter shall be graduated uniformly upto C.T. primary current and with a compressed end scale upto 6 times the C.T. primary current. Red pointer shall be provided, which can be adjusted at site for indicating full load current.

6.7.7 KWH meter shall be 3 phase 4 wire type. These shall conform to the requirements of relevant IS and shall be C.T. operated. The current coil shall be rated for 5 Amp.

6.7.8 All kWh meters shall be provided with test blocks for current and voltage coils for testing them at site without interrupting their recording while in service.

6.8 **Push Button and Control Switches**

6.8.1 The switches and push buttons shall conform to utilization category AC 11/DC 11 as per IS/IEC:60947 . The contact shall be rated to make, break and carry inductive current of 5 Amp. at 415 V AC and 1 Amp at 220 V DC.

6.8.2 The control switches shall be spring return rotary type unless otherwise specified and provided with pistol grip type handle. The control switches for circuit breakers shall be additionally fitted with lost motion devices and sequencing devices.

6.8.3 The selector switches shall be stay-put rotary type and provided with oval shape handles.

6.8.4 The push buttons shall be of momentary contact spring loaded type with a set of normally close and open contacts. The push button for 'Start' shall be shrouded type and coloured green, stop push button shall be un-shrouded type and coloured red and other push buttons shall be un-shrouded type coloured black. The fixing ring shall be metallic white.

6.8.5 Emergency stop push buttons, if specified, shall be lockable in pushed position.

6.9 **Miniature Circuit Breakers**

6.9.1 The miniature circuit breakers shall conform to IS: 13032 and shall be of duty category M-9.

6.9.2 It shall be provided with overload and short circuit protective devices in a heat resistant housing.

6.9.3 A certificate of short circuit rating and current time tripping curve shall be furnished alongwith the offer.

6.10 **Signal Lamps**

6.10.1 Signal lamps shall be provided to indicate the various circuit conditions as shown in scheme drawings. The colour of the lamps for various functions shall be as follows:

Red	--	Switch/Contactor closed.
Green	--	Switch/Contactor open.

6.10.2 The lamps shall be LED type having lumen output 200 milli candela in axial direction.

6.10.3 It shall be possible to remove the globe from outside for replacement of lamps.

7.0 ACCESSORIES

7.1 The supplier shall include the following accessories.

-- Fuse Puller.

-- Test plug for kWh meters.

7.2 **Space Heater**

Each vertical section shall be provided with a thermostatically controlled space heater, rated for 240 V, 50 Hz and controlled through double pole miniature circuit breaker.

7.3 **Name Plates**

7.3.1 The distribution board shall have large name plate on the top to indicate its name and designation.

7.3.2 Each feeder shall be provided with name plate. Each single front panel shall have name plate both in front and back.

7.3.3 All control switches, push buttons, lamps etc. shall have functional identification labels.

7.3.4 Name plate shall be of black perspex with white engraving and of minimum 3 mm thick.

7.3.5 Any other accessories required, but not specified shall also be supplied to make the distribution board complete in all respects to ensure safe and proper operation.

8.0 PAINTING

8.1 The enclosure after degreasing, pickling in acid, cold rinsing phosphatising, passivating etc. shall be painted with two coats of anti-rust paint followed by two coats of anticorrosive paint.

8.2 Epoxy based paint shall be used.

8.3 All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

8.4 Unless otherwise specified, the finishing shade shall be light grey Shade No.631 as per IS: 5.

8.5 One litre of paint shall be supplied along with each board for touch up at site.

9.0 TESTS AND INSPECTION

9.1 The distribution boards shall be subjected to routine test as per IS: 8623.

9.2 Additional tests, wherever specified, shall be carried out.

9.3 All the above tests shall be carried out in presence of purchaser's representative. In addition, the equipment shall be subjected to stage inspection during process of manufacture at works and site inspection.

9.4 These inspections shall however, not absolve the vendor from his responsibility for making good any defect which shall be noticed subsequently.

10.0 DRAWINGS AND DOCUMENTS

10.1 Drawings and documents as per Annexure-I shall be supplied unless otherwise specified.

10.2 All drawings and documents shall have the following description written boldly:

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

11.0 SPARES

11.1 Commissioning Spares: Commissioning spares, as required, shall be supplied with the main equipment. Item-wise list of recommended commissioning spares shall be furnished for information.

11.2 Spare for 2 Years Operation (Mandatory), as specified shall be supplied.

11.3 List of Recommend Spares (other than Mandatory Spares) alongwith recommended quantity and item-wise price shall be furnished.

11.4 All spare parts shall be identical to the parts used in the equipment.

12.0 PACKING

12.1 The distribution board shall be properly packed before despatch to avoid damage during transport, storage and handling.

12.2 The packing box shall contain a copy of the installation, operation and maintenance manual.

12.3 A sign to indicate the upright position of the panels to be placed during transport and storage shall be clearly marked. Also proper arrangement shall be provided to handle the equipment.

ANNEXURE - I

DOCUMENTATION FOR SHEET STEEL DISTRIBUTION BOARDS

Sl.No.	Documents	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Specification Sheet	N	Y	Y
2.	Technical Particulars	N	Y	Y
3.	Feeder Details	N	Y	Y
4.	General Arrangement and Foundation Drawings	N	Y	Y
5.	Schematic Diagrams with Terminal arrangement drawings	N	Y	Y
6.	Calculation for Bus-bar sizing	N	Y	N
7.	Illustrative and Descriptive literature	N	N	Y
8.	Catalogues for bought out accessories	N	N	Y
9.	Installation, Operation and Maintenance Manual	N	N	Y
10.	Test Certificates			
	-- Type (for MCCB & MCB)	N	N	N
	-- Routine	N	N	Y
11.	Guarantee Certificates	N	N	Y
12.	Spare Parts List	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION

LIGHTING SUB DISTRIBUTION BOARDS

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	SERVICE CONDITIONS
4.0	OPERATING REQUIREMENTS
5.0	GENERAL DESIGN AND CONSTRUCTIONAL FEATURES
6.0	SPECIAL FEATURES FOR FLAME PROOF LIGHTING SUB DISTRIBUTION BOARDS
7.0	COMPONENT DETAILS
8.0	PAINTING
9.0	TESTS AND INSPECTION
10.0	DRAWINGS AND DOCUMENTS
11.0	SPARES
12.0	PACKING
ANNEXURE - I	DOCUMENTATION FOR LIGHTING SUB DISTRIBUTION BOARDS

1.0 SCOPE

1.1 This standard covers the technical requirements of design, manufacture, testing at works and delivery in well packed condition of lighting sub distribution boards.

1.2 This standard shall be read in conjunction with relevant part of Design Philosophy - Electrical.

2.0 STANDARDS TO BE FOLLOWED

2.1 The design, manufacture and testing of the equipment covered by this standard shall comply with the latest issue of the following Indian Standards. Equipment complying with equivalent IEC standards shall also be acceptable

IS/IEC:60947	-	Low voltage switchgear and control gear
IS: 8623	-	Specification for low voltage switchgear and control gear assemblies

2.2 The design and operational features of the equipment offered shall also comply with the provisions of latest issue of the Indian Electricity Rules and other relevant statutory acts and regulations. The supplier shall, wherever necessary, make suitable modification in the equipment to comply with the above.

2.3 Wherever any requirement, laid down in this standard, differs from that in Indian Standard Specifications, the requirement specified herein shall prevail.

3.0 SERVICE CONDITIONS

3.1 **Ambient Conditions**

These shall be as indicated in Design Philosophy - Electrical.

3.2 **System Details**

These shall be as indicated in Design Philosophy - Electrical.

4.0 OPERATING REQUIREMENTS

The lighting sub-distribution boards shall be suitable for operating continuously under the ambient conditions and with the voltage and frequency variations, without exceeding the specified temperature rise and without any detrimental effect on any part.

5.0 GENERAL DESIGN AND CONSTRUCTIONAL FEATURES

5.1 The lighting sub distribution boards shall be fabricated out of 2.5 mm thick cold rolled sheet steel and shall be suitable for mounting on wall/structure. These shall have dust and vermin proof construction conforming to IP-65 as per IS/IEC:60947. For outdoor installation, the enclosure shall conform to IPW-55. Suitable canopy made out of 2 mm thick Aluminium sheet shall be supplied along with the board.

5.2 The miniature circuit breakers shall be so mounted inside the enclosure that their operating knobs project outside for easy operation. The cut-out for the knobs on the enclosure shall be lined with gasket for dust proofness. For further protection against ingress of dust, the portion where the knobs have protruded out, shall be provided with another external front cover, internally hinged at the top, gravity operated and with a knurled knob at the bottom. The external cover shall be flushed with the main cover. Continuous neoprene gasket shall be provided to make the board completely dust and weather proof.

5.3 All external hard ware of diameter less than 8 mm shall be of stainless steel and those of diameter 8 mm and above shall be of mild steel cadmium plated or zinc passivated.

5.4 The sub-distribution boards to be located indoors shall have top entry arrangement for outgoing cables and bottom entry for incoming cable. However for outdoor locations, all cable entries shall be from the bottom only.

5.5 Three phase and neutral bus bar system of adequate size shall be provided to which all outgoing and incoming MCB's shall be connected.

5.6 The internal wiring shall be carried out by means of single core PVC insulated 2.5 sq. mm stranded copper conductor cables.

5.7 Two earthing terminals outside the board shall be provided.

5.8 Suitable label inscription consisting of black perspex with engraving for the board and circuit nos. of all outgoing feeders shall be provided. The label inscription of the board shall contain description and code no. The circuit nos. of outgoing feeders shall be serially indicated as 1L, 2L.....17L, 18L.

5.9 The board shall be complete with terminal block, cable glands, cable lugs and other accessories as specified.

6.0 SPECIAL FEATURES FOR FLAME PROOF LIGHTING SUB DISTRIBUTION BOARDS

6.1 The enclosure shall be in addition of flame proof execution as per IS: 2148.

6.2 The enclosure group and temperature class shall be as indicated in Design Philosophy – Electrical.

6.3 The enclosure shall be of cast iron/cast Aluminium alloy (4600 as per IS: 617).

6.4 Cables shall enter the terminal chamber through flame proof compression type cable glands. From terminal chamber to the main enclosure connection shall be made through bushings. Direct entry of external cables into the main enclosure shall not be accepted.

6.5 The sub-distribution board shall be of 6 way type.

6.6 Individual earth terminals shall be provided for the earth conductor of the outgoing cables beside the phase and neutral terminals.

6.7 The sub-distribution board must be certified by Central Mining Research Institute, Dhanbad or other statutory authority for use in specified hazardous area.

7.0 COMPONENT DETAILS

7.1 The lighting sub-distribution board shall be wired and have components as per SD-8083 (copy attached).

7.2 **Miniature Circuit Breaker (MCB)**

The MCB shall be of duty category M-9 and shall conform to IS/IEC:60898-1:2002. It shall be provided with overload and short circuit protective devices. MCB shall be of C Curve Type.

7.2.1 The incoming MCB's or switches shall be of triple pole and switched neutral type and outgoing MCB's of single pole and switched neutral type, single phase earth leakage protection in each phase of the incomer shall be provided.

7.3 **Terminal Block**

Pressure clamp type terminal blocks shall be provided both for incoming and outgoing cables. The rating of the terminal block shall be at least 1.5 times the rating of the MCB.

7.4 **Cable Glands**

Heavy duty double compression type Aluminium cable glands suitable for PVC insulated, armoured and PVC sheathed 1.1 KV grade incoming and outgoing cables shall be provided.

8.0 PAINTING

8.1 The enclosure after suitable pre-treatment shall be painted with two coats of anti rust paint followed by two coats or anticorrosive paint.

8.2 Epoxy based paint shall be used.

8.3 All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

8.4 The finishing shade shall be light grey shade no.631 as per IS: 5.

9.0 TESTS AND INSPECTION

9.1 All the lighting sub-distribution boards shall be subjected to routine tests as per IS: 8623.

9.2 Additional tests, wherever specified, shall be carried out on one lighting sub-distribution board of each type.

9.3 The above mentioned tests shall be carried out in the manufacturer's works in the presence of purchaser's representative. In addition, the equipment shall be subjected to stage inspection at works and inspection at site for final acceptance.

9.4 The purchaser's inspection shall, however, not absolve the vendor from his responsibility for making good any defects which may be noticed subsequently.

10.0 DRAWINGS AND DOCUMENTS

10.1 Drawings and documents as per Annexure-I shall be supplied, unless otherwise specified.

10.2 All drawings and documents shall have the following description written boldly.

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

11.0 SPARES

11.1 Commissioning Spares: Commissioning spares, as required, shall be supplied with the main equipment. Item-wise list of recommended commissioning spares shall be furnished for information.

11.2 Spare for 2 Years Operation (Mandatory), as specified shall be supplied.

11.3 List of Recommend Spares (other than Mandatory Spares) alongwith recommended quantity and item-wise price shall be furnished.

11.4 All spare parts shall be identical to the parts used in the equipment.

12.0 PACKING

12.1 The equipment shall be properly packed to safeguard against weather conditions and handling during transit. It shall be wrapped in polythene bags and an additional wrapping of bitumen paper shall also be provided to make it completely water proof before the equipment is packed in wooden crates.

12.2 The packing box shall contain a copy of the installation, operation and maintenance manual.

ANNEXURE - I

DOCUMENTATION FOR LIGHTING SUB DISTRIBUTION BOARDS

SL.NO.	Description	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Specification Sheet	N	Y	Y
2.	Technical particulars	N	Y	Y
3.	General arrangement Drgs.	N	Y	Y
4.	Certificate for flameproofness from statutory testing authority wherever applicable	N	N	Y
5.	Schematic diagram	N	Y	Y
6.	Descriptive literature of Various equipment	N	N	Y
7.	Guarantee certificate	N	N	Y
8.	Test certificate	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION

INTERLOCKING SWITCH SOCKET AND PLUG

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	SERVICE CONDITIONS
4.0	OPERATING REQUIREMENTS
5.0	GENERAL DESIGN AND CONSTRUCTIONAL FEATURES
6.0	SPECIAL FEATURES FOR FLAME PROOF SWITCH SOCKET AND PLUGS
7.0	COMPONENT DETAILS
8.0	PAINTING
9.0	TESTS AND INSPECTION
10.0	DRAWINGS AND DOCUMENTS
11.0	PACKING
12.0	SPARES
ANNEXURE - I	DOCUMENTATION FOR INTERLOCKING SWITCH SOCKET AND PLUG

1.0 SCOPE

1.1 The standard covers the technical requirements of design, manufacture, testing at works and delivery in well packed condition of interlocking switch socket and plug.

1.2 The standard shall be read in conjunction with relevant part of Design Philosophy - Electrical.

2.0 STANDARDS TO BE FOLLOWED

2.1 The design, manufacture and testing of the equipment covered by this standard shall comply with the latest issue of IS-4160/ IEC-309 and other relevant Indian Standards, unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

2.2 The design and operational features of the equipment offered shall also comply with the provisions of latest issue of Indian Electricity Rules and other statutory acts and regulations. The supplier shall, wherever necessary, make suitable modifications in the equipment to comply with the above.

2.3 Wherever any requirement, laid down in this standard differs from that in Indian Standard Specifications, the requirement specified herein shall prevail.

3.0 SERVICE CONDITIONS

3.1 **Ambient conditions**

These shall be as indicated in Design Philosophy - Electrical.

3.2 **System details**

These shall be as indicated in Design Philosophy - Electrical.

4.0 OPERATING REQUIREMENTS

The equipment shall be suitable for operating at the rated capacity continuously without exceeding the specified temperature rise and without any detrimental effect on any part.

5.0 GENERAL DESIGN AND CONSTRUCTIONAL FEATURES

5.1 The switch socket shall be heavy duty industrial type. The interlocking arrangement shall be such that it is not possible to insert or withdraw the plug with the switch in 'ON' position.

5.2 The switch sockets shall have dust, hose and weather proof construction conforming to IPW55 as per IS/IEC:60947 and shall be suitable for outdoor use without any extra protection. All jointing surfaces shall be smoothly machined and of sufficient width to prevent ingress or dust. Further the covers shall be provided with continuous gaskets made of neoprene to prevent ingress of dust and moisture.

5.3 The enclosure of switch sockets and plugs shall be of cast aluminium alloy 4600 and suitable for fixing on wall / structure.

5.4 The enclosure shall be largely dimensioned in order to avoid temperature rise inside it which may damage the insulating materials and gaskets employed therein.

5.5 The insulating materials used shall be non-hygroscopic, mould proof and treated with suitable varnish to withstand the ambient conditions.

5.6 All external hardware of diameter less than 8 mm shall be of stainless steel and those of diameter 8 mm or above shall be of mild steel cadmium plated or zinc passivated.

5.7 Suitable arrangement for looping of cables from one switch socket to the other shall be provided. For switch sockets rated above 63A, looping shall be done from busbars and

for switch sockets rated 63A and below, looping may be done from terminal block. Necessary terminals, cable glands and lugs for looping shall be provided. Also one no. The readed plug for each switch socket shall be supplied loose.

5.8 All the relevant information shall be provided on engraved name plate made of aluminium.

5.9 The enclosure shall be provided with two earthing terminals outside the body.

6.0 SPECIAL FEATURES FOR FLAME PROOF SWITCH SOCKET AND PLUGS

6.1 The enclosure shall be in addition of flame proof execution as per IS: 2148.

6.2 The enclosure group and temperature class shall be as indicated in Design Philosophy - Electrical.

6.3 Cable shall enter the terminal chamber through flame proof compression type cable glands. From the terminal to the main enclosure, the connection shall be made through proper bushings. Direct entry of external cables into the main enclosure shall not be accepted.

6.4 An additional earthing terminal inside the terminal chamber shall be provided.

6.5 Switch socket, plug and cable glands must be certified by the Central Mining Research Institute, Dhanbad or any other statutory authority for use in the specified hazardous area.

6.6 Further interlocking shall be provided so that the contacts cannot be energised when the plug and socket are separated.

7.0 COMPONENT DETAILS

Makes of all components shall be subject to owner's / consultant's approval

7.1 Air Break Switches

7.1.1 The switches shall be quick make, quick break rotary type and of utilisation category AC-23 as per IS/IEC:60947.

7.1.2 Switches shall be hand operated from outside the cover. The switch handle shall remain fixed to the front cover while removing the front cover.

7.2 H.R.C. Fuses

7.2.1 The sockets shall be provided with link type HRC fuses.

7.2.2 The fuses shall be capable of withstanding a short circuit current of 50 KA and shall be delayed action type conforming to IS: 13703. These shall be mounted on a shrouded base.

7.3 Socket Outlets

7.3.1 The socket outlet shall be located in the lower part of the enclosure and shall be provided with a threaded aluminium cover attached to the body with G.I. chain, to protect the socket after extraction of the plug. Spring loaded automatic shutter shall not be acceptable.

7.3.2 The socket contacts shall maintain satisfactory spring pressure and contact with the corresponding plug under normal service conditions.

7.3.3 The socket contacts shall be sunk well below the surface of the socket- outlets so as to make it impossible to be touched unintentionally.

7.3.4 An earthing contact shall be provided in the socket outlet which shall ensure making and breaking respectively of its contact with the earthing pin of the plug before and after making and breaking of the corresponding current carrying contacts.

7.4 **Plugs**

7.4.1 The plugs shall be so constructed so that these can be easily fitted in to the socket outlets.

7.4.2 These shall be provided with knurled knob arrangement for screwing on the body of the socket so that it can be securely fixed on the top.

7.4.3 The plug base and cover shall be firmly secured to each other and shall be sufficiently robust in construction to withstand normal usage.

7.4.4 The plug pins shall preferably be of single part. The earthing pin shall be slotted with a single slot and shall be larger in dimension than other pins.

7.4.5 The plug and socket contacts shall be self aligning type with best electrical continuity.

7.4.6 The plug shall be provided with dust proof cable entry suitable for receiving TRS flexible heavy duty copper conductor cable of specified size. The arrangement shall be such that the conductors are relieved from strain including twisting where they are connected to the terminals and that the outer surface of the cable at the place of entry is not damaged.

7.4.7 Insulating barriers forming an integral part of the plug shall ensure separation of metals and bare flexible conductors at different potentials.

7.5 **Cable Termination**

7.5.1 Switch socket shall have cable termination arrangement on the upper part of the housing and shall be provided with side entries, one on either side, through heavy duty double compression type rolled aluminium cable glands suitable for 1.1 KV grade PVC insulated armoured and PVC sheathed cables of size.

7.5.2 The terminal blocks shall be pressure clamp type for switch socket rated up to 63A and bolted lug type for higher ratings. The terminals shall be rated for at least 1.5 times the switch rating.

8.0 PAINTING

8.1 The enclosure after suitable pre-treatment shall be painted with two coats of anti-rust paint followed by two coats of anti-corrosive paint.

8.2 Epoxy based paint shall be used.

8.3 All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

8.4 The finishing shade shall be light grey shade no.631 as per IS: 5, unless specified otherwise.

9.0 TESTS AND INSPECTION

9.1 The switch sockets and plugs shall be subjected to routine tests as per IS-4160 and other relevant standards.

9.2 Wherever specified, additional tests shall be carried out on one switch socket and plug of each rating.

9.3 The tests shall be carried out in the manufacturer’s works in the presence of purchaser’s representative. In addition to the above tests, the equipment shall be subject to stage inspection at works and inspection at site for final acceptance.

9.4 These inspections shall, however, not absolve the vendor from their responsibility for making good any defect which may be noticed subsequently.

10.0 DRAWINGS AND DOCUMENTS

10.1 Drawings and documents as per Annexure-I shall be supplied, unless otherwise specified.

10.2 All drawings and documents shall have the following descriptions written boldly.

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

11.0 PACKING

11.1 The switch socket and plug shall be properly packed to safeguard against weather conditions and handling during transit. It shall be wrapped in polythene bags and an additional wrapping of bitumen paper shall also be provided to make it completely water proof before the equipment is packed in wooden crates.

11.2 The packing box shall contain a copy of the installation, operation and maintenance manual.

12.0 SPARES

12.1 Commissioning Spares: Commissioning spares, as required, shall be supplied with the main equipment. Item-wise list of recommended commissioning spares shall be furnished for information.

12.2 Spare for 2 Years Operation (Mandatory), as specified shall be supplied.

12.3 List of Recommend Spares (other than Mandatory Spares) alongwith recommended quantity and item-wise price shall be furnished.

12.4 All spare parts shall be identical to the parts used in the equipment.

ANNEXURE – I

DOCUMENTATION FOR INTERLOCKING SWITCH SOCKET AND PLUG

Sl.No.	Description	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Specification Sheet	N	Y	Y
2.	Technical Particulars	N	Y	Y
3.	General arrangement and foundation drawing	N	Y	Y
4.	Schematic / wiring diagram	N	Y	Y
5.	Illustrative and descriptive literature	N	N	Y
6.	Catalogue for bought out accessories	N	N	Y
7.	Installation operation and maintenance manual	N	N	Y
8.	Test Certificates			
	a) Type	N	N	Y
	b) Routine	N	N	Y
9.	Guarantee Certificate	N	N	Y
10.	Certificate of flameproofness from statutory testing authority wherever applicable.	N	N	Y
11.	Spare parts list with identification marks	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION

CABLES

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	SERVICE CONDITIONS
4.0	OPERATING REQUIREMENTS
5.0	GENERAL DESIGN AND CONSTRUCTIONAL FEATURES
6.0	SPECIAL PURPOSE CABLES
7.0	CABLE DRUM
8.0	TESTS AND INSPECTION
9.0	DRAWINGS AND DOCUMENTS
ANNEXURE - I	DOCUMENTATION FOR CABLES

1.0 SCOPE

1.1 This standard covers the technical requirements of design, manufacture, testing at works and dispatch in well packed condition of power and control cables.

1.2 The standard shall be read in conjunction with relevant part of Design Philosophy - Electrical and other relevant references as specified therein.

2.0 STANDARDS TO BE FOLLOWED

2.1 The design, manufacture and testing of cables covered by this standard shall comply with the latest issue of following Indian Standards, unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

IS: 1554 Part (I)	--	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100 volts.
IS: 1554 Part (II)	--	PVC insulated (heavy duty) electric cables for working voltages from 3.3 KV upto and including 11 KV.
IS: 7098 Part (I)	--	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100 volts.
IS: 7098 Part (II)	--	Cross linked polyethylene insulated PVC sheathed cables for working voltages from 3.3 KV upto and including 33 KV
IS: 694	--	PVC insulated cables for working voltages upto and including 1100 volts
IS: 5831	--	PVC insulation and sheath of electric cables

2.2 The design and operational features of the cables offered shall also comply with the provisions of latest issue of the Indian Electricity Rules and other relevant Statutory Rules & Regulations. The supplier shall, whenever necessary, make suitable modification in the cables to comply with the above mentioned rules.

2.3 Wherever any requirement, laid down in this standard, differs from that in Indian Standard Specifications, the requirement specified herein shall prevail.

3.0 SERVICE CONDITIONS

3.1 Ambient Conditions

These shall be as indicated elsewhere in Design Philosophy - Electrical.

3.2 System Details

These shall be as indicated elsewhere in Design Philosophy - Electrical.

4.0 OPERATING REQUIREMENTS

The cables shall be suitable for operating continuously at the rated capacity as specified in relevant I.S. under the ambient conditions without exceeding the permissible temperature rise and without any detrimental effect on any part.

5.0 GENERAL DESIGN AND CONSTRUCTIONAL FEATURES

5.1 The design, manufacture and workmanship of cables shall be in accordance with the latest practice.

5.2 All materials to be used shall be new, unused and of the best quality.

5.3 **Conductors**

The power cables shall be of stranded Aluminium / copper round or shaped conductors and control cables shall be of annealed high conductivity stranded copper round conductors. The conductors shall comply with the requirements of IS: 8130.

5.4 **Insulation**

The conductor insulation shall be XLPE and shall comply with relevant IS.

5.5 **Fillers**

The cables shall have suitable fillers wherever required, laid up with conductors to provide substantially circular cross section before the inner sheath is applied.

5.6 **Inner Sheath**

Inner sheath, wherever applicable shall be ST1/ ST2 type compound applied by extrusion process except for paper cables for which it shall be of lead or lead alloy.

5.7 **Armouring**

All power and control cables shall be armoured. The single core cables shall be armoured with hard drawn Aluminium taps/ wires or any other suitable nonmagnetic material. All other cables shall have galvanized steel wire / strip armouring.

5.8 **Outer Sheath**

The outer sheath shall be ST1/ ST2 type compound applied by extrusion process and suitable to withstand atmospheric pollution, resistance to termites, fire retardant and coloured black.

5.9 **Screening**

Screening over conductor and insulation shall be provided as per relevant standard unless specified otherwise. The screening for control cables if specified shall be of aluminium, mylor or equivalent and provided with tinned drain wire which shall be continuous and permanently connected to the screen.

5.10 **Identification**

The individual cores of cables shall be coloured as per relevant IS. Where it is not possible to distinguish the cores by colour, coloured strip shall be applied on the cores or core nos. shall be marked on each core at regular intervals. All cables shall carry the manufacturer's name or trade mark, the cable size, voltage rating and year of manufacture at intervals not exceeding 100 meters. Running meter markings shall also be provided throughout the length of the cable.

5.11 **Dimension**

The overall dia. and dia. under armour of the cables shall be indicated by the vendor in the technical particulars. These shall be guaranteed with a tolerance of ± 5% but not exceeding 2 mm.

5.12 The cut ends of the cables shall be sealed by means of non-hygroscopic materials.

6.0 SPECIAL PURPOSE CABLES

6.1 **Flame Retardant Low Smoke Cables**

Flame retardant low smoke cables shall have outer sheath of PVC having following values.

- Minimum oxygen index - 29%
- Minimum temperature index - 250ºC

- Maximum acid gas generation - 20%
- Maximum smoke density rating - 60%

6.2 **Heat Resistant Cables**

Heat resistant cables shall be of silicon rubber insulated laid circular with asbestos worming and overall glass fibre braided and varnished. Silicon rubber insulating compound shall conform to IS: 6380 and the constructional features shall conform generally to IS: 9968.

7.0 CABLE DRUM

7.1 The cables shall be supplied in non-returnable wooden drums (or steel drums if specified) of heavy construction. The wood used for construction of the drums shall be properly seasoned, sound and free from defects.

7.2 Cables shall be supplied in specified drum lengths. Where no such indication is given, standard drum lengths may be offered.

7.3 The tolerance on each drum of cable shall not exceed ± 2.5%. However, no negative tolerance on HV cables is acceptable.

7.4 All cable drums shall have stencilled data as per relevant IS as well as the purchaser's order no., item no. & drum no.

8.0 TESTS AND INSPECTION

8.1 The following tests shall be carried out on the cables as per relevant IS.

i) Routine Tests - On all cables
ii) Acceptance tests - On representative length of each size
iii) Type tests - Wherever specified on one cable drum of each size

8.2 In addition, the following tests shall be carried out on all fire retardant low smoke cables as per IS or as per the following standards:

i) Oxygen and temperature index test as per ASTM-D-2863
ii) Acid gas emission test as per IEC-754 Part-I
iii) Smoke density test as per ASTM-D-2843
iv) Flammability test as per IEC-332 Part-I or IS-10810

8.3 All the above mentioned tests shall be carried out in the presence of purchaser's representative. In addition, the cables shall be subjected to stage inspection at works and inspection at site for final acceptance.

8.4 These tests and inspections shall, however, not absolve the vendor from their responsibility for making good any defect which may be noticed subsequently.

9.0 DRAWINGS AND DOCUMENTS

9.1 Drawings and documents as per Annexure-I shall be supplied, unless otherwise specified.

9.2 All drawings and documents shall have the following descriptions written boldly.

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

ANNEXURE - I

DOCUMENTATION FOR CABLES

Sl. No.	Document Description	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Specification Sheet	N	Y	Y
2.	Technical Particulars	N	Y	Y
3.	Illustrative and Descriptive catalogues	N	N	Y
4.	Installation, Termination and Jointing Instructions	N	N	Y
5.	Test certificates			
	a) Routine	N	N	Y
	b) Type	N	N	Y
6.	Guarantee Certificates	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION

PREFABRICATED LADDER TYPE CABLE RACKS

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	GENERAL DESIGN AND CONSTRUCTIONAL FEATURES
4.0	MARKING
5.0	TESTS AND INSPECTION
6.0	DRAWINGS AND DOCUMENTS
ANNEXURE - I	DOCUMENTATION FOR PREFABRICATED LADDER TYPE CABLE RACKS

1.0 SCOPE

1.1 This standard covers the technical requirements of design, fabrication, testing at works and delivery in well-packed condition of prefabricated ladder type cable racks.

1.2 The standard shall be read in conjunction with Drawing Nos. PDS: E 530 to 538 (9 Sheets).

2.0 STANDARDS TO BE FOLLOWED

2.1 The design, manufacture and testing of the cable racks covered by this standard shall comply with the latest issue of following and other relevant Indian Standards, unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

IS: 733	--	Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purposes
IS: 2629	--	Recommended practice for hot dip galvanising on iron and steel
IS: 4759	--	Hot dip zinc coatings on structural steel and other allied products

2.2 Wherever any requirement, laid down in this standard, differs from that in Indian Standard Specifications, the requirement specified herein shall prevail.

3.0 GENERAL DESIGN AND CONSTRUCTIONAL FEATURES

3.1 Ladder type cable racks shall be fabricated as per attached Drawing Nos. PDS: E 530 to PDS: E 538 (9 Sheets).

3.2 Cable racks and accessories such as coupler plate, tees, bend, elbows etc. shall be fabricated from 3 mm thick mild steel galvanised sheet or 4 mm thick aluminium 19000 H2 alloy sheet extrusion conforming to designation No. 64430 and condition WP as per IS: 733.

3.3 G.I. racks and accessories shall have zinc coating of 800 gm/sq. metre applied by hot dip galvanising process. Galvanising shall be uniform, adherent, smooth and free from defects.

3.4 The finished rack and accessories shall be free from sharp edges and corners, burrs and un-evenness. Stepped arrangement of bending is not acceptable. The channel members in the bending shall have uniform curvature and shall be made out of single piece.

3.5 The racks shall be supplied in minimum length of 2.4 metre.

3.6 Each straight length and bend shall be supplied with two coupling plates fitted at each side channel at one end. The coupling plates shall be supplied with bolts, nuts and washers fitted at the other four holes for fixing to adjoining member.

3.7 Coupling plate shall be designed to permit longitudinal adjustment upto ± 10 mm and skew upto 10^{o}.

3.8 Clamping arrangement as per attached drawings shall be provided for fixing the rack with the cross support as required.

3.9 All the bends, tees and junctions shall be made sufficiently rigid by providing suitable reinforcement on rungs as required.

3.10 The rungs shall be connected to the side channels by continuous welding alongwith three sides of rung. Aluminium rack shall be welded by TIG welding process.

3.11 All hard wares such as nuts, bolts, washers and crank bolts shall be cadmium plated.

3.12 Tolerances in various dimension shall be follows:

Length	--	± 5 mm
Width	--	± 2 mm
Height	--	± 1 mm
Bend	--	± 1 mm
Thickness	--	± 0.2 mm

Positive tolerance on total quantity upto ± 5% is acceptable. However, negative tolerance on total quantity is not acceptable.

4.0 MARKING

The packing shall be clearly marked on the outside (on top side & ends) in indelible ink with the following minimum details:

-- Part No.

-- Size of Tray (Length x Width x Height)

-- No. of Tray / Section, Total Weight

-- Material Specification

-- Client's Name

-- Purchase Order No.

-- Manufacturer's Name

5.0 TESTS AND INSPECTION

5.1 Following tests shall be carried out on prefabricated cable racks:

Visual inspection and checking for

i) Quality and thickness of raw material

ii) Dimensions as per drawing.

iii) Quality of welding (before galvanising for G.I. racks)

iv) Preparation of metal surfaces (for G.I. racks).

5.2 After galvanising, G.I. cable racks shall be subjected to following tests as per IS:4759.

i) Mass of galvanising coating -- At any location the thickness of zinc coating shall not be less than 90 micron. However, average thickness of zinc coating shall not be less than 113 micron.

ii) Uniformity of galvanising coating.

iii) Adhesion of galvanising coating.

iv) 3 samples from each lot shall be taken for testing.

v) From each lot and size of rack, measure length of 10 trays and average length to be multiplied by number of trays to arrive for total length.

5.3 All the above tests shall be carried out in the manufacturer's works in the presence of Purchaser's representative. In addition to the above tests, the cable racks and its accessories shall be subjected to stage inspection at works and inspection at site for final acceptance.

5.4 These tests and the Purchaser's inspection shall, however, not absolve the vendor from their responsibility for making good any defect which may be noticed subsequently.

6.0 DRAWINGS AND DOCUMENTS

6.1 Drawings and documents as per Annexure-I shall be supplied, unless otherwise specified.

6.2 All drawings and documents shall have the following descriptions written boldly.

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

ANNEXURE - I

DOCUMENTATION FOR PRE-FABRICATED LADDER TYPE CABLE RACKS

Sl. No.	Document Description	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Illustrative and Descriptive catalogues	N	N	Y
2.	Installation, Termination and Jointing Instructions	N	N	Y
3.	General Arrangement Drawings, showing details of rack, coupling pieces, fasteners, etc.	N	Y	Y
4.	Test certificates	N	N	Y
5.	Guarantee Certificates	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION

JUNCTION BOX

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	SCOPE
2.0	STANDARDS TO BE FOLLOWED
3.0	SERVICE CONDITIONS
4.0	GENERAL DESIGN & CONSTRUCTIONAL FEATURES
5.0	SPECIAL FEATURES FOR JUNCTION BOXES FOR HAZARDOUS AREA
6.0	PAINTING
7.0	TESTS & INSPECTION
8.0	PACKING
9.0	DRAWINGS AND DOCUMENTS
10.0	SPARES
ANNEXURE - I	DOCUMENTATION FOR JUNCTION BOXES

1.0 **SCOPE**

1.1 This standard covers the technical requirements of design, manufacture, testing and inspection at works and delivery in well packed condition of junction boxes.

1.2 This standard shall be read in conjunction with relevant part of Design Philosophy - Electrical and other relevant references as specified their in.

2.0 **STANDARDS TO BE FOLLOWED**

2.1 The design, manufacture and testing of the equipment covered by this standard shall comply with the latest issue of relevant Indian standards unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

2.2 Flameproof & increased safety junction boxes shall in addition, comply with the requirement as laid down in IS: 2148 & IS: 6381 respectively.

2.3 The design and constructional features of the junction boxes offered shall also comply with the provision of latest issue of the Indian Electricity Rules and other relevant Statutory Rules & Regulations. The supplier shall, whenever necessary, make suitable modification in the equipment to comply with the above mentioned rules.

2.4 Wherever any requirement laid down in this standard differs from that in Indian Standard specifications, the requirement specified herein shall prevail.

3.0 **SERVICE CONDITIONS**

3.1 **Ambient Conditions**

These shall be as indicated in Design Philosophy - Electrical.

3.2 **System Details**

The details of power supply system shall be as indicated in Design Philosophy – Electrical.

4.0 **GENERAL DESIGN & CONSTRUCTIONAL FEATURES**

4.1 The junction boxes shall be dust and weather proof and suitable for installation outdoors without extra protection. The degree of protection shall be IP-55 as per IS/IEC:60529.

4.2 The junction boxes shall be of die cast aluminium alloy LM-6 with domed / suspension covers.

4.3 The casting of the junction boxes and their cover shall be pressure die cast. The casting shall be uniform and free from blow holes. All mechanical surfaces shall be free from burrs, dents and internal roughness.

4.4 All external hardware of diameter less than 8 mm shall be of stainless steel and those of diameter 8 mm and above shall be of mild steel cadmium plated or zinc passivated. For fibre glass enclosure Nylon PVC bolts of diameter 8 mm may be used.

4.5 The clearances and creepage distances shall be maintained inside the junction boxes as per relevant Indian standard.

4.6 The junction boxes shall be suitable for wall / structure / ceiling mounting and necessary arrangement for mounting the same shall be provided.

4.7 The junction boxes shall be provided with continuous gasket made of neoprene or synthetic rubber to prevent ingress of dust. The gasket shall be held in position in groove provided in the enclosure and shall be pressed all around uniformly by suitably shaped projection of the door. Gaskets simply glued to the surface are not acceptable.

4.8 The junction boxes housing terminal block shall be moulded type made of DMC / Fibre glass. Threaded terminals shall be made of brass (nickel plated or tinned) and provided

with two tightening threaded nuts and four washers all made of brass (nickel plated or tinned). The terminals shall have two shorting links each horizontally placed connecting three terminals.

4.9 The terminal block shall be fitted with junction boxes base by means of 2 nos. 1/2" long nickel plated brass screws.

4.10 The junction boxes shall be provided with two nos. external earthing terminals and 1 no. internal earthing terminal.

4.11 All live parts inside the junction boxes shall be insulated and shall withstand a test voltage of 2.5 KV for 1 minute.

4.12 The junction boxes shall be provided with heavy duty double compression type rolled Al cable glands to suit the cable entries.

4.13 Threaded blanking plugs shall be provided for junction boxes to plug out the entries not in use as indicated in bill of quantities enclosed.

4.14 The junction boxes shall be provided with a blank stainless steel tag plate fastened to the junction box top cover with two stainless steel screws. The plate shall be at least 25 mm wide, 100 mm long and 1 mm thick.

4.15 For flameproof / increased safety junction boxes, the manufacturer shall submit copies of test certificates from statutory authorities clearly stating that the junction boxes as well as cable glands / blanking plugs are suitable for hazardous area.

4.16 **15 Amp. Junction Box**

4.16.1 The junction boxes shall be 4 way dome cover type.

4.16.2 The dimensions of the junction boxes with their cover and accessories shall be generally as per PDS: E-547.

4.16.3 The junction boxes housing terminal block shall be moulded type made of DMC / Fibre glass as per Drg. no. PDS: E-557.

4.17 **63 Amp. Junction Box**

4.17.1 The junction boxes shall be 3 / 4 way dome cover type.

4.17.2 The minimum internal diameter of the box shall be 240 mm.

5.0 SPECIAL FEATURES FOR JUNCTION BOXES FOR HAZARDOUS AREA

5.1 For increased safety junction boxes, the terminals shall be provided with positive locking device against loosening.

5.2 The enclosure shall be in addition, of increased safety execution, Exe, as per relevant standard and shall be suitable for installation in classified hazardous area.

5.3 The junction boxes shall be liberally dimensioned in order to avoid temperature rise inside the enclosure which may damage the insulating materials or gaskets employed therein.

5.4 Cables shall enter the terminal box through increased safety compression type cable glands. From the terminal chamber to the main enclosure, the connections shall be made through proper bushings.

5.5 An additional earthing terminal inside the terminal chamber shall be provided.

5.6 The junction boxes shall be provided with Brass-Nickel plated shorted links. The terminal block shall be made of non-hygroscopic compound. Bakelite / Hylam shall not acceptable.

5.7 All screws / bolts and nuts shall be of stainless steel.

5.8 Junction boxes and cable glands must be certified by Statutory Authorities for use in the specified hazardous area. Equipments certified by overseas authorities shall obtain certificate of compliance / letter of opinion from respective statutory authorities.

5.9 Type Test certificates for increased safety type junction boxes and cable glands along with blanking plugs shall be supplied.

6.0 PAINTING

6.1 Epoxy based electrostatic powder coating paint shall be provided on exterior surface while the interior of junction boxes shall be painted with anti-condensate paint. The painting shall be able to withstand corrosive atmosphere.

6.2 Unless otherwise specified, the finishing shade shall be grey having shade no. 632 as per IS-5.

6.3 The terminal block of junction boxes shall be painted with Red, Yellow, Blue & Black colour for phase indication.

7.0 TESTS AND INSPECTION

7.1 The junction boxes shall be routine tested as per relevant standards.

7.2 Additional tests, wherever specified, shall be carried out on one unit of each rating.

7.3 The procedure & extent of the physical checks, routine & type test shall be governed by Quality Assurance Plan mutually agreed and approved by Inspection Authority.

7.4 All the above mentioned tests shall be carried out in the presence of purchaser's representative. In addition, the equipment shall be subjected to stage inspection at works and inspection at site for final acceptance.

7.5 These inspections shall, however, not absolve the vendor from their responsibility for making good any defect which may be noticed subsequently.

8.0 PACKING

Each junction box and cable gland shall be suitably packed and protected from damage due to transportation, loading and unloading. Threaded fittings shall have plastic caps to protect the threading.

9.0 DRAWINGS AND DOCUMENTS

9.1 Drawings and documents as per Annexure-I shall be supplied, unless otherwise specified.

9.2 All drawings and documents shall have the following descriptions written boldly:

- Name of client
- Name of consultant
- Enquiry / order number with plant / project name
- Motor Code No. and Description

10.0 SPARES

10.1 Commissioning Spares : Commissioning spares, as required, shall be supplied with the main equipment. Item-wise list of recommended commissioning spares shall be furnished for information.

10.2 Spares for 2 Years Operation (Mandatory), as specified shall be supplied.

10.3 List of Recommend Spares (other than Mandatory Spares) alongwith recommended quantity and item-wise price shall be furnished.

10.4 All spare parts shall be identical to the parts used in the equipment.

ANNEXURE - I

DOCUMENTATION FOR JUNCTION BOXES

Sl. No.	Document Description	Documents Required (Y / N)		
		With Bid	For Approval	Final
1.	Specification Sheet	N	Y	Y
2.	Technical Particulars	N	Y	Y
3.	Certified dimensional drawing, including mounting details	N	Y	Y
4.	Drawing showing constructional details	N	Y	Y
5.	Illustrative and Descriptive catalogues	N	N	Y
6.	Spare parts list	N	N	Y
7.	FLP/Exe certificates for junction boxes and terminals conforming to IEC/ISS (CMRI, CCE, DGFASLI and BARC for terminals)	N	N	Y
8.	Certificate for weather proof construction for junction boxes as per IPW-55	N	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.
2. 8 hard copies & 2 soft copies in CD shall be submitted as final documents prior to despatch of the equipment. These shall be made in sets and supplied in fine plastic coated folder.

Y - Yes, N - No

TECHNICAL SPECIFICATION - ELECTRICAL ERECTION, TESTING & COMMISSIONING

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	Scope
2.0	Codes and Standards
3.0	Equipment Specification
4.0	General Procedure for Erection
5.0	Specification for Electrical Erection
6.0	General Procedure for Testing & Commissioning
7.0	Testing & Commissioning Specifications
8.0	Documentation
9.0	Handing over to Owner
10.0	Obligations & Responsibilities of Contractor
11.0	Terms and Conditions
12.0	Deleted
13.0	Prior Approval of the material to be supplied by Contractor
14.0	Deleted
15.0	Statutory Approvals
16.0	Guidelines for Safety Measures

1.0 SCOPE

1.1 This standard covers the technical requirements of erection, testing and commissioning of all Electrical equipments at site.

1.2 This standard shall be read in conjunction with the relevant technical specifications and other references specified therein.

1.3 **Scope of Work**

1.3.1 The scope of work shall generally include supply (wherever specified), handling, transportation, unpacking, checking, reporting of damages/defects, storage, assembling, erection, installation, including fabrication, alignment, levelling, grouting, welding, bolting, painting, etc., testing and commissioning of various electrical equipments and machineries, illumination system, earthing system, lightning protection and fabrication & installation of steel structural etc. required for the complete electrical system as per drawings & documents, specifications, standards & codes, prevalent rules & regulations and best engineering practices.

1.3.2 Detailed Scope of Work (Supply and Erection) shall be as indicated in project specific Design Philosophy/Technical Specifications.

1.3.3 The entire electrical installation work shall be carried out in accordance with the following:

a) Indian Electricity Rules & all applicable Statutory Acts & Regulations

b) This specification

c) The latest issue of approved drawings of vendors/consultant

d) The recommendation of the manufacturers

e) Latest issue of Relevant IS

f) The direction of the site engineers

Any additional revision made to the drawings at a later stage, which in the opinion of the consultant/owner is necessary, will be binding on the contractor and shall have to be carried out.

1.3.4 The contractor shall be responsible for:

a) Obtaining approval from the Electrical Inspector/Factory inspector or any other Statutory Authority for equipment, plant design/drawings and complete installation work.

b) Carrying out modifications in the equipment & installation as required to comply with the above.

c) Submitting installation certificates on completion of installation to Electrical Inspector & obtaining certificates of approval of the installation.

These jobs shall be carried at the contractor's own cost and the work shall be deemed to have not completed unless the approved certificates mentioned under (c) are submitted to the owner.

1.3.5 No erection material shall be supplied by the owner. All materials like clamps and tags for cable/conduit and earthing including hardware material, all tools and tackles required for erection, testing and commissioning such as, but not limited to jacks, welding sets, oxygen/acetylene gas, cutting set, drilling machines, grinders, pipe bending machine, dies for pipe threading, scaffolding materials, cables, switches for erection power supply and workshops, temporary lightning protection, cable jointing tools, megger, earth tester, primary and secondary injection test sets, substandard meters for calibration of ammeters & voltmeters etc. and any other tools required shall have to be arranged by the contractor.

1.3.6 Consumable materials required for the erection jobs such as, but not limited to kerosene, cotton waste, jute, duster shims for alignment & levelling, cement, concrete, bricks, welding electrodes, paints, carbon tetrachloride, unleaded petrol, solder, flux, raul-plug, phill-plug, nylon-plug, anti corrosive grease for copper, aluminium contacts etc. shall also have to be arranged by the contactor.

1.3.7 Cleaning of site after completion of erection as well as regular clearance of unwanted material from site, returning of all packing materials, & excess of other material supplied by owner back to owner's stores shall also be covered under the scope of work.

1.3.8 All equipments and instruments shall be inscribed with proper number, nomenclature, cautionary signals & other instructions as may be necessary.

1.3.9 The contractor shall supply and touch-up any surface of switchgear and other electrical equipments which are scratched and/or damaged during transportation and erection. The paint used shall match exactly the surface being touched up.

1.3.10 Major civil engineering works pertaining to electrical equipment like foundation and plate inserts etc., if excluded from the scope of work, the contractor shall check their correctness as per latest manufacturer's drawing and carry out minor civil jobs such as, but not limited to, grouting of base plates, channels, supports and foundation bolts, cutting holes in wall and ceiling, chipping of floor and ceiling, sealing of cable entries and making good the same after installation of the equipment, levelling and any other minor similar civil works advised by site engineer has to be carried out by the contractor.

1.3.11 The contractor shall furnish all supervision, labour, tools, rigging material and incidental material such as bolts, welding electrodes, anchors etc. required to install, test and adjust the equipment.

1.3.12 The contractor shall employ all skilled, semi-skilled and non-skilled labourers for erection, installation & testing as required. All Electricians, cable jointers, wiremen, welder and other employed shall be suitably qualified possessing valid certificates/licenses recognized by the complement authorities. The owner at its own discretion, put any electrician, wireman, cable jointer to test about competency of technician concerned and the contractor shall have to replace any

such staff found incompetent in the opinion of the owner, to execute the job as per the requirement.

1.3.13 The contractor shall also furnish a list of Engineers/Supervisors and staff employed by him for erection and installation jobs giving in brief qualification and experience of such staff and indicating whether they hold such competency certificates/licences to supervise the electrical installation jobs as required under Indian Electricity Rules & State Electrical Inspectorate Rules.

1.3.14 The contractor shall set up his own work-shop and other facilities at site allocated place to undertake fabrication jobs, pipe bending, threading etc.

1.3.15 The contractor shall be responsible for recording of all readings and observations during erection, testing and commissioning in registers or on prescribed Performa. These shall be carried out in the presence of owner's representative. All such test data and records shall be duly signed by the contractor's Engineer/Owner's representative and shall be submitted to owner in triplicate.

1.3.16 The contractor shall hand over completed job. Minor details not specifically mentioned in the scope but required for completeness of the job shall have to be carried out by the contractor without any extra cost.

1.3.17 The contractor shall commission all Electrical equipments and carry out all tests inclusive of load test as per the performance guarantee and will be responsible for final adjustment of relays, instruments, meters, breakers etc.

1.3.18 The specifications given under Cl. Nos. 5 & 7 are only guidelines and doesn't give the details entirely. It shall be the responsibility of the contractor to execute the work without any extra cost to owner, in accordance with the standard code of practices, the relevant manufacturer's drawings, owner's drawings, consultant's drawings and as per Site engineer's directions. Further, the stipulations of general conditions of the contract shall prevail over all other conditions stipulated in this specification.

2.0 CODES AND STANDARDS

2.1 The erection, testing & commissioning of the equipment shall comply with the latest issues of all relevant Indian Standards and Codes of practices. Design, manufacture, testing & installation of supply items shall also comply with the relevant standards. Equipments complying with equivalent IEC standards shall also be acceptable.

2.2 Some of the relevant Indian Standards are as follows:

IS: 10028 (Part-2)	Code of practice for selection, installation and maintenance of transformers
IS: 6600	Guide for loading of oil immersed transformers.
IS: 10118 (Part-3)	Code of practice for selection, installation and maintenance of Switchgear and controlgear

IS: 11039	Requirements for mounting on rails in switchgear and controlgear installations.
IS: 1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IEC 62305	Protection against lightning
IS: 2551	Danger notice plates
IS: 3043	Code of practice for Earthing
IS: 5216	Recommendations on safety procedures and practices in electrical work
IS: 8437	Guide on effects of current passing through human body
IS: 900	Code of practice for installation and maintenance of induction motors
IS: 15429	Storage, installation and maintenance of DC motors – Code of practice
IS: 13408	Code of practice for the selection, installation & maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining application or explosive process manufacture)
IS: 14665 (Part 2)	Electric Traction Lifts: Code of practice for installation, operation and maintenance

2.3 The contractor shall observe safety rules and take all necessary safety precautions to carry out the work in the plant.

3.0 EQUIPMENT SPECIFICATION

3.1 All equipments shall conform to the relevant specifications indicated in project specific Technical Specifications. They shall be suitable for specified site & climatic conditions.

3.2 Make of equipments shall be as per project specific requirements. Make of equipment not specified shall be as indicated and shall be subject to Owner/Consultant's approval.

3.3 Drawings and documents for various equipments shall be submitted as per Documentation Schedule indicated in relevant specifications.

4.0 GENERAL PROCEDURE FOR ERECTION

The general procedure governing "Transfer of equipment and materials to Contractor", erection and Final acceptance of Owner/Consultant are given below:

4.1 Drawal of Equipment from Owner's stores

All equipment and materials, excepting, equipment/erection materials included in Contractor's scope of supply, shall be issued from Owner's store, if applicable as per project specific Design Philosophy/Technical Specifications. Contractor shall arrange to draw the necessary equipment/material in the sequence required for erection and transports the same to contractor's store or directly to erection point.

4.2 Contractor's inspection at Owner's stores/Site

On receipt of any material (supplied by the owner, if applicable) at site, before removing any issued item, contractor shall fully unpack and inspect all equipment received for completeness, signs of damages, defect etc. in the presence of owner’s representative and shall get all discrepancies (damage/short supply) duly recorded by owner's/consultant's authorised representative on the issue note, failing which, no claim by the contractor shall be entertained at a later date and he shall be required to make good/replace/repair the defective/damaged items at no extra cost.

4.3 Handling and cleaning

4.3.1 Contractor shall be responsible for proper handling and cleaning of all materials/equipment drawn/supplied by him until Owner/Consultant finally accepts the erected equipment.

4.3.2 Equipment shall be handled with care by experienced riggers under guidance of competent supervisors and as per rigging marks given on cases. Dragging on floor shall be avoided and crane/suitable rollers shall be used for moving the equipment at any times.

4.3.3 The contractor shall be fully responsible for the safe keeping of equipment issued to him till these are erected, tested, commissioned by him and accepted by owner/consultant.

4.4 Transportation

This involves transportation of various electrical equipments/materials from owner's stores/store siding to erection site/Contractor's stores & Contractor’s Stores to erection site. When transporting the equipment, it shall be loaded on suitable trailer/trucks as per capacity and size of equipment, and shall be properly supported on the trailers/trucks by means of ropes/stoppers to avoid damage or tilting due to heavy jerks and vibration. Precautions, if any, displayed on equipment shall be strictly observed.

4.5 Storage

Whenever materials are required to be stored by the Contractor in his own stores at site, the contractor shall strictly observe the following requirements: -

4.5.1 The contractor shall keep a proper record of the materials handed over to him by owner/consultant at the initial start of the work and the materials drawn by him and kept in his stores.

4.5.2 All equipment and materials shall be properly stored by the contractor at site in the designated storage area provided by the owner.

4.5.3 The contractor shall ensure that all the materials drawn/supplied by him are stored indoor/under shade. However, if a package is temporarily stocked outdoor due to unavoidable reasons, this shall be ensured that the storage area is dry, hard and well-drained area.

4.5.4 Goods must not be placed directly on the floor/ground but shall be kept on blocks, 60 mm to 120 mm above the floor level such that the bottom is well ventilated.

4.5.5 In case of outdoor storage, the contractor at his own cost shall provide waterproof PVC sheets/tarpaulin to cover all goods so as to protect them from rain etc. These sheets/tarpaulin shall be removed for inspection once in a week and if found moist or mouldy, shall be dried in direct sunlight.

4.5.6 In addition to the above, the equipment manufacturer's storage instructions, if any, shall be strictly followed.

4.6 **Erection Requirements**

4.6.1 All work shall be carried out as per drawings supplied. Placing of equipment on foundation, aligning, grouting, connecting, fixing danger notice plate/board on equipment shall be done as specified. Meggering, labelling and painting shall form part of erection requirements.

4.6.2 Fixing of supporting frames/pedestals, grouting, cutting and dressing holes in walls/ceiling and any other minor civil work necessary for installation and levelling of electrical equipment are included in electrical erection scope.

4.6.3 The scope of erection also includes cable dressing/clamping/minor rerouting, minor relocation of fittings, internal cleaning of equipment, overhauling and minor repairs.

4.6.4 Fabrication of clamps from the materials specified and clamping of cables on racks, trays etc. fixing of single core cables in tri-foil formation in aluminium clamps, earthing of cable armour and lead sheath, wherever necessary (and as per the details given by Consultant) fall under erection scope of work.

4.6.5 Marking of cables by fixing/grouting the cable marks/number tags for every 25 meters along entire route of cables is included in the scope of work. The tags shall be made of Aluminium Strips.

4.6.6 The contractor shall without any extra cost, touch up with paint all electrical equipment which are damaged/scratched during handling, erection or repair. The paint used shall match exactly the painted surface of the equipment on which touch-up is done, and shall be epoxy based.

4.6.7 The descriptions given above are only to give a preliminary idea about the scope of work and they do not limit the entire scope to these descriptions only. Hence all other parts of the tender document shall be read in conjunction with the

referred standards, associated drawings, specification sheets and schedule of materials & services to assess actual scope of work.

4.6.8 The contractor shall undertake erection of all equipment specified herein in accordance with good engineering practices in conformity with statutory regulations and Code of Practice and to the entire satisfaction of the purchaser/owner.

4.6.9 The contractor shall arrange all the necessary erection tools, tackles, testing and measuring instruments and shall supply all erection materials as required.

4.7 **Services of Suppliers' Erectors**

For guiding/supervising erection of sophisticated equipment, services of main equipment supplier's engineers/erectors may be made available free of cost to Contractor as per discretion of Owner/Consultant. However, this will not absolve the contractor from his responsibility nor his obligation to provide his own supervisors or technical personnel.

The contractor shall comply with all the directions, drawings etc. issued to him within the scope of his contract by Supplier's Engineer/Erector.

4.8 **Installation Certificate**

On completion of work the contractor shall submit installation certificates in prescribed Performa as required under prevailing Electricity Act/Rules to Electrical Inspector or other competent statutory body and obtain certificates of acceptance/approval of Electrical Installation carried out by him.

5.0 SPECIFICATION FOR ELECTRICAL ERECTION

5.1 **General**

5.1.1 These specifications lay down the erection procedures to be followed for each type of equipment, over and above the general "Erection Requirements".

5.1.2 The contractor shall also follow manufacturer's instructions and any other instructions of consultant/owner/Statutory bodies during erection.

5.1.3 Erection Drawings for Lighting, Earthing, Cable Tray Routing, etc. may be suitably modified, if required, to suit site requirement with the approval of owner/consultant.

5.1.4 As-Built Drawings shall be prepared by the Contractor and supplied to owner/consultant.

5.2 DELETED

5.3 **Transformers**

5.3.1 Contractor's inspection

Particular attention is to be paid to the following while inspecting/examining the transformers for any sign of damage:

a) Tank side and cooling tubes dented

b) Cooling Tubes damaged

c) Any sight glasses broken (including explosion vents)

d) Bushings cracked/broken

e) Bolts loose

f) Oil leakage (particularly along welds)

g) If gas filled, whether gas pressure O.K.

h) Valves leakage

i) Any other damage

5.3.2 Handling

a) Lift the transformers by lugs or shackles provided for the purpose.

b) Use lugs and shackles to avoid unbalance while lifting.

c) Lifting chains not to interfere with any part of the transformer.

d) Check cover bolts for tightness. Tighten fully (if found loose) before handling. Care shall be taken that the bolt does not rotate to avoid damage of the gasket.

e) In case use of jacks is necessary, use jacks only on jacking pads provided for the purpose. (Jacks shall never be used under valves or radiator tubes).

f) Do not keep transformer on bare ground. Where it is not possible, unload transformer directly on the foundation. This can be done with the permission of consultant/Owner.

g) Never leave the transformer without putting stoppers of the wheels.

5.3.3 Erection

a) Foundation of the transformer shall be prepared and checked for its level as per Drg. before shifting/transferring the transformers from the stores.

b) Transformer shall be placed on the prepared foundation only.

c) For transformers of high rating (above 1000 KVA) place the transformer on foundation (channels/rails already grouted on the foundation) as per drawing. Proper time shall be given for curing the level of rails. Rails must be checked and adjusted.

d) Wheels shall be fixed before placing of the transformer in position. Wheels of the transformers shall be checked for its proper/free movement on the rails/plates. Greasing shall also be done on the shaft of wheel before placing the wheels in position. Split pins must be used/placed in position before its rolling. It shall also be levelled & aligned with the bus ducts, if bus ducts are to be connected on the LT side of the transformer.

e) Clamp stoppers to the transformer wheels, immediately after alignment to prevent any movement.

f) Clean all the accessories like radiators, cooling fans, valves, conservator tanks, explosion vent pipe, bushing and other accessories.

g) Flush the radiators with hot oil before assembly.

h) Cloth only shall be used for cleaning purposes (CAUTION: While working on the transformers with hand-holes or bushing holes, take care that no tools or any other foreign matters are dropped into the tanks. All the loose tools shall be properly tied and secured).

i) Assemble all accessories such as radiators, conservator, valves, explosion vents, Buchholz relay, HV and LV bushings, cable-end termination boxes, marshalling kiosk/box, instruments, capillary tubes, silica gel breathers with dried silica gel, fans etc. as per vendor's drawings and instructions.

j) Prior to topping up of oil, check for proper tightness of all gaskets joints and operation of shut-off valves. Also fix thermometers.

k) Test oil samples from each drum for dielectric strength before topping. (Do not fill oil from the drums, which cannot with stand 40 KV for 1 minute).

l) Filter oil before filling.

m) Oil shall be filled through filtering machine using metallic hose.

n) Fill oil to the transformer tank through bottom drain valve to prevent aeration in oil.

o) Ensure during oil filling operation that no air pockets are left in the tank, and that no dust or moisture enters the oil. Open all air vents. Reduce oil flow rate when oil level is almost up to the bottom of the main cover to prevent internal pressure from rupturing the diaphragm of pressure relief pipe. Allow sufficient time for all air bubbles to escape. Release any air bubble accumulated in Buchholz relay. Close vent plugs.

p) In case of gas filled transformers, the oil to be filled up under vacuum as per manufacturer's instructions.

q) Connect cables to HV terminals and cables/bus duct to LV terminals of transformer.

r) Connect control cables/power cables to the marshalling box. Connect Stop push button mounted on the wall of transformer room to trip the transformer.

s) Transformer body, HV cable box and MV/LV cable box to be earthed at 2 separate points to the main earthing grid.

t) Transformer neutral to be earthed to separate and distinct neutral earth pits (through Neutral Earthing Resister, where applicable) as per design and drawings.

u) Provide danger notice board conforming to IS: 2551 and IE Rules 1956 on enclosure or door of the enclosure.

v) Earth Transformer Room's door/enclosures as per IE Rules, 1956.

w) Provide Safety items i.e. fire extinguishers, shock treatment chart, fire buckets with screened sand etc.

5.4 Switch Boards

5.4.1 Handling

a) As far as possible lifting of switchboards is to be done by making use of eyebolts provided. Ensure that before lifting, all eyebolts are fully tightened and that panel supports, nuts and bolts are intact and tight.

b) If lifting arrangement is not provided/not feasible and final positioning by sliding is unavoidable, retain packing base as long as possible and rolled on suitable pipes. Avoid sliding/dragging panel directly on floor by crowbars.

c) Maximum care shall be taken to avoid any damage to insulator, bushings, meters and protective equipment.

5.4.2 Erection

a) Check the foundation according to the drawings. Ensure that all pockets have been rightly made. Fix the datum level, and level the foundation by chipping in such a way that the prescribed point of cubicle base plate is flush with finished floor.

b) Check the individual cubicle for any deformity and ensure that all faces are straight. Any dent on sheet steel frame is rectified before placing on foundation.

c) Wherever separate base frames are supplied level and the foundation in both directions (lateral and transverse) and ensure that these have been correctly levelled throughout. In case of runner rails, check the rails for level in both the directions and ensure that they are parallel to each other.
Wherever base frame is fixed to cubicle, place the cubicle on foundation ensuring that holding down bolts are directly over the foundation pockets.

d) Obtain correct level of panel with respect to floor/existing bus-bar by putting shims below base frame (as per drawing). Shims are to be supplied by the contractor. Measure the level of each frame with reference to datum and ensure that level difference between the two ends of the switchboard base frame is within ± 2 mm.

Owner shall provide a level benchmark in each sub-station. All levels shall be checked with this mark by Theodolite and the Contractor shall keep a record.

e) Cubicle shall be so adjusted that front face of all the panels are in one plane, all sides are plumb and corresponding horizontals on all panel faces (e.g. minimum lines, door edges, inter cubicle joints) line up in the same horizontal line(s). Match the cubicles and adjust properly. Provide gasket between edges, if required, so that no inter-panel gaps are seen.

f) Bolt adjacent cubicles and base frame together. (Drill new holes where corresponding holes of cubicles do not match after levelling, if found necessary).

g) Grout the foundation bolts with mortar. Also run grouting mixture under base of the cubicle frame and ram to ensure solidity. After grout has set properly, tighten the foundation bolts.

h) Fix bushing/insulators of bus-bars as per drawing if these have been despatched loose.
In case of extension panels for existing boards, this must be done before step (d).

5.4.3 Bus Connections and Installation of Loose items

a) Fix bus bar links and inter panel bus-bar connections with coupling bolts/supporting insulators. Clean the contact surface of bus bars and links and smear with contact grease before bolting.

b) Wherever recommended, fix shroud on the joints and fill compound, or compound may be put on joint to form smooth homogenous & spherical shaped mass and then wrapped with tape. Simple taping of joints may also be done. Recommendation of manufacturer/consultant/owner shall be followed in this respect.

c) In case of misalignment of bus bars, adjustments may be necessary. The connecting pieces may have to be re-drilled or re-fabricated.

d) Check tightness of bus bars bolts connections with torque wrench. Follow vendor's recommendations in this regard.

e) Install all loose relays, instruments, cable boxes, metering and protective CTs, PTs etc. Before fixing the relays, make sure that they are cleaned and all packing materials have been removed from them and proper operation. Clean the contacts.

f) Connect all inter-panel bus wiring. Connections of relays and instruments shall be done as per drawings. Check the wiring according to wiring diagram.

g) Connect all earthing bus bar between the cubicles and it shall be connected at two points by Al/GI strip or cable to the main earthing ring. Fix all glands

for incoming and outgoing and control cable connections on the holes provided for the purpose, as per drawings.

h) Drill holes for fixing cable glands/cable boxes as per drawings, if such holes are not provided. All spare holes, gaps etc. shall be blanked as per instructions of Owner/Consultant.

5.4.4 Cleaning

After erection is complete all cubicles, switches, starters, CTs, PT Chambers, Bus Bar Chambers etc. shall be cleaned by blowing air (preferably hot air). Surface of the insulation shall be cleaned with cloth soaked in CTC/Benzene.

5.4.5 Circuit Breaker installation

5.4.5.1 Air Circuit Breaker

a) Clean the contacts properly with both soaked in CTC/Benzene etc. Clean and lubricate the operating mechanism, check and rectify the main insulating contacts and bushings and also secondary contact for any damage/misalignment. Check the locking mechanism.

b) Manually close and trip the breaker several times and check contact alignment and pressure. Adjustment, if required, shall be done according to the manufacturer's instruction. The arc chute if despatched separately shall be fixed properly, only after checking of contact alignment etc. After fixing the Arc Chute, operate manually the breaker and check the contacts make properly. Measure contact resistance with ductor. Check the operation of OFF-ON indicator.

5.4.5.2 Vacuum Circuit Breaker/SF6 Circuit Breaker

a) Check the breaker frame for any damage. In case of vertical isolation type, raise and lower the breaker several times and ensure that breaker moves freely on guide, lubricate the mechanism.

b) Check the operation of locking mechanism. Check the secondary isolating contacts for any deformity. Check HT bushings for any damage and repair if it is minor.

c) Manually close and trip the breaker several times. Adjust the mechanism as per manufacturer's instruction. Measure the contact resistance with ductor. Check the oil level in the chamber. If level is low, due to leakages, rectify and fill up as per manufacturer's instruction. Check the operation of ON-OFF Indicator.

d) Check that safety shutter open and close smoothly. Remove the lock if provided before racking in the circuit breakers. Put the circuit breaker inside the cubicles. If cubicle is aligned properly, the circuit breaker shall go smoothly inside the cubicle.

e) In case of horizontal isolation type circuit breaker, engage the racking mechanism and put the interlock mechanism operates smoothly and adjustment if required shall be done. Slowly rack in the breaker to service position. While racking in, ensure that safety shutters open smoothly. Check the mechanical interlock mechanism. Also check that the main and secondary isolating contacts mesh properly. Conduct this operation a few times to ensure proper functioning and alignment of all mechanism.

f) For vertical isolation type circuit breaker, put it first at the test position and check interlock mechanism and also the secondary isolating contacts engaged properly. Put it at service position, and slowly raise it to fully raised position. Ensure that main isolating contact bushings enter bush bars spouts smoothly and contacts mesh properly. Conduct the raising/lowering operation several times to ensure a smooth functioning of all mechanism. Any other allied work thought necessary for completion of the erection will have to be done by the Contractor.

5.4.6 General Checks

a) Ensure that all gaskets are in position, replace the same if found damaged.

b) All opening covers and rear doors shall be bolted with required number of bolts. Take care that no bolt/nut/washer gets lost during handling and erection.

c) Check inter-changeability of breakers of same rating.

5.5 Motor Control Centre/Power & Motor Control Centre (MCC/PMCC)

Erection of MCC/PMCC, if required, is to be carried in accordance with Cl. No. 5.4 above. In addition, the following points are to be observed:

a) Cable glands shall be fixed in cable gland plates/cable alloys (Drilling of holes in gland plates are to be done at site as required).

b) Cable entries are to be made vermin proof.

5.6 Panelled Equipment

These include AC/DC Distribution Boards, Thyristor Control Panels, Inverters etc. In addition to the procedure laid down in Clause Nos. 4.0 & 5.4, any other instruction given by the manufacturer shall also be followed.

5.7 Storage Batteries

a) Installation work for storage battery cells on steel/wooden racks shall be done strictly as per supplier's drawings and instructions.

b) Steel/wooden racks shall be installed in the battery room on support insulators. The racks shall be plumbed and aligned properly.

c) Each cell shall be inspected for any damage of its positive, negative plates, containers etc. Cell shall be cleaned properly and all packing materials removed as per manufacturer's instructions.

d) The cells after assembling the plates, indicators etc. shall be placed on cell insulators over racks and interconnected to each other so as to avoid strain on cell-terminals.

e) All necessary safety precautions shall be taken while preparing the electrolyte i.e. goggles, rubber apron, and gloves etc. shall be used.

f) No foreign materials, dust or dirt etc. shall be allowed to fall in the electrolyte and it shall be kept duly covered.

g) Connection to the battery charger shall be made.

h) Prepared electrolyte shall be filled in cells up to mark level of at least 10 mm above upper edge of the plates in a manner approved by manufacturer. Electrolyte shall be allowed to cool down.

i) While giving initial charges to the cells, instructions of the manufacturer's regarding rate of charging shall be strictly followed and care taken that charging unit is not over loaded more than the rated capacity. During the period of charging, the cells must be topped up as often as necessary to prevent the electrolyte falling below the required level. Distilled water to be used for topping purposes and quantity of distilled water used for topping up of the cells shall be noted.

j) After initial charging battery shall be discharged at specified rate. Thereafter battery shall be recharged.

k) Record all battery voltage of each cell, specific gravity, temperature, charging current during charging/discharging and shall be kept in Performa supplied by the supplier or in a form approved by the consultant/Owner. Discharging and recharging operations shall be done as recommended. After final charging the battery shall be put on float charge.

l) No naked flame or sunlight shall be permitted in battery room and smoking shall be strictly prohibited.

m) During initial charging and discharging battery shall not be left unattended.

n) It is to be assured that battery room is properly ventilated with an exhaust fan/blower.

5.8 Cable Installation

5.8.1 General

a) Fabrication of chequered plates for trench covers, cutting of all types of Al/GI Cable trays to desired length, laying, spacing, fixing etc. of all types of cables, trays, supports, hangars etc. shall be according to the drawings or according to the instructions given by consultant/owner.

b) Contractor shall keep accurate record of cable drums issued to him, the drum nos. and actual length of cable taken out of each drum. Each cable length shall be cut from a specific drum as per approved schedule of cable. Length of cable runs shown in the cable schedules is the calculated length only and the actual lengths shall be measured at site before laying and cutting the cable. The contractor shall take extreme care to adjust cable runs from drums so that joints in the cable are avoided and wastage reduced to minimum.

c) For purpose of measurement of cable run for payment the length of cable between and terminations only will be considered.

5.8.2 Laying

a) The cable drums shall be properly mounted on jack/on a cable wheel. Make sure that the spindle is suitable for carrying weight of the drum without bending. Check that spindle is laying horizontal on the bearing so as to prevent the drum creeping to one side or to the other while rotating.

b) Unroll the cables from the drum in correct direction. Rotate drum only as per arrow mark given in the cable drum. Ensure that the end protection box attached to the flange of the drum is removed and securing rope cut to allow cable and move freely. Rotate the cable drum and simultaneously pull cable steadily and with even pulls and not with unnecessary jerk or strain. In no case the cable shall be allowed to twist or kink since this is likely to spring the armour and fracture the insulation and outer serving of the cable.

c) Do not drag the cable on floor or hard surface. Use only wooden/steel cable rollers for this purpose.

d) Cable shall not be bent sharply to a small radius. The cable bending radius shall be as large as possible and will not be less than 12 times for PVC cables and 15 times for XLPE cables. At joint termination, the individual core of cable shall not be bent with bending radius of less than 15 times the diameter over the insulation.

e) Where cables are laid on the MS racks, trays etc. ensure that trays/racks/supports are fixed properly in an approved manner or according to the drawings. Check from drawings that for horizontal runs of cable, bracket, risers, supports and angles are grouted or fixed in formation as required.

f) In sub-station where large no. of cables rise to panels/switchboards, it shall be ensured that these risers and rising cables do not interfere with cables on racks and rising cables do not cross the other cables in horizontal runs. Risers are to be properly supported so that weight of cable does not fall on terminations. All cable crossings shall be avoided. Cable cross section/power layout drawings shall be followed.

g) Cable laid in trenches shall be sealed at the entry to hazardous area/non-hazardous area as per details given by Consultant/Owner/Engineer-in-charge.

h) Openings in substation/MCC rooms and floors for entry of cables shall be sealed after the cables are laid.

i) Cables shall be clamped as shown in the drawings Care to be taken to space clamps to such intervals as to prevent buckling of cables.

j) Cables are laid in concrete trenches built by Consultant/Owner having covers of concrete of slabs or chequered plates. The laying of the cable on the racks shall be done in an approved manner and according to the drawings supplied.

k) Where cables are laid in open concrete trenches/slits, the trench/slits after laying cables shall be filled with sand & lean cement mixture and plastered so that surface flushes with top of trench/slit.

l) Care shall be taken that cables are not laid in waterlogged area as far as practicable. When laid above ground, cables shall be properly supported on rigid poles at least 2M high. At road crossing, minimum head clearance of 6M shall be provided.

5.8.3 Laying of Cables in underground pipes

a) Laying of cables in underground pipes shall include excavation of earth along the cable route, laying of pipes, back-filling, ramming and removing extra earth including supply of bricks and sand.

b) Ground trenches which shall be dug for laying of pipes such as to ensure that depth of the top of the pipe below the ground level shall be 600 mm min. Bottom of the trench shall be properly levelled up and all odd and sharp materials removed. HDPVC/GI pipe shall be laid in the trenches. Proper bends & pull boxes wherever required shall be provided.

c) After laying of pipes, fill up earth in trench and ram properly. Remove all extra earth from the sides.

d) Lay the cables as per drawings and instructions of site engineer.

e) Fix cable markers at 100 M apart and at joints on the entire route length of the cables. The cable markers shall be made of pre-cast concrete block of 300 x 350 x 350 mm size with letter HT Cable, LT Cable, depth of the cable, arrow marks etc. inscribed. These shall have to be supplied by contractor at no extra cost and fixed as per the directions of the Consultant/Owner. The top of the above concrete slab shall have a smooth finish with cement only.

f) Laying of cables under road crossing shall be avoided to the extent possible. If required, it shall be done in pipes. When a larger number of pipes are laid across the road, manholes shall be built on either side to terminate the surface of road. Backfilled soil shall be rammed thoroughly to prevent road surface cracking due to settlement of loose soil.

g) Railway Crossing

Where the cable is laid under railway track, it shall be laid through cast iron pipe or spun concrete pipe of suitable diameter and strength. The pipe shall be laid not less than 1 M below the surface of the formation level. Pipes shall be laid with the gradient to facilitate drainage of water. Pipes shall be laid up to a minimum distance of 3 M from the centre of the end tracks on either side. The work shall have to be carried out in accordance with the rules and regulations of railways for cable crossings.

Where number of pipes is to be laid along road/rail crossing, these shall be laid in horizontal formation.

Masonry pipes to be constructed at both ends of road/railway crossing pipe and specified notice to be erected at crossing as per railway rules.

5.8.4 Directly buried Cables

a) Laying of underground cables shall include excavation of earth along the cable route, laying of cables, back-filling, ramming and removing extra earth including supply of bricks and sand.

b) Where cables are laid directly into ground trenches which shall be dug up for laying cables such as to ensure that depth of the top of the entire cable below the ground level shall be 750 mm min. for medium and low voltage, 900 mm min. for cables from 3.3 KV to 11 KV grade, 1050 mm min. for cables from 22 KV to 33 KV grade and 1000 mm min. for cables at road crossing and at railway level crossing respectively.

c) Bottom of the trench shall be properly levelled up and all odd and sharp materials removed. Trench bottom shall then be bedded with a 75 mm thick layer of sand. Before laying the cable over this bed, approval of consultant/owner for preparation of bed shall be taken. Cable shall be laid in the trenches in straight run, care shall be taken that any kinks or bend are not formed. After laying the cables, bricks shall be placed lengthwise on both the sides of the cable along the entire length to form through.

d) Fill up space between bricks with sand to height of the bricks.

e) Place bricks closely width wise on the top of the sand filled through. Fill up earth in trench and ram properly. Remove all extra earth from side. Do not use broken bricks. Only Class-I (of relevant IS) bricks shall be used.

f) If new cables are to be laid crossing existing cables, the new cables will be laid under existing cable at depth of not less than 200 mm from the existing cable. Ensure that the approach of the new cable to the crossing is uniform and gradually sloped.

g) Lay the cables as per drawings and instructions of site engineer.

h) Fix cable markers at 100 M apart and at joints on the entire route length of the cables. The cable markers shall be made of pre-cast concrete block of

300 x 350 x 350 mm size with letter HT Cable, LT Cable, depth of the cable, arrow marks etc. inscribed. These shall have to be supplied by contractor at no extra cost and fixed as per the directions of the consultant/owner. The top of the above concrete slab shall have a smooth finish with cement only.

5.8.5 Laying in Trenches

a) RCC slabs and chequered plates lifted from trenches for laying cables shall be put back in position at close of work every day to avoid accident & damage to cables in the trench.

b) When cables pass through pipes, ends shall be sealed by pouring bitumen compound or any other approved compound as required.

c) Pipes shall be provided for protection of the cables entering from the floor, trench etc. in the switchgears, MCCs, and pipes shall be sealed against water ingress.

5.8.6 Laying of single core HT un-armoured cables shall be done in manner stated hereunder. Cables shall be arranged in trefoil formation and clamped with suitable clamps. The clamps shall be fixed on cable hanger, racks etc. The cables shall be laid with extreme care without causing any damage to the sheathing cables in trefoil formation shall be bounded at a regular interval and earthed. Where necessary the bounding on trefoil groups shall be interconnected. The cables shall in no case be drawn through metallic pipe, ducts etc.

5.9 Cable Joining & Termination

5.9.1 General

The scope of work includes:

a) Soldering/crimping of sockets/ferrules and connections at all joints/terminations as per specifications. Sockets shall be provided at all terminations except where pressure clamp type terminals are provided.

b) Glanding of cable and fixing of cable boxes.

5.9.2 Specifications

a) All PVC cables shall be terminated in conventional type cable boxes, fitted with wiping gland/compression type gland/clamps with rubber bush. For outdoor terminations double compression type gland and for indoor terminations single compression cable gland shall be used. Boxes may be filled with bituminous compound, epoxy M-seal, as and where specified.

b) For XLPE cables, special termination kits (heat shrink type) shall be used.

c) All LT and control cables shall be terminated through compression type gland.

d) In explosion proof equipment sealing accessories, where provided in cable box, are to be used for sealing the cable entry to the box and termination.

e) All lighting and control cables shall be provided with crimped Al/Cu Sockets before termination in junction boxes.

f) In case of LT cables, armours shall be suitably earthed in compression type glands. For HT cables, this shall be done either in glands or by any other suitable means like bonding the armour with suitable wire and connecting same to the earth terminals inside cable box.

5.9.3 Crimping

All cable lugs for Cu conductor's sizes up to 400 sq. mm shall be of crimped type solder less Cu lugs, which shall be crimped by special hand/hydraulic crimping tools. Cable lugs for conductor sizes exceeding above shall be conventional soldering type, heavy duty. All the control cables, which shall be of copper conductor, shall be terminated without any additional lugs in screwed type terminals provided in various equipments. Before crimping the socket inhibiting grease shall be smeared over the conductor. Conductor shall be shaped properly before sliding the socket over it. Crimping shall be done in an approved manner.

5.9.4 Jointing

a) The jointing shall be done in an approved manner with proper jointing kits. Care shall be taken not to damage the insulation when opening the cable for jointing. Taped/temporary joints shall be avoided.

b) In case of LT PVCA cables, armours shall be suitably earthed in compression type glands. For HT cables, this may be done either in glands or by any other suitable means, like bounding the armour with suitable wire and connecting same to the earth terminals inside cable box.

c) Before commencing soldering of the socket, conductor shall be thoroughly cleaned and insulation protected. The ferrules shall be thoroughly cleaned. Ferrule and each strand of the cable shall be thoroughly sweated with solder to completely tin them and fill the conductor gaps and to remove all air pockets. Soldering materials of approved quality as per IES practice shall be used. Taping of the conductors shall be done in an approved manner after crimping/soldering.

d) Filling up compounds and sealing the cable box, shall never be done in one operation. After the first pouring of compound, it shall be topped up again with compound and then sealed.

e) Straight through Joints

Jointing of XLPE & PVC/HRPVC cables shall be done with extreme care and manufacturer's instructions shall be strictly followed. Soldering of ferrules shall be done with extreme care as stated earlier.

Earth continuity wire shall be plumbed and or clamped. Compound shall be filled according to the instruction of manufacturer of terminating kit/cable. Joints made inside trench or racks shall be properly supported. Wherever, joints are made inside the ground, brick masonry work shall be done around

the joint box and filled with sand and thereafter covered with earth at no extra cost.

f) A tent shall be used in all circumstances where jointing work is being done outdoor for protection against rain and to prevent dust from being blown into exposed joint and jointing materials. Extreme care shall be taken to maintain proper phase sequence while terminating at equipment ends. Record of connection details shall be maintained. Conductor shall be shaped properly while terminating and no sharp bend shall be given. Where numbers of cables are connected in parallel, proper tests shall be done before connecting so that no cross connection is made. No phase crossing shall be allowed for making the connection.

g) Cables shall be supported adequately at the entry to cable box/equipment so that load of cable does not come on cable gland.

h) All cables shall be meggered (checked for insulation resistance) before and after jointing and insulation resistance values recorded.

i) While terminating at equipment end, each core shall be properly tagged with numbering ferrules as per nomenclature given in the drawings. Wires shall be dressed and clamped neatly. Bolting shall be done properly.

5.10 Earthing

5.10.1 General

a) Painting of all earth strip joints with anti-corrosive paint shall be carried out as per details given in the respective drawings/specifications and instructions of owner/Engineer-in-Charge.

b) All electrical equipment rated 415V and above shall be connected to earth bus by two separate and distinct earth connections. All equipment rated 240V and below shall be earthed with single earth conductor.

5.10.2 Specifications

a) Earthing conductor above ground shall be of aluminium/copper wire bare or insulated or strip. Earthing conductor buried in ground shall be of G.I. or PVC insulated aluminium/copper cables. Sizes of earthing conductors shall be according to specified drawings. All earthing installations shall conform to IS: 3043 and other relevant standards.

b) The earthing wires or strips shall be laid along the cable racks, cable trenches, risers and supports. Underground conductors shall run at a depth of 600 mm below ground level. Where these conductors run along with cables, they shall be laid at the same depth as cables. Where conductors run on wall, ceilings, they shall be laid on clamps or brackets made out of Al/GI strips.

c) Wherever earthing conductor is passing through floor, walls etc., the conductor shall be taken through PVC/GI pipes.

d) All paints, enamel etc. shall be removed from point of contact before making connections.

e) Connections between Al/GI strips shall be done by welding for connecting Al/Cu/GI wire. For connecting Al/Cu/GI wires, tinned Cu Socket shall be crimped on the wire. At the equipment end, connections shall be done by bolting. However, connections between GI strips shall be done by welding. Connection between Al/Cu & GI shall be done by bolting. Graphite grease shall be applied on contact surfaces.

f) Epoxy resin paint or bitumen shall be applied on welded or bolted joints to prevent corrosion and taping done as indicated in the drawing. Connections between Al/Cu wires shall be done by crimping weak back Al/Cu ferrules.

g) Earth electrodes shall be provided as per drawings/specifications. Work includes excavation of earth, installation of electrodes and test links etc. supply and filling of ground enhancing material, back filling of earth and removal of extra earth. It also includes making brick wall around the electrode and cover according to drawings/specifications. The testing links shall be grouted on brick wall and connections with earth electrode and conductors shall be made. Distance between two electrodes shall not be less than 6 meters and may be located 4 M away from building foundation.

h) Earth pits for equipment earthing, transformers neutral earthing and lightning protection shall be separate. However, these pits shall be inter-connected.

5.11 Lightning Protection

5.11.1 Air termination rod shall be installed as indicated in drawings.

5.11.2 Fixing of termination rod on roof with Al sheet shall be done with crank bolt and watertight compound provided.

5.11.3 Laying of down conductors and connection shall be done as per drawings. Lightning Protection installations shall conform to relevant IS.

5.11.4 Earthing of static equipment like vessels, chimneys etc. where no termination rod and down conductor is provided, shall be done by connecting the equipment base to earth pit by GI/Al strip or PVC insulated Al/Cu wire. Clamps shall be bolted or welded to the base of the equipment.

5.11.5 Structures for the storage, protection or use of highly inflammable solids, vapour or gases or in which highly inflammable or explosive dusts or vapour may be present shall be protected against lightning. Such protection is to be carried out as per prevailing Indian/IEC Standards. The following shall be taken care of:

a) All major members of metallic structure shall be bonded together and connected to the lightning protective system. Such connections shall be made at least in 2 places.

b) Metallic pipe, electrical cable sheath, steel ropes, rails etc. entering the structure but not in electrical contact with earth, shall be bonded to the lightning protective system.

c) All metal forming part of the structure, its reinforcement or its equipment shall be bonded or welded together and connected in two places with the lightning protective system.

d) The bonding ring conductor shall be run externally about 0.5 M above ground level in order to provide a convenient point for the connection. The ring conductor shall be visible throughout its length. The arrangement of bonding shall be such as to avoid possible sparking.

5.12 Plant Lighting

5.12.1 The electrical installation covered by this specification shall conform to relevant Indian Standards and Codes of practices.

5.12.2 Where a number of cables are run together inside or outside the plant, the wiring shall be supported on GI/Al trays/steel structures.

5.12.3 Erection of light fittings, plug sockets etc. - Fabrication of supports for lighting fittings, sockets, junction boxes shall be done as per the relevant drawings/instructions given by the consultant/owner and same shall be grouted to walls, ceiling or welded to insert plates, steel structures etc. Insert plates on ceilings shall normally be provided. However, if required, the contractor shall, under instruction of the consultant/owner weld such supports to the reinforcement rods after exposing by chipping off concrete at no extra cost. Installation of lighting fittings includes control boxes, where supplied separately, and shall be done as per drawings. Before installation, checking of internal parts, assembly of accessories shall be done as per manufacturer's instruction/drawings.

5.12.4 The explosion-proof fittings shall be earthed through third core of the cable used for wiring. The third pin and body of 15 amps switch sockets shall be earthed similarly.

5.12.5 Installation of explosion proof equipment shall be done strictly following manufacturer's instruction or relevant Standards. Cable termination shall be done as per relevant drawings. No drilling of holes or any change in construction of equipment or part thereof shall be done.

5.12.6 Wiring for AC supply light and plugs may be fixed in the same brackets but wiring for emergency DC supply lights will be fixed separately. In a circuit controlled by one switch in Group Control Switchboard, there will be a number of points. Drawings for lighting layout give only tentative location of fittings and wiring route shall be decided in consultation with consultant/owner. Wiring of circuit shall be bunched together to the extent possible in the same route.

5.12.7 For wiring and laying of cables, Cl. 5.8 shall be referred. Cable for wiring, light points, socket outlets, shall normally be laid along wall, ceilings and structures on suitable brackets made out of M.S./Al sheets or strips. Connections to the points in one circuit shall be taken through junction boxes. Junction boxes shall be

suitably located for branching off from the circuit to the individual point. Wherever indicated, cables may be laid directly on walls, ceilings etc. by clamping on saddles.

5.12.8 Terminations shall be done in a manner as detailed in Cl. 5.9. Wherever indicated, the wire can be drawn through PVC bushings provided in the fittings. Relevant drawings may also be referred to.

5.12.9 Lamps shall be installed after installation of fittings and wirings.

5.12.10 All light fittings and corresponding control switches shall be numbered in a permanent way as instructed by consultant/owner/engineer-in-charge.

5.13 **Street Lighting**

In addition to the requirements stated in Clause No. 5.12, the following are also involved:

5.13.1 Excavation of earth, pouring of concrete foundations, erecting, aligning and grouting of poles.

5.13.2 Assembly of arms, fixing of lighting fittings, accessories like fuse carrier, control box etc.

5.13.3 Laying of cables directly underground as per Cl. 5.8 and connecting to Junction boxes and lighting fittings as per Cl. 5.9.

5.14 **Installation of Cable Trays/Risers/Supports**

5.14.1 Deleted

5.14.2 Erection of racks, risers, cable supports etc.

a) Erection of racks and risers for cable supports shall be done along the cable routes as indicated in the drawings. The contractor before erection shall check the route for any obstruction like process pipelines, structures, equipment etc. In case obstructions are noticed, the matter shall be brought to the notice of consultant/Owner in writing and racks shall be re-routed as per his instructions.

b) As and where indicated in the drawings, supports for racks, risers etc. shall be clamped/welded on the steel structure, such as MS beams, pipe trestles, insert plates provided in the RCC column etc. for erection of racks.

c) Wherever indicated, supports for racks, risers, shall be grouted on walls. Racks & risers shall be installed on such supports and these shall be welded properly.

d) Opening on walls/floors shall be provided where racks/risers are crossing floors/walls.

e) Heavy channels, risers may also be grouted on the floors in addition to supports provided from walls, ceilings and steel structures.

f) As indicated in the drawings, racks and risers shall be erected either in multi-tier or single-tier formation.

5.14.3 Erection of supports in Trench

a) Supports and Hangers shall be grouted with rag bolts on the walls of prepared concrete trench. Insert plates shall be supplied by owner/consultant.

b) Pockets on walls, floors for erection of racks, etc. shall be provided where such racks, risers are crossing floors and walls. In prepared trench wall, pockets shall be provided for grouting rag bolts. But if needed the contractor shall arrange to make suitable pockets or modify pockets already provided for grouting the cable supports and/or erection of riser, racks etc. at no extra costs.

c) Wherever insert plates are not provided, but required for support of cable rack, the contractor shall weld such plates to the reinforcement MS rods. This shall be done by chipping the concrete for exposing the reinforcement MS rods and thereafter welding the plates and making good the concrete chipping by plastering.

5.14.4 The pipes will have to be bent (wherever required) and fixed/embedded in floor, wall and ground for laying the cables. Neoprene bushes shall have to be fixed at the end of such pipes.

5.14.5 GI/Al trays of different sizes shall be cut in size and fixed on racks and risers. Supports for the main cable racks shall be provided by the owner. However, supports for small branch cable racks & risers may have to be fabricated by the contractor. Fixing of trays shall only be done after erection/welding/painting of the supports as required.

5.14.6 Erection of support frames for miscellaneous equipments, base channels for transformers and switchboards etc. shall be carried out.

5.14.7 Dismantling of steel fabrication and re-erecting as required by consultant/owner/engineer-in-charge shall have to be carried out.

5.14.8 Dismantling of cable racks and re-erecting shall have to be carried out.

6.0 GENERAL PROCEDURE FOR TESTING & COMMISSIONING

6.1 Before proceeding with the work, contractor shall fully inspect all installed Electrical Equipment for completeness, signs of damages, defects etc. and shall get all discrepancies duly recorded by Owner/Consultant, failing which no claims by the contractor shall be entertained at a later date and shall be required to make good/repair/replace the damaged components.

6.2 **Cleaning and Regular Maintenance**

Till the commissioned equipment is finally accepted by Owner/Consultant/Engineer-in-Charge, Contractor shall be responsible for

regular cleaning and maintenance of all electrical equipment. The maintenance job is to be done in consultation with or on advice from the Owner/Consultant.

6.3 Testing & Commissioning Requirements

6.3.1 All works shall be carried out in accordance with the drawings, suppliers' instructions/manuals for equipment and as per relevant standards and codes of practices.

6.3.2 Before conducting test on any equipment, the contractor shall obtain permission from Owner/Consultant/engineer-in-charge and all tests shall be conducted in their presence.

6.3.3 Records/results of each test shall be recorded by the contractor immediately after the test on approved Performa and counter signed by both the contractor and the owner's authorised representative.

6.3.4 Copies of the record shall be handed over to Owner/Consultant/engineer-in-charge.

6.3.5 The contractor shall commission all electrical equipment and carry out all pre-commissioning/commissioning tests inclusive of no-load and on-load tests on motors/generators and shall be responsible for final adjustments of relays, motors, instruments, starters, breakers etc. as per operational data supplied and as per directions of Engineer-in-Charge.

6.3.6 Painting

The contractor shall without any extra cost, touch up with paint all electrical equipment which are damaged/scratched during testing and commissioning work. The paint used shall match exactly painted surface of the equipment on which touch up is done.

6.3.7 All terminations, cable joints, which are opened for testing purposes shall be re-terminated and re-insulated to restore their original state.

7.0 TESTING & COMMISSIONING SPECIFICATIONS

7.1 These specifications lay down the testing and commissioning procedures to be followed for each type of equipment, over and above the general requirements laid down in specifications for erection.

Manufacturer's instructions and any other instructions of consultant/owner/Statutory bodies shall also be followed by the contractor during testing and commissioning.

The contractor shall maintain and furnish the records of all equipments i.e. HT/LT panels, motors, transformers, CT, PT, relays etc. including any special test as per manufacturer's manual.

7.2 Transformers

7.2.1 The final testing shall be done in cold condition after drying out (Disconnect H.V. and L.V. side cables by removing links in disconnecting chamber, bus ducts or cables and also earth connections to neutral).

7.2.2 The insulation between windings and between winding and earth shall be measured with a motorized 2500/1100V megger. Compare the test result with the manufacturer's Test Certificates (for 11 KV windings, polarisation index to be noted). Auxiliary power cables and control wiring shall be tested with 500V megger and values shall be preferably more than 2 MΩ.

Polarization Index shall be recorded as below to determine whether drying is necessary or not:-

$$PI = \frac{IR\ 10\ Min}{IR\ 1\ Min}$$

Evaluation of insulation condition based	Base on PI	Drying on PI
Hazardous	< 1	Mandatory
Bad	1-1.5	Mandatory
Doubtful	1.5 - 2	Recommended
Adequate	2 - 3	No
Good	3 - 4	No
Excellent	> 4	No

7.2.3 Oil Tests

Crackle test: Cleaned Iron piece shall be heated red hot and put in the oil taken in a pot. In case of crackle sound, presence of moisture is indicated.

Dielectric strength test: It shall be carried out as prescribed in Appendix 'C' of IS: 335. The oil should withstand minimum of 40 KV for 1 minute.

Even if the oil condition after final topping up is found to be satisfactory, it is advisable that as an additional precaution, the transformers shall be dried out as per following procedures.

7.2.4 Drying out

Drying out of the transformers shall be carried out in accordance with IS: 10028 and other relevant standards/manufacturer's recommendation or as advised by consultant/owner.

a) Before drying out, check for the following:

- Any oil leakage through bushings and radiators.
- Transformer tank is connected to earth.
- Temperature indicators are suitably calibrated.
- Capillary tube connections made to respective temperature indicators.
- MOG, if provided, is working properly.

b) Precautions when drying

i) Use only Alcoholic type thermometers for temperature measurement. Mercury Thermometers shall only be used where pockets are provided for this purpose.

ii) Maximum sustained temperature shall not be more than 80^{o}C. Do not leave the transformer unattended during drying out period. Watch the transformer during drying out process and record carefully all observations viz. oil temperature winding temperature and insulation resistance of H.V. and L.V. windings.

iii) Drying out to be continued till the insulation resistance value is steady prescribed in standard code of practice and IS: 10028 Part-II and that the steady value remains constant for 12 hours. Within the above period, several samples of oil are to be tested to ascertain dielectric strength. Record all readings (hourly/half hourly as advised by consultant/owner) of insulation resistance and temperature of oil & winding. Collect samples of oil from transformers from bottom only after the oil has been allowed to settle for at least 24 hours (collection of oil will be done in accordance with code of practice).

iv) It may be desirable that transformer oil shall be filtered by using filtration machine and Breakdown Voltage shall be measured before and after the filtration. The minimum Breakdown Voltage shall be 45KV for one minute.

v) In case the insulation resistance does not improve by the above method, it may be desirable to run the transformer for few hours on short circuit applying low voltage, approximately equal to impedance voltage, to the HV side after short-circuiting the LV side. During this process take regular readings of insulation resistance of the winding to earth, winding to winding and temperature against time and record.

vi) If found necessary/depending upon the manufacturer's recommendations, a vacuum pressure of 635 mm of mercury shall be applied for the removal of air bubbles.

vii) After drying out process, release hot air by opening vent cocks/screws. Close vent cocks and screws after release of air.

7.2.5 Ratio Test

Apply 3 phase 415 V supply on H.V. side for every tap position. Measure the voltage at L.V. side at all tap positions. Switch off supply before changing tap in case of off-load tap changer for every tap changing.

7.2.6 Polarity Test

Apply 3 phase 415 V supply to H.V. side. Join one terminal of H.V. side to corresponding terminal of L.V. side, say A-a, Measure voltage across A-a, A-b, A-c, B-a, B-b, B-c, C-a, C-b, C-c, N-a, N-b, N-c. Ascertain vector group from above test.

7.2.7 Magnetizing Current

Apply 3 phase 415 V supply to H.V. side and simultaneously measure the current readings of the three phases using low range A.C. ammeters of the same accuracy class.

7.2.8 Phasing of Transformers (for paralleling)

Connect two transformers in parallel on primary side. Connect secondary terminal ‘a’ to the bus bar which corresponds to the equivalent terminal of second transformer. Ensure that both transformers are at same tap. Then apply 415V 3-phase supply on the primary side. Close circuit breaker of second transformer. Measure voltage between corresponding secondary terminals of two transformers a1-a2, b1-b2, c1-c2. This voltage shall be zero in case both the transformers are of same polarity and phase displacement.

Use voltmeter having range double the reading of secondary voltage under test conditions.

In case of star connected secondary windings having star point earthed, secondary terminals need not be connected as stated earlier.

7.2.9 Buchholz relay testing

Insert air pressure through petcock gently till alarm contacts make. Pressurise further till trip contacts make. Check whether trip contacts make in case of low oil level.

7.2.10 Temperature indicators

Calibrate temperature indicator and test whether alarm contacts make properly.

7.2.11 Checks before commissioning

Before commissioning transformers, the following points shall be checked and ensured for safe energising of the transformer.

a) General Inspection

i) Check assembly with reference to accessories and mountings according to relevant drawing.

ii) Check tightness of all cover bolts, flange connections etc.

iii) Check oil leakage through bushings, valves etc.

iv) Check shut off/open marking of radiator valves.

b) Oil Level

i) Check for correct level in conservators.

ii) Check for oil level in disconnecting chamber & pockets for thermometers.

c) Buchholz relay

i) Check that floats are at normal position and unlocked.

ii) Check shut off valve between relay and conservator is open.

d) Breather

i) Check that protective cover on air passage removed.

ii) Check oil level in seal chamber and condition of silica gel.

e) Explosion vent

i) Check diaphragm is intact and no oil visible in gauge glass.

ii) Check equaliser pipe valve between vent and conservator open.

f) Radiator

i) Check that all valves between banks and main tank open.

g) Thermometer

i) Check CT and Heater element connection for winding temperature indicator.

h) Wiring

i) Check wiring from instruments to Marshalling Kiosk & to switchboard/control panel.

ii) Check wiring of driving mechanism and control gears for tap-changer.

iii) Check wiring of cooling fans & pump circuits.

i) HV and LV bushing & Connections

i) Clean bushing and check connections with incoming/outgoing lines etc.

ii) Check oil level in bushings (in case oil filled & HV bushings) and release air.

iii) Check & adjust gap of arcing horn (HV bushings).

j) Check & release air through screwed petcocks, cocks etc. from Main tank, Radiator banks, Buchholz relays etc.

k) Check & release air through screwed petcocks, cocks etc. from Main tank, Radiator banks, Buchholz relays etc.

l) After all checking is found O.K., the breaker for incoming of transformer shall be made ON for charging the transformer. It shall be watched for at 24 hours without load. Then it can be loaded after finding every thing O.K.

7.3 Switch Boards

7.3.1 General Checks

a) Check all auxiliary contacts of breakers for proper make-break operation.

b) If necessary, make minor adjustments to circuit breakers mechanism, auxiliary contacts etc. for proper operation of circuit breakers. Proper greasing and lubrication or mechanism must also be done before final commissioning.

c) Check for termination of control circuit wiring as per drawing and ensure that the terminals at equivalent and panel are mechanically sound.

d) Ensure proper operation of all test operation switches and push button.

e) Check wiring of all space heaters, indication lamps bells, buzzers etc.

7.3.2 Insulation resistance test

a) Measure the insulation resistance of main bus-bars (Phase to phase & Phase to earth) with 5000 V, 2500 V and 1000 V Megger (IR values shall generally be not less than 100 MΩ, 50 MΩ and 10 MΩ respectively in case of 11 KV, 6.6/3.3 KV & 415 V).

b) Insulation resistance of circuit breaker shall be measured with 1000 V Megger.

c) Control wiring shall be tested with 500 V Megger (IR values shall not be less than 2 MΩ).

7.3.3 High voltage Test

The test shall be conducted on switchgear rated 3.3 KV and above. Test voltage shall be as per relevant Indian Standard. However, for AC High voltage test, the value shall be twice the working voltage of the switchgear plus 1000 V. This voltage shall be maintained for one minute. Each phase shall be tested in turn, with remaining phases earthed. After high voltage test, a further Megger test shall be made to make sure that insulation resistance to earth has not altered appreciably. The reading of second megger test shall be consistent with that of the first.

AC test voltage for 1 minute duration shall be as follows:

24 KV for 11 KV panel, 15 KV for 6.6 KV panel and 8 KV for 3.3 KV panel

7.3.4 Testing of current transformer

a) Insulation resistance to earth of secondary winding shall be tested with 500V megger (remove earth connection before test).

b) Check the polarity of C.T. – Connect zero centre voltmeter in the secondary winding, connect 6 V batteries with switch in the primary. Close the switch and from the kick of the voltmeter, ascertain the polarity.

c) Ratio test shall be carried out by injecting current in the primary and subsequently secondary side current shall be checked.

7.3.5 Testing of P.T. Insulation.

Testing of HT & LT side of PT shall be done with 1000 V & 500 V megger respectively (the value shall not be less than 100 MΩ, 50 MΩ & 10 MΩ, respectively for the voltage rating 11KV, 6.6KV & 400V).

7.3.6 Testing of Relays

a) Checking of wiring shall be done according to Manufacturer's drawings. Check relay continuity at all taps also ensure plug bridge contact satisfactory.

b) Secondary injection test.

Use secondary injection test set incorporating timer. Testing of all protective relays such as but not limited to over current, earth fault differential, motor protection, directional feeder protection, under voltage relays etc. shall be done as per the procedure set by the manufacturers of the relays. All time delay relays shall be tested to verify their characteristics for IDMT and instantaneous relay pick up and drop off values shall be noted at various taps. Relays shall be tested at all taps. Errors shall be calculated and compared with permissible limits specified by manufacturers. Adjustment, such as in establishing circuit, shall be done as recommended by manufacturer. After testing, relays shall be set at values given by Consultant.

c) Timer relay shall be tested and calibrated and set properly.

d) All auxiliary relays shall be tested for proper operation.

7.3.7 Testing of Instruments

All indicating and recording instruments like Ammeter, Voltage meter, KWh meter etc. shall be calibrated. Zero error of each instrument shall be corrected.

7.3.8 Operational Tests

Conduct the following operational tests after putting the circuit breaker at test and service position. Check that the fuses of proper rating are put in control circuit as per wiring diagram.

a) Close and trip the circuit breaker several times with power or manually. In case of motor operated spring charged closing mechanism, check the operation of charging motor. Ensure that it cuts in/off properly.

b) Check the indication scheme: 'ON', 'OFF', trip circuit healthy, auto-trip indication etc.

c) Trip the breaker by operating the protective relays (operate contact manually).

d) Check the trip free feature.

e) Check the anti-pumping feature.

f) Check operation of voltage selector relay scheme for supply.

g) Check annunciation scheme for AC/DC power supply failure.

7.4 Motor Control Centres/Power & Motor Control Centres

In addition to checks and tests (wherever applicable) detailed under Clause No. 7.3 above, the following shall also be carried out:

7.4.1 Insulation resistance test of the main bus bars, starter units control wiring etc. shall be done with 500 V megger.

7.4.2 Each motor starter shall be tested for correct operation. All operational tests to verify sequence of operation, inter-locking and alarm indication schemes (by simulating the connection) shall be done.

7.4.3 Bi-metallic type thermal over load relay shall be tested at different settings. Current shall be injected through the thermal elements (three elements can be connected in series) at twice and thrice the set value and tripping time shall be noted. The values shall be compared with the data supplied by manufacturer.

7.4.4 Single-phase prevention relays shall be tested for proper operation.

7.4.5 Check that fuses of specified ratings are put in various outlets.

7.5 **Soft Starter Panel**

In addition to the procedure laid above in Clause Nos. 7.3 & 7.4, any other instruction given by the manufacturer shall also be followed.

7.6 **Panelled Equipments**

These include relay and alarm panels, Rectifier panels, Battery charger panels DC/AC distribution boards, conveyors/control cum power supply panels, UPS, inverter static power supply, Variable Frequency Drive and PLC.

7.6.1 Test insulation resistance with 500 V megger.

7.6.2 All operational tests to verify function of each component like relays, switches etc. and sequence of operation, interlock, alarm system as per circuit diagram.

7.6.3 Invertors/Thyristor controlled panels, static power supply system units, Variable Frequency Drive and PLC panels shall be tested as per the instructions of manufacturer.

7.7 **Cables**

7.7.1 All HT (11KV, 6.6KV & 3.3KV) cables shall be tested for insulation resistance with 5KV/2.5KV motorized meggers and LT cables shall be tested for insulation resistance with 1000 V megger before and after termination. IR shall be measured between phases and between phase and earth. The voltage shall be applied for 1 minute.

7.7.2 All the 3.3KV, 6.6 KV and 11 KV cable joints shall be tested on high voltage as per IS: 1255 after making all termination and joints followed by IR test.

7.8 **Lighting**

7.8.1 Before energising any lighting circuit, the IR values (phase/phase and phase/earth) shall be recorded for entire wiring installation. The testing shall be done with 500 V megger. After switching on the power supply, load of each circuit shall be measured.

7.8.2 Illumination levels shall be tested and same shall not be less than the levels mentioned in Design Philosophy/Technical Specifications

7.9 **Earthing**

The continuity of earthing and resistance of each earth pit and grid shall be measured with earth megger. The resistance of grid connecting all earth pits shall be less than one ohm.

7.10 **Miscellaneous Equipment**

Under this are included, exhaust fans, blowers, limit switches, vibrators, electro-magnets, air pressurisation unit etc. The following tests shall be conducted:

7.10.1 Measurement of insulation resistance

7.10.2 Check up the direction of rotation.

7.10.3 Operational test

7.11 **Motors/Generators**

7.11.1 General Checks

a) Check the alignment of motor/generator with the driven equipment/prime mover.

b) Check and calibrate motors/generators, safety switches, bearings/air temperature indicators, winding temperature indicators, water flow/air flow pressure meters, lubricating oil pump motors.

c) Check operation of space heaters.

d) For motor/generator standing idle for a long time, carry out overhauling, re greasing and drying.

7.11.2 Check the condition of grease in bearings and if required replace completely with fresh grease after proper cleaning of bearings. This work shall preferably be taken up before final alignment of motor with driven equipment.

7.11.3 In case of oil lubricated bearings, the bearing housing shall be flushed with oil and then filled up to the specified level. Check that oil ring rotates freely along with motor. In case of pedestal type journal bearing, it may be necessary to open the top cover, and check the bearings.

7.11.4 Fix up all accessories like techno-generators, water pressure relay, temperature detectors and any other safety switches after calibration.

7.11.5 Check that the shaft rotates freely. This shall be done after decoupling the motor from driven equipment.

7.11.6 Check air gap between rotor and stator (wherever possible) at three places at 120^{o} apart on both sides of drive and verify with the figures furnished by the manufacturers. The variation shall not exceed 10% of average value.

7.11.7 Check the tightness of foundation bolts. Ensure pins are fitted before commissioning of motor.

7.11.8 Check that power and control cables are properly connected and tightened. All earth connections of the machine shall be checked.

7.11.9 In case of forced ventilated motor, clean the ventilation duct. Ensure that recommended flow and pressure of air is available to produce the required cooling effect. If the motor is provided with air to water heat exchanger, check for the adequate flow of water. If necessary, clean the exchanger to remove any obstruction to water flow. Check that there is no leakage from water cooler, pipe connections.

7.11.10 Check the space heater circuit. Space heaters shall be provided on all HT and special type LT motors. Switch on spare heater supply at least one week before the commissioning of motor. Wherever drain plugs are provided in motor body, open and check for water accumulation inside motor.

7.11.11 Testing

a) Insulation Resistance Test

The insulation resistance of LT motors shall be measured between the winding of the machine and its frame by means of 500/1000V megger. A minimum value of 1 MΩ for 400 V motors shall be considered a safe value.
3.3KV, 6.6KV and 11KV motors/generators shall be tested for insulation by 1000 5000 V megger and its value shall not be less than 1 MΩ for each KV. However, it is desirable that before commissioning the motors, the insulation resistance shall be improved substantially above the lower limits. The contractor shall carry out heating of winding as per the advice of the consultant/Owner. The following methods may be adopted.

b) Drying

i) Blowing hot air

ii) Placing heater or lamps around and inside, in case of small motors after making suitable guarding and covering arrangement so as to conserve that heat.

iii) Heating by injecting low voltage in the winding low voltage output of welding set shall be used. The winding shall be inter-connected so that current flows through each phase, and particular care shall be exercised to prevent local overheating. The voltage applied shall be suitably adjusted. The maximum temperature of winding, while drying, shall be 70^{o} to 80^{o}C by thermometer or 90o to 95^{o}C by resistance method. Heating shall be done slowly first till steady temperature of winding is reached (may be within 4 to 8 hours depending upon size of motor) once the steady temperature is reached, maintain it for some time.

iv) Check the insulation resistance which will drop first and then become steady. Hourly reading of IR shall be taken and temperature shall be recorded 1/2 hourly. If IR is reasonably steady, supply can be switched off. Measure IR under cold condition. Never keep the motor unattended during drying process.

v) For checking polarisation index of HT motor, use electric driven megger. Note IR value after 1 minute and 10 minutes. The ratio shall be compared with data supplied by manufacturer (but shall be not less than 2.5).

7.11.12 Operational Test

a) Check control gear and set the protective relays as per settings supplied by Consultant. It is preferable that before first no-load run, the settings may be kept lower than 100%. However, during load running, settings shall be restored to Normal. Simulation test shall be conducted on motor starter, circuit breaker (main fuses removed on CB at test position). All interlock shall be incorporated in the control system. Testing shall be done from local and remote control station and shall be ensured that the control system works satisfactorily. In case of any defect in the integrated control wiring the contractor shall locate and rectify such defects.

b) Any other tests recommended by the manufacturer for special type equipment like variable speed motors etc. shall be done.

7.11.13 No-load Test

Finally the motor shall be started on no load after decoupling. Check the direction of rotation and change if required. The motor shall be run for 8 to 10 hours. Voltage, starting current, and starting time shall be noted. Hourly reading of current, winding and bearing temperature, (for small motors body temperature to be measured by thermometer) shall be noted. Note vibration, excessive noise if any.

In case of variable speed motor, variation of speed shall be checked and regulation of speed noted.

7.11.14 After switching off the motor, the insulation resistance shall be measured under hot and cold condition.

7.11.15 If the no-load trial run is found satisfactory, the motor shall be run on load after adjusting the protective relay setting to 100% value. Note the starting time, load current, winding temperature etc. The temperature rise shall not be more than the specified value. Check for any excessive vibration or noise.

7.11.16 Generator shall be tested in the presence of manufacturer's representative only as per their instructions.

8.0 DOCUMENTATION

8.1 For the purpose of completion certificate, the following documents will be deemed to form completion document:

i) The technical documents according to which the work was carried out.

ii) Final check-list and completion report.

8.2 Three sets of construction drawings showing therein the modifications and correction made during the course of execution signed by Owner/Consultant/Engineer-in-charge.

8.3 Test certificates for the materials purchased by Contractor.

8.4 No claim certificate by the Contractor certifying that the entire work done by him under the contract has been measured and accepted for the final bill to his satisfaction and that he will have no claim(s) concerning any work(s) or part thereof performed by him under the Contract, to Owner except otherwise indicated in the final bill.

8.5 The completion certification shall be issued by Owner within 30 days of the Contractor furnishing documents listed in this clause jointly certified by Owner/Consultant and Contractor's Site Engineer.

9.0 HANDING OVER TO OWNER

9.1 The contractor shall hand over the complete installation as a whole. Minor details not specified or mentioned in the scope but required to complete the job as a whole will have to be done by the contractor without extra cost. Any equipment/installation shall not be deemed as handed over to Owner until the same is complete in all respect and is accepted in writing by the Owner/Consultant.

9.2 The final acceptance of the work shall be after the demonstration of guarantees by the Contractor and Owner shall issue the final acceptance/taking over certificate upon fulfilment of the guarantees.

10.0 OBLIGATIONS & RESPONSIBILITIES OF CONTRACTOR

The contractor's obligations and responsibilities shall include but not limited to the following:

10.1 To deploy skilled, semi skilled and unskilled personnel in requisite numbers and as per scheduled programme so as to complete the WORK as per overall project schedule.

10.2 To deploy suitably qualified supervisors and engineers in requisite numbers to assure execution of good quality job as per best engineering practices and to the full satisfaction of Owner/Consultants/Engineer-in-charge.

10.3 To prepare detailed planning and execution schedule considering the availability of fronts and materials. This shall be reviewed by Owner & consultant and Contractor shall be required to keep updating the same (as per the instructions of Owner/Consultant/Engineer-in-charge) to take care of any changes in the availability of fronts and materials and to complete all jobs as per the overall project schedule. Owner/Consultant/Engineer-in-charge shall in no way be held responsible for such changes because such changes are deemed quite a common feature in any project of this size.

10.4 Construction power shall be made available at one point. Arrangement for distributing the same to various areas for construction shall be the contractor's responsibility.

10.5 To arrange and supply all tools and tackles, consumables, instruments, erection materials & machineries etc. for handling erection, testing & commissioning of

complete electrical installation. List of major tools and tackles required are as listed below:

i. Cranes, winches, chain pulley blocks etc. in required quantity and of suitable capacity.

ii. Trailers with prime mover/Tractor trailers.

iii. D-Shackles, slings, wire ropes etc.

iv. Transformer welding sets

v. Water level, spirit level etc. for levelling and alignment.

vi. Gas cutting sets

vii. Drilling/Grinding machines

viii. Jacks with spindles (for cable drums)

ix. Pipe bending machine

x. Hydraulic crimping tools set

xi. Hand crimping tools set

xii. Air blower/vacuum cleaner

xiii. Streamline transformer oil filtration machine with temperature and pressure gauges.

xiv. Transformer oil dielectric strength testing machine, portable type.

xv. High voltage testing set.

xvi. Secondary injection testing set

xvii. 5 KV motorised Megger Insulation tester

xviii. 500 V to 2.5 KV each rating hand operated ‘Megger’ Insulation tester

xix. Earth resistance tester with leads and spikes

xx. Clip on ammeters/tong testers

xxi. Tachometers/Tacho-generators (for RPM checking)

xxii. Phase sequence meter

xxiii. Primary injection set up to 2000 amps., if required

xxiv. Grease gun for greasing of motors

xxv. Wooden sleepers of proper size and in adequate numbers.

xxvi. Scaffolding materials as required.

xxvii. Any other tools and tackles and facilities required completing all the jobs as per ITB to the best engineering practices.

xxviii. Drilling M/C for drilling hole in RCC Roof/Column for grouting expansion bolts.

xxix. DG set for construction power

10.6 To arrange and supply all consumables (required for executing the under question) such as but not limited to the following in sufficient quantity, of required quality and in time to meet the schedules:

Electrodes, filler wires, industrial gases, such as oxygen, acetylene, diesel, petrol, kerosene, CTC, standard grease/lubricant for motor bearings, insulating tapes, compounds, solders, fluxes, rawl plugs, phil plugs, saddles & bars, ferrules, bricks, sand, cement, stone chips, clamps, tags, shims, hardwares, paints, thinners (as required), salt and charcoal (for each electrode pits), copper lugs for GI earth wires, cotton waste, marking cloth, sand papers, emery papers, thread, nylon ropes.

10.7 To arrange and supply storage tanks for drinking water so as to avoid any inconvenience that may be caused due to interruption in water supply at times.

10.8 To provide proper storage and security arrangements for Contractor's tools, tackles, equipments, materials etc. as well as equipment and materials issued by Owner/Consultant to Contractor (if applicable). Owner/Consultant shall not be responsible for any loss or damage to items in the custody of Contractor at site for any reason whatsoever.

10.9 Completion of all repairs arising out of defective work done by Contractor Owner/Consultant/Engineer-in-charge may at his discretion require the Contractor to rectify certain defects in materials caused due to bad workmanship of supplier and/or during transportation.

10.10 To maintain all the records for men, materials and execution of job as required by law as well as Owner/Consultant/Engineer-in-charge.

10.11 To get his work inspected by Owner/Engineer-in-charge and approved from statutory agencies such as but not limited to Electrical Inspector, Factory Inspector etc.

All co-ordination with Statutory Authorities shall be contractor’s responsibility. Only statutory fee required for approval shall be paid by the owner.

10.12 To make arrangements for services such as transport, medical, lighting, canteen etc. for working round the clock.

10.13 In addition to safety regulations indicated in this enquiry Owner/Consultant/ Engineer-in-charge may issue certain safety directives, which shall have to be followed meticulously without any reservation.

10.14 To undertake and execute work and supply as per scope of work, scope of supply, to follow Technical Conditions including specification for electrical erection, specification for electrical testing and commissioning. In honour all other obligations listed in other sections and sub-sections of this enquiry.

10.15 Reconciliation of materials issued to Contractor (if applicable) as directed by Owner/Consultant/Engineer-in-charge.

10.16 Handing over of the completed works to Owner/Consultant/Engineer-in-charge as per procedure laid down by Consultant.

10.17 To submit documentation forming part of request for issue of completion certificate.

10.18 Clearing the site after cleaning the areas where the Contractor executed the job, stored the materials and built his office, fabrication shop etc.

11.0 TERMS AND CONDITIONS

11.1 All the work shall be carried out in accordance with drawings and the entire installation shall conform to the Indian Electricity Rules/Regulations/Acts and with latest issue of relevant IS, Specifications, drawings & documents supplied by Consultant/Supplier/Owner and as per the directions of Owner/Consultant/ Engineer-in-charge.

11.2 Contractor's Staff

The contractor shall employ all skilled, semi-skilled, non-skilled labourers necessary for erection, installation testing and commissioning. All electricians, cable jointer, wire man and others employed by the contractor shall be suitably qualified and must possess valid certificates/licences recognised by the competent authorities.

Engineer-in-charge at his own discretion may put any electrician/wireman/wire cable jointer to test for ascertaining the competence of the technician concerned and the contractor shall have to replace any staff found incompetent to execute the jobs as per requirements, in the opinion of the Owner/Consultant/Engineer-in-charge. The contractor shall also furnish a list of such staff and indicating whether he holds such competence certificate to supervise electrical installation jobs as required under Indian Electricity Rules and Regulations, and State Inspectorate Rules.

11.3 Contractor's Workshop

The Contractor shall set up his own workshop having facilities to undertake all jobs connected with, Erection, Testing and Commissioning. He shall provide all facilities at site to undertake steel fabrication work e.g. fabrication of cable racks/ trays, cable supports/brackets/frameworks/base frames for electrical equipment etc.

The contractor will be required to provide workshop and other facilities to undertake minor fabrication work, including conduit bending and threading, fixing

rawl plugs, welding supports, making brackets, small foundation bolts, protective guards, and such other miscellaneous items as may be necessary for completing the erection, testing and commissioning jobs. The contractor shall also, on his own, set up adequate office, stores, godowns etc. for his work in the area/space provided by the Owner/Consultant/Engineer-in-charge.

11.4 Tools and Tackles

The contractor shall have to arrange all tools, tackles including various erection machineries and instruments for measuring, testing, calibrating etc. required for erection as well as for Testing and commissioning on his own, such as compressors, cranes, winches, jacks, chain pulley blocks, welding sets, oxygen, acetylene gas cutting set, drilling machines, grinders, pipe bending machines, dies for pipe threading, scaffolding materials, cable jointing/crimping tools, megger, ductor, filtering machines, earth tester, secondary injection sets, sub-standard meters for calibration of ammeters, voltmeter, oil testing-sets, Multi meters, phase sequence meters, HT test set, primary injection (if required), clip on ammeters (tong testers), techo-generators etc.

11.5 Materials

11.5.1 All materials shall be in contractor's scope of supply, unless indicated to be supplied by Owner. The contractor shall have to arrange at his own expenses all consumables required by him for erection as well as for testing and commissioning like Kerosene oil, petrol, CTC, grease, petroleum jelly, rawl plug, phil plug, screws/nails, wires for portable tools, lights, plugs, cotton waste, jute dusters, shims for alignment/levelling, cement, sand, stone chips, bricks, reinforcement rods, welding electrodes paint, insulating taps, compounds, solders fluxes, ferrules, nut bolts, washers, cable clamps, cable tags and such other materials contractor might need to execute the complete job. The contractor might need to execute the complete job. The contractor shall also provide foundation bolts, for all floor/wall mounting equipment as per requirement at site. All hardwares supplied by the contractor shall be of GI. All GI materials shall have a minimum zinc coating of 610 g/m^2 at any point on the surface.

11.5.2 All equipment and materials including Instruments/meters required for measuring, checking, testing and commissioning are included in the scope of the contractor and shall be arranged and supplied by the contractor himself.

11.6 Inspection

11.6.1 Electrical Installation work shall be subject to inspection by Owner's/Consultant's engineers, statutory bodies like Electrical Inspector, Factory Inspector, and wherever applicable by equipment supplier's engineer. The contractor shall carry out all damages/rectification/modification desired by the above engineers/ inspectors or to make the installation conform to relevant Electricity Rules etc.

11.6.2 Further the Owner/Consultant may reject any portion of the work considered defective or of poor workmanship and contractor shall make good these defects without extra cost.

11.6.3 Owner/Consultant reserves the right to get such repairs/replacements done from any other agencies in case the contractor fails to do the job within a period of 7 days after the request has been made to him in writing and the cost of such alteration/repair/testing shall be recovered from the contractor and will be adjusted against any bill due to the contractor.

11.7 **Completion of work**

Work shall be deemed to be incomplete until such certificates as required under statutory regulations are obtained and delivered to Owner/Consultant/Engineer-in-charge.

11.8 **Clearing of Site**

The contractor will be responsible for the final clearing of site after completion of erection works as well as after completion of jobs connected with testing and commissioning. He will return all excess materials such as cables, earthing materials etc. to the Stores under instructions from Owner/Consultant/Engineer-in-charge. All empty cable drums, packing materials, cut-pieces of cables, steel scraps, and other materials, supplied by Owner (if applicable) for the job shall be shifted to a suitable place by contractor as per instruction of Owner/Consultant/ Engineer-in-charge. Contractor will also be responsible for demolition and clearance of temporary sheds and structures put up by him.

All clearance of unwanted materials shall regularly be done as per advice of the Owner/Consultant/Engineer-in-charge.

12.0 DELETED

13.0 PRIOR APPROVAL OF THE MATERIAL TO BE SUPPLIED BY CONTRACTOR

All items to be supplied by the contractor shall be of superior quality and shall be of approved make. These shall be as per specifications and conforming to relevant Standards.

14.0 DELETED

15.0 STATUTORY APPROVALS

All co-ordination at site with statutory authorities (including inspection of completed WORKS from statutory authorities) shall be in the scope of CONTRACTOR. However, statutory fee required for approval shall be paid by the owner.

16.0 GUIDELINES FOR SAFETY MEASURES

Requirement of electrical power for any construction activity is of prime importance. The utilization of power in any construction site shall be done with utmost care to avoid accidents due to electrical shocks, fire due to electrical short circuits. Electrical installation increase the risk of such accidents, if it is exposed to adverse environmental conditions i.e. presence of hazardous gases. Hence, it

is absolutely essential to take extra precaution for such installation to ensure safety of personnel and equipments.

This standard gives details of required safety measures to be adopted for the electrical installations by all contractors during construction activities. Following are some general guidelines & check points that should be followed:

16.1 All electrical connections for electrical installations shall be carried out as per provisions of the followings latest codes and standards in addition to the requirements of statutory authorities and IE rules:

OISD–STD–173 : Fire prevention and protection system for electrical installations

IS–30 : National electric code

16.2 All electrical connections shall be done by a competent electrician having valid license and to the satisfaction of Engineer-in-charge and one competent licensed electrician shall be made available by contractor at site round the clock to attend the normal/emergency jobs.

16.3 All necessary personal protective equipment (PPE), Safety equipment shall be made available to use for persons employed by the contractors on the site and shall be maintained in condition suitable for immediate use. Protective equipment for head protection, body protection, eye protection, hand protection, hearing protection & respiratory protection shall be made available by the contractor. No loose clothing shall be allowed.

16.4 When workers are employed on electrical installations, adequate safety items/charts viz. fire extinguishers, insulating mats, hand gloves, multilingual (English, Hindi & local languages) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name and telephone number of contact person in emergency shall be provided in substation and near all distribution boards/local panels. The workers shall not wear any rings, watches & carry keys or other materials, which are good conductors of electricity.

16.5 When work has to be done on elevated places, towers, roofs, pipe racks & other lofty positions where plat-forms & other fall guards are not there, use of SAFETY BELT is compulsory. Safety Nets will prove very helpful in case somebody slipped from height.

16.6 All welding machines and switchboards shall be kept in well-ventilated and covered shed. The shed shall be elevated to avoid water logging. Use of flammable material shall be prohibited for construction shed; also flammable material shall not be stored in and around electrical equipments. Adequate clearance and operational space shall be provided around the equipment.

16.7 No work, however, small should be undertaken/started without obtaining valid work permit from the concerned department. Confined space entry should be done only by valid entry permit from the Engineer-in-charge. Safety permit shall

be obtained before taking the temporary electrical equipment inside the hazardous area.

16.8 No work must be carried out on any live equipment. Electrical equipment should be considered live unless it is ensured that they are isolated & made dead/safe. A 'permit-to-work' shall be issued before any work is carried out. Don't tamper with any type of electric switches/equipments or any other appliances or moving machinery installed in factory area without permission.

16.9 Before the contractor connects any electrical appliance to any plug/socket belonging to the other contractor/owner, he shall:

i) Indicate to the Engineer-in-charge that the appliance is in good working condition.

ii) Inform the Engineer-in-charge of the maximum current rating, voltage and phase of appliance.

iii) Obtain the permission of the owner dealing the sockets to which the appliance may be conducted.

16.10 The Engineer-in-charge shall not grant permission to plug-in until he is satisfied that:

i) The appliance is in good working condition and is fitted with a suitable plug.

ii) The appliance is fitted with a suitable cable having earth conductors.

16.11 All temporary installation shall be tested before energizing to ensure proper earthing, bonding and suitability of protection system and adequacy of feeders/cables.

16.12 Voltage for all portable equipment viz. drilling machine, temporary lighting etc. will not exceed 240 volts.

16.13 Earth leakage device shall be checked for operation regularly by temporarily connecting the series lamps. The operating current of earth leakage device shall not exceed 30mA.

16.14 All the electrical equipments should be properly earthed as per Indian Electricity Rules.

16.15 Use of hoisting machines & tackle including their attachments, anchorage & supports shall be good of mechanical construction, sound materials & adequate strength & free from patent defect & shall be kept in good condition & in good working order.

16.16 No welding/grinding/cutting/soldering or open flare/fire etc. should be done without valid safety permit issued by the Engineer-In-charge. While welding/grinding/cutting make sure that sparks & molten slag etc. don't fly or come into contact with combustible materials surrounding equipments, valves etc. i.e. make provision for collection of sparks by using 'Fire Blankets'.

16.17 Use of SAFETY APPLIANCES like safety goggles, canvas hand gloves, welding helmet, chrome-leather hand gloves, safety shoes, etc. during welding/chipping/ grinding should be enforced.

16.18 The following design features shall be ensured for all electrical installation during construction phase:

i) Each installation shall have a main switch with a protective device, installed in enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5M. The main switch shall be connected to the point of supply by means of armoured cables.

ii) The outgoing feeders shall be double or triple pole switch with fuses/MCB. Loads connected to three phase circuit shall be balanced as far as possible and load on neutral shall not exceed 20% of load in the phase.

iii) The installation shall be provided adequate protection against overload, short circuit and earth leakage by using suitable protective devices. Fuses wherever required, shall be of HRC type only. Use of rewireable fuses shall be strictly prohibited.

iv) Connections to the welding receptacles/hand tools shall be taken through proper switches, sockets and plugs.

v) It shall be ensured that all single phase sockets shall be 3-pin type only and all unused sockets shall be provided with socket caps.

vi) Contractor shall use 3 core (P+N+E) overall sheath flexible cables with minimum conductor size of 1.5 sq. mm. copper for all hand tools.

vii) Metallic distribution boxes with double earthing shall be used only at site. No wooden boxes shall be used.

viii) It shall be ensured that cables to be used for installation purpose shall be free from insulation damage.

ix) An independent earthing facility should preferably be provided within the temporary premises.

x) For local earthing, separate earth electrodes shall be installed near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earthing shall have insulation of green colour.

xi) It shall be ensured that structures shall not be used as a neutral. Separate core shall be provided for neutral earth.

xii) ON/OFF position of all switches shall be clearly marked/painted for easy isolation in emergency.

16.19 Don’t check gas leaks with lighter, matches or other flame. Always keep gas cylinders away from direct rays of sun, hot place, welding, grinding & cutting sparks. Valves on cylinders should not be lubricated. Gas cylinders should be

kept away from work place & Acetylene cylinders should be kept vertical. Cylinder should not be rolled on roads for transportation from stores or one place to another place, use suitable handcart for the purpose. It is prohibited to carry gas cylinder up-stair in the plant or in-side the vessel or confined spaces for cutting/welding job.

16.20 Permission of a supervisor before any excavation is a must. Also the presence of underground electric cables or any pipelines must be taken care of during excavation. Excavated earth must not be dumped within five feet. The further the better.

16.21 All the sewers or openings/cut-outs should be kept covered to avoid pit falls. Red illuminated signal should be displayed so that nobody goes near the pit/opening during dark hours. Proper approaches/scaffoldings/ladders etc. must be provided to avoid falls.

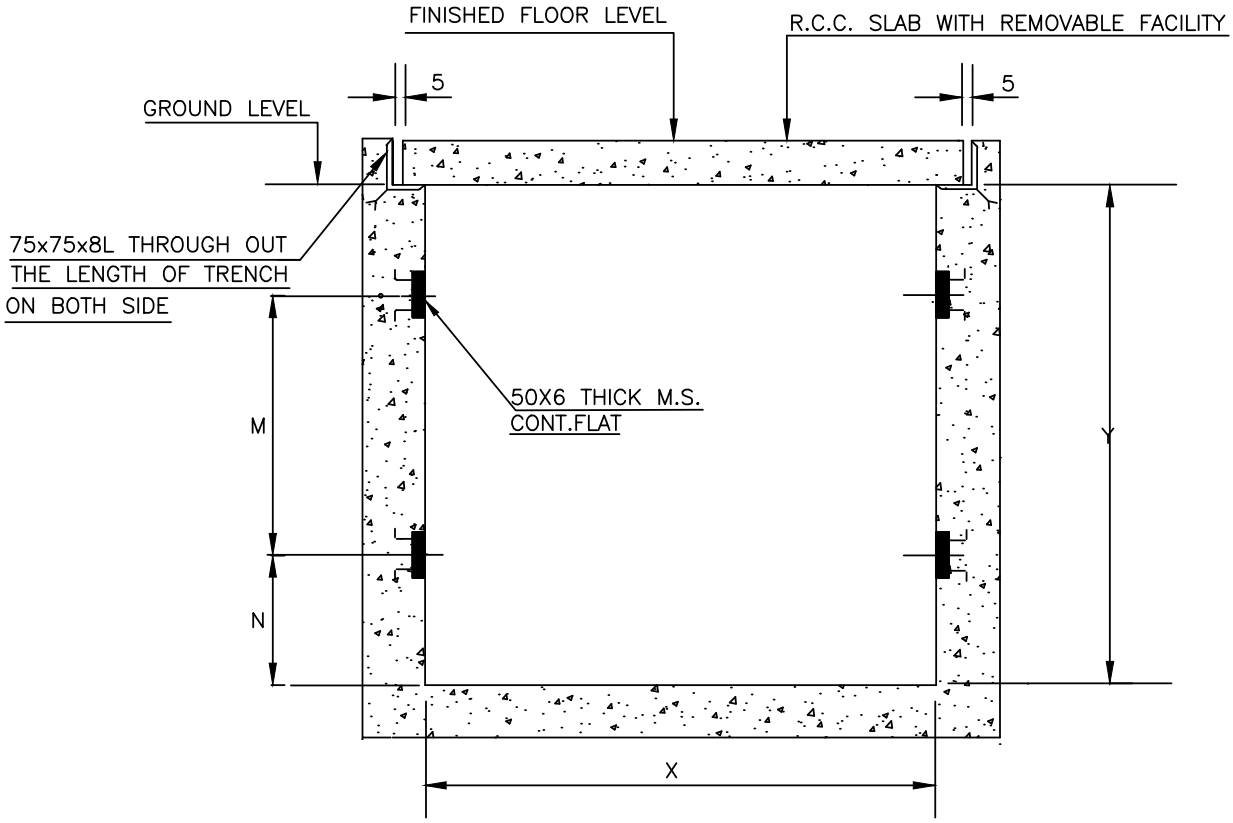
16.22 Be careful to keep all aisles, passageways and stairways clean & unobstructed. All discarded metal & other scrap should be collected. Storage area for keeping equipments, machines & other raw materials should be isolated & properly protected. Combustible materials like wooden pieces, cotton waste, bags etc. should be immediately removed to safe places.

16.23 Sitting or walking on rail tracks, crossing between wagons, taking rest under stabled wagons, crossing the rail through the openings underneath the stationary wagons shall be strictly prohibited. Standing under a suspended load is very dangerous. It may slip & fall on you thereby causing serious injury & even death.

16.24 Hands should be thoroughly washed before touching anything that goes in your mouth. All concerned personnel at site should maintain a high standard of ‘Cleanliness’. Smoking & carrying matchbox, cigarettes, lighter, bidis etc. shall be prohibited.

16.25 Unauthorized entry into any battery limit of plant shall be strictly prohibited. Reckless driving or other non-observance of traffic safety rules shall result into withdrawal of permission to carry vehicles in side factory.

पी डी आई एल PDIL	DETAILS OF CONCRETE CABLE TRENCH	PC183-PDS:E 510	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



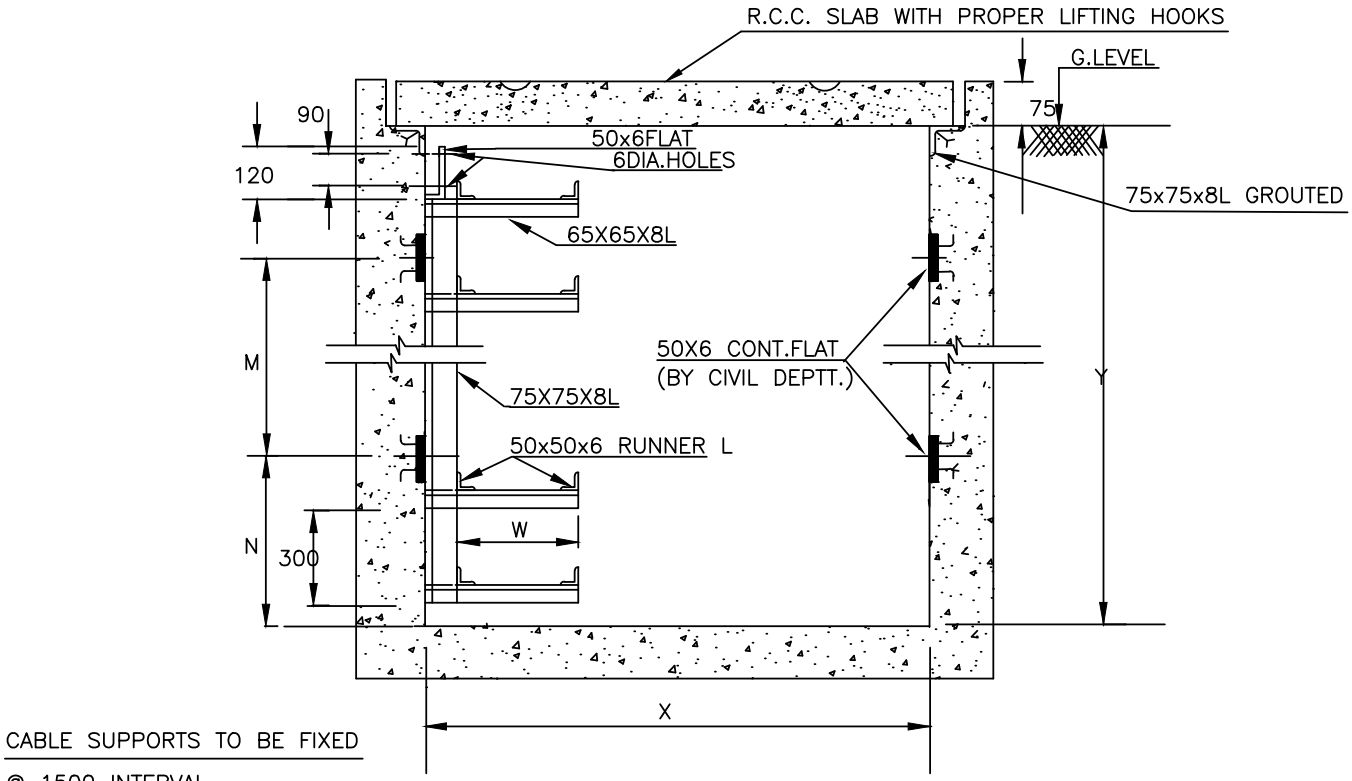
SECTION OF TRENCH

DESIGN TYPE	X	Y	N	M
5T 350DS.	1400	1500	400	650
4T 350DS.	1400	1200	250	650
3T 350DS.	1400	900	250	300
5T 350SS.	1000	1500	400	650
4T 350SS.	1000	1200	250	650
3T 350SS.	1000	900	250	300
5T 250DS.	1200	1500	400	650
4T 250DS.	1200	1200	250	650
3T 250DS.	1200	900	250	300
5T 250SS.	900	1500	400	650
4T 250SS.	900	1200	250	650
3T 250SS.	900	900	250	300

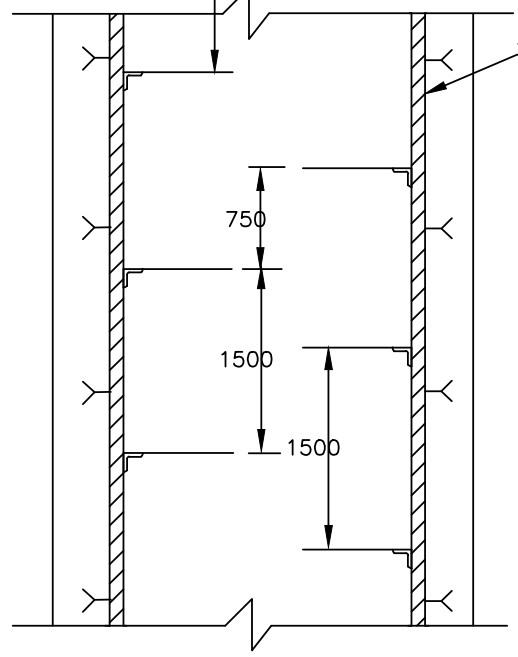
NOTES:–

1. THE TOP OF TRENCH SHALL MATCH THE FLOOR LEVEL IN PLANT AREA.
2. IN INDOORS INSTEAD OF RCC SLAB,20mm.THICK Al. EXTRUDED PLANK OR 10mm.THICK M.S.CHEQUERED PLATE SHALL BE USED AS PER PDS:E 507.
3. PROPER SLOPE TO BE GIVEN IN THE TRENCH FOR NATURAL DRAINAGE.
4. SS–SINGLE SIDE CABLE SUPPORTS.
5. DS–DOUBLE SIDE CABLE SUPPORTS.
6. ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	CABLE RACK ARRANGEMENT IN TRENCHES	PC183-PDS:E 511	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



SECTION OF TRENCH

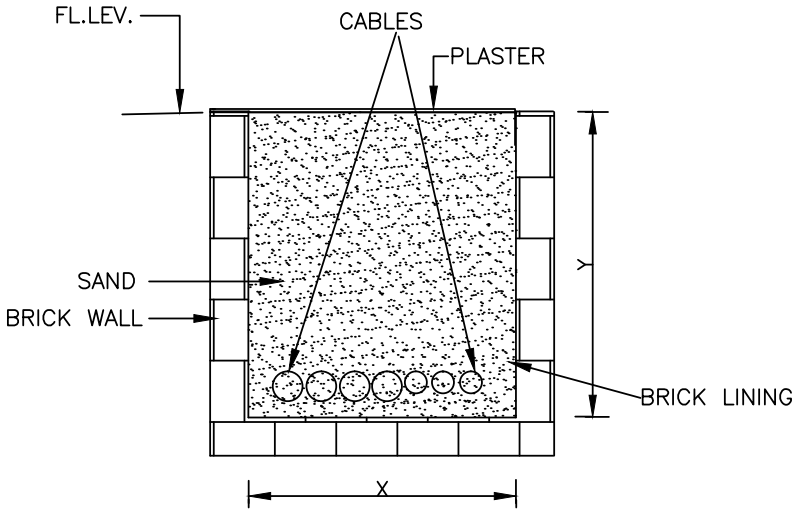


TYPICAL PLAN OF TRENCH

DESIGN TYPE	X	Y	N	M	W
5T-350-DS.	1400	1500	400	650	350
4T-350-DS.	1400	1200	250	650	350
3T-350-DS.	1400	900	250	300	350
5T-350-SS.	1000	1500	400	650	350
4T-350-SS.	1000	1200	250	650	350
3T-350-SS.	1000	900	250	300	350
5T-250-DS.	1200	1500	400	650	250
4T-250-DS.	1200	1200	250	650	250
3T-250-DS.	1200	900	250	300	250
5T-250-SS.	900	1500	400	650	250
4T-250-SS.	900	1200	250	650	250
3T-250-SS.	900	900	250	300	250

NOTES:-
1. SS-SINGLE SIDE CABLE SUPPORT.
2. DS-DOUBLE SIDE CABLE SUPPORT.
3. ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	TYPICAL ARRANGEMENT OF CABLES BURRIED IN SLITS	PC183-PDS:E 516	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



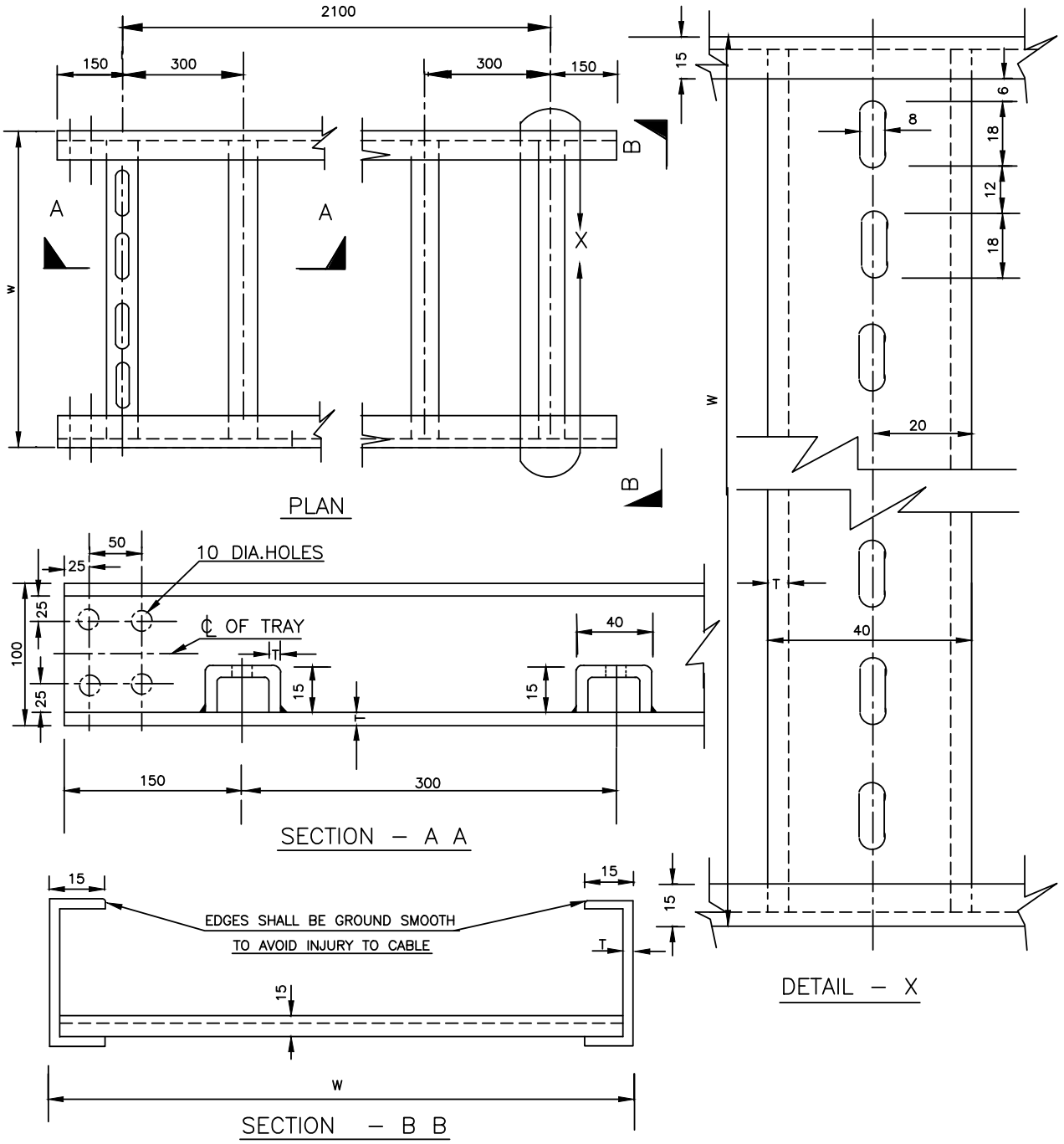
SECTION OF SLIT

DESIGN TYPE	X	Y
S 300	300	300
S 200	200	200

NOTE:-

1. CABLE SLITS SHALL BE FILLED WITH SAND AND PROPERELY PLASTERED WITH LEAN CONCRETE AFTER LAYING OF CABLES.
2. WHEREVER CABLES ARE COMING OUT OF THE SLIT, SUITABLE MECH.PROTECTION TO BE PROVIDED.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY STRAIGHT RUN	PC183–PDS:E 530	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	

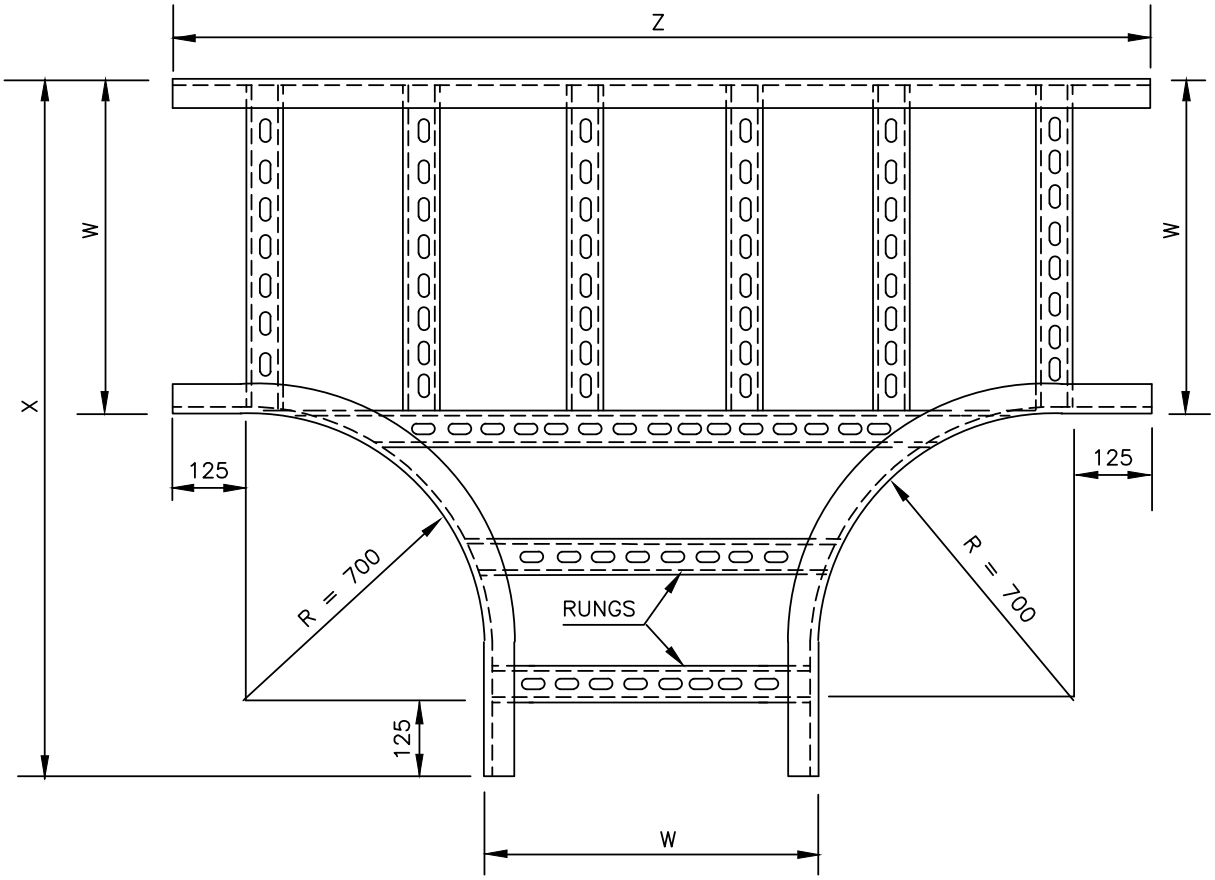


DESIGN TYPE (WIDTH)	MAX.SUPPORTING SPAN		WEIGHT/METER APPROX. IN Kg.	
	G. I.	A. L	G. I.	A. L
SR 900	2000	2000	10.5	3.6
SR 600	2000	2000	8.9	3.05
SR 450	2000	2000	8.0	2.75
SR 300	2000	2000	7.6	2.6
SR 150	2000	2000	6.8	2.33

NOTE:–

THICKNESS " T " SHALL BE 3mm FOR G.I AND 4mm.FOR AL.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY HORIZONTAL TEE	PC183–PDS:E 531	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



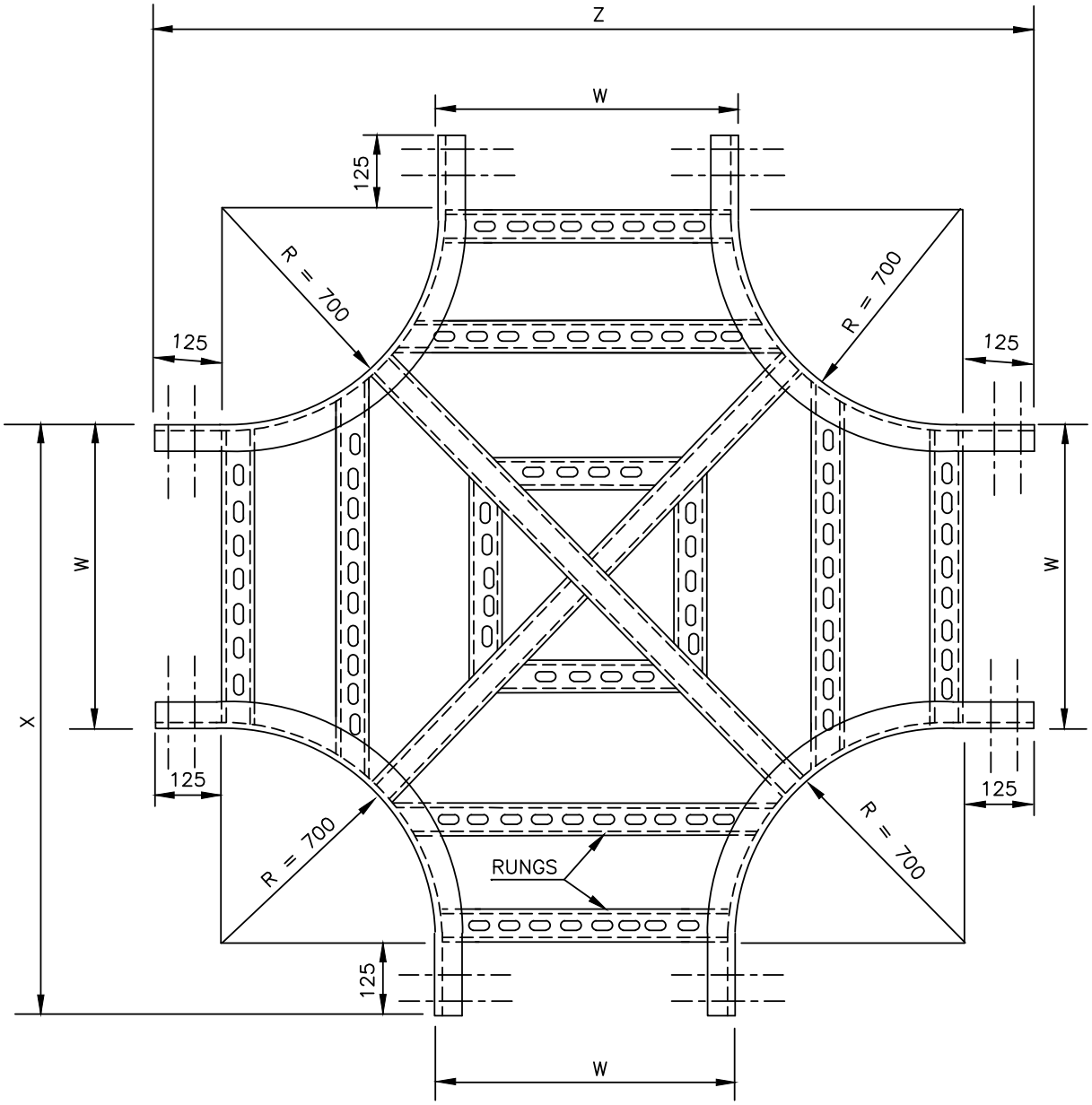
PLAN

DESIGN TYPE	W	X=R+W+125	Z=2R+W+250
HT 900	900	1725	2550
HT 600	600	1425	2250
HT 450	450	1275	2100
HT 300	300	1125	1950

NOTES :–

1. DISTANCE BETWEEN TWO RUNGS SHOULD BE APPROX. 300mm.
2. ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY HORIZONTAL CROSS	PC183–PDS:E 532	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



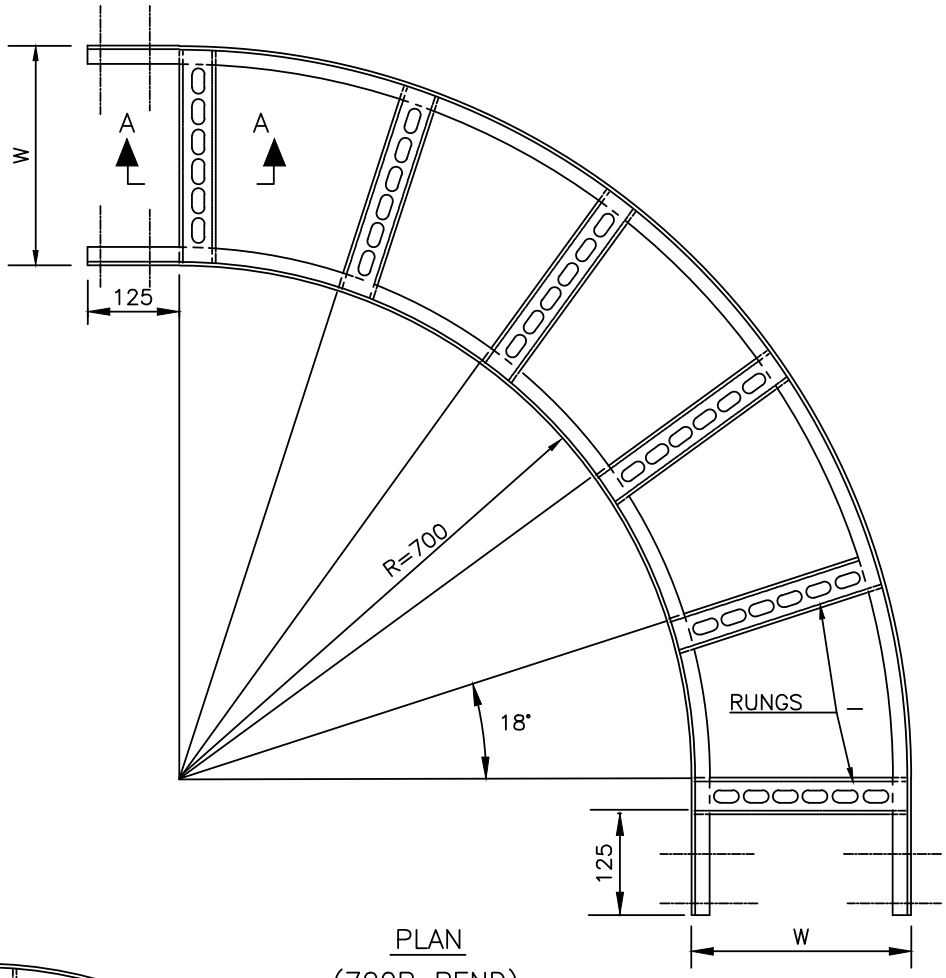
PLAN

DESIGN TYPE	W	X=R+W+125	Z=2R+W+250
HC 900	900	1725	2550
HC 600	600	1425	2250
HC 450	450	1275	2100
HC 300	300	1125	1950

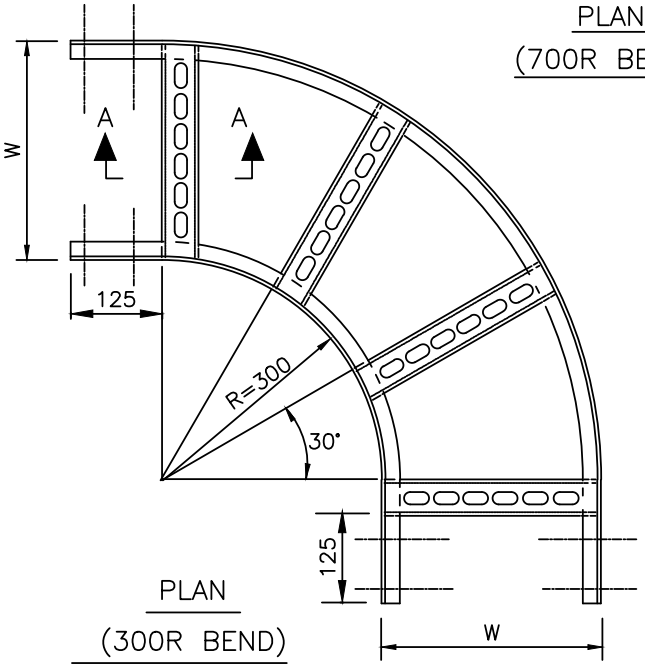
NOTES :–

1. DISTANCE BETWEEN TWO RUNGS SHOULD BE APPROX. 300mm.
2. ALL DIMENSIONS ARE IN mm.

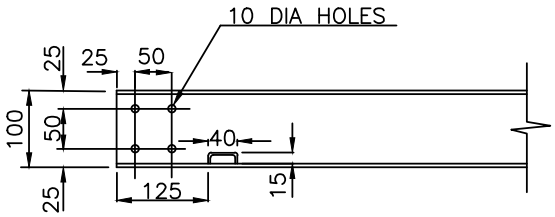
पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY 90° HORIZONTAL BENDS	PC183 –PDS:E 533	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



PLAN
(700R BEND)



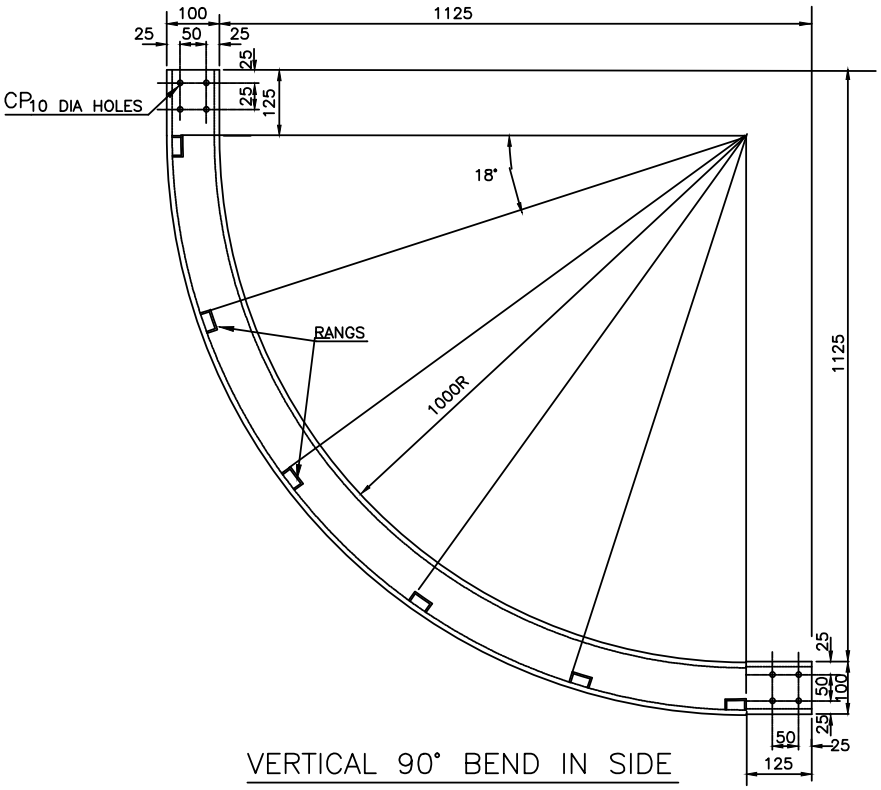
PLAN
(300R BEND)



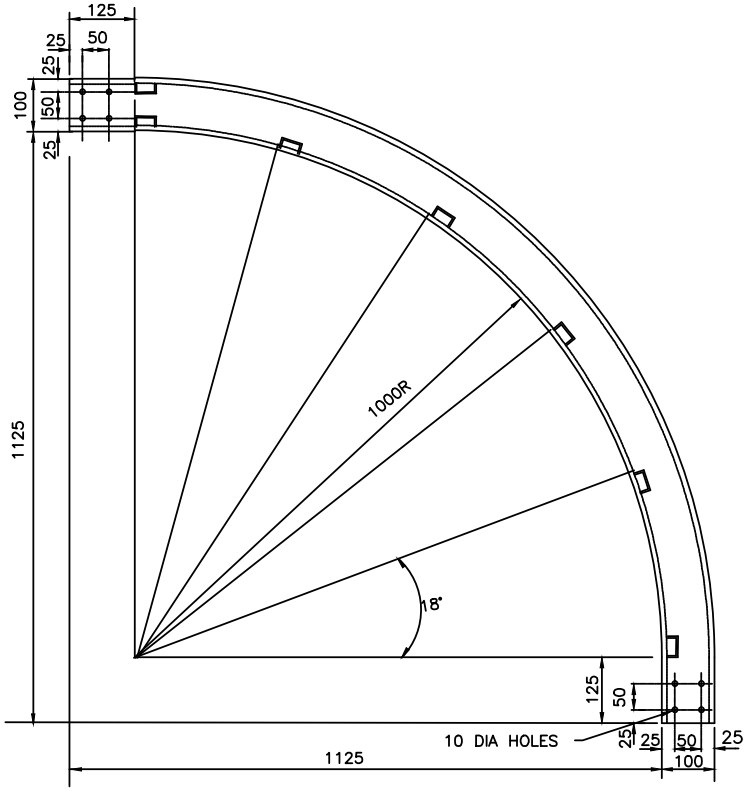
SECTION A–A

ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY 90° VERTICAL BEND BENDING RADIUS 1000 mm	PC183–PDS:E 534	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



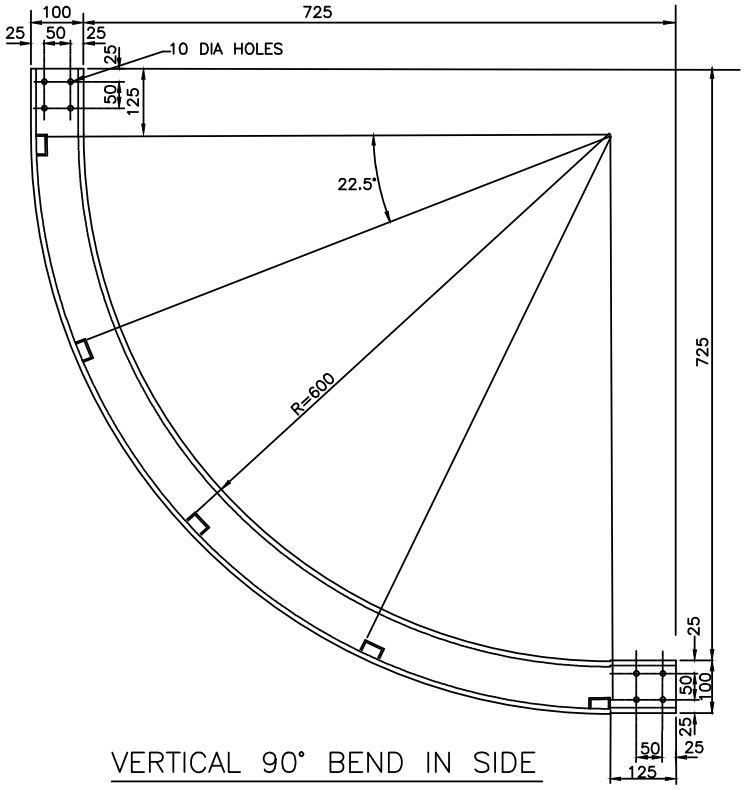
VERTICAL 90° BEND IN SIDE



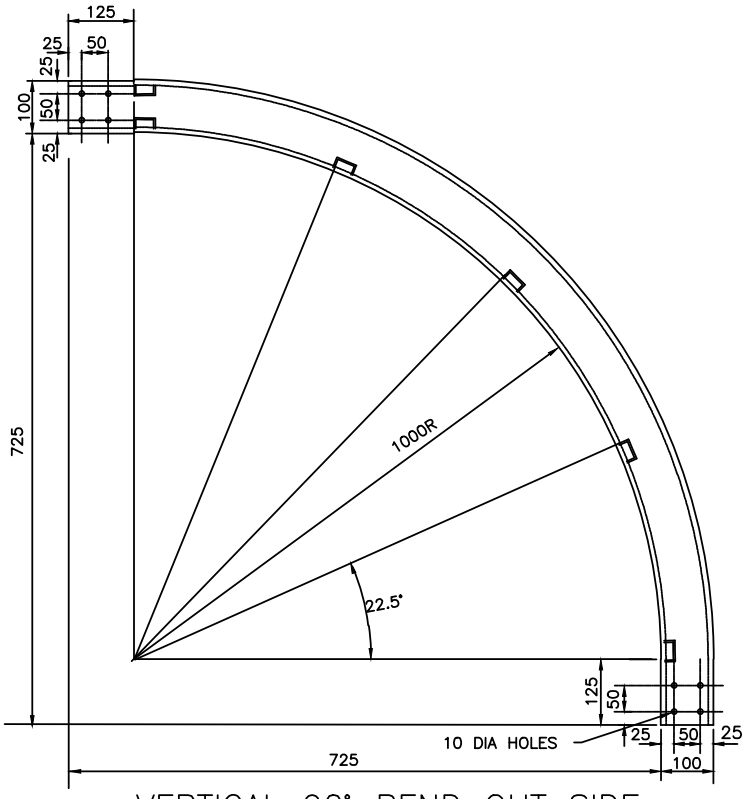
VERTICAL 90° BEND OUT SIDE

DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY 90° VERTICAL BENDS BENDING RADIUS 600 mm	PC183–PDS:E 535	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



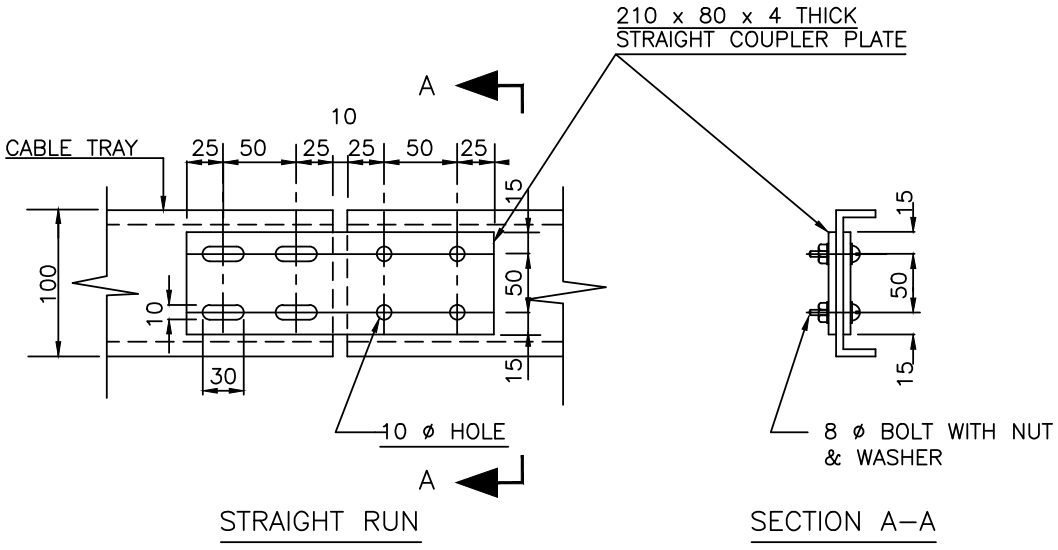
VERTICAL 90° BEND IN SIDE



VERTICAL 90° BEND OUT SIDE

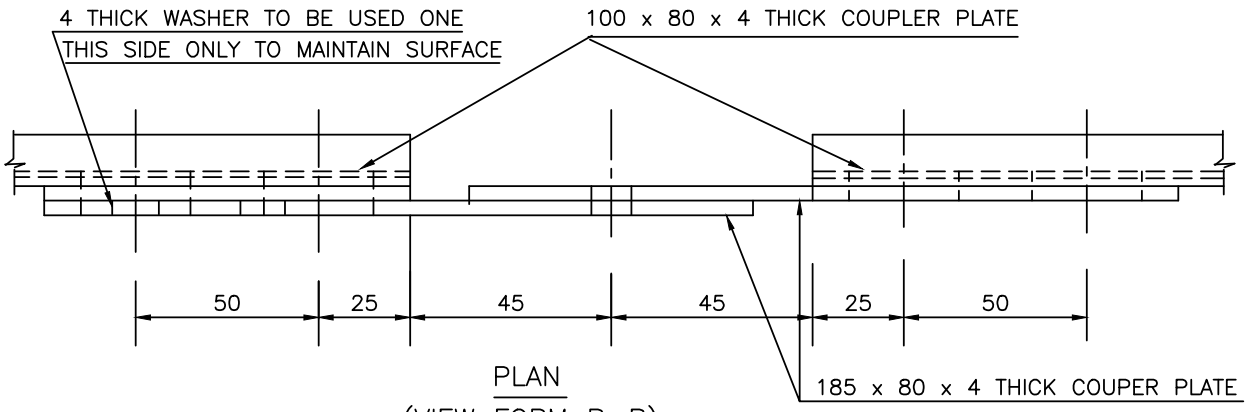
ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY COUPLING ARRANGEMENT	PC183-PDS:E 536	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	

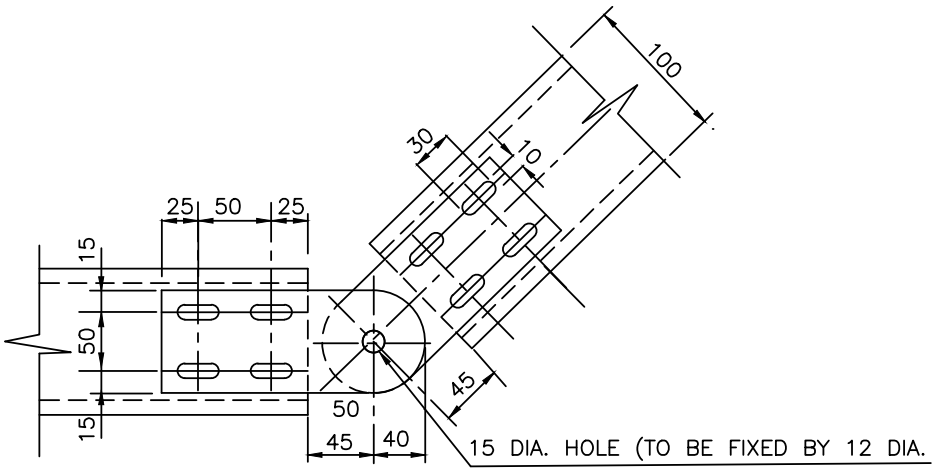


STRAIGHT RUN

SECTION A–A



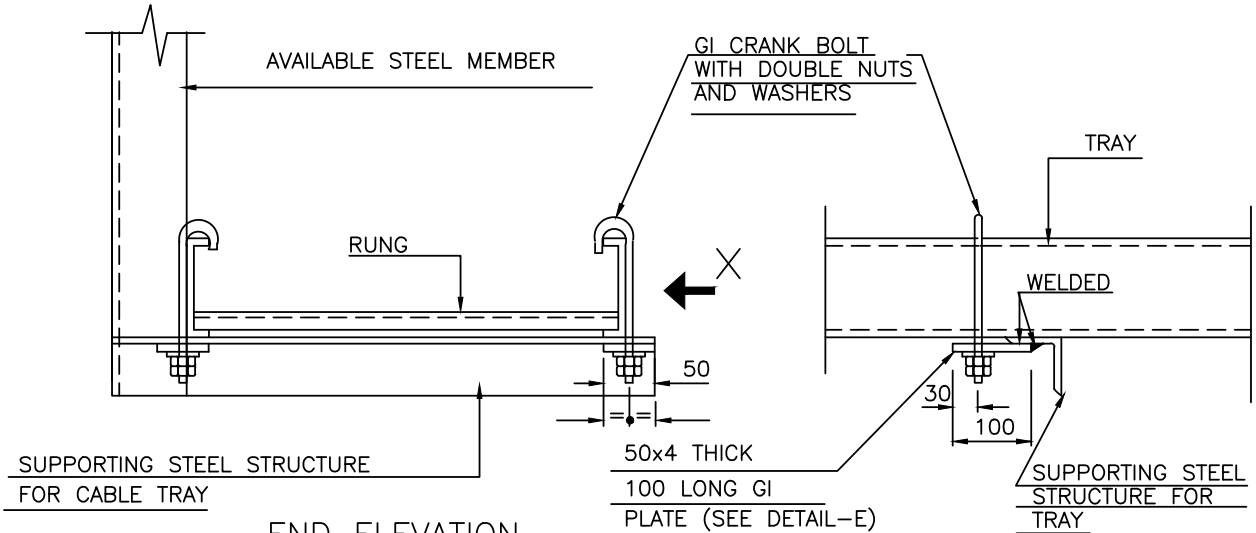
PLAN
(VIEW FORM B–B)



ELEVATION
(ADJUSTABLE BEND)

ALL DIMENSIONS ARE IN mm.

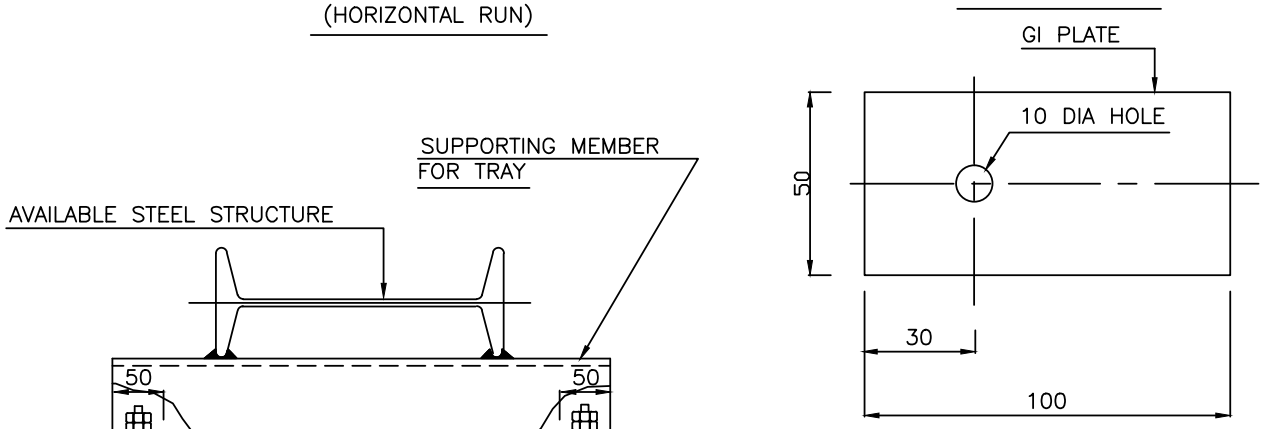
PDIL	PRE–FABRICATED CABLE TRAY FIXING ARRANGEMENT	PC183-PDS:E 537	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



END ELEVATION

(HORIZONTAL RUN)

VIEW AT –X

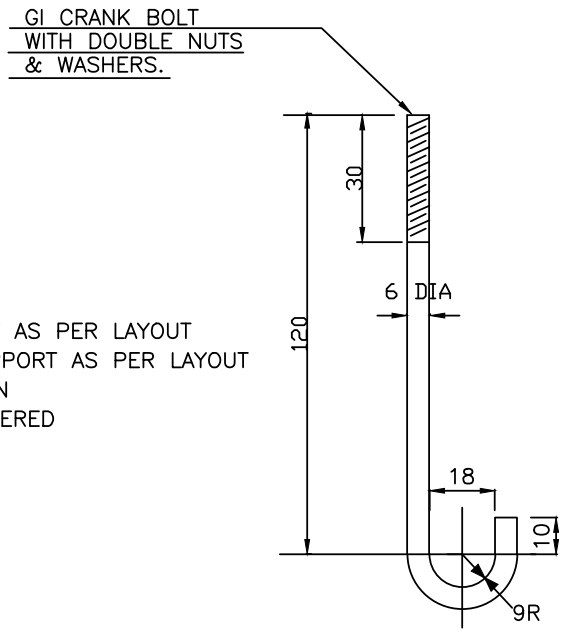


PLAN

DETAIL–E

PLAN

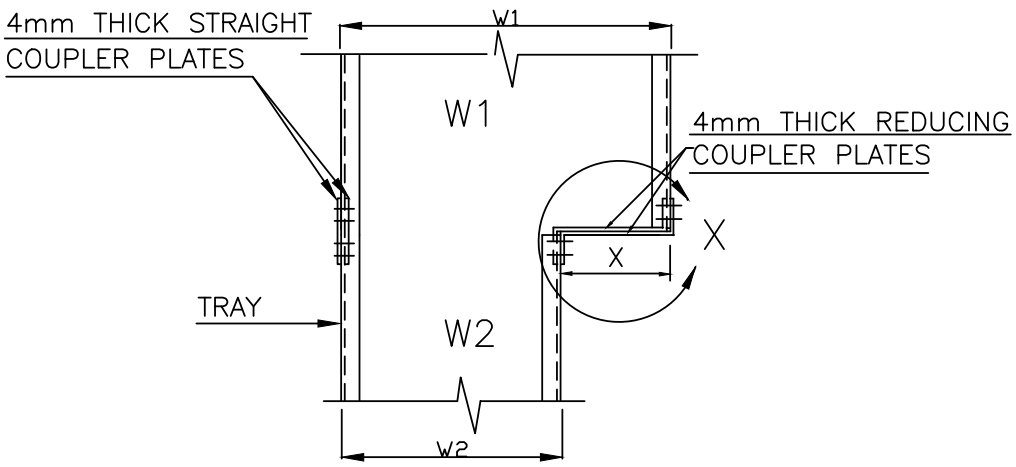
VERTICAL RUN (RISER)



NOTES:–

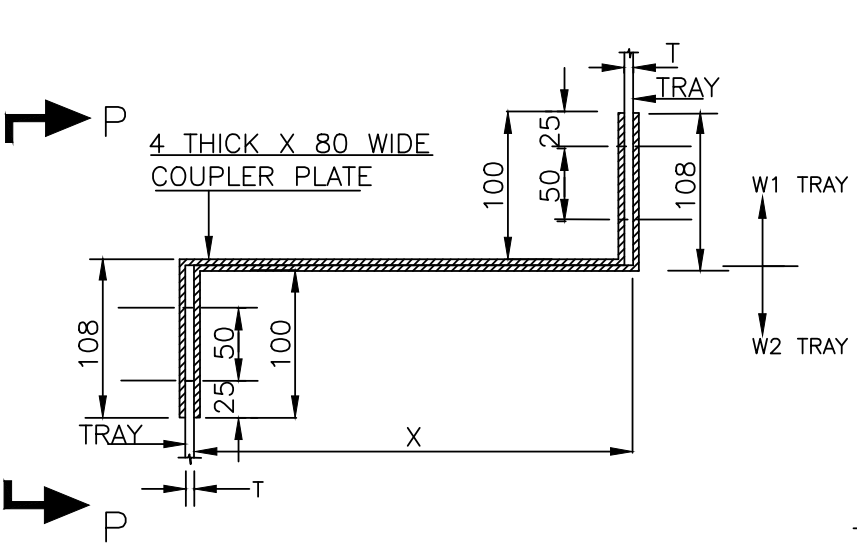
1. HORIZONTAL RUN TO BE CLAMPED WITH EVERY SUPPORT AS PER LAYOUT
2. VERTICAL RUN/ RISER TO BE CLAMPED WITH EVERY SUPPORT AS PER LAYOUT
3. EACH CRANK HOOK SHALL BE SUPPLIED WITH ONE PLAIN WASHER, ONE SPRING WASHER AND TWO DOUBLE CHAMFERED HEX NUTS. THESE SHAL BE GALVANISED ITEMS.
4. ALL DIMENSIONS ARE IN mm.

पी डी आई एल PDIL	PRE–FABRICATED CABLE TRAY REDUCING COUPLER PLATE	PC183–PDS:E 538	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



PLAN

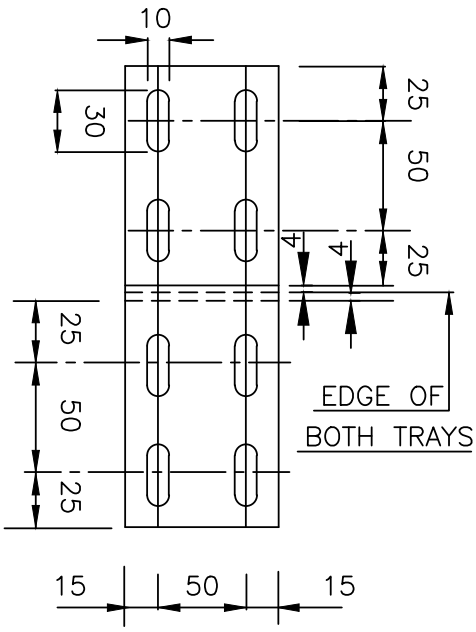
(REDUCING TRAY JOINT)



DETAIL– X

DETAIL OF REDUCING

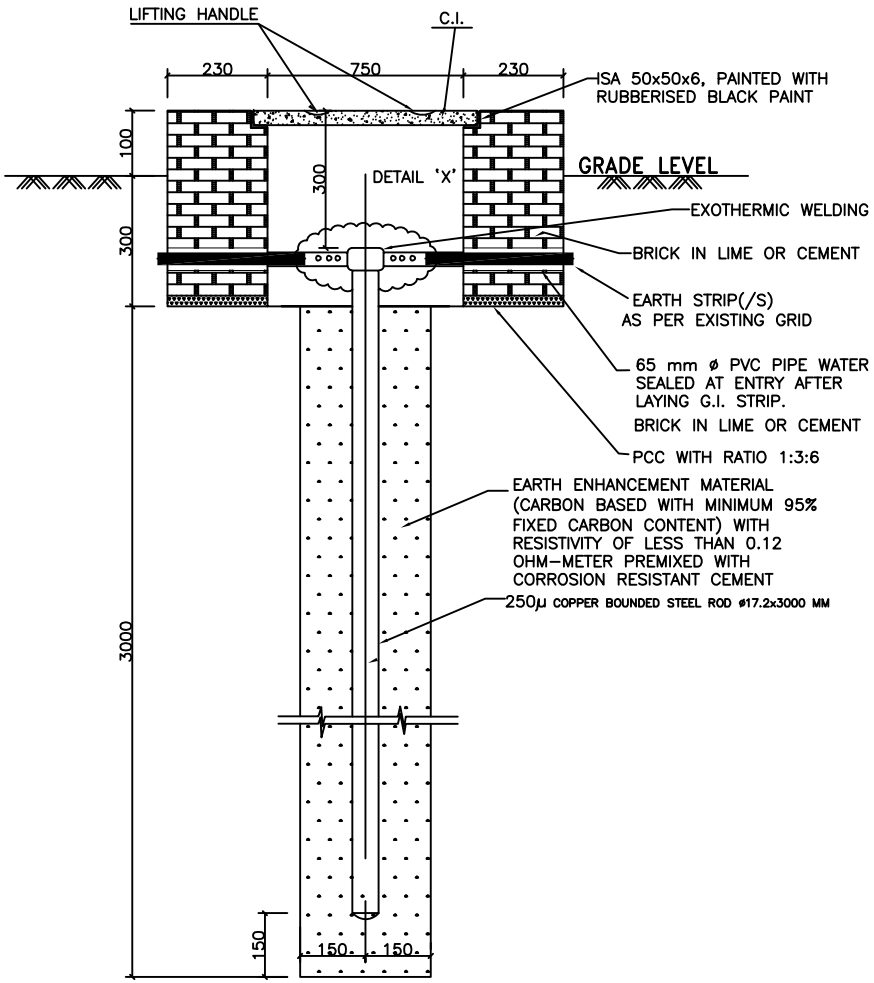
COUPLER PLATE (4 THICK)

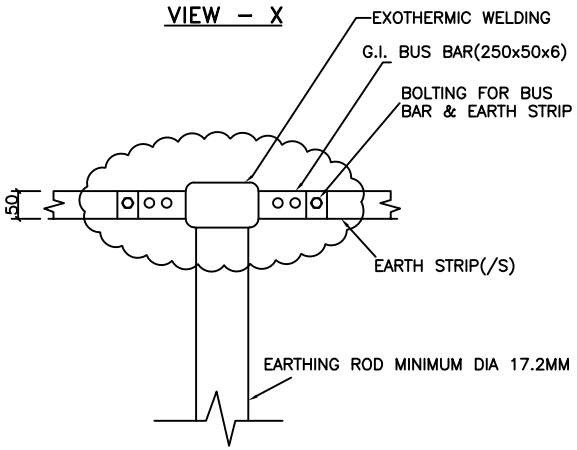


VIEW – P–P

ALL DIMENSIONS ARE IN mm.

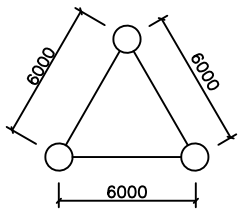
SL. NO.	W1	W2	X
1	900	600 450 300	300 450 600
2	600	450 300	150 300
3	450	300 150	150 300



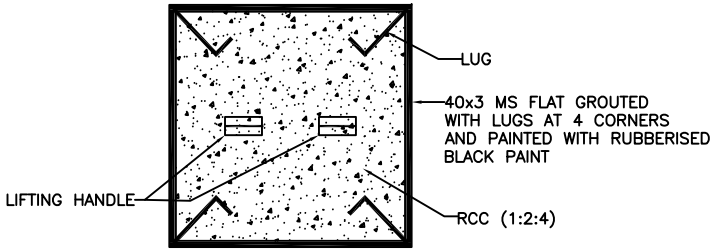


NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. EARTH ELECTRODE SHALL BE COPPER BONDED STEEL ROD HIGH TENSILE–LOW CARBON STEEL ROD HAVING DIAMETER NOT LESS THAN 17.2 MM COMPLYING WITH REQUIREMENTS OF BS 4360 GRADE 43A OR EN10025:2–004 S275JR, MOLECULARLY BONDED BY 99.99% PURE HIGH CONDUCTIVITY COPPER ON OUTER SURFACE WITH COPPER COATING THICKNESS 250 MICRON OR MORE, LENGTH 3000 MM (MINIMUM).
3. WELDING OF EARTH STRIP IS TO BE DONE BY OVER– LAPING EARTH STRIP WITH MINIMUM OF TWICE THE STRIP WIDTH.
4. HIGH TENSILE STRENGTH STAINLESS STEEL FASTENERS, FLAT & SPRING WASHER TO BE USED FOR BOLT CONNECTIONS.
5. EARTH ENHANCEMENT MATERIAL SHALL CONFORM TO IEC 62561–7 HAVING THE FOLLOWING CHARACTERISTICS:–
   SHALL BE CARBON BASED WITH MIN 95% OF FIXED CARBON CONTENT PREMIXED WITH CORROSION RESISTANT CEMENT TO HAVE SET PROPERTIES. CEMENT SHALL NOT MIX SEPARATELY & SHALL NOT HAVE BENTONITE.
   SHALL HAVE HIGH CONDUCTIVITY, IMPROVES EARTH'S ABSORBING POWER AND HUMIDITY RETENTION CAPABILITY.
   SHALL BE NON–CORROSIVE IN NATURE HAVING LOW WATER SOLUBILITY BUT HIGHLY HYGROSCOPIC.
   SHALL HAVE RESISTIVITY OF LESS THAN 0.12 OHMS –METER.
6. HOLE DIA ON G.I. BUS BAR SHALL BE 12MM.
7. MINIMUM QUANTITY OF BACK FILL PER ELECTRODE SHALL BE 50 Kg.



ARRANGEMENT OF ELECTRODES



SECTION PLAN OF PIT COVER

REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
0	22.02.2022	ISSUED FOR TENDER	SS	RK	SKB

CLIENT:– TALCHER FERTILIZER LIMITED

REV. 0 | SHEET 1 OF 1 | SCALE: N.T.S.

TITLE:– TYPICAL ARRANGEMENT OF CHEMICAL EARTHING

DRG. NO.– PC183–PDS:E 1201

FILE:

PDIL प्रोजेक्ट्स एंड डेवलपमेंट इंडिया लिमिटेड नोएडा
PROJECTS & DEVELOPMENT INDIA LTD.–NOIDA

Talcher Fertilizers	GENERAL NOTES ON EARTHING AND LIGHTNING PROTECTION	PC183–PDSE: 601	0
		DOCUMENT NO.	REV
		SHEET 1 OF 2	

A. GENERAL

1. EARTHING AND LIGHTNING PROTECTION SHALL BE CARRIED OUT IN ACCORDANCE WITH IS : 3043 AND IEC : 62305 RESPECTIVELY AND SHALL ALSO CONFORM TO THE REQUIREMENTS OF INDIAN ELECTRICITY RULES.
2. THESE NOTES SHALL BE READ IN CONJUCTION WITH EARTHING & LIGHTNING PROTECTION LAYOUT DRGS. AND RELEVENT EARTHING STANDARDS (PDS:E)
3. THE SIZE OF EARTH CONDUCTORS & SYMBOLS SHOWN IN THE LAYOUT DRGS. SHALL AS PER PDSE: 602
4. AS FOR AS POSSIBLE, THE EARTH CONDUCTORS SHALL BE TAKEN ALONG POWER & CONTROL CABLE ROUTES.
5. EARTHING CONDUCTORS BURIED UNDER THE GROUND SHALL BE LAID ATLEAST 500 MM BELOW THE GROUND LEVEL UNLESS REQUIRED OTHERWISE, e.g FOR CROSSING ANY UNDER GROUND PIPE OR TRENCH ETC. WHERE THE EARTHING CONDUCTORS SHALL RUN AT A MINIMUM DEPTH 300 MM BELOW THE BOTTOM OF THE PIPE/TRENCH.
6. BARE ALUMINIUM CONDUCTORS SHALL NOT BE BURIED DIRECTLY UNDER THE GROUND.
7. TAPPING FROM THE UNDER GROUND EARTH GRID SHALL BE TAKEN ONLY FROM EARTH PIT OR A PIT WITHOUT ELECTRODE PROVIDED FOR THIS PURPOSE.
8. JOINTING OF UNDERGROUND EARTHING STRIPS SHALL BE AVOIDED TO THE EXTENT POSSIBLE. HOWEVER, IF JOINTING IS TO BE DONE DUE TO UNAVOIDABLE REASONS, THIS SHALL BE DONE BY ELECTRIC ARC WELDING.
9. TERMINAL JOINTING & CLAMPING ARRANGEMENT SHALL BE AS SHOWN IN PDSE:603. ALL WELDED OR BOLTED JOINTS SHALL BE PAINTED WITH EPOXY RESIN PAINT OR BITUMINOUS PAINT.
10. EARTH BUSES, AS PER CONVENIENCE, SHALL BE PROVIDED IN PLANTS FOR EARTHING GROUPS OF EQUIPMENT TO EARTHING GRID. THESE EARTH BUSES, SHALL BE AS SHOWN IN PDSE: 615.
11. DETAILS OF EARTH PIT CONNECTIONS & ACCESSORIES FOR EARTH ELECTRODES SHALL BE AS SHOWN IN PDSE :604, 605 , 610 AND 611.
12. EARTH PITS FOR EQUIPMENT EARTHING, SYSTEM NEUTRAL EARTHING & LIGHTNING PROTECTION SHALL BE SEPARATE. HOWEVER, THESE PITS SHALL BE INTERCONNECTED.
13. SPACING BETWEEN TWO EARTH PITS SHALL NOT BE LESS THAN 10 M & THESE MAY BE LOCATED ABOUT 4M AWAY FROM THE BUILDING / STRUCTURE.
14. TYPICAL ARRANGEMENT OF NEUTRAL & EQUIPMENT EARTHING SHALL BE AS SHOWN IN PDSE: 617.

B. SYSTEM NEUTRAL EARTHING

1. THE NEUTRALS OF H.T & L.T SYSTEMS SHALL BE EARTHED BY USING 2 NOS. 150 SQ. MM ALUMINIUM CABLE OF RESPECTIVE VOLTAGE GRADE. EACH EARTH CONNECTION SHALL BE TERMINATED ON SEPERATE EARTH PITS. HOWEVER, FOR ECONOMY REASONS, 2 EARTH CONNECTIONS OF 2 DIFFERENT EQUIPMENT CAN BE TERMINATED ON THE SAME EARTH PIT AS SHOWN IN PDSE: 617.
2. THE NEUTRAL OF H.T. SYSTEM SHALL BE CONNECTED TO EARTH PIT AS ABOVE THROUGH THE NEUTRAL EARTHING RESISTOR (N.E.R.) AS REQUIRED, WHERE AS THE NEUTRAL OF L.T. SYSTEM SHALL BE SOLIDLY EARTHED THROUGH RESPECTIVE L.T. SWITCH BOARD.
3. FOR D.C. SYSTEM, POSITIVE POLE SHALL BE EARTHED THROUGH HIGH IMPEDANCE IN BATTERY CHARGER.

C. ELECTRICAL EQUIPMENT EARTHING

1. ALL EQUIPMENT RATED ABOVE 250V SHALL HAVE TWO EXTERNAL EARTH CONNECTIONS & THOSE RATED 250V & BELOW SHALL HAVE ONE EXTERNAL EARTH CONNECTION.

   FLAME PROOF EQUIPMENT, IN ADDITION, SHALL HAVE ONE INTERNAL EARTH CONNECTION THROUGH ADDITIONAL CORE OF POWER / CONTROL CABLE.

2. EARTHING CONNECTION TO INDIVIDUAL EQUIPMENT SHALL BE TAPPED ONLY FROM THE EARTHING GRID / RING OR EARTH BUS EXCEPT FOR EQUIPMENT RATED 250V & BELOW, FOR WHICH THE CONNECTION MAY BE TAKEN FROM THE NEAR BY EARTH CONDUCTOR OF A LARGER EQUIPMENT OR FROM THE BODY OF THE LARGER EQPT.
3. EARTHING ARRANGEMENT OF MOTOR AND ASSOCIATED LOCAL CONTROL STATION SHALL BE AS SHOWN IN PDSE: 608.
4. EARTHING ARRANGEMENT OF RAILS SHALL BE AS SHOWN IN PDSE: 609 WITH BOTH ENDS EARTHED.
5. CABLES RACKS/RISERS/TRAYS SHALL BE ELECTRICALLY CONTINUOUS BY BONDING THE JOINTS BETWEEN THE RUNNER MEMBERS OF THE ADJACENT SECTIONS. THE CABLE RACKS SHALL BE CONNECTED TO THE EARTHING GRID AT SUITABLE INTERVALS.
6. EARTHING ARRANGEMENT OF LIGHTING FIXTURES & PLUG SOCKETS RATED 250V AND BELOW SHALL NOT BE SHOWN IN THE EARTHING LAYOUT DRGS. HOWEVER, PLUG SOCKETS SHALL BE EARTHED BY 10 SWG SIZE G.I./AL. CONDUCTOR TAKEN FROM THE NEAREST EARTHING GRID/CONDUCTOR AND LIGHTING FIXTURES SHALL BE PROVIDED EARTHING THROUGH CABLE ARMOURS.
7. IN SWITCH YARD AND GENERATING STATIONS SUITABLE EARTHING MAT SHALL BE PROVIDED TO REDUCE THE VALUE OF STEP/TOUCH POTENTIAL TO PERMISSIBLE VALUE.
8. SWITCH YARD FENCE SHALL BE CONNECTED TO EARTH AT A REGULAR INTERVAL, NOT EXCEEDING 10 M.

D. STATIC EARTHING

1. ALL PROCESS EQUIPMENT WHICH ARE LIKELY TO GET STATICALLY CHARGED, e.g. STORAGE TANKS, HIGH PRESSURE & MIDIUM PRESSURE VESSELS/PIPES, HIGH PRESSURE COMPRESSORS. HIGH PRESSURE STEAM EJECTORS ETC. SHALL BE EARTHED AGAINST STATIC CHARGE ACCUMULATION.
2. EARTHING ARRANGEMENT ACROSS PIPE JOINTS/VALVES SHALL BE AS SHOWN IN PDSE: 612
3. DETAILS OF EARTHING OF VESSELS SHALL BE AS SHOWN IN PDSE: 613.
4. MOBILE EQUIPMENT, REQUIRING EARTHING AGAINST STATIC CHARGE, SHALL BE TEMPORARILY EARTHED AS SHOWN IN PDSE: 608.
5. PIPE TRESTLE CARRYING PIPES WITH HYDRO CARBONS SHALL BE CONNECTED TO EARTH GRID AT REGULAR INTERVALS, NOT EXCEEDING 25 M.
6. WHEREVER PROCESS EQUIPMENT ARE MOUNTED ON STEEL STRUCTURE, THE BASE OF THE STRUCTURES SHALL BE EARTHED INSTEAD OF EARTHING THE INDIVIDUAL EQUIPMENT.

E. LIGHTNING PROTECTION

1. FIXING ARRANGEMENT ON AIR TERMINATION AND ROOF/DOWN CONDUCTOR FOR LIGHTNING PROTECTION SYSTEM SHALL BE AS SHOWN IN PDSE: 614.
2. FOR LIGHTNING PROTECTION OF TALL STEEL STRUCTURES/VESSELS/TANKS, DOWN CONDUCTOR SHALL BE TAKEN FROM THE BASE AND CONNECTED TO EARTH PITS. AIR TERMINATION ROD SHALL NOT BE REQUIRED.
3. LIFT SHAFT SHALL NOT BE USED FOR FIXING THE DOWN CONDUCTOR.
4. IN CASE EARTH PITS FOR CONNECTING THE DOWN CONDUCTORS ARE NOT AVAILABLE IN THE BEGINNING OF FABRICATION/ERECTION OF SUCH STRUCTURES/VESSELS / TANKS. THEIR BASES SHALL TEMPORARILY BE CONNECTED TO NEAR BY STEEL COLUMN. ELECTRICAL CONTINUITY OF THE STRUCTURES, HOWEVER, SHALL BE CHECKED AND ENSURED.
5. FOR ALL HIGH RISE CONCRETE STRUCTURES, TEMPORARY LIGHNING PROTECTION NEED BE PROVIDED DURING CONSTRUCTION AND MAINTAINED TILL PERMANENT LIGHTNING PROTECTION IS INSTALLED. FOR THIS PURPOSE THE VERTICAL REINFORCEMENT, PROJECTING OVER EACH LIFT, SHALL BE CONNECTED TO EARTH PITS BY MEANS OF 2 NOS. FLEXIBLE COPPER CONDUCTOR CABLES. EACH OF THE FLEXIBLE CABLE SHALL BE OF 95 Sq. mm SIZE HAVING ONE END PERMANENTLY CONNECTED TO EARTH PIT AND OTHER END PROVIDED WITH A CLAMP FOR CONNECTING TO THE EXPOSED REINFORCREMENT.

SL. No.	EQUIPMENT TO BE EARTHED	FAULT LEVEL (MVA)	G.I.STRIPS/WIRES			ALUMINIUM					REMARKS
			MIN.SIZE (mm^2)	SIZE TO BE USED (mm^2)	SYMBOL	MIN.SIZE (mm^2)	STRIPS/WIRES SIZE TO BE USED (mm^2)	STRIPS/WIRES SYMBOL	1.1kv PVC SINGLE CORE CABLE SIZE (mm^2)	1.1kv PVC SINGLE CORE CABLE SYMBOL	
1A.	FOR PLANTS HAVING SWITCHYARDS/ GENERATING STATION										
I.	SWITCH YARD EQUIPMENT,GENERATORS,H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	750 AT 11KV	706	2-50x8	2 (2)	491	2-38.1x6.35=484	2 (12)	500	21	AS PER CLAUSE 17.3.2 OF IS:3043
II.	SWITCH YARD EQUIPMENT,GENERATORS,H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	500 AT 11KV 300 AT 6.6KV 150 AT 3.3KV	471	60x8	1	328	50.8x6.35=323	11	400	22	-DO-
III.	SWITCH YARD EQUIPMENT,GENERATORS,H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	250 AT 6.6KV 125 AT 3.3KV	392	50x8	2	272	50.8x6.35=323	11	300	23	-DO-
IV.	SWITCH YARD EQUIPMENT,GENERATORS,H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	350 AT 11KV 200 AT 6.6KV 100 AT 3.3KV	330 314 314	50x8	2	229 218 218	38.1x6.35=242	12	240	24	-DO-
V.	SWITCH YARD EQUIPMENT,GENERATORS,H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	250 AT 11KV 150 AT 6.6KV 75 AT 3.3KV	235	50x6	3	163	31.75x4.78=152	13	185	25	-DO-
1B	FOR PLANTS WITHOUT SW.YARD/GENERATING STN. H.T.SWITCH BOARDS,TRANSFORMERS,MAIN EARTHING GRID, CONNECTION FROM EARTH BUS TO EARTHING GRID.	ANY FAULT LEVEL AT ANY VOLTAGE	210	50x6	3	120	38.1x3.18=121	14	120	27	AS PER CLAUSE 12.3.2 OF IS:3043
1C	ALL M.V.SWITCH BOARDS		210	50x6	3	120	38.1x3.18=121	14	120	27	AS PER CLAUSE 12.3.2 OF IS:3043
2	H.V. MOTORS		210	50x6	3	120	38.1x3.18=121	14	120	27	-DO-
3	TRANSFOMER NEUTRALS		–	–	–	120	–		150	26	-
4	M.V. MOTORS RATED 75KW & ABOVE		210	50x6	3	120	38.1x3.18=121	14	120	27	AS PER CLAUSE 12.3.2 OF IS:3043
5	M.V. MOTORS ABOVE 30KW &LESS THAN 75KW		175	35x6	4	93	31.75x3.18=101	15	95	28	-DO-

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EARTHING CONDUCTOR DETAILS

PC183-PDS:E 602

DOCUMENT NO.

REV. 0

SHEET 1 OF 2

SL. No.	EQUIPMENT TO BE EARTHED	FAULT LEVEL (MVA)	G.I.STRIPS/WIRES			ALUMINIUM					REMARKS
			MIN.SIZE (mm^2)	SIZE TO BE USED (mm^2)	SYMBOL	MIN.SIZE (mm^2)	STRIPS/WIRES		1.1kv PVC SINGLE CORE CABLE		
							SIZE TO BE USED (mm^2)	SYMBOL	SIZE (mm^2)	SYMBOL	
6	M.V.MOTORS ABOVE 5.5KW & LESS THAN 30KW 63A SW.SOCKETS,BATTERY CHARGERS,LIGHTING SUB–DIST.BDS.,D.C.BDS.		44	25x6	5	25	2 SWG=38.6	17	25	29	AS PER CLAUSE 12.3.2 OF IS:3043
7	M.V.MOTORS RATED 5.5KW & BELOW		7	8 SWG= 13	6	5	10 SWG=8.3	18	6	30	–DO–
8	ALL MINOR EQUIPMENT RATED FOR 250V & BELOW		–	10 SWG= 8.3	7	–	10 SWG=8.3	18	6	30	
9	NON ELECTRICAL EQUIPMENT,SUCH AS VESSELS STRUCTURES IN HAZARDOUS AREA & LIGHTNING PROTECTION CONDUCTORS		32x6	35x6	4	–	25.4x3.18=81	16	–	–	AS PER IS:2309

NOTE:–EARTHING CODUCTOR SIZES FOR ITEMS AT SL.No.4,5,6 & 7 SHOULD BE CHOSEN AS HALF THE POWER CABLE SIZES ACTUALLY USED.

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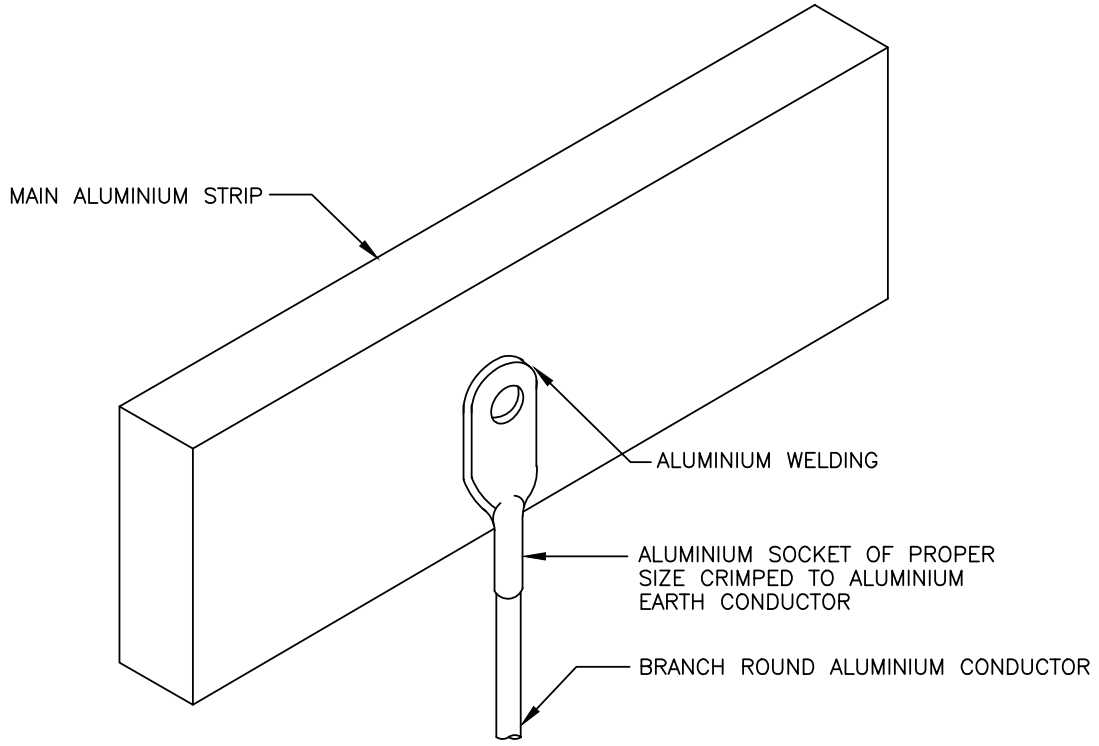
EARTHING CONDUCTOR DETAILS

PC183–PDS:E 602

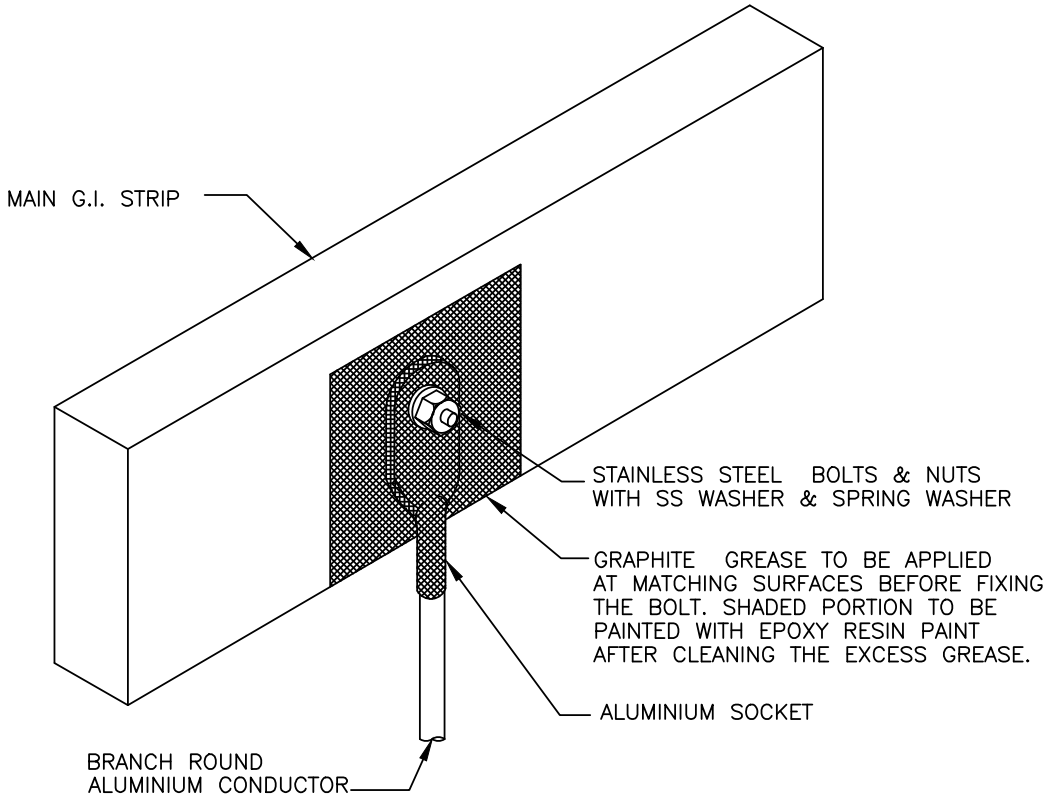
DOCUMENT NO.

REV. 0

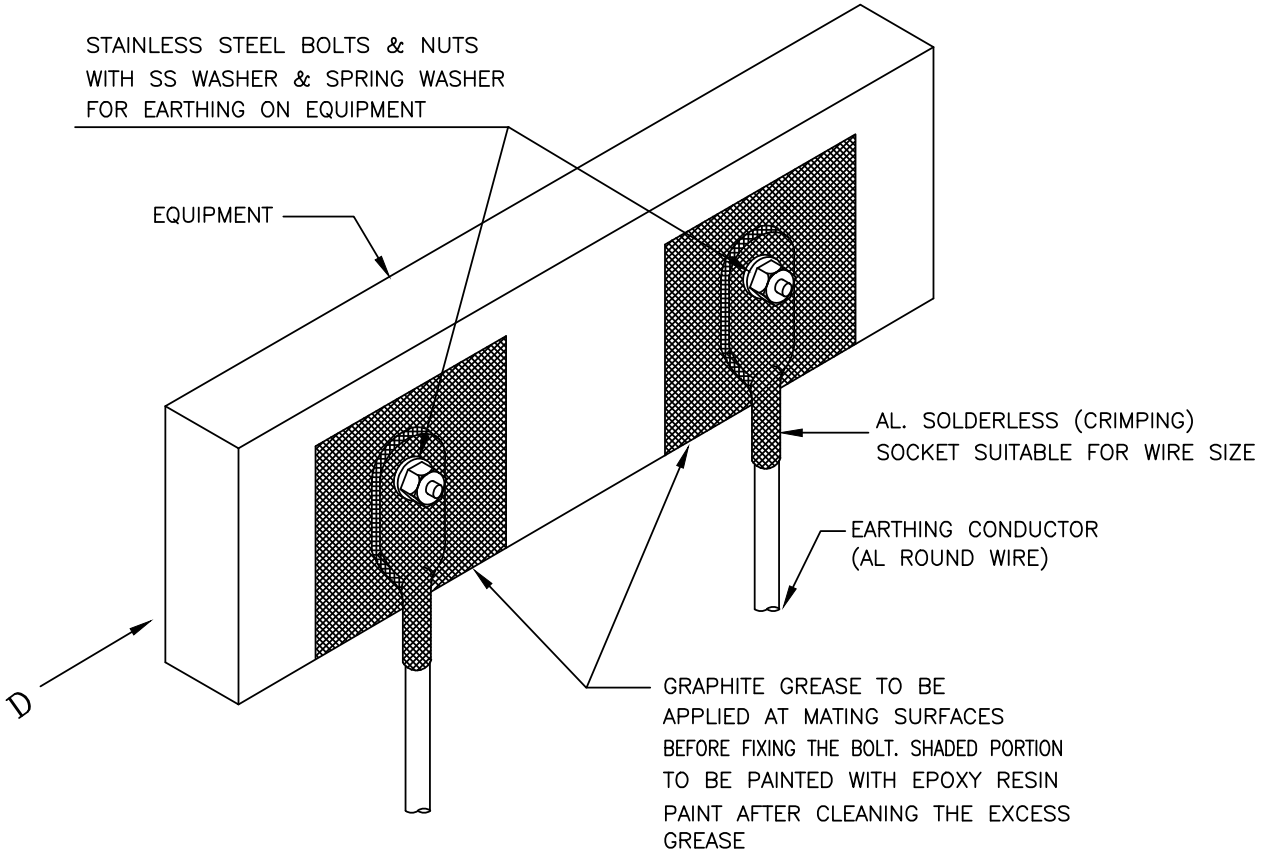
SHEET 2 OF 2



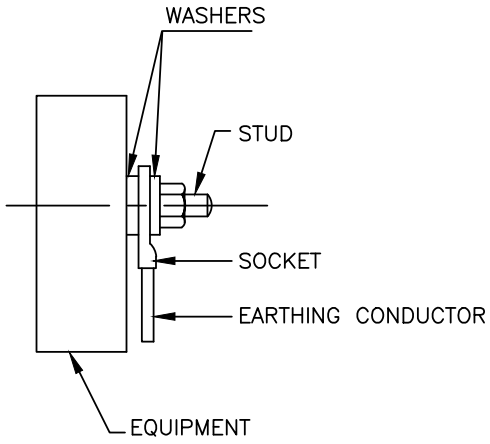
' T ' JOINT ALUMINIUM STRIP TO ROUND ALUMINIUM CONDUCTOR



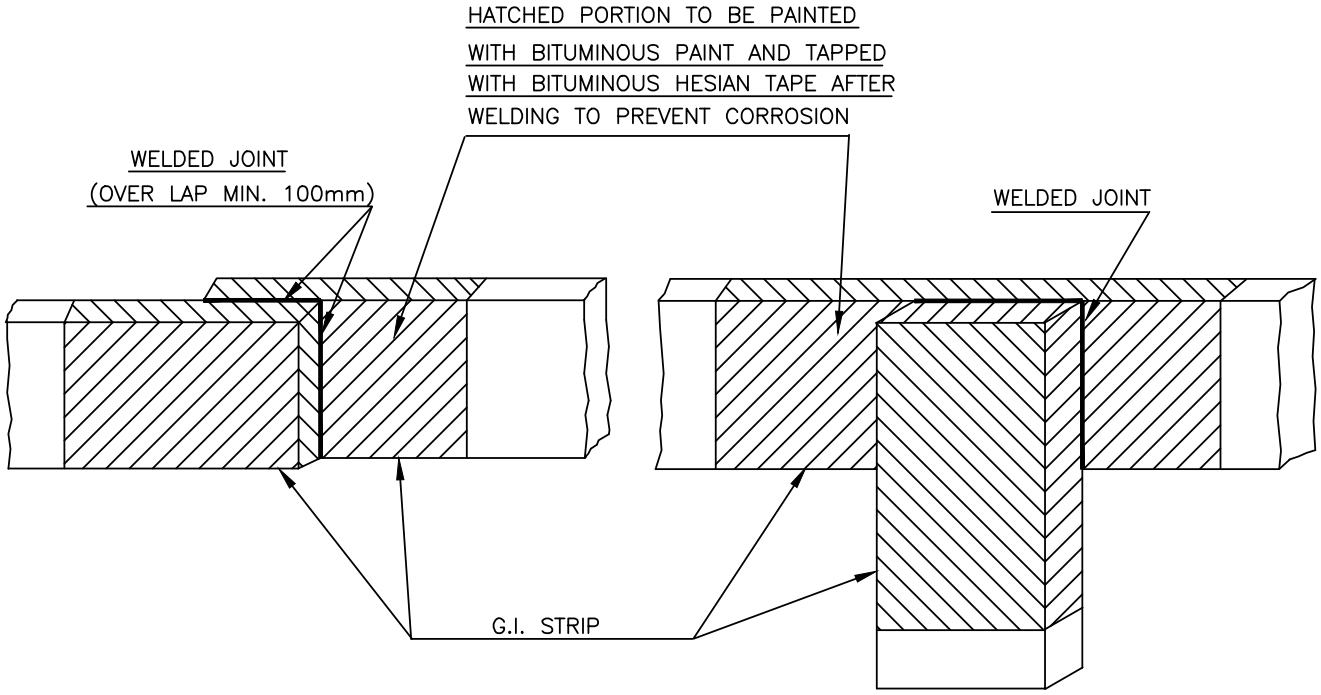
' T ' JOINT G.I. STRIP TO ROUND ALUMINIUM CONDUCTOR



ARRANGEMENT OF DOUBLE EARTH CONNECTIONS TO EQUIPMENT

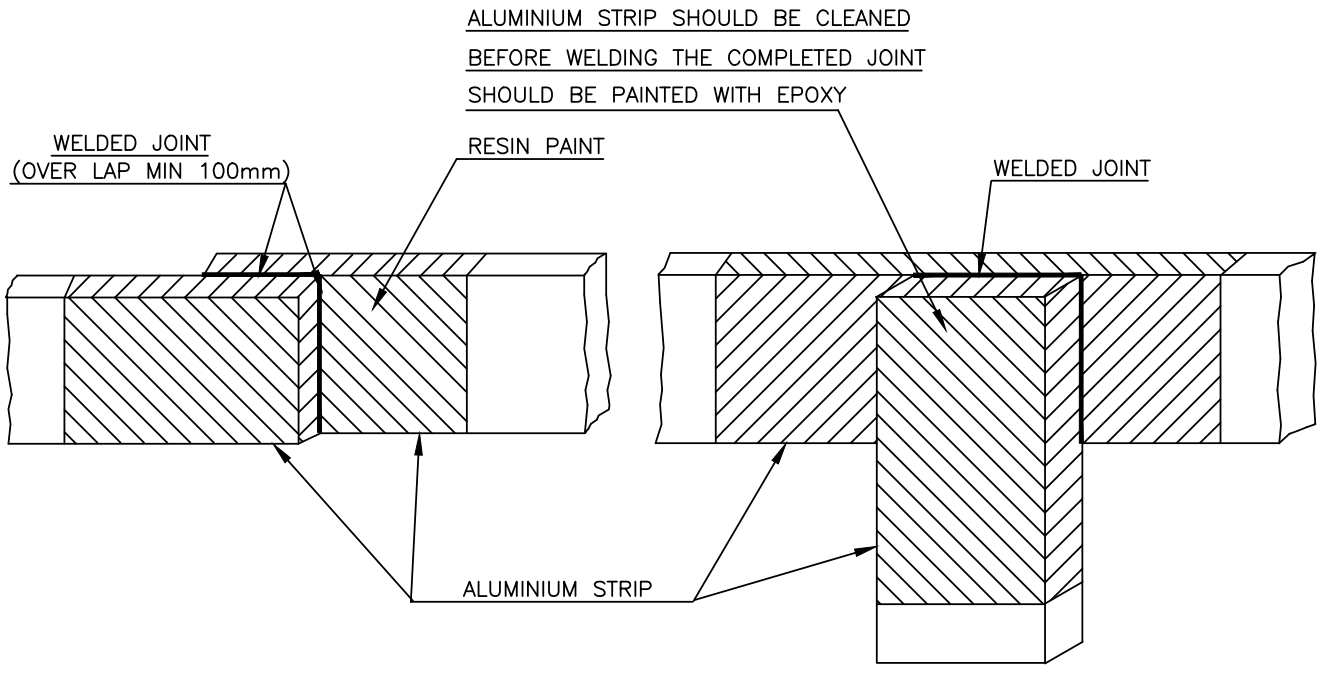


V I E W F R O M – D



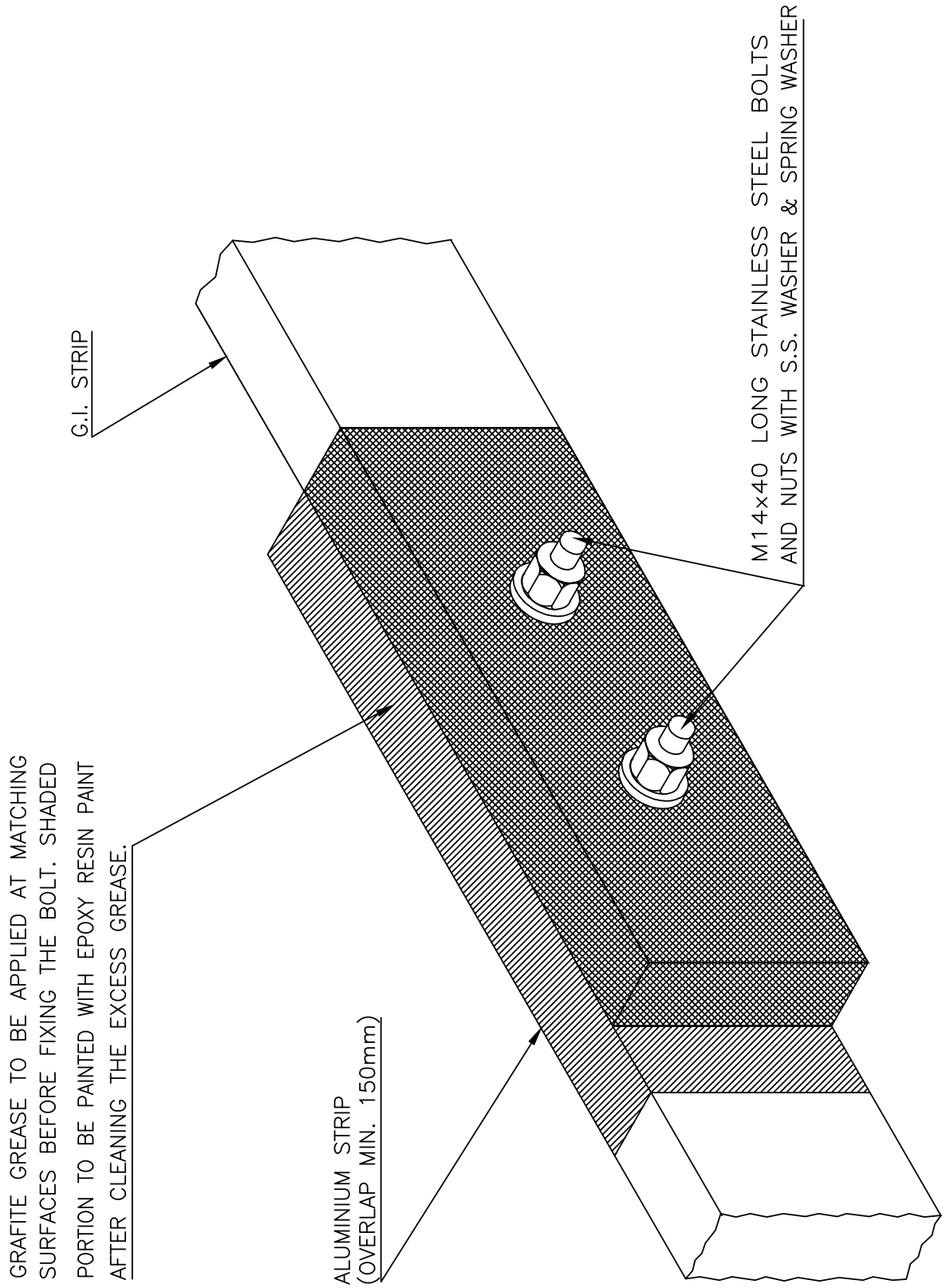
STRAIGHT JOINT G.I TO G.I. STRIP

" T " JOINT G.I. TO G.I. STRIP



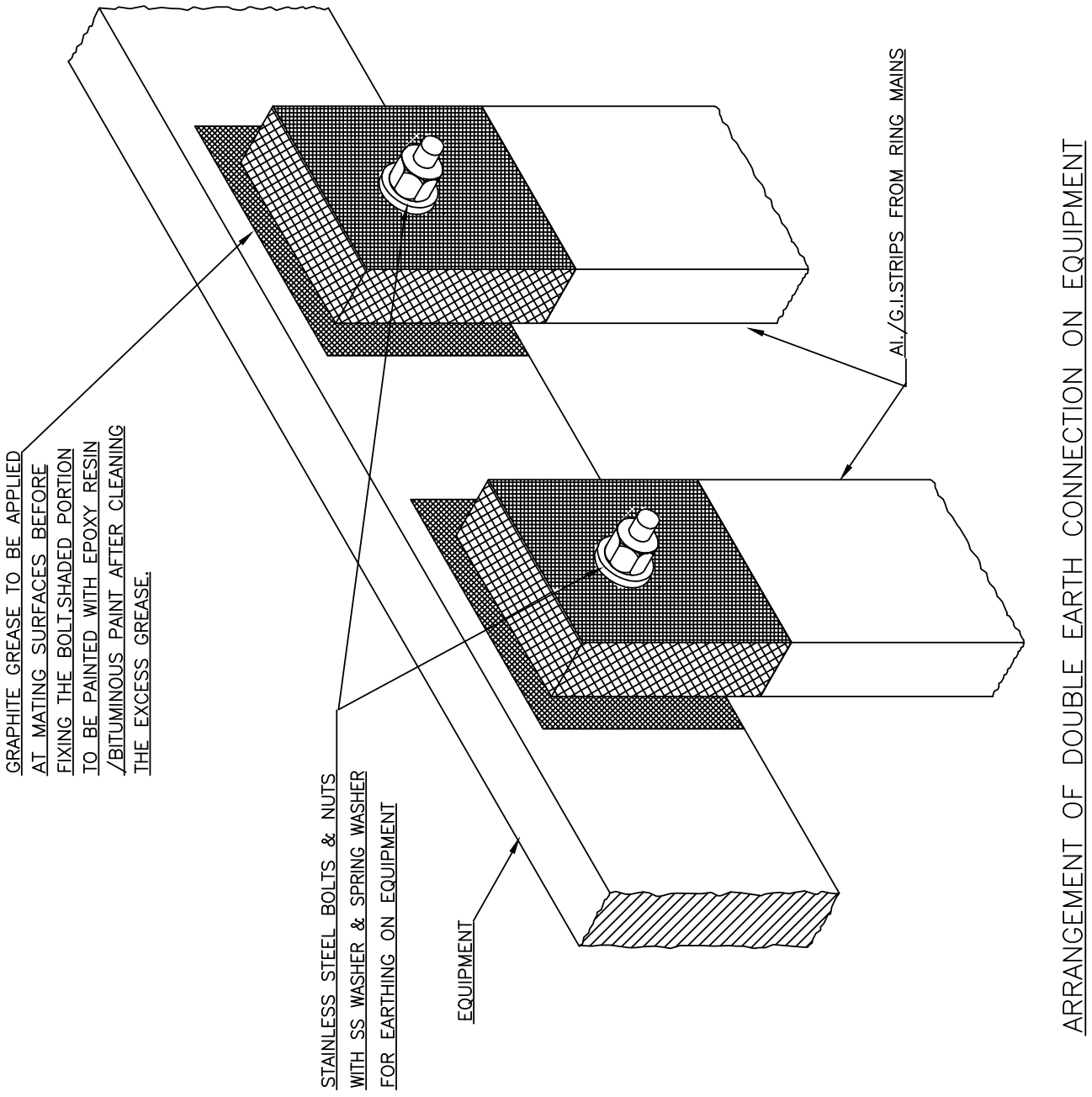
STRAIGHT JOINT AL. TO AL. STRIP

" T " JOINT AL TO AL STRIP



ARRANGEMENT OF LAP JOINT BETWEEN

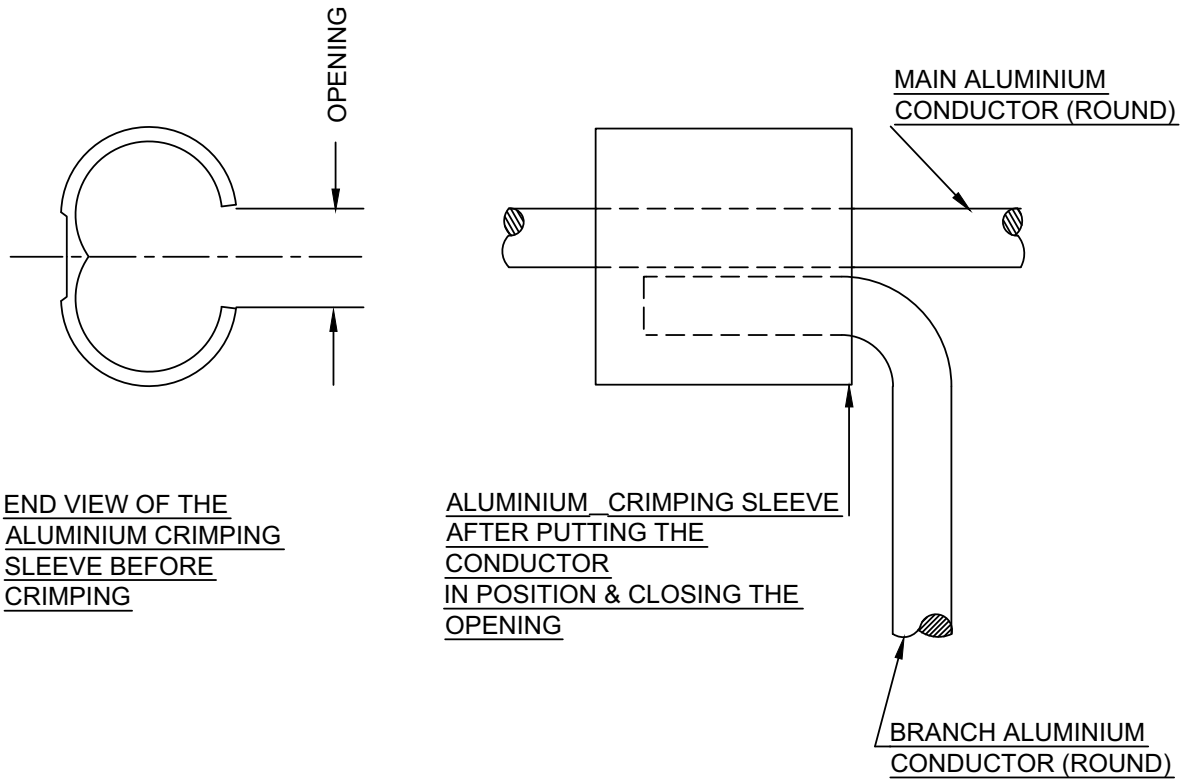
AI. EARTH STRIP TO G.I. EARTH STRIP



ARRANGEMENT OF DOUBLE EARTH CONNECTION ON EQUIPMENT

NOTE:-

EPOXY RESIN PAINT SHALL BE USED FOR AL STRIP AND BITUMINOUS PAINT FOR G.I.STRIP.

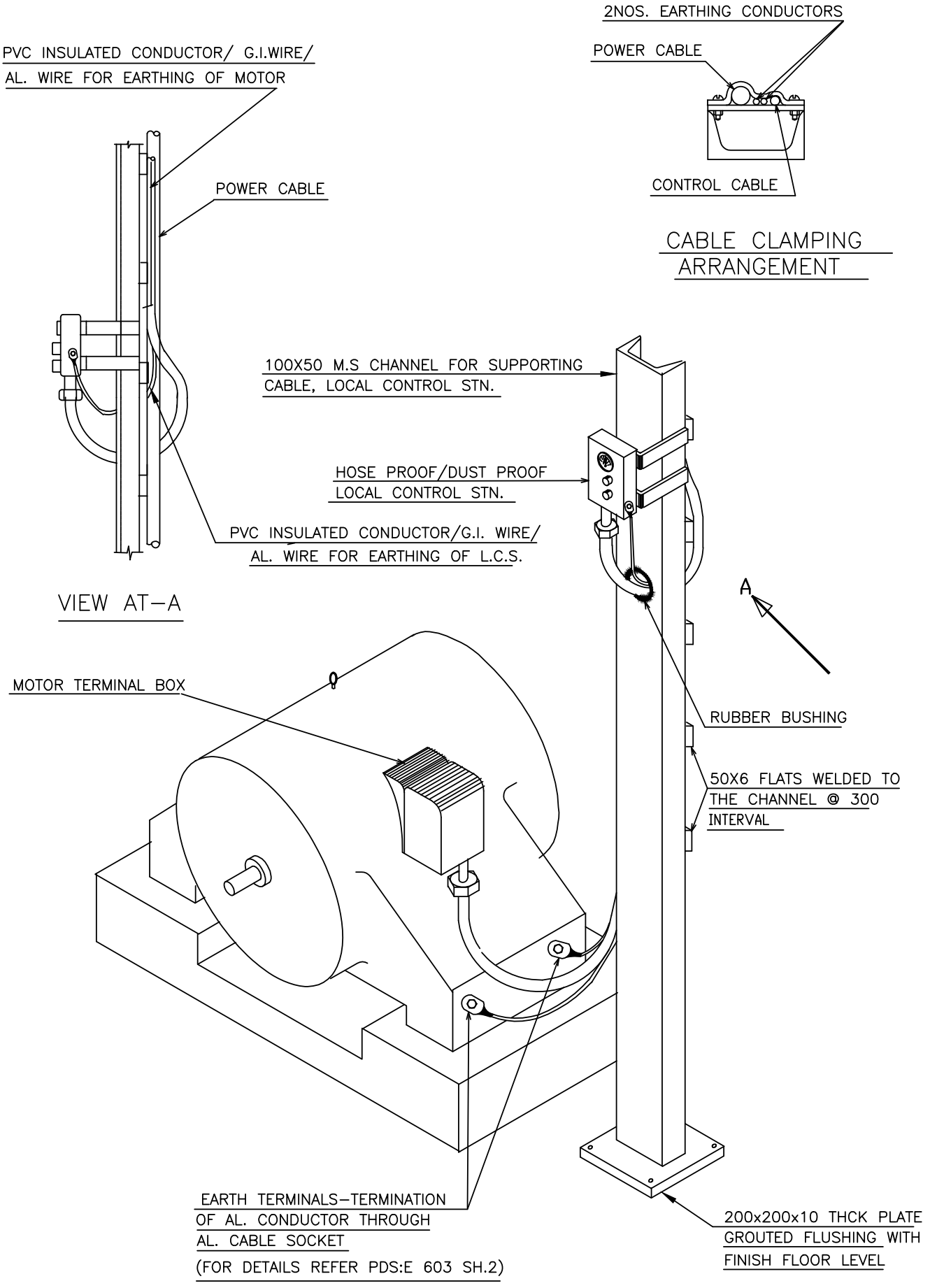


"T" JOINT ROUND ALUMINIUM CONDUCTOR TO ROUND ALUMINIUM CONDUCTOR (CRIMPING TYPE)

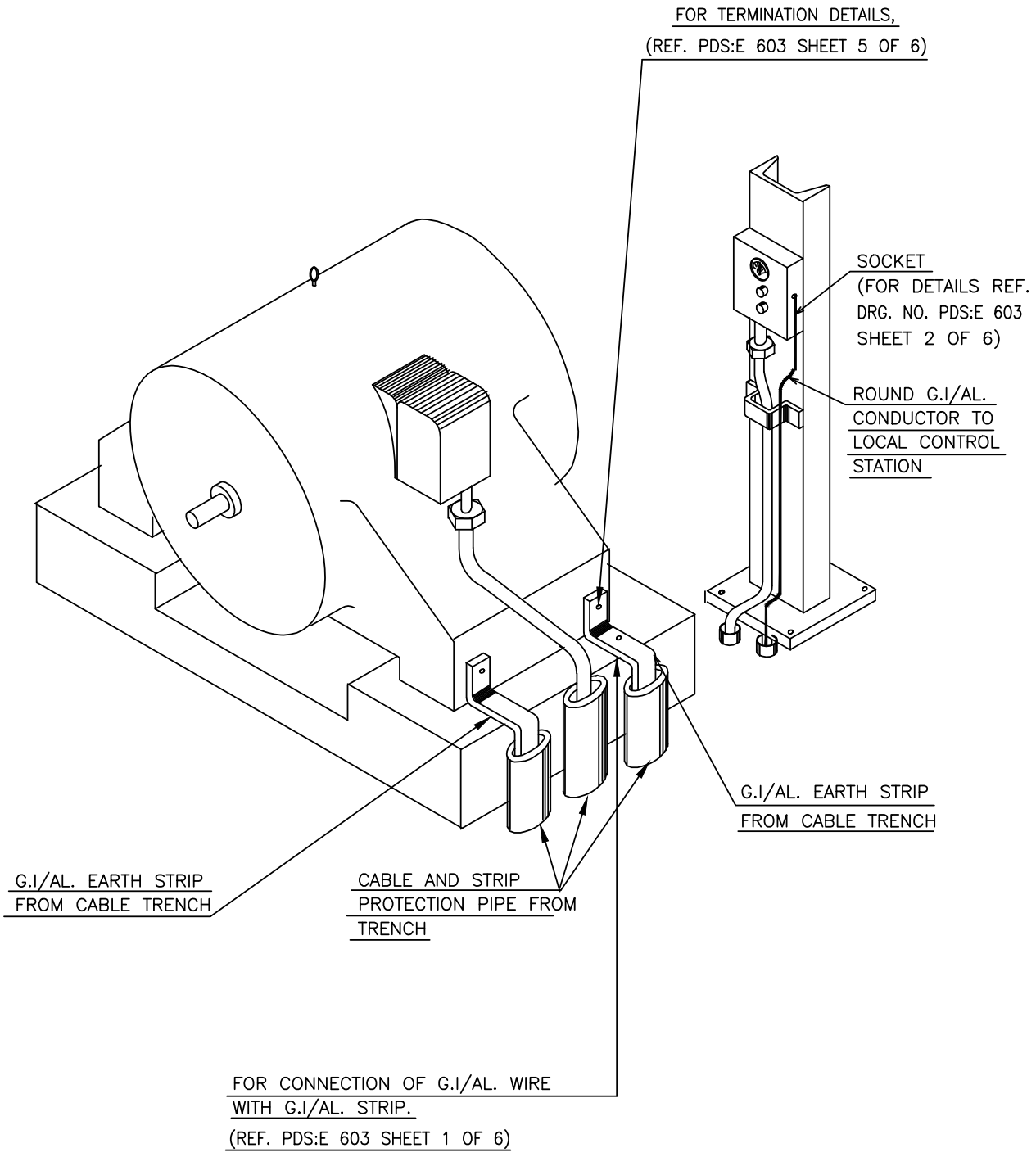
NOTE :-

USE CORRECT SIZE OF COMPRESSION DIES.

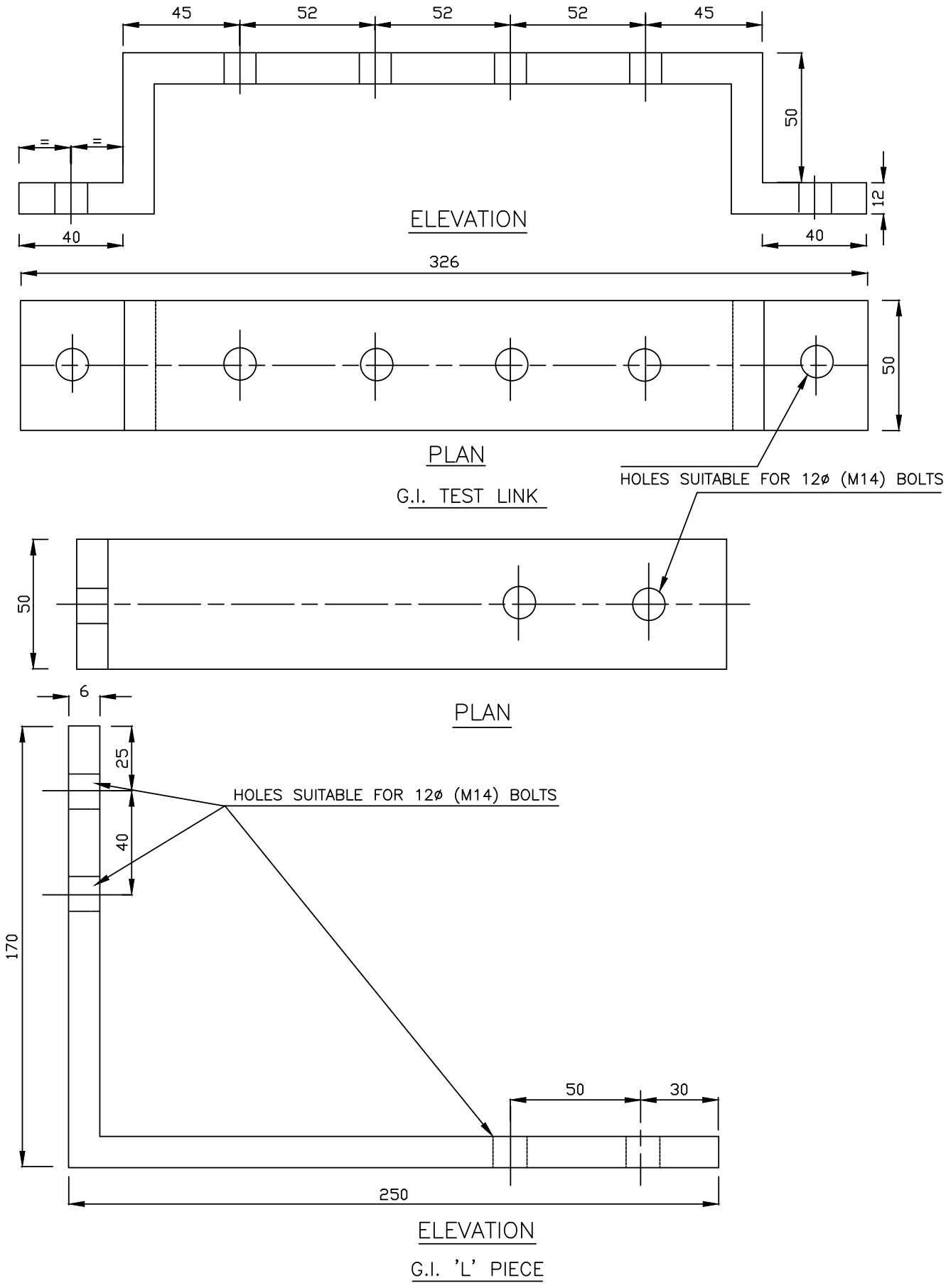
पी डी आई एल PDIL	TYPICAL ARRANGEMENT OF EARTHING FOR MOTOR AND START STOP PUSH BUTTON STATION	PC183–PDS:E 606	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 2	

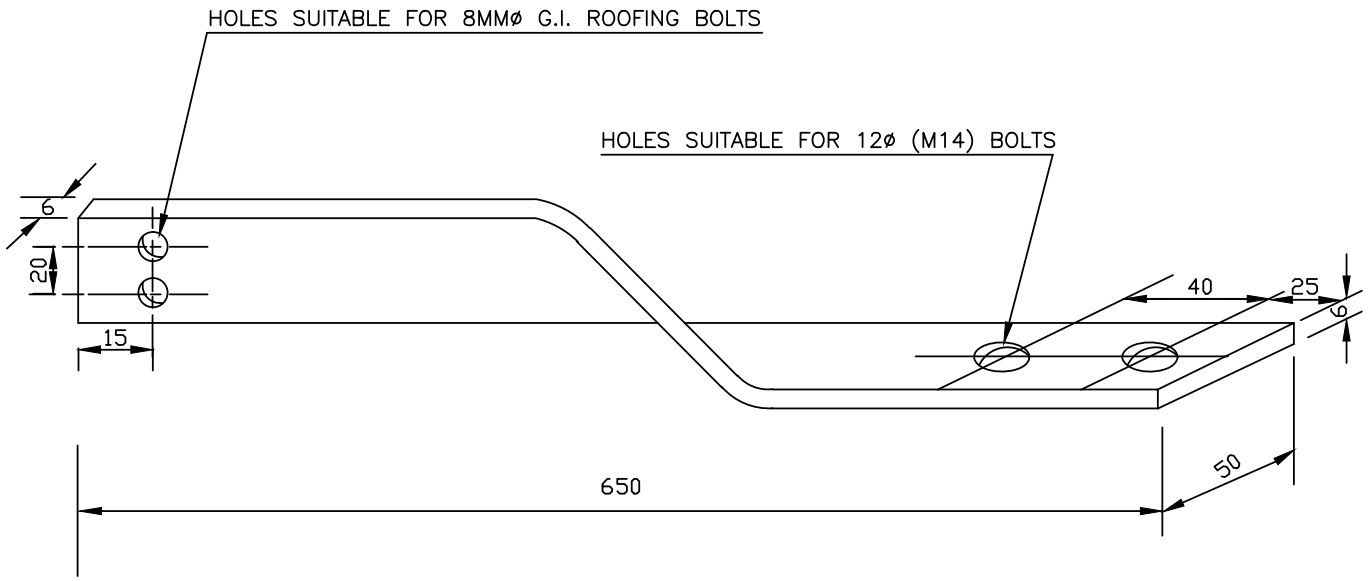


पी डी आई एल PDIL	TYPICAL ARRANGEMENT OF EARTHING FOR MOTOR AND START STOP PUSH BUTTON STATION	PC183-PDS:E 606	0
		DOCUMENT NO.	REV.
		SHEET 2 OF 2	

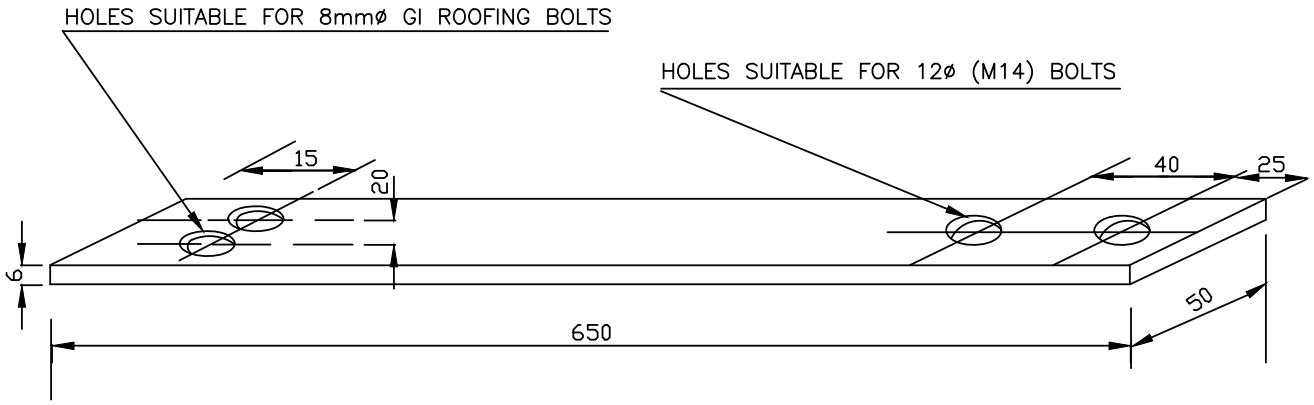


पी डी आई एल PDIL	GI / AL ACCESSORIES FOR EARTH PIT	PC183–PDS:E 611	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 2	



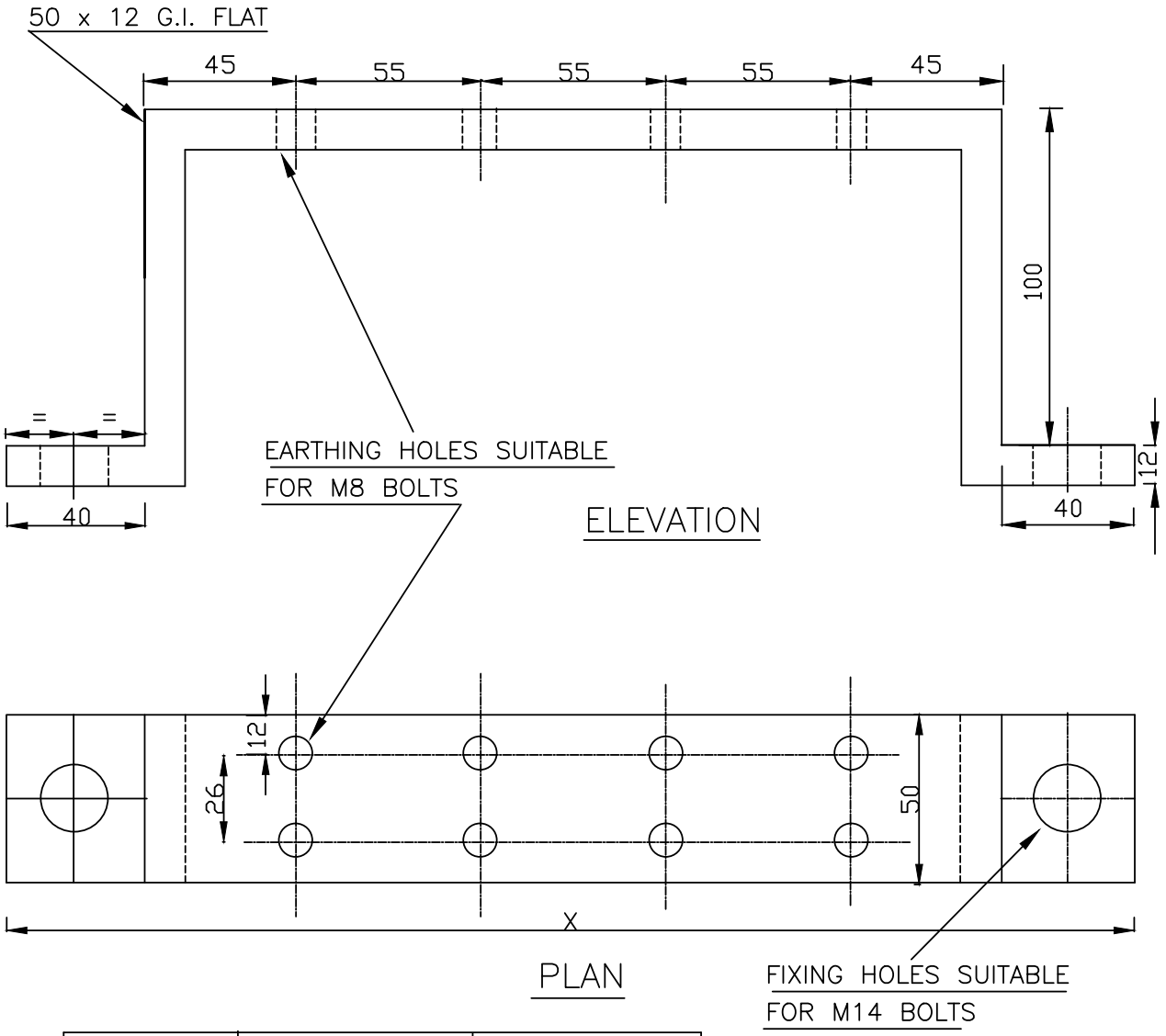


CONNECTING TWISTED ALUMINIUM FLAT PIECE



CONNECTING ALUMINIUM / G.I. FLAT PIECE

पी डी आई एल PDIL	G.I. EARTH BUS	PC183-PDS:E 615	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	

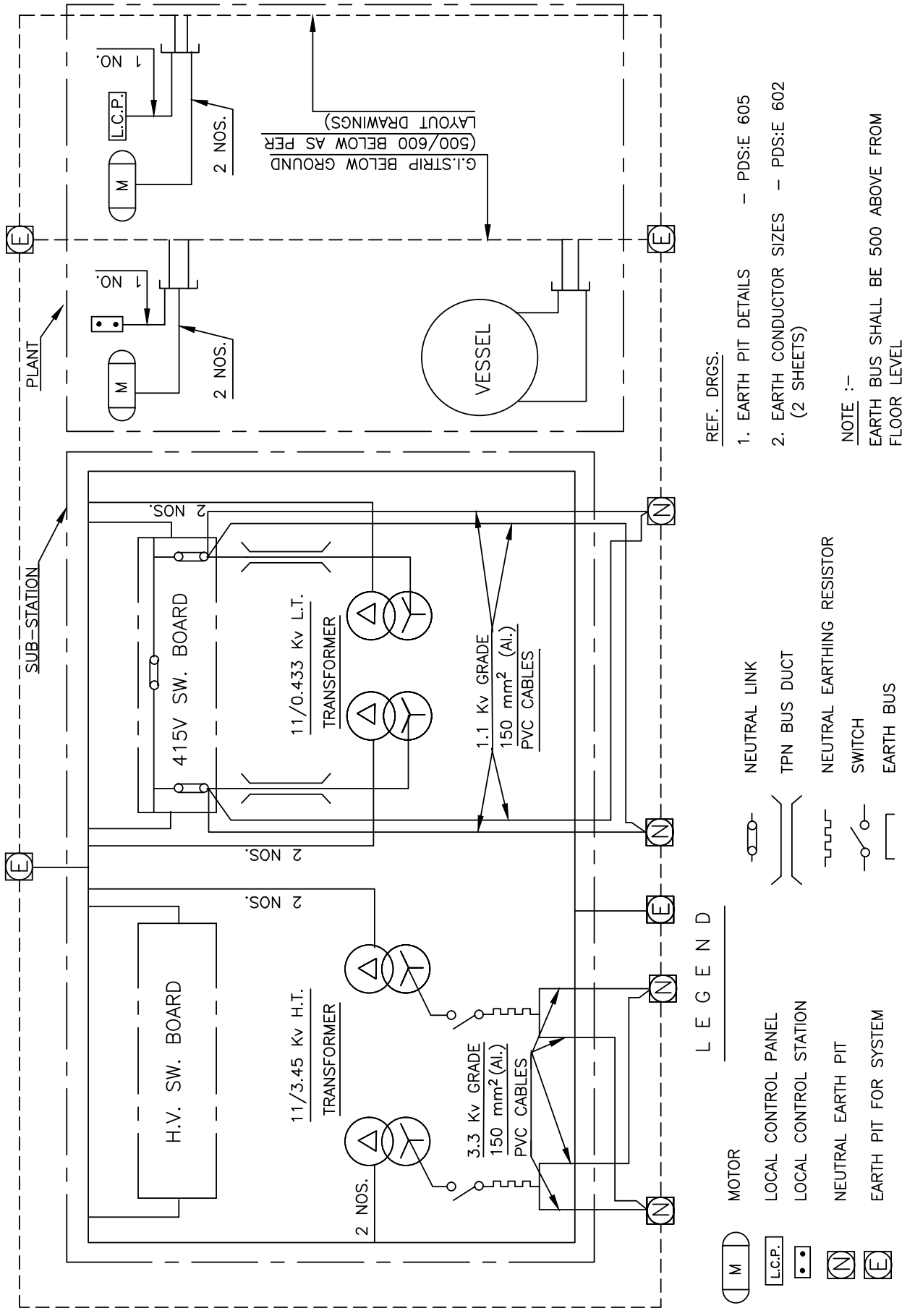


TYPE OF EARTH BUS	NO.OF EARTHING HOLES	OVERALL LENGTH x (mm)
1	8	335
2	10	390

NOTES:-

1. LOCATION OF EARTH BUS TO BE DECIDED AS PER EQUIPMENT POSITION AT SITE.
2. EARTH BUSES SHALL BE LOCATED ON STRUCTURES/COLUMNS WALLS/EQUIPMENT FOUNDATION ETC.
3. MOUNTING HEIGHT OF EARTH BUS SHALL NOT BE LESS THAN 500mm FROM FINISHED FLOOR LEVEL
4. ALL DIMENSIONS ARE IN mm

पी डी आई एल PDIL	TYPICAL ARRANGEMENT FOR NEUTRAL AND EQUIPMENT EARTHING	PC183 – PDS:E 617	0
		DOCUMENT NO.	REV.
		SHEET 1 OF 1	



SECTION – VI
ANNEXURE 2

TECHNICAL SPECIFICATION – PIPING

PLANT: FLARE SYSTEM

PROJECT: INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL, DISTRICT- ODISHA, INDIA

CONTENTS

SECTION NUMBER	DESCRIPTION	SHEET NUMBER
1.0	GENERAL PIPING SCOPE OF WORK	3
2.0	DESIGN & DETAILED ENGINEERING	3
3.0	PROCUREMENT & SUPPLY BY BIDDER	4
4.0	INSPECTION	4
5.0	PAINTING	5
6.0	CONSTRUCTION	5
7.0	BIDDER'S RESPONSIBILITY	5
8.0	DRAWING/ DOCUMENTATION SCHEDULE	6
9.0	PACKAGING	6
10.0	DOCUMENTATION WITH BID	6

LIST OF ATTACHMENTS

SL NO.	DOC.NO.	DESCRIPTION	NO.OF SHEETS
1	EM0000-PNMP-TS951	DESIGN PHILOSOPHY- PIPING	45
2	TFL-PDS-600	PIPING MATERIAL SPECIFICATION	162
3	PC183-0000-0001	PLOT PLAN (OVERALL)	1

1.0 GENERAL PIPING SCOPE OF WORK

1.1 The detail scope of work includes such as, but not limited to, complete management, Design, Detailed Engineering, 3D modelling, Stress Analysis, to provide all the necessary data, drawings, documents required as per the project requirements, Procurement, Supply, Transportation of materials, shop & site Fabrication, Erection, Installation, Supporting, Non-Destructive Testing (NDT) & required Inspection, pre-heating, dye-penetrant test, Magnetic Particle Test, post weld heat treatment, radiography, Ultrasonic test, Testing, Flushing, Air drying, blowing, cardboard-blasting, seal/leak-testing, Pre-Commissioning, Trial run, Commissioning and Guarantee of all the associated works pertaining to complete piping system and related facilities for Flare system package at TFL, TALCHER.

1.2 Design, material, fabrication and erection shall be in accordance with latest edition of ASME B31.3 chemical plant and petroleum refinery piping code. The dimensions, manufacturing tolerances shall conform to applicable standards.

1.3 All works described in this package shall be performed in accordance with the design-basis, specifications, drawings, and other requirements of NIT and shall be subject to Owner's review and approval.

1.4 MATERIAL OF CONSTRUCTION

Materials as per internationally acceptable code shall be used for piping based on service requirement. All materials for piping Components shall conform to ASTM or API Specifications as per enclosed piping specifications. All piping materials and valves shall be procured from the approved suppliers/vendors.

1.5 Cost of piping job shall also include the cost of supervision, Labour, overheads / profits, materials, consumables, scaffolding and all other associated arrangements required to execute the related activities of this package.

1.6 PIPING INTER - CONNECTION

Piping lines as per P&ID shall be provided at battery limit which shall be indicated later by Owner. Bidder shall provide valve at battery limit for respective piping system of the package unit.

1.7 SPARES

Mandatory spares shall be quoted by bidder as per spares section of NIT.

2.0 DESIGN AND DETAILED ENGINEERING BY BIDDER

2.1 Collection of all data/ information furnished in the NIT and additionally collected/ generated by Bidder.

2.2 Finalization of design data/ basis for carrying out design, detailed Engineering for complete scope of work as per project specifications, contained in the NIT.

2.3 Performing design and detailed engineering of the following:

a) Complete piping system for the package unit.

b) Carry Out all necessary calculations in accordance with approved design basis, drawings / documents and requirements of the NIT.

c) Finalization of layouts for the unit and preparation of construction drawing, preparation of piping drawings, equipment layouts, piping general layout drawings (GAD's) , pipe supports, piping isometrics. Typical indicative sketches/drawings included in NIT document shall be taken as broad basis for developing the layouts. Since the availability of free space is limited, Bidder shall plan its piping layouts in such a way so as to minimize the area requirement while giving due importance to ease of access, operation and maintenance of the facilities installed by the Bidder. The fabrication/erection & all other piping jobs shall be carried out as per drawings/documents approved by Owner.

d) Carrying out Material Take Off for the entire piping system for the package unit.

e) The detail design shall take into consideration of local Statutory Regulation, if any, for the package unit.

3.0 PROCUREMENT & SUPPLY BY BIDDER

3.1 Bidder shall procure and supply all materials whatsoever required for temporary/permanent installation of piping system in sequence and at appropriate time. All equipments, materials, components etc shall be suitable for the service and the design life of the system.

3.2 Bidder shall procure & provide all materials, components, equipments, safety showers, consumables etc required for successful completion of the piping & package plant system. Bidder shall also procure spares required for pre-commissioning and commissioning/start-up as recommended for all the items supplied by him as per specifications provided in the NIT. Where no specifications are available in the contract, the same shall be prepared by the Bidder, and shall be subject to Owner's approval.

3.3 Material take-off (linewise and consolidated) with complete description of size, rating, material, thickness and specifications.

3.4 Preparation and finalization of data sheets for all piping materials e.g. all valves etc. All data-sheets shall be subject to review and approval by Owner.

3.5 Preparation of Material requisitions, Request for Quotation & its evaluation and recommend Bidders for Owner's approval. Preparation of purchase requisitions, review of Bidder's drawings and calculations, approval of manufacturing procedures wherever necessary, and the party inspection at manufacturer's works of the materials by reputed agencies as required. Quality control and expediting of all procured items at Bidder's shop or at fabrication yard.

3.6 Bidder shall procure materials as per specifications and list of approved Vendors/Suppliers (for major Items) included in the bid document.

3.7 Carry out proper documentation of inspection and quality assurance programs for all equipment and bulk materials duly approved by Owner. Bidder shall maintain an accurate and traceable listing of procurement records for the location, quality and character of all permanent materials in the Project.

3.8 Bidder shall immediately report to the Owner of all changes which will affect material quality, and take necessary corrective actions. Purchase requisitions including Purchase Orders of all major items shall be approved by Owner. For balance items, records shall be furnished for information only.

3.9 Compliance with Bidders and supplier's instructions and recommendations for transportation, handling, installation and commissioning.

4.0 INSPECTION

4.1 Inspection authority means the Third Party Inspection Agencies (TPIA) approved by the Owner to carryout inspection of materials.

4.2 The inspecting authority shall have the right to select random samples for check test and reject materials, if samples furnished as above and tested as per the specifications fail to meet the requirement specified.

4.3 All the items shall be inspected and tested in the presence of one or more representatives of the purchaser during various stages of manufacturing. Material shall be considered acceptable for dispatch only after final certificate of acceptance is issued by the Inspector.

4.4 Testing performed in the presence of the purchaser's representatives shall not relieve the supplier of their own responsibilities and guarantees and any other contractual obligations.

4.5 Quality Assurance plan (QAP) / Inspection Test Plan (ITP) shall be submitted by bidder for approval by Third Party Inspection Agency (TPIA).

4.6 Scope of Inspection by TPIA:

- Review of Chemical composition report, MTC (all batches)
- Positive Material Identification (PMI) for Alloy/Stainless steels (10% random witness)
- Hydrostatic test (10% random witness)
- Non Destructive Examination- Report review
- Dimensional check, Marking, Visual check for surfaces, external appearance (10% random witness)
- Packing: Report review

5.0 PAINTING

Painting shall be as per specification attached elsewhere in NIT.

6.0 CONSTRUCTION

All construction works be carried out as per "Approved for Construction" drawings, procedures, specifications and applicable codes and standards. Any changes at site shall also need prior approval from the Owner/PMC and revision of drawings.

Bidder shall procure and supply all materials whatsoever required for temporary/permanent installations of piping system in required and at appropriate time. All equipment, materials, components etc. shall be suitable for the intended service and the design life of the system. Wherever no specification is available in the contract, the same shall be prepared by the Bidder and shall be subject to Owner approval.

After completion of erection jobs, all piping system will be suitably hydraulically tested as per the test pressure indicated in the line list / relevant document approved by owner.

7.0 BIDDER'S RESPONSIBILITY

All works shall be carried out by Bidder in accordance with the drawings / documents / specifications indicated in the subsequent paragraphs.

7.1 Specifications

7.2 Standards

7.3 Piping Support Standards

7.4 Drawings

7.5 Design Review

7.6 Bidder shall submit all proposal designs, analysis, drawings, installation and testing procedure for review & approval by Owner as mentioned in the scope work. Bidder shall as a minimum, provide above deliverables for Owner's information / records & review / approval.

7.7 Typical Plot Plan drawing of package unit is attached in the NIT. This drawing is INDICATIVE only and is furnished for Bidder's information. Issued for construction (IFC) drawings shall be prepared by Bidder after detailed engineering being done by him and shall be subject to approval by the Owner.

7.8 The Bidder shall submit separately, the material take off for piping, valves, fittings and all other accessories as per requirements.

7.9 Bidder shall obtain statutory approval from various authorities having jurisdiction over the area, as necessary, for construction of the unit package.

8.0 DRAWINGS/ DOCUMENTATION SCHEDULE

Bidder shall furnish all the drawings/ documents to Owner for comments/ approval. He shall incorporate all comments/modification suggested by Owner. The drawings/documents should be properly organised, supplied & submitted as per documentation schedule of NIT.

Number of sets shall be as stipulated elsewhere in the tender document. Final documentation shall be supplied in hard copies (4nos.) as well as soft copies.

9.0 PACKAGING

9.1 Items shall be thoroughly dried, cleaned and shall be free from moisture, dirt & loose foreign materials, with ends protected from mechanical damage during transportation, shipment & storage.

9.2 For transportation overseas, protection and packing shall be adequate to prevent damage from sea atmosphere.

10.0 DOCUMENTATION WITH BID

Following drawings/documents must be submitted along with the bid.

i) Proposed equipment layout drawing.

DESIGN PHILOSOPHY – PIPING

PACKAGE UNITS

INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL, DISTRICT- ODISHA, INDIA

CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	Scope
2.0	Design Philosophy
3.0	Codes, standards and supplementary specifications
4.0	General Design
5.0	Design Philosophy / Criteria General
5.1	Equipment Layout
5.2	Unit Piping
5.3	Offsite & Yard Piping
5.4	Flare Piping
5.5	Underground Piping
5.6	Air Systems
5.7	In-Line Instruments
5.8	Sample Connections
5.9	Vents and Drains
5.10	Line Strainers
5.11	Spectacle Blinds
5.12	Flexibility Analysis and Supporting
5.13	Personnel Protection
5.14	Mechanical Handling
6.0	Materials
7.0	Painting
8.0	Welding

LIST OF ATTACHMENTS

DOCUMENT/ANNEXURE NUMBER	DESCRIPTION
1	Table Of Basic Span
2	Accessibility For Valves & Instruments
3	Vertical And Horizontal Guides Spacing
4	Clearances
5	Design Philosophy For Stress Analysis
5A	Criteria for Identifying Extremely Critical Lines (Level I)
5B	Criteria for Identifying Moderately Critical Lines (Level II)
5C	Minimum allowable nozzle loadings: Vessels and S/T heat exchangers

1.0 SCOPE

The scope of this document is pertaining to the design philosophy, norms .and specific requirements which shall be adhered to by contractor or his associates and representatives during the course of the project in designing, procurement & construction of piping material.

1.1 APPLICABLE STANDARD & CODES

Standard No.	Title
ASME/ANSI B16.5	Steel Pipe Flanges and Flanged Fittings
ASME/ANSI B16.9	Steel Butt-Welding Fittings
ASME/ANSI B16.10	Face to Face and End to End Dimensions of Valves
ASME/ANSI B16.11	Forged Fittings Socket Welded and Threaded -
ASME/ANSI B16.20	Metallic Gaskets for Pipe Flanges – Ring Joint, Spiral Wound, and Jacketed.
ASME/ANSI B16.21	Non-Metallic Flat Gaskets for Pipe Flanges
ASME/ANSI B16.25	Butt-Welding Ends
ASME/ANSI B16.34	Valves – Flanged, Threaded Welding End.
ASME/ANSI B16.47	Large Diameter Steel Flanges
ASME/ANSI B31.1	Power Piping
ASME/ANSI B31.3	Process Piping
ASME/ANSI B31.5	Refrigeration Piping
ASME/ANSI B36.10M	Welded and Seamless Wrought Steel Pipe.
ASME/ANSI B36.19M	Stainless Steel Pipe
API 6D	Specification for Pipe Line Valves (Gate, Plug, Ball and Check Valves).
API 6FA	Fire Test for Valves
API 501	Specifications for Metallic Gaskets for Refinery Piping
API 594	Check Valves:, Wafer-Lug and double flanged type
API 598	Valve Inspections and Testing
API 599	Steel Plug Valves, Flanged and Butt-weld ends
API 600	Steel Gate Valves, Flanged and Butt-welding ends, Bolted Bonnets
API 602	Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries
API 603	Class 150 – Corrosion Resistant Flanged End gate valves.
API 604	Ductile Iron gate valves – flanged ends.
API 606	Compact C.S. Gate Valve extended body.
API 607	Fire Test for soft seated Ball Valve.
API-608	Metal Ball Valves, Flanged, Threaded & BW Ends.
API 609	Butterfly Valves, Lug type & Wafer type
API 623	Steel Globe Valves—Flanged and Butt-welding Ends, Bolted Bonnets
IBR	Indian Boiler Regulations
AWWA C207-D	Large Dia. Steel Flanges (Ring Type).
EJMA	Expansion Joints Manufacture Association
MSS SP 6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting End Flanges of Valves and Fittings
MSS SP 25	Standard Marking System for Valves, Fittings, Flanges & Unions
MSS SP 43	Wrought Stainless Steel Butt-weld Fitting

MSS SP 45	By-pass and Drain Connection
NACE MR0175-94	Sulphide Stress Cracking resistant Metallic Material
NFPA	National Fire Protection Association
EN 10204	Metallic Products - Types of Inspection documents
ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

2.0 DESIGN PHILOSOPHY

2.1 Piping systems shall be in accordance with Clause 1.1, which permits the use of the following specifications:

ASME B31.1 Power Piping
ASME B31.3 Process Piping
Materials, design, construction, testing and inspection shall be fully in accordance with the selected specification.

2.2 The dimensions, manufacturing tolerances and marking of ferrous and non ferrous piping components shall conform to the applicable standards .The design shall comply with all applicable codes, laws and statutory regulations. The Contractor shall optimize the layout with the approval of the owner and include any changes resulting from HAZOP studies and taking into consideration the following :

i) General site layout taking into account the topographical geo-technical aspect of the site.
ii) Access for maintenance and fire appliances.
iii) The interdependency of units and buildings with each other within the complex.
iv) Safety escape routes for personnel based on emergency or disaster management plans in the event of environmental upset or fire.
v) Suitable drainage system of Project site.

2.3 Material of construction shall be suitable for specified process duty (both normal and abnormal operations) and have a projected life and corrosion/ erosion allowance in excess of minimum life of the project. Piping materials specified in piping materials specification shall be used for selection of material of construction of major services.
All materials under steam service shall be supplied with proper certificates in prescribed forms.

3.0 CODES, STANDARDS AND SUPPLEMENTARY SPECIFICATIONS

3.1 The latest edition of codes shall be applicable for piping system design, materials, fabrication, manufacture, erection, construction and inspection etc. For any item not covered in the list of codes and standards / International Standards / proven design may be finalized based on discussion with OWNER/Consultant.

3.2 Where conflict occurs, the order of precedence shall be:

a) Statutory Regulations
b) National, International and Industry Standards and Codes of Practice.
c) Technical Specifications

3.3 Standards, Codes and Supplementary Specifications for piping design shall be applied as follows:

i) Process and utility piping to ASME B31.3 Process Piping

ii) Power Plant piping to ASME B 31.1

Fire protection system shall be designed and installed in accordance with applicable NFPA (National Fire Protections Associations) Codes.

4.0 GENERAL DESIGN

4.1 Flanges for process and utility piping shall be in accordance with ANSI B16.5 and ANSI B16.47.

4.2 Wherever possible all purchased equipment shall be supplied with flanges that comply with ANSI B16.5/B16.47.

4.3 The minimum size of piping to be used in pipe-racks shall be 2" NB.

4.4 With the exception of equipment connections the minimum size of piping shall be ½" NPS.

4.5 Pipe sizes 1 ¼", 2 ½", 3 ½" 5" and 22" NPS shall not be used except as connections to purchased equipment.

4.6 Threaded pipe nipples between headers and vent, drain and instrument isolation valves shall be Schedule 160 for CS and Schedule 80S for SS in the size range ½" to 2" NPS.

4.7 Piping 2" NPS and above shall be butt-welded. All weld joints in piping 1½" NPS and below shall be socket welded using socket weld fittings.

4.8 In Class 900 and higher pressure rating double block valves shall be used for systems open to atmosphere, such as vents and drains. Piping in hazardous service shall have vents, drains and bleeds routed to a safe location. Category 'M' substances shall be vented to the flare system.

4.9 When a line of one material specification is connected to a line of higher material specification, the connecting line shall be constructed of the higher material specification or pressure rating up to & including the first block valve.

4.10 As a minimum, piping systems shall have isolation facilities as follows:

ASME B31.3 Category 'M' service and Normal service (Class 900 and above) shall have double block isolation valves with a downstream drop-out spool.

ASME B31.3 Normal service (upto Class 600) shall have a valve and downstream spectacle blind.

ASME B31.3 Category 'D' service shall have a valve and downstream spectacle blind.

Generally, equipment shall have provision for isolation of piping to each equipment connection by means of valving and /or blinds as determined by service conditions.

5.0 DESIGN PHILOSOPHY / GENERAL CRITERIA

5.1 Equipment Layout

5.1.1 Basis of Equipment Layout

Equipment Layout shall be finalised based on the following data:

a) Overall Plot Plan

b) P&I Ds

c) Equipment Data Sheets

d) Wind Direction

e) Safety Distance and Specific Distance mentioned in Piping Design Basis and as

per statutory requirements.

5.1.2 **Development of Equipment Layout**

The following aspects shall be considered during development of equipment layout.

a) Process Requirement -Proper interconnection between equipment as per P&I Ds to achieve the intended process parameters.

b) Economy of piping material- Minimize the quantity of costly piping.

c) Erection & Construction requirements:

Erection scheme and schedule of all equipment must be considered during equipment layout to have smooth erection mainly in case of tall columns, heavy equipments like thick walled reactors, space for laying tall columns, approach roads for cranes / derricks for lifting the column or reactors and requirement of special foundation / pile etc.

d) Operation and Maintenance Requirement

- Overhead and side clearances for exchangers and pumps
- Horizontal & overhead clearances for easy movement of working personnel.
- Crane approaches for air coolers/fired heaters.
- Provision of monorail for pumps and exchangers

e) Similar equipment grouping - All columns, exchangers, pumps etc. should be grouped together for convenience of maintenance and safety wherever feasible.

f) The technological structures should be interconnected for easy movement of operational personnel.

g) U/G piping corridors for main headers should be marked in equipment layout for all under ground piping.

5.1.3 **Plant Layout & Design guidelines**

5.1.3.1 **General**

The plant layout shall be based on ensuring adequate access, to allow construction, inspection, maintenance and operation to be performed in a safe and efficient manner. The alignment of equipment and pipe shall offer an organised appearance. The layout shall be in accordance with, but not limited to the design practices described in this criteria.

Where dynamic loading, limited pressure drop or other severe service condition applies, particular care shall be taken in routing pipe lines.

Flushing connections shall be provided on all lines containing flammable or toxic material, slurries, and materials which solidify- when the line is dead. Sufficient Nitrogen purging points shall also be provided. Supply piping of fuel gas shall be arranged for equal flow distribution.

Trolley beams, pipe davits, shall be provided with appropriate removable hoists mechanism for charging and discharging catalysts, chemicals, packing rings etc.

Piping and all other services shall be arranged so as to permit ready access of Cranes for removal of Equipment for inspection and servicing.

All utility and process piping shall be located above ground, and major lines shall be located in overhead pipe ways.

Lines that must be run below grade, and must be periodically inspected or replaced, shall be identified on the P & ID's; these lines must be placed in covered concrete trenches. Sleeper-ways shall not be used in process areas where they may block access for personnel and equipment.

Drip legs and dead ends shall be avoided, especially for piping where solids or fluids may congeal from corrosive condensate.

Where sleeper ways are used the elevations shall be staggered to permit ease of crossing or change of direction at intersections. Flat turns may be used when entire sleeper ways change direction. Flat turns must not be used within pipe racks.

Spacing and routing of piping shall be such that expanding/contracting lines (including insulation) will not clash with adjacent lines, structures, instruments and electrical equipment during warm up and cool down.

Piping to be sloped shall be indicated on the P&I D's.

5.1.3.2 **Pipe-Rack/T-Post/Small Portals**

In general, equipment layout shall be prepared considering straight pipe rack, however other shapes like L / T / U / H / Z etc can also be considered based on area available.

The width of the rack shall be 4M, 6M, 8M, 10M or 12M for single bay having four (4) tiers maximum. In general, the spacing between pipe rack portals (span) shall be taken as 8 M for main rack. However it can be decreased to 6 M depending on the size/number of the pumps to be housed below pipe rack. Intermediate Beams between two portals shall be provided to support smaller pipes <= 2". 20% extra space shall be provided on the pipe rack and portals on each tier for future expansion/modifications.

-Clearance beneath pipe rack shall be 3.8 M minimum.

-Height between two pipe rack tiers shall be 2.0M minimum.

-Road clearance shall be 9 M minimum wherever heavy duty crane movement is required during construction and future maintenance.

-Road clearance shall be 7.5 M minimum for main roads.

-Road clearance shall be 5 M minimum for secondary roads.

-T-Portal's width shall not be more than 2.5 M and height shall not be less than.3.0 M

5.1.3.3 **Pumps**

Wherever practical, pumps shall be arranged in rows with the centre line of the discharge on a common line. In general, pumps shall be kept inside the pipe rack. However in case of smaller racks, pumps shall be kept on one side or outside the pipe rack to provide clear access under the rack as per clause applicable.

Pump foundation height shall be 300 mm above H.P.P.

Gap between each pump foundation / and foundation of technical structure should be sufficient for easy removal of equipment after piping. Clearance between two adjacent pumps shall be such that clear 900 mm aisle is available.

All pumps not open to sky with motor rating >= 45 KW shall be provided with monorail. No monorail should normally be provided for pumps outside rack and sufficient space below rack shall be available for pump maintenance.

5.1.3.4 **Clearance and Accessibility**

5.1.3.4.1 **Access to Pumps**

Clear access of 3.8M vertically and 4.5M horizontally shall be provided centrally under main pipe rack for small mobile equipment to service pumps, wherever these are put under pipe ways with prior specific approval. Pumps outside rack shall be approachable by small cranes etc. from under the pipe rack.

5.1.3.4.2 **Access to lower items to grade (Lowering Area)**

Clear access shall be provided at grade on the access side for lowering external and internal fittings from tall elevated equipment by providing pipe davits.

5.1.3.4.3 **Layout & Access Requirements for Platforms ladders and Stairs**

For providing platform ladder & staircase following guidelines shall be followed.

- Two means of access (i.e. two ladders or one ladder and one stair case) shall be provided at any elevated platform which serves three or more vessels & for B/L valves operating platform.
- Platforms, ladders and stairways shall be the minimum, consistent with access and safety requirements.
- Stairway for tanks to be provided on upstream of predominant wind direction.

i) Platform at elevated structure

a) Dual access (i.e. one staircase and one ladder) shall be provided at large elevated structure if any part of platform has more than 22.65M (75 ft) of travel.

ii) Platforms with stair access shall be provided for:

a) Location at which normal monitoring (once a day or more) is required or where samples are taken.

b) Locations where vessels or equipment items need operator attention "such as compressors, heaters, boilers etc.

iii) Platforms with ladder access shall be provided for:

a) Points which require occasional operating access including valves, spectacle blind and motor operated valves, heater stack sampling points.

b) Man ways above grade on equipment.

iv) Ladder location

a) Wherever practicable, ladder shall be so arranged that users face equipment or platform rather than facing open space.

b) Landings shall be staggered. No ladder shall be more than 6 M in one flight.

5.1.3.5 **Clearances**

Minimum clearances shall be as indicated in Annexure.

5.2 Unit Piping

5.2.1 Basis of Unit Piping

- Piping & Instrument Diagram
- Equipment layout
- Equipment Data sheet & Setting plan
- Line list
- Instrument Data sheet
- Structural & building drawings
- Topography of the plant
- Piping material specification
- Overall plot plan
- Tie in point drawing.

The following objective shall be ascertained during piping layout.

- Proper access to all operating points including valves, and for all orifice tapping points and instruments in particular.
- Proper access to interrelated operating points for specific purpose and for maintenance.

5.2.2 Pipe Ways/Rack piping

5.2.2.1 Racks shall be designed to give the piping shortest possible run and to provide clear head rooms over main walkways, secondary walkways and platforms.

5.2.2.2 Predominantly process lines are to be kept at lower tier and, utility & hot process lines on upper tier.

5.2.2.3 Generally the top tier is to' be kept for Electrical (if not provided in underground trench as per electrical design basis) and Instrument cable trays. Cable tray laying to take care of necessary clearances for the fire proofing of structure.

5.2.2.4 Generally the hot lines and cold lines shall be kept apart in different groups on a tier. .

5.2.2.5 Generally the bigger size lines shall be kept nearer to the column.

5.2.2.6 Minimum spacing between adjacent lines shall be decided based on O.D of bigger size flange'(minimum rating 300# to be considered), O.D of the smaller pipe, individual insulation thickness and additional 25 mm clearance, preferably. Wherever even if flange is not appearing the minimum spacing shall be based on above basis only. '

5.2.2.7 Actual line spacing, especially at 'L' bend and loop locations, shall take care of thermal expansion / thermal contraction / non expansion of adjacent line. Non expansion / thermal contraction may stop the free expansion of the adjacent line at "L' bend location.

5.2.2.8 Anchors on the racks are to be provided on the anchor bay, if the concept of anchor bay is adopted. Otherwise anchors shall be distributed over two to three consecutive bays.

5.2.2.9 Anchors shall be provided within unit on all hot lines leaving the unit.

5.2.2.10 Process lines crossing units (within units or from unit to main pipe way) are normally provided with a block valve, spectacle blind and drain valve. Block valves are to be grouped and locations of block valves in vertical run of pipe are preferred. If the block valves have to be located in an overhead pipe way, staircase access to platform above the lines shall have to be provided.

5.2.2.11 Provision of block valves, blinds etc. shall be as per Process Design Basis and P & IDs.

5.2.2.12 All small bore piping shall be designed in a way so as to ensure adequate space for maintenance and operation. For small bore piping intermediate support shall be provided in between portals.

5.2.2.13 Stubs on saline water (if applicable) service shall be from top of main header.

Minimum branch size for tapping including for instruments e.g. PG/PTI TE etc. shall be of 3" NPD and 150 mm height on internal cement lined pipes.

5.2.2.14 Aboveground lines shall be grouped to run on pipe racks or sleepers in so far as practicable.

5.2.2.15 Hot lines on pipe racks or sleepers shall be grouped and expansion loops shall be nested together. The number of expansion loops shall be kept to a minimum.

5.2.2.16 Piping handling corrosive fluids shall be run under piping handling non corrosive fluids, and shall not, where possible, be run overhead across walkways or normal passages for personnel.

5.2.2.17 All process and utility piping will be located aboveground within the plant battery limit, except water mains.

5.2.2.18 All piping shall be arranged in horizontal banks, where possible, to facilitate supporting.

Banks running north-south shall be at different elevations from banks running east-west. Exceptions are permitted to avoid unnecessary change in elevation at change of direction or where essential to avoid pockets.

5.2.2.19 All piping shall be routed for the shortest possible run and have the minimum number of fittings consistent with provision for expansion and flexibility. All piping shall be arranged in a neat manner, providing free access around all operating equipment.

5.2.2.20 Vertical lines at vessels shall run close to the vessel shell to facilitate supporting. The line shall be arranged and grouped to allow the use of single support.

5.2.2.21 Lines carrying molten solids, slurries or highly viscous liquids shall have a sufficient

slope for each gravity flow.

5.2.2.22 The shortest and most direct layout possible shall be provided for gravity flow lines, especially when the fluid is subject to solidification and when the differential pressure is

small.

5.2.2.23 Piping shall be arranged to facilitate handling of equipment for inspection or maintenance.

5.2.2.24 Vapor collecting system shall be routed so that the vapor rises continuously from the vessel being vented to a higher point without pocketing.

5.2.2.25 Pockets shall be avoided in lines, particularly those carrying corrosive chemicals, slurries, vents, blow down lines, etc.

5.2.3 Column / Vessel Piping Control Valves

5.2.3.1 Piping shall be supported from cleats welded on the vessel as far as possible.

5.2.3.2 Proper guides at intervals shall be provided for long vertical lines.

5.2.3.3 Access platforms/ladders shall be provided along the column for valves and instruments.

5.2.3.4 For ease of operation and maintenance, column and vessels which are grouped together, shall have their platforms at the same elevation interconnected by walkways wherever feasible. However each column \ vessel shall have an independent access also. Column vessel platforms should be designed in such a way so that all the nozzles should be approachable from platforms.

5.2.3.5 Unless specifically indicated in P&ID's control valves shall preferably be kept at grade instead of platform.

5.2.3.6 Piping intended for vacuum services shall be routed as short as possible, with minimum bends and flanged joints.

5.2.3.7 Piping support cleats shall be designed for safety valves considering impact loading during popping off.

5.2.4 **Pump Piping**

5.2.4.1 Pump drives shall have clear access.

5.2.4.2 Pump suction piping shall be as short as possible and shall be arranged with particular care to avoid vapor pockets.

5.2.4.3 Reducers immediately connected to the pump suction shall be eccentric type flat side up to avoid the accumulation of gas pocket. For end suction pumps, elbows shall not be directly connected to the suction flange. A straight piece minimum 3 times the line size shall have to be provided at the suction nozzle.

5.2.4.4 Pump discharge check valve if installed in vertical lines shall be fitted with a drain connection as close as possible downstream of the valve.

When a suction vessel operates under vacuum, the vent connection of the pump has to be permanently connected to vapour space of the suction vessel to allow possible filling of the pump with liquid before it is started.

5.2.4.5 Unless otherwise specified T -type strainers shall be used on pump suction piping for sizes 2" and above.

5.2.4.6 Y-type strainers to be used for all sizes in steam services and for pump suction lines 1½ and below.

5.2.4.7 All small bore piping connected to pump (drain to OWS & CBD, seat and gland leak drain) shall have provision for break up flanges for removal of pumps.

5.2.4.8 Piping shall be so arranged that forces and moments imposed on the pump nozzle do not exceed the allowable values as per API 610.

5.2.4.9 Pump discharge should preferably be routed away from the pump rather than towards the motor side.

5.2.4.10 Pump cooling water connection shall be taken from the top of circulating cooling water header.

5.2.5 **Steam Header & Supply Lines / Steam and Condensate Systems**

5.2.5.1 Steam piping shall be designed to have complete condensate removal. Drip legs shall be provided with steam traps at low points in the system.

5.2.5.2 All steam branch connections shall be taken from the top of the header.

5.2.5.3 Return exhaust steam / condensate lines shall connect to the top of the exhaust steam Condensate header.

5.2.5.4 Where block valves have been installed in the main steam header such that condensate can collect either side of the valve when closed, a safe means of draining the condensate prior to opening the valve shall be provided.

- Steam header shall be located generally on the upper tier and at one end of the rack adjacent to columns.
- Branch lines from horizontal steam header, except condensate collection points, shall be connected to the top of the pipe header.
- Isolation valves (if provided) on the branch line shall preferably be provided on the horizontal run and outside the pipe rack.
- All branch lines shall be drainable.
- Drip legs & steam traps shall be provided at all low points and dead ends of steam header. Drip legs at low points shall be closer to downstream riser and shall be provided to suit bidirectional flows, if applicable.
- All turbines on automatic control for startup shall be provided with a steam trap in the steam inlet line.
- All traps shall be provided with strainers if integral strainers are not provided.
- Steam traps discharging to atmosphere shall be connected to storm water drain/storm sewer, in case of open system. In case of condensate recovery, traps shall discharge into condensate header.
- Expansion loops are to be provided to take care of the expansions within units.
- Wherever condensate is to be drained, proper condensate draining facility shall be provided.

5.2.6. **Water Piping**

5.2.6.1 Water piping shall be designed to minimize the possibility of water hammer.

5.2.6.2 Water main headers may run underground to prevent freezing.

5.2.6.3 Unless local code or regulation prohibits, firewater lines shall be underground to prevent freezing. Firewater piping system shall conform to egulations of the competent governmental authorities.

5.2.7 **Instrument Air Piping**

5.2.7.1 Instrument air lines shall not be connected to process lines, service lines, and other equipment.

5.2.7.2 Instrument air shall not be used as plant air or service air.

5.2.7.3 Branch lines form the instrument air header shall be taken from the top of the header and shall be provided with a block valve close to the header. Also in the upstream of Instrument manifold, Gate valve has to be provided.

5.2.8 **Supports and Anchors**

5.2.8 1 Supports and/or anchors shall be provided close to changes in direction of lines, branch lines

and, particularly, close to valves to prevent excessive sagging, vibration and strain.

5.2.8 2 Allowable spans between pipe supports shall be determined to keep the maximum deflection within 16 mm.

5.2.8 3 In cases where periodic maintenance requires removal of equipment, such as pumps and relief valves, and where lines must be dismantled for cleaning, piping shall be supported to minimize the necessity of temporary supports.

5.2.8.4 Spring-loaded hangers may be used on piping subject to thermal expansion or contraction. In cases where the movement is very large, or the limitation of reaction and

stress are very severe, constant support spring hangers shall be used.

5.2.8.5 Suction and discharge lines of rotating equipment shall be supported as close as possible to equipment nozzles, and shall be relieved of excessive strains by using proper pipe supports.

5.2.8.6 Supports shall not be directly welded to pipes. Where welding is unavoidable, supports having the same chemical composition as pipe shall be carefully welded.

5.2.8.7 All piping shall be properly supported to minimize vibration.

5.2.8.8 Outlet piping of safety and relief valves shall be supported so that the inlet piping is capable of withstanding the reaction caused by operation of safety and relief valves. Furthermore, the supports shall be designed to minimize the stresses due to thermal expansion and the stresses in the valve body due to the weight of piping.

5.2.8.9 Expansion joints shall be guided and anchored to the extent necessary for their proper operation and alignment.

5.2.8.10 Anchors shall provide sufficient fixation to substantially transmit all load effects into the foundations.

5.2.8.11 Underground piping shall be given special anchoring consideration for differential settlement.

5.2.9 **Utility Stations**

Requisite number of utility stations shall be provided throughout the unit to cater for the utility requirement. Utility stations shall have four connections one for LP steam (SL), one for Plant Air (AP), one for Service Water (WS) and one for nitrogen each of 1.0" with isolation valves unless otherwise specified in P&ID.

Utility connection with nitrogen shall be provided with NRV along with isolation valve kept at a separate location other than this cluster @ 15 M.

Air and water lines shall have quick type hose connection and steam line shall have flanged type hose connection. All connections shall be directed downward. All connections shall have globe valve for isolation purpose. An inter connection with valve shall be provided between steam and service water lines shall be provided. Inert gas hose, when required, shall have built in non return valve in quick connection coupling of piping end.

Number of utility stations shall be such that all equipments shall be approachable from at least one utility station. The approach of utility station shall be considered 15 M all around the station location.

The Utility stations shall generally be located adjacent to pipe-rack column.

The utility stations shall also be provided on elevated structures like - technological structure, operating platforms of vertical equipments etc.

Operating platforms having manholes must have a utility station. Utility station locations shall be limited to a height of 35 M from H.P.P.

5.3 Offsite & Yard Piping

In general, offsite piping (except tank ages area), electrical cable and instrumentation cable shall also be laid either on pipe rack or pipe sleepers.

Wherever piping is laid on pipe sleepers, it shall have hard surfacing below it keeping a gap of 300 mm from the bottom of the pipes. Hard surfacing should be completed before start of pipe laying. Width of hard surfacing shall be about 1.0 meter more than the piping corridor. This extra hard surfacing shall be for movement of operating personnel along the piping corridor.

Pipes at road crossing shall be under culverts in general. Overhead pipe bridges may be used for areas where pipe racks are provided. Where culverts are not provided, pipe sleeves shall be used for underground road crossing. Culverts / overhead pipe bridges shall be adequately designed to take care of future requirements. Minimum 20% extra width shall be provided in all such structures.

Clearances between lines shall be minimum "C" as given below:

$C=(Do+D_f)/2$ + 25 mm + Insulation thickness(es) where,

Do - outside diameter of smaller pipe (mm)

D_f - outside diameter of flange of bigger pipe (mm)

However this 'C' spacing between the offsite piping on the rack/sleeper can be suitably increased so that the lines should not touch each other after insulation / lateral thermal expansion.

Adequate clearance shall be provided for every long & high temperature lines to avoid clashing at the bends. See 5.2.2 also for line spacing at 'L' bends and loops.

Expansion loops for all lines shall generally be kept at the same location.

Vents shall be provided on all high points & drains shall be provided at all low points. Drain valves at sleeper piping shall be kept outside the sleeper way if the same is not accessible and valves shall be put in horizontal only.

Places where piping is extended to make drain valves accessible - 2 nos. of stiffeners, irrespective of pipe rating, shall be provided as per 5.13.1. Spacing of guides on each line on a pipe bay shall not exceed the value given in clause 5.13.1

5.4 Flare Piping

Flare header shall be sloped towards flare knock-out drum. Only horizontal loop shall be provided as per requirement to accommodate thermal expansion. The desired slope shall be ensured throughout including flat loop. Flare header shall be supported on shoe of height ranging from 100mm to 300mm.

Proper thermal analysis temperature shall be established including the possibility of temperature gradient along the line before providing expansion loops. Efforts shall be made to minimize the number of loops. Flare line between knock out drum and water seal drum shall be designed for pressure fluctuations and adequately supported to avoid vibrations.

5.5 Underground Piping

5.5.1 Underground steel piping shall be protected from electric corrosion.

5.5.2 Underground piping passing under loaded areas, such as main roads in the plant, shall be protected from heavy traffic by casing pipes or covers extending at least 1 m on either side of the area or having the wall thickness sufficient to bear earth pressure.

5.5.3 Underground piping shall be sloped to all drain points with a downward slope of not less than 1 m in 150 m.

5.5.4 Expansion elbows or joints of underground piping for hot fluids, such as steam or heated heavy oil, shall be enclosed in a conduit from which they are separated to allow free longitudinal expansion.

5.5.5 Where it is impossible to run pipe aboveground or underground, trenches may be used.

5.5.6 Trenches for piping close to process equipment should be avoided, whenever possible.

5.5.7 All underground pipe work shall be provided with following protection:

a) At location where Underground Piping becomes above ground, INSULATING GASKET with material Glass Filled Teflon or equivalent shall be provided.

b) CATHODIC PROTECTION (CP) shall be provided to all underground piping. Specification shall be submitted by the CONTRACTOR & shall be approved by the OWNER.

c) Underground piping shall be wrapped & coated by “PYP KOTE” or equivalent tapes / sheets, 4.00 mm thick & shall be “HOLIDAY TESTED” before Hydro Test.

d) All underground pipes shall have Sand Bed, at least 150 MM all around the pipe.

e) All road crossings by Underground piping shall be through Hume Pipe Sleeves.

5.5.8 **Buried Pipes**

The following points to be considered in designing of buried pipes

i) All underground metallic piping shall be coated and wrapped and provided with cathodic protection system. If sacrificial metal is used, permanent testing arrangement shall be provided.

ii) All cooling water distribution headers 18" and higher shall be laid underground.

iii) All Sewage lines (oily and chemical) from catch basin to mains and manholes shall be laid underground.

iv) Underground pipe crossing roads, access ways and rails shall have casing pipe (R.C.C or C.S).

v) Valve chamber wherever required shall be made of brick or concrete. Valve chamber should be spacious to attend valves during operation/Maintenance.

vi) All U.G. headers shall clear equipment foundations as far as possible. Under special cases, the C.W. header may be laid over the footing of foundations.

vii) Provide break flange at + 500 MM from floor level connection with cathodic protection to isolate underground pipe from above ground piping with insulating gasket KIT.

viii) Pipes shall be laid below electrical cables if any.

ix) Top of underground piping shall be below grade level at least 1 meter deep in case of open areas and 1.5 meter deep for roads.

5.5.9 Piping in Trenches

The following points to be considered in designing of trench pipes

i) Piping located below grade, requiring inspection, servicing or provided with protective heating.

ii) Fire water lines/Process lines.

iii) Drain lines requiring gravity flow trenches.

iv) Sump for valves and trenches shall be provided.

v) Suitable draining scheme for trenches shall be provided.

5.6 Air Systems

5.6.1 Branch connections shall be taken from the top of the header.

5.6.2 Low points shall be fitted with drains.

5.7 In-Line Instruments

5.7.1 Liquid level controllers and level glasses shall be located so as to be accessible from grade, platform or permanent ladder. The level glass shall be readable from grade wherever possible.

5.7.2 Relief valves shall be accessible. Relief valves with a centre line elevation over 4.5 M above grade (expect in pipe racks) shall be accessible from a platform or permanent ladder.

5.7.3 Relief valves that discharge to a closed system shall be installed higher than the collection header, with no pockets in the discharge line.

5.7.4 Relief valves that discharge to atmosphere shall have tail-pipes extended to a minimum of 3.0 M above the nearest operating platform that is within a radius of 8 M.

5.7.5 Provide steam traps at pocketed low points and at dead ends of steam headers. Provide steam traps on excessively long runs of steam piping to ensure dry quality steam at destination. Steam traps located more than 4.5 M above grade, except in pipe racks, shall be accessible from a platform.

5.7.6 Control valves shall be accessible from grade or platforms. In general, the instruments or indicators showing the process variables shall be visible from the control valve.

5.7.7 Orifice runs shall be located in the horizontal. Orifice flanges with a centre line elevation over 4.5m above grade, except in pipe racks, shall be accessible from a platform or permanent ladder.

5.7.8 Orifice taps shall be located as follows:

i) Air, Gas and steam
Top vertical centreline (preferred)
45 degrees above horizontal centreline (alternate)

ii) Liquid
Horizontal centreline (preferred)
45 degrees below horizontal centreline (alternate)

iii) Tap orientation shall be shown on piping isometrics.

5.8 **Sample Connections**

Sample connections shall be accessible from grade or platforms. In general, where liquid samples are taken in a bottle, locate the sample outlet above a drain funnel to permit free running of the liquid before sampling.

5.9 **Vents and Drains**

5.9.1 The minimum size of vent and drain connections shall be as follows:

For process & utilities lines :

4" & Below	NPS ¾"
6" & 10"	NPS 1"
12" & above	NPS 11/2"

Vent & Drain shall be provided with the valve & blind flange. For all vents / drains of process lines / utilities lines, double valves shall be required for 600 # & more rating.

Process vents and drains shall be indicated on the P&ID's

5.9.2 Vent, drain and sampling valves on process lines, not connected to a piping system, shall be provided with appropriate end closures.

5.9.3 Vents shall be located at high points of pipelines when necessary.

5.9.4 Drains shall be located at low points to empty pipelines or equipment after testing or during maintenance (i.e for every loop).

5.9.5 All drains and vents shall be provided with valve, except that vents for test purpose for flare liens (header), may be plugged. Exposed threads shall generally be seal welded.

Low-point hydrostatic drains and high-point hydrostatic vents shall be added as required; locations to be determined during the design review.

5.9.6 Vent valves shall be the globe or gate type and drain valves the gate type.

5.9.7 Valved bleeds shall be provided at control valve stations, level switches, level controllers, and gauge glasses.

5.10 Line Strainers

5.10.1 Provide temporary conical type strainers in 2" NB and above butt weld pump suction lines for use during start-up. Arrange piping to facilitate removal.

5.10.2 Provide permanent Y-type strainers for pump suction piping below 2" NB Thd or SW.

5.10.3 Provide temporary basket type strainers located at the suction pulsation device inlet for start-up of reciprocating compressors. Arrange piping to facilitate removal of the filter.

5.10.4 Provide temporary basket type strainers and locate them as close as possible to the compressor inlet flange for start-up of centrifugal compressors. Arrange piping to facilitate removal of the filter.

5.10.5 Allowable pressure drop when specified shall be certified by vendor along with the offer. If asked specifically, vendor shall furnish pressure drop calculations

5.10.6 All 2" & higher sized Y type strainers shall be provided with 3/4" threaded, tap and solid threaded plug as drain connection. For less than 2", this shall be ½ " size.

5.10.7 Bottom flange of Y-type strainer shall not have tapped hole. Full length standard size studs shall be used for joining blind flange.

5.10.8 For fabricated strainers, all BW joints shall be fully radiographed and fillet welds shall be 100% DP/MP checked.

5.10.9 All the strainers shall be hydrostatically tested at twice the design pressure.

5.11 Spectacle Blinds

5.11.1 Spectacle blinds shall be provided to isolate equipment. In hazardous service flanged drop-out spools shall be provided for safety purposes. Both shall be shown on the P&ID's.

5.11.2 Spectacle blinds shall be accessible from grade or platforms. Blinds located in a pipe-rack are considered to be accessible. Blinds that weigh over 40kg shall be accessible by mobile equipment. Where this is not possible davits or hitching points shall be provided.

5.12 **Flexibility Analysis and Supporting**

5.12.1 **Pipe Supporting Criteria & General Guidelines.**

Piping system shall be properly supported taking into account the following points:

1. Load of bare pipe + fluid + insulation (if any).
2. Load of bare pipe + water fill.
3. Load of valves and online equipment and instrument.
4. Thermal loads during operation.
5. Steam-out condition, if applicable.
6. Wind loads for piping at higher elevation, e.g. transfer lines, column over head lines, flare headers, etc.
7. Forced vibration due to pulsating flow.
8. Vibration due to two phase flow.
9. Loads due to internal pressure.
10. Any external loads/concentrated loads and cold load of springs.

Pipe supporting shall preferably follow the minimum basic span as given in Annexure-1 except for flare line in off site on trestles in which case the maximum basic span shall be restricted to 18.0 meters, irrespective of line size.

For sizes not covered in Annexure-1, basic span shall be established based on project requirement. For piping on rack or sleeper, as a minimum, providing resting support on every grid of pipe rack / sleeper is mandatory. Depending on the pipe size, as a rule, guides shall be provided on straight run of pipes at intervals as specified in Annexure-3 unless specifically becomes non-viable due to flexibility problems.

Additional supports, guides, anchors, special supports like spring supports and sway braces shall be provided after detailed analysis of piping system to restrict the forces experienced on nozzles of critical items like pumps, compressors, turbines, exchangers, air fin coolers etc.

For lines which do not need any support otherwise but become unsupported by opening of flange, etc, during maintenance and thereby may transfer the total load on a small branch

off, a permanent support shall be suitably provided which may be a spring support also. Bare pipes of size 14" and above on elevated structures shall be supported with pad or shoe. While bare pipes of size 6" and' above, on sleepers, corrosion pads shall be provided.

Pads shall be provided for insulated pipes before welding the shoes for sizes 8" & above.

Adequate stiffening shall be provided for the following:

a) Lines in above 600#,

b) Lines having two phase flow,

c) Lines having Pulsating flow such as discharge of reciprocating compressors & reciprocating pumps,

For pulsating flow lines detailed thermal and vibration analysis by analog study shall be done to decide location of anchor supports and guides etc. Pulsating flow lines shall be as identified by licensor/owner.

Wherever two phase flow in piping is expected, piping design shall be checked by dynamic analysis to prevent vibrations.

Pipe support design shall be such that deflection in piping systems due to sustained loads shall not exceed 15mm, in any case, between two adjacent supports.

As far as possible long trunnion types of supports (more than 0.5 metre) are to be avoided. In case long trunnion support is unavoidable in straight length of pipe, trunnion height to be restricted to 0.5 M and balance height to be made up by providing extended structure.

In the heaters where steam air decoking provision is there, the main lines and decoking lines should be supported in a way so that either of the lines should not be in the hanging position while connected to other one. Same philosophy shall be adopted for similar type of switch over arrangement.

Piping passing through the technology structure or passing near the concrete column etc. should have adequate annular space to avoid restriction of line movement during thermal expansion. The gap should take care the thermal expansion along with insulation thickness.

High density PUF blocks shall be considered for cold piping supports. Use of wood blocks shall be avoided.

All pipes supports shall be so designed that there is no undue tension on equipment flanges. Flange joints should not move away from each other in case of unbolting of the joint.

5.12.2 Flexibility Analysis Criteria & General Guidelines

5.12.2.1 Formal flexibility analysis by computer program of piping system shall be performed on latest version of CAESAR-II software as per Annexure 5, 5A & 5B.

5.12.2.2 The directions of forces and moments shall be in accordance with Welding Research Council Bulletin 107 (WRC 107), with the exception that the radial force (P) shall be away from the vessel. All forces and moments shall be assumed to act simultaneously and apply at the nozzle/vessel interface.

5.12.2.3 Air coolers to API 661 shall be specified with Fx forces and Mz moments increased to 1.2 times the value shown in Figure 8 of API 661 for nozzle sizes 6”NPS and larger to simplify piping flexibility analysis and facilitate piping layout.

5.12.2.4 Piping stress analysis and equipment nozzle loading analysis shall be in accordance with ASME B31.3 and the relevant API, ANSI/ISO and NEMA Codes.

5.12.2.5 API 610 Pumps

The allowable nozzle loads on centrifugal pumps shall meet the load criteria of API 610. Heavy duty base plate shall be specified where the pump design temperature is in excess of 150°C.

ASME or Manufacturer's Standard Pumps

The allowable nozzle loads on horizontal centrifugal pumps design to ASME B73.1 shall be specified by the manufacturer. For preliminary layout and analysis NEMA SM 23 criteria shall be used for individual nozzles.

Other Horizontal Centrifugal Pumps

The allowable nozzle loads shall meet the load criteria specified by the manufacturer.

Vertical Turbine, Can-Types Pumps

The combined bending and tensional thermal stress in the piping attached to the nozzle shall be limited to 25 percent of the allowable stress range shown in ASME B31.3. The combined stress due to dead load and other sustained loads shall be limited to 25 percent of the allowable hot stress.

5.12.2.6 For piping design purposes, differential settlement between items of major equipment on separate foundations shall be taken as 10 mm.

5.12.2.7 Cold springing in piping shall not be permitted without written permission from the Owner. Cold springing of piping directly connected to rotating equipment is not permitted under any circumstances.

Piping shall be analyzed for expansion, contraction, differential settlement, relief, valve reaction and effects mentioned at CI. 5.12.1.

The design of piping systems shall take into account the different conditions expected during operation, start-up, shut-down, cold branch in case of standby pump, tracing, etc. Hydrocarbon lines shall be designed for steam-out conditions, if specified in line schedule. The use of expansion joints shall be considered only when space oar pressure drop

limitation does not permit pipe bends. Expansion joint of axial type shall be avoided.

Forces and moments due to weight, thermal loads and other imposed loads on the equipment nozzle must not exceed the allowed loads for the equipment.

Minimum analysis temperature shall be the design temperature of the line as per line list.

5.12.3 **Method of Analysis**

Formal computer analysis shall be performed on piping systems as per design philosophy for stress analysis

The package used shall be latest version of CEASER / AUTO PIPE / SIMPLEX / CAEPIPE. Only one of these packages shall be used for the project & not a combination of the above packages.

All lines shall be analyzed at design / analysis temperature. In the absence of analysis temperature lines shall be analyzed at design temperature.

However in case of wide difference in design and operating temperature, temperature for analysis shall be established in process documents. (e.g. flare line)

All non-critical lines may be analyzed using other methods.

Special analysis methods shall be followed for lines involving pulsating flow such as those connected to reciprocating pumps & compressors which require acoustical plus analog study by approved agencies and shall require entire system analysis along with piping / equipments.

Seismic analysis shall be done for line sizes 12" and above.

5.13 Personnel Protection

5.13.1 Eyewash and emergency safety showers shall be provided in areas where operating personnel are subject to hazardous sprays, emissions or spills.

5.13.2 Personnel protection shall be provided on un-insulated lines and equipment operating above 70 deg C when they constitute a hazard to the operators during normal operation of the facility.

5.13.3 Leakage indicating tape and spray impingement shrouds shall be provided at flanged joints in hazardous service.

5.14 Mechanical Handling

5.14.1 Handling facilities such as davits and monorails shall be provided on vessels over 10m in height where the weight of removable internal and/or external equipment is greater than 35 Kg.

6.0 MATERIALS

6.1 General

6.1.1 Basic material selection of particular line depending on its service, temperature and corrosivity shall be spelt out in process package. Material specification shall follow the requirements as per process parameters & attached PMS / VMS.

6.1.2 Only piping materials listed in ASME B31.3 shall be used for Category 'M' and Normal Service piping. Unless otherwise specified in PMS, For Category 'D' utility piping, where scaling and impurities are to be avoided (such as instrument air, potable water and deluge water) hot dipped galvanised and threaded fittings may be used in sizes up to and including 4" NB. Galvanised piping shall not be used in environments containing acids or other corrosive commodities. In corrosive environments stainless steel piping material shall be used for such utility systems.

6.1.2 All items/parts of Austenitic Stainless Steel shall be supplied in solution annealed condition.

6.1.3 In absence of specific requirement, Natural Rubber shall be used for lining in rubber lined piping items, wherever applicable. The Vendor shall confirm the suitability of Rubber Material for specified service. Unless otherwise specified, rubber lining shall be in accordance with IS4682 Part-I.

6.1.4 Unless otherwise specified, HDPE pipes & fittings shall be in accordance to ASTM D3035/ ASTM D3261/ASTM D3350 or equivalent.

6.1.5 **Specification for FRP material**

6.1.5.1 Anticorrosion Barrier of Polymer veil having minimum thickness 2.5 mm shall be provided for

chemical resistance. Mechanical resistance to be sustained by FRP.

6.1.5.2 The selected nominal pipe wall thickness will include manufacturers full under tolerance, and the specified corrosion and/or erosion allowance. The pipe thickness will be adequate to resist all external loads from thermal, mechanical and other sources in addition to the process pressure-temperature requirements. However the pipe thickness will be according to vendor's norms and standard calculations but not be lower than indicated in DIN 16965 Part 4. External FRP layer shall be protected against ultra-violet light.

6.1.6 Cast Iron shall not be used as Material of Construction for any piping items like Pipes, fittings, flanges, valves, fasteners, gaskets, etc.

6.2 Pipe

6.2.1 Calculation of pipe thickness and branch reinforcement shall be based on requirements of ASME B31.3. Proper corrosion allowance and mill tolerance shall be considered to achieve the selected thickness.

6.2.2 Unless specifically exempted, welded pipes shall be acceptable only with longitudinal weld made employing automatic welding. 100% radiography for all welds except for pipes for category D service.

6.2.3 Double seam 180˚ apart is allowed for sizes 36" and larger only.

6.2.4 Galvanized Pipes shall be only Hot Dip galv. to ASTM A53.

6.2.5 Hydrostatic tests shall be applied to each length of pipe and be in accordance with the requirements of ASTM A530/A530M, unless otherwise specified.

6.3 **Fittings**

6.3.1 Type of fittings shall be equivalent to pipe type in construction.

6.3.2 Thickness of fittings at ends to match pipe thickness for BW fittings. For reducing BW fittings having different wall thicknesses at each end, the greater one shall be employed and the ends shall be matched to suit respective thickness.

6.3.3 Unless and otherwise specified in the requisition all socket weld and screwed fittings shall be in accordance with ANSI B16.11 to the extent covered in the specification except for unions which shall be in accordance with MSS-SP-83.

6.3.4 Special fittings like Weldolet, Sockolet, Sweepolet etc. which are not covered in ANSI , MSS-SP shall be as per Manufacturer's Std. Contours of these fittings shall meet the requirements of ANSI 31.3. Manufacturer shall submit drawings/catalogues of these items along with the offer & also shall be submitted for approval before manufacturing.

6.3.5 All pipes employed for manufacturing of fittings shall be required to have undergone Hydro test to ASTM A530.

6.3.6 All welded fittings shall be 100% Radio-graphed by X-Ray on all welds.

6.4 **Flanges**

6.4.1 All flanges shall be of forged one piece material (seamless), and plate may not be substituted without written approval from the Purchaser.

6.4.2 All flange joints on piping system including flanges on the equipment, manholes, etc shall be tightened using Torque wrench / hydraulic bolt tensioner depending upon service criticality.

6.5 **Gaskets**

Gaskets shall be as per piping material specification/ applicable standard.

6.6 **Stud, Bolts, Nuts and Jack Screws**

6.6.1 All bolting shall be as per ASME/ANSI 818.2.1 for Studs, M/C Bolts and Jack screws, and ASME/ANSI B18.2.2 for nuts. Machine Bolts shall not be used in piping flange joint, except for Butterfly Valves, which shall be lug type, having UNC Threads in lugs facilitating opening of flanges from both sides.

6.6.2 Screw threads of bolting shall be unified coarse threads in accordance with ANSI / ASME B1.1 having Class 2A for bolts and Class2B for nuts. Screw threads in sizel-1/8 and larger shall be 8 threads per inch.

6.7 **Valves**

6.7.1 **General**

All flanged valves (except forged) shall have flanges integral with the valve body.

Yoke material shall be at least equal to body material.

Forgings are acceptable in place of Castings but not vice-versa.

No cast iron material valves to be used in any service.

Valves in saline water (if applicable) service shall be with non ferrous trims and all wetted parts other than trims shall be epoxy coated.

Valve body basic MOC shall be equivalent or above basic MOC of connecting pipe.

6.7.2 **Ball/Plug/Butterfly Valves**

Use of soft seated ball/plug/butterfly valves shall be suitably selected based on temperatures handled.

Butterfly valves shall be suitable for throttling application.

Lug type Butterfly valves shall be with threaded lugs only. Each butterfly valve shall be provided with the Bolts to be installed from both sides separately.

PN equivalent rating for Class150# valves shall be minimum PN16.

Ball valves may be used in place of gate or plug valves with the following limitations:

i) Operating conditions are within the permissible pressure - temperature range of seat materials.

ii) Fire safe type to be used for hydrocarbon services.

6.7.3 **Valve Dimensions**

Face-to-Face/End-to-End dimension shall be as per ANSI B16.10. In case the same is not covered under B16.10, the dimension shall be as per BS 2080/manufacturer standard.

Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500 mm on each side. Effort to operate shall not exceed 35 kgf at hand wheel periphery. However, failing to meet the above requirement, vendor shall offer gear operation.

Quarter-turn valves shall have "open" position indicators with limit stops.

6.7.4 **Non Destructive Testing of Valves**

6.7.4.1 Radiography procedure, areas of casting to be radiographed, and the acceptance criteria shall be as per ASME/ANSI B16.34.

All valve castings shall be of radiographic quality.

The minimum requirement of radiography shall be as under:

Class	Size	Qty
150	Up to 24”	5%
150	26” & above	100%
300	Up to 16”	10%
300	18” & above	100%
600 & above	All	100%

6.7.4.2 The welds of body-to-bonnet and body-to-end flange shall be subjected to 100% NDT; both radiographic and magnetic or liquid penetrant examinations.

6.7.4.3 Beveled ends on each butt welding end valve shall be subjected 100% magnetic particle or liquid penetrant examination.

6.7.4.4 Each valve shall be pressure tested in accordance with API 598.

6.7.5 **Criteria for Isolation Valves**

Installation	Process Isolation	Drain/ Vent	Pressure Taping	Level Taping	Flow Element	Safety Valve	Control Valve
150 / 300#	Single	Single	Single	Single	Single	Single	Single
600 #	Single	Single	Double	Single	Double	Single	Single
Above 600#	Double	Double	Double	Double	Double	Double	Single

Note: For S/D & at battery limit, it will be as per process requirements.

6.8 **Traps**

Vendor shall also furnish the performance curve indicating the capacity in mass/hour at various differential pressures across the trap.

Parts subject to wear and tear shall be suitably hardened. Traps shall have integral strainers.

All traps shall be hydrostatically tested to twice the design pressure.

6.9 **Hoses**

Manufacturer shall guarantee suitability of hoses for the service and working conditions specified in the requisition, if the material is not specified in the Material Requisition for any particular service.

All hoses shall be marked with service and working pressure at minimum two ends clearly.

Hoses shall be resistant to ageing, abrasion and suitable for outdoor installations.

Complete Hose assembly shall be tested at two times the design pressure

Steam hoses shall be subject to steam resistance test.

6.10 **Expansion Joints (Metallic)**

The applicable codes are ASME B31.3 and EJMA (Expansion Joint Manufacturer's Association).

Bellows shall be formed from solution annealed sheet conforming to the latest ASTM Spec. Any longitudinal weld shall be 100% radiographed. The finished longitudinal weld must be of the same thickness and same surface finish as the parent material.

Circumferential welds are not permitted. Bellows are to be hydraulically or expansion (punched) formed. Rolled formed bellows are not acceptable. Noticeable punch or die marks resulting from expansion operation are not acceptable.

No repairs of any kind are allowed on the bellows after forming. Deep scratches and dents are not acceptable.

The out of roundness shall be limited to ± 3mm. This is the max deviation between the max & min diameter.

The actual circumference of the welding end shall be maintained to ± 3mm of the theoretical circumference.

Apart from the usual requirements, the vendor shall also furnish

a) Design calculations to justify stiffness and fatigue life.

b) Axial, lateral stiffness, angular stiffness, effective pressure thrust area.

c) Installation/maintenance manual.

6.11 Supports & Spring Assemblies

The Material, Design, Manufacture and Fabrication shall be generally as per MSS-SP-58/ MSS-SP-89 and/or BS 3974.

Testing of springs shall be as per BS1726.

6.12 Non Destructive Examination

10% radiography of butt welds and 10%DP/ MP test of fillet welds shall be done for pipe Classes in 150# & 300#.

100% radiography on butt weld joints and 100% DP/MP for fillet welds test shall be done for Pipe Classes in 600# & above.

7.0 PAINTING

Painting shall be as per attachment provided elsewhere in NIT.

8.0 WELDING

Welding shall be as per ASME BPV- Sec. IX

ANNEXURE – 1

TABLE OF BASIC SPAN

Pipe Size In.	SCH/Thk (in)	PIPE- VAPOR INSULATION BASIC SPAN (L)M			PIPE- LIQUID INSULATION BASIC SPAN (L)M			BARE PIPE EMPTY		BARE PIPE WATER FILLED		Pipe size in.
		UPTO 175^0 C	176^0 C TO 315^{0}C	316^{0}C TO 400^{0}C	UPTO 175^0 C	176^0 C TO 315^{0}C	316^{0}C TO 400^{0}C	SPAN(L) M	WEIGHT KG/M	SPAN(L) M	WEIGHT KG/M	
3/4"	SCH 40	3.5	3.5	2.5	3.5	3.0	2.0	4.5	1.68	4.0	2.04	*3/4"*
1"	SCH 40	4.5	4.0	3.0	4.5	3.5	3.0	5.0	2.52	4.5	'3.07	1"
1-1/2"	SCH 40	5.0	5.0	4.5	5.0	4.5	3.5	6.0	4.08	5.0	.5.4	*1-1/2"*
2"	SCH 40	5.5	5.0	4.5	5.0	4.5	3.5	8.5	5.47	5.5	7.65	2"
2-112"	SCH 40	6.5	6.0	5.0	6.0	5.5	4.5	7.5	8.7	6.5	11.79	*2-112"*
3"	SCH 40	7.5	6.5	5.5	6.5	6.0	5.0	8.0	11.35	6.5	16.15	3"
4"	SCH 40	8.0	7.5	6.5	7.5	7.0	6.0	9.0	16.2	7.5	24.45	4"
6"	SCH 40	10.0	9.5	8.5	9.0	8.0	7.5	10.5	28.3	9.0	46.7	6"
8"	SCH 40	12.0	11.0	10.0	10.0	10.0	9.0	12.0	42.84	10.0	75.22	8"
10"	SCH 40	13.5	13.0	12.0	11.5	10.5	10.5	14.0	60.74	11.5	111.9	10"
12"	*3/8"* w	14.5	13.5	13.0	12.0	11.5	11.0	15.0	74.40	12.0	147.5	12"
14"	*318"*w	15.0-	14.5	13.5	12.0	12.0	11.5	16.0	82.5	12.5	172.05	14"
16"	*318"*w	16.0	15.5	14.5	13.0	12.5	12.0	17.0	94.5	13.0	213.15	16"
18"	*3/8"* w	17.0	16.5	15.0	13..5	13.0	12.0	18.0	106.5	13.5	258.3	18"
20"	*318"* w	18.0	17.5	16.0	14.0	13.5	12.5	19.0	118.5	14.0	307.5	20"
24"	*3/8"*w	20.0	19.0	17.5	14.5	14.5	13.0	21.0	1425	15.0	418.2	24"
3/4"	SCH 80	3.5	3.5	2.5	3.5	3.0	2.0	4..5	2.20	4.0	2.49	*3/4"*
1"	SCH 80	4.5	4.0	3.0	4.5	3.5	3.0	5.0	3.25	4.5	3.72	1"
1-112"	SCH 80	5.0	5.0	4.5	5.0	4.5	4.0	6.0	5.45	5.0	6.60	*1-112"*
2"	SCH 80	6.0	5.0	4.5	5.5	5.0	4.0	6.5	7.53	6.0	9.45	2"
2-112"	SCH 80	6.5	6.0	5.5	6.0	6.0	5.0	7.5	11.49	6.5	14.25	*2-1/2"*
3"	SCH 80	7.5	6.5	6.0	6.5	6.5	6.0	8.0	15.37	7.0	19.66	3"
4"	SCH 80	8.0	8.0	7.0	7.5	7.5	6.5	9.0	22.47	8.0	29.94	4"
6"	SCH 80	10.5	10.0	9.0	9.5	9.0	8.5	10.5	42.90	9.5	59.85	6"
8"	**½" w**	12.0	11.5	10.5	10.5	10.0	10.0	12.0	65.10	11.0	94.8	8"
10"	**½" w**	13.5	13.0	12.0	11.5	11.5	10.5	14.0	82.20	12.0	130.69	10"
12"	**½" w**	14.5	13.5	./, 3.0	12.5	12.0	11.5	15.0	98.13	13.0	168.64	12"
14"	**½" w**	15.0	14.5	13.5	13.0	12.5	12.0	16.0	108.15	13.5	194.4	14"
16"	**½" w**	16.0	15.5	15.0	13.5	13.0	13.0	17.0	124.2	14.0	240.0	16"
18"	**½" w**	17.5	17.0	.16.0	14.5	14.0	13.5	18.0	140.25	14.5	286.64	18"

Pipe Size In.	SCH/Thk (in)	PIPE- VAPOR INSULATION			PIPE- LIQUID INSULATION			BARE PIPE EMPTY		BARE PIPE WATER FILLED		Pipe size in.
		BASIC SPAN (L)M			BASIC SPAN (L)M							
		UPTO 175^{0}C	176^{0}C TO 315^{0}C	316^{0}C TO 400^{0}C	UPTO 175^{0}C	176^{0}C TO 315^{0}C	316^{0}C TO 400^{0}C	SPAN(L) M	WEIGHT KG/M	SPAN(L) M	WEIGHT KG/M	
20"	**½" w**	18.0	17.5	..:.17. 0.	15.0	14.5	14.0	19.0.	157.5	15.0	341.8	20"
24"	**½" w**	20.0	19.0	. 18.5	16.0	15.0	15.0	21.0	188.25	16.0	458.44	24"
1"	10S	4.0	3.5	3.0	4.0	3.0	2.5	4.5	2.08	4.0	2.7	1"
1-112"	10S	5.0	4.5	3.5	4.5	4.0	3.0	5.5	3.12	5.0	4.57	*1-112"*
2"	10S	5.0	4.5	3.5	4.5	4.0	3.0	6.0	3.94	5.5	6.33	2"
2-112"	10S	6.5	5.5	4.5	5.5	5.0	4.5	7.0	5.26	6.0	8.85	*2-1/2"*
3"	10S	7.0	6.0	5.0	6.0	5.5	5.0	7.5	6.45	6.0	11.91	3"
4"	10S	7.5	7.0	6.0	*6.p*	6.0	6.0	8.0	8.34	7.0	17.87	4"
6"	10S	9.5	9.0	8.0	8.0	7.5	7.5	10.0	13.82	8.5	34.54	6"
8"	10S	11.0	10.5	10.0	9.5	9.5	8.5	11.5	19.94	10.0	55.5	8"
10"	10S	12.5	12.0	11.0	10.5	10.0	9.5	13.0	27.S3	11.0	83.4	10"
12"	10S	14.0	13.0	12.0	11.0	11.0	10.0	14.5	36.00	11.5	114.6	12"
14"	105	14.5	14.0	13.0	11.5	11.0	11.0	15.5	41.18	11.5	132.6	14"
16"	10S	16.5	14.5	14.0	12.0	11.5	11.5	16.5	47.33	12.5	172.2	16"
IS"	10 S	16.5	15.5	14.5	12.5	12.5	11.5	17.5	53.18	13.0	212.1	18"
20"	10 S	17.5	16.5	15.5	13.0	13.0	12.0	18.5	68.50	13.0	264.5	20"
24"	10 S	19.0	18.0	17.0	14.0	13.5	12.5	20.5	94.37	14.0	376.8	24"

ANNEXURE – 2

ACCESSIBILITY FOR VALVES AND INSTRUMENTS

VALVES, INSTRUMENTS, EQUIPMENT TO BE OPERATED	CENTRELINE OF ITEM TO BE OPERATED, LOCATED LESS THAN 3.6m ABOVE GRADE, 2.75 m ABOVE FLOOR OR PLATFORM OR 1.8m ABOVE WING PLATFORM	CENTRELINE OF ITEM TO BE OPERATED, LOCATED MORE THAN 3.6m ABOVE GRADE, 2.75m ABOVE FLOOR OR PLATFORM OR 1.8m ABOVE WING PLATFORM
EXCHANGER HEADS	NIL	PLATFORM
OPER.VALVES 2" & SMALLER	FIXED LADDER	FIXED LADDER
OPER. VALVES 3" & ABOVE	PLATFORM	PLATFORM
MOTOR OPERATED VALVES	PLATFORM	PLATFORM
CONTROL VALVES	PLATFORM	PLATFORM
RELIEF VALVES 2" & SMALLER	FIXED LADDER	FIXED LADDER
RELIEF VALVES 3" & ABOVE	PLATFORM	PLATFORM
BLOCK VALVES 2" & SMALLER	PORTABLE LADDER	PLATFORM
BLOCK VALVES 3" & ABOVE	PLATFORM (NOTE-1)	PLATFORM (NOTE-1)
BATTERY LIMIT VALVES	PLATFORM	PLATFORM
PRESSURE INSTRUMENT	FIXED LADDER IF ABOVE 2.2m HEIGHT	FIXED LADDER
TEMPERATURE INSTRUMENT	FIXED LADDER IF ABOVE 2.2 M Ht	FIXED LADDER
SAMPLE POINTS	PLATFORM	PLATFORM
GAUGE GLASSES	FIXED LADDER	FIXED LADDER
LEVEL CONTROLLERS	PLATFORM	PLATFORM
PROCESS BLINDS AND SPACERS 2" & SMALLER	PORTABLE LADDER / PLATFORM	PLATFORM
PROCESS BLINDS AND SPACERS 3" & ABOVE	PLATFORM	PLATFORM
MANWAYS/MANHOLES	PLATFORM	PLATFORM
HANDHOLES/INSPECTION HOLES	PLATFORM	PLATFORM
NOZZLES (process}	PLATFORM	PLATFORM
VESSEL VENTS	PORTABLE LADDER	FIXED LADDER
LINE DRAINS & VENTS	PORTABLE LADDER	PORTABLE LADDER
ORIFICE FLANGES	PLATFORM (NOTE-1)	PLATFORM (NOTE-1)

NOTE -1:-BLOCK VALVES / ORIFICE FLANGES, IF LOCATED, WITH CENTRE LINES GREATER THAN 2 METER FROM THE OPERATING FLOOR / OPERATING PLATFORM, SHALL BE PROVIDED WITH PORTABLE PLATFORM OR CHAIN FOR OPERATION.

NOTE -2 : PLATFORM SHALL BE PROVIDED FOR THE ORIFICE FLANGES ON PIPE RACK.

ANNEXURE-3

MAXIMUM SPACING OF GUIDES FOR VERTICAL & HORIZONTAL PIPES

NOM PIPE SIZE IN INCHES	VERTICALSPACING METRES	HORIZONTAL SPACING METRES
1	6.0	6.0
1 ½	6.0	6.0
2	6.0	6.0
3	8.0	12.0
4	8.0	12.0
6	8.0	12.0
8	8.0	12.0
10	12.0	18.0
12	12.0	18.0
14	12.0	18.0
16	12.0	18.0
18	12.0	18.0
20	16.0	18.0
24	16.0	18.0
26 & ABOVE	16.0	18.0

NOTES:-

1. These spacings may be varied to suit column spacing of rack. The above spacing is for straight runs of pipe & does not include guides which are used for control of thermal movements, as decided by stress group.

2. The guide spacings given in the above table are indicative only.

ANNEXURE – 4

CLEARANCES

Minimum clearances for piping, equipment, structures, platforms, and supports shall be in accordance with the following table:

Item	Description	
Roads	Headroom for primary access roads wherever heavy duty crane movement is required.	9 M
	Headroom for primary access roads	7.5 M
	Width of primary access roads excluding shoulders.	Refer Civil
	Headroom for secondary roads	5 M
	Width of secondary roads excluding shoulders.	Refer Civil
	Clearance from edge of road shoulders to platforms, equipment, pipe associated with equipment, or similar features.	1.5 M**
Maintenance Aisles at Grade	Horizontal clearances for equipment maintenance by hydraulic crane (12t capacity)	3 M
	Vertical clearance for equipment maintenance by hydraulic crane (12t capacity)	3.6 M
	Horizontal clearance for fork lift and similar equipment (2500 kgs capacity)	2.4 M
	Vertical clearance for fork lift and similar equipment (2500 kgs capacity)	2.4 M
	Horizontal clearances for equipment maintenance by portable manual equipment (A-frames, hand trucks, dollies or similar equipment)	1 M
	Vertical clearances for equipment maintenance by portable manual equipment (A-frames, hand trucks, dollies or similar equipment)	2.4 M
Walkways	Horizontal clearance (not necessarily in a straight line)	750 mm
	Headroom (except for hand wheels)	2.2 M
Platforms	Minimum width	1200mm
	Headroom from stairwell treads.	2.2 M

Item	Description	
Platforms	Minimum clearance around any obstruction on the platform.	500 mm
	Headroom	2.2 M
	Maximum vertical distance between platforms	6 M
	Minimum toe clearance behind a ladder.	210 mm
	Minimum handrail clearance.	100 mm
Equipment	Minimum maintenance space required between flanges of exchangers or other equipment arranged in pairs.	500 mm
	Minimum maintenance space required for structural members or pipe.	300 mm
	Clearance from edge of road shoulder (the extreme projection)	1.5 M
Fired Equipment	Horizontal clearance from hydrocarbon equipment (shell to shell)	15 M
	Exception: Reactors or equipment in alloy systems shall be located for the most economical piping arrangement.	
	Clearance from edge of road to heater shell.	3 M
Valve Hand wheels	Clearance between the outside of the hand wheel and any obstruction.	25 mm*
Pipe (aboveground)	Clearance between the outside diameter of the flange and the outside diameter of pipe insulation.	25 mm*
	Clearance between the outside diameter of the pipe, flange or insulation and a structural member.	50 mm*
	Clearance between the outside diameter of the flange and the outside diameter of bare pipe.	25 mm*
	Minimum distance from underside of pipe to grade or platform.	300 mm
Control Valve Arrangement	Centreline of control valve above grade or platform.	450 mm
	Minimum centreline of control valve from face of column or wall.	600 mm
	Where process conditions require steam or hydrocarbon vapours to be discharged to atmosphere at a safe location,	

Item	Description	
	the tail pipe shall terminate as below:	
	Distance above nearest operating platform.	3 M
	Within radius of nearest operating platform.	7.5 M
** Verify conformance with local regulations. * With full consideration of thermal movements		

ANNEXURE – 5

DESIGN PHILOSOPHY FOR STRESS ANALYSIS

1.0 PURPOSE

This design basis deals with the subject of Identification of Stress Critical pipelines and preparation of Critical line list. This procedure also defines the minimum requirements for performing stress analysis, design and location of spring, support and level of system

Analysis with the extent of documentation required for flexibility analysis.

Purpose of piping stress analysis is to ensure:

Safety of piping and piping components

Safety of connected equipment and supporting structure

Piping deflections are within the limits

2.0 SCOPE

This specification covers the supply of engineering services to perform a complete piping and pipe support analysis for piping systems.

3.0 DEFINITIONS

3.1 Critical Lines / Critical Line List

Critical lines or Critical Line List as referred to in this procedure relates to Piping Stress Critical Lines and does not include or refer to process critical lines.

3.2 Stress Analysis Temperature

Stress Analysis Temperature refers to either “Maximum Operating Temperature” or “Steam-out temperature / hot nitrogen purging temperature” of the lines under review whichever is higher. In absence of the above values, it refers to the Design Temperature of the line under review. The Line List should be strictly followed in obtaining the above temperature values.

3.3 Design Pressure

Design Pressure refers to the “Design Pressure” of the line under review as indicated on the Line List. Design Pressure is as defined in clause 301.2 of ASME B 31.3.

3.4 Temperature for Flexibility Analysis

The temperature to be used for the flexibility analysis shall be taken as the maximum / minimum temperature which the pipe will see under any combination of different normal / abnormal operating conditions, as defined in clause 301.3 of ASME B 31.3. Where piping is exposed to direct sunlight, solar radiation temperature of 70 ^{0}C is considered in establishing the maximum temperature of piping. Even, for non-critical piping exposed to direct sunlight on pipe rack or elsewhere, expansion loops, wherever essential, are provided to take care of pipe movements resulting from piping skin temperature due to solar radiation.

In general, unless there is a difference of more than 50 ^{0}C between working Temperature and the design temperature, the design temperature should be taken as Flexibility temperature. Ambient Temperature shall be considered as 21ºC the assumed piping installation temperature. The displacement stress range from this installation temperature to the minimum recorded ambient temperature of 0^{0} C being less than the same from installation temperature

to the maximum operating temperature of hot piping in most cases, the later governs as per clause 319.2.3 of ASME B 31.3

The temperature under fire condition is normally not considered for flexibility analysis.

1.0 SELECTION

A line is selected and listed as a Critical Line provided it falls under any one of the categories defined below and is intended to include the special requirements of Piping Stress Engineer. It is hence defined as any line for which a flexibility review is required or where pipe supporting is deemed to be critical and needs review by a Stress Engineer. Line DN 50 and smaller is inherently flexible and is not normally considered critical unless built from non-metallic or non-ferrous materials. In case of more than one applicable line size, larger line size governs. Lines are classified as Level I, Level II & Level III according to the criteria listed below.

4.1 Level I [Extensive Analysis]

Piping systems or lines that meet Annexure 5A criteria are deemed to be extremely critical. These lines are categorized as Level I and require careful study to ensure that the code compliance is met and the accurate determination of nozzle and support loads have been made. The routing of these lines is very important. They must be analyzed in the early stages of the project during routing studies so that the impact on the location of less critical lines is minimized. Normally, these systems require computer analysis. The general intent of the Level I analysis criteria is to study lines size DN 80 & larger that are affected by thermal expansion and / or a dynamic response, and that can't be evaluated by a weight-only analysis (as per the general intent of Level II analysis). Consideration has to be given to other special situations that augment the Level I general intent guidelines such as for lines that are excessively large and stiff.

4.2 Level II [Normal Analysis]

Piping systems or lines that meet Annexure 5B criteria are moderately critical lines and often do not require such rigorous study to ensure code compliance or accurate determination of nozzle and support loads. These lines are smaller in size and operate at lower temperatures (in general) than the lines to be analyzed using Level I Criteria. Normally, only manual calculations, by use of appropriate monographs are required for analysis of these systems.

4.3 Level III [Minimum Analysis]

All lines that are outside the purview of Level I or Level II criteria will be classified as level III and shall be reviewed by the Piping Engineer during the squad check of the piping drawings and or fabrication Iso's. If more detailed analysis is required, the Piping Engineer may change the level of analysis during the squad check as applicable. Normally, only visual analysis is required for these systems.

4.4 Lines Deemed To Be Support Critical

Lines subjected to two-phase flow.

Cross country pipelines.

Lines with pipe thickness Sch 160 or greater.

Lines DN 400 and above with pipe thickness less than 8 mm.

Lines DN 250 and above with corrosion allowance 3 mm and above.

Lines with high concentrated loads such as heavy valves or fittings etc.

Lines downstream of Relief Valve / letdown Control Valves / bursting (rupture) discs.

Connecting to vent or flare systems or discharging to atmosphere

Liquid Blow down Lines.

Lined pipes

Non-metallic pipes

4.5 Lines Needing Dynamic Analysis

There are instances where in the frequency of the applied load is comparable to the natural frequency of the piping system. Such systems tend to store the energy and release it according to certain scientific laws. Such a system is dynamic in nature and the study of the response of such a system is referred to as “Dynamic Analysis”. Examples of such kind of systems are Relief Valve discharge lines, water hammer and surge in pipe lines, two phase flow in pipelines, reciprocating pumps and compressor piping, submarine piping etc.

4.6 Special Piping

Special piping forming part of reformer tubes, heater internal piping, etc. are treated as proprietary piping and nozzle loading at the Interface connections are to be co-ordinate with vendor.

5.0 RELATED DOCUMENTATION

5.1 Critical Line List Format.

The critical line list shall be prepared from the project line list document by inserting following relevant fields such as Stress level, stress package no., stress analysis temperature, support critical nature of the line, dynamic loadings, steam out / purge temperature etc.

The list shall reflect analysis status of line that includes its input received date from design & output handover date to design and specific remark if any.

5.2 Lines Affecting the Flexibility of Critical Lines

Non-critical Lines found to affect the flexibility of critical lines which have not been included during the initial review are subsequently added to the Critical Line List.

Non-critical Lines on which advice may be sought by the Lead Piping Engineer are not normally entered into the Critical Line List but covered verbally, or by a memorandum if a record is required.

6.0 PIPE STRESS ANALYSIS AND SUPPORTING

6.1 Piping system shall be properly supported taking in to account of the following points:

Piping stress analysis shall follow ASME B 31.3 and shall be complete to prevent overstressing of the pipe during operating conditions with wind and seismic loadings. During sustained, occasional (wind and seismic) & thermal expansion loading on piping,

The material allowable stresses shall be as per ASME B 31.3 for ASTM materials. For DIN material specifications the allowable stress values shall be calculated as per ASME

B 31.3 clause 302.3.2(d), wherein yield strength and ultimate strength values at temperature shall be taken from DIN material standards. For DIN material specifications, the other material properties viz. elastic modulus, density, coefficient of thermal expansion shall be taken from the respective DIN material standards.

6.2 Analysis shall include, but not be limited to the following; thermal, dead weight, internal pressure, wind and seismic, and a combination of these based on ASME B 31.3.

6.3 Piping shall be designed in accordance with the Indian Standard criteria for earthquake resistance design for structures IS: 1893 for seismic zone-IV (refer project design basis). As a minimum, two (2) orthogonal horizontal components and a vertical component of ground motion will be considered in the seismic analysis. For American standard, loading applied to piping would be in accordance with uniform building code (UBC).

The equivalent horizontal static force method shall apply in general .The contractor shall also carry out special designs and provisions as necessary for piping which is considered to be dynamically sensitive to earthquake.

Seismic analysis to be performed for lines equal to and above 12".Seismic load case shall ALGEBRIC combination with operating cases.

Heavy rigid masses like valves shall be restrained in their vicinity to avoid large seismic movements. Guides or snubbers as the case may be used for this purpose.

Horizontal seismic coefficient (Ah) to be considered as 0.26 and Vertical (Av) to be considered as 0.173.

6.4 Wind loads shall be calculated in accordance with IS-875 code of practice for structural safety of building – Loading Standards for Indian code requirement using basic wind speed as mentioned in project design basis. For American standard, wind load in accordance to ASCE 07 shall be calculated. Reduction in velocity pressure due to apparent shielding afforded by buildings and structure or terrain shall not be permitted.

Wind loading shall only be considered for lines larger than 20" OD at elevation higher than 10m above grade. Displacements due to wind and earthquake should be limited to 50 mm.

Both the horizontal directions shall be analyzed independently in two cases

+X, -X, +Z, -Z

Wind and seismic loading will not occur simultaneously.

6.5 Analysis of all nozzles loading on vessels within the piping boundaries is covered in this specification. Nozzle analysis shall follow the guidelines of ASME Section VIII, Division 1, and WRC 297 & 107 (latest editions). Nozzle stresses shall fall within the allowable per ASME.

6.6 Piping system shall have sufficient flexibility to avoid leakage at joints. Flanged joints imposed by external moments may be analyzed and the stresses evaluated by using the methods of equivalent pressure given in the ASME boiler and pressure code section III. Flange leakage shall be assessed as per "Pressure Equivalent Method". In case of Failure in Pressure Equivalent Method, the Flanges shall be checked for leakage using Caesar Flange leakage Module. Flange leakage shall be assessed for all PSV flanges, Control valve flanges, High Pressure lines, all steam lines and also for equipment flanges where loads are high.

6.7 All forces on connections to equipment shall not exceed maximum allowable as specified by equipment vendor.

6.8 Pipe supports loads shall be based on the maximum loads determined by the piping analysis. Adjustments shall be made to the piping system and model such that the pipe supports loads are within a reasonable uniformity throughout the piping system.

6.9 Various Load cases built in Caesar II to check stress in piping system are listed below.

1	WW+HP	HYD	
2	W+T1+P1	OPE	
3	W+T2+P1	OPE	
4	W+T1+P1+U1	OPE	
5	W+T1+P1+U2	OPE	
6	W+T1+P1+U3	OPE	
7	W+T1+P1-U1	OPE	
8	W+T1+P1-U2	OPE	
9	W+T1+P1-U3	OPE	
10	W+T1+P1+WIN1	OPE	
11	W+T1+P1+WIN2	OPE	
12	W+P1	SUS	
13	W+P2	SUS	
14	L2-L12	EXP	
15	L3-L12	EXP	
16	L4-L2	OCC	
17	L5-L2	OCC	
18	L6-L2	OCC	
19	L7-L2	OCC	
20	L8-L2	OCC	
21	L9-L2	OCC	
22	L10-L2	OCC	
23	L11-L2	OCC	
24	L12+L16	OCC	
25	L12+L17	OCC	
26	L12+L18	OCC	
27	L12+L19	OCC	
28	L12+L20	OCC	
29	L12+21	OCC	
30	L12+L22	OCC	
31	L12+L23	OCC	

P1- Maximum Operating Pressure W- Dead Weight

T1- Maximum Operating Temperature WW- Water Weight

P2- Design Pressure WIN- Wind Load

T2- Design Temperature U- Uniform Load

HP- Hydro test Pressure L2- Load case

SUS, EXP, OCC, HYD, OPE- Various load types, viz., sustained, occasional, hydro test, operating etc.

7.0 CODES AND STANDARDS

The following codes and standards shall apply in the design and analysis of the piping systems covered under this specification:

Allowable Stress ASME B 31.3

Piping ASME B 31.3

Nozzle Loadings PMC's Standard, WRC297/107(Welding Research Council) /

Allowable Vendor

Wind Analysis ASCE 7 – 98

8.0 SOFTWARE USED

The package used shall be latest version of CEASER-II 5.2. Only one of these packages shall be used for the project & not a combination of the above packages.

9.0 DOCUMENT REQUIREMENT

9.1 A written report shall be submitted on the piping and equipment analysis. The report shall include all pertinent information that shall include but not be limited to the following.

Location and type of pipe supports with loads and movements.

Location of expansion joints and movements.

Vertical and horizontal loads including moments at all support points.

Vertical and horizontal loads including moments on all equipment and

Vessel connections.

Caesar II analysis report, which shall include as a minimum, restraint forces, movements and stresses for all load cases. For flange connection, loaded with high bending moments and/or tensile forces in piping or at equipment connections, Caesar II flange leakage report will be provided. For piping analyzed, if subjected to hydro test, hydro test load case will be made in Caesar II to check for loading under hydro test & the requirement of any additional temporary supports for hydro test.

Detailed nodal model used for the stress analysis

All assumptions and limitations applied to the analysis

9.2 All dimensions and analysis shall be performed using metric and SI units.

9.3 The final report / stress package folder shall be submitted as follows:

1. Front sheet with Approval status
2. Isometrics with following information
   - Node numbers
   - Type of supports selected by stress engineer
   - Springs / Bellows data required for procurement like spring rate, loads, tide/untied information and SM (special material) identification.
   - Maximum Expansion and sustain stress values with node number
   - Nozzle/Anchors initial movements and piping imposed forces and moments on the same
   - Support loads (anchors, guides or rest) only they are above limit (The limit is defined in

the beginning of the project in consultation with civil)

- Design and maximum operating conditions
- Coordinate axis system considered for inputs
- Dimensional details for piping designer to locate supports in piping model/layout.

3. Checklist as per Work instructions.
4. Following outputs
   - Load Cases
   - Restraint summary
   - Spring hanger report, if any
5. Stress critical line list extract for the lines analysed
6. Piping material specifications
7. Equipment drawings with allowable loads, if available
8. PID

ANNEXURE-5A

CRITERIA FOR IDENTIFING EXTREMELY CRITICAL LINES (LEVEL I)

Temperature T, Degree C	Pipe Diameter DN (mm)	Piping Material	Service and Description
All	All	All	Piping which will undergo hydraulic shock, auto-ignition or is in service.
All	DN≥80	All	Category M (Lethal) fluid service per ASME B31.3 (No cyclic service).
All	DN≥80	All	Piping which is openly exposed to winds> 75 mph.
T<-29	DN≥80	Carbon Steel	All Services.
T<-45	DN≥80	All	All Services
T≥65	DN≥80	Non-Metallic	All Services
T≥65	DN≥80	All	Lines with pressure≥900 psig.
T≥150	DN≥80	All	All Services
ALL	DN≥400	All	All Services.
T≥260	ALL	ALL	ALL Services.
-29≥T≥65 OR -7≥T≥50	DN≥80 DN≥100	All	Piping connected to nozzle load sensitive equipment, air-cooled exchangers and rotating equipment (see note 1).
ALL	ALL	All	Lines requiring expansion joints or flexible connectors.
DELTA T≥27 (NOTE 2)	DN≥80	All	Jacketed piping.
-29≥T≥65	DN≥100	All	Internally lined pipe (except glass).
All	ALL	All	Glass lined piping.
All	DN≥80	All	Differential Tank Settlement (Upto 3 supports from nozzle).
-40≥T≥80 -29≥T≥70	DN≥100 DN≥200	Metallic Metallic	Underground Piping

NOTES:

1) Load sensitive equipment include fired heaters, reformers, lined vessels with lining of brittle material, non-ferrous equipments, graphite heat exchangers, plate & frame heat exchangers, etc.
2) This criterion is not to be applied to auxiliary piping such as seal flush; bearing cooling, etc. delta T refers to the differential temperature between the process piping and jacket.

ANNEXURE-5B

CRITERIA FOR IDENTIFYING MODERATELY CRITICAL LINES (LEVEL II)

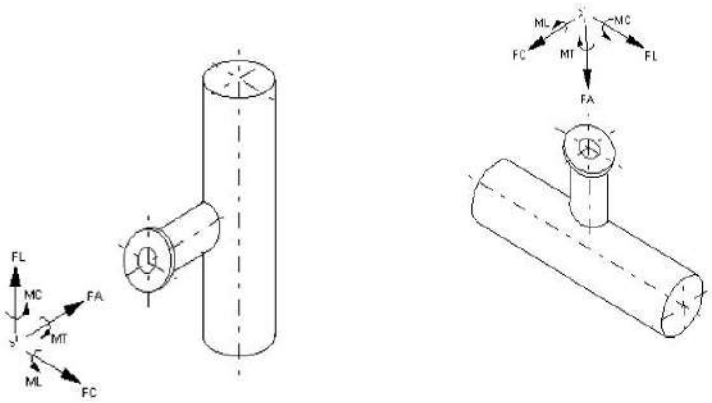
Temperature T, Degree C	Pipe Diameter DN (mm)	Piping Material	Service and Description
All	DN<80	All	Lethal fluid service.
T<-29	DN<80	Carbon Steel	All Services.
T<-46	DN<80	All	All Services
95<T<150	80<DN<200	All	All Services
T≥65	DN<80	Non-Metallic	All Services
T≥65	DN<80	All	All Services
T≥65	DN<80	All	Lines with pressure≥900 psig.
T≥150	DN<80	All	All Services
ALL	200<DN<400	All	All Services.
T≥260	ALL	ALL	ALL Services.
ALL	ALL	ALL	Piping connected to nozzle load sensitive equipment, air-cooled exchangers and rotating equipment (see note 1 of Table-1).
DELTA≥27(NOTE 2 of Table-1)	DN<80	All	Jacketed piping.
All	ALL	All	Internally lined pipe (except glass).
All	DN<80	All	Differential Tank Settlement (Upto 3 supports from nozzle).
All	ALL	All	Underground Piping
All	ALL	All	Piping connected to pressure relief
All	ALL	All	Close coupled interconnecting piping between equipment with differential movement greater than 6.0mm.

ANNEXURE-5C

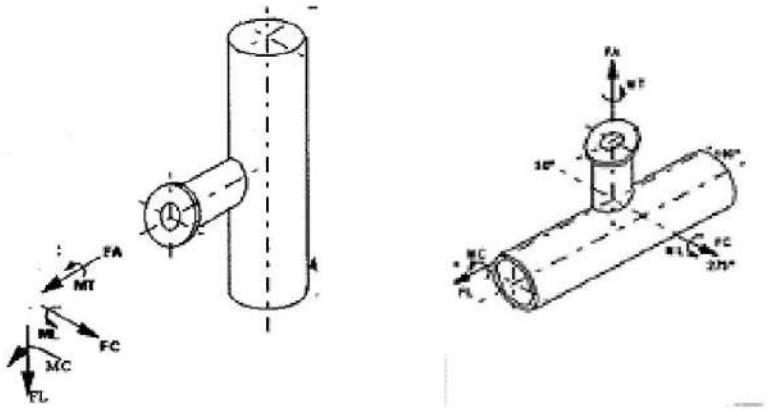
MINIMUM ALLOWABLE NOZZLE LOADINGS- VESSELS AND S/T HEAT EXCHANGERS

NOZZ. SIZE	FLANGE RATING	NOZZLE FORCES (N)				NOZZLE MOMENTS (Nm)			
(in)	(lbs)	FL	FA	FC	F	MT	ML	MC	M
1.5	150#	2250	2250	1688	2385	253	219	169	238
1.5	300#	2250	2250	1688	2385	253	219	169	238
1.5	600#	3750	3750	2813	3975	422	366	281	397
1.5	900#	4500	4500	3375	4770	506	439	338	476
1.5	1500#	6000	6000	4500	6360	675	585	450	635
2	150#	3000	3000	2250	3180	450	390	300	423
2	300#	3000	3000	2250	3180	450	390	300	423
2	600#	5000	5000	3750	5300	750	650	500	705
2	900#	6000	6000	4500	6360	900	780	600	846
2	1500#	8000	8000	6000	8480	1200	1040	800	1128
3	150#	4500	4500	3375	4770	1013	878	675	952
3	300#	4500	4500	3375	4770	1013	878	675	952
3	600#	7500	7500	5625	7950	1688	1463	1125	1586
3	900#	9000	9000	6750	9540	2025	1755	1350	1904
3	1500#	12000	12000	9000	12720	2700	2340	1800	2538
4	150#	6000	6000	4500	6360	1800	1560	1200	1692
4	300#	6000	6000	4500	6360	1800	1560	1200	1692
4	600#	10000	10000	7500	10600	3000	2600	2000	2820
4	900#	12000	12000	9000	12720	3600	3120	2400	3384
4	1500#	16000	16000	12000	16960	4800	4160	3200	4512
6	150#	9000	9000	6750	9540	4050	3510	2700	3807
6	300#	9000	9000	6750	9540	4050	3510	2700	3807
6	600#	15000	15000	11250	15900	6750	5850	4500	6345
6	900#	18000	18000	13500	19080	8100	7020	5400	7614
6	1500#	24000	24000	18000	25440	10800	9360	7200	10152
8	150#	12000	12000	9000	12720	7200	6240	4800	6768
8	300#	12000	12000	9000	12720	7200	6240	4800	6768
8	600#	20000	20000	15000	21200	12000	10400	8000	11280
8	900#	24000	24000	18000	25440	14400	12480	9600	13536
8	1500#	32000	32000	24000	33920	19200	16640	12800	18048
10	150#	15000	15000	11250	15900	11250	9750	7500	10575
10	300#	15000	15000	11250	15900	11250	9750	7500	10575
10	600#	25000	25000	18750	26500	18750	16250	12500	17625
10	900#	30000	30000	22500	31800	22500	19500	15000	21150
10	1500#	40000	40000	30000	42400	30000	26000	20000	28200
12	150#	18000	18000	13500	19080	16200	14040	10800	15228
12	300#	18000	18000	13500	19080	16200	14040	10800	15228
12	600#	30000	30000	22500	31800	27000	23400	18000	25380
12	900#	36000	36000	27000	38160	32400	28080	21600	30456
12	1500#	48000	48000	36000	50880	43200	37440	28800	40608
14	150#	21000	21000	15750	22260	22050	19110	14700	20727
14	300#	21000	21000	15750	22260	22050	19110	14700	20727
14	600#	35000	35000	26250	37100	36750	31850	24500	34545
14	900#	42000	42000	31500	44520	44100	38220	29400	41454
14	1500#	56000	56000	42000	59360	58800	50960	39200	55272

NOZZ. SIZE	FLANGE RATING	NOZZLE FORCES (N)				NOZZLE MOMENTS (Nm)			
(in)	(lbs)	FL	FA	FC	F	MT	ML	MC	M
16	150#	24000	24000	18000	25440	28800	24960	19200	27072
16	300#	24000	24000	18000	25440	28800	24960	19200	27072
16	600#	40000	40000	30000	42400	48000	41600	32000	45120
16	900#	48000	48000	36000	50880	57600	49920	38400	54144
16	1500#	64000	64000	48000	67840	76800	66560	51200	72192
18	150#	27000	27000	20250	28620	36450	31590	24300	34263
18	300#	27000	27000	20250	28620	36450	31590	24300	34263
18	600#	45000	45000	33750	47700	60750	52650	40500	57105
18	900#	54000	54000	40500	57240	72900	63180	48600	68526
18	1500#	72000	72000	54000	76320	97200	84240	64800	91368
20	150#	30000	30000	22500	31800	45000	39000	30000	42300
20	300#	30000	30000	22500	31800	45000	39000	30000	42300
20	600#	50000	50000	37500	53000	75000	65000	50000	70500
20	900#	60000	60000	45000	63600	90000	78000	60000	84600
20	1500#	80000	80000	60000	84800	120000	104000	80000	112800
22	150#	33000	33000	24750	34980	54450	47190	36300	51183
22	300#	33000	33000	24750	34980	54450	47190	36300	51183
22	600#	55000	55000	41250	58300	90750	78650	60500	85305
22	900#	66000	66000	49500	69960	108900	94380	72600	102366
22	1500#	88000	88000	66000	93280	145200	125840	96800	136488
24	150#	36000	36000	27000	38160	64800	56160	43200	60912
24	300#	36000	36000	27000	38160	64800	56160	43200	60912
24	600#	60000	60000	45000	63600	108000	93600	72000	101520
24	900#	72000	72000	54000	76320	129600	112320	86400	121824
24	1500#	96000	96000	72000	101760	172800	149760	115200	162432
26	150#	39000	39000	29250	41340	76050	65910	50700	71487
26	300#	39000	39000	29250	41340	76050	65910	50700	71487
26	600#	65000	65000	48750	68900	126750	109850	84500	119145
26	900#	78000	78000	58500	82680	152100	131820	101400	142974
26	1500#	104000	104000	78000	110240	202800	175760	135200	190632
28	150#	42000	42000	31500	44520	88200	76440	58800	82908
28	300#	42000	42000	31500	44520	88200	76440	58800	82908
28	600#	70000	70000	52500	74200	147000	127400	98000	138180
28	900#	84000	84000	63000	89040	176400	152880	117600	165816
28	1500#	112000	112000	84000	118720	235200	203840	156800	221088
30	150#	45000	45000	33750	47700	101250	87750	67500	95175
30	300#	45000	45000	33750	47700	101250	87750	67500	95175
30	600#	75000	75000	56250	79500	168750	146250	112500	158625
30	900#	90000	90000	67500	95400	202500	175500	135000	190350
30	1500#	120000	120000	90000	127200	270000	234000	180000	253800
32	150#	48000	48000	36000	50880	115200	99840	76800	108288
32	300#	48000	48000	36000	50880	115200	99840	76800	108288
32	600#	80000	80000	60000	84800	192000	166400	128000	180480
32	900#	96000	96000	72000	101760	230400	199680	153600	216576
32	1500#	128000	128000	96000	135680	307200	266240	204800	288768



ORIENTATION OF THE FORCES AND MOMENTS AS PER WRC BULETTIN107



ORIENTATION OF THE FORCES AND MOMENTS AS PER PD 5500

PIPING MATERIAL SPECIFICATION

AMMONIA UREA COAL BASED FERTILIZER PROJECT.

TALCHER FERTILIZER LTD., ODISHA.

REV	REV DATE	EFF DATE	PURPOSE	PREPD	REVWD	APPD
5	22.02.2022	22.02.2022	ISSUED FOR USE	NAZ	NS	GL/HOD
4	12.10.2021	12.10.2021	ISSUED FOR COMMENT	NAZ	NS/RK	GL/HOD
3	03.02.2021	03.02.2021	ISSUED FOR COMMENT	VINEETA	NS/RK	GL/HOD
2	28.12.2020	28.12.2020	ISSUED FOR COMMENT	VINEETA	NS/RK	GL/HOD
1	25.15.2020	28.12.2017	ISSUED	VINEETA	NS/RK	GL/HOD
0	09.03.2020	09.03.2020	ISSUED	VINEETA	NS/RK	GL/HOD

CONTENTS

- Service Index
- Piping Element Data Sheets
- Branch Tables
- Valve Data Sheets
- Strainer Data sheets
- Other Standards

PDIL	Service Index (SI) of Piping Material Classes		TFL-PDS-600		5
			DOCUMENT NO.		REV. NO.

SL.NO.	PMC	SERVICE	RATING, FACE ,D.TEMP.	BASIC MATERIAL	CORROSION ALLOW. (MIN.)	REV. NO.
1	B14	AG,AL,FG	CLASS 150, RF,250^{0}C Max, -33^{0}C Min.	LTCS	1.5 MM	1
2	B20	CW (UG)	CLASS 150, RF, 70^{0}C Max	CS	1.5MM	1
3	B22G	DW	CLASS 150, RF, 70^{0}C Max	CS (GALV)	1.5MM	1
4	B22IS	CONST.WATER	CLASS 150, FF, 80^{0}C Max	CS	1.5 MM	1
5	B22ISG	FW	CLASS 150, FF, 80^{0}C Max	CS (GALV)	1.5 MM	0
6	B24	BD,CW,CWS,CWR,DO,ES,FG,FN,FO,FW,IAW,NI,,PA,PG,PN, PV,PW,SA,SC,SW,TC,WW.	CLASS 150, RF, 200 ^{0}C Max	CS	1.5 MM	1
7	B24D	WASTE EFFLUENT	CLASS 150, FF, 50^{0}C Max	HDPE	0.0 MM	0
8	B24FL	EFFLUENT,ACIDIC H2O ETC.	CLASS 150, FF, 80^{0}C Max	CS FRP LINED	1.5 MM	0
9	B24G	FW	CLASS 150, FF, 200 ^{0}C Max	CS (GALV)	1.5 MM	0
10	B24P	ETP	CLASS 150, FF, 80^{0}C Max	CPVC	0.0 MM	0
11	B24RL	EFFLUENT, WASTE H2O, CHLORINATED H2O	CLASS 150, FF, 80^{0}C Max	CSRL	1.5 MM	0
12	B24S	SL,SC (IBR)	CLASS 150, RF, 240^{0}C Max	CS	1.5 MM	0
13	B24Z	FLARE	CLASS 150, RF, 400 ^{0}C Max	CS	3.0 MM	1
14	B40	CD,FG,HG,PA,PC	CLASS 150, RF,150^{0}C Max	304L SS	0.0 MM	0
15	B50	AF, AW, CD, DW, HZ, IA, MDA, PC, PH, VS	CLASS 150, RF,150^{0}C Max	304 SS	0.0 MM	1
16	B52	UL, WET ACID FLARE GAS	CLASS 150, RF,150^{0}C Max	316L SS	0.0 MM	2
17	D14	AG,AL,FG	CLASS 300, RF,70^{0}C Max, -35^{0}C Min.	LTCS	1.5 MM	1
18	D24	AG,AL,AW,FG,FN,HG,IAH,IAW, PA	CLASS 300, RF,280^{0}C Max	CS	1.5 MM	0
19	D50	AW,PH,PC	CLASS 300, RF,200^{0}C Max	304 SS	0.0 MM	0
20	D52	UL	CLASS 300, RF,150^{0}C Max	316L SS	0.0 MM	2
21	F24	AW,HG,PA,PC,PN,SG	CLASS 600, RF,425^{0}C Max	CS	1.5 MM	0
22	F24S	BB,BF,SC,SM	CLASS 600, RF,425^{0}C Max	CS(IBR)	1.5 MM	0
23	H24S	BB,BF,SC,SH	CLASS 1500, RJ,340^{0}C Max	CS(IBR)	1.5MM	0
24	J36S	SC,SH	CLASS 2500, RJ,540^{0}C Max	AS(IBR)	1.5 MM	1

Abbrev.	Service
AF	Antifoam solution
AG	Ammonia Gaseous
AL/LA	Ammonia Liquid
AW	Ammonia water
BB	Boiler BlowDown
BD	Blow Down
BF	Boiler feed water
CD	CO2/Steam mixture
CW	Cooling water
CWS	Cooling water supply
CWR	Cooling water return
DM	DM water
DW	Drinking Water
DO	Diesel Oil
ES	Exhaust steam
FG	Fuel gas
FO	Fuel oil
FN	Fuel Naphtha
FW	Fire Water
HC	Mixed Hydrocarbons
HG	Hydrogen Gas
HZ	Hydrazine
IA	Instrument air
IAH	Instrument air(High pressure)
IAW	Instrument air(Wet)
IG	Inert gas
NG	Natural gas
NI	Nitrogen
PA	Process Air
PC	Process condensate
PG	Process Gas

Abbrev.	Service
PH	Phosphate Solution
PN	Process Nephtha
PV	Vent gas
PW	Process Water
SA	service air
SC	Steam condensate
SG	Synthesis Gas
SH/HPS/HP	High Pressure Steam
SL/LP/LPS	LP Steam
SM/MPS	Medium Pressure Steam
SW	Service water
TC	Turbine Condensate
UL	Urea solutions handling
WW	Waste Water

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B14

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AG,AL,FG	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	LT CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 21/2	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		3 - 4	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		5 - 6	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		8 - 10	SCH 20	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		12 - 12	SCH 20	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		14 - 16	SCH 10	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		18 - 20	SCH 10	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		22 - 24	SCHSTD	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
FLANGE							
LONG W.N.FLANGE		1 - 1	300#	WN-RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,24mmBORE,200mmLONG	LN3570802	
W.N.FLANGE		1/2 - 24	150#	WN-RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,WELD NECK	WN3570801	5
W.N.FLANGE		1/2 - 24	300#	WN-RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,WELD NECK	WN3570802	6
SPACER AND BLIND		14 - 24	150#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.48,	RS352PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.48,	SP352PO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,	BF3520801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A320 GR.L7/ASTM A194 GR.7,,	SNDA00000	
FITTING (BW)							
BRANCH WELD WITH RP		2 - 24		BW	LT CARBON STEEL,ASME B31.3,	WBE211200	
CAP		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	CP4910900	
ELBOW		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	EL4910900	
REDUCER CONC.		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	RC4910900	
REDUCER ECC.		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	RE4910900	
TEE		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	TE4910900	
WELDOLET		2 - 24		BW	ASTM A350 LF2 CL.1,MSS SP 97,	WL3513300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	CP3530207	W
COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	CN3530207	
ELBOW		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	EL3530207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	HF3530207	W
SOCKOLET		1/2 - 24	3000#	SOCW	ASTM A350 LF2 CL.1,MSS SP 97,	SL3533307	
TEE		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	TE3530207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	ASTM A350 LF2 CL.1,ASME B16.11,	CP3540207	T
HALF COUPLING		1/2 - 11/2	3000#	THD	ASTM A350 LF2 CL.1,ASME B16.11,	HF3540207	T
PLUG		1/2 - 11/2		THD	ASTM A350 LF2 CL.1,ASME B16.11,ROUND HEAD	PG3540200	
THREDOLET		1/2 - 24	3000#	THD	ASTM A350 LF2 CL.1,MSS SP 97,	TL3543307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,ASTM A333 GR.6,ASME B36.10,	NPP651312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,ASTM A333 GR.6,ASME B36.10,NPT	NPP661312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,ASTM A333 GR.6,ASME B36.10,NPT	NPP641312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A420 WPL6-SMLS,MSS SP 95,	NC49J4500	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B14

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)			
AG,AL,FG	Ref.SI	Ref.SI		

RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	LT CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A420 WPL6-SMLS,MSS SP 95,	NE49J4500	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,GAV101,	GAV101	W
GATE VALVE		1/2 - 11/2	150#	FLG	LTCS BODY ASTM A352 GR LCB,GAV110,	GAV110	F
GATE VALVE		2 - 24	150#	FLG	LTCS BODY ASTM A352 GR LCB,GAV110,	GAV110	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,GLV101,	GLV101	W
GLOBE VALVE		2 - 8	150#	FLG	LTCS BODY ASTM A352 GR LCB,GLV110,	GLV110	
GLOBE VALVE		1/2 - 11/2	150#	FLG	LTCS BODY ASTM A352 GR LCB,GLV110,	GLV110	F
CHECK VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,CHV101,	CHV101	
CHECK VALVE		2 - 24	150#	FLG	LTCS BODY ASTM A352 GR LCB,CHV110,	CHV110	
BALL VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,BAV101,	BAV101	W
BALL VALVE		1/2 - 11/2	150#	FLG	LTCS BODY ASTM A352 GR LCB,BAV110,	BAV110	F
BALL VALVE		2 - 24	150#	FLG	LTCS BODY ASTM A352 GR LCB,BAV110,	BAV110	
BUTTERFLY VALVE		2 - 24	150#	FLG	LTCS BODY ASTM A352 GR LCB,BUV101,	BUV101	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B20

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
CW(UG)	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE	SMLS,API 5L GR.B,C&W,ASME B36.10,	PPX111300	
PIPE		40 - 42	10.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		44 - 46	10.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		48 - 48	10.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		8 - 10	SCH 10	BE	ERW,API 5L GR.B,C&W,ASME B36.10,	PPX411300	
PIPE		12 - 14	SCH 10	BE	ERW,API 5L GR.B,C&W,ASME B36.10,	PPX411300	
PIPE		16 - 18	SCH 10	BE	LSAW,API 5L GR.B,C&W,ASME B36.10,	PP1A11300	
PIPE		20 - 24	SCH 10	BE	LSAW,API 5L GR.B,C&W,ASME B36.10,	PP1A11300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,API 5L GR.B,C&W,ASME B36.10,	PPX121300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,API 5L GR.B,C&W,ASME B36.10,	PPX121300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,API 5L GR.B,C&W,ASME B36.10,	PPX121300	
PIPE		26 - 28	08.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		30 - 32	08.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		34 - 36	08.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		38 - 38	08.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		52 - 54	12.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		56 - 58	12.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		60 - 62	12.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		64 - 66	12.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		68 - 70	14.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
PIPE		72 - 72	14.00 MM	BE	LSAW,IS 3589 GR.FE410 C&W,ASME B36.10,	PPQW11300	
FLANGE							
FLANGE		1/2 - 24	150#	SO-RF 125 AARH	CS ASTM A105,ASME B16.5,SLIP ON	FL0260801	
FLANGE		26 - 72	150#	SO-FF	IS2062 GR.B,AWWA C207-D,RING TYPE,SLIP ON	FLA452701	
SPACER AND BLIND		14 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220801	
BLIND FLANGE		26 - 72	150#	FF	IS2062 GR.B,AWWA C207-D,	BFA412701	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		26 - 72	150#	3.0 MM THK FF	GSKT FLAT RNG,GARLOCK 3000(SYN FBR W/NBR BDR),ASME B16.21/AWWA C207-D,RING TYPE	GSTO8QS01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 48		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 48		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		8 - 24		BW	ASTM A234 WPB-WLDD,ASME B16.9,	ELOY10900	
ELBOW		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
ELBOW		26 - 48		BW	IS2062 GR.B,ASME B16.9,	ELA410900	
REDUCER CONC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER CONC.		8 - 24		BW	ASTM A234 WPB-WLDD,ASME B16.9,	RCOY10900	
REDUCER CONC.		26 - 48		BW	IS2062 GR.B,ASME B16.9,	RCA410900	
REDUCER ECC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
REDUCER ECC.		8 - 24		BW	ASTM A234 WPB-WLDD,ASME B16.9,	REOY10900	
REDUCER ECC.		26 - 48		BW	IS2062 GR.B,ASME B16.9,	REA410900	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B20

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
CW(UG)	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
TEE		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
TEE		8 - 24		BW	ASTM A234 WPB-WLDD,ASME B16.9,	TEOY10900	
TEE		26 - 48		BW	IS2062 GR.B,ASME B16.9,	TEA410900	
WELDOLET		2 - 48		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	
SOCKOLET		1/2 - 48	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 48	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,API 5L GR.B,ASME B36.10,	NPA151312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA161312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA141312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	
GATE VALVE		2 - 48	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 10	150#	FLG	CS BODY ASTM A216 GR WCB,GLV210,	GLV210	
BUTTERFLY VALVE		2 - 24	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:2

Class: B22G

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
DW,AIR	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# THD	1.5 MM(MIN.)	CS(GALVANISED)			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH XS	THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC31300	
PIPE		1 - 11/4	SCH XS	THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC31300	
PIPE		11/2 - 2	SCH XS	THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC31300	
PIPE		21/2 - 3	SCHSTD	THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC31300	
PIPE		4 - 4	SCHSTD	THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC31300	
PIPE		6 - 8	SCHSTD	BE	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,	PPAC11300	
FLANGE							
FLANGE		1/2 - 4	150#	THD-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	FLFDK0801	
W.N.FLANGE		6 - 8	150#	WN-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	WNFD70801	
SPECL BLIND		1/2 - 8	150#	THD-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.48,	SPFDKPO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 8	150#	RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	BFFD20801	
GASKET							
GASKET		6 - 8	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		1/2 - 4	150#	3.0 MM THK RF	BUTYL RUBBER,ASME B16.21,	GS6720401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193GR.B7/A194GR.2H,HOT DIP GALV.,,	SNZC00000	
FITTING (BW)							
CAP		6 - 8		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	CPPD10900	
ELBOW		6 - 8		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	ELPD10900	
REDUCER CONC.		6 - 8		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	RCPD10900	
REDUCER ECC.		6 - 8		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	REPD10900	
TEE		6 - 8		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	TEPD10900	
WELDOLET		6 - 8		BW	ASTM A105 HOT DIP GALV.,MSS SP 97,	WLFD13300	
FITTING (THD)							
CAP		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CPFD40207	
COUPLING		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CNFD40207	
ELBOW		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	ELFD40207	
HALF COUPLING		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	HFFD40207	
PLUG		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,ROUND HEAD	PGFD40200	
REDUCER CONC.		2 - 4		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	RCFD40200	
REDUCER ECC.		2 - 4		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	REFD40200	
TEE		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	TEFD40207	
THREDOLET		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,MSS SP 97,	TLFD43307	
NIPPLE							
NIPPLE		1/2 - 12		THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,NPT	NPAC41344	
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,MSS SP 95,	NCFD44500	
SWAGE (ECC)		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,MSS SP 95,	NEFD44500	
VALVES							
GATE VALVE		2 - 8	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GATE VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,GAV207,	GAV207	
CHECK VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,CHV207,	CHV207	
CHECK VALVE		2 - 8	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	
BUTTERFLY VALVE		2 - 8	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	
PLUG VALVE		2 - 8	150#	FLG	CS BODY ASTM A216 GR WCB,PLV202,	PLV202	

Note : 1. Hot Dip Galvanizing shall be done in accordance with ASTM A53 for Pipes & ASTM A153 for flanged &fittings.

2.Surface where Galvanizing has been burnt off during welding etc. shall be wire brushed ,zinc coated or cold galvanized.

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B22IS

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
CONSTRUCTION WATER	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 21/2	04.50 MM	BE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD512600	
PIPE		3 - 3	4.80 MM	BE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD512600	
PIPE		4 - 5	05.40 MM	BE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD512600	
PIPE		6 - 6	05.40 MM	BE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD512600	
PIPE		1/2 - 3/4	3.20 MM	PE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD522600	
PIPE		1 - 11/4	04.00 MM	PE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD522600	
PIPE		11/2 - 11/2	04.00 MM	PE	SMLS,IS1239 BLACK,IS 1239 PART I,HVY	PPD522600	
PIPE		8 - 10	6.30 MM	BE	ERW,IS 3589 GR.FE410,IS 3589,	PP521PK00	
PIPE		12 - 14	6.30 MM	BE	ERW,IS 3589 GR.FE410,IS 3589,	PP521PK00	
PIPE		16 - 18	6.30 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		20 - 20	6.30 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		22 - 24	08.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		26 - 28	08.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		30 - 30	08.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		32 - 34	10.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		36 - 38	10.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		40 - 42	12.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		44 - 46	12.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
PIPE		48 - 48	12.00 MM	BE	LSAW,IS 3589 GR.FE410,IS 3589,	PPT11PK00	
FLANGE							
FLANGE		1/2 - 11/2	150#	SW-RF 125 AARH	CS ASTM A105,ASME B16.5,	FL02L0801	
FLANGE		2 - 24	150#	SO-RF 125 AARH	CS ASTM A105,ASME B16.5,SLIP ON	FL0260801	1
FLANGE		26 - 48	150#	SO-FF	IS2062 GR.B,AWWA C207-D,RING TYPE,SLIP ON	FLA452701	C
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,38mmBORE,200mmLONG	LN0270802	
W.N.FLANGE		26 - 48	150#	WN-RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,WELD NECK	WN0270701	B
W.N.FLANGE		2 - 24	150#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,WELD NECK	WN0270801	2
SPACER AND BLIND		14 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO01	
BLIND FLANGE							
BLIND FLANGE		26 - 48	150#	RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,	BF0220701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		26 - 48	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20/B16.47 SR.B,	GSQN3QJ01	9
GASKET		26 - 48	150#	3.0 MM THK FF	GSKT FLAT RNG,GARLOCK 3000(SYN FBR W/NBR BDR),ASME B16.21/AWWA C207-D,RING TYPE	GSTO8QS01	F
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 48		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 48		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 48		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	ELOY10900	
REDUCER CONC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER CONC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	RCOY10900	
REDUCER ECC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
REDUCER ECC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	REOY10900	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B22IS

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)			
CONSTRUCTION WATER	Ref.SI	Ref.SI		

RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
TEE		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
TEE		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	TEOY10900	
WELDOLET		2 - 48		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	
SOCKOLET		1/2 - 48	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 48	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH 80	PLN-PLN	SMLS,IS1239 BLACK,IS 1239 PART I,	NPD552611	1
NIPPLE		1/2 - 11/2	SCH 80	PLN-THD	SMLS,IS1239 BLACK,IS 1239 PART I,NPT	NPD562611	2
NIPPLE		1/2 - 11/2	SCH 80	THD	SMLS,IS1239 BLACK,IS 1239 PART I,NPT	NPD542611	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NC7364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NE7364500	T
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	W
GATE VALVE		1/2 - 11/2	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	F
GATE VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 12	150#	FLG	CS BODY ASTM A216 GR WCB,GLV210,	GLV210	
CHECK VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,CHV201,	CHV201	
CHECK VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	
BALL VALVE		1/2 - 1	800#	SOCW	CS BODY ASTM A105,BAV201,	BAV201	
BALL VALVE		11/2 - 11/2	800#	SOCW	CS BODY ASTM A105,BAV201,	BAV201	W
BALL VALVE		11/2 - 11/2	150#	FLG	CS BODY ASTM A216 GR WCB,BAV210,	BAV210	F
BALL VALVE		2 - 16	150#	FLG	CS BODY ASTM A216 GR WCB,BAV210,	BAV210	
BUTTERFLY VALVE		3 - 24	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	
PLUG VALVE		1/2 - 1	600#	THRD	CS BODY ASTM A105,PLV201,	PLV201	
PLUG VALVE		11/2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,PLV202,	PLV202	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B22ISG

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
FW	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# THD	1.5 MM(MIN.)	CS(GALVANIZED)			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	3.20 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		1 - 11/4	04.00 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		11/2 - 11/2	04.00 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		2 - 21/2	04.50 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		3 - 3	4.80 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		4 - 5	05.40 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
PIPE		6 - 6	05.40 MM	THD	SMLS,IS1239 GALV.,IS 1239 PART I,HVY	PPDH32600	
FLANGE							
FLANGE		1/2 - 6	150#	THD-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	FLFDK0801	
SPECL BLIND		1/2 - 6	150#	RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.48,	SPFD2PO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 6	150#	RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	BFFD20801	
GASKET							
GASKET		1/2 - 4	150#	3.0 MM THK RF	BUTYL RUBBER,ASME B16.21,	GS6720401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193GR.B7/A194GR.2H,HOT DIP GALV.,,	SNZC00000	
FITTING (THD)							
CAP		1/2 - 6	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CPFD40207	
COUPLING		1/2 - 6	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CNFD40207	
ELBOW		1/2 - 6	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	ELFD40207	
HALF COUPLING		1/2 - 6	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	HFFD40207	
PLUG		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,ROUND HEAD	PGFD40200	
REDUCER CONC.		2 - 6		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	RCFD40200	
REDUCER ECC.		2 - 6		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	REFD40200	
TEE		1/2 - 6	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	TEFD40207	
THREDOLET		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,MSS SP 97,	TLFD43307	
NIPPLE							
NIPPLE		1/2 - 11/2		THD	SMLS,ASTM A106 GR.B,HOT DIP GALV.,ASME B36.10,NPT	NPAC41344	
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,MSS SP 95,	NCFD44500	
SWAGE (ECC)		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,MSS SP 95,	NEFD44500	
VALVES							
GATE VALVE		2 - 6	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GATE VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,GAV207,	GAV207	
CHECK VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,CHV207,	CHV207	
CHECK VALVE		2 - 6	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	
BUTTERFLY VALVE		3 - 6	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	
PLUG VALVE		2 - 6	150#	FLG	CS BODY ASTM A216 GR WCB,PLV202,	PLV202	

Note : 1. Hot Dip Galvanizing shall be done in accordance with ASTM A53 for Pipes & ASTM A153 for flanged &fittings.

2.Surface where Galvanizing has been burnt off during welding etc. shall be wire brushed ,zinc coated or cold galvanized.

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
BD,CWS,CWR,DO,ES,FG,FN,FO,FW,IAW,NI,PA,PG ETC	Ref.SI	Ref.SI			
RATING ASME 150# RF	CORROSION ALLOWANCE 1.5 MM(MIN.)	MATERIAL CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		8 - 10	SCH 20	BE	ERW,API 5L GR.B,ASME B36.10,	PPA211300	
PIPE		12 - 12	SCH 20	BE	ERW,API 5L GR.B,ASME B36.10,	PPA211300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		14 - 14	SCH 10	BE	ERW,API 5L GR.B,ASME B36.10,	PPA211300	
PIPE		16 - 18	SCH 10	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		20 - 20	SCH 10	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		22 - 24	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		26 - 28	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		30 - 32	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		34 - 34	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		36 - 38	SCH XS	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		40 - 42	SCH XS	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		44 - 46	SCH XS	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		48 - 48	SCH XS	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
FLANGE							
FLANGE		1/2 - 24	150#	SO-RF 125 AARH	CS ASTM A105,ASME B16.5,SLIP ON	FL0260801	
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,24mm Bore,200mm Long	LN0270802	
W.N.FLANGE		26 - 48	150#	WN-RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,WELD NECK	WN0270701	
SPACER AND BLIND		14 - 48	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO01	
BLIND FLANGE							
BLIND FLANGE		26 - 48	150#	RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,	BF0220701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		26 - 48	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20/B16.47 SR.B,	GSQN3QJ01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
DRIP RING							
DRIP RING		3 - 3	150#	RF 125 AARH	CS ASTM A105,PDIL-PDS-600,	DR022QK01	
FITTING (BW)							
BRANCH WELD		2 - 48		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 48		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 48		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	ELOY10900	L
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=3D	ELOY1QK00	3
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=5D	ELOY1QK00	5
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=7D	ELOY1QK00	7
REDUCER CONC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER CONC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	RCOY10900	
REDUCER ECC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
REDUCER ECC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	REOY10900	
TEE		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
TEE		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	TEOY10900	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)	
BD,CWS,CWR,DO,ES,FG,FN,FO,FW,IAW,NI,PA,PG ETC	Ref.SI	Ref.SI

RATING ASME	CORROSION ALLOWANCE	MATERIAL
150# RF	1.5 MM(MIN.)	CS

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
WELDOLET		2 - 48		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	W
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	HF0230207	
SOCKOLET		1/2 - 48	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
COUPLING		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CN0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 48	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,API 5L GR.B,ASME B36.10,	NPA151312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA161312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA141312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NC7364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NE7364500	T
STRAINER							
T-TYPE STRAINER		2 - 24	150#	FLGD	CS ASTM A216 GR WCB,TTS210,	TTS210	
Y-TYPE STRAINER		1/2 - 11/2	600#	SOCW	CS ASTM A105,YTS201,	YTS201	
Y-TYPE STRAINER		2 - 24	150#	FLGD	CS ASTM A216 GR WCB,YTS210,	YTS210	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	
GATE VALVE		2 - 48	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 12	150#	FLG	CS BODY ASTM A216 GR WCB,GLV210,	GLV210	
CHECK VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,CHV201,	CHV201	
CHECK VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	
BALL VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,BAV201,	BAV201	
BALL VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,BAV210,	BAV210	
BUTTERFLY VALVE		2 - 24	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	
BUTTERFLY VALVE		26 - 48	150#	FLG	CS BODY ASTM A216 GR WCB,BUV204,	BUV204	
PLUG VALVE		1/2 - 1	600#	THRD	CS BODY ASTM A105,PLV201,	PLV201	
PLUG VALVE		11/2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,PLV202,	PLV202	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24D

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
WASTE EFFLUENT,HCL	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# FF	NONE	HDPE			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1 - 11/4	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
PIPE		11/2 - 2	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
PIPE		3 - 4	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
PIPE		5 - 6	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
PIPE		8 - 10	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
PIPE		12 - 12	CALC	PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035,SDR7	PP5922A00	
FLANGE							
FLANGE		1 - 12	150#	LJ-FF	DI ASTM A536 GR.65-45-12,MF.STD/ASME B16.5,	FL5193501	
BLIND FLANGE							
BLIND FLANGE		1 - 12	150#	FF	CS ASTM A105,ASME B16.5,	BF0210801	
GASKET							
GASKET		1 - 12	150#	3.0 MM THK FF	EPDM,ASME B16.21,	GS7880401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			A307 GR.B/A563 GR.B,,	SN3B00000	
FITTING							
ELBOW		1 - 12		PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035/MF.STD,SDR7	EL59J2B00	
REDUCER CONC.		1 - 12		PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035/MF.STD,SDR7	RC59J2B00	
REDUCER ECC.		1 - 12		PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035/MF.STD,SDR7	RE59J2B00	
STUB END		1 - 12		PE	HDPE ASTM D3350 CELL 345464C(PE 3608),MF.STD/ASME B16.5,SDR7	SE59J3500	
TEE		1 - 12		PE	HDPE ASTM D3350 CELL 345464C(PE 3608),D-3035/MF.STD,SDR7	TE59J2B00	
VALVES							
CHECK VALVE		1 - 12	150#	FLG	CS BODY ASTM A216 GR.WCB RUBBER LINED,CHV210D,	CHV210D	
BALL VALVE		1 - 12	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	
BUTTERFLY VALVE		1 - 12	150#	FF	CS BODY ASTM A216 GR.WCB RUBBER LINED,BUV203F,LUG TYPE	BUV203F	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24FL

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
EFFLUENT,ACIDIC H2O ETC.	Ref.SI	Ref.SI			
RATING ASME 150# FF	CORROSION ALLOWANCE NONE	MATERIAL CS FRP LND.			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1 - 11/4	SCH XS	FLGD	CS,SMLS,API 5L GR.B,FRP LND.,ASME B36.10,THK OF LING AS PER MFR.	PP5661300	
PIPE		11/2 - 11/2	SCH XS	FLGD	CS,SMLS,API 5L GR.B,FRP LND.,ASME B36.10,THK OF LING AS PER MFR.	PP5661300	
PIPE		2 - 21/2	SCHSTD	FLGD	CS,SMLS,API 5L GR.B,FRP LND.,ASME B36.10,THK OF LING AS PER MFR.	PP5661300	
PIPE		3 - 4	SCHSTD	FLGD	CS,SMLS,API 5L GR.B,FRP LND.,ASME B36.10,THK OF LING AS PER MFR.	PP5661300	
PIPE		5 - 6	SCHSTD	FLGD	CS,SMLS,API 5L GR.B,FRP LND.,ASME B36.10,THK OF LING AS PER MFR.	PP5661300	
PIPE		8 - 10	SCH 20	FLGD	CS,ERW,API 5L GR.B,FRP LND,ASME B36.10,THK OF LING AS PER MFR.	PP5761300	
PIPE		12 - 12	SCH 20	FLGD	CS,ERW,API 5L GR.B,FRP LND,ASME B36.10,THK OF LING AS PER MFR.	PP5761300	
FLANGE							
FLANGE		1 - 2	150#	SO-FF	CS,ASTM A105,FRP LND.,ASME B16.5,THK OF LING AS PER MFR.	FL5850801	
W.N.FLANGE		1 - 12	150#	WN-FF	CS,ASTM A105,FRP LND.,ASME B16.5,THK OF LING AS PER MFR.	WN58M0801	
SPECL BLIND		1 - 12	150#	FF	CS PLT,ASTM A516 GR.60,FRP LND.,ASME B16.48,THK OF LING AS PER MFR.	SP641PO01	
BLIND FLANGE							
BLIND FLANGE		1 - 12	150#	FF	CS,ASTM A105,FRP LND.,ASME B16.5,THK OF LING AS PER MFR.	BF5810801	
GASKET							
GASKET		1 - 12	150#	FLAT	GASKET,SOFT RUBBER,ASME B16.21,3MM THK.	GSW190401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING							
ELBOW		1 - 6		FLGD	CS,ASTM A234 WPB-SMLS,FRP LND,ASME B16.9,THK OF LING AS PER MFR.	EL62Z0900	
ELBOW		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,FRP LND.,ASME B16.9,THK OF LING AS PER MFR.	EL63Z0900	
REDUCER CONC.		1 - 6		FLGD	CS,ASTM A234 WPB-SMLS,FRP LND,ASME B16.9,THK OF LING AS PER MFR.	RC62Z0900	
REDUCER CONC.		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,FRP LND.,ASME B16.9,THK OF LING AS PER MFR.	RC63Z0900	
REDUCER ECC.		1 - 6		FLGD	CS,ASTM A234 WPB-SMLS,FRP LND,ASME B16.9,THK OF LING AS PER MFR.	RE62Z0900	
REDUCER ECC.		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,FRP LND.,ASME B16.9,THK OF LING AS PER MFR.	RE63Z0900	
TEE		1 - 6		FLGD	CS,ASTM A234 WPB-SMLS,FRP LND,ASME B16.9,THK OF LING AS PER MFR.	TE62Z0900	
TEE		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,FRP LND.,ASME B16.9,THK OF LING AS PER MFR.	TE63Z0900	
VALVES							
GATE VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GAV510,	GAV510	
GLOBE VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GLV510,	GLV510	
CHECK VALVE		2 - 12	150#	FLG	CS BODY ASTM A216 GR.WCB RUBBER LINED,CHV210D,	CHV210D	
BALL VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	
BUTTERFLY VALVE		2 - 12	150#	FF	CS BODY ASTM A216 GR.WCB RUBBER LINED,BUV203,LUG TYPE	BUV203	

NOTE: 1. S.O. Flanges shall be used with pipe spools.
2. All fittings shall have ends connected to flanges.

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24G

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
FW	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150#	1.5 MM(MIN.)	CS(GALVANIZED)			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH 80	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW231300	
PIPE		1 - 11/4	SCH 80	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW231300	
PIPE		11/2 - 2	SCH 80	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW231300	
PIPE		21/2 - 3	SCH 40	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW231300	
PIPE		4 - 4	SCH 40	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW231300	
PIPE		6 - 6	SCH 40	BE	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,	PPW211300	
FLANGE							
FLANGE		1/2 - 4	150#	THD-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	FLFDK0801	
W.N.FLANGE		6 - 6	150#	WN-RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	WNFD70801	
SPECL BLIND		1/2 - 6	150#	RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.48,	SPFD2PO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 6	150#	RF 125 AARH	ASTM A105 HOT DIP GALV.,ASME B16.5,	BFFD20801	
GASKET							
GASKET		6 - 6	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		1/2 - 4	150#	3.0 MM THK RF	BUTYL RUBBER,ASME B16.21,	GS6720401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193GR.B7/A194GR.2H,HOT DIP GALV.,,	SNZC00000	
FITTING (BW)							
CAP		6 - 6		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	CPPD10900	
ELBOW		6 - 6		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	ELPD10900	
REDUCER CONC.		6 - 6		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	RCPD10900	
REDUCER ECC.		6 - 6		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	REPD10900	
TEE		6 - 6		BW	ASTM A234 WPB-SMLS,HOT DIP GALV.,ASME B16.9,	TEPD10900	
FITTING (THD)							
CAP		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CPFD40207	
COUPLING		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	CNFD40207	
ELBOW		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	ELFD40207	
PLUG		1/2 - 11/2		THD	ASTM A105 HOT DIP GALV.,ASME B16.11,ROUND HEAD	PGFD40200	
REDUCER CONC.		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	RCFD40207	
REDUCER ECC.		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	REFD40207	
TEE		1/2 - 4	3000#	THD	ASTM A105 HOT DIP GALV.,ASME B16.11,	TEFD40207	
THREDOLET		1/2 - 11/2	3000#	THD	ASTM A105 HOT DIP GALV.,MSS SP 97,	TLFD43307	
NIPPLE							
NIPPLE		1/2 - 6	SCH160	THD	SMLS,API 5L GR.B,HOT DIP GALV.,ASME B36.10,NPT	NPW241312	
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		THD	ASTM A234 WPB-SMLS,HOT DIP GALV.,MSS SP 95,	NCPD44500	
SWAGE (ECC)		1/2 - 11/2		THD	ASTM A234 WPB-SMLS,HOT DIP GALV.,MSS SP 95,	NEPD44500	
VALVES							
GATE VALVE		2 - 6	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GATE VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,GAV207,	GAV207	
CHECK VALVE		1/2 - 11/2	800#	THRD	CS BODY ASTM A105,CHV207,	CHV207	
CHECK VALVE		2 - 6	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	

Note : 1. Hot Dip Galvanizing shall be done in accordance with ASTM A53 for Pipes & ASTM A153 for flanged &fittings.

2.Surface where Galvanizing has been burnt off during welding etc. shall be wire brushed ,zinc coated or cold galvanized.

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24P

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
ETP	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# FF	NONE	CPVC			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 3	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
PIPE		4 - 6	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
PIPE		8 - 10	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
PIPE		12 - 12	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
PIPE		1/2 - 3/4	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
PIPE		1 - 11/2	SCH 80	PE	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE	PP552QC00	
FLANGE							
FLANGE		1/2 - 12	150#	FF	CPVC,ASTM F441,MF.STD/ASTM F441,SCH80	FL551QC01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 12	150#	FF	CPVC,ASTM F441,MF.STD/ASTM F441,	BF551QC01	
GASKET							
GASKET		1/2 - 12	150#	3.0 MM THK FF	EPDM,MF.STD./ASME B16.21,FULL FACE	GS788PA01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD WITH RP		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	WB55JQC00	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CPVC,ASTM F441,MF.STD/ASTM F441,	CP554QC07	
FITTING							
ELBOW		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	EL55JQC00	
REDUCER CONC.		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	RC55JQC00	
REDUCER ECC.		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	RE55JQC00	
TEE		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	TE55JQC00	
UNION (GJ)		1/2 - 12		PE	CPVC,ASTM F441,MF.STD/ASTM F441,	UN55JQC00	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	CPVC,ASTM F441,MF.STD/ASTM F441,	NP555QC12	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE NPT	NP556QC12	2
NIPPLE		1/2 - 11/2	SCH160	THD	CPVC,ASTM F441,MF.STD/ASTM F441,PLASTIC PIPE NPT	NP554QC12	3
VALVES							
GATE VALVE		1/2 - 12	150#	FF	CPVC BODY W/ PP PLUG & EPDM SEATS,GAV500C,	GAV500C	
CHECK VALVE		1/2 - 12	150#	FF	CPVC BODY,CHV500C,	CHV500C	
BALL VALVE		1/2 - 2	150#	FF	CPVC BODY WITH CPVC BALL,BAV500C,	BAV500C	
BALL VALVE		3 - 6	150#	FF	CPVC BODY WITH CPVC BALL,BAV501C,	BAV501C	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24RL

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
EFFLUENT,WASTE H2O,CHLORINATED H2O	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# FF	1.5 MM(MIN.)	CSRL			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH 80	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		1 - 11/4	SCH 80	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		11/2 - 11/2	SCH 80	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		2 - 21/2	SCH 40	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		3 - 4	SCHSTD	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		5 - 6	SCHSTD	FLGD	CS,SMLS,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PPX761300	
PIPE		8 - 10	SCHSTD	FLGD	CS,ERW,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PP2A61300	
PIPE		12 - 12	SCHSTD	FLGD	CS,ERW,API 5L GR.B,NATURAL RBR LND,ASME B36.10,3MM THK LING	PP2A61300	
FLANGE							
FLANGE		1/2 - 12	150#	SO-FF	CS,ASTM A105,NATURAL RBR LND,ASME B16.5,3MM THK LING	FLX650801	
SPECL BLIND		1 - 12	150#	FF	CS PLT,ASTM A516 GR.60,NATURAL RBR LND,ASME B16.48,3MM THK LING	SPX81PO01	
BLIND FLANGE							
BLIND FLANGE		1 - 12	150#	FF	CS,ASTM A105,NATURAL RBR LND,ASME B16.5,3MM THK LING	BFX610801	
GASKET							
GASKET		1 - 12	150#	FLAT	GASKET,SOFT RUBBER,ASME B16.21,3MM THK.	GSW190401	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING							
DIAPH. VALVE		1 - 12	150#	FLG	CS BODY ASTM A216 GR.WCB RUBBER LINED,DPV500,	DPV500	
ELBOW		1/2 - 6		FLGD	CS,ASTM A234 WPB-SMLS,NATURAL RBR LND,ASME B16.9,3MM THK LING	ELX9Z0900	
ELBOW		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,NATURAL RBR LND,ASME B16.9,3MM THK LING	EL3AZ0900	
REDUCER CONC.		1/2 - 6		FLGD	CS,ASTM A234 WPB-SMLS,NATURAL RBR LND,ASME B16.9,3MM THK LING	RCX9Z0900	
REDUCER CONC.		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,NATURAL RBR LND,ASME B16.9,3MM THK LING	RC3AZ0900	
REDUCER ECC.		1/2 - 6		FLGD	CS,ASTM A234 WPB-SMLS,NATURAL RBR LND,ASME B16.9,3MM THK LING	REX9Z0900	
REDUCER ECC.		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,NATURAL RBR LND,ASME B16.9,3MM THK LING	RE3AZ0900	
TEE		1/2 - 6		FLGD	CS,ASTM A234 WPB-SMLS,NATURAL RBR LND,ASME B16.9,3MM THK LING	TEX9Z0900	
TEE		8 - 12		FLGD	CS,ASTM A234 WPB-WLDD,NATURAL RBR LND,ASME B16.9,3MM THK LING	TE3AZ0900	
VALVES							
GATE VALVE		1/2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GAV510,	GAV510	
GLOBE VALVE		1/2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GLV510,	GLV510	
CHECK VALVE		2 - 12	150#	FLG	CS BODY ASTM A216 GR.WCB RUBBER LINED,CHV210D,	CHV210D	
BALL VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	
BUTTERFLY VALVE		2 - 12	150#	FF	CS BODY ASTM A216 GR.WCB RUBBER LINED,BUV203RL,LUG TYPE	BUV203RL	

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NOTE: 1. S.O. Flanges shall be used with pipe spools.
2. All fittings shall have ends connected to flanges.

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
SL,SC (IBR)	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		8 - 10	SCH 20	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		12 - 12	SCH 20	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		1/2 - 3/4	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		1 - 11/4	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		11/2 - 11/2	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		14 - 16	SCH 10	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		18 - 20	SCH 10	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		24 - 24	SCHSTD	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		26 - 28	SCHSTD	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		30 - 32	SCHSTD	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		34 - 34	SCHSTD	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		36 - 38	SCH XS	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		40 - 42	SCH XS	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		44 - 46	SCH XS	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
PIPE		48 - 48	14.27 MM	BE IBR	EFW,ASTM A671 GR.CC60 CL.22,ASME B36.10,	PPRXA1300	
FLANGE							
FLANGE		1/2 - 24	150#	SO-RF 125 AARH IBR	CS ASTM A105,ASME B16.5,SLIP ON	FL02F0801	
W.N.FLANGE		26 - 48	150#	WN-RF 125 AARH IBR	CS ASTM A105,ASME B16.47 SR.B,WELD NECK	WN02G0701	
SPACER AND BLIND		14 - 24	150#	RF 125 AARH IBR	CS ASTM A105,ASME B16.48,	RS02BPO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH IBR	CS ASTM A105,ASME B16.48,	SP02BPO01	
BLIND FLANGE							
BLIND FLANGE		26 - 48	150#	RF 125 AARH IBR	CS ASTM A105,ASME B16.47 SR.B,	BF02B0701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH IBR	CS ASTM A105,ASME B16.5,	BF02B0801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		26 - 48	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20/B16.47 SR.B,	GSQN3QJ01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 48		BW IBR	CARBON STEEL,ASME B31.3,	RWOJA1200	
BRANCH WELD WITH RP		2 - 48		BW IBR	CARBON STEEL,ASME B31.3,	WBOJA1200	
CAP		2 - 48		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	CP73A0900	
ELBOW		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	EL73A0900	
ELBOW		26 - 48		BW IBR	ASTM A234 WPB-WLDD,ASME B16.9,	ELOYA0900	
REDUCER CONC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RC73A0900	
REDUCER CONC.		26 - 48		BW IBR	ASTM A234 WPB-WLDD,ASME B16.9,	RCOYA0900	
REDUCER ECC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RE73A0900	
REDUCER ECC.		26 - 48		BW IBR	ASTM A234 WPB-WLDD,ASME B16.9,	REOYA0900	
TEE		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	TE73A0900	
TEE		26 - 48		BW IBR	ASTM A234 WPB-WLDD,ASME B16.9,	TEOYA0900	
WELDOLET		2 - 48		BW IBR	CS ASTM A105,MSS SP 97,	WL02A3300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CP02C0207	W
COUPLING		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CN02C0207	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
SL,SC (IBR)	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
ELBOW		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	EL02C0207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	HF02C0207	
SOCKOLET		1/2 - 48	3000#	SOCW IBR	CS ASTM A105,MSS SP 97,	SL02C3307	
TEE		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	TE02C0207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD IBR	CS ASTM A105,ASME B16.11,	CP02D0207	T
PLUG		1/2 - 11/2		THD IBR	CS ASTM A105,ASME B16.11,ROUND HEAD	PG02D0200	
THREDOLET		1/2 - 48	3000#	THD IBR	CS ASTM A105,MSS SP 97,	TL02D3307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	NP03E1312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03F1312	2
NIPPLE		1/2 - 11/2	SCH160	THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03D1312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73Q4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73F4500	T
SWAGE (ECC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73Q4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73F4500	T
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,GAV201S,	GAV201S	
GATE VALVE		2 - 48	150#	FLG IBR	CS BODY ASTM A216 GR WCB,GAV210S,	GAV210S	
GLOBE VALVE		1/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,GLV201S,	GLV201S	
GLOBE VALVE		2 - 12	150#	FLG IBR	CS BODY ASTM A216 GR WCB,GLV210S,	GLV210S	
CHECK VALVE		1/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,CHV201S,	CHV201S	
CHECK VALVE		2 - 24	150#	FLG IBR	CS BODY ASTM A216 GR WCB,CHV210S,	CHV210S	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B24Z

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
FLARE	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	3.0 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 2	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		21/2 - 3	SCHSTD	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		4 - 5	SCHSTD	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		6 - 6	SCHSTD	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		8 - 10	SCHSTD	BE	ERW,API 5L GR.B,ASME B36.10,	PPA211300	
PIPE		12 - 14	SCHSTD	BE	ERW,API 5L GR.B,ASME B36.10,	PPA211300	
PIPE		1/2 - 3/4	SCH160	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		1 - 11/4	SCH160	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		11/2 - 11/2	SCH160	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		16 - 18	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		20 - 22	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
PIPE		24 - 24	SCHSTD	BE	LSAW,API 5L GR.B,ASME B36.10,	PP9611300	
FLANGE							
FLANGE		1/2 - 24	150#	SO-RF 125 AARH	CS ASTM A105,ASME B16.5,SLIP ON	FL0260801	
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,24mm Bore,200mm Long	LN0270802	
W.N.FLANGE		26 - 48	150#	WN-RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,WELD NECK	WN0270701	
SPACER AND BLIND		14 - 48	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO01	
BLIND FLANGE							
BLIND FLANGE		26 - 48	150#	RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,	BF0220701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30301	
GASKET		26 - 48	150#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20/B16.47 SR.B,	GSQN3QJ01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
DRIP RING							
DRIP RING		3 - 3	150#	RF 125 AARH	CS ASTM A105,PDIL-PDS-600,	DR022QK01	
FITTING (BW)							
BRANCH WELD		2 - 48		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 48		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 48		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	ELOY10900	L
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=3D	ELOY1QK00	3
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=5D	ELOY1QK00	5
ELBOW		8 - 48		BW	ASTM A234 WPB-WLDD,PDIL-PDS-600,R=7D	ELOY1QK00	7
REDUCER CONC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER CONC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	RCOY10900	
REDUCER ECC.		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
REDUCER ECC.		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	REOY10900	
TEE		2 - 6		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
TEE		8 - 48		BW	ASTM A234 WPB-WLDD,ASME B16.9,	TEOY10900	
WELDOLET		2 - 48		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	W
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B24Z

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
FLARE	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	3.0 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
HALF COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	HF0230207	
SOCKOLET		1/2 - 48	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
COUPLING		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CN0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 48	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,API 5L GR.B,ASME B36.10,	NPA151312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA161312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA141312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NC7364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NE7364500	T
STRAINER							
T-TYPE STRAINER		2 - 24	150#	FLGD	CS ASTM A216 GR WCB,TTS210,	TTS210	
Y-TYPE STRAINER		1/2 - 11/2	600#	SOCW	CS ASTM A105,YTS201,	YTS201	
Y-TYPE STRAINER		2 - 24	150#	FLGD	CS ASTM A216 GR WCB,YTS210,	YTS210	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	
GATE VALVE		2 - 48	150#	FLG	CS BODY ASTM A216 GR WCB,GAV210,	GAV210	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 12	150#	FLG	CS BODY ASTM A216 GR WCB,GLV210,	GLV210	
CHECK VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,CHV201,	CHV201	
CHECK VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,CHV210,	CHV210	
BALL VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,BAV201,	BAV201	
BALL VALVE		2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,BAV210,	BAV210	
BUTTERFLY VALVE		2 - 24	150#	RF	CS BODY ASTM A216 GR WCB,BUV203,LUG TYPE	BUV203	
BUTTERFLY VALVE		26 - 48	150#	FLG	CS BODY ASTM A216 GR WCB,BUV204,	BUV204	
PLUG VALVE		1/2 - 1	600#	THRD	CS BODY ASTM A105,PLV201,	PLV201	
PLUG VALVE		11/2 - 24	150#	FLG	CS BODY ASTM A216 GR WCB,PLV202,	PLV202	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B40

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
CD,FG,HG,PA,PC	Ref.SI	Ref.SI			
RATING ASME 150# RF	CORROSION ALLOWANCE NONE	MATERIAL SS 304L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		26 - 28	SCH 10	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.10,	PPZ511300	
PIPE		30 - 32	SCH 10	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.10,	PPZ511300	
PIPE		34 - 36	SCH 10	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.10,	PPZ511300	
PIPE		2 - 4	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
PIPE		1/2 - 3/4	SCH40S	PE	SMLS,ASTM A312 TP304L,ASME B36.19,	PP8521400	
PIPE		1 - 11/4	SCH40S	PE	SMLS,ASTM A312 TP304L,ASME B36.19,	PP8521400	
PIPE		11/2 - 11/2	SCH40S	PE	SMLS,ASTM A312 TP304L,ASME B36.19,	PP8521400	
PIPE		6 - 8	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
PIPE		10 - 12	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
PIPE		14 - 16	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
PIPE		18 - 20	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
PIPE		22 - 24	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304L,ASME B36.19,	PPZ511400	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	ASTM A182 F304L,ASME B16.5,38mmBORE,200mmLONG	LN8170802	
W.N.FLANGE		26 - 36	150#	WN-RF 125 AARH	ASTM A182 F304L,ASME B16.47 SR.B,WELD NECK	WN8170701	
W.N.FLANGE		1/2 - 24	150#	WN-RF 125 AARH	ASTM A182 F304L,ASME B16.5,WELD NECK	WN8170801	5
W.N.FLANGE		1/2 - 24	300#	WN-RF 125 AARH	ASTM A182 F304L,ASME B16.5,WELD NECK	WN8170802	6
SPACER AND BLIND		14 - 24	150#	RF 125 AARH	ASTM A182 F304L,ASME B16.48,	RS812PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	ASTM A182 F304L,ASME B16.48,	SP812PO01	
BLIND FLANGE							
BLIND FLANGE		26 - 36	150#	RF 125 AARH	ASTM A182 F304L,ASME B16.47 SR.B,	BF8120701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	ASTM A182 F304L,ASME B16.5,	BF8120801	1
BLIND FLANGE		1/2 - 24	300#	RF 125 AARH	ASTM A182 F304L,ASME B16.5,	BF8120802	2
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20,	GSQL30301	1
GASKET		1/2 - 24	300#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20,	GSQL30302	2
GASKET		26 - 36	150#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20/B16.47 SR.B,	GSQL3QJ01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B8 CL.2/ASTM A194 GR.8,,	SNA600000	
DRIP RING							
DRIP RING		3 - 3	150#	RF 125 AARH	ASTM A182 F304L,PDIL-PDS-600,	DR812QK01	
FITTING (BW)							
BRANCH WELD		2 - 36		BW	STAINLESS STEEL,ASME B31.3,	RWOK11200	
BRANCH WELD WITH RP		2 - 36		BW	STAINLESS STEEL,ASME B31.3,	WBOK11200	
CAP		2 - 36		BW	ASTM A403 WP304L-SMLS,ASME B16.9,	CP8310900	
ELBOW		2 - 36		BW	ASTM A403 WP304L-WLDD,ASME B16.9,	EL8410900	L
ELBOW		2 - 36	19.05 MM	BW	ASTM A403 WP304L-WLDD,PDIL-PDS-600,R=3D	EL841QK60	3
ELBOW		2 - 36	19.05 MM	BW	ASTM A403 WP304L-WLDD,PDIL-PDS-600,R=5D	EL841QK60	5
REDUCER CONC.		2 - 36		BW	ASTM A403 WP304L-WLDD,ASME B16.9,	RC8410900	
REDUCER ECC.		2 - 36		BW	ASTM A403 WP304L-WLDD,ASME B16.9,	RE8410900	
TEE		2 - 36		BW	ASTM A403 WP304L-WLDD,ASME B16.9,	TE8410900	
WELDOLET		2 - 36		BW	ASTM A182 F304L,MSS SP 97,	WL8113300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	ASTM A182 F304L,ASME B16.11,	CP8130207	W
COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304L,ASME B16.11,	CN8130207	
ELBOW		1/2 - 11/2	3000#	SOCW	ASTM A182 F304L,ASME B16.11,	EL8130207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304L,ASME B16.11,	HF8130207	
SOCKOLET		1/2 - 36	3000#	SOCW	ASTM A182 F304L,MSS SP 97,	SL8133307	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: B40

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
CD,FG,HG,PA,PC	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	NONE	SS 304L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
TEE		1/2 - 11/2	3000#	SOCW	ASTM A182 F304L,ASME B16.11,	TE8130207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	ASTM A182 F304L,ASME B16.11,	CP8140207	T
PLUG		1/2 - 11/2		THD	ASTM A182 F304L,ASME B16.11,ROUND HEAD	PG8140200	
THREDOLET		1/2 - 36	3000#	THD	ASTM A182 F304L,MSS SP 97,	TL8143307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH80S	PLN-PLN	SMLS,ASTM A312 TP304L,ASME B36.19,	NP8551413	1
NIPPLE		1/2 - 11/2	SCH80S	PLN-THD	SMLS,ASTM A312 TP304L,ASME B36.19,NPT	NP8561413	2
NIPPLE		1/2 - 11/2	SCH80S	THD	SMLS,ASTM A312 TP304L,ASME B36.19,NPT	NP8541413	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A403 WP304L-SMLS,MSS SP 95,	NC83J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304L-SMLS,MSS SP 95,	NC8364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A403 WP304L-SMLS,MSS SP 95,	NE83J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304L-SMLS,MSS SP 95,	NE8364500	T
VALVES							
GATE VALVE		1/2 - 1	800#	SOCW	SS BODY ASTM A182 GR F304,GAV501,	GAV501	
GATE VALVE		11/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GAV501,	GAV501	W
GATE VALVE		11/2 - 11/2	150#	FLG	SS BODY ASTM A351 GR CF8,GAV510,	GAV510	F
GATE VALVE		2 - 24	150#	FLG	SS BODY ASTM A351 GR CF8,GAV510,	GAV510	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GLV501,	GLV501	
GLOBE VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GLV510,	GLV510	
CHECK VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,CHV501,	CHV501	
CHECK VALVE		2 - 24	150#	FLG	SS BODY ASTM A351 GR CF8,CHV510,	CHV510	
BALL VALVE		1/2 - 1	800#	THRD	SS BODY AISI 316,BAV501,	BAV501	
BALL VALVE		11/2 - 11/2	800#	THRD	SS BODY AISI 316,BAV501,	BAV501	T
BALL VALVE		11/2 - 11/2	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	F
BALL VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B50

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)	
AF,AW,CD,DM,HZ,IA,MDA,PC,PH,VS,CH	Ref.SI	Ref.SI

RATING ASME	CORROSION ALLOWANCE	MATERIAL
150# RF	NONE	SS 304

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		26 - 28	06.35 MM	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		30 - 32	SCH 10	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		34 - 36	SCH 10	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		38 - 40	SCHSTD	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		42 - 44	SCHSTD	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		46 - 48	SCHSTD	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		1/2 - 3/4	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		1 - 11/4	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		11/2 - 11/2	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		2 - 4	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		6 - 8	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		10 - 12	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		14 - 16	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		18 - 20	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		22 - 24	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
FLANGE							
W.N.FLANGE		26 - 48	150#	WN-RF 125 AARH	ASTM A182 F304,ASME B16.47 SR.B,WELD NECK	WN0670701	
W.N.FLANGE		1/2 - 24	150#	WN-RF 125 AARH	ASTM A182 F304,ASME B16.5,WELD NECK	WN0670801	
SPACER AND BLIND		14 - 24	150#	RF 125 AARH	ASTM A182 F304,ASME B16.48,	RS062PO01	
SPECL BLIND		1/2 - 12	150#	RF 125 AARH	ASTM A182 F304,ASME B16.48,	SP062PO01	
BLIND FLANGE							
BLIND FLANGE		26 - 48	150#	RF 125 AARH	ASTM A182 F304,ASME B16.47 SR.B,	BF0620701	
BLIND FLANGE		1/2 - 24	150#	RF 125 AARH	ASTM A182 F304,ASME B16.5,	BF0620801	
GASKET							
GASKET		1/2 - 24	150#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20,	GSQL30301	
GASKET		26 - 48	150#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20/B16.47 SR.B,	GSQL3QJ01	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B8 CL.2/ASTM A194 GR.8,,	SNA600000	
DRIP RING							
DRIP RING		3 - 3	150#	RF 125 AARH	ASTM A182 F304,PDIL-PDS-600,	DR062QK01	
FITTING (BW)							
BRANCH WELD		2 - 48		BW	STAINLESS STEEL,ASME B31.3,	RWOK11200	
BRANCH WELD WITH RP		2 - 48		BW	STAINLESS STEEL,ASME B31.3,	WBOK11200	
CAP		2 - 48		BW	ASTM A403 WP304-SMLS,ASME B16.9,	CP7410900	
ELBOW		2 - 48		BW	ASTM A403 WP304-WLDD,ASME B16.9,	ELZ410900	
REDUCER CONC.		2 - 48		BW	ASTM A403 WP304-WLDD,ASME B16.9,	RCZ410900	
REDUCER ECC.		2 - 48		BW	ASTM A403 WP304-WLDD,ASME B16.9,	REZ410900	
TEE		2 - 48		BW	ASTM A403 WP304-WLDD,ASME B16.9,	TEZ410900	
WELDOLET		2 - 48		BW	ASTM A182 F304,MSS SP 97,	WL0613300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	CP0630207	W
COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	CN0630207	
ELBOW		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	EL0630207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	HF0630207	
SOCKOLET		1/2 - 48	3000#	SOCW	ASTM A182 F304,MSS SP 97,	SL0633307	
TEE		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	TE0630207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	ASTM A182 F304,ASME B16.11,	CP0640207	T

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: B50

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AF,AW,CD,DM,HZ,IA,MDA,PC,PH,VS,CH	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	NONE	SS 304			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PLUG		1/2 - 11/2		THD	ASTM A182 F304,ASME B16.11,ROUND HEAD	PG0640200	
THREDOLET		1/2 - 48	3000#	THD	ASTM A182 F304,MSS SP 97,	TL0643307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH80S	PLN-PLN	SMLS,ASTM A312 TP304,ASME B36.19,	NPPE51413	1
NIPPLE		1/2 - 11/2	SCH80S	PLN-THD	SMLS,ASTM A312 TP304,ASME B36.19,NPT	NPPE61413	2
NIPPLE		1/2 - 11/2	SCH80S	THD	SMLS,ASTM A312 TP304,ASME B36.19,NPT	NPPE41413	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A403 WP304-SMLS,MSS SP 95,	NC74J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304-SMLS,MSS SP 95,	NC7464500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A403 WP304-SMLS,MSS SP 95,	NE74J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304-SMLS,MSS SP 95,	NE7464500	T
STRAINER							
T-TYPE STRAINER		2 - 24	150#	FLGD	SS ASTM A351 GR CF8,TTS510,	TTS510	
Y-TYPE STRAINER		2 - 24	150#	FLGD	SS ASTM A351 GR CF8,YTS510,	YTS510	
Y-TYPE STRAINER		1/2 - 11/2	600#	SOCW	ASTM A182 F304,YTS501,	YTS501	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GAV501,	GAV501	
GATE VALVE		2 - 24	150#	FLG	SS BODY ASTM A351 GR CF8,GAV510,	GAV510	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GLV501,	GLV501	
GLOBE VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF8,GLV510,	GLV510	
CHECK VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,CHV501,	CHV501	
CHECK VALVE		2 - 24	150#	FLG	SS BODY ASTM A351 GR CF8,CHV510,	CHV510	
CHECK VALVE		26 - 36	150#	FLG	SS BODY ASTM A351 GR CF8,CHV520,	CHV520	
BALL VALVE		1/2 - 11/2	800#	THRD	SS BODY AISI 316,BAV501,	BAV501	
BALL VALVE		2 - 6	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV510,	BAV510	
BALL VALVE		8 - 24	150#	FLG	SS BODY ASTM A351 GR CF8M,BAV520,	BAV520	
BUTTERFLY VALVE		6 - 48	150#	RF	SS BODY ASTM A351 GR CF8,BUV510,WAFER TYPE	BUV510	
PLUG VALVE		1/2 - 1	600#	THRD	SS BODY AISI 316,PLV501,	PLV501	
PLUG VALVE		11/2 - 6	150#	FLG	SS BODY ASTM A351 GR CF8M,PLV510,	PLV510	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:2

Class: B52

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
UL,WET ACID FLARE GAS	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	NONE	SS 316L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH40S	PE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9121400	
PIPE		1 - 11/2	SCH40S	PE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9121400	
PIPE		2 - 3	SCH10S	BE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9111400	
PIPE		4 - 6	SCH10S	BE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9111400	
PIPE		8 - 10	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
PIPE		12 - 14	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
PIPE		16 - 18	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
FLANGE							
FLANGE		1/2 - 11/2	150#	SW-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,SOCKET WELD	FL88L0801	5
FLANGE		1/2 - 11/2	300#	SW-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,SOCKET WELD	FL88L0802	6
W.N.FLANGE		2 - 4	150#	WN-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,WELD NECK	WN8870801	5
W.N.FLANGE		6 - 18	150#	WN-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,WELD NECK	WN8870801	
W.N.FLANGE		2 - 4	300#	WN-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,WELD NECK	WN8870802	6
SPACER AND BLIND		18 - 18	150#	RF 125 AARH	ASTM A240 TP316L,ASME B16.48,	RS932PO01	
SPECL BLIND		1/2 - 16	150#	RF 125 AARH	ASTM A240 TP316L,ASME B16.48,	SP932PO01	
BLIND FLANGE							
BLIND FLANGE		1/2 - 18	150#	RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,	BF8820801	
GASKET							
GASKET		1/2 - 4	150#	SPRL-WND RF	GASKET,TP316L SS WDG;GPH FLR;TP316L SS INR RNG/ OTR RNG,ASME B16.20,	GS0830301	5
GASKET		6 - 18	150#	SPRL-WND RF	GASKET,TP316L SS WDG;GPH FLR;TP316L SS INR RNG/ OTR RNG,ASME B16.20,	GS0830301	
GASKET		1/2 - 4	300#	SPRL-WND RF	GASKET,TP316L SS WDG;GPH FLR;TP316L SS INR RNG/ OTR RNG,ASME B16.20,	GS0830302	6
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
CAP		2 - 18		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	CP8910900	
ELBOW		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	EL8910900	
ELBOW		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	EL9010900	
REDUCER CONC.		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	RC8910900	
REDUCER CONC.		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	RC9010900	
REDUCER ECC.		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	RE8910900	
REDUCER ECC.		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	RE9010900	
TEE		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	TE8910900	
TEE		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	TE9010900	
WELDOLET		2 - 18		BW	SS,ASTM A182 F316L,MSS SP 97,	WL8813300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	CP8830207	
COUPLING		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	CN8830207	W
ELBOW		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	EL8830207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	HF8830207	W
SOCKOLET		1/2 - 18	3000#	SOCW	SS,ASTM A182 F316L,MSS SP 97,	SL8833307	
TEE		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	TE8830207	
FITTING (THD)							
COUPLING		1/2 - 11/2	3000#	THD	SS,ASTM A182 F316L,ASME B16.11,	CN8840207	T
ELBOLET		1/2 - 18	3000#	THD	SS,ASTM A182 F316L,MSS SP 97,	ET8843307	
HALF COUPLING		1/2 - 11/2	3000#	THD	SS,ASTM A182 F316L,ASME B16.11,	HF8840207	T
PLUG		1/2 - 11/2		THD	SS,ASTM A182 F316L,ASME B16.11,ROUND HEAD	PG8840200	
THREDOLET		1/2 - 18	3000#	THD	SS,ASTM A182 F316L,MSS SP 97,	TL8843307	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:2

Class: B52

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
UL,WET ACID FLARE GAS	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
150# RF	NONE	SS 316L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
NIPPLE							
NIPPLE		1/2 - 11/2	SCH80S	PLN-PLN	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9151413	1
NIPPLE		1/2 - 11/2	SCH80S	PLN-THD	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9161413	2
NIPPLE		1/2 - 11/2	SCH80S	THD	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9141413	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	SS,ASTM A182 F316L,MSS SP 95,	NC88J4500	
SWAGE (ECC)		1/2 - 11/2		PE	SS,ASTM A182 F316L,MSS SP 95,	NE88J4500	
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,GAV401,	GAV401	
GATE VALVE		2 - 6	150#	FLG	SS BODY ASTM A351 GR CF3M,GAV410,	GAV410	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,GLV401,	GLV401	
GLOBE VALVE		2 - 6	150#	FLG	SS BODY ASTM A351 GR CF3M,GLV410,	GLV410	
CHECK VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,CHV401,	CHV401	
CHECK VALVE		2 - 12	150#	FLG	SS BODY ASTM A351 GR CF3M,CHV410,	CHV410	
BUTTERFLY VALVE		6 - 18	150#	RF	SS BODY ASTM A351 GR CF3M,BUV410,WAFER TYPE	BUV410	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: D14

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AG,AL,FG	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	1.5 MM(MIN.)	LT CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		8 - 10	SCH 30	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		12 - 14	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP621300	
PIPE		16 - 18	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		20 - 22	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
PIPE		24 - 24	SCH 40	BE	SMLS,ASTM A333 GR.6,ASME B36.10,	PPP611300	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,38mmBORE,200mmLONG	LN3570802	
W.N.FLANGE		1/2 - 24	300#	WN-RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,WELD NECK	WN3570802	
SPACER AND BLIND		14 - 24	300#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.48,	RS352PO02	
SPECL BLIND		1/2 - 12	300#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.48,	SP352PO02	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	300#	RF 125 AARH	ASTM A350 LF2 CL.1,ASME B16.5,	BF3520802	
GASKET							
GASKET		1/2 - 24	300#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30302	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A320 GR.L7/ASTM A194 GR.7,,	SNDA00000	
FITTING (BW)							
BRANCH WELD WITH RP		2 - 24		BW	LT CARBON STEEL,ASME B31.3,	WBE211200	
CAP		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	CP4910900	
ELBOW		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	EL4910900	
REDUCER CONC.		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	RC4910900	
REDUCER ECC.		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	RE4910900	
TEE		2 - 24		BW	ASTM A420 WPL6-SMLS,ASME B16.9,	TE4910900	
WELDOLET		2 - 24		BW	ASTM A350 LF2 CL.1,MSS SP 97,	WL3513300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	CP3530207	W
COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	CN3530207	
ELBOW		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	EL3530207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	HF3530207	
SOCKOLET		1/2 - 24	3000#	SOCW	ASTM A350 LF2 CL.1,MSS SP 97,	SL3533307	
TEE		1/2 - 11/2	3000#	SOCW	ASTM A350 LF2 CL.1,ASME B16.11,	TE3530207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	ASTM A350 LF2 CL.1,ASME B16.11,	CP3540207	T
PLUG		1/2 - 11/2		THD	ASTM A350 LF2 CL.1,ASME B16.11,ROUND HEAD	PG3540200	
THREDOLET		1/2 - 24	3000#	THD	ASTM A350 LF2 CL.1,MSS SP 97,	TL3543307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,ASTM A333 GR.6,ASME B36.10,	NPP651312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,ASTM A333 GR.6,ASME B36.10,NPT	NPP661312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,ASTM A333 GR.6,ASME B36.10,NPT	NPP641312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A420 WPL6-SMLS,MSS SP 95,	NC49J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A420 WPL6-SMLS,MSS SP 95,	NC4964500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A420 WPL6-SMLS,MSS SP 95,	NE49J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A420 WPL6-SMLS,MSS SP 95,	NE4964500	T
VALVES							

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: D14

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AG,AL,FG	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	1.5 MM(MIN.)	LT CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
GATE VALVE		1/2 - 1	800#	SOCW	LTCS BODY ASTM A350 GR LF2,GAV101,	GAV101	
GATE VALVE		11/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,GAV101,	GAV101	W
GATE VALVE		11/2 - 11/2	300#	FLG	LTCS BODY ASTM A352 GR LCB,GAV111,	GAV111	F
GATE VALVE		2 - 24	300#	FLG	LTCS BODY ASTM A352 GR LCB,GAV111,	GAV111	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,GLV101,	GLV101	
GLOBE VALVE		2 - 8	300#	FLG	LTCS BODY ASTM A352 GR LCB,GLV111,	GLV111	
CHECK VALVE		1/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,CHV101,	CHV101	
CHECK VALVE		2 - 24	300#	FLG	LTCS BODY ASTM A352 GR LCB,CHV111,	CHV111	
BALL VALVE		1/2 - 1	800#	SOCW	LTCS BODY ASTM A350 GR LF2,BAV101,	BAV101	
BALL VALVE		11/2 - 11/2	800#	SOCW	LTCS BODY ASTM A350 GR LF2,BAV101,	BAV101	W
BALL VALVE		11/2 - 11/2	300#	FLG	LTCS BODY ASTM A352 GR LCB,BAV111,	BAV111	F
BALL VALVE		2 - 14	300#	FLG	LTCS BODY ASTM A352 GR LCB,BAV111,	BAV111	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: D24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)	
AG,AL,AW,FG,FN,HG,IAH,IAW,NG,NI,PA,PN,VS ETC.	Ref SI	Ref SI

RATING ASME	CORROSION ALLOWANCE	MATERIAL
300# RF	1.5 MM(MIN)	CS

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		8 - 8	SCH 20	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		10 - 12	SCH 30	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		14 - 14	SCH 30	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		16 - 18	SCH XS	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		20 - 20	SCH XS	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		22 - 22	17.48 MM	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		24 - 24	SCH 40	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		26 - 28	17.40 MM	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,38mmBORE,200mmLONG	LN0270802	
W.N.FLANGE		26 - 28	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,WELD NECK	WN0270702	
W.N.FLANGE		1/2 - 24	300#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,WELD NECK	WN0270802	
SPACER AND BLIND		14 - 24	300#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO02	
SPECL BLIND		1/2 - 12	300#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO02	
BLIND FLANGE							
BLIND FLANGE		26 - 28	300#	RF 125 AARH	CS ASTM A105,ASME B16.47 SR.B,	BF0220702	
BLIND FLANGE		1/2 - 24	300#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220802	
GASKET							
GASKET		1/2 - 24	300#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30302	
GASKET		26 - 28	300#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20/B16.47 SR.B,	GSQN3QJ02	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
DRIP RING							
DRIP RING		3 - 3	300#	RF 125 AARH	CS ASTM A105,PDIL-PDS-600,	DR022QK02	
FITTING (BW)							
BRANCH WELD		2 - 28		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 28		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 28		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		2 - 28		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
REDUCER CONC.		2 - 28		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER ECC.		2 - 28		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
TEE		2 - 28		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
WELDOLET		2 - 28		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	HF0230207	
SOCKOLET		1/2 - 28	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 28	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: D24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AG,AL,AW,FG,FN,HG,IAH,IAW,NG,NI,PA,PN,VS ETC.	Ref SI	Ref SI			
RATING ASME 300# RF	CORROSION ALLOWANCE 1.5 MM(MIN)	MATERIAL CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,API 5L GR.B,ASME B36.10,	NPA151312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA161312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA141312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NC7364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NE7364500	T
VALVES							
GATE VALVE		2 - 24	300#	FLG	CS BODY ASTM A216 GR WCB,GAV211,	GAV211	
GATE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 12	300#	FLG	CS BODY ASTM A216 GR WCB,GLV211,	GLV211	
CHECK VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,CHV201,	CHV201	
CHECK VALVE		2 - 24	300#	FLG	CS BODY ASTM A216 GR WCB,CHV211,	CHV211	
BALL VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,BAV202,	BAV202	
BALL VALVE		2 - 6	300#	FLG	CS BODY ASTM A216 GR WCB,BAV211,	BAV211	
BALL VALVE		8 - 24	300#	FLG	CS BODY ASTM A216 GR WCB,BAV221,	BAV221	
BUTTERFLY VALVE		3 - 24	300#	RF	CS BODY ASTM A216 GR WCB,BUV202,WAFER TYPE	BUV202	
PLUG VALVE		1/2 - 1	600#	THRD	CS BODY ASTM A105,PLV201,	PLV201	
PLUG VALVE		11/2 - 6	300#	FLG	CS BODY ASTM A216 GR WCB,PLV205,	PLV205	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: D50

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AW,PH,PC,AF,DM,MD,IA	Ref Sl	Ref Sl			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	NONE	SS 304			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		14 - 14	SCHSTD	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.10,	PPZ111300	
PIPE		16 - 18	SCH XS	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		20 - 20	SCH XS	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		24 - 24	SCH 40	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		26 - 28	17.48 MM	BE	EFW,ASTM A358 GR.TP304 CL.1,ASME B36.10,	PPW911300	
PIPE		1/2 - 3/4	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		1 - 11/4	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		11/2 - 11/2	SCH40S	PE	SMLS,ASTM A312 TP304,ASME B36.19,	PPPE21400	
PIPE		2 - 4	SCH10S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		6 - 8	SCH40S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
PIPE		10 - 12	SCH40S	BE	EFW,STR.WELD,ASTM A312 TP304,ASME B36.19,	PPZ111400	
FLANGE							
W.N.FLANGE		26 - 28	300#	WN-RF 125 AARH	ASTM A182 F304,ASME B16.47 SR.B,WELD NECK	WN0670702	
W.N.FLANGE		1/2 - 24	300#	WN-RF 125 AARH	ASTM A182 F304,ASME B16.5,WELD NECK	WN0670802	
SPACER AND BLIND		14 - 28	300#	RF 125 AARH	ASTM A182 F304,ASME B16.48,	RS062PO02	
SPECL BLIND		1/2 - 12	300#	RF 125 AARH	ASTM A182 F304,ASME B16.48,	SP062PO02	
BLIND FLANGE							
BLIND FLANGE		26 - 28	300#	RF 125 AARH	ASTM A182 F304,ASME B16.47 SR.B,	BF0620702	
BLIND FLANGE		1/2 - 28	300#	RF 125 AARH	ASTM A182 F304,ASME B16.5,	BF0620802	
GASKET							
GASKET		1/2 - 24	300#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20,	GSQL30302	
GASKET		26 - 28	300#	SPRL-WND RF	TP304 SS WDG; GPH FLR; TP304 SS INR RNG/ OTR RNG,ASME B16.20/B16.47 SR.B,	GSQL3QJ02	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B8T CL.2/ASTM A194 GR.8TA,,	SNQG00000	
DRIP RING							
DRIP RING		3 - 12	300#	RF 125 AARH	ASTM A182 F304,PDIL-PDS-600,	DR062QK02	
FITTING (BW)							
BRANCH WELD		2 - 28		BW	STAINLESS STEEL,ASME B31.3,	RWOK11200	
BRANCH WELD WITH RP		2 - 28		BW	STAINLESS STEEL,ASME B31.3,	WBOK11200	
CAP		2 - 24		BW	ASTM A403 WP304-SMLS,ASME B16.9,	CP7410900	
ELBOW		2 - 28		BW	ASTM A403 WP304-WLDD,ASME B16.9,	ELZ410900	L
ELBOW		2 - 28	19.05 MM	BW	ASTM A403 WP304-WLDD,PDIL-PDS-600,R=3D	ELZ41QK60	3
REDUCER CONC.		2 - 28		BW	ASTM A403 WP304-WLDD,ASME B16.9,	RCZ410900	
REDUCER ECC.		2 - 28		BW	ASTM A403 WP304-WLDD,ASME B16.9,	REZ410900	
TEE		2 - 28		BW	ASTM A403 WP304-WLDD,ASME B16.9,	TEZ410900	
WELDOLET		2 - 28		BW	ASTM A182 F304,MSS SP 97,	WL0613300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	CP0630207	W
COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	CN0630207	
ELBOW		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	EL0630207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	HF0630207	
SOCKOLET		1/2 - 28	3000#	SOCW	ASTM A182 F304,MSS SP 97,	SL0633307	
TEE		1/2 - 11/2	3000#	SOCW	ASTM A182 F304,ASME B16.11,	TE0630207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	ASTM A182 F304,ASME B16.11,	CP0640207	T
PLUG		1/2 - 11/2		THD	ASTM A182 F304,ASME B16.11,ROUND HEAD	PG0640200	
THREDOLET		1/2 - 28	3000#	THD	ASTM A182 F304,MSS SP 97,	TL0643307	
NIPPLE							

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: D50

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AW,PH,PC,AF,DM,MD,IA	Ref Sl	Ref Sl			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	NONE	SS 304			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
NIPPLE		1/2 - 11/2	SCH80S	PLN-PLN	SMLS,ASTM A312 TP304,ASME B36.19,	NPPE51413	1
NIPPLE		1/2 - 11/2	SCH80S	PLN-THD	SMLS,ASTM A312 TP304,ASME B36.19,NPT	NPPE61413	2
NIPPLE		1/2 - 11/2	SCH80S	THD	SMLS,ASTM A312 TP304,ASME B36.19,NPT	NPPE41413	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A403 WP304-SMLS,MSS SP 95,	NC74J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304-SMLS,MSS SP 95,	NC7464500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A403 WP304-SMLS,MSS SP 95,	NE74J4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A403 WP304-SMLS,MSS SP 95,	NE7464500	T
VALVES							
GATE VALVE		1/2 - 1	800#	SOCW	SS BODY ASTM A182 GR F304,GAV501,	GAV501	
GATE VALVE		11/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GAV501,	GAV501	W
GATE VALVE		11/2 - 11/2	300#	FLG	SS BODY ASTM A351 GR CF8M,GAV511,	GAV511	F
GATE VALVE		2 - 24	300#	FLG	SS BODY ASTM A351 GR CF8M,GAV511,	GAV511	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,GLV501,	GLV501	
GLOBE VALVE		2 - 12	300#	FLG	SS BODY ASTM A351 GR CF8M,GLV511,	GLV511	
CHECK VALVE		1/2 - 11/2	800#	SOCW	SS BODY ASTM A182 GR F304,CHV501,	CHV501	
CHECK VALVE		2 - 24	300#	FLG	SS BODY ASTM A351 GR CF8M,CHV511,	CHV511	
BALL VALVE		1/2 - 11/2	800#	THRD	SS BODY AISI 316,BAV501,	BAV501	
BALL VALVE		8 - 24	300#	FLG	SS BODY ASTM A351 GR CF8M,BAV521,	BAV521	
PLUG VALVE		1/2 - 1	600#	THRD	SS BODY AISI 316,PLV501,	PLV501	
PLUG VALVE		11/2 - 6	300#	FLG	SS BODY ASTM A351 GR CF8M,PLV511,	PLV511	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:2

Class: D52

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
UL	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	NONE	SS 316L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH40S	PE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9121400	
PIPE		1 - 11/2	SCH40S	PE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9121400	
PIPE		2 - 3	SCH10S	BE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9111400	
PIPE		4 - 6	SCH10S	BE	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	PP9111400	
PIPE		8 - 10	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
PIPE		12 - 14	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
PIPE		16 - 18	SCH10S	BE	SS,EFW,ASTM A358 TP316L CL.1,ASME B36.19,	PP9211400	
FLANGE							
FLANGE		1/2 - 11/2	300#	SW-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,SOCKET WELD	FL88L0802	
W.N.FLANGE		2 - 18	300#	WN-RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,WELD NECK	WN8870802	
SPACER AND BLIND		18 - 18	300#	RF 125 AARH	ASTM A240 TP316L,ASME B16.48,	RS932PO02	
SPECL BLIND		1/2 - 16	300#	RF 125 AARH	ASTM A240 TP316L,ASME B16.48,	SP932PO02	
BLIND FLANGE							
BLIND FLANGE		1/2 - 18	300#	RF 125 AARH	SS,ASTM A182 F316L,ASME B16.5,	BF8820802	
GASKET							
GASKET		1/2 - 18	300#	SPRL-WND RF	GASKET,TP316L SS WDG;GPH FLR;TP316L SS INR RNG/ OTR RNG,ASME B16.20,	GS0830302	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
CAP		2 - 18		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	CP8910900	
ELBOW		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	EL8910900	
ELBOW		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	EL9010900	
REDUCER CONC.		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	RC8910900	
REDUCER CONC.		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	RC9010900	
REDUCER ECC.		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	RE8910900	
REDUCER ECC.		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	RE9010900	
TEE		2 - 6		BW	SS,ASTM A403 WP316L-SMLS,ASME B16.9,	TE8910900	
TEE		8 - 18		BW	SS,ASTM A403 WP316L-WLDD,ASME B16.9,	TE9010900	
WELDOLET		2 - 18		BW	SS,ASTM A182 F316L,MSS SP 97,	WL8813300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	CP8830207	
COUPLING		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	CN8830207	W
ELBOW		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	EL8830207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	HF8830207	W
SOCKOLET		1/2 - 18	3000#	SOCW	SS,ASTM A182 F316L,MSS SP 97,	SL8833307	
TEE		1/2 - 21/2	3000#	SOCW	SS,ASTM A182 F316L,ASME B16.11,	TE8830207	
FITTING (THD)							
COUPLING		1/2 - 11/2	3000#	THD	SS,ASTM A182 F316L,ASME B16.11,	CN8840207	T
ELBOLET		1/2 - 18	3000#	THD	SS,ASTM A182 F316L,MSS SP 97,	ET8843307	
HALF COUPLING		1/2 - 11/2	3000#	THD	SS,ASTM A182 F316L,ASME B16.11,	HF8840207	T
PLUG		1/2 - 11/2		THD	SS,ASTM A182 F316L,ASME B16.11,ROUND HEAD	PG8840200	
THREDOLET		1/2 - 18	3000#	THD	SS,ASTM A182 F316L,MSS SP 97,	TL8843307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH80S	PLN-PLN	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9151413	1
NIPPLE		1/2 - 11/2	SCH80S	PLN-THD	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9161413	2
NIPPLE		1/2 - 11/2	SCH80S	THD	SS,SMLS,ASTM A312 TP316L,ASME B36.19,	NP9141413	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	SS,ASTM A182 F316L,MSS SP 95,	NC88J4500	
SWAGE (ECC)		1/2 - 11/2		PE	SS,ASTM A182 F316L,MSS SP 95,	NE88J4500	

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:2

Class: D52

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
UL	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
300# RF	NONE	SS 316L			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
VALVES							
GATE VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,GAV401,	GAV401	
GATE VALVE		2 - 6	300#	FLG	SS BODY ASTM A351 GR CF3M,GAV411,	GAV411	
GLOBE VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,GLV401,	GLV401	
GLOBE VALVE		2 - 6	300#	FLG	SS BODY ASTM A351 GR CF3M,GLV411,	GLV411	
CHECK VALVE		1/2 - 11/2	800#	SOCW	SS BODY AISI 316L,CHV401,	CHV401	
CHECK VALVE		2 - 12	300#	FLG	SS BODY ASTM A351 GR CF3M,CHV411,	CHV411	
BUTTERFLY VALVE		6 - 18	300#	RF	SS BODY ASTM A351 GR CF3M,BUV411,WAFER TYPE	BUV411	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: F24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AW,HG,PA,PC,PN,SG	Ref Sl	Ref Sl			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
600# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 3	SCH 40	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		4 - 5	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		6 - 8	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		10 - 12	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		14 - 16	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		18 - 20	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		22 - 24	SCH 80	BE	SMLS,API 5L GR.B,ASME B36.10,	PPA111300	
PIPE		1/2 - 3/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		1 - 11/4	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
PIPE		11/2 - 11/2	SCH 80	PE	SMLS,API 5L GR.B,ASME B36.10,	PPA121300	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	600#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,38mmBORE,200mmLONG	LN0270803	
W.N.FLANGE		1/2 - 24	600#	WN-RF 125 AARH	CS ASTM A105,ASME B16.5,WELD NECK	WN0270803	
SPACER AND BLIND		10 - 24	600#	RF 125 AARH	CS ASTM A105,ASME B16.48,	RS022PO03	
SPECL BLIND		1/2 - 8	600#	RF 125 AARH	CS ASTM A105,ASME B16.48,	SP022PO03	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	600#	RF 125 AARH	CS ASTM A105,ASME B16.5,	BF0220803	
GASKET							
GASKET		1/2 - 24	600#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30303	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 24		BW	CARBON STEEL,ASME B31.3,	RWOJ11200	
BRANCH WELD WITH RP		2 - 24		BW	CARBON STEEL,ASME B31.3,	WBOJ11200	
CAP		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	CP7310900	
ELBOW		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	EL7310900	
REDUCER CONC.		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RC7310900	
REDUCER ECC.		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	RE7310900	
TEE		2 - 24		BW	ASTM A234 WPB-SMLS,ASME B16.9,	TE7310900	
WELDOLET		2 - 24		BW	CS ASTM A105,MSS SP 97,	WL0213300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CP0230207	W
COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	CN0230207	
ELBOW		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	EL0230207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	HF0230207	
SOCKOLET		1/2 - 24	3000#	SOCW	CS ASTM A105,MSS SP 97,	SL0233307	
TEE		1/2 - 11/2	3000#	SOCW	CS ASTM A105,ASME B16.11,	TE0230207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD	CS ASTM A105,ASME B16.11,	CP0240207	T
PLUG		1/2 - 11/2		THD	CS ASTM A105,ASME B16.11,ROUND HEAD	PG0240200	
THREDOLET		1/2 - 24	3000#	THD	CS ASTM A105,MSS SP 97,	TL0243307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN	SMLS,API 5L GR.B,ASME B36.10,	NPA151312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA161312	2
NIPPLE		1/2 - 11/2	SCH160	THD	SMLS,API 5L GR.B,ASME B36.10,NPT	NPA141312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NC73J4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NC7364500	T
SWAGE (ECC)		1/2 - 11/2		PE	ASTM A234 WPB-SMLS,MSS SP 95,	NE73J4500	P

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: F24

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
AW,HG,PA,PC,PN,SG	Ref Sl	Ref Sl			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
600# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
SWAGE (ECC)		1/2 - 11/2		PLN-THD	ASTM A234 WPB-SMLS,MSS SP 95,	NE7364500	T
VALVES							
GATE VALVE		11/2 - 11/2	600#	FLG	CS BODY ASTM A216 GR WCB,GAV212,	GAV212	F
GATE VALVE		2 - 24	600#	FLG	CS BODY ASTM A216 GR WCB,GAV212,	GAV212	
GATE VALVE		1/2 - 1	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	
GATE VALVE		11/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GAV201,	GAV201	W
GLOBE VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,GLV201,	GLV201	
GLOBE VALVE		2 - 8	600#	FLG	CS BODY ASTM A216 GR WCB,GLV212,	GLV212	
CHECK VALVE		1/2 - 11/2	800#	SOCW	CS BODY ASTM A105,CHV201,	CHV201	
CHECK VALVE		2 - 16	600#	FLG	CS BODY ASTM A216 GR WCB,CHV212,	CHV212	
BALL VALVE		4 - 24	600#	FLG	CS BODY ASTM A216 GR WCB,BAV222,	BAV222	
NEEDLE VALVE		1/2 - 1/2	800#	SOCW	SS BODY ASTM A182 GR F316,NEV501,	NEV501	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: F24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
BB,BF,SM,SC (IBR)	Ref SI	Ref SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
600# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		2 - 6	SCH 40	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		8 - 10	SCH 60	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		12 - 14	SCH 60	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		16 - 18	SCH 60	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		20 - 22	SCH 60	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		24 - 24	SCH 60	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		1/2 - 3/4	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		1 - 11/4	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		11/2 - 11/2	SCH 80	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	600#	WN-RF 125 AARH IBR	CS ASTM A105,ASME B16.5,38mmBORE,200mmLONG	LN02G0803	
W.N.FLANGE		1/2 - 24	600#	WN-RF 125 AARH IBR	CS ASTM A105,ASME B16.5,WELD NECK	WN02G0803	D
W.N.FLANGE		1/2 - 24	600#	WN-RJ IBR	CS ASTM A105,ASME B16.5,WELD NECK	WN02W0803	R
SPACER AND BLIND		10 - 24	600#	RF 125 AARH IBR	CS ASTM A105,ASME B16.48,	RS02BPO03	
SPECL BLIND		1/2 - 8	600#	RF 125 AARH IBR	CS ASTM A105,ASME B16.48,	SP02BPO03	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	600#	RF 125 AARH IBR	CS ASTM A105,ASME B16.5,	BF02B0803	
GASKET							
GASKET		1/2 - 24	600#	SPRL-WND RF	TP304 SS WDG;GPH FLR;TP304 SS INR RNG;CS OTR RNG,ASME B16.20,	GSQN30303	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 24		BW IBR	CARBON STEEL,ASME B31.3,	RWOJA1200	
BRANCH WELD WITH RP		2 - 24		BW IBR	CARBON STEEL,ASME B31.3,	WBOJA1200	
CAP		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	CP73A0900	
ELBOW		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	EL73A0900	
REDUCER CONC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RC73A0900	
REDUCER ECC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RE73A0900	
TEE		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	TE73A0900	
WELDOLET		2 - 24		BW IBR	CS ASTM A105,MSS SP 97,	WL02A3300	
FITTING (SW)							
CAP		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CP02C0207	W
COUPLING		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CN02C0207	
ELBOW		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	EL02C0207	
HALF COUPLING		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	HF02C0207	
SOCKOLET		1/2 - 24	3000#	SOCW IBR	CS ASTM A105,MSS SP 97,	SL02C3307	
TEE		1/2 - 11/2	3000#	SOCW IBR	CS ASTM A105,ASME B16.11,	TE02C0207	
FITTING (THD)							
CAP		1/2 - 11/2	3000#	THD IBR	CS ASTM A105,ASME B16.11,	CP02D0207	T
PLUG		1/2 - 11/2		THD IBR	CS ASTM A105,ASME B16.11,ROUND HEAD	PG02D0200	
THREDOLET		1/2 - 24	3000#	THD IBR	CS ASTM A105,MSS SP 97,	TL02D3307	
NIPPLE							
NIPPLE		1/2 - 11/2	SCH160	PLN-PLN IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	NP03E1312	1
NIPPLE		1/2 - 11/2	SCH160	PLN-THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03F1312	2
NIPPLE		1/2 - 11/2	SCH160	THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03D1312	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73Q4500	P

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: F24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
BB,BF,SM,SC (IBR)	Ref SI	Ref SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
600# RF	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
SWAGE (CONC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73F4500	T
SWAGE (ECC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73Q4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73F4500	T
VALVES							
GATE VALVE		1/2 - 1	800#	SOCW IBR	CS BODY ASTM A105,GAV202S,	GAV202S	
GATE VALVE		11/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,GAV202S,	GAV202S	W
GATE VALVE		11/2 - 11/2	600#	FLG IBR	CS BODY ASTM A216 GR WCB,GAV212S,	GAV212S	F
GATE VALVE		2 - 24	600#	FLG IBR	CS BODY ASTM A216 GR WCB,GAV212S,	GAV212S	
GLOBE VALVE		1/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,GLV201S,	GLV201S	
GLOBE VALVE		2 - 12	600#	FLG IBR	CS BODY ASTM A216 GR WCB,GLV212S,	GLV212S	
CHECK VALVE		1/2 - 11/2	800#	SOCW IBR	CS BODY ASTM A105,CHV201S,	CHV201S	
CHECK VALVE		2 - 16	600#	FLG IBR	CS BODY ASTM A216 GR WCB,CHV212S,	CHV212S	
NEEDLE VALVE		1/2 - 1/2	800#	SOCW IBR	SS BODY ASTM A182 GR F316,NEV501S,	NEV501S	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: H24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
BB,BF,HS,SC (IBR)	Ref SI	Ref SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
1500# RJ	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCH160	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		1 - 11/4	SCH160	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		11/2 - 11/2	SCH160	PE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03B1300	
PIPE		2 - 3	SCH160	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		4 - 5	SCH120	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		6 - 8	SCH120	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		10 - 12	SCH140	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		14 - 16	SCH140	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		18 - 20	SCH140	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
PIPE		22 - 24	SCH140	BE IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	PP03A1300	
FLANGE							
LONG W.N.FLANGE		11/2 - 11/2	1500#	WN-RJ IBR	CS ASTM A105,ASME B16.5,38mmBORE,200mmLONG	LN02W0805	
W.N.FLANGE		1/2 - 24	1500#	WN-RJ IBR	CS ASTM A105,ASME B16.5,WELD NECK	WN02W0805	
SPACER AND BLIND		8 - 24	1500#	WN-RJ IBR	CS ASTM A105,ASME B16.48,	RS02WPO05	
SPECL BLIND		1/2 - 6	1500#	WN-RJ IBR	CS ASTM A105,ASME B16.48,	SP02WPO05	
BLIND FLANGE							
BLIND FLANGE		1/2 - 24	1500#	WN-RJ IBR	CS ASTM A105,ASME B16.5,	BF02W0805	
GASKET							
GASKET		1/2 - 24	1500#	RJ OCT	SOFT IRON,ASME B16.20,	GS7940305	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B7/ASTM A194 GR.2H,,	SNDE00000	
FITTING (BW)							
BRANCH WELD		2 - 24		BW IBR	CARBON STEEL,ASME B31.3,	RWOJA1200	
BRANCH WELD WITH RP		2 - 24		BW IBR	CARBON STEEL,ASME B31.3,	WBOJA1200	
CAP		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	CP73A0900	
ELBOW		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	EL73A0900	
REDUCER CONC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RC73A0900	
REDUCER ECC.		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	RE73A0900	
TEE		2 - 24		BW IBR	ASTM A234 WPB-SMLS,ASME B16.9,	TE73A0900	
WELDOLET		2 - 24		BW IBR	CS ASTM A105,MSS SP 97,	WL02A3300	
FITTING (SW)							
CAP		1/2 - 11/2	6000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CP02C0208	W
COUPLING		1/2 - 11/2	6000#	SOCW IBR	CS ASTM A105,ASME B16.11,	CN02C0208	
ELBOW		1/2 - 11/2	6000#	SOCW IBR	CS ASTM A105,ASME B16.11,	EL02C0208	
HALF COUPLING		1/2 - 11/2	6000#	SOCW IBR	CS ASTM A105,ASME B16.11,	HF02C0208	
SOCKOLET		1/2 - 24	6000#	SOCW IBR	CS ASTM A105,MSS SP 97,	SL02C3308	
TEE		1/2 - 11/2	6000#	SOCW IBR	CS ASTM A105,ASME B16.11,	TE02C0208	
FITTING (THD)							
CAP		1/2 - 11/2	6000#	THD IBR	CS ASTM A105,ASME B16.11,	CP02D0208	T
PLUG		1/2 - 11/2		THD IBR	CS ASTM A105,ASME B16.11,ROUND HEAD	PG02D0200	
THREDOLET		1/2 - 11/2	6000#	THD IBR	CS ASTM A105,MSS SP 97,	TL02D3308	
NIPPLE							
NIPPLE		1/2 - 11/2	SCHXXS	PLN-PLN IBR	SMLS,ASTM A106 GR.B,ASME B36.10,	NP03E1314	1
NIPPLE		1/2 - 11/2	SCHXXS	PLN-THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03F1314	2
NIPPLE		1/2 - 11/2	SCHXXS	THD IBR	SMLS,ASTM A106 GR.B,ASME B36.10,NPT	NP03D1314	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73Q4500	P
SWAGE (CONC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NC73F4500	T
SWAGE (ECC)		1/2 - 11/2		PE IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73Q4500	P

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:0

Class: H24S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
BB,BF,HS,SC (IBR)	Ref Sl	Ref Sl			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
1500# RJ	1.5 MM(MIN.)	CS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
SWAGE (ECC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WPB-SMLS,MSS SP 95,	NE73F4500	T
VALVES							
GATE VALVE		1/2 - 1	1500#	SOCW IBR	CS BODY ASTM A105,GAV204S,	GAV204S	
GATE VALVE		11/2 - 24	1500#	BW IBR	CS BODY ASTM A216 GR WCB,GAV216S,	GAV216S	
GLOBE VALVE		1/2 - 1	1500#	SOCW IBR	CS BODY ASTM A105,GLV204S,	GLV204S	
GLOBE VALVE		11/2 - 8	1500#	BW IBR	CS BODY ASTM A216 GR WCB,GLV216S,	GLV216S	
CHECK VALVE		1/2 - 1	1500#	SOCW IBR	CS BODY ASTM A105,CHV204S,	CHV204S	
CHECK VALVE		11/2 - 24	1500#	BW IBR	CS BODY ASTM A216 GR WCB,CHV216S,	CHV216S	
NEEDLE VALVE		1/2 - 1/2	1500#	SOCW IBR	SS BODY ASTM A182 GR F316,NEV502S,	NEV502S	

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PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: J36S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
SH,SC (IBR)	Ref.SI	Ref.SI			
RATING ASME 2500#RJ	CORROSION ALLOWANCE 1.5 MM(MIN.)	MATERIAL AS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
PIPE							
PIPE		1/2 - 3/4	SCHXXS	PE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34B1300	
PIPE		1 - 11/4	SCHXXS	PE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34B1300	
PIPE		11/2 - 11/2	SCHXXS	PE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34B1300	
PIPE		2 - 4	SCHXXS	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		6 - 6	24.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		8 - 8	30.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		10 - 10	38.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		12 - 12	44.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		14 - 14	48.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		16 - 16	55.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		18 - 18	62.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
PIPE		20 - 20	68.00 MM	BE IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	PP34A1300	
FLANGE							
LONG W.N.FLANGE		1/2 - 11/2	2500#	WN-RJ IBR	ASTM A182 F22,ASME B16.5,LONG WELD NECK	LN05W0806	
W.N.FLANGE		1/2 - 12	2500#	WN-RJ IBR	ASTM A182 F22,ASME B16.5,WELD NECK	WN05W0806	
SPACER AND BLIND		6 - 12	2500#	WN-RJ IBR	ASTM A182 F22,ASME B16.48,	RS05WPO06	
SPECL BLIND		1 - 4	2500#	WN-RJ IBR	ASTM A182 F22,ASME B16.48,	SP05WPO06	
BLIND FLANGE							
BLIND FLANGE		1/2 - 12	2500#	WN-RJ IBR	ASTM A182 F22,ASME B16.5,	BF05W0806	
GASKET							
GASKET		1/2 - 12	2500#	RJ OCT	ASTM A182 F5,ASME B16.20,	GSB340306	
STUD & NUTS							
STUD & 2NUTS HVY HEX		-			ASTM A193 GR.B16/ASTM A194 GR.7,,	SNB100000	
FITTING (BW)							
BRANCH WELD		2 - 20		BW IBR	ALLOY STEEL,ASME B31.3,	RWE3A1200	
BRANCH WELD WITH RP		2 - 20		BW IBR	ALLOY STEEL,ASME B31.3,	WBE3A1200	
CAP		2 - 20		BW IBR	ASTM A234 WP22,ASME B16.9,	CPD2A0900	
ELBOW		2 - 20		BW IBR	ASTM A234 WP22,ASME B16.9,	ELD2A0900	
REDUCER CONC.		2 - 20		BW IBR	ASTM A234 WP22,ASME B16.9,	RCD2A0900	
REDUCER ECC.		2 - 20		BW IBR	ASTM A234 WP22,ASME B16.9,	RED2A0900	
TEE		2 - 20		BW IBR	ASTM A234 WP22,ASME B16.9,	TED2A0900	
WELDOLET		2 - 20		BW IBR	ASTM A182 F22,MSS SP 97,	WL05A3300	
FITTING (SW)							
CAP		1/2 - 11/2	9000#	SOCW IBR	ASTM A182 F22,ASME B16.11,	CP05C0209	W
COUPLING		1/2 - 11/2	9000#	SOCW IBR	ASTM A182 F22,ASME B16.11,	CN05C0209	
ELBOW		1/2 - 11/2	9000#	SOCW IBR	ASTM A182 F22,ASME B16.11,	EL05C0209	
HALF COUPLING		1/2 - 11/2	9000#	SOCW IBR	ASTM A182 F22,ASME B16.11,	HF05C0209	
SOCKOLET		1/2 - 20	6000#	SOCW IBR	ASTM A182 F22,MSS SP 97,	SL05C3308	
TEE		1/2 - 11/2	9000#	SOCW IBR	ASTM A182 F22,ASME B16.11,	TE05C0209	
FITTING (THD)							
CAP		1/2 - 11/2	6000#	THD IBR	ASTM A182 F22,ASME B16.11,	CP05D0208	T
PLUG		1/2 - 11/2		THD IBR	ASTM A182 F22,ASME B16.11,ROUND HEAD	PG05D0200	
THREDOLET		1/2 - 20	6000#	THD IBR	ASTM A182 F22,MSS SP 97,	TL05D3308	
NIPPLE							
NIPPLE		1/2 - 11/2	SCHXXS	PLN-PLN IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,	NP34E1314	1
NIPPLE		1/2 - 11/2	SCHXXS	PLN-THD IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,NPT	NP34F1314	2
NIPPLE		1/2 - 11/2	SCHXXS	THD IBR	SMLS,ASTM A335 GR.P22,ASME B36.10,NPT	NP34D1314	3
SWAGE NIPPLE							
SWAGE (CONC)		1/2 - 11/2		PE IBR	ASTM A234 WP22,MSS SP 95,	NCD2Q4500	P

PIPING MATERIAL SPECIFICATION

CLIENT : M/S..TFL
PROJECT : AMMONIA/UREA COAL BASED FERTILIZER PROJECT.
LOCATION : TALCHER,ODISHA

Project .:TFL
DOC. No.TFL-PDS-600
Rev.:1

Class: J36S

PROJECTS AND DEVELOPMENT INDIA LIMITED

SERVICE	TEMPERATURE LIMITS (Deg.C)				
SH,SC (IBR)	Ref.SI	Ref.SI			
RATING ASME	CORROSION ALLOWANCE	MATERIAL			
2500#RJ	1.5 MM(MIN.)	AS			

ITEM	NOTES	SIZE (NPS)	SCH/ RAT	END	DESCRIPTION	COMM CODE	SPCL REV
SWAGE (CONC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WP22,MSS SP 95,	NCD2F4500	T
SWAGE (ECC)		1/2 - 11/2		PE IBR	ASTM A234 WP22,MSS SP 95,	NED2Q4500	P
SWAGE (ECC)		1/2 - 11/2		PLN-THD IBR	ASTM A234 WP22,MSS SP 95,	NED2F4500	T
VALVES							
GATE VALVE		1/2 - 1	2500#	SOCW IBR	CR-MO BODY ASTM A182 GR F22,GAV305S,	GAV305S	
GATE VALVE		11/2 - 11/2	2500#	SOCW IBR	CR-MO BODY ASTM A182 GR F22,GAV305S,	GAV305S	W
GATE VALVE		11/2 - 11/2	2500#	BW IBR	CR-MO BODY ASTM A217 GR WC9,GAV326S,	GAV326S	B
GATE VALVE		2 - 16	2500#	BW IBR	CR-MO BODY ASTM A217 GR WC9,GAV326S,	GAV326S	
GLOBE VALVE		1/2 - 11/2	2500#	SOCW IBR	CR-MO BODY ASTM A182 GR F22,GLV305S,	GLV305S	
GLOBE VALVE		2 - 8	2500#	BW IBR	CR-MO BODY ASTM A217 GR WC9,GLV326S,	GLV326S	
CHECK VALVE		1/2 - 11/2	2500#	SOCW IBR	CR-MO BODY ASTM A182 GR F22,CHV305S,	CHV305S	
CHECK VALVE		2 - 18	2500#	BW IBR	CR-MO BODY ASTM A217 GR WC9,CHV326S,	CHV326S	
NEEDLE VALVE		1/2 - 1/2	2500#	SOCW IBR	SS BODY ASTM A182 GR F316,NEV503S,	NEV503S	

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	PROJECTS & DEVELOPMENT INDIA LTD	TFL-PDS-600	1
		DOCUMENT NO	REV

BRANCH TABLE : TABLE-A1
APPLICABLE PIPING MATERIAL SPECIFICATIONS:B14,D14,B20,B22IS,B24,D24,B24S, B24Z
PRESSURE RATING <= 300#

<-----------------------B R A N C H S I Z E--------------------------->

	M	3Q	1	1Q	1M	2	2M	3	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58
M	T																																			
3Q	E	T																																		
1	E	E	T																																	
1Q																																				
1M	E	E	E		T																															
2	S	S	S		E	T																														
2M	S	S	S		E	E	T																													
3	S	S	S		E	E	E	T																												
4	S	S	S		S	E	E	E	T																											
6	S	S	S		S	W	W	E	E	T																										
8	S	S	S		S	W	W	W	E	E	T																									
10	S	S	S		S	W	W	W	W	E	E	T																								
12	S	S	S		S	W	W	W	W	W	E	E	T																							
14	S	S	S		S	W	W	W	W	W	W	E	E	T																						
16	S	S	S		S	W	W	W	W	W	W	P	E	E	T																					
18	S	S	S		S	W	W	W	W	W	W	P	P	E	E	T																				
20	S	S	S		S	W	W	W	W	W	W	P	P	P	E	E	T																			
22	S	S	S		S	W	W	W	W	W	W	P	P	P	P	E	E	T																		
24	S	S	S		S	W	W	W	W	W	W	P	P	P	P	P	E	E	T																	
26	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T																
28	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T															
30	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T														
32	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T													
34	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T												
36	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T											
38	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T										
40	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T									
42	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T								
44	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T							
46	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T						
48	S	S	S		S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T					
50																																				
52																																				
54																																				
56																																				
58																																				
A-																																				

E TE REDUCING TEE
P WB BRANCH WELD WITH RP
S SL SOCKOLET
T TE EQUAL TEE
W WL WELDOLET

BRANCH TABLE: TABLE-A2
APPLICABLE PIPING MATERIAL SPECIFICATIONS: B40,B50,B52,D50,D52 .
PRESSURE RATING <=300#

	<----------B R A N C H S I Z E---------->																															
	3	1	1	2			1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	
	M	Q	1	Q	M	2	M	3	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	6	8	
M	T																															
3Q	E	T																														
1	E	E	T																													
1Q																																
1M	E	E	E		T																											
2	S	S	S		E	T																										
2M																																
3	S	S	S		E	E		T																								
4	S	S	S		S	E		E	T																							
6	S	S	S		S	P		E	E	T																						
8	S	S	S		S	P		P	E	E	T																					
10	S	S	S		S	P		P	P	E	E	T																				
12	S	S	S		S	P		P	P	P	E	E	T																			
14	S	S	S		S	P		P	P	P	P	E	E	T																		
16	S	S	S		S	P		P	P	P	P	P	E	E	T																	
18	S	S	S		S	P		P	P	P	P	P	P	E	E	T																
20	S	S	S		S	P		P	P	P	P	P	P	P	E	E	T															
22	S	S	S		S	P		P	P	P	P	P	P	P	P	E	E	T														
24	S	S	S		S	P		P	P	P	P	P	P	P	P	P	E	E	T													
26	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	E	E	T												
28	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	E	E	T											
30	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	E	E	T										
32	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T									
34	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T								
36	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T							
38	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T						
40	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T					
42	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T				
44	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T			
46	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T		
48	S	S	S		S	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	E	T	
50																																
52																																
54																																
56																																
58																																
A-																																

E TE REDUCING TEE
P WB BRANCH WELD WITH RP
S SL SOCKOLET
T TE EQUAL TEE

BRANCH TABLE : TABLE-A3
APPLICABLE PIPING MATERIAL
SPECIFICATIONS:**F24,F24S,H24S,J36S**

<----------------------**B R A N C H S I Z E**-------------------------->

	M	3Q	1	1Q	1M	2	2M	3	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58
M	T																																		
3Q	E	T																																	
1	E	E	T																																
1Q																																			
1M	E	E	E		T																														
2	S	S	S		E	T																													
2M																																			
3	S	S	S		E	E		T																											
4	S	S	S		S	E		E	T																										
6	S	S	S		S	W		E	E	T																									
8	S	S	S		S	W		W	E	E	T																								
10	S	S	S		S	W		W	W	E	E	T																							
12	S	S	S		S	W		W	W	W	E	E	T																						
14	S	S	S		S	W		W	W	W	W	E	E	T																					
16	S	S	S		S	W		W	W	W	W	W	E	E	T																				
18	S	S	S		S	W		W	W	W	W	W	W	E	E	T																			
20	S	S	S		S	W		W	W	W	W	W	W	W	E	E	T																		
22	S	S	S		S	W		W	W	W	W	W	W	W	W	E	E	T																	
24	S	S	S		S	W		W	W	W	W	W	W	W	W	W	E	E	T																
26	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	E	E	T															
28	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	W	E	E	T														
30	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	W	W	E	E	T													
32	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	W	W	W	E	E	T												
34	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	W	W	W	W	E	E	T											
36	S	S	S		S	W		W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	E	E	T										
38																																			
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56																																			
58																																			
A-																																			

E TE TEE
S SL SOCKOLET
T TE TEE
W WL WELDOLET

BRANCH TABLE : TABLE-R1
APPLICABLE PIPING MATERIAL SPECIFICATIONS:B22G,B22ISG,B24G,B24RL,B24FL.
PRESSURE RATING <= 300#

```
   <-----------------B R A N C H    S I Z E------------>
       3   1 1   2         1 1
     M Q 1 Q M 2 M 3 4 6 8 0 2

    M
   3Q
    1     T
   1Q
   1M     E   T
    2     E   E T
   2M
    3     E   E E   T
    4     E   E E   E T
    6     E   E E   E E T
    8     E   E E   E E E T
   10     E   E P   P E E E T
   12     E   E P   P P E E E T

   A-


E  TE  REDUCING TEE
P  WB  BRANCH WELD WITH RP
T  TE  EQUAL TEE
```

BRANCH TABLE : TABLE-R2
APPLICABLE PIPING MATERIAL SPECIFICATIONS: B24D, B24P.
PRESSURE RATING <= 300#

<-----------------------B R A N C H S I Z E-------->

	3	1 1	2	1 1
	M Q 1 Q M 2 M 3 4 6 8 0 2			
M				
3Q				
1				
1Q				
1M				
2		T		
2M				
3		E	T	
4		E	E T	
6		E	E E T	
8		E	E E E T	
10		E	E E E E T	
12		E	E E E E E T	

A-

E TE REDUCING TEE
T TE EQUAL TEE

VALVE DATA SHEETS

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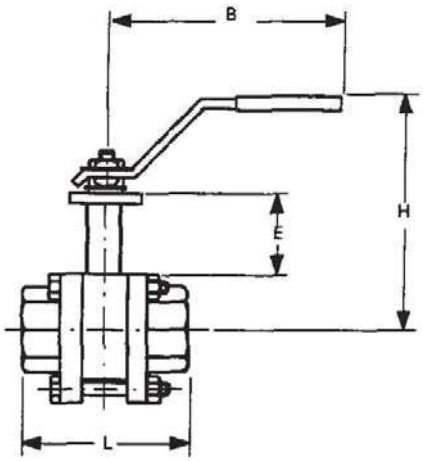
PDIL

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 101	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	THREE PIECES TYPE FULL BORE FLOATING BALL	
EXTENDED STEM	YES b)	
WRENCH OPERATED	YES	
GEAR OPERATED	NO	
FIRE SAFE	YES	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A 350 Gr. LF2	
BALL	AISI 316	
BODY SEAT RING	PTFE	
STEM PACKING	PTFE GRAPHITE	
STEM	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	API 602	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NDT PERMITTED
2.
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

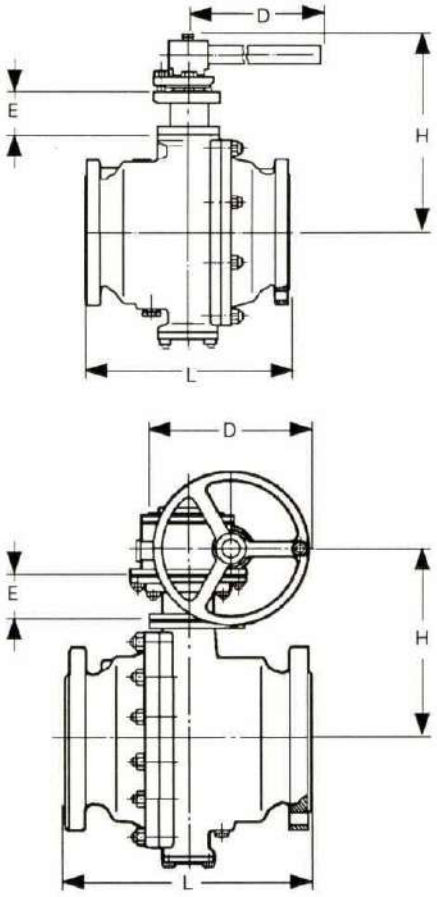
MANDATORY STANDARDS:

API 598, API 602, API 607, API 608, ANSI B16.11, ANSI B16.34

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E = 120MM (FOR MAX. 70MM COLD INSULATION)

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 110	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	SPLIT BODY, FULL BORE FLOATING BALL = < 4" TRUN. MOUNT BALL > 4" LONG PATTERN	
EXTENDED STEM	YES b)	
WRENCH OPERATED	1 1/2" - 6"	
GEAR OPERATED	8" - 14"	
FIRE SAFE	YES	
NOMINAL SIZE	1 1/2" - 14"	
MATERIALS		
BODY	A 352 Gr. LCB	
BALL	AISI 316	
BODY SEAT RING	PTFE	
STEM PACKING	PTFE GRAPHITE	
STEM	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2.
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E= 150mm (FOR MAX 100mm COLD INSULATION)

NOM. DIA. INCH	1 1/2	2	3	4	6	8	10	12	14	16	18	20	24			
LENGTH L mm																
H mm																
D mm																
APPROX WT Kg																

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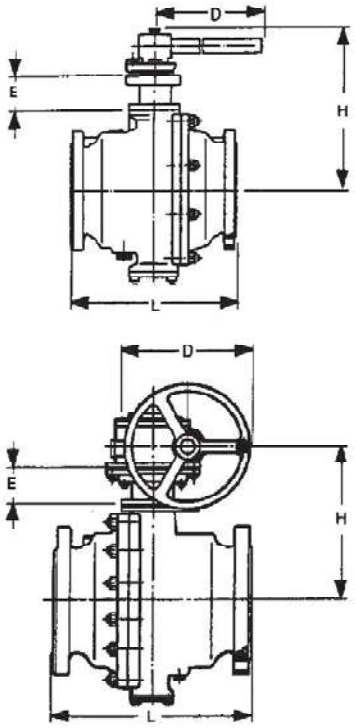
BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 111	
PRESSURE RATING CLASS	300	
FACE	RF	
CONSTRUCTION		
BODY	SPLIT BODY, FULL BORE FLOATING BALL = < 4" TRUN MOUNT BALL > 4" LONG PATTERN	
EXTENDED STEM	YES b)	
WRENCH OPERATED	1 1/2" - 6"	
GEAR OPERATED	8" - 14"	
FIRE SAFE	YES	
NOMINAL SIZE	1 1/2" - 14"	
MATERIALS		
BODY	A 352 Gr. LCB	
BALL	AISI 316 OR C.S. CHROMEPLATED	
BODY SEAT RING	PTFE	
STEM PACKING	PTFE GRAPHITE	
STEM	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2.
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

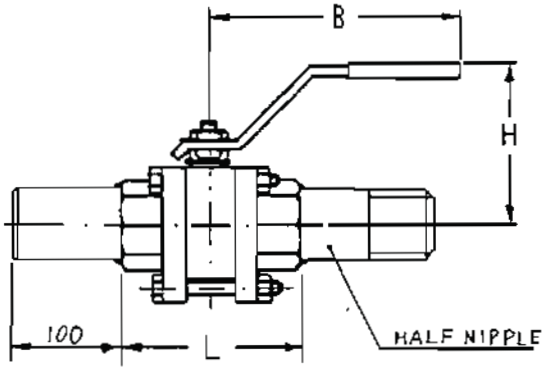
API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E= 150mm (FOR MAX 100mm COLD INSULATION)

PDIL

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 201
PRESSURE RATING CLASS	800
FACE	SW b)
CONSTRUCTION	
BODY	THREE PIECES TYPE FULL BORE FLOATING BALL
EXTENDED STEM	NO
WRENCH OPERATED	YES
GEAR OPERATED	NO
FIRE SAFE	YES
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BALL	AISI 316
BODY SEAT RING	PTFE
STEM PACKING	PTFE GRAPHITE
STEM	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2 IF OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

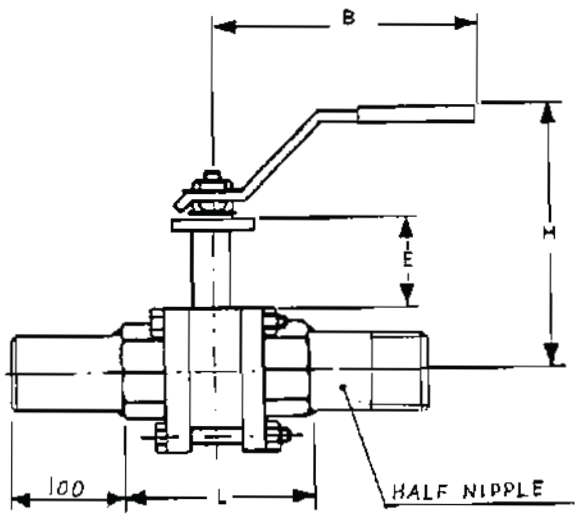
API 598, API 602, API 607, API 608, ANSI B16.11, ANSI B16.34

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) VALVE PROVIDED WITH EXTENTED ENDS, 100mm LONG SCH 80/HALF NIPPLE

PDIL

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 202
PRESSURE RATING CLASS	800
FACE	SW c)
CONSTRUCTION	
BODY	THREE PIECES TYPE FULL BORE FLOATING BALL
EXTENDED STEM	YES b)
WRENCH OPERATED	YES
GEAR OPERATED	NO
FIRE SAFE	YES
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BALL	AISI 316
BODY SEAT RING	PTFE
STEM PACKING	PTFE GRAPHITE
STEM	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2 IF OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

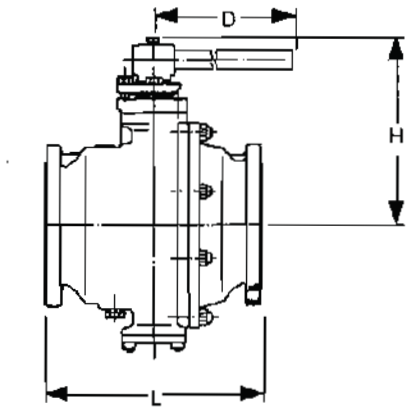
API 598, API 602, API 608, ANSI B16.11, ANSI B16.34

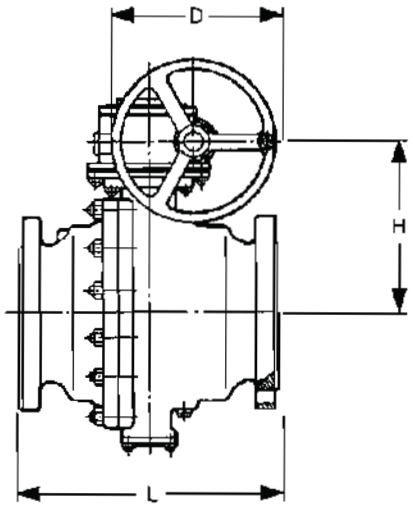
NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E = 120mm (FOR MAX. 70mm COLD INSULATION)
c) VALVE PROVIDED WITH EXTENDED ENDS, 100mm LONG SCH 80/HALF NIPPLE

PDIL

BALL VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 210	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	SPLIT BODY, FULL BORE FLOATING BALL = <4" TRUN. MOUNT BALL >4" LONG PATTERN	
EXTENDED STEM	NO	
WRENCH OPERATED	2" - 6"	
GEAR OPERATED	8" - 24"	
FIRE SAFE	YES	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 216 Gr. WCB	
BALL	AISI 316 OR C.S. CHROMEPLATED	
BODY SEAT RING	PTFE	
STEM PACKING	PTFE GRAPHITE	
STEM	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

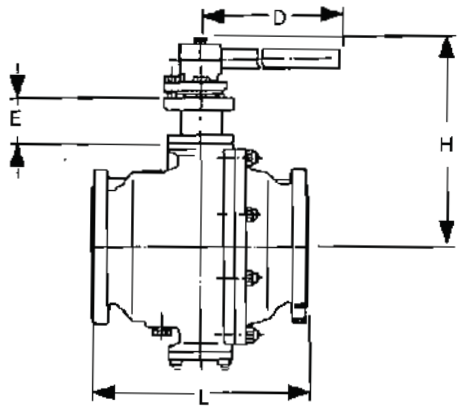
API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

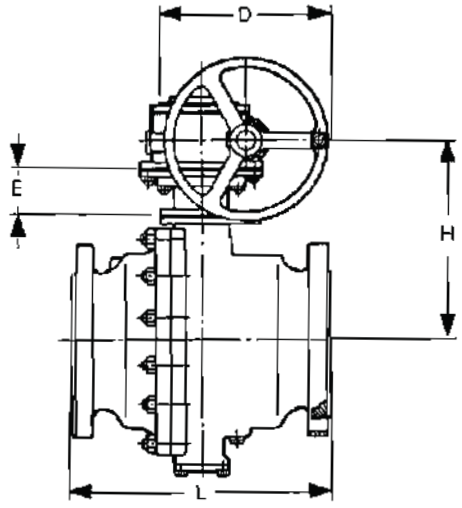
NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD

PDIL

BALL VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**BAV 211**
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	SPLIT BODY, FULL BORE FLOATING BALL = < 4" TRUN. MOUNT BALL > 4" LONG PATTERN
EXTENDED STEM	YES b)
WRENCH OPERATED	2" - 6"
GEAR OPERATED	8" - 12"
FIRE SAFE	YES
NOMINAL SIZE	2" - 12"
MATERIALS	
BODY	A 216 Gr. WCB
BALL	AISI 316 OR C.S. CHROMEPLATED
BODY SEAT RING	PTFE
STEM PACKING	PTFE GRAPHITE
STEM	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E= 120mm (FOR MAX 70mm COLD INSULATION)

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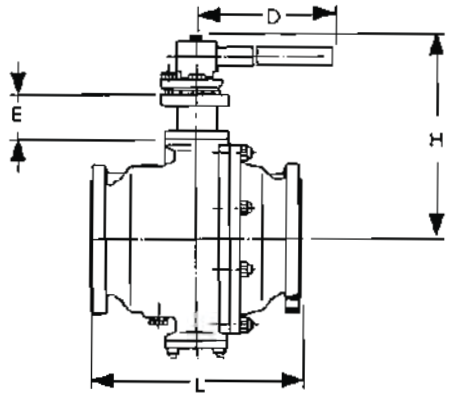
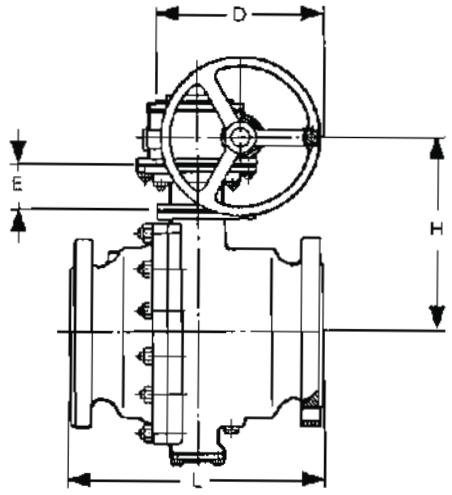
PDIL

BALL VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 222	
PRESSURE RATING CLASS	600	
FACE	RF	
CONSTRUCTION		
BODY	SPLIT BODY FULL BORE TRUNNION MOUNTED BALL LONG PATTERN	
EXTENDED STEM	NO	
WRENCH OPERATED	NO	
GEAR OPERATED	YES	
FIRE SAFE	YES	
NOMINAL SIZE	8" - 24"	
MATERIALS		
BODY	A 216 Gr. WCB	
BALL	A 351 Gr. CF 8M OR CS CHROMEPLATED	
BODY SEAT RING	AISI 316 STELLITED	
STEM PACKING	PTFE GRAPHITE	
STEM	AISI 316	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

rev.1

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2.
3.IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

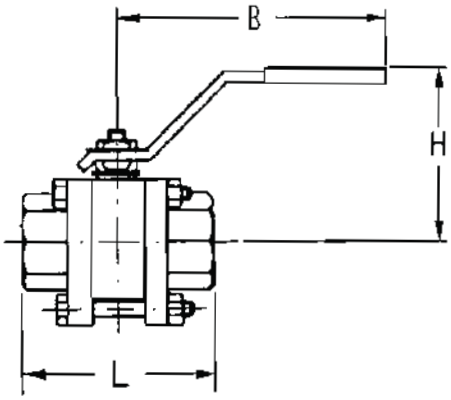
API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E = 150 mm

PDIL

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 501
PRESSURE RATING CLASS	800
FACE	THREADED (NPT)
CONSTRUCTION	
BODY	THREE PIECES TYPE FULL BORE FLOATING BALL
EXTENDED STEM	NO
WRENCH OPERATED	YES
GEAR OPERATED	NO
FIRE SAFE	YES
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	AISI 316
BALL	AISI 316
BODY SEAT RING	PTFE
STEM PACKING	PTFE GRAPHITE
STEM	AISI 316
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

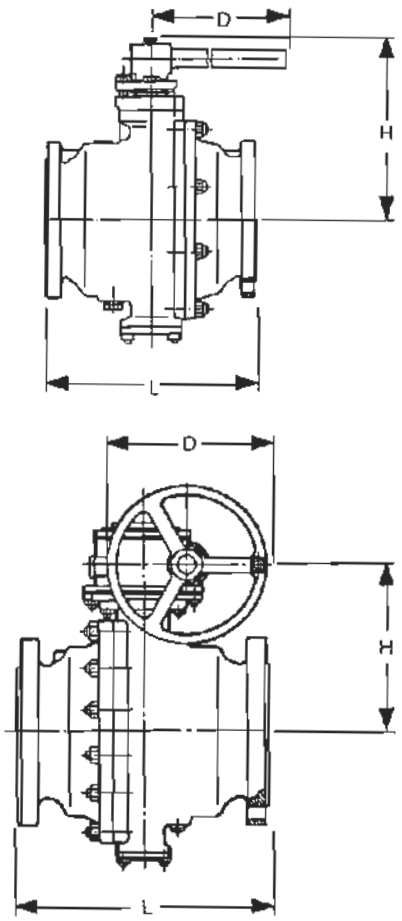
API 598, API 602, API 607, API 608, ANSI B16.11, ANSI B16.34

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) BOTH ENDS FEMALE SCREWED

PDIL

BALL VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	SPLIT BODY, FULL BORE, FLOATING BALL = < 4" TRUN. MOUNT BALL > 4" LONG PATTERN
EXTENDED STEM	NO
WRENCH OPERATED	2" - 6"
GEAR OPERATED	8" - 12"
FIRE SAFE	YES
NOMINAL SIZE	2" - 12"
MATERIALS	
BODY	A 351 Gr. CF 8M
BALL	AISI 316
BODY SEAT RING	PTFE
STEM PACKING	PTFE GRAPHITE
STEM	AISI 316
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

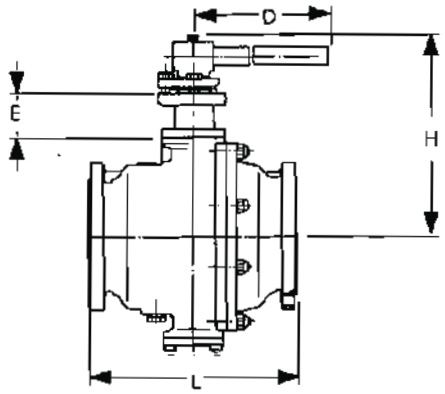
API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

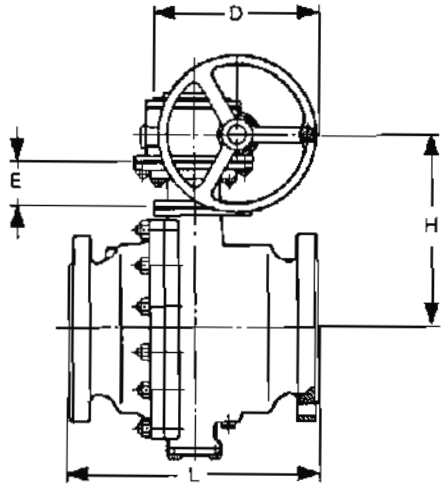
NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD

PDIL

BALL VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BAV 520
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	SPLIT BODY FULL BORE TRUNNION MOUNTED BALL LONG PATTERN
EXTENDED STEM	NO
WRENCH OPERATED	NO
GEAR OPERATED	YES
FIRE SAFE	YES
NOMINAL SIZE	8" - 24"
MATERIALS	
BODY	A 351 Gr. CF 8M
BALL	A 351 Gr. CF 8M or CS Chromeplated
BODY SEAT RING	AISI 316 STELLITED
STEM PACKING	PTFE GRAPHITE
STEM	AISI 316
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

2. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

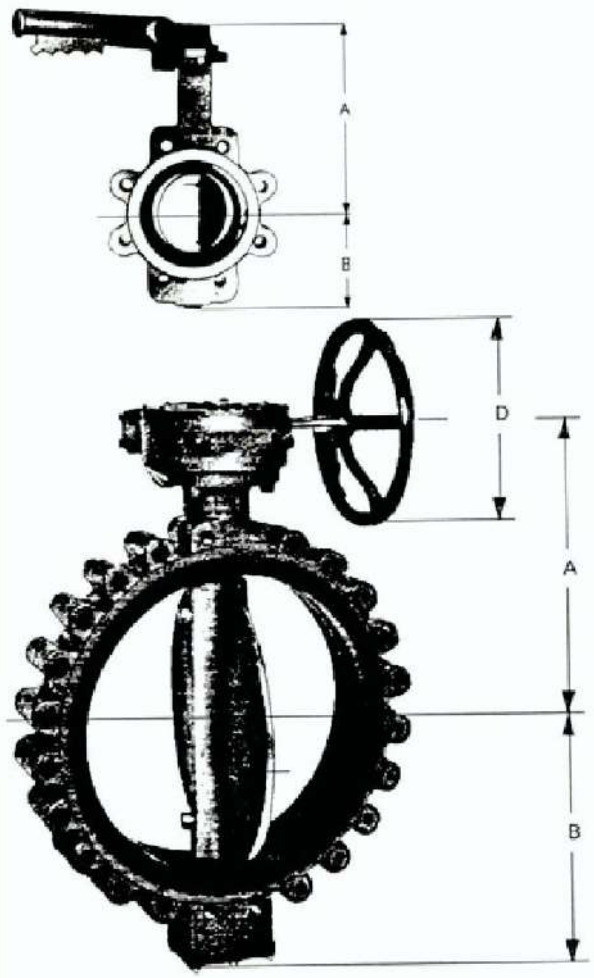
MANDATORY STANDARDS:

API 598, API 607, API 608, ANSI B16.10, ANSI B16.34, ANSI B16.5

NOTES:

a) SEAT RATING ACC. TO MANUFACTURER'S STANDARD
b) STEM EXTENSION E = 150mm

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BUV 101	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	LUG TYPE WITH THREADED HOLES	
	METAL SEATED	
	CATEGORY "B"	
GEAR OPERATED	> = 8"	
NOMINAL SIZE	2" - 20"	
MATERIALS		
BODY	A 352 Gr. LCB	
BODY SEAT	A 182 F304	
DISC	AISI 304 STELLITED	
SHAFT	AISI 304	
SHAFT PACKING	GRAPHITE	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C
LIQUID LPG/PROPANE/BUTANE	3.5	- 45

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. FACE-TO-FACE DIMENSIONS SHALL BE PER API 609

MANDATORY STANDARDS:

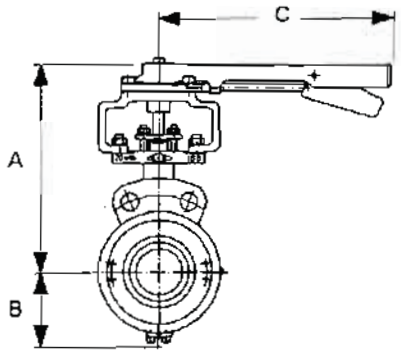
API 609, ANSI B16.34, ANSI B16.5

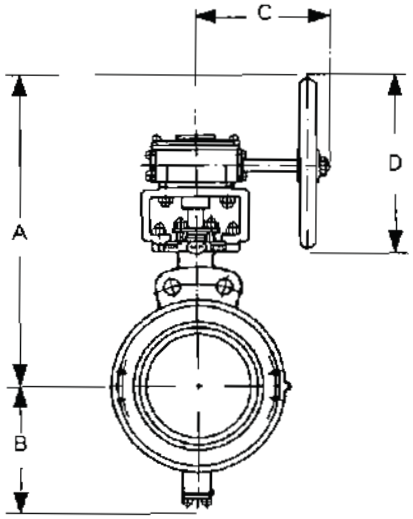
NOTES:

a) EXTENDED SHAFT TO BE PROVIDED FOR VALVES WITH GEARBOX TO AVOID HEATING OF GEARBOX

PDIL

BUTTERFLY VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BUV 202
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	WAFER TYPE
	METAL SEATED
	CATEGORY "B"
GEAR OPERATED	> = 8"
NOMINAL SIZE	3" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT	A 182 Gr. F6a
DISC	A 216 Gr. WCB HARD FACED
SHAFT	13 Cr.
SHAFT PACKING	GRAFOIL
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. FACE-TO-FACE DIMENSIONS SHALL BE PER API 609

MANDATORY STANDARDS:

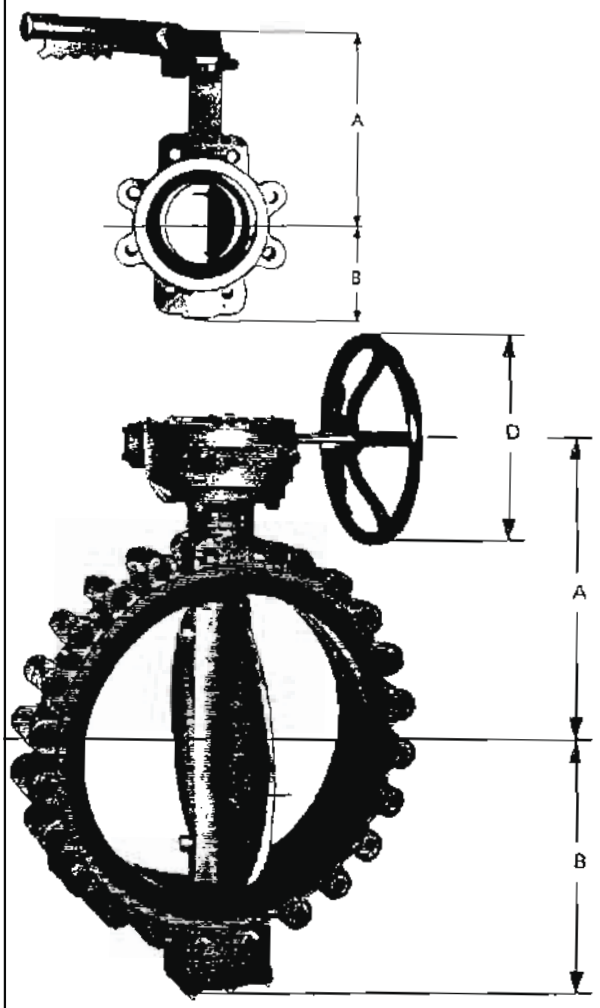
API 609, ANSI B16.34, ANSI B16.5

NOTES:

a) EXTENDED SHAFT TO BE PROVIDED FOR VALVES WITH GEARBOX TO AVOID HEATING OF GEARBOX

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**BUV 203**
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
	LUG TYPE WITH
	THREADED HOLES
	RUBBER LINED
GEAR OPERATED	YES > = 8"
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY LINING	ETHYLENE-PROPYLENE
DISC	A216 GR.WCB+
SHAFT	13 Cr
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	API 609

rev.1

GENERAL

1. RUBBER LINING: THE WETTED SURFACES OF VALVE SHALL BE FULLY LINED AND THE LINING SHALL EXTEND OVER THE FLANGE SEALING FACE
2. LEVER OPERATORS SUITABLE FOR THROTTLING PURPOSES SHALL BE PROVIDED FOR VALVES 6" AND SMALLER
3. FACE-TO-FACE DIMENSIONS SHALL BE PER API 609
4. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

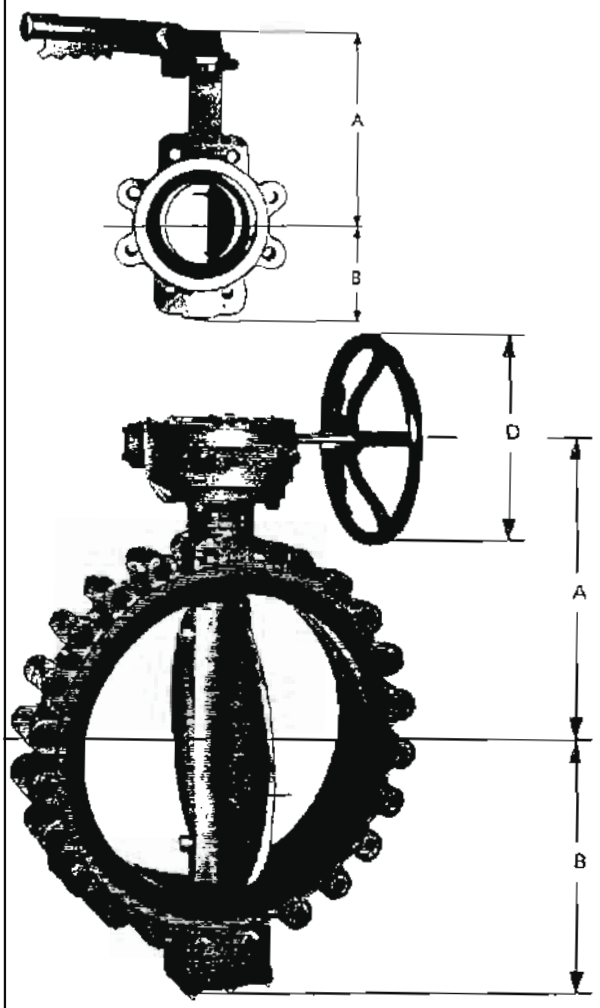
API 609, ANSI B16.5

NOTES:

a) THE VALVE SHALL BE DESIGNED FOR CLOSURE IN DEAD-END-PIPING

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**BUV 203** RL
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
	LUG TYPE WITH
	THREADED HOLES
	RUBBER LINED
GEAR OPERATED	YES > = 8"
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY LINING	ETHYLENE-PROPYLENE
DISC	A216 GR.WCB+ RUBBER LINED rev.1
SHAFT	13 Cr ~~rev.1~~
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	API 609

GENERAL

1. RUBBER LINING: THE WETTED SURFACES OF VALVE SHALL BE FULLY LINED AND THE LINING SHALL EXTEND OVER THE FLANGE SEALING FACE
2. LEVER OPERATORS SUITABLE FOR THROTTLING PURPOSES SHALL BE PROVIDED FOR VALVES 6" AND SMALLER
3. FACE-TO-FACE DIMENSIONS SHALL BE PER API 609
4. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 609, ANSI B16.5

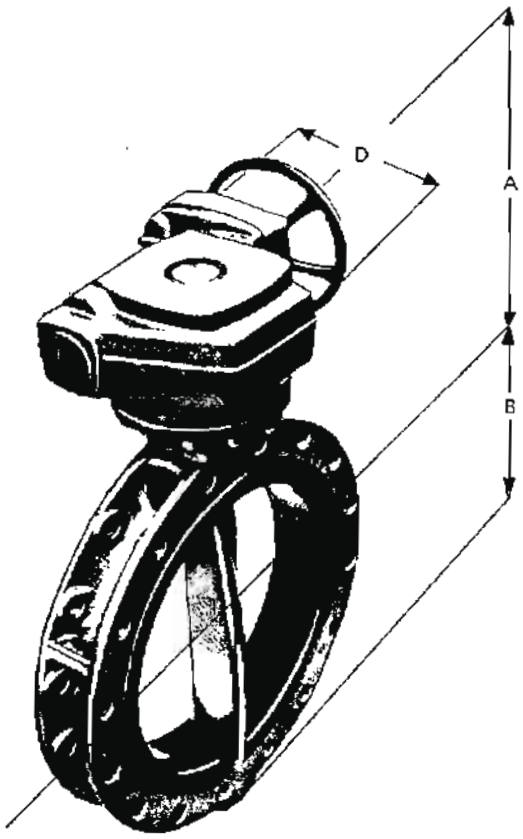
NOTES:

a) THE VALVE SHALL BE DESIGNED FOR CLOSURE IN DEAD-END-PIPING

b)THIS VALVE SHALL BE RUBBERLINED FOR CORROSSIVE SERVICE.

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**BUV 204**
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	FLANGED SHORT BODY
	FULL-DRILLED
	BOLTHOLES IN FLANGES
	RUBBER LINED
GEAR OPERATED	YES
NOMINAL SIZE	26" - 64"
MATERIALS	
BODY	A 216 Gr. WCB
BODY LINING	ETHYLENE-PROPYLENE
DISC	A216 GR.WCB+ RUBBER LINED rev.1
SHAFT	13 Cr rev.1
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ASME B16.47

GENERAL

1. RUBBER LINING: THE WETTED SURFACES OF VALVE SHALL BE FULLY LINED AND LINING SHALL EXTEND OVER THE FLANGE SEALING FACE
2. FACE-TO-FACE DIMENSIONS SHALL BE PER AWWA C 504 SHORT-BODY
3. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

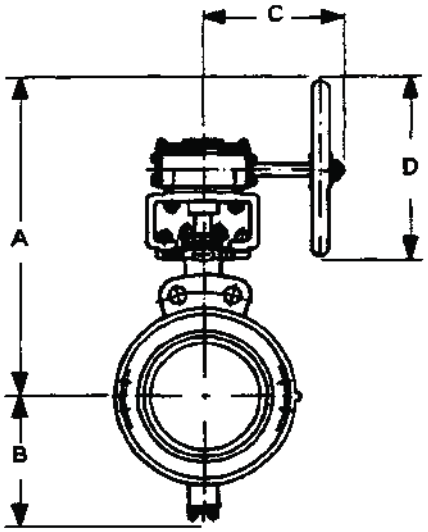
AWWA C 504, ASME B16.47

NOTES:

a) THE VALVE SHALL BE DESIGNED FOR CLOSURE IN DEAD-END-PIPING
b) FLANGES ACC. TO ASME B16.47 SERIES B

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BUV 410
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	WAFER TYPE
	CATEGORY "B"
GEAR OPERATED	> = 8"
NOMINAL SIZE	6" - 48"
MATERIALS	
BODY	A351 Gr.CF3M
BODY SEAT	REINFORCED PTFE a)
DISC	SS316L
SHAFT	A276 Gr.316L
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. FASE-TO-FASE DIMENSIONS SHALL BE PER API 609

MANDATORY STANDARDS:

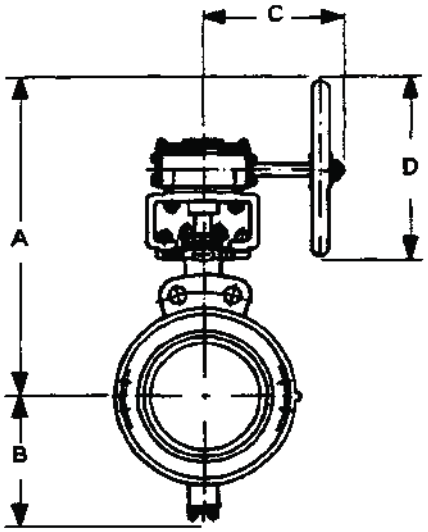
API 609, ANSI B16.34, ANSI B16.47, ANSI B16.5

NOTES:

a) MANUFACTURER MAY RECOMMEND ALTERNATIVE SEAT MATERIAL AND SEAT RATING SUBJECT TO PURCHASER APPROVAL
b) FLANGES > 24" ACC. TO ASME B16.47 SERIES B

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BUV 411
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	WAFER TYPE
	CATEGORY "B"
GEAR OPERATED	> = 8"
NOMINAL SIZE	6" - 48"
MATERIALS	
BODY	A351 Gr.CF3M
BODY SEAT	REINFORCED PTFE a)
DISC	SS316L
SHAFT	A276 Gr.316L
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. FASE-TO-FASE DIMENSIONS SHALL BE PER API 609

MANDATORY STANDARDS:

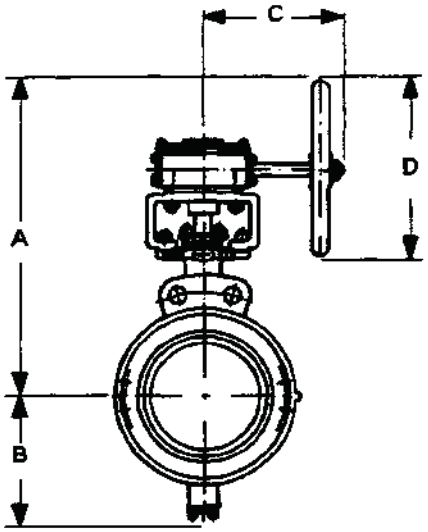
API 609, ANSI B16.34, ANSI B16.47, ANSI B16.5

NOTES:

a) MANUFACTURER MAY RECOMMEND ALTERNATIVE SEAT MATERIAL AND SEAT RATING SUBJECT TO PURCHASER APPROVAL
b) FLANGES > 24" ACC. TO ASME B16.47 SERIES B

PDIL

BUTTERFLY VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	BUV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	WAFER TYPE
	CATEGORY "B"
GEAR OPERATED	> = 8"
NOMINAL SIZE	6" - 48"
MATERIALS	
BODY	A 351 Gr. CF8
BODY SEAT	REINFORCED PTFE a)
DISC	STAINLESS TYPE 304
SHAFT	A 276 Gr. 304
SHAFT PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. FASE-TO-FASE DIMENSIONS SHALL BE PER API 609

MANDATORY STANDARDS:

API 609, ANSI B16.34, ANSI B16.47, ANSI B16.5

NOTES:

a) MANUFACTURER MAY RECOMMEND ALTERNATIVE SEAT MATERIAL AND SEAT RATING SUBJECT TO PURCHASER APPROVAL
b) FLANGES > 24" ACC. TO ASME B16.47 SERIES B

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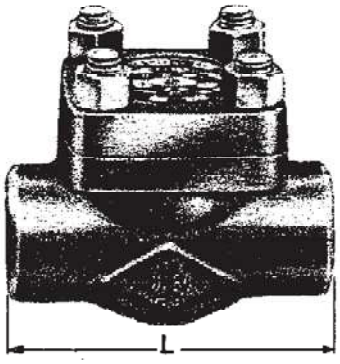
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 101	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BONNET TO BODY CONNECTION	BOLTED	
SEAT RING	RENEWABLE	
TYPE OF DISC	BALL	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A 350 Gr. LF2	
BODY SEAT RING	AISI 304	
DISC	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	API 602	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

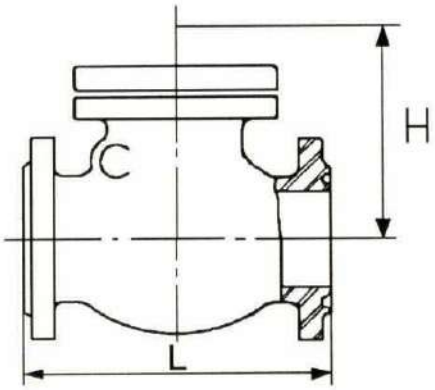
MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 110
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 352 Gr. LCB
BODY SEAT RING	AISI 304
DISC	AISI 304
HINGE PIN	AISI 304

DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

NOM. DIA. INCH	2	3	4	6	8	10	12	14	16	18	20	24				
LENGTH L mm																
H mm																
APPROX WT Kg																

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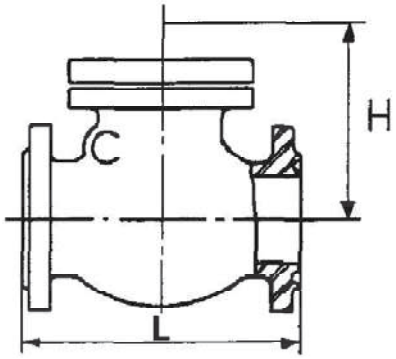
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 111	
PRESSURE RATING CLASS	300	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BONNET TO BODY CONNECTION	BOLTED	
SEAT RING	RENEWABLE	
TYPE OF DISC	SWING TYPE	
ACCESSORIES	NO	
BY-PASS	NO	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 352 Gr. LCB	
BODY SEAT RING	AISI 304	
DISC	AISI 304	
HINGE PIN	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C
AMMONIA GAS	30	50/-33
AMMONIA LIQUID	40	50/-33

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

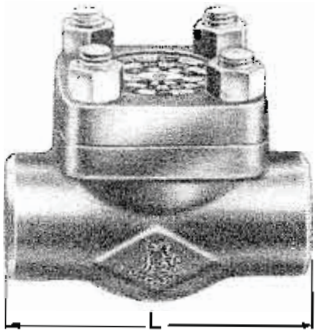
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**CHV 201S**
PRESSURE RATING CLASS	800
FACE	SW IBR
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	BALL
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	**13 Cr Stellited.**
DESIGN CONDITIONS	
PRESSURE RATING	API 602

rev.1

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

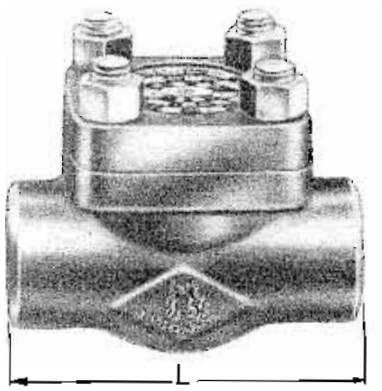
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 201
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	BALL
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602

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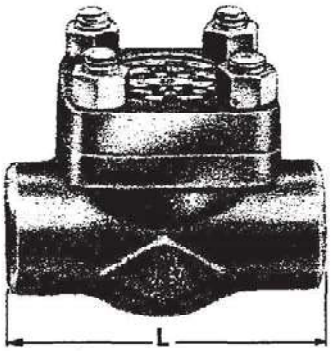
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 204S
PRESSURE RATING CLASS	1500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	PISTON
NOMINAL SIZE	1/2" - 1"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a STELLITED
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

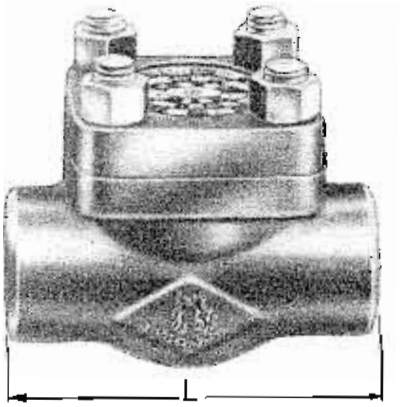
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 207
PRESSURE RATING CLASS	800
FACE	THD
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	BALL
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

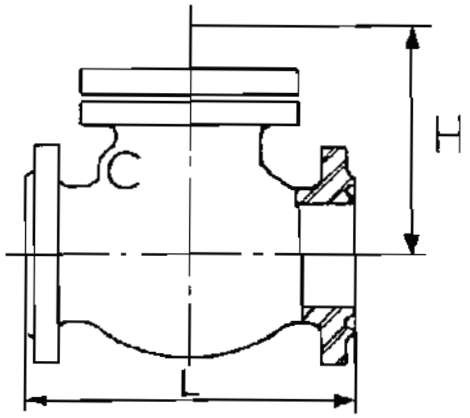
API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 210
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13Cr. FACED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

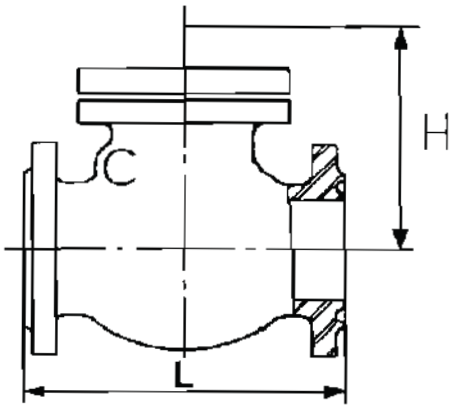
1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI 816.34, ANSI B16.5, MSS-SP 45

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 210D
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A216 GR.WCB RUBBER LINED
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13Cr. FACED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

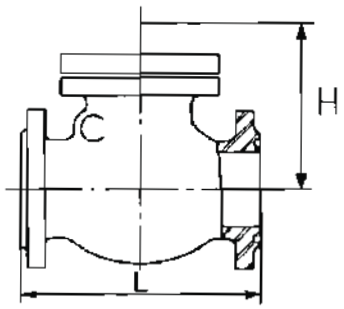
1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 210S	
PRESSURE RATING CLASS	150	
FACE	RF IBR	
CONSTRUCTION		
BODY	CAST	
BONNET TO BODY CONNECTION	BOLTED	
SEAT RING	RENEWABLE	
TYPE OF DISC	SWING TYPE	
ACCESSORIES	NO	
BY-PASS	NO	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 216 Gr. WCB	
BODY SEAT RING	A105 STELLITED	
DISC	A 216 Gr. WCB 13Cr. FACED	
HINGE PIN	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

rev.1

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

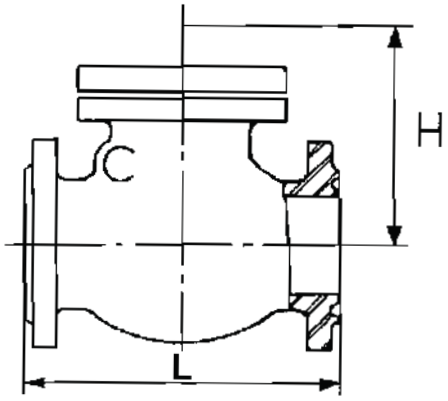
API 598, ANSI B16.10, ANSI B16 34, ANSI B16.5, MSS-SP 45

NOTES:

a) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 211
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13 Cr. FACED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

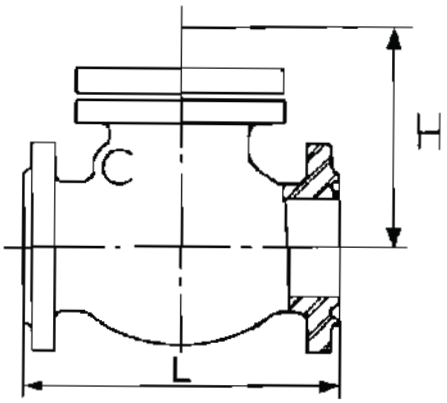
1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 212	
PRESSURE RATING CLASS	600	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BONNET TO BODY CONNECTION	BOLTED	
SEAT RING	RENEWABLE	
TYPE OF DISC	SWING TYPE	
ACCESSORIES	NO	
BY-PASS	NO	
NOMINAL SIZE	2" - 16"	
MATERIALS		
BODY	A 216 Gr. WCB	
BODY SEAT RING	A 105 STELLITED	
DISC	A 216 Gr. WCB STELLITED	
HINGE PIN	13 Cr.	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

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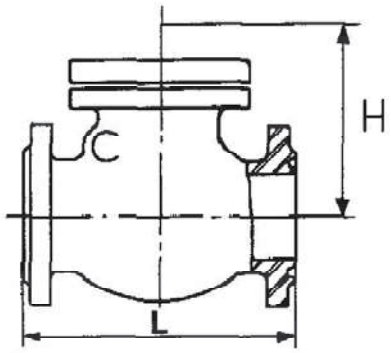
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 212S
PRESSURE RATING CLASS	600
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 16"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a STELLITED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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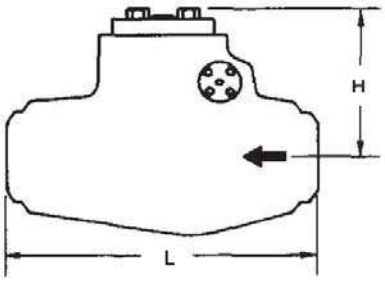
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 216S
PRESSURE RATING CLASS	1500
FACE	BW
CONSTRUCTION	
BODY	CAST a)
BONNET TO BODY CONNECTION	PRESSURE SEAL
SEAT RING	WELDED
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 182 Gr. F6a STELLITED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSIONS SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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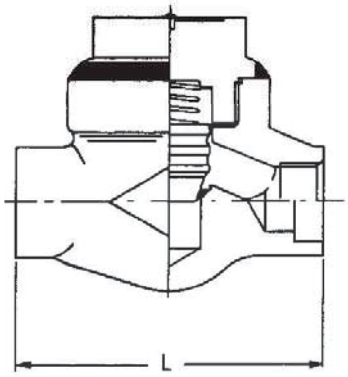
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 305S
PRESSURE RATING CLASS	2500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	WELDED
SEAT RING	INTEGRAL
TYPE OF DISC	PISTON
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F22
BODY SEAT RING	STELLITED
DISC	A 182 Gr. F6a STELLITED
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16,34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATDRY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) VALVE TO BE SUPPLIED WITH I8R CERTIFICATION

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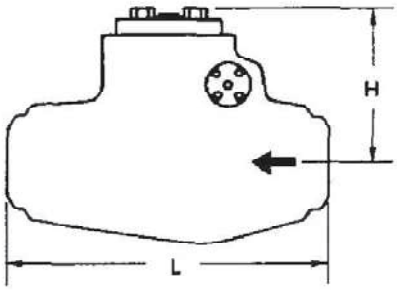
CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 326S
PRESSURE RATING CLASS	2500
FACE	BW
CONSTRUCTION	
BODY	CAST a)
BONNET TO BODY CONNECTION	PRESSURE SEAL
SEAT RING	WELDED
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 18"
MATERIALS	
BODY	A 217 Gr. WC9
BODY SEAT RING	A 182 Gr. F22 STELLITED
DISC	A 182 Gr. F22 STELLITED
HINGE PIN	13 Cr.
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

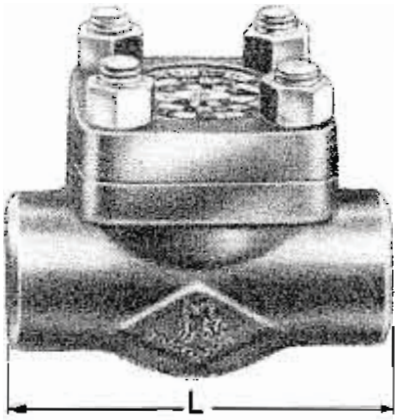
API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSIONS SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV401	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BONNET TO BODY CONNECTION	BOLTED	
SEAT RING	RENEWABLE	
TYPE OF DISC	BALL	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A182 Gr.F316L	rev.1
BODY SEAT RING	SS316L	rev.1
DISC	SS316L	rev.1
DESIGN CONDITIONS		
PRESSURE RATING	API 602	

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

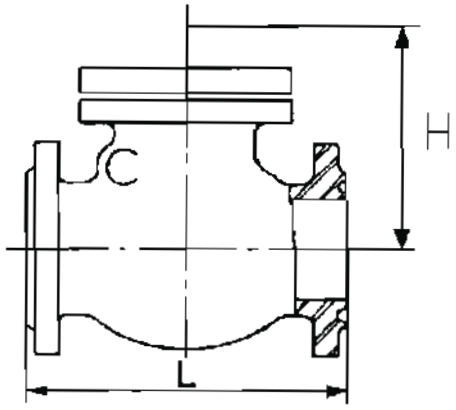
API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV410
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	INTEGRAL
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A351 Gr.CF3M rev.1
BODY SEAT RING	SS316L rev.1
DISC	SS316L rev.1
HINGE PIN	SS316L rev.1
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

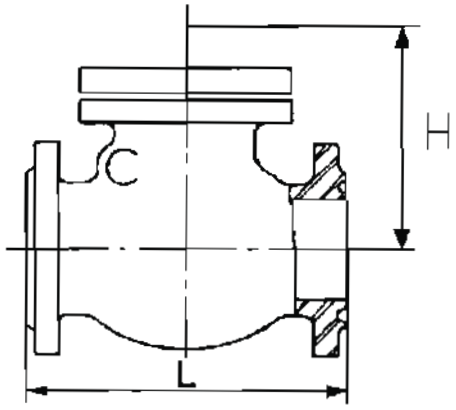
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV411
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	INTEGRAL
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A351 Gr.CF3M rev.1
BODY SEAT RING	SS316L rev.1
DISC	SS316L rev.1
HINGE PIN	SS316L rev.1
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

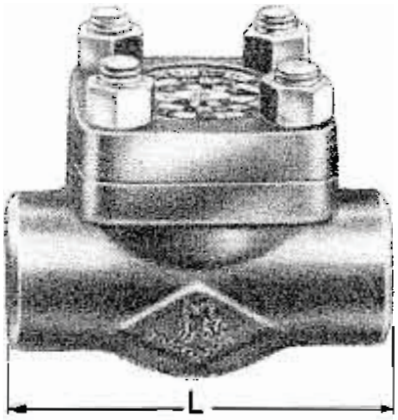
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 501
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	BALL
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F304
BODY SEAT RING	AISI 304
DISC	AISI 304
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. IF NOT OTHERWISE STATED THE VALVE SHALL BE FULL BORE

MANDATORY STANDARDS:

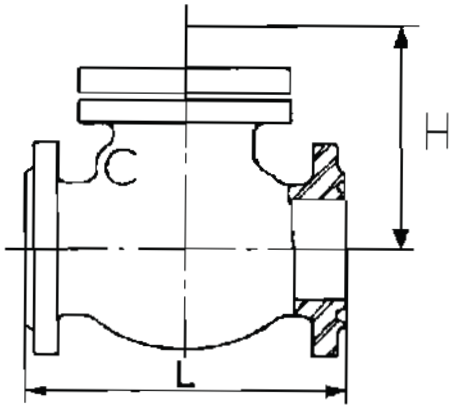
API 598, API 602, ANSI B16.11, ANSI B 16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	INTEGRAL
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 351 Gr. CF8
BODY SEAT RING	A 182 Gr. F304 OR INTERGRAL
DISC	AISI 304
HINGE PIN	A 276 Gr. 304
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

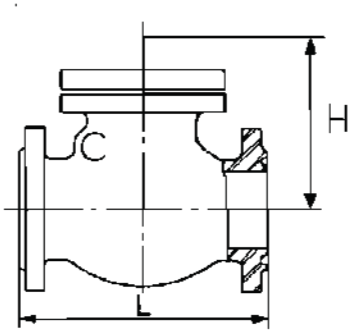
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 511F
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
SEAT RING	INTERGRAL
TYPE OF DISC	SWING TYPE
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 351 Gr. CF8M
BODY SEAT RING	INTEGRAL
DISC	AISI 316
HINGE PIN	A 276 Gr. 316
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

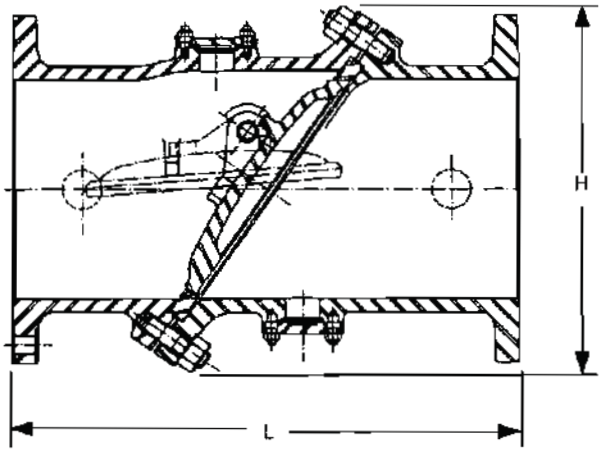
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

CHECK VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	CHV 520
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BODY CONNECTION	BOLTED
SEAT RING	RENEWABLE
TYPE OF DISC	TILTING DISC
ACCESSORIES	NO
BY-PASS	NO
NOMINAL SIZE	26" - 36"
MATERIALS	
BODY	A 351 Gr. CF8
BODY SEAT RING	A 182 Gr. F304
DISC	A 351 Gr. CF8
HINGE PIN	A 276 Gr. 304
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ASME B16.47 SERIES B

NOTES:

a) DIMENSIONS ACC. TO MANUFACTURERS STANDARD WITH REFERENCE TO ANSI B16.10

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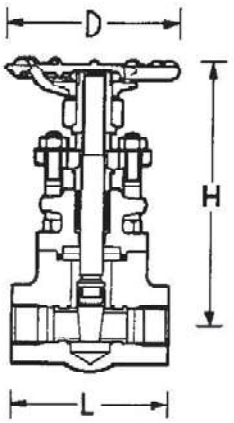
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 101
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	ND
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 350 Gr. LF2
BODY SEAT RING	AISI 304
GATE	AISI 304
STEM	AISI 304
STEM PACKING	Graphoil
TRIM NUMBER	2

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKAGE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS		
PRESSURE RATING	API 602	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

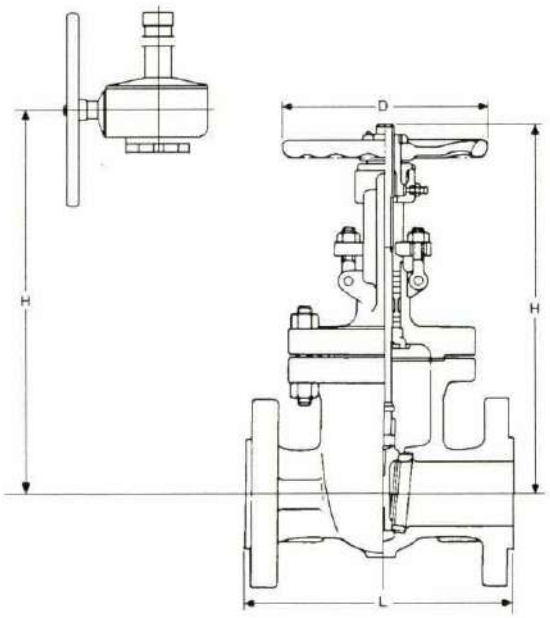
MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 110
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 10"
BY-PASS VALVE	NO
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 352 Gr. LCB
BODY SEAT RING	AISI 304
GATE	AISI 304
STEM	AISI 304
STEM PACKING	GRAPHITE
TRIM NUMBER	

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

NOM. DIA. INCH	1 1/2	2	3	4	6	8	10	12	14	16	18	20	24	28	32	36
LENGTH L mm																
H OPEN mm																
H CLOSED mm																
HANDWHEEL øD mm																
APPROX WT Kg																

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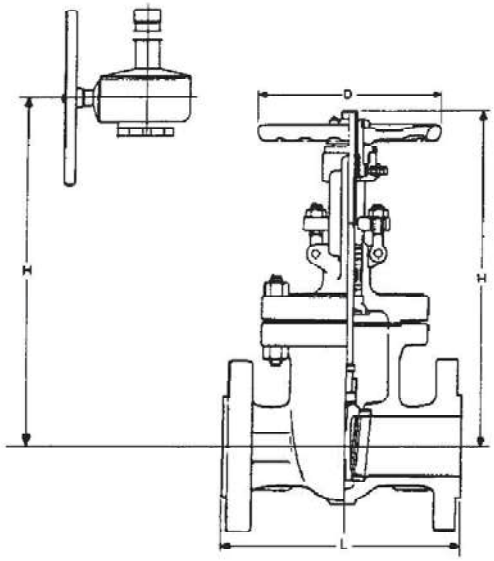
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 111
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 10"
BY-PASS VALVE	NO
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 352 Gr. LCB
BODY SEAT RING	AISI 304
GATE	AISI 304
STEM	AISI 304
STEM PACKING	Graphoil
TRIM NUMBER	2

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

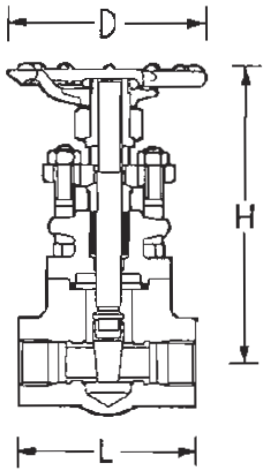
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 201
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM (NO CASTING)	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a
STEM	13 Cr.
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER

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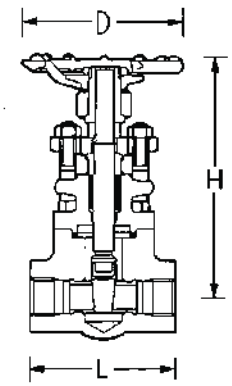
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 201S
PRESSURE RATING CLASS	800
FACE	SW IBR
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a
STEM	13 Cr.
STEM PACKING	GRAPHITE
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

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GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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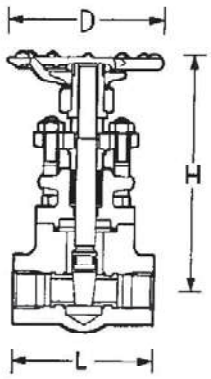
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 202S
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	5
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDAROS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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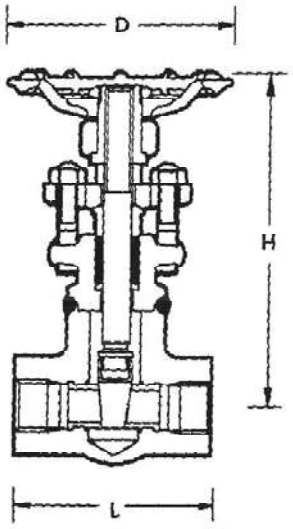
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 204S
PRESSURE RATING CLASS	1500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	8

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

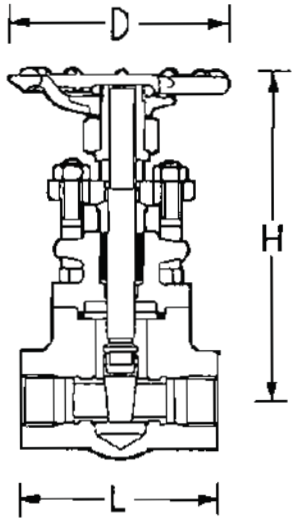
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER
b) VALVE TO BE SUPPLIED WITH I&R CERTIFICATION

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 207
PRESSURE RATING CLASS	800
FACE	THD
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM (NO CASTING)	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a
STEM	13 Cr.
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON ØR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER

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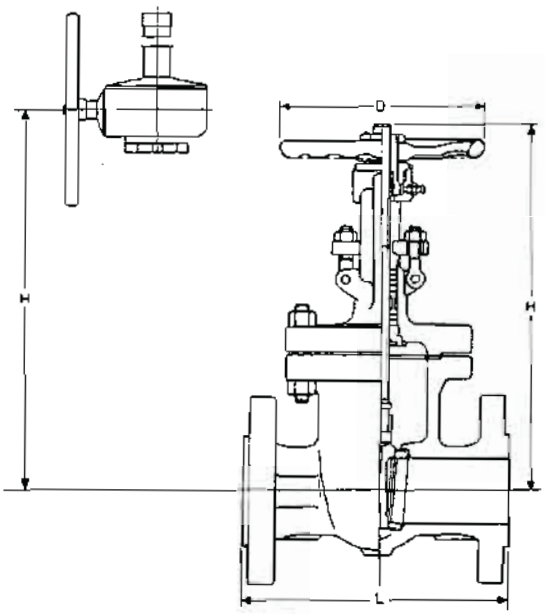
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 210
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 14"
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 48"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
GATE	A 216 Gr. WCB 13 Cr. FACED
STEM (NO CASTING)	13 Cr.
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES >= 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45, ASME B16.47

NOTES:

a) FLANGES > 24" ACC. TO ASME B16.47 SERIES B

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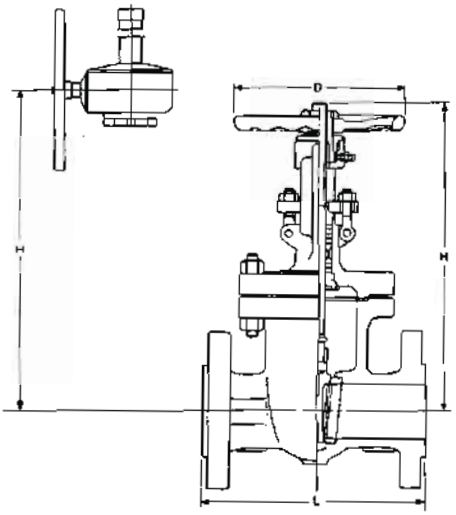
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 210S
PRESSURE RATING CLASS	150
FACE	RF IBR
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF c)
GEAR OPERATED	YES > = 14"
BY-PASS VALVE	NO
NOMINAL SIZE	1 1/2" - 48"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
GATE	A 216 Gr. WCB 13 Cr FACED
STEM	13 Cr.
STEM PACKING	GRAPHITE
TRIM NUMBER	8

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45, ASME B16.47

NOTES:

a) FLANGES > 24" ACC. TO ASME B16.47 SERIES B
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION
c) WSF IS ACCEPTABLE FOR SIZES < =12" ONLY

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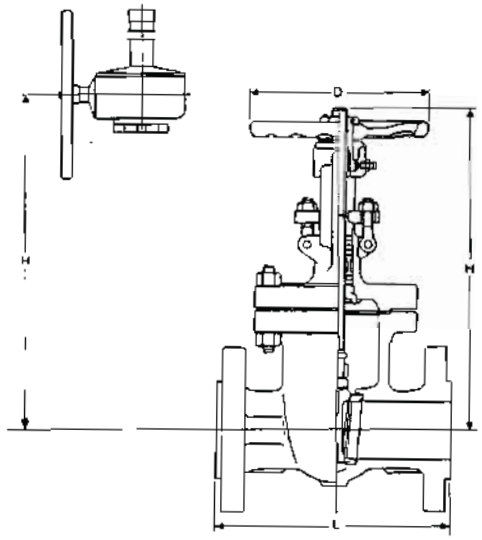
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 211
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF a)
GEAR OPERATED	YES > = 10"
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
GATE	A 216 Gr. WCB 13 Cr. FACED
STEM (NO CASTING)	13 Cr.
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

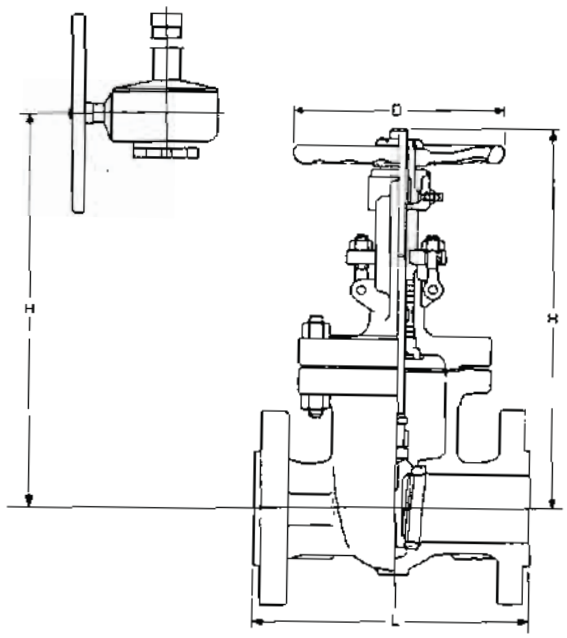
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) WSF IS ACCEPTABLE FOR SIZES < = 12" ONLY

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 212
PRESSURE RATING CLASS	600
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF a)
GEAR OPERATED	YES > = 8"
BY-PASS VALVE	NO, SEE GEN. NOTE 4
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
GATE	A 216 Gr. WCB
STEM	13 Cr.
STEM PACKING	GRAFOIL
TRIM NUMBER	8
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) WSF IS ACCEPYABLE FOR SIZES < = 6" ONLY

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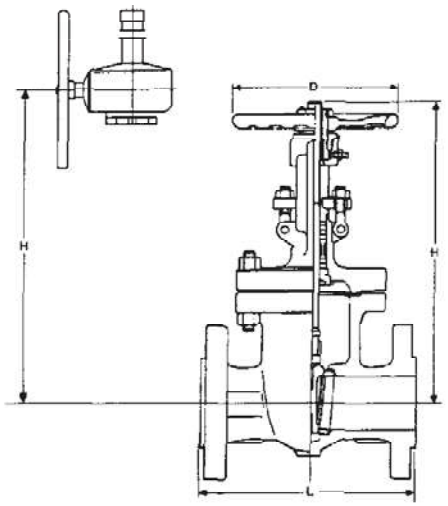
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 212S
PRESSURE RATING CLASS	600
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES >= 8"
BY-PASS VALVE	NO, SEE GEN. NOTE 4
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	5

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES >= 10" AND >= 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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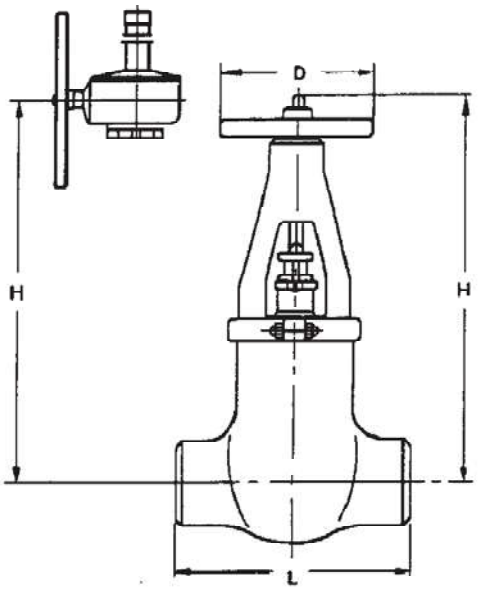
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 216S
PRESSURE RATING CLASS	1500
FACE	BW
CONSTRUCTION	
BODY	CAST OR FORGED a)
BONNET TO BODY CONNECTION	PRESSURE SEAL
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 8"
BY-PASS VALVE	NO, SEE GEN. NOTE 4
NOMINAL SIZE	1 1/2" - 24"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	8

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WOF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSION SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERFITICATION
c) VALVES > = 6" SHALL HAVE YOKE BUSHING THRUST BEARINGS

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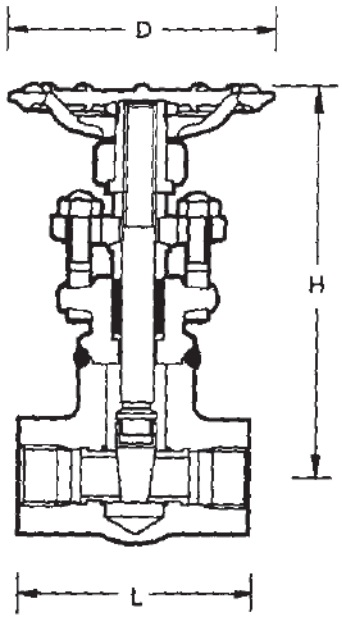
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 305S
PRESSURE RATING CLASS	2500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F22
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	5
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER
b) VALVE TO BE SUPPLIED WITH IBR CERFITICATION

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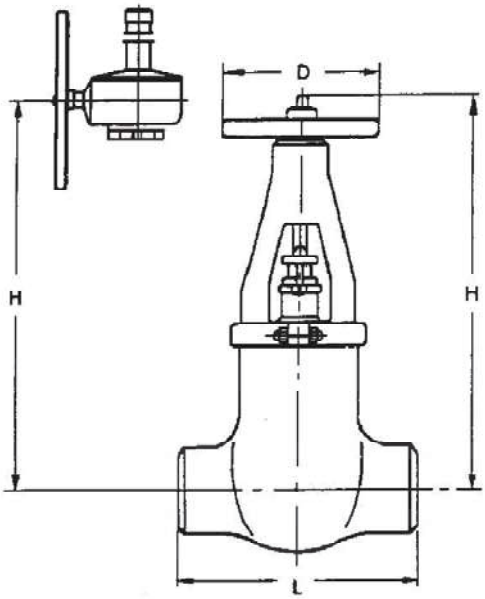
GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 326S
PRESSURE RATING CLASS	2500
FACE	BW
CONSTRUCTION	
BODY	CAST OR FORGED a)
BONNET TO BODY CONNECTION	PRESSURE SEAL
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 8"
BY-PASS VALVE	ND, SEE GEN. NOTE 4
NOMINAL SIZE	1 1/2" - 16"
MATERIALS	
BODY	A 217 Gr. WC9
BODY SEAT RING	A 182 Gr. F6a STELLITED
GATE	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	5
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

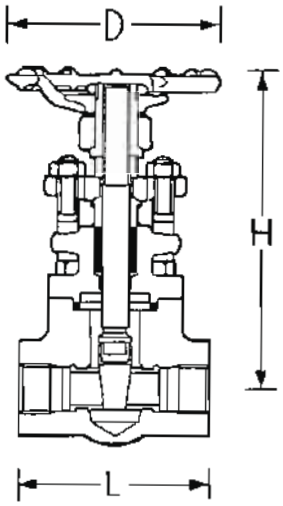
API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSION SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION
c) VALVES > = 6" SHALL HAVE YOKE BUSHING THRUST BEARINGS

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 401	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BONNET TO BODY CONNECTION	BOLTED	
HANDWHEEL	NON-RISING	
STEM	RISING	
STEM AND YOKE TYPE	OS & Y	
GATE TYPE	WSS	
GEAR OPERATED	NO	
BY-PASS VALVE	NO	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A182 GR.F316L	rev.1
BODY SEAT RING	A182 GR.F316L	rev.1
GATE	A182 GR.F316L	rev.1
STEM	A182 GR.F316L	rev.1
STEM PACKING	GRAFOIL /GRAPHITE	
TRIM NUMBER	2	
DESIGN CONDITIONS		
PRESSURE RATING	API 602	

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

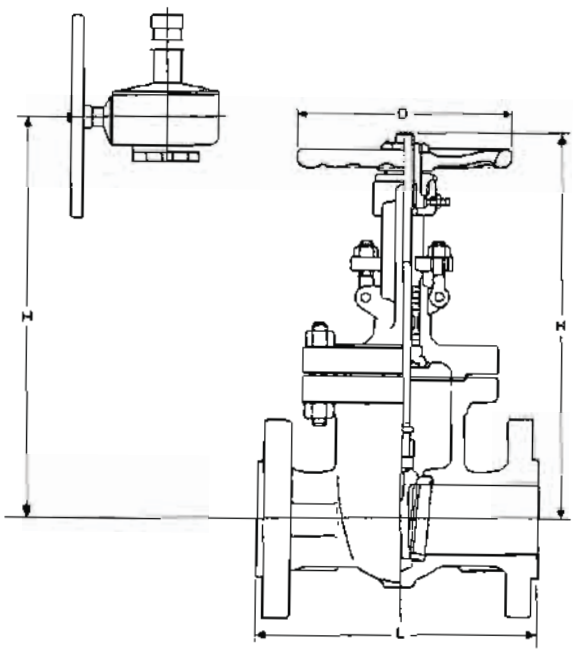
MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 410
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 14"
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A351 Gr.CF3M rev.1
BODY SEAT RING	A182 Gr.F316L rev.1
GATE	SS 316L rev.1
STEM	SS 316L rev.1
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	2
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

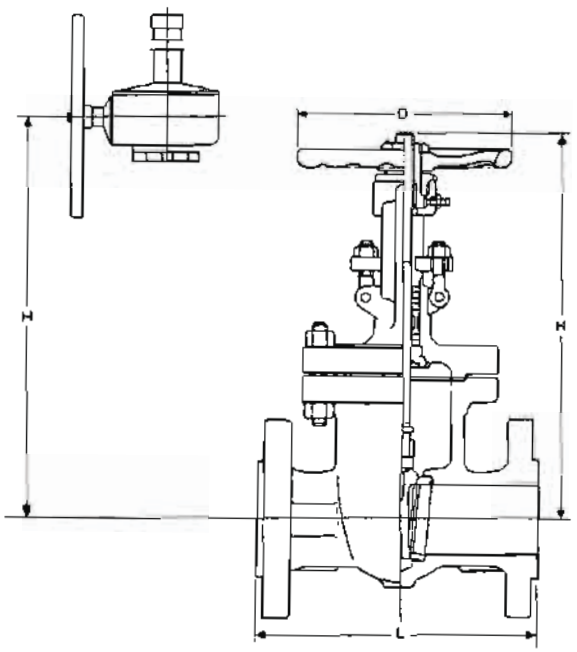
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 411	
PRESSURE RATING CLASS	300	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BONNET TO BODY CONNECTION	BOLTED	
HANDWHEEL	NON-RISING	
STEM	RISING	
STEM AND YOKE TYPE	OS & Y	
GATE TYPE	WSF OR WDF	
GEAR OPERATED	YES > = 14"	
BY-PASS VALVE	NO	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A351 Gr.CF3M	rev.1
BODY SEAT RING	A182 Gr.F316L	rev.1
GATE	SS 316L	rev.1
STEM	SS 316L	rev.1
STEM PACKING	GRAFOIL /GRAPHITE	
TRIM NUMBER	2	
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

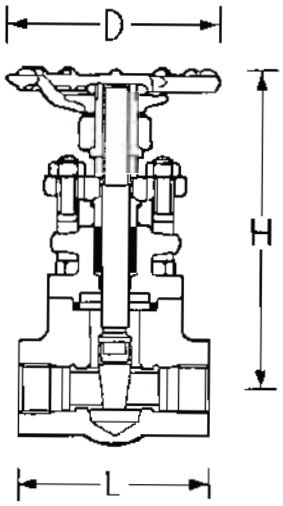
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 501
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSS
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F304
BODY SEAT RING	A 182 Gr. F304
GATE	A 182 Gr. F304
STEM	A 276 Gr. 304
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	2
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

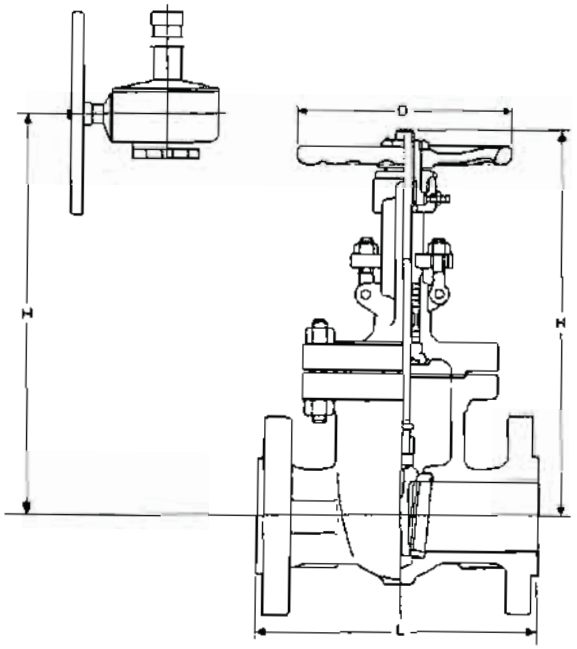
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) LENGTH TO BE VERIFIED BY MANUFACTURER

PDIL

GATE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GAV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
GATE TYPE	WSF OR WDF
GEAR OPERATED	YES > = 14"
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 24"
MATERIALS	
BODY	A 351 Gr. CF8
BODY SEAT RING	A 182 Gr. F304
GATE	AISI 304
STEM	A 276 Gr. 304
STEM PACKING	GRAFOIL /GRAPHITE
TRIM NUMBER	2
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GATE SYMBOLS	TYPE OF SEAT	TYPE OF GATE	TYPE OF BLOCKADE
WSS	WEDGE	SINGLE	SOLID WEB
WSF			FLEX. SOLID WEB
WDF		DOUBLE	SLIP ON OR SPLIT
PDF	PARALLEL		FLEXIBLE

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO API 600 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

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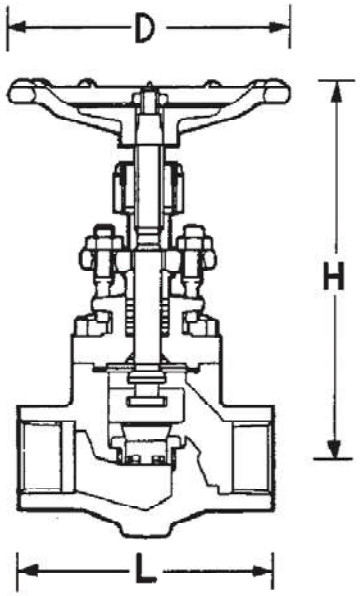
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 101
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 350 Gr. LF2
BODY SEAT RING	AISI 304
DISC	AISI 304
STEM	AISI 304
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

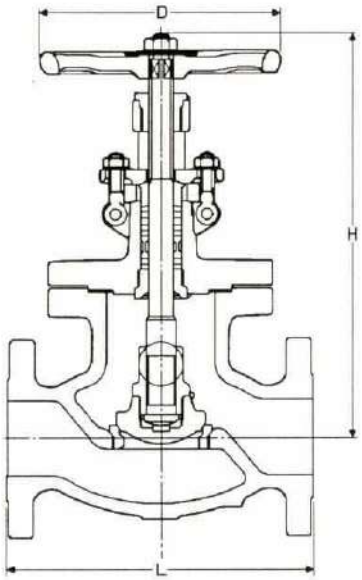
MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 110	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BONNET TO BODY CONNECTION	BOLTED	
HANDWHEEL	RISING	
STEM	RISING	
STEM AND YOKE TYPE	OS & Y	
DISC TYPE	PARABOLIC	
GEAR OPERATED	NO	
BY-PASS VALVE	NO	
NOMINAL SIZE	2" - 8"	
MATERIALS		
BODY	A 352 Gr. LCB	
BODY SEAT RING	AISI 304	
DISC	AISI 304	
STEM	AISI 304	
STEM PACKING	GRAPHITE	
TRIM NUMBER		
DESIGN CONDITIONS		
PRESSURE RATING	ANSI B16.34	
FLUID	Kg/cm2g	°C

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"
Cv	50	120	220	490	900	1400	2100

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

NOM. DIA.																
LENGTH L mm																
H OPEN mm																
H CLOSED mm																
HANDWHEEL øD mm																
APPROX WT Kg																

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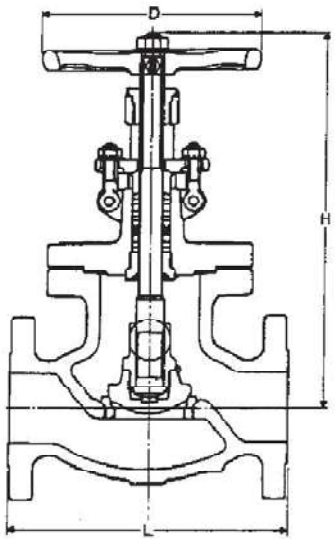
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 111
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	ND
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 8"
MATERIALS	
BODY	A 352 Gr. LCB
BODY SEAT RING	AISI 304
DISC	AISI 304
STEM	AISI 304
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34
FLUID	Kg/cm2g °C

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"
Cv	50	120	220	490	900	1400	2100

GENERAL

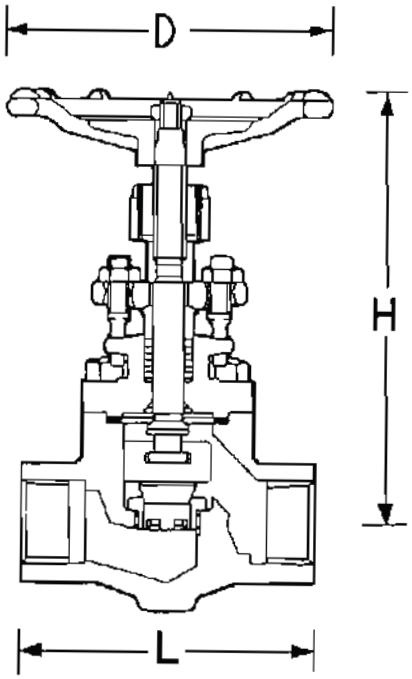
1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 201
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a
STEM (NO CASTING)	13 Cr.
STEM PACKING	GRAFOIL/GRAPHITE
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

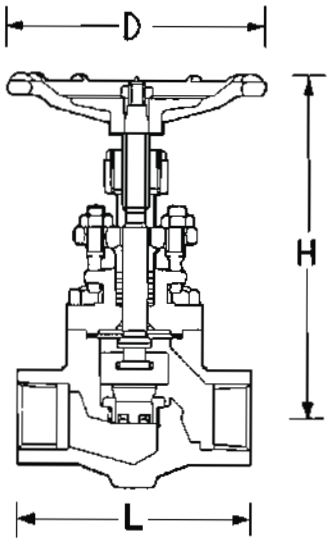
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 201S
PRESSURE RATING CLASS	800
FACE	SW IBR
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a
STEM	13 Cr.
STEM PACKING	GRAPHITE
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	API 602

rev.1

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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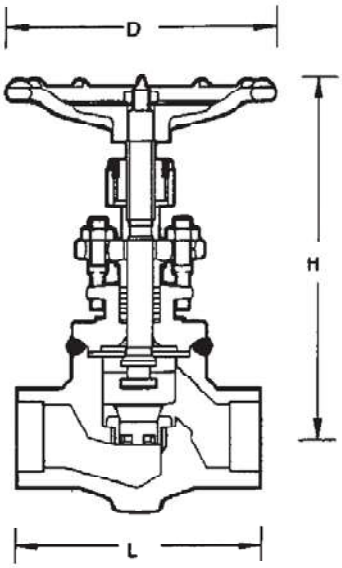
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 204S
PRESSURE RATING CLASS	1500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 105
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 1B2 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

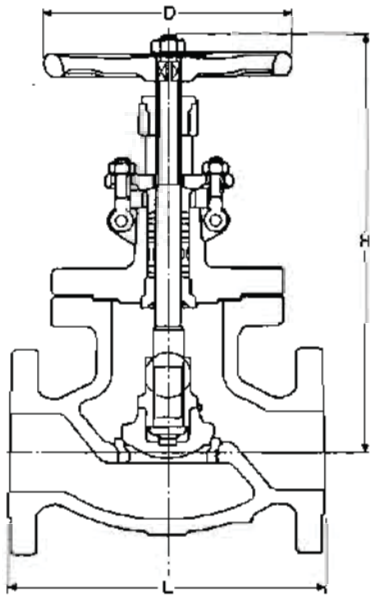
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 210
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 12"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13 Cr. FACING
STEM (NO CASTING)	13 Cr.
STEM PACKING	GRAFOIL/GRAPHITE
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

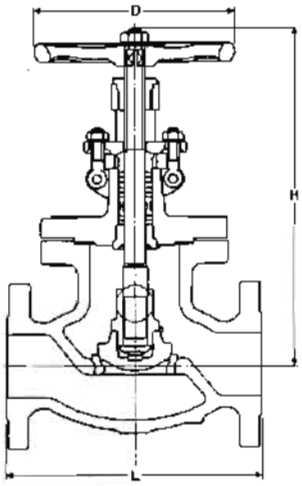
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 210S
PRESSURE RATING CLASS	150
FACE	RF IBR
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 12"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13 Cr. FACING
STEM	13 Cr.
STEM PACKING	GRAPHITE
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

rev.1

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

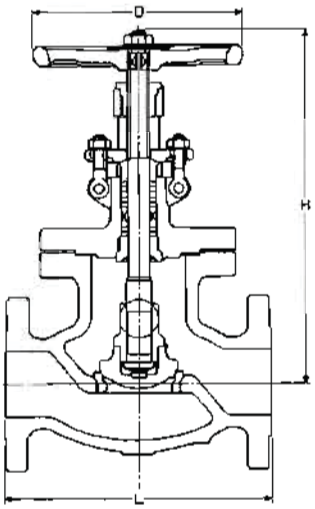
API 598, ANSI B16.10, ANSI B16.34, ANSI B16 5, MSS-SP 45

NOTES:

a) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 211
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 12"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13 Cr. FACING
STEM (NO CASTING)	13 Cr.
STEM PACKING	GRAFOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

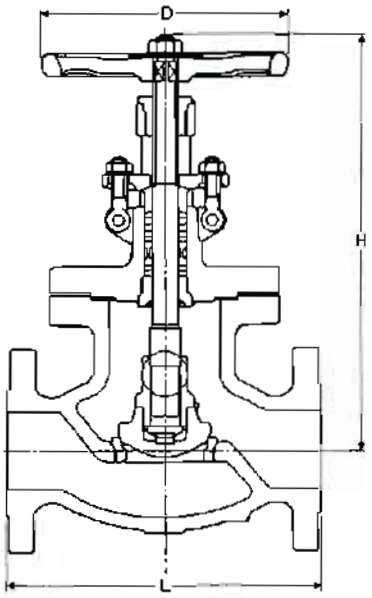
MANDATORY STANDARDS:

API 598, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 212
PRESSURE RATING CLASS	600
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 8"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 105 STELLITED
DISC	A 216 Gr. WCB 13 Cr. FACING
STEM	13 Cr.
STEM PACKING	Grafoil
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

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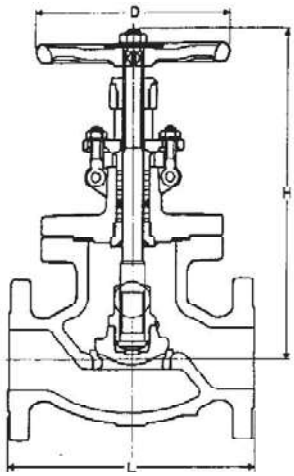
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 212S
PRESSURE RATING CLASS	600
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 8"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"
Cv	50	120	220	490	900	1400	2100

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES >= 10" AND >= 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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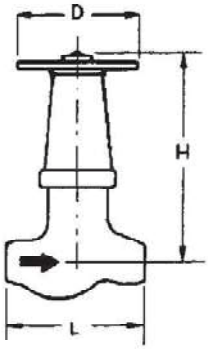
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 216S
PRESSURE RATING CLASS	1500
FACE	BW
CONSTRUCTION	
BODY	CAST OR FORGED a)
BONNET TO BODY CONNECTION	PRESSURE SEAL c)
HANDWHEEL	NON-RISING c)
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	YES >= 8"
BY-PASS VALVE	NO
NOMINAL SIZE	1 1/2" - 8"
MATERIALS	
BODY	A 216 Gr. WCB
BODY SEAT RING	INTEGRAL STELLITED
DISC	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"		1½		
Cv	50	120	220	490	900		30		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES >= 10" AND >= 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSION SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION
c) WELDED BONNET AND RISING STEM ARE ACCEPTABLE FOR SIZE 1 1/2"
d) VALVES >= 6" SHALL HAVE YOKE BUSHING THRUST BEARINGS

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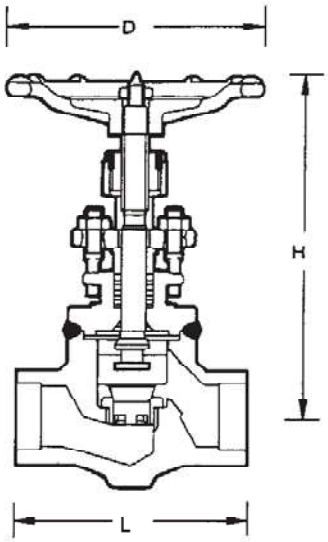
GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 305S
PRESSURE RATING CLASS	2500
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F22
BODY SEAT RING	A 182 Gr. F6a STELLITED
DISC	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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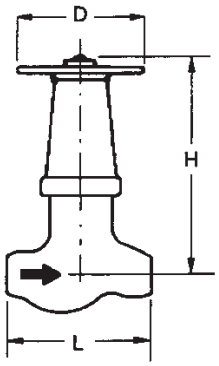
GLOBE VALVE



ITEM NO	GLV 326S
PRESSURE RATING CLASS	2500
FACE	BW
CONSTRUCTION	
BODY	CAST OR FORGED a)
BONNET TO BODY CONNECTION	PRESSURE SEAL
HANDWHEEL	NON-RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 4"
MATERIALS	
BODY	A 217 Gr. WC9
BODY SEAT RING	INTEGRAL STELLITED
DISC	A 182 Gr. F6a STELLITED
STEM	13 Cr.
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

DESIGN (ILLUSTRATIVE ONLY)

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"				
Cv	50	120	220	490	900				

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

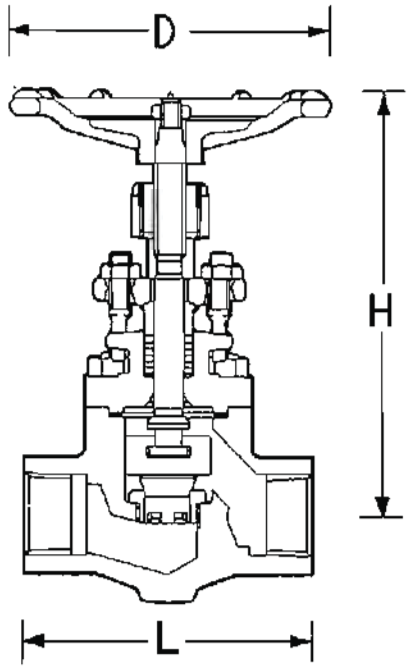
API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

a) END TO END DIMENSION SHALL BE SHORT PATTERN
b) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**GLV** 401	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BONNET TO BODY CONNECTION	BOLTED	
HANDWHEEL	RISING	
STEM	RISING	
STEM AND YOKE TYPE	OS & Y	
DISC TYPE	SWIVEL PLUG	
GEAR OPERATED	NO	
BY-PASS VALVE	NO	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A182 GR.F316L	rev.1
BODY SEAT RING	A182 GR.F316L	rev.1
DISC	A182 GR.F316L	rev.1
STEM	SS316L	rev.1
STEM PACKING	GRAFOIL	
TRIM NUMBER		
DESIGN CONDITIONS		
PRESSURE RATING	API 602	

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

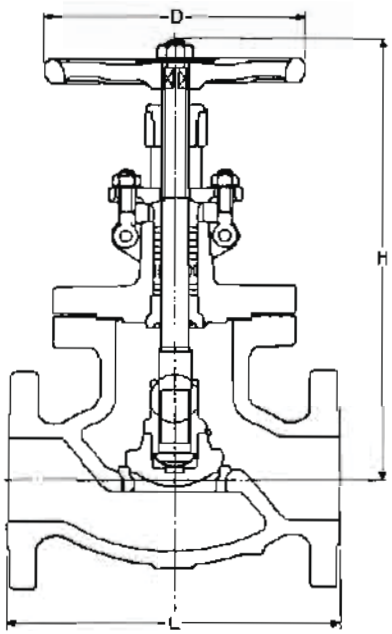
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 410
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2"-24"
MATERIALS	
BODY	A 351 GR.CF3M rev.1
BODY SEAT RING	A182 GR.F316L rev.1
DISC	AISI 316L rev.1
STEM	AISI 316L rev.1
STEM PACKING	GRAFOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

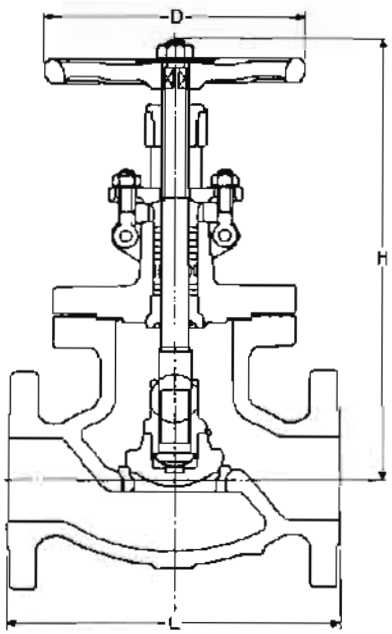
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV411
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2"-24"
MATERIALS	
BODY	A 351 GR.CF3M
BODY SEAT RING	A182 GR.F316L
DISC	AISI 316L
STEM	AISI 316L
STEM PACKING	GRAFOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

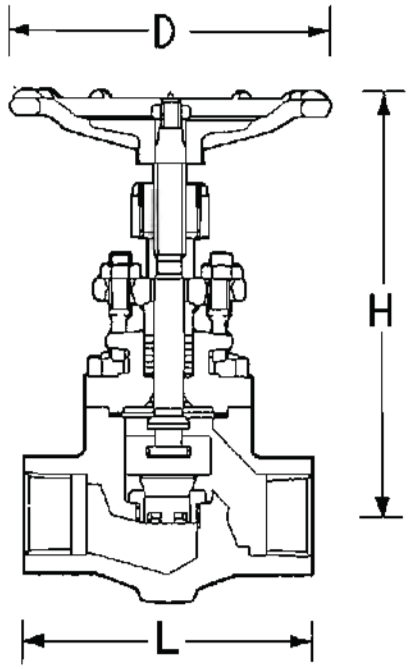
MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 501
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL PLUG
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F304
BODY SEAT RING	A 182 Gr. F304
DISC	A 182 Gr. F304
STEM	A 276 Gr. 304
STEM PACKING	GRAFOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

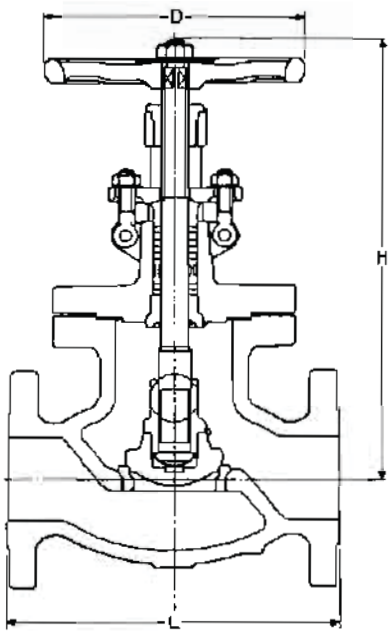
API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) LENGTH TO BE VERIFIED BY MANUFACTURER

PDIL

GLOBE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	GLV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	CAST
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	PARABOLIC
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	2" - 8"
MATERIALS	
BODY	A 351 Gr. CF8
BODY SEAT RING	A 182 Gr. F304
DISC	AISI 304
STEM	A 276 Gr. 304
STEM PACKING	GRAFOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

RATED Cv VALUES: (+-10%)

SIZE	2"	3"	4"	6"	8"	10"	12"		
Cv	50	120	220	490	900	1400	2100		

GENERAL

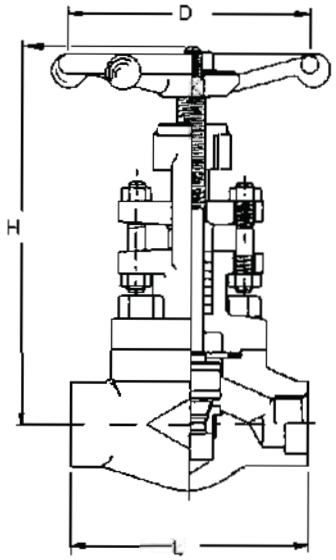
1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE
4. VALVES > = 10" AND > = 600" RATING SHALL HAVE BOSSES FOR BY-PASS CONNECTION ACC. TO ANSI B16.34 AND MSS-SP 45, LOCATION E-F

MANDATORY STANDARDS:

API 598, API 600, ANSI B16.10, ANSI B16.34, ANSI B16.5, MSS-SP 45

NOTES:

NEEDLE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	NEV 501	
PRESSURE RATING CLASS	800	
FACE	SW	
CONSTRUCTION		
BODY	FORGED b)	
BONNET TO BODY CONNECTION	BOLTED	
HANDWHEEL	RISING	
STEM	RISING	
STEM AND YOKE TYPE	OS & Y	
DISC TYPE	SWIVEL NEEDLE	
GEAR OPERATED	NO	
BY-PASS VALVE	NO	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A 182 Gr. F316	
BODY SEAT RING	INTEGRAL STELLITED	
DISC	A 182 Gr. F316 STELLITED	
STEM	A 276 Gr. 316	
STEM PACKING	GRAFOIL	
TRIM NUMBER		
DESIGN CONDITIONS		
PRESSURE RATING	API 602	
FLUID	Kg/cm2g	°C

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) REDUCED BORE (LOW VOLUME TYPE)

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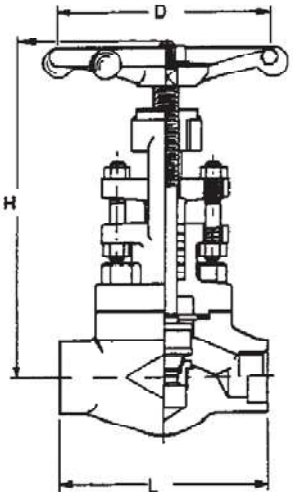
NEEDLE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	NEV 501S
PRESSURE RATING CLASS	800
FACE	SW
CONSTRUCTION	
BODY	FORGED b)
BONNET TO BODY CONNECTION	BOLTED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	DS & Y
DISC TYPE	SWIVEL NEEDLE
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F316
BODY SEAT RING	INTEGRAL STELLITED
DISC	A 182 Gr. F316 STELLITED
STEM	A 276 Gr. 316
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	API 602

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NDTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) REDUCED BORE (LOW VOLUME TYPE)
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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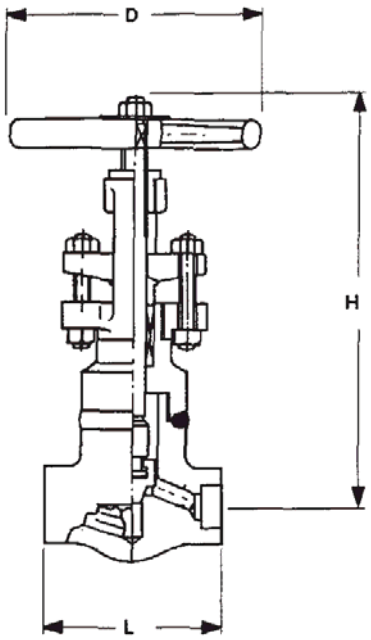
NEEDLE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	NEV 502S
PRESSURE RATING CLASS	1500
FACE	SW
CONSTRUCTION	
BODY	FORGED b)
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL NEEDLE
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F316
BODY SEAT RING	INTEGRAL STELLITED
DISC	A 182 Gr. F316 STELLITED
STEM	A 276 Gr. 316
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

API 598, API 602, ANSI B16.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) REDUCED BORE (LOW VOLUME TYPE)
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

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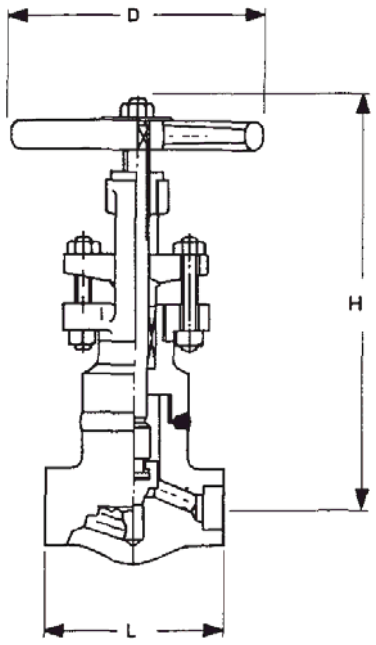
NEEDLE VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	NEV 503S
PRESSURE RATING CLASS	2500
FACE	SW
CONSTRUCTION	
BODY	FORGED b)
BONNET TO BODY CONNECTION	WELDED
HANDWHEEL	RISING
STEM	RISING
STEM AND YOKE TYPE	OS & Y
DISC TYPE	SWIVEL NEEDLE
GEAR OPERATED	NO
BY-PASS VALVE	NO
NOMINAL SIZE	1/2" - 1 1/2"
MATERIALS	
BODY	A 182 Gr. F316
BODY SEAT RING	INTEGRAL STELLITED
DISC	A 182 Gr. F316 STELLITED
STEM	A 276 Gr. 316
STEM PACKING	GRAPHOIL
TRIM NUMBER	
DESIGN CONDITIONS	
PRESSURE RATING	ANSI 816.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED
2. GLAND SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE WHEN VALVE IS FULLY OPEN
3. IF NOT OTHERWISE STATED THE VALVES SHALL BE FULL BORE

MANDATORY STANDARDS:

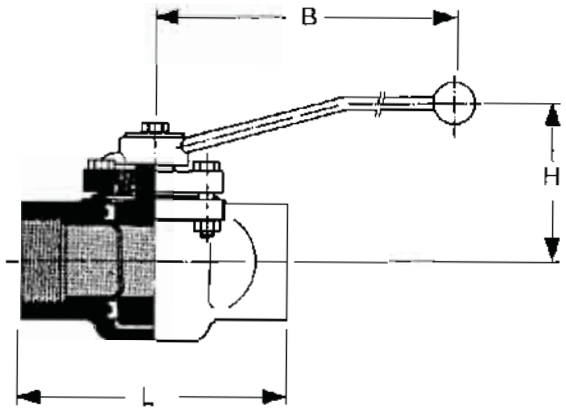
API 598, API 602, ANSI 816.11, ANSI B16.34

NOTES:

a) VALVE DESIGN SHALL GENERALLY COMPLY WITH API 602
b) REDUCED BORE (LOW VOLUME TYPE)
c) VALVE TO BE SUPPLIED WITH IBR CERTIFICATION

PDIL

PLUG VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	PLV 201
PRESSURE RATING CLASS	600
FACE	TREADED (NPT)
CONSTRUCTION	
BODY	FULL BORE NON-LUBRICATED
PLUG	TAPER PLUG
WRENCH OPERATED	YES
GEAR OPERATED	NO
FIRE SAFE	NO
NOMINAL SIZE	1/2" - 1"
MATERIALS	
BODY	A 105 a)
PLUG	A 105 CHROMEPLATED a)
BODY SEAT RING	REINFORCED PTFE
STEM PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

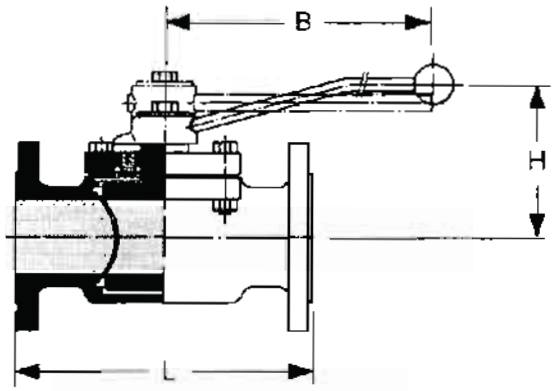
API 598, API 6D, ANSI B16.11, ANSI B16.34

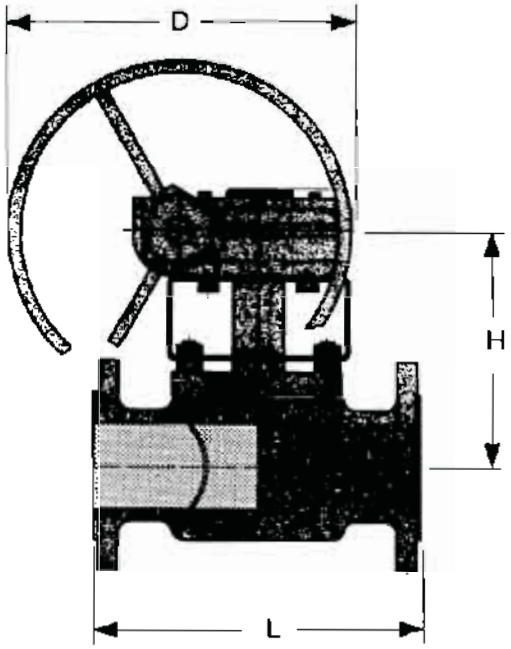
NOTES:

a) EQUIVALENT CAST MATERIAL IS ACCEPTABLE

PDIL

PLUG VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	PLV 202
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	NON-LUBRICATED FULL BORE
PLUG	TAPER PLUG
WRENCH OPERATED	1 1/2" - 4"
GEAR OPERATED	6"
FIRE SAFE	NO
NOMINAL SIZE	1 1/2" - 6"
MATERIALS	
BODY	A 216 Gr. WCB
PLUG	A 105 CHROMEPLATED a)
BODY SEAT RING	REINFORCED PTFE
STEM PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

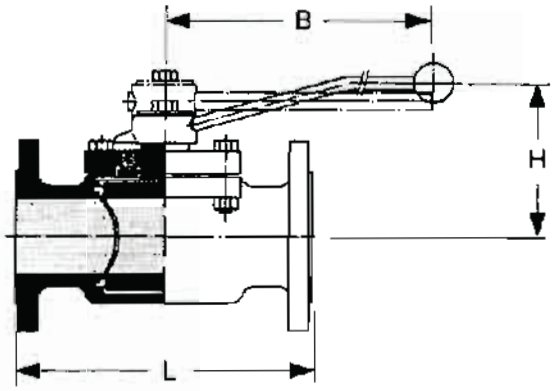
API 598, API 599, ANSI B16.10, ANSI B16.5

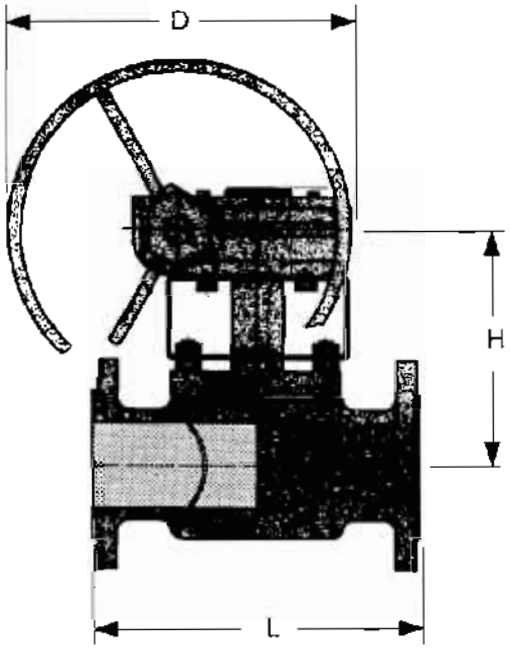
NOTES:

a) EQUIVALENT CAST MATERIAL IS ACCEPTABLE

PDIL

PLUG VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	PLV 205
PRESSURE RATING CLASS	300
FACE	RF
CONSTRUCTION	
BODY	NON-LUBRICATED FULL BORE
PLUG	TAPER PLUG
WRENCH OPERATED	1 1/2" - 4"
GEAR OPERATED	6"
FIRE SAFE	NO
NOMINAL SIZE	1 1/2" - 6"
MATERIALS	
BODY	A 216 Gr. WCB
PLUG	A 105 CHROMEPLATED a)
BODY SEAT RING	REINFORCED PTFE
STEM PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

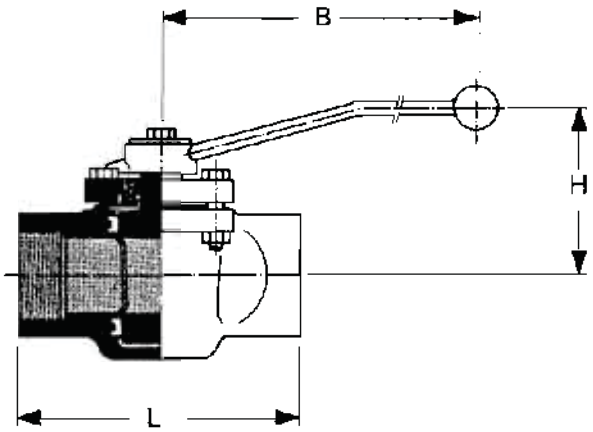
API 598, API 599, ANSI B16.10, ANSI B16.5

NOTES:

a) EQUIVALENT CAST MATERIAL IS ACCEPTABLE

PDIL

PLUG VALVE



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	**PLV 501**
PRESSURE RATING CLASS	600
FACE	TREADED (NPT)
CONSTRUCTION	
BODY	FULL BORE NON-LUBRICATED
PLUG	TAPER PLUG
WRENCH OPERATED	YES
GEAR OPERATED	NO
FIRE SAFE	NO
NOMINAL SIZE	1/2" - 1"
MATERIALS	
BODY	AISI 316
PLUG	AISI 316
BODY SEAT RING	REINFORCED PTFE
STEM PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

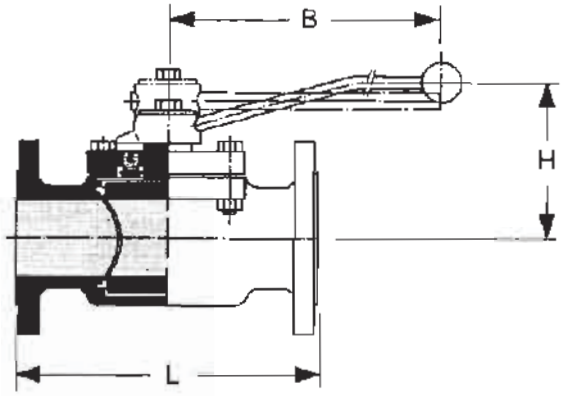
MANDATORY STANDARDS:

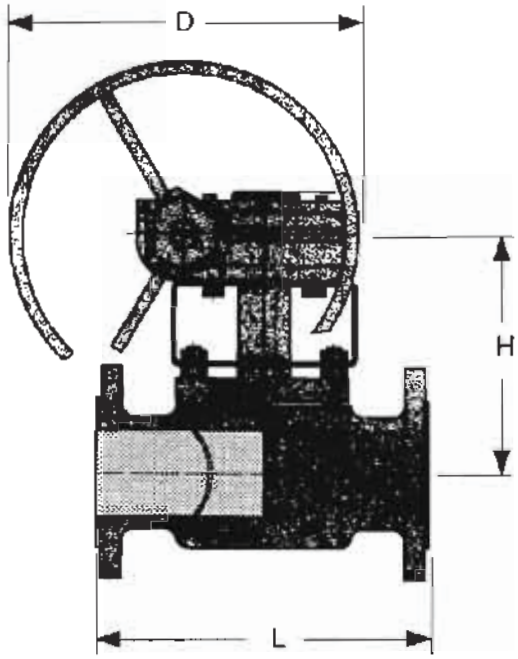
API 598, API 6D, ANSI B16.11, ANSI B16.34

NOTES:

PDIL

PLUG VALVE





DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	PLV 510
PRESSURE RATING CLASS	150
FACE	RF
CONSTRUCTION	
BODY	NON-LUBRICATED FULL BORE
PLUG	TAPER PLUG
WRENCH OPERATED	1 1/2" - 4"
GEAR OPERATED	6"
FIRE SAFE	NO
NOMINAL SIZE	1 1/2" - 6"
MATERIALS	
BODY	A 351 Gr. CF8M
PLUG	A 182 Gr. F316 a)
BODY SEAT RING	REINFORCED PTFE
STEM PACKING	PTFE
DESIGN CONDITIONS	
PRESSURE RATING	ANSI B16.34

GENERAL

1. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

API 598, API 599, ANSI B16.10, ANSI B16.5

NOTES:

a) EQUIVALENT CAST MATERIAL IS ACCEPTABLE

GAV500C :FLANGED GATE VALVE ; 150# ;CPVC BODY(ASTM F441);POLY PROPYLENE PLUG; EPDM SEALS ;TAPERED CYLINDRICAL PLUG DESIGN; BOLTED BONNET; FLAT FACE; FLANGE DIMENSION AS PER ASME B16.1 .

CHV500C :SOCKET WELD CHECK VALVE ; 150# ; H OR V ; UNION OR BOLTED COVER ; BALL TYPE CPVC BODY(ASTM F441);TRIM AS PER BODY MATERIAL ; SOCKET WELD ENDS AS PER ASME B16.11 MANUFACTURER'S STANDARD CONSTRUCTION .

BAV500C :SOCKET WELD BALL VALVE ; 150# ; FLOATING BALL;FULL PORT ;WRENCH OPERATED ; CPVC BODY(ASTM F441);CPVC BALL;VITON O RING SEALS; SOCKET WELD ENDS AS PER ASME B16.11 MANUFACTURER'S STANDARD CONSTRUCTION .

BAV501C : FLANGED BALL VALVE ; 150# ; FLOATING BALL;FULL PORT ;WRENCH OPERATED ; CPVC BODY(ASTM F441);CPVC BALL;VITON O RING SEALS; FLAT FACE; FLANGE DIMENSION AS PER ASME B16.1 ;MANUFACTURER'S STANDARD CONSTRUCTION .

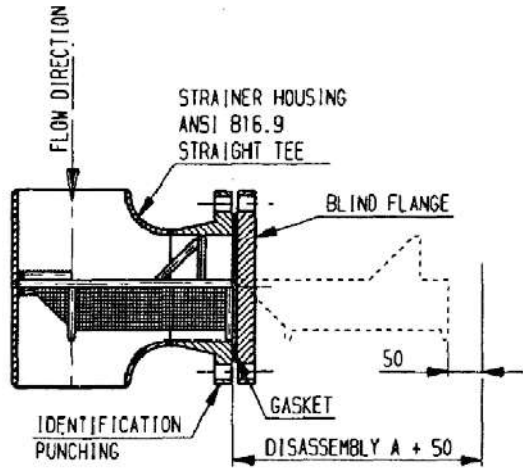
DPV500 : DIAPHRAGM VALVE :150#; RUBBER DIAPHRAGM; FLANGED END; BODY ASTM A216GR.WCB RUBBER LINED ; BONNET ASTM A216 GR.WCB ; STEM/COMPRESSOR 13% CR. ; MANUFACTURER'S STANDARD CONSTRUCTION. rev.1

DPV501 : DIAPHRAGM VALVE :150#; RUBBER DIAPHRAGM; FLANGED END; BODY AUSTENITIC SS 304 ; BONNET SS304 ; STEM/COMPRESSOR SS304 ; MANUFACTURER'S STANDARD CONSTRUCTION. rev.1

STRAINER DATA SHEETS

PDIL

T -TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	TTS 210	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BODY TO BONNET CONNECTION	BOLTED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 1,5 MM	
NOS STRAINER HOLES / SQ.CM	18	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 216 Gr. WCB	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

ASME B16.34, ASME B16.5, MSS-SP 45

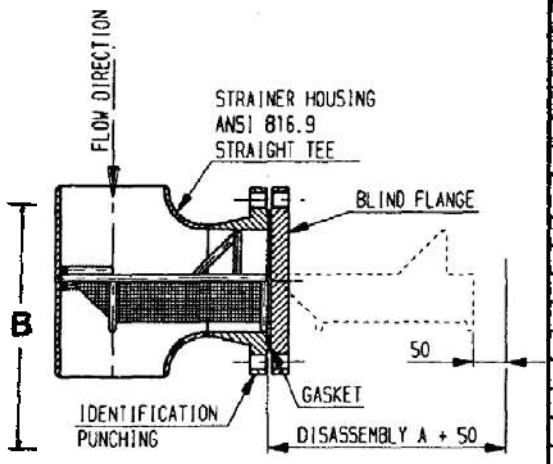
NOTES:

1.

STRAINER SIZE	BLOW OFF CONNECTION
2" - 4"	3/4" NPT PLUG
6" - 8"	1" NPT PLUG
10"	1 1/4" NPT PLUG
12" - 24"	1 1/2" NPT PLUG

PDIL

T-TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	TTS 510	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BODY TO BONNET CONNECTION	BOLTED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 1,5 MM	
NOS STRAINER HOLES / SQ.CM	18	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 351 Gr. CF8	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

ASME B16.34, ASME B16.5, MSS-SP 45

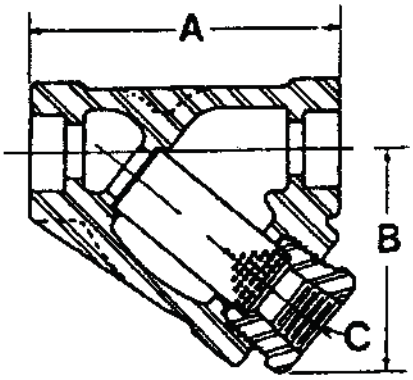
NOTES:

1.

STRAINER SIZE	-	BLOW OFF CONNECTION
2" - 4"		3/4" NPT PLUG
6" - 8"		1" NPT PLUG
10"		1 1/4" NPT PLUG
12" - 24"		1 1/2" NPT PLUG

PDIL

Y-TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	YTS 201	
PRESSURE RATING CLASS	600	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BODY TO BONNET CONNECTION	SCREWED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 0,8 MM	
NOS STRAINER HOLES / SQ.CM	40	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A 105	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

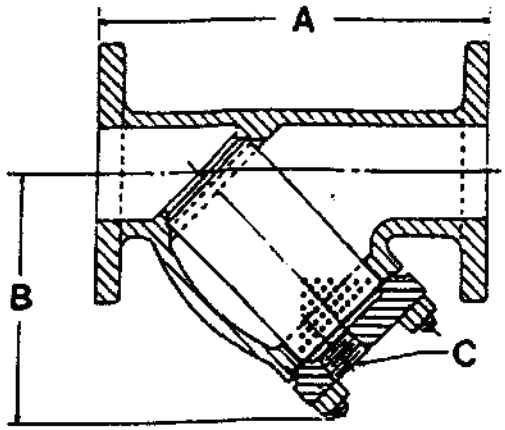
ASME B16.11, ASME B16.34

NOTES:

1. STRAINER SIZE - BLOW OFF CONNECTION
   1/2" - 3/4" 1/4" NPT PLUG
   1" - 1 1/2" 3/4" NPT PLUG

PDIL

Y-TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	YTS 210	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BODY TO BONNET CONNECTION	BOLTED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 1,5 MM	
NOS STRAINER HOLES / SQ.CM	16	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 216 Gr. WCB	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

ASME B16.34, ASME B16.5, MSS-SP 45

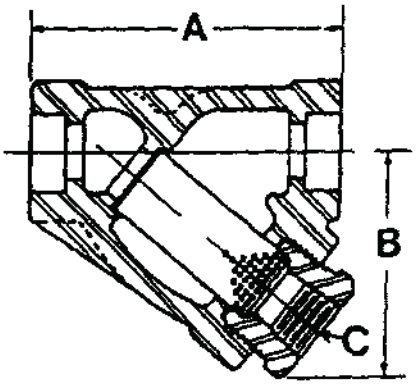
NOTES:

1.

STRAINER SIZE	BLOW OFF CONNECTION
2" - 4"	3/4" NPT PLUG
6" - 8"	1" NPT PLUG
10"	1 1/4" NPT PLUG
12" - 24"	1 1/2" NPT PLUG

PDIL

Y-TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	YTS 501	
PRESSURE RATING CLASS	600	
FACE	SW	
CONSTRUCTION		
BODY	FORGED	
BODY TO BONNET CONNECTION	SCREWED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 0.8 MM	
NOS STRAINER HOLES / SQ.CM	40	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	1/2" - 1 1/2"	
MATERIALS		
BODY	A 182 Gr. F304	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

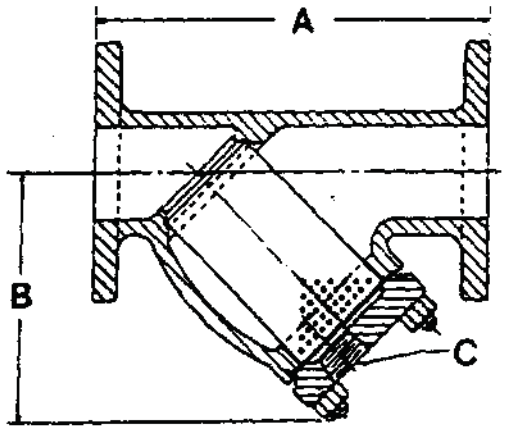
ASME B16.11, ASME B16.34

NOTES:

1. STRAINER SIZE - BLOW OFF CONNECTION
   1/2" - 3/4" 1/4" NPT PLUG
   1" - 1 1/2" 3/4" NPT PLUG

PDIL

Y-TYPE STRAINER



DESIGN (ILLUSTRATIVE ONLY)

ITEM NO	YTS 510	
PRESSURE RATING CLASS	150	
FACE	RF	
CONSTRUCTION		
BODY	CAST	
BODY TO BONNET CONNECTION	BOLTED	
STRAINER	PERFORATED PLATE	
STRAINER HOLES, SIZE	Ø 1,5 MM	
NOS STRAINER HOLES / SQ.CM	18	
BLOW OFF CONNECTION	NOTE 1	
NOMINAL SIZE	2" - 24"	
MATERIALS		
BODY	A 351 Gr. CF8	
STRAINER	AISI 304	
DESIGN CONDITIONS		
PRESSURE RATING	ASME B16.34	
FLUID	Kg/cm2g	°C

GENERAL

1. STRAINER MUST BE REMOVABLE
2. COPPER AND COPPER ALLOYS NOT PERMITTED

MANDATORY STANDARDS:

ASME B16.34, ASME B16.5, MSS-SP 45

NOTES:

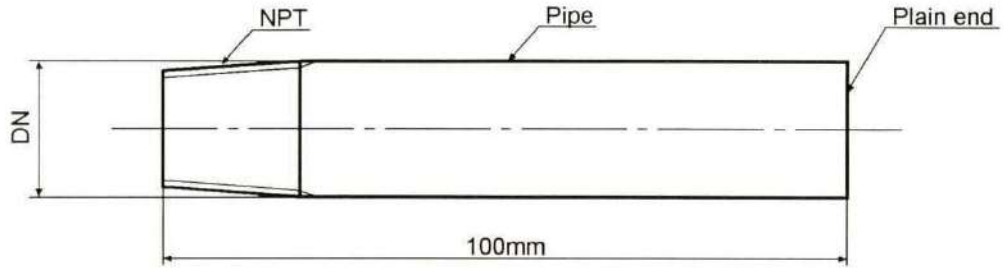
1. STRAINER SIZE - BLOW OFF CONNECTION

STRAINER SIZE	BLOW OFF CONNECTION
2" - 4"	3/4" NPT PLUG
6" - 8"	1" NPT PLUG
10"	1 1/4" NPT PLUG
12" - 24"	1 1/2" NPT PLUG

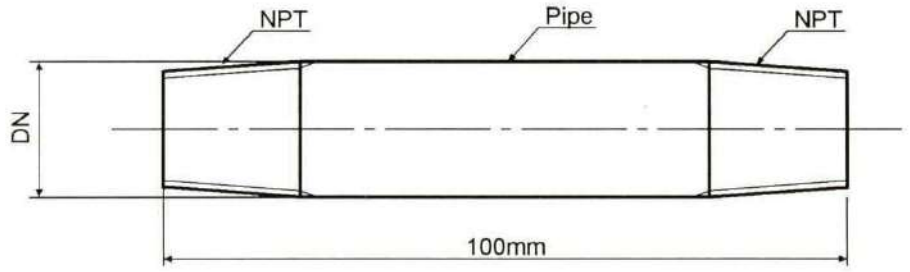
OTHER STANDARDS/DATASHEETS

NIPPLES

1) Half nipple (1/2-nipple)



2) Nipple

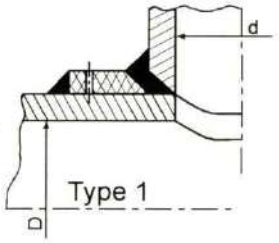


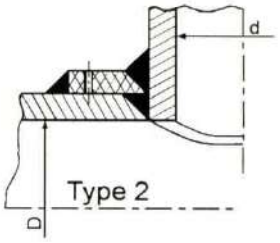
DN = 1/2", 3/4", 1" or 11/2"
Schedule and material of pipe acc. to
piping class specification

Threading acc. to ANSI B 1.20.1-1983

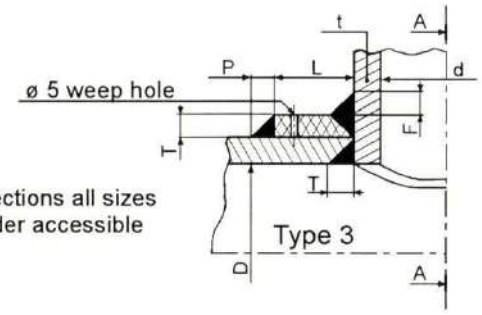
REINFORCING RINGS

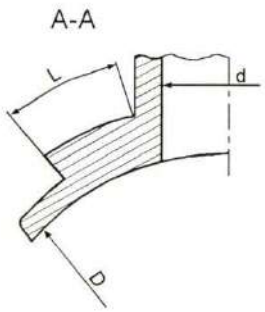
Branch connections-sizes under 24"
inside of header inaccessible





Branch connections all sizes
inside of header accessible





1. Reinforcing of branch connections shall be in accordance with limitations given in the General Piping Specification.
"Reinforcing rings" shall conform to the requirements of this specification.

2. All welds are to be continuous. Fillet welds to have concave contour.

3. Backchipping or gouging to sound metal before welding reverse side is required.

4. The periphery of the cut hole should be examined for laminations when using type 1.

5. Weld details for inclined nozzles are to be similar to the details shown for 90 degree nozzles.

6: The type must be determined by the frabricator.

Legend

T - Thickness of reinforcing ring, to be of the same thickness as header and of equal or better material. Preferably cut from header.

P - Fillet weld leg dimension, equal to T.

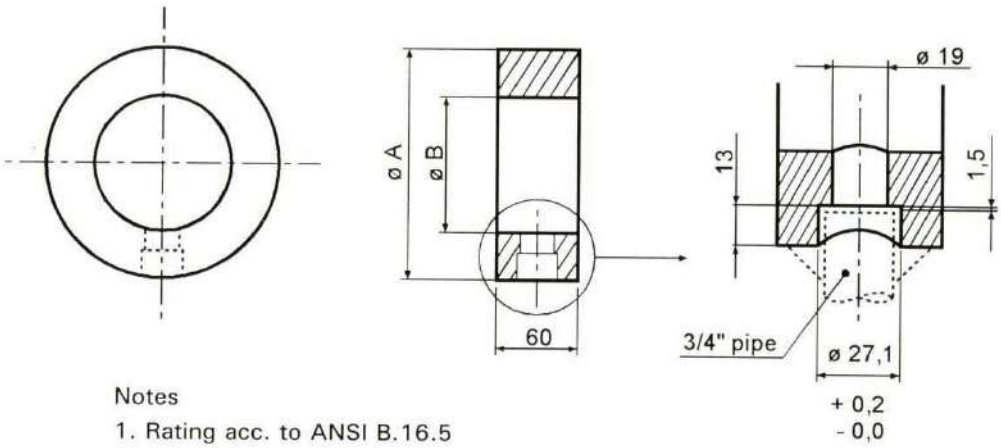
F - Fillet weld leg dimension equal to t.

L - Width of reinforcing ring, see table. For branch sizes > 36" L = d/2

Reinforcing ring table

Nom. Branch size "d" inch.	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	26"	28"	30"	32"	34"	36"
Ring width "L" mm	30	45	55	80	105	130	150	170	190	215	240	290	310	330	360	380	405	430

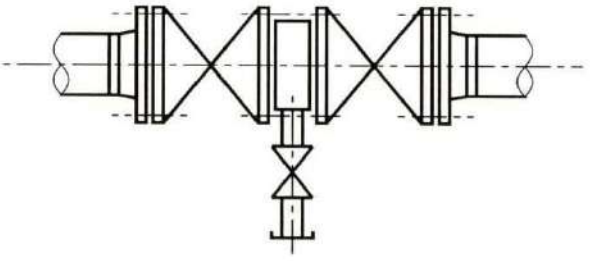
DRIP RING



Notes

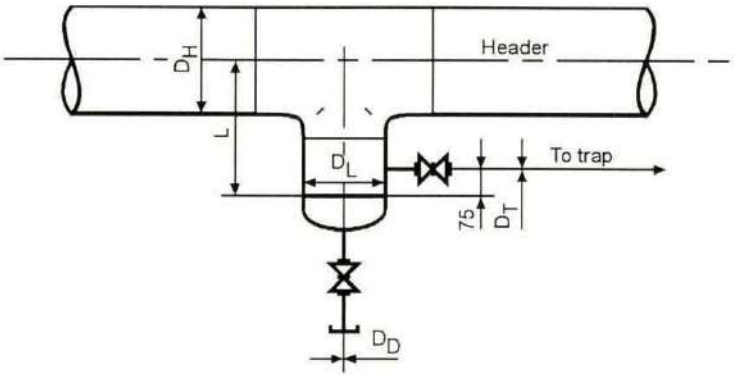
1. Rating acc. to ANSI B.16.5
2. Material in accordance with piping class
3. Faces to be machined parallel and finish to be in accordance with ANSI B.16.5
4. Nom. dia., rating and material to be engraved on edge in letters min. 5mm high e.g. 3"-CL. 600-A 182 Gr. F1

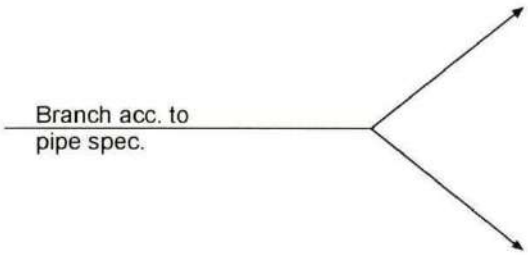
DN Inch.	Class 150 RF		Class 300 RF		Class 600 RF	
	A mm	B mm	A mm	B mm	A mm	B mm
2"	100	52	107	52	107	52
3"	132	78	145	78	145	78
4"	170	102	177	102	190	102
6"	220	154	247	154	263	154
8"	276	206	304	205	317	198
10"	336	260	358	254	396	247
12"	406	311	418	303	453	295
14"	447	343	480	334	487	317
16"	510	394	535	381	560	363
18"	545	445	592	429	608	409
20"	602	495	650	478	678	455
24"	713	590	770	575	786	547

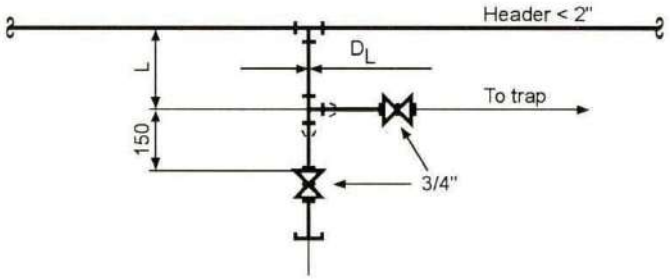


Only where no alternative installation is possible, driprings shall be used.

DRIP LEG ON STEAM HEADERS



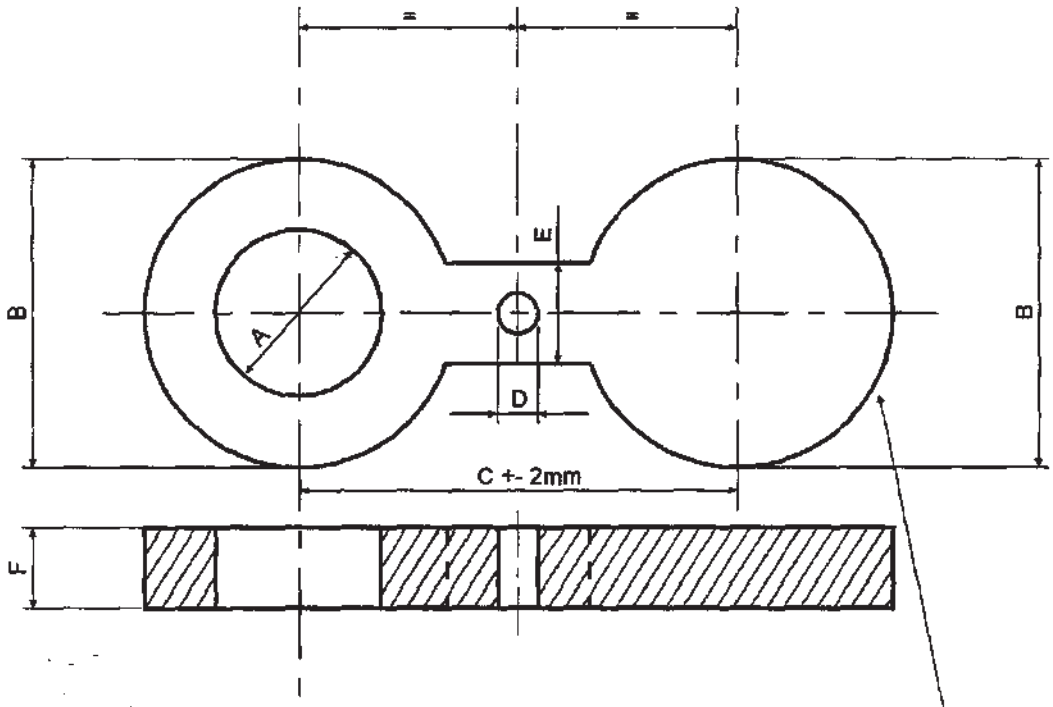




*) D_L = Header size

D_H	= < 2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
D_L	*)	3"	4"	6"	6"	8"	8"	10"	12"	12"	12"	12"
L	250	300	300	350	350	400	400	450	500	525	550	600
D_D	3/4"	3/4"	3/4"	1"	1"	1"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
D_T	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1"

SPECTACLE PLATE CLASS 150 RF

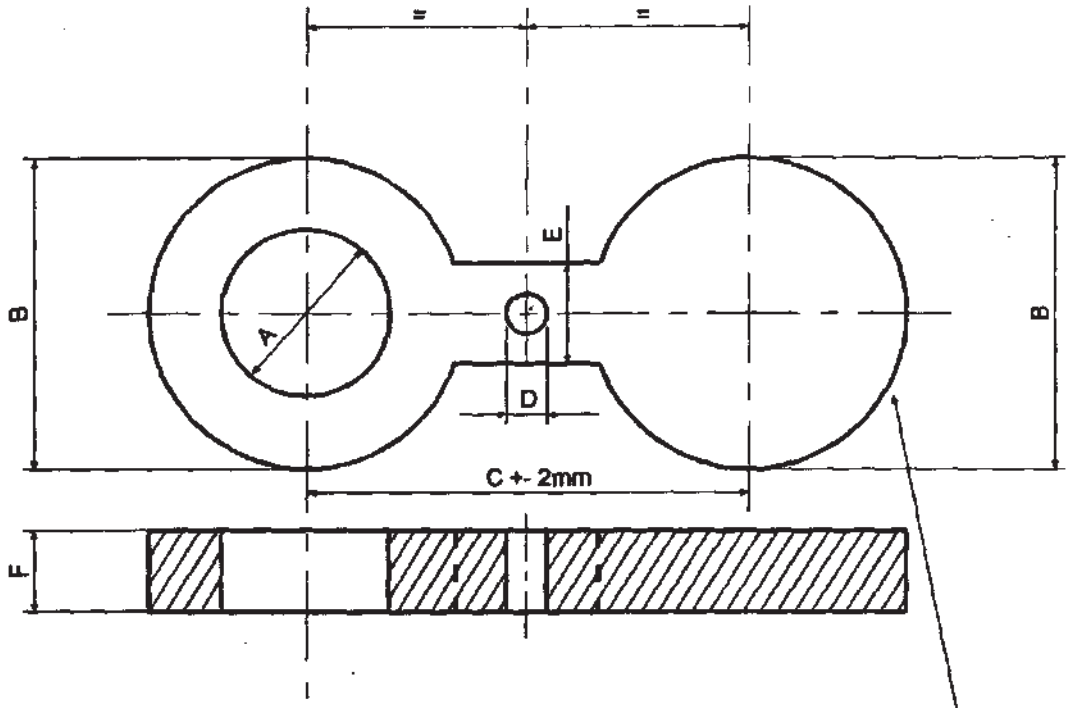


Spectacle plate suitable for flanges acc. to ANSI B16.5. Material as for flanges acc. to piping class.

Nom. dia., rating and material to be engraved on edge in letters min. 5 mm high for example thus: 3"-class 150 -A105

Nominal diameter inches	Min. reqd. overlength bolt	A	B	C	D	E	F
1"	8	33	64	79	16	38	6
1 1/2"	8	48	83	99	16	38	6
2"	8	60	102	121	20	51	6
3"	8	89	133	152	20	64	6
4"	8	114	171	191	20	64	6
6"	12	168	218	241	22	76	10
8"	15	219	277	299	22	76	13
10"	18	273	337	362	26	102	16
12"	24	324	407	432	26	102	22
14"	27	356	447	476	30	108	25
16"	27	406	511	540	30	108	25
18"	27	457	546	578	33	114	25
20"	31	508	603	635	33	121	29
24"	37	610	714	749	36	140	35

SPECTACLE PLATE CLASS 300 RF

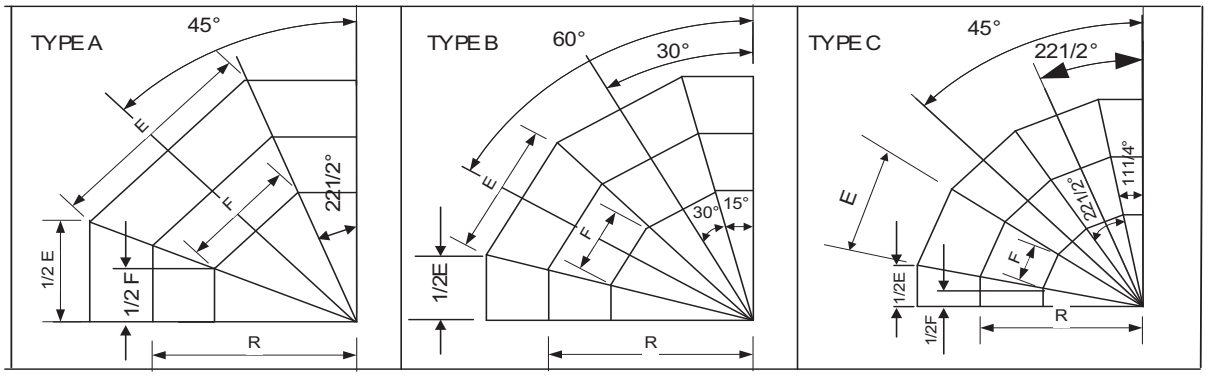


Spectacle plate suitable for flanges acc. to ANSI B16.5. Material as for flanges acc. to piping class.

Norm. dia., rating and material to be engraved on edge in letters min. 5 mm high for example thus: 3"-class 300 -A105

Nominal diameter inches	Min. reqd. overlength bolt	A	B	C	D	E	F
1"	8	33	70	89	20	38	6
1 1/2"	8	48	92	114	22	51	6
2"	8	60	108	127	20	51	6
3"	12	89	146	168	22	64	10
4"	15	114	178	200	22	64	13
6"	18	168	248	270	22	76	16
8"	21	219	305	330	26	89	19
10"	27	273	358	387	30	102	25
12"	31	324	419	451	33	102	29
14"	34	356	482	514	33	121	32
16"	39	405	537	572	36	124	37
18"	43	457	594	629	36	114	41
20"	46	508	651	686	36	121	44
24"	56	610	772	813	42	140	54

MITRE BENDS

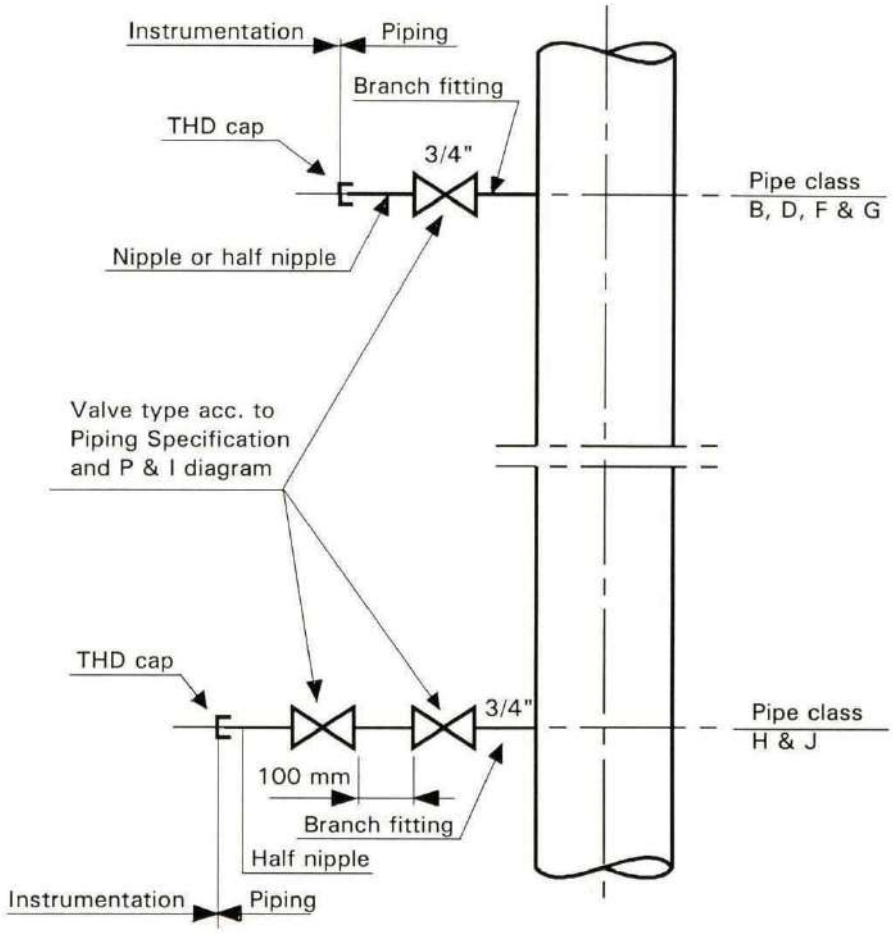


NOM SIZE INCH	OUTSIDE DIAM D mm	R =1.5D mm	30° 60°	45°	90°	$22^1/_2°$	DIMENSION					
							TYPE A		TYPE B		TYPE C	
							E mm	F mm	E mm	F mm	E mm	F mm
2	60.3	76	B	A	A	C	88	38	57	24	42	18
3	88.9	114	B	A	A	C	131	58	85	37	63	28
4	114.3	152	B	A	A	C	173	79	112	51	83	38
6	168.3	229	B	A	A	C	259	120	168	78	125	58
8	219.1	305	B	A	B	C	343	162	222	105	165	78
10	273.1	381	B	A	B	C	429	203	277	131	206	97
12	323.9	457	B	A	B	C	513	244	332	158	246	117
14	355.6	533	B	C	B	C			381	190	283	141
16	406.4	610	B	C	B	C			436	218	323	162
18	457	686	B	C	B	C			490	245	364	182
20	508	762	B	C	B	C			544	272	404	202
22	559	838	B	C	B	C			599	300	445	222
24	610	914	B	C	B	C			654	327	485	243
26	660	991	B	C	C	C			707	354	525	263
28	711	1,067	B	C	C	C			762	381	566	283
30	762	1,143	B	C	C	C			817	408	606	303
32	813	1,219	B	C	C	C			871	436	647	323
34	864	1,295	B	C	C	C			926	463	687	344
36	914	1,372	B	C	C	C			980	490	727	364
38	965	1,448	B	C	C	C			1,034	517	768	384
40	1,016	1,524	B	C	C	C			1,089	544	808	404
42	1,067	1,600	B	C	C	C			1,144	572	849	424
44	1,118	1,677	B	C	C	C			1,198	599	890	445
46	1,168	1,752	B	C	C	C			1,252	626	929	465
48	1,219	1,829	B	C	C	C			1,307	653	970	485
52	1,321	1,982	B	C	C	C			1,416	708	1,051	526
56	1,422	2,134	B	C	C	C			1,524	762	1,131	566
60	1,524	2,286	B	C	C	C			1,633	817	1,213	606
64	1,626	2,439	B	C	C	C			1,743	871	1,294	647
68	1,727	2,591	B	C	C	C			1,851	925	1,374	687
72	1,829	2,743	B	C	C	C			1,960	980	1,455	728
76	1,931	2,897	B	C	C	C			-	-	1536	768

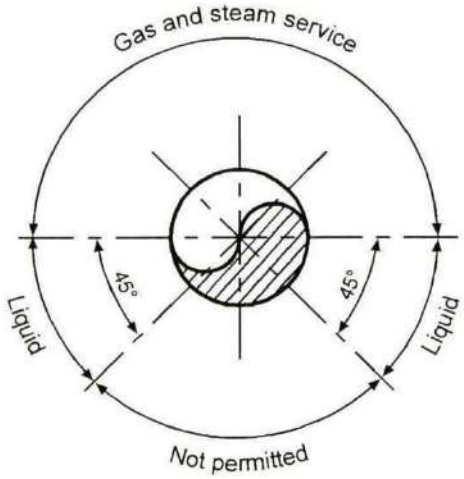
P1	27.12.2017		FOR REVIEW/COMMENT	NAZ	NS	GL/HOD
P	21.10.2017		FOR REVIEW/COMMENT	NAZ	NS	DM
REV	REV DATE	EFFDATE	PURPOSE	PREPD	REVWD	APPD

BRANCH FOR ANALYSIS - AND PRESSURE CONNECTIONS ON PIPING

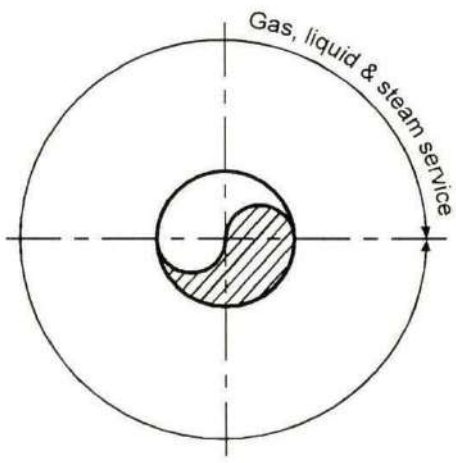
(FOR ANALYSIS CONNECTIONS WITH PROBE SEE SPECIAL DRAWINGS)



Location of branch in horizontal line

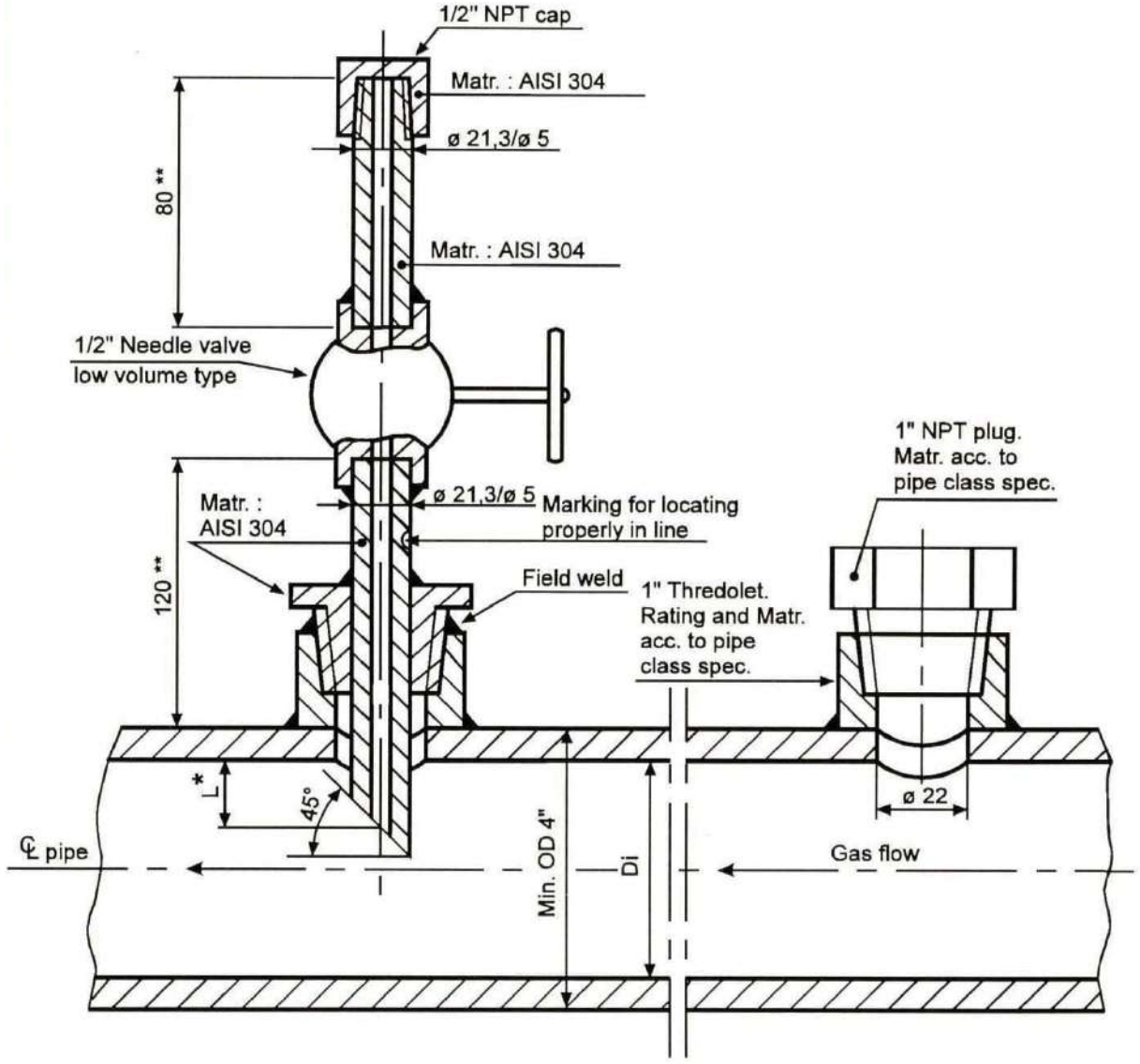


Location of branch in vertical line



All branch fittings and valves to be specified acc. to pipe class.

ANALYSIS CONNECTION WITH PROBE ON PIPE
FOR RATINGS < = CLASS 900



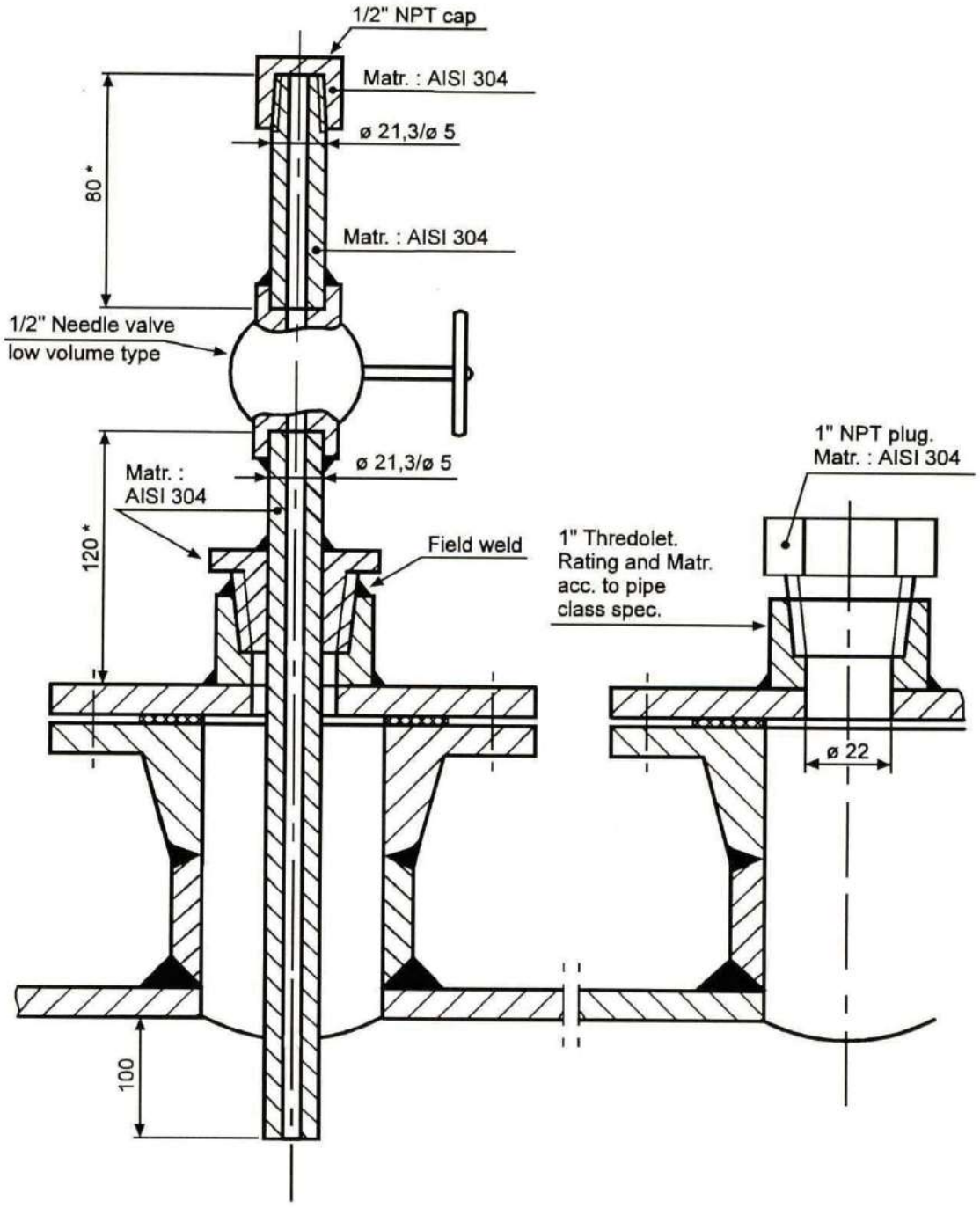
Final execution
Instrumentation supply

During pressure test and cleaning
Piping supply

* For Di > 6", L = 1/3 Di +- 1/6 Di
For Di < = 6", L = 1/2 Di +- 1/6 Di

** Shortest possible

ANALYSIS CONNECTION WITH PROBE ON EQUIPMENT FOR RATINGS < = CLASS 900

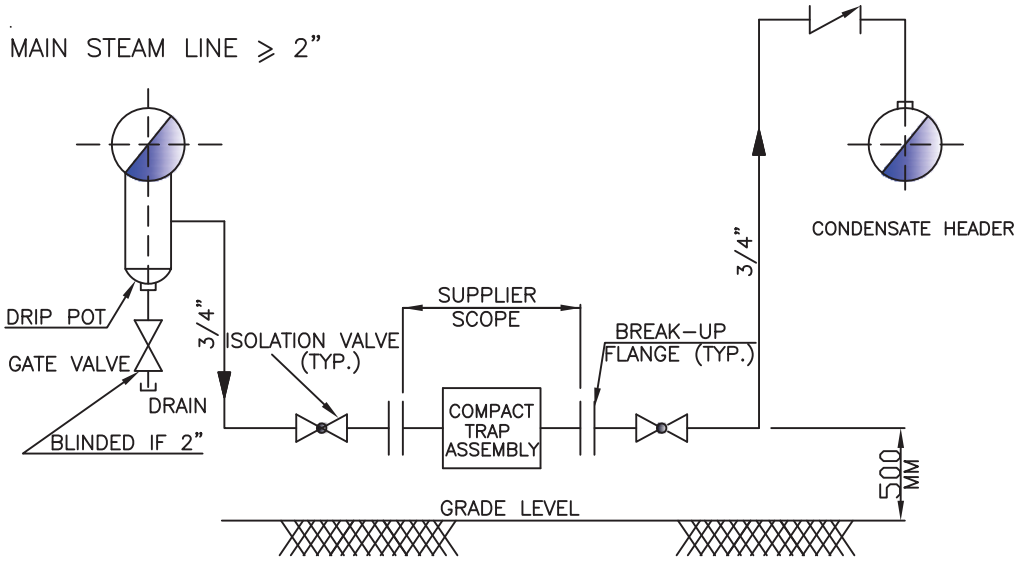


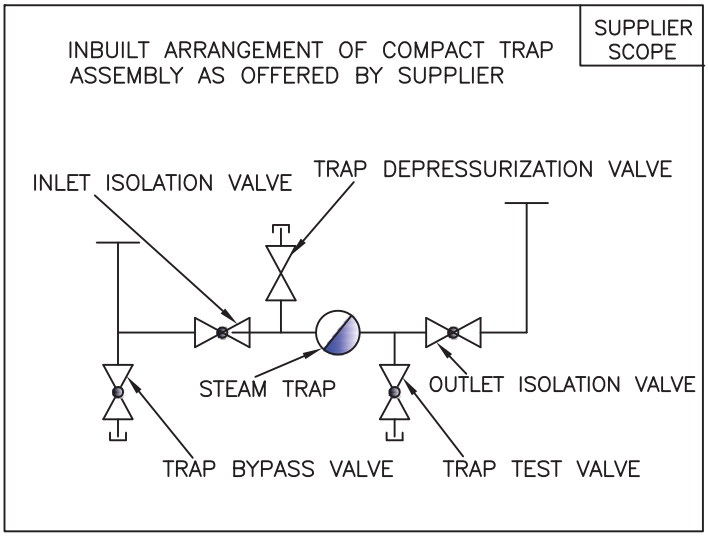
Final execution
Instrumentation supply

During pressure test and cleaning
Piping supply

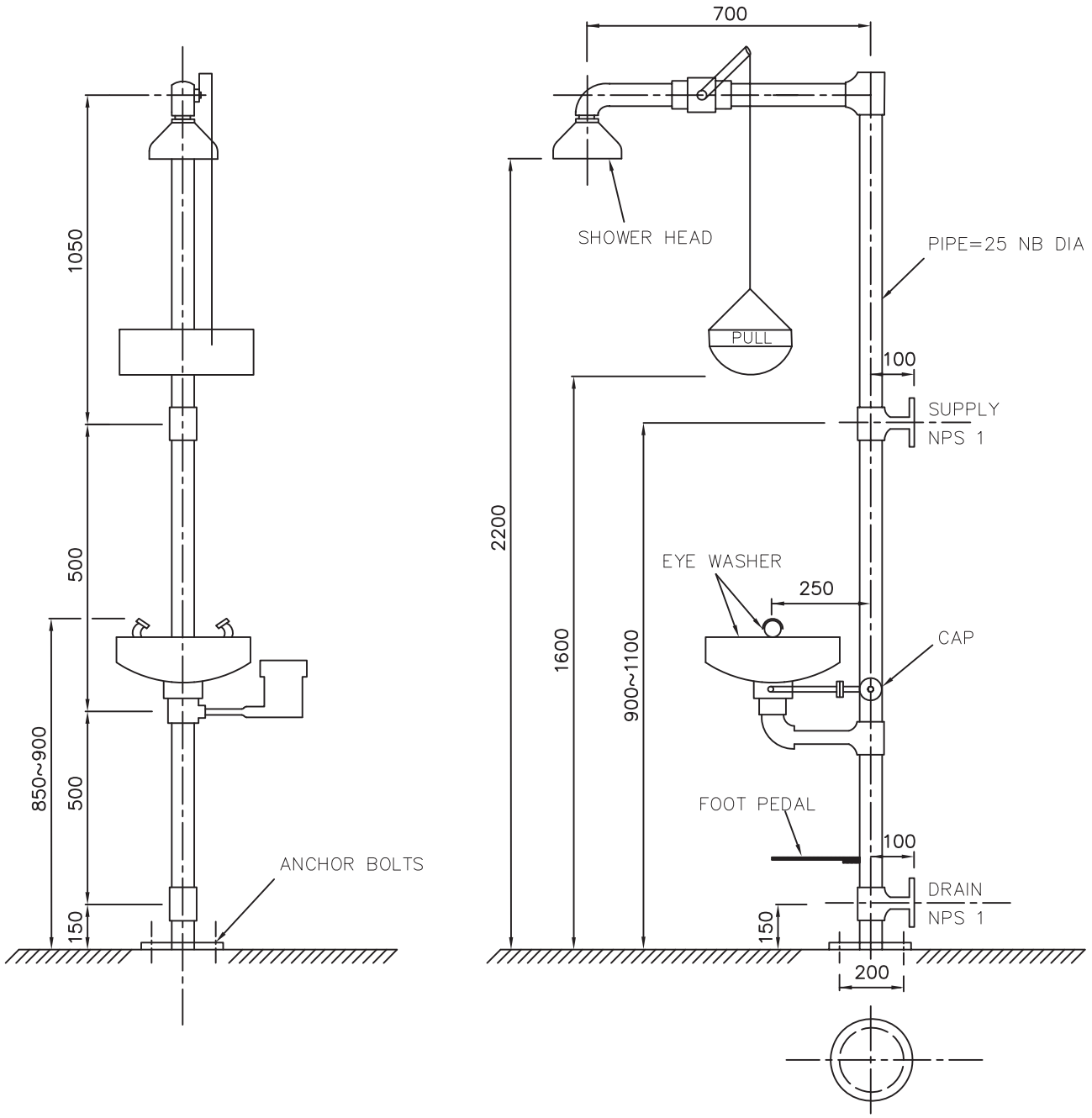
* Shortest possible

TYPICAL ARRANGEMENT OF DRAIN FOR STEAM LINES AND STEAM TRAP





DATASHEET FOR SAFETY SHOWER AND EYE WASH UNIT (COMBINED)



SUPPLY WATER CONDITIONS

1) SUPPLY WATER	: POTABLE WATER
2) DESIGN PRESS.	: 7 kg/cm2g
3) DESIGN TEMP.	: 70 °C
4) HYDRO. TEST PRESS.	: 1.5 times of Design Pr.
5) MINIMUM FLOW.	
a) SAFETY SHOWER	: 110 Lit/min.
b) EYE WASH	: 12 Lit/min.

MATERIAL

1) PIPE	: SS304
2) FITTING	: SS304
3) FLANGE	: SS304
4) VALVES/STRAINER	: SS304
5) BOWL FOR EYEWASH	: SS304
6) EYE WASH NOZZLE	: SS304
7) SHOWER HEAD	: SS304
8) PULL CHAIN	: SS304
9) FOOT PEDAL	: SS304
10) SPRING	: SS304
CODE/STANDARD	: IS 10592

NOTES:

1) THE GIVEN DIMENSIONS ARE ONLY FOR REFERENCE; THE MANUFACTURER'S STANDARD DIMENSIONS MAY BE APPLIED, SUBJECT TO APPROVAL .

2) THE COMBINED UNIT OF SAFETY SHOWER & EYE WASH SHALL BE PULL ROD AND FOOT PEDAL OPERATED AND PROVIDED WITH DUST COVER & FILTER.

3) ALL SAFETY SHOWER & EYE WASH UNIT SHALL BE PAINTED WITH FLOURESCENT PAINT SO THAT IT CAN BE VISIBLE IN NIGHT. NAME PLATE TO BE PROVIDED ON EACH SAFETY SHOWER & EYE WASH UNIT.

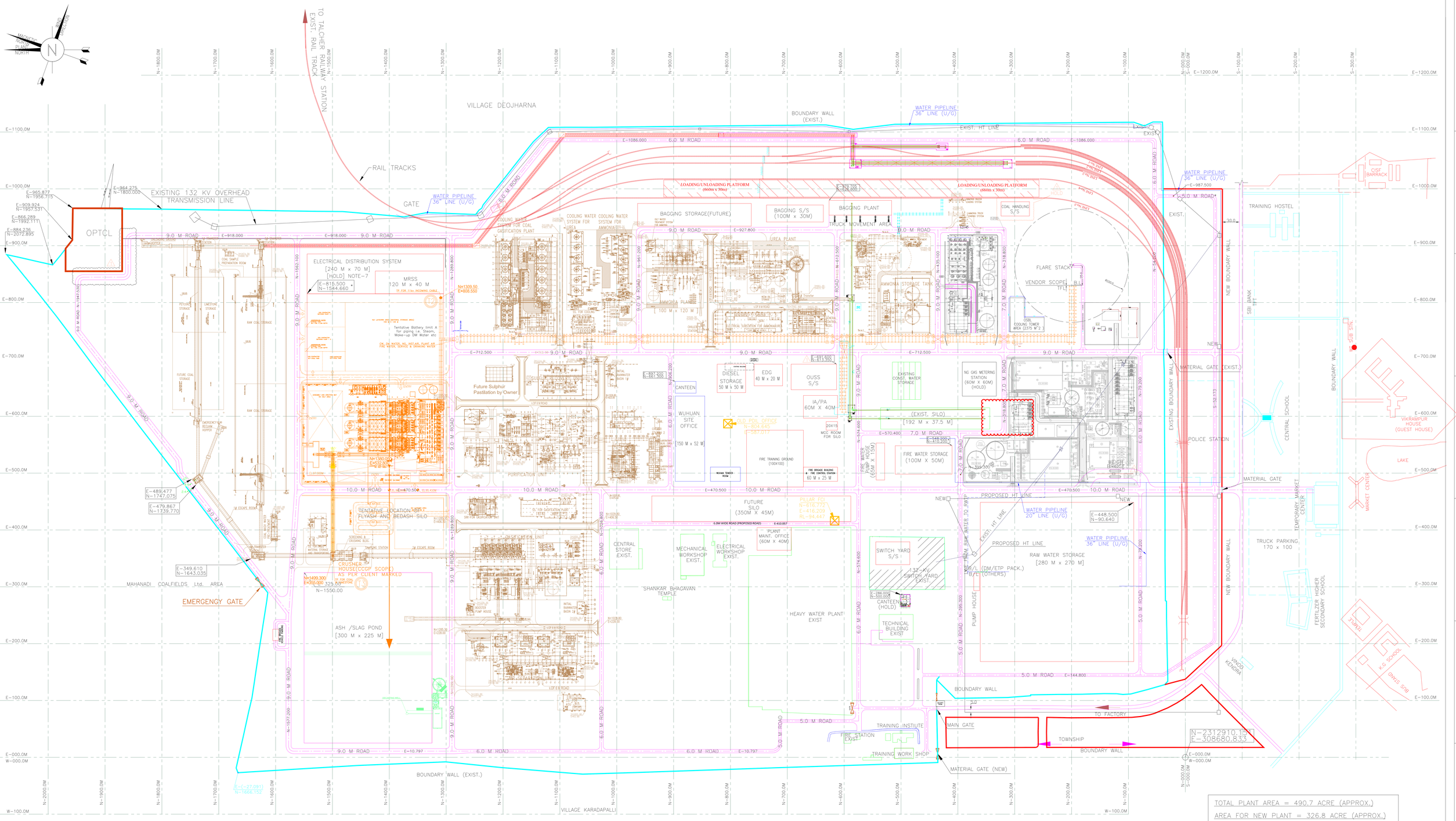
4) SAFETY SHOWER & EYE WASH UNIT SHOULD BE ISI MARKED.

5) THE COMBINED UNIT OF SAFETY & EYE WASH SHOULD BE CAPABLE TO PROVIDE A CUPIOUS FLOW OF WATER FOR ATLEAST 15 MINUTES.

6) ALL DIMENSIONS ARE IN MILLIMETERS.

7) OTHER SIZES BY VENDOR.

8) The spray nozzles shall be so designed as to deliver a spray of rinse water without harsh jets or misting. The water cone shall have vortex angle of 45^0.



TOTAL PLANT AREA = 490.7 ACRE (APPROX.)
AREA FOR NEW PLANT = 326.8 ACRE (APPROX.)
TOTAL GREENBELT AREA = 163.9 ACRE (APPROX.)

TABLE-1 LSTK FACILITIES/UNITS OF GASIFICATION PLANT

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	AIR SEPARATION UNIT	200 M x 120 M	
2.	GASIFICATION UNIT	200 M x 115 M	
3.	PURIFICATION UNIT	213.7 M x 110 M	
4.	SULFUR RECOVERY UNIT	78 M x 55 M	
5.	COOLING WATER SYSTEM FOR GASIFICATION PLANT	98.5 M x 161.5M	
6.	INITIAL RAIN WATER BASIN-1	15 M x 28 M	
7.	INITIAL RAIN WATER BASIN-2	17.8 M x 23.5 M	
8.	COAL WASH WATER PRE-TREATMENT	12.5M X 46.5 M	
9.	ELECTRICAL SUBSTATION FOR GASIFICATION PLANT	7.5 M x 24 M	
10.	ELECTRICAL SUBSTATION FOR COOLING WATER SYSTEM FOR GASIFICATION PLANT	27 M x 36 M	
11.	ELECTRICAL SUBSTATION FOR PURIFICATION UNIT	36 M x 28 M	
12.	ELECTRICAL SUBSTATION FOR SOLTS MATERIAL STORAGE & TRANSPORTING	31 M x 28 M	
13.	ELECTRICAL SUBSTATION FOR ASU	37 M x 28 M	
14.	GENERAL CONTROL BUILDING	40 M x 47 M	
15.	RAW COAL STORAGE	90 M x 375 M	
16.	PETCOKE/LIMESTONE STORAGE	90 M x 97 M	
17.	LABORATORY BUILDING	5615 M x 2139M	

TABLE-2 LSTK FACILITIES/UNITS OF AMMONIA/UREA PLANT

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	AMMONIA UNIT	100 M x 120 M	
2.	UREA UNIT	156 M x 93 M	
3.	COOLING WATER SYSTEM FOR AMMONIA	52.5 M x 125 M	
4.	COOLING WATER SYSTEM FOR UREA	59 M x 140 M	
5.	COOLING WATER SYSTEM FOR AMMONIA STORAGE	22 M X 27 M	
6.	OILY WATER TREATMENT SYSTEM FOR AMMONIA	16 M X 24 M	
7.	OILY WATER TREATMENT SYSTEM FOR UREA	29 M X 17 M	
8.	ELECTRICAL SUBSTATION FOR AMMONIA & UREA	96.5 M x 28 M	
9.	ELECTRICAL SUBSTATION FOR COOLING WATER SYSTEM FOR AMMONIA & UREA PLANT	24 M X 31 M	
10.	ELECTRICAL SUBSTATION FOR AMMONIA TANK	18 M X 42 M	
11.	DIESEL GENERATOR ROOM	22 M x 15 M	
12.	GENERAL CONTROL BUILDING	52 M x 38 M	
13.	AMMONIA STORAGE TANK	100 M x 170 M	
14.	LABORATORY BUILDING	20.75 M x 21.6M	

TABLE-3 OSBL (PDIL/TFL) FACILITIES/UNITS

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	DM WATER PLANT	-	PACKAGE
2.	WATER TREATMENT PLANT	-	PACKAGE
3.	ETP	-	PACKAGE
4.	RAW WATER STORAGE	-	PACKAGE
5.	BAGGING PLANT	110 M x 26 M	
6.	OSBL COOLING TOWER	2375 M^2	
7.	LOADING UNLOADING PLATFORM	660 M x 30 M	
8.	STEAM GENERATION PLANT	-	PACKAGE
9.	ELECTRICAL DISTRIBUTION SYSTEM	240 M x 70 M	PACKAGE
10.	IN AIR / PLANT AIR	60 M x 40 M	PACKAGE
11.	FIRE WATER STORAGE	100 M x 50 M	PACKAGE
12.	FIRE WATER PUMP HOUSE	65 M x 15 M	PACKAGE
13.	EDG	40 M x 20 M	
14.	DIESEL STORAGE	50 M x 50 M	
15.	FIRE BRIGADE BUILDING & FIRE CONTROL STATION	25 M x 60 M	
16.	FUTURE SILO	45 M x 350 M	
17.	EXISTING SILO	192 M x 37.5 M	
18.	PLANT MAINTENANCE OFFICE	60 M x 40 M	
19.	TRUCK PARKING AREA	170 M x 100 M	
20.	ASH / SLAG POND (ASH POND)	300 M x 225 M	

TABLE-3 OSBL (PDIL/TFL) FACILITIES/UNITS

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
21.	CENTRAL STORE	-	EXISTING
22.	MECHANICAL WORKSHOP	-	EXISTING
23.	ELECTRICAL WORKSHOP	-	EXISTING
24.	SWITCH YARD	-	EXISTING
25.	CANTEEN	20.6 M x 15.5 M	
26.	TECHNICAL BUILDING	-	EXISTING
27.	FIRE BRIGADE VEHICLE PARKING	33 M x 20 M	

TABLE-4 OSBL (PDIL/TFL) SUBSTATION

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	SUB-STATION (DM WATER PLANT)	-	PACKAGE
2.	SUB-STATION (WATER TREATMENT PLANT)	-	PACKAGE
3.	SUB-STATION (ETP)	-	PACKAGE
4.	SUB-STATION (BAGGING PLANT)	100 M x 30 M	
5.	SUB-STATION (COAL HANDLING)	HOLD	
6.	SUB-STATION (STEAM GENERATION)	-	PACKAGE
7.	SUB-STATION (ASH DYKE)	-	PACKAGE
8.	SUB-STATION (EDG BUILDING + PANEL ROOM)	40 M x 20 M	HOLD
9.	SUB-STATION (COOLING TOWER-MCC ROOM)	-	PACKAGE
10.	SUB-STATION (132-KV SWITCH YARD)	-	EXISTING
11.	SUB-STATION (MRSS-ESS)	120 M X 40 M	PACKAGE
12.	SUB-STATION (ASH HANDLING)	HOLD	PACKAGE
13.	SUB-STATION (OUSS)	80 M X 45 M	
14.	SUB-STATION (SILO-MCC ROOM)	20 M X 15 M	PACKAGE

NOTES:-

1. ALL DIMENSIONS AND COORDINATES ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. REFERENCE BENCH MARK (⊕) POINTS IS W.R.T GLOBAL CO-ORDINATES HAVING N-2312910.151 & E-308680.833 (GRID COORDINATES N-000.0M, E-000.0M)
3. EL. 91.000M CORRESPONDS TO EL. 100.000M.
4. BLOCK SIZE OF FACALITIES ARE TO BE FINALIZED AFTER GETTING VENDOR INFO.
5. IT IS ASSUMED THAT 220 KV EXTERNAL POWER SUPPLY TIE-IN SHALL BE AT THE BOUNDARY WALL CLOSE TO THE LOCATION OF ELECTRICAL DISTRIBUTION SYSTEM BLOCK.
6. * INDICATES HOLD.

LEGEND :~

- PLANT BOUNDARY
- PROPOSED FACILITIES (PDIL/TFL)
- PROPOSED FACILITIES (WUHAN)
- EXISTING FACILITIES
- RAILWAY LINE
- PROPOSED ROAD
- PROPOSED GREEN BELT
- PIPE RACK

S.NO.	REFERENCE DRAWINGS	NUMBERS
05.	TOPOGRAPHICAL & CONTOUR SURVEY DRAWING	SA/RCF/TALCHER/2017/TOPO-DWG
04.	MASTER PLAN OF MINING	FURNISHED BY CLIENT
03.	MASTER PLAN [FCI, TALCHER UNIT].	DRG. NO. 501
02.	INDEX PLAN [FCI, TALCHER UNIT].	DRG. NO. 635
01.	PLANTS LAYOUT [FCI, TALCHER UNIT].	TFU-M-GN-6341

REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
1	28.07.2022	ISSUED	ANIL	RKV/NSY	AMAR
0	15.02.2022	ISSUED FOR COMMENT	SAYEED	RKV/NSY	AMAR
P	19.01.21	PRELIMINARY ISSUE	AM	DD/NS	AMAR

CLIENT : M/s. TALCHER FERTILIZER LIMITED

REV. P 0 1

SHEET 1 OF 1

PROJECT : INTEGRATED COAL BASED FERTILIZER AND CHEMICAL COMPLEX

SCALE : 1: 2200

DRG. No.: PC183-0000-0001

TITLE : OVERALL PLOT PLAN

FILE : PC183-0000-0001_Rev 1

PROJECTS & DEVELOPMENT INDIA LTD. NOIDA

SECTION – VI

ANNEXURE 2.1

DESIGN SPECIFICATION – FIRE FIGHTING SYSTEM

FLARE SYSTEM

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

TABLE OF CONTENTS

SECTION NUMBER	DESCRIPTION
1.0	Purpose
2.0	Scope
3.0	Design Criteria
4.0	Fire Protection Systems
5.0	Material specifications
6.0	First aid fire fighting equipments
7.0	Safety equipments/ Personnel protective equipments
8.0	Execution, Inspection & Testing
9.0	Quality assurance system
10.0	Inspection
11.0	Testing
12.0	Documentation

LIST OF ATTACHMENTS

ATTACHMENT NUMBER	DESCRIPTION	NUMBER OF SHEETS
PC183-PNMP-TS-PPE	Technical specification of personnel protective equipment	12
PC183-4012-921-001	Conceptual fire water layout	01

1.0 PURPOSE

The purpose of this document is to establish the requirements of the fire fighting system for applicable facilities of the package plant.

This document is a general specification providing typical requirements of layout, material, testing, etc. for various fire fighting systems.

This specification covers design basis and execution requirements for fire protection system for fertilizer plant. The provisions shall be made, in order of precedence, as per statutory regulations, TAC guidelines, job specifications and safe engineering practices.

2.0 SCOPE

Contractor shall provide fire fighting system as mentioned in this document in accordance with TAC/NFPA/NBC 2016 (and/or Latest Edition) for applicable facilities of the package plant.

3.0 DESIGN CRITERIA

The Fire Protection Philosophy is based on Loss Preventive and Control. The adequacy of fire protection facilities for fertilizer plant is very important because of the inherent hazard it carries. A fire in one part/section of the plant can endanger other sections of plant as well. If fire breaks out, it must be controlled / extinguished as quickly as possible to minimise the loss to life and property and to prevent further spread of fire. In this job, the design of the package plant is a part of Ammonia, Urea, Coal based methane plant (Coal Gasification plant) which is considered in high hazard (B), as per NBC 2016.

Unless otherwise specified in the NIT the design shall meet requirement of applicable standard over and above the standards mentioned below:
IS 3034: 1993 - Fire Safety of Industrial Buildings: Electrical Generating and Distributing Stations - Code of Practice [CED 36: Fire Safety]
IS 12459: 1988 Code of Practice for Fire Safety in Cable Runs [CED 36: Fire Safety]
IS 1646: 1997 Code of Practice for Fire Safety of Buildings (General): Electrical Installations
CEA (Measures relating to Electrical Safety) Regulations 2010
IS 15394: 2003 - Fire Safety in Petroleum Refineries and Fertilizer plants
IS 3844: Installation and maintenance of internal fire hydrants and hose reels on premises
National Building Code 2016 (and/or Latest)

4.0 FIRE PROTECTION SYSTEMS

The following fire protection facilities shall be provided depending upon the nature or the installation and risk involved wherever applicable.

a) Fire hydrant system
b) Water spray/sprinkler system
c) Gas flooding system
d) Fire detection, alarm & communication system
e) First aid fire fighting equipments including Portable fire extinguishers
f) Personnel protective equipments (PPE)

4.1 Fire Hydrant System

Fire water network shall consist of mostly aboveground and/or underground, if required, piping systems.

Around units the fire water mains shall be laid aboveground and directly buried and/or in trenches, if it is laid underground. The underground ring main network system shall be laid at minimum one meter earth cushion. Top of casing pipe (RCC Hume pipe) of underground piping crossing roads (peripheral road, package unit road, access road/ways) shall be at min. 1.5 metre depth.

All underground fire water piping shall be externally protected from corrosion by wrapping and coating of cold tape as per attached specification, for underground CS pipe which shall extend up to min. 500 mm, above / beyond grade wherever applicable.

Above ground fire water piping shall be painted as per painting specification and the paint shall be conforming to shade as per IS 5.

Wherever fire water line will cross the roads, same shall be put under a suitable hume pipe or culvert, with proper wrapping, coating as a anticorrosive treatment (Cold Tape Type, as per detailed specification provided elsewhere in NIT).

Flushing point with isolation gate valve and pressure gauge points (approx at the rate 300mtr. and at all battery limit tie in points) with isolation gate valve shall be provided on all headers.

Network shall be laid in closed loops to ensure multidirectional flow. Isolation valve to be provided at every 300m (max) and at crossings (Junctions) to ensure easy maintenance and uninterrupted water supply in case of break down and shall be planned in such a way that outage of any section of fire water line should not affect other section.

Hydrant posts shall be installed with a branch “L” shape piping to avoid directly fall of leaking water on main header.

RCC slabs (Minimum 1500mmX1500mmX100mm thk.) shall be provided at the grade level beneath of each Hydrant/Monitor/HVLR post and respective hose box.

Up to 2.0 m portions of the headers (if above ground) on both sides of hydrant branching and the entire branch piping near of hydrants shall be epoxy painted.

Isolation valves (gate valves, rising spindle) shall be provided below monitors and at all hydrants. Suitable restriction orifice shall be provided at downstream of isolation valve of hydrant post to maintain the pressure requirements as per TAC / IS15394.

Fire water pressure at the farthest point shall be a minimum of 7 kg/cm2 after installation of headers and sub headers.

All fire water piping shall be tested to hydraulic test pressure of 18 kg/ cm2 (g) and/or as calculated considering pump shut-off pressure.

Radiography requirements shall be as per TAC (minimum 10%).

For process units, external ring header with hydrants and an internal distribution with monitors and hose reels shall be installed.Hydrant heads shall be placed at a minimum distance of 15m from process equipment.

Monitors around heater areas, if any, shall be necessarily provided and located in such a manner that the heater can be isolated from the plant.

Monitors shall be provided to cover the high rise columns, equipments etc. of height 15 mtr. and above, unless otherwise specified in layout drawing.

There may be cases where due to horizontal obstruction, a particular vessel/ process column may not be approachable by ordinary monitor or hydrant, elevated monitors shall be provided to take care of such conditions.

Tall columns, structure, towers and equipment where it may not be possible to provide access staircases with hydrants on landing, will be considered as protected by hydrants at ground level, provided they are less than 15 m in height. When the height exceeds 15 m, the concerned hydrants shall be replaced by monitors.

Alternate hydrants for protection of loading unloading bays, rail/truck gantries shall be replaced by water/foam monitors.

Number of hydrants shall be based on one hydrant post with two hydrant valves for every 30m (max.) of external perimeter of process units and storage tank area. For utility and other building areas, this distance shall be a maximum of 45m.

Hydrants and/or water monitors shall be located keeping in view the different risks within the premises which are to be protected and ensuring effective coverage.

Double hydrants (IS: 5290 type A, hydrant valve with single outlet) on each hydrant post (i.e. two hydrant valves mounted on each stand post) and at every 30m centre to centre, along the hydrant mains, shall be provided.

Extension of hydrants/monitors for spill fire (as required by TAC/ IS15394) shall also to be provided.

Indoors hydrants with hydrant valves (landing valves), hose reels and hose box containing accessories, for plant buildings and non-plant buildings, shall be provided as per IS-3844. In case of buildings, hydrants shall be located at not be less than 2 m and not more than 15 m from the face of building.

Double headed landing valves (two numbers, type-A, Landing valves on single stand post), shall be provided on the landing of first floor and above on all the buildings/Tech structure/platforms etc. with isolation valve at each tapping for landing valve assembly.

The monitors shall have isolation valve. Monitor location shall be given special consideration for protection of cluster of towers, heaters and other high structures, where it may not be possible to approach the higher levels. Minimum of two monitors shall be provided for each such area.

Field adjustable variables flow type remote operated monitors shall be provided for the protection of inaccessible equipment.

Contractor to finalise hydrant layout on plot plan, with all the requirements such as number of Hydrants, Monitors, Foam system, sprinkler system etc., based on all statutory requirements & Code Guidelines, considering ease of maintenance and safe approach for fire fighting. Due consideration is to be given for providing Emergency escape routes also. Hydrants are to be strategically located to obtain maximum advantage of layout.

Fire brigade connection (3 way & 4 way) points with Isolation gate valve as per TAC/ IS shall be provided at strategic locations

Above ground pipe shall be supported on RCC pedestals (refer attached drawing). wrapper plate (thickness same as pipe & covering approx. 120 degree at bottom portion of pipe) shall be provided at each support for above ground pipe (6" NB and above). Supports for piping system and structures shall be provided as per support specifications of NIT. If support specification not provided in NIT, safe adequacy calculations shall be submitted by bidder for review/approval by PMC/owner.

4.1.1 Buried Pipes

The following points to be considered in designing of buried pipes

i) All underground buried metallic piping shall be coated and wrapped with cold tape and laid at minimum one meter earth cushion.
ii) Underground pipe at crossing roads, access ways shall have RCC casing pipe (Culvert or Hume pipe). Underground piping at rail crossing shall be as per Indian railways.
iii) Valve chamber wherever required shall be made of brick or concrete. Valve chamber should be spacious to attend valves during operation/maintenance.
iv) All U.G. headers shall clear equipment foundations.
v) Provide break flange at + 500 MM from floor level to isolate underground pipe from above ground piping with insulating gasket kit.
vi) Pipes shall be laid below electrical cables, if any.
vii) Buried Pipes shall be laid in trenches after excavation, covered with 150mm sand bed all around them, backfilled and properly rammed.
viii) RCC thrust blocks shall be provided as per engineering requirement.
ix) Cathodic protection shall be provided for buried pipes.

4.1.2 Piping in Trenches

The following points to be considered in designing of trench pipes:

i) Piping located below grade, requiring inspection, servicing or provided with protective heating.
ii) Fire water lines/Process lines.
iii) Drain lines requiring gravity flow trenches.
iv) Sump for valves and trenches shall be provided.
v) Suitable draining scheme for trenches shall be provided.
vi) Valves in trenches shall be provided with extended stems. If hand wheels of the valves are located more than 300 mm below the cover plate, the valves shall be provided with extended stems extending to within 100 mm below the cover plate.
vii) The trenches shall be lined with RCC, then provided with 150mm sand bed and also shall be covered with RCC cover after laying of wrapped and coated pipes in them. Top of pipe shall be at minimum one meter depth.
viii) RCC thrust blocks shall be provided as per engineering requirement.

4.2 Water Spray System, water sprinkler system and water curtain system

Water spray systems shall be provided as per TAC / job specifications.

Water spray, water curtain systems, permanently connected to fire water network, shall be provided with piping system, detectors, spray nozzles (chrome plated brass), deluge valves (dry type,

pneumatically & hydraulically operated (only use where air is not available) with manual by pass valve, remote automatic and local manual operation), isolation valves, strainer, low point drain with valve and suitable restriction orifice to maintain the pressure requirements as per TAC/ IS.

Instrument air service Piping/ Tubing shall be SS304.
Downstream of deluge valve shall be provided with galvanized carbon steel piping system.
Water spray application rates shall be as per TAC/IS/NFPA.

4.2.1 Medium velocity Water Spray (MVWS) System

- To be provided for the followings locations, but not limited to.

- Compressor seals
- Lube oil consoles
- Knock out drums (with hydrocarbon bearing service)
- Cable cellars
- Diesel/Petrol/Kerosene oil or any hydrocarbon liquid / oil tank
- Coal/ Pet coke/ solid hydrocarbon material handling plant area
- Pumps under racks.
- Empty bag storage area

4.2.2 High velocity Water Spray (HVWS) System

To be provided for the followings locations, but not limited to.

- Transformers of 10 MVA and above rating or in case of oil filled transformers with oil capacity of more than 2000 liters, as per CEA Safety Regulation.

4.2.3 Water curtain system

To be provided for the followings locations, but not limited to.

- Ammonia/ Toxic gas/ vapour compressor and pumps
- Ammonia/ Toxic gas/ vapour storage tank
- Ammonia liquid tanker loading area

4.2.4 Sprinkler System

The sprinkler system, with galvanized carbon steel piping, shall be designed and installed at the following locations, but not limited.

Sprinkler system with deluge valves (dry type), shall be installed at the following Location:

- All Buildings as per NBC 2016 (and/or latest edition)
- Laboratory
- Chemical room/storage area.

Sprinkler system (wet type with QBD), shall be installed at the following Location:

- All buildings as per NBC 2016 (and/or latest edition)
- Admin Building
- Workshop building
- Technical Building
- Meeting Room/Hall
- Canteen
- Fire brigade building.

4.3 Foam System

Foam system shall be provided for transformer area and hydrocarbon oil tank area.
The transformer area shall be surrounded by at least 2 foam monitors strategically installed.
Hydrocarbon oil tank area and LPG/NG gas skid area shall be surrounded by at least 3 foam monitors strategically installed, so that each tank or each gas skid is fully covered within the monitors throw range.
Water cum foam monitors (SS304 body & nozzle, fixed stand post type, manual operation, 500-750 USGPM variable type flow, self inducting foam induction mechanism) along with portable type foam cans (each 200 Litres capacity) with 3% AFFF Foam, shall be provided for above areas.

The foam system shall be considered for protecting tanks and other applicable equipments for hydrocarbon services as per NFPA requirements. The foam system shall comprise of foam concentrate proportioning equipment, foam makers, piping system and foam discharge devices, as applicable, as per NFPA. The system shall automatically actuate foam on detection of fire.

4.4 Clean agent flooding system

Gas flooding system with clean agent, diverter valve (if feasible), detectors & accessories for Control Room, Computer room, Computer console room, UPS room, Battery room, server/database rack room etc. shall be protected by clean agent system as per NFPA-2001(Inergen/ Argonite/ Novec 1230).

4.5 Pump House & Pumping System

4.5.1 Pumps

Wherever practicable pumps shall be arranged in rows with the centre line of the discharge on a common line. In general, pumps shall be kept inside the pipe rack / Shed. However in case of smaller racks, pumps shall be kept on one side or outside the pipe rack to provide clear access under the rack.

Pump foundation height shall be 300 mm above H.P.P.

Gap between each pump foundation / and foundation of technical structure should be sufficient for easy removal of equipment after piping. Clearance between two adjacent pumps shall be such that clear 900 mm aisle is available.

All pumps, Engines. Motors along with their accessories shall be inside Pump house & provided with EOT crane, and lifting device of suitable capacity. (Min 10 Ton)

4.6 Pump Piping

4.6.1 Pump drives shall have clear access.

4.6.2 Pump suction piping shall be as short as possible and shall be arranged with particular care to avoid vapor pockets.

4.6.3 Reducers immediately connected to the pump suction shall be eccentric type flat side up to avoid the accumulation of gas in pockets.

4.6.4 For end suction pumps, elbows shall not be directly connected to the suction flange. A straight piece minimum 3 times the line size shall have to be provided at the suction nozzle.

4.6.5 Unless otherwise specified T -type strainers shall be used on pump suction piping for sizes 2" and above.

4.6.6 All small bore piping connected to pump shall have provision for break up flanges for removal of pumps.

4.6.7 Piping shall be so arranged that forces and moments imposed on the pump nozzle do not exceed the allowable values as per API 610.

4.6.8 Pump discharge should preferably be routed away from the pump rather than towards the motor / Engine side.

4.6.9 Pump cooling water connection if any, shall be taken from the circulating cooling water header.

5.0 MATERIAL SPECIFICATION

a) Materials & equipments used for fire protection system shall be in accordance with NFPA/TAC requirements and/or attached specifications of NIT.
b) Pipes(API 5L Gr.B, SMLS upto 6"NPS and welded for higher sizes) fittings(ANSI/ASME),valves(API/ASME), flanges(ANSI/ASME), Spray nozzles and deluge valves, quartzoid bulb detectors(QBD), Detector piping, Hydrant, Monitors, Hose Boxes, Hoses shall be as per piping material specifications (PMS), and/or attached specifications of NIT.
c) Cast Iron valves or any cast iron piping component like pipes, fittings, flanges, valves, fasteners, gaskets, etc. shall not be used for fire fighting system or for any service.
d) Spiral welded pipes shall not be used.
e) Seamless pipes/fittings are acceptable in lieu of welded pipes/fittings, but welded pipes/fittings are not acceptable in lieu of seamless pipes/fittings.
f) LSAW pipes are acceptable in place of ERW pipes, for same thickness.
g) Double seam , 180 degree apart , is allowed for pipe sizes 36" and larger only.
h) Circumferential seams (minimum 2 meter apart) is allowed for pipe sizes 36" and larger only.
i) Flanges shall be in one piece material, without any joints.
j) All flanged valves (except forged) shall have flanges integral with the valve body.
k) Forgings are acceptable in place of castings but not vice-versa.
l) Valves in saline water (if applicable) service shall be with non ferrous trims and all wetted parts other than trims shall be epoxy coated.
m) Generic material of valves body, required as per process/service conditions but not specifically mentioned, shall not be lower in chemical composition than the connecting pipe material.
n) PN equivalent rating for Class150# valves shall be minimum PN16.

5.1 Hydrant Valve shall be BIS approved (IS-5290) with following detail:

Inlet	: 3"-ANSI 150 # RF
Outlet	: 63mm
Pipe Size & material	: 4" CS
Capacity	: 36 cum/hr
Type	: Oblique angle type as per TAC requirement
Material	: SS304

5.2 Water Monitor

Nozzle bore size	: 38mm (Aqua fog /foam with arrangement of jet and spray).
End connection	: 4"- 150 # RF
Run Pipe Size	: Min. 6", CS
Capacity	: 2580 LPM
Material	: SS304
Approval	: IS-8442

5.3 Water cum Foam Monitor:

Nozzle bore size	: 38mm (Non aspirating type-Aqua fog / foam with Arrangement of jet and spray)
Run Pipe Size	: Min. 6", CS
Capacity	: 750 GPM
Material	: SS304
Approval	: UL

5.4 Long Range Water monitor

Capacity	: 2000/1000/750/500 GPM (as required)
Horizontal Range	: 50 m approx.
Material	: SS304
Approval	: UL

5.5 Hose Reel

Fire hose reels (IS-444) shall be considered at strategic locations around block as first aid fire contingency. These shall be indoor wall mounted and outdoor floor mounted type on structure and shall have water connection from hydrant network. Each hose reel shall have 30 metre long hose with nozzle. Hose reel shall be minimum 30m long x 20mm bore.
Hose reel shall cover all process areas in ground floor. Indoor wall mounted Hose reel shall be provided with each landing valve. Outdoor floor mounted type on structure at strategic locations @ 01 no.(minimum) for each package area.

5.6 Hose Box

Hose boxes shall be made of M.S. material and painted red with dimensions 18 SWG thick M.S. sheet, size 750 mm x 600 mm x 250 mm. Each box shall contain 2 nos.x 15 m of 21/2" fire hose (IS-636 Type-B) with gun metal nozzle, coupling, universal branch pipe (IS-903), MS spanner. 1no. Hose Box with accessories shall be provided for each hydrant post and each fire brigade connection (3 Way, 4 Way with isolation gate valve).

5.7 Portable Fire Extinguishers

Portable fire extinguishers (IS-2190, BIS marked / BIS approved) as per TAC shall be provided for plant & non plant buildings & areas, at strategic locations. Portable extinguishers of 9 kg (wheeled) & 50kg (wheeled) DCP (ABC type), 4.5kg (mounted), 6 kg (mounted) & 22.5kg and above (wheeled) CO2 type shall be provided. Contractor shall specify the numbers and location for Owner's review and approval.

5.8 Deluge valve

Deluge valve shall have flanged body/housing & cover (Cast Steel ASTM 216 Gr. WCB), Internal Metallic parts SS304, Diaphragm Rubber/ Non metallic) UL listed, Red Painted, pneumatically actuated.

6.0 FIRST AID FIRE FIGHTING EQUIPMENTS

The selection of safety equipment should be such that it is correctly related to the type of fire expected in the area.
The general guideline for selection and use shall be as per TAC/IS requirements. Fire extinguishers shall be provided as per TAC/IS.
Contractor shall provide the Fire extinguishers items (BIS approved) as specified in tender.

6.1 Fire extinguisher

Fire extinguishers as per TAC shall be provided for process risk and at each landing of operating platform of technological structures, for the protection of equipment as a means to cope up with fire at incipient stage. Supply of all Fire Extinguishers shall be with BIS Mark.
Powder used in DCP type fire extinguishers shall be MAP 90% ABC powder, UL listed & BIS approved.
The number should be determined based on the max. travelling distance of 15 M. At least one fire extinguisher shall be provided for every 250 m2 of hazardous operating area.
Chemicals/ Consumables used in the fire extinguisher shall UL listed.

Following Fire Extinguisher types shall be provided.

1) 6 Kgs., 9 Kgs. Capacity DCP Extinguishers (ABC type) shall be provided on Technological platforms/process ground floor and Control rooms.
2) 4.5 Kgs. Capacity Co2 Extinguishers shall be provided for buildings, sub stations, panel rooms & control rooms.
3) 22.5 Kgs Capacity Co2 Extinguisher shall be provided near transformer bay.
4) 50 Kgs capacity DCP Extinguishers (ABC type) shall be provided at critical operating area in plant.
5) 2 Kgs, 4 Kgs capacity clean agent Extinguishers shall be provided for Control Room, Computer room, Computer console room, UPS room, Battery room, server/database rack room etc.

6.2 Sand Bucket

Sand buckets filled with sand along with scoops, mounted on structural support stand each with at least 3 sand buckets), shall be provided in Transformer bay, Sub Station, buildings, Technical structure, platforms, Pump house, etc.

The sand buckets shall have round bottom with bottom handle having 9 liter water capacity conforming to IS: 2546. The sand stored in bucket shall be fine and free from oil, water or rubbish. Rain protection of suitable design shall be provided for all sand buckets.

6.3 SAFETY SIGNAGES

Contractor shall provide the safety signages (in English & Hindi language) as per NBC/TAC , at strategic locations, for plant/ non plant areas buildings, technological structure, areas.
Safety signages must be visible under both lighted & darkness conditions.

7.0 SAFETY EQUIPMENTS/PERSONNEL PROTECTIVE EQUIPMENTS (PPE)

Contractor shall provide the following safety items with minimum qty. specified for their scope of work:

a) Safety helmets – 10 nos.
b) Stretcher – 02 nos.
c) Fibre glass First Aid Box with all necessary items/kit & anti snake serum -02 sets.
d) Rubber hand gloves for electrical jobs– 10 pairs per type for each substation, each panel room and each control room. (min.10 pairs per type irrespective of facility requirement).
e) Explosimeter- 02 nos.
f) Fire Proximity suit – 02 nos.
g) Rescuscitator–02 nos.
i) Hand operated siren - 1 no.
j) Water jel blanket – 02 nos.
l) Positive Pressure type self contained breathing apparatus – 02 nos. each per control room & per substation. (min. 02 nos. irrespective of facility requirement).
m) Hand held battery loaded Emergency light, each with 1 set spare battery- 02 nos.
n) Sand Bucket & accessories - 02 sets.

8.0 EXECUTION, INSPECTION AND TESTING

All execution, inspection and testing for completion of fire protection system shall be carried out based on codes, standards and specifications. Contractor shall develop detail inspection and testing procedures for review by owner. Contractor shall carryout demonstration test for each installed system as per scope of work.

The Contractor shall meet all requirements for inspection and testing of the systems.

9.0 QUALITY ASSURANCE SYSTEM

All work/services to be performed by the Contractor under this contract shall be of specified/approved quality and Contractor shall have a quality assurance/quality control (QA/QC) system during the performance of various activities such as engineering, procurement, tendering, construction etc. Review/approval of activities by Owner/PMC shall not however dilute the responsibility of Contractor for maintaining quality.

The objective of the quality assurance scheme of the Contractor shall be to ensure the conformity of equipment, material, site construction (if any) to various standards, specifications, drawings and technical requirements that are being mutually agreed between the Contractor and Owner/PMC/TPI. Quality Assurance System should clearly indicate the organisational approach for quality control and quality assurance of the various equipment/construction activities (if any) and also provide a verifiable evidence of the Contractor having carried out all the activities laid down in the bid document and the procedure. Such conformity to quality level shall be ensured by controlling the quality level of purchased items at vendor's/sub-vendor's shop/site and shall cover from source surveillance to final inspection. The Contractor to submit a detailed inspection and testing plan for various shop/site activities for review by Owner/PMC/TPIA.

10.0 INSPECTION

The Contractor is required to organize a proper inspection and expediting system so as to ensure timely delivery of all the items/equipment meeting the specified quality criteria. This function has to be carried out by appropriate deployment of qualified personnel who have wide experience in their respective fields. Inspection of all items supplied under this contract shall be carried out by independent third party inspection agencies like Lloyds/ BV/ TUV/DNV. Third party inspection charges for foreign origin items shall be quoted by bidder. Third Party Inspection shall be done by owner approved third party inspection agencies.

Inspection authority means the Third Party Inspection Agencies (TPIA) approved by the Owner to carryout inspection of materials.

The inspecting authority shall have the right to select random samples for check test and reject materials, if samples furnished as above and tested as per the specifications fail to meet the requirement specified.

All the items shall be inspected and tested in the presence of one or more representatives of the purchaser during various stages of manufacturing. Material shall be considered acceptable for dispatch only after final certificate of acceptance is issued by the Inspector. Testing performed in the presence of the purchaser's representatives shall not relieve the supplier of their own responsibilities and guarantees and any other contractual obligations.

Quality Assurance plan (QAP) / Inspection Test Plan (ITP) shall be submitted by bidder for approval by Third Party Inspection Agency (TPIA).

The Contractor shall make arrangement for inspection and testing by statutory authorities, if applicable, at various stages of the work.

10.1 Scope of Inspection by TPIA:

i) Review of MTC (all batches).
ii) Visual check for surfaces, external appearance (10% random witness).
iii) Dimensional check (10% random witness).
iv) Positive Material Identification (PMI) for alloy steels/austenitic steels (10% random witness).
v) Hydrostatic test (10% random witness for pipes, fittings, valves, strainers, traps, collecting heads, draw off connection, hoses, hose reels, extinguishers, bellows, personnel protective equipments (if applicable for any item), fire fighting/protection equipments.
Hydrostatic test shall be10% random review for other items.
vi) Any testing/demonstration required as per relevant code/standard/specification:10% random review.
vii) Packing: Report review.
viii) Documentation (MTC, Inspection Release Note): 100% Review.

11.0 TESTING

All testing shall be done, as per relevant specifications and/or NIT specifications.

11.1 Non Destructive Testing

10% radiography of butt welds and 10% DP/ MP test of fillet welds shall be done for pipe classes in 150# & 300#.
100% radiography on butt weld joints and 100% DP/MP for fillet welds test shall be done for pipe classes in 600# & above.

Radiography procedure, areas of casting to be radiographed, and the acceptance criteria of valves shall be as per ASME B16.34.

The minimum requirement of radiography shall be as under :

Pipe Class	Size (NPS)	Qty
150	Up to 24”	5%
150	26” & above	100%
300	Up to 16”	10%
300	18” & above	100%
600 & above	All	100%

12.0 DOCUMENTATION

Drawings and documents (4 hard copies, 1 electronic copy & 1 as-built copy of each drawing/document), for fire fighting/fire protection system, design basis, general arrangement/layout drawings of fire water/ spray system/ sprinkler system/fire extinguishers/fire fighting equipments, design adequacy calculations, material specifications, material take-offs (linewise/consolidated), supplier drawings/specifications, inspection test plans, test certificates, spares list, etc. shall be submitted by the Contractor for review/approval/information of Owner/PMC/ Statutory authorities.

TECHNICAL SPECIFICATION OF PERSONNEL PROTECTIVE EQUIPMENT

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

1.0 Safety Helmet

Safety helmets are made of fibre glass shall be supplied and shall confirm to IS:2925 (Latest amendment) & EN-397. These shall be moulded seamless in one piece from natural reinforced fibre glass/polyester resin, which can withstand heavy impact. The helmet shall be made of material highly impact, heat & chemical resistant, high dielectric strength and shall also have better quality abrasion resistance and higher softening temperature. The shell structure of the helmet shall be designed to provide extra strength and toughness. The helmet shall have sweat band and adjustable head band and shall bear IS approval. The colour of the helmets shall be decided at the time of placement of order.

2.0 Safety Goggles

A device worn over the eyes & held in place by a headband used for protecting the eyes & eye sockets from flying particles & injurious radiations, chemical & heat resistant and shall conform to IS-5983.

3.0 Stretcher with Blanket

Stretcher (size 6 feet X 3 feet with tying belts & blanket) shall be supplied and shall conform to IS:4037. Material of the stretcher and other related accessories should be as per the IS standard of practice.
Heavy duty aluminium poles for easy handling and heavy duty, vinyl-coated nylon covers that resist stains and will not absorb body or bodily fluids

4.0 Fiber glass First Aid Box with Medicines

Fiber glass First Aid Box portable type with locking arrangement and compartmentalised storage facility and containing the required first aids as below:

- First aid for cuts, burns, sprains (instant relief sprays) - 1 each.
- Antiseptic lotion, liquids (Dettol / Savlon tincture iodine) - 1 bottle
- Pain relieving medicines, anti vomiting medicines etc. - 2 stripes of 10 each.
- 500 mg Paracetamol I.P - 100 tablets.
- Anti snake serum bottle - 1 No.
- Band-Aids - 20 pcs.
- 25 gms of Soda Bi-Carb. I.P. - 1 pkt.
- Wound dressing small (for fingers) - 12 pcs.
- Wound dressing medium (for hands and feet) - 6 pcs.
- Wound dressing large (for body) - 6 pcs.
- Burn dressing large (for body) - 6 pcs.
- Absorbent cotton wool 13 gms each - 6 pcs.
- Dressing arrangements (scissors / blade etc.) - 1 set.

- Eye pad with bandage in separate pkt. - 08 pcs.
- Tourniquet cotton with belt & buckles. - 1 No.
- Polythene wash bottle 500 c.c. - 1 No.
- Book of instruction on first aid to injured - 1 No.
- Copy of First Aid Leaflet issued by DG FASLI – 1 No.

5.0 PVC Hand Gloves

Acid alkali proof PVC hand gloves made of superior quality PVC in yellow colour. The fingers and palm should be embossed/ ribbed for better grip. Palm size should be 9" and overall length 14". The gloves should be confirming to IS: 6994/1973(part-ii).

5.1 Nitrile Hand Gloves

CE Marked fully Nitrile rubber hand gloves (In pair) shall have inside soft cotton flocked lining. It shall be able to resist Acid, alkali & solvent while providing solid protection against snags, abrasion, puncture & cuts. Nitrile Rubber hand glove should meet requirement of EN-388 & EN-374.The overall length of the Gloves shall not be less than 12 Inches (from middle finger to end of the sleeve).

5.2 Electrical resistance, Insulating Rubber Hand Gloves in pair (one for Right Hand, one for Left Hand.)- 1100 Volts

1. Four Fingers and One Thumb
2. MAKE: CATU / Honeywell / Oberon / SICAME or equivalent
3. Maximum voltage of use A.C volts: 1000 Volts (rms)
4. Class - 0
5. Size: 9
6. Type: Gauntlet type
7. Max thickness (approx.): 1.6 mm
8. Construction: Seamless
9. Standard: IEC 60903
10. Category: RC
11. Tested by authorized Government Test houses / NABL accredited LAB and relevant test certificate / Batch certificate with hand gloves serial number to be furnished with the material.
12. Made from specially compounded latex or equivalent for complete insulation & totally shock proof.
13. Test certificate of the suplied item to be furnished along with the supply.
14. Packed in sealed plastic bag.
15. The gloves shall be marked indelibly at the back-
    A) Size, class & category of gloves
    B) Month and year of manufacturing
16. Following tests will be conducted under inspection of TPIA :

A) Leakage current Test
B) Tensile strength and elongation at break
C) Resistance to mechanical puncture
D) AC Proof Test
E) Flame retardancy Test

5.2.1 Electrical resistance RUBBER INSULATING HAND GLOVES in pair (one for Right Hand, one for Left Hand.)- 36 KV (rms)

1. Four Fingers and One Thumb
2. MAKE: CATU / Honeywell / Oberon / SICAME or equivalent
3. Class - 4
4. Max. Voltage of use A.C volts: 36 KV (rms)
5. Size: 10
6. Type: Gauntlet type
7. Max thickness (Approx.): 4.2 mm
8. Construction: Seamless
9. Confirming to IEC 60903
10. Category: RC
11. Tested by authorized Government Test LAB / NABL Accredited LAB and relevant test certificate / Batch certificate with hand gloves serial number to be furnished with the material.
12. Made from specially compounded latex or equivalent for complete insulation & totally shock proof.
13. Technical catalogue and test certificate of the offered item to be furnished along with the offer.
14. Packed in sealed plastic bag.
15. The gloves shall be marked indelibly at the back-
    A) Size, class & category of gloves
    B) Month and year of manufacturing
16. Following tests will be conducted at ERDA
    A) Leakage current Test
    B) Tensile strength and elongation at break
    C) Resistance to mechanical puncture
    D) AC Proof Test
    E) Flame retardancy Test

6.0 Portable Explosive Meter cum Oxygen Meter (Explosimeter)

S.N	Particulars	Specification
1.	Use	Able to measure LEL (In Inert atmosphere) and oxygen in zone 0 area.
2.	Type	The metering unit shall be microprocessor based. It shall be suitable for use in open as well as confined space for one hand operation and rugged with casing of protective rubberized over-mold.

S.N	Particulars	Specification
3.	Sensor	Combustible (LEL) sensor- IR type Oxygen sensor: Electro-chemical type. Sensors shall be replaceable type.
4.	Ambient Condition	0°C to 50°C & humidity: up to 90% RH(non-condensing). (Locations e.g Leh/ Ladakh etc. with extreme weather conditions may decide ambient conditions as per site requirement)
5.	Housing	Minimum IP65 or Better. IP rating should also be tested & certified by accredited agencies like FM/UL/CENELEC/BASSEFA/ATEX/CIMFR/IEC etc.
6.	Area Of Use	The detector shall be intrinsically safe for use in hazardous area classification conforming to Class I, Division I, Group A, B, C & D or Zone - 0, Group-IIA, IIB & IIC, having certified for use by accredited agencies like FM/UL/CENELEC/BASSEFA/ ATEX/CIMFR/IEC etc. and PESO approval at the time of supply of material.
7.	Range	Combustible Gases: 0-100% LEL O_2 : 0 – 25% by Vol. (Min.)
8.	Sampling Pump	Each instrument shall be fitted with motorized pump with audio and visual low flow alarm.
9.	Remote Sampling Accessories	Minimum 10 feet long sampling hose and sampling probe equipped with quick connect device shall be supplied along with instrument with suitable filter.
10.	Alarm	Minimum 85 Decibel audible alarm at 30 cm & bright red LED flashing visible alarm with vibration. Two levels of alarms for each gas sensed and low battery as minimum. Set points shall be adjustable over entire range.
11.	Battery	Rechargeable Battery (NiMH / Li-ion) shall be suitable for minimum 8 hrs. duration (with pump). Charger operable with 230V+ 5%, 50 Hz, AC supply shall be supplied with each instrument.
12.	Size & Weight	Weight shall not exceed 1Kg. (Including Battery & Sampling pump).
13.	Calibration	Frequency Shall be as per OEM recommendation or once in six month whichever is earlier. Calibration shall be easily performed using instrument's pushbuttons no other special tools will be required. Instrument should show calibration due date. Minimum 4 No calibrations within warranty period to be carried out by OEM or its authorized representative.
14.	Accessories	The instrument shall be supplied with necessary calibration cup/adaptor and calibration tubing to facilitate calibration locally.
15.	Display	Self-illuminating back-light digital display.

S.N	Particulars	Specification
16.	Fast Response	Maximum 30 Sec. to reach to 90% of measured value The above response time shall be with 10 feet long sampling hose.
17.	Hands Free Operation	The unit shall also have a suitable arrangement for hands free operation.
18.	Rf Protection	Shall be compliant with EMC directive against EMI/RF interferences.
19.	Accuracy	+/- 2% of measured value
20.	Maximum Resolution	Combustible gas: 1.0% LEL O_2 : 0.1 % by Vol
21.	Performance Guarantee	Minimum 2 years including sensors. The vendor shall guarantee the design, material, workmanship and the performance of the unit for a period of 24 months from the date of supply. Any defect, faulty workmanship or operational defects found during this period shall be rectified by the vendor without any extra cost of Owner/ PMC. Suitable instrument like BG etc shall be furnished by the vendor in line with tender conditions against performance guarantee.
22.	Documentation	Vendor shall be OEM or its authorized supplier having valid authorization from OEM. All other details shall be as per ANSI/ISA 12.03.01(Combustible gases) and ANSI/ISA 92.0.01 to 92.06.01 or equivalent IEC standards.
23.	Inspection, Testing And Performance Parameter	Owner/ PMC reserve its right to get material tested at a lab of repute or vendor to submit third party inspection certificate along with all accessories by Owner/ PMC approved third party inspection agency as per the requirement of Technical Specification. In the event of non-conformity with specifications, Owner/ PMC shall be at liberty to take action as deemed appropriate at its sole discretion. Prior to dispatch of the material from vendor's / manufacture's place the following inspection and tests shall be carried at the vendor place to complete satisfaction of Owner/ PMC representative or his authorized third-party agency without any extra cost to Owner/ PMC for: • Visual inspection of Explosi & Oxygen Meter (Explosimeter) to ensure no apparent damage or deficiency. • Examination of documents / certificates / test reports/

S.N	Particulars	Specification
		instructions/ Guidelines. • All consumable required for inspection and testing work shall be arranged by vendor at his own cost. • Vendor shall arrange all facilities to carry out inspection and testing. Details of field demonstration: Owner/ PMC at its discretion may ask the vendor for field demonstration/ Training for end users at a location specified by Owner/ PMC.
24.	Packing	Material should be packed in OEM packing.
25.	Damage Of Material	Any damage and / or manufacturing defects to the supplied material will not be accepted.

NOTE:

- The default measurement of LEL shall be for Methane. The detector is calibrated to Methane.
- During supply, vendor shall submit operational & maintenance manual, warranty certificate and TPI report along with each instrument.
- Vendor shall supply calibration certificate by OEM for all the sensors. The calibration certificate should contain identification numbers of the sensors & instruments supplied by the OEM.
- Vendor shall clearly indicate the point-wise acceptance/deviation against the above specification in the offer.
- Vendor shall arrange to rectify the defects within two weeks from reporting of the defect at site/owner's premises specified by the owner without any extra cost to owner during warranty period.
- Vendor shall submit the declaration on the cross-sensitivity of sensors with other gasses of concern.
- Owner/ PMC authorized Inspection Agency shall inspect the material before dispatch of the material for quality assurance, testing & performance evaluation as per technical specification.

7.0 Aluminised Fire Proximity Suit.

7.1 General

The suit shall be made up of aluminised glass fabric. It shall be stitched with fire retardant Kevlar yarn or equivalent threads. The material used for the suit, shall not chemically react with water and shall not show any tendency to absorb oil, grease, petrol etc.

The suit shall include hood, coat, pants, boots, mitts and pouch suitable for accommodating BA set. Shoes shall be of standard size with proper insulation and leather lining with non-skid type sole. Metal zip fasteners shall be provided for easy donning and removal of the suit.

No discomfort shall be experienced while climbing a ladder, in running while carrying a pressurised hose pipe or first aid box. The suit shall get dried easily. The complete set with maintenance manual shall be packed in a strong case / box.

7.2 Shelf life : Minimum 10 years.

7.3 Donning time : 1.5 minutes.

7.4 Protection Level : Outer shell fabric shall withstand a radiant temperature of 2000 deg.F approx.

7.5 Size : Regular size suitable for a fireman of height 5'6" to 6'2" approx.

7.6 Certification : The fabric of the fire proximity suit shall confirm to the any one of the following standards / specifications
European Standard (EN)
Listed by Underwriters
Laboratories UL 214.

8.0 Resuscitator

The Resuscitator should be as per WHO specifications or UL listed. The resuscitator shall be an intermittent positive pressure respirator type for artificial respiration with a human non-return, non- rebreathing valve. The resuscitator shall be of bag type, manually operated and shall be packed in a transparent bag along with a first aid chart displaying its operation. The resuscitator shall be suitable to be used by an adult person.

9.0 Electrically Operated Siren (Range - 3 Kms)

The general requirements, 3 phase electric motor, siren, heads, starter for on/off operations, without warbling relay, acoustic power shall comply with IS:1941 (Part I)/1976. The Siren shall be approx. range of 3 KMS. It shall be suitable anywhere in the country. Siren shall be horizontal complete with mounting. The electric motor shall be totally enclosed with greased sealed ball bearing and shall conform to IS:325.

10.0 Hand Operated Siren (Range - 1.6 Kms)

The shape, components, material, design and construction shall comply with IS:6026-1970. It shall have portable stand as per IS:6026. The Siren shall be approx. range of 1.6 KMS.

11.0 Low Temperature Gas Protective Suit Suitable for Handling LPG, Liquid ammonia, Propane and Other Toxic Hazardous Gases.

1.	MATERIAL OF CONSTRUCTION	:	Polyamide fabric coated with viton / silicon

2.	SEAMS	:	Sewn with chemical resistance special thread to ensure leak proof design.
3.	SEALANT	:	Shall be used for the suit for achieving chemical resistance.
4.	GLOVES	:	Shall be made up of the same material used for the suit, and they shall be covered with neoprene as an extra protection. Gloves shall be fixed with the wrist.
5.	COLOUR	:	Cherry / Brownish Red / Yellow
6.	LOW TEMPERATURE WITHSTANDING CAPABILITY	:	The suit shall be able to withstand a low temperature of minus 45 deg. centigrade without any physical damages whatsoever
7.	APPROVAL	:	The Vendor shall enclose latest Test Certificates duly approved by DIFR / GIRDA, clearly indicating the followings: - That the gloves can withstand a temperature of minus 45 deg C for a period of 30 minutes. - No cracking, blistering was noticed on the suit after the low temperature test.

12.0 Water Jel Blanket

Water jel blanket (Hydro jel blanket) to be used in case of fire burns shall be supplied the minimum size should be 2.5mX1.5m. It should have necessary approval from any of these agencies (UL of USA, FM of USA, LPCB of UK, and VDS of Germany). Blanket shall be woven out of new wool, impregnated with sterile water based gel. Blanket shall be capable to protect the user from heat, smoke and to provide to the burn victim. The water gel blanket shall bear approvals of IS/DGMS/DIFR or equivalent.

The wool carried is capable of absorbing upto 13 times its own weight. The Water Jel Blanket shall be packed in good quality poly-jar / canister. Water Jel Blanket shall be having 5 years usable life.

13.0 Fire escape mask / filter type emergency respirators

Emergency respirator is a self rescue hood, ideal for escape from room and buildings contaminated with toxic fumes and gases created by fire or accidental pollution. It should be as per IS: 8523.

14.0 Self Contained Breathing Apparatus (45 Minutes)

Self-contained breathing apparatus (SCBA) suitable for fire fighting, rescue operation in toxic and oxygen deficient atmospheres. The equipment consists of compressed air cylinder, full face wide vision mask (with inner mask), pressure reducer, pressure gauge, low pressure warning whistle, exhalation valve, speech diaphragm, comfortable shoulder harness and light weight back plate, straps, buckles and easy to wear.
The Cylinder shall be capable to operate for 30 minutes. The Cylinder and Valve shall have CCOE approval. BA Set shall be confirming to IS: 10245 (Part-2). One number of spare cylinder shall also be supplied

15.0 PVC suit

It shall be used in handling acid and alkali. Chemical protection clothing can be manufactured from a special grade heavy duty high visibility yellow PVC. The material shall have excellent chemical resistance, high tensile, tear & elongation strength, abrasion, ozone as well as heat resistance. The clothing seam shall be welded by high frequency electrical heating.

16.0 Red and Green Flag

Red and green flag suitable for the fire drill operation shall be supplied. Handle should be made of aluminium. The flag should have minimum of 0.5m x0.30m dimensions.

17.0 Fireman Axe

Forged Axe head, Insulated Handle, IS-926.

18.0 Flame Proof Search Light (Rechargeable safety hand held torch)

S.N	Particulars	Specification
1.	Description	Rechargeable Hand-Held Torch
2.	Power	Rechargeable without removing batteries & Charging in Safe area.
3.	Battery Run Hours	Not less than 3 hours after complete one cycle charge. (To be certified by OEM)
4.	Lumens	Not less than 130 lmn. When measured at a distance of 1-2 Metres for major light (Lumens of the torch to be certified by OEM and NABL/ Govt. accredited Lab.)
5.	Clip/Strap	Strap/ clip
6.	Weight with battery & fittings.	Max. 400 Grms.
7.	Certification	Intrinsically safe for use in hazardous area classification conforming to Zone '0' of Gas Group IIC hazardous area Certified by PESO.
8.	IP	Ingress Protection- Min. IP65 or better (To be certified by OEM along with relevant test certificate)

S.N	Particulars	Specification
9.	Housing/ Body	Housing body should be made of material of Anti-static, high impact properties
10.	Lens	Polycarbonate
11.	DROP Test	2 Meter to be certified by OEM and NABL accredited Lab./ Govt. approved Lab.
12.	Battery with Compatible Charger	Rechargeable, Li-ion / NiMH. Charger operable with 230V ± 5%, 50 Hz± 3% AC supply and compatible charger shall be supplied with each torch.
13.	Light Source	LED only
14.	Marking	As a minimum the product shall have following markings • Marking towards intrinsically safety of the product. • Name of the Manufacturer
15.	Warranty	Minimum one year including battery and battery charger. The vendor shall guarantee the design, material, workmanship and the performance of the unit for a period of 12 months from the date of acceptance at site..
16.	Certification	• A copy of relevant approval including PESO and other documentation along with the offer. • During supply, vendor shall submit operational & maintenance manual, warranty certificate along with each instrument.
17.	Packing	Material should be packed in OEM packing
18.	Damage of Material	Any damage and / or manufacturing defects to the supplied material will not be accepted.

19. WINDSOCKS

LED Illuminated Windsock with heavy duty stainless steel SS-304 Stand.

Made of Stainless Steel SS-304, 360-degree rotating system to rotate the sock to wind

i) LED light of 20 watt of above suitable for outdoor installation, Cable of size 2C, 1 Sq./mm copper of 10 mtr with LED light.
ii) Wind Sock made of parachute polyester double lining 2-layer Combination of fluorescent colour red& white or Fluorescent Orange & Lime green with 25 mm wide reflective tape four rows for night reflection of windsock.
iii) The LED illuminated wind socks frame shall be made of heavy duty SS-304 rod and SS-304 strips with Extended Spokes cage two feet long as per design shown in the photos.
iv) The frame shall be fixed on rotatable pipe stand 32mm height 5 Feet long with pedestal flange.

v) Windsock Size: Dia 2 feet × 6 Feet Long made of parachute polyester double lining 2-layer fluorescent colour red & white Combination or Fluorescent Orange & Lime green Combination with 25 mm reflective tape four rows for night reflection.

vi) Windsock shall be fixed with the frame along with red coloured industrial type weather proof Led lights of 20 watt and above1 Sq./mm cable fitted with light of 10mtr per with each set.

vii) The two bearing to be used must be maintenance free and weather proof

20.0 Sand Drum with Scoop

Metal sand scoops with handle of large size manufactured from best quality steel duly painted.

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TIE-IN POINT DETAILS (TYP.)

WUHAN | TFL

TABLE-1 LSTK FACILITIES/UNITS OF GASIFICATION PLANT

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	AIR SEPARATION UNIT	210 M x 101 M	
2.	GASIFICATION UNIT	200 M x 115 M	
3.	PURIFICATION UNIT	213.7 M x 110 M	
4.	SULFUR RECOVERY UNIT	78 M x 55 M	
5.	COOLING WATER SYSTEM FOR GASIFICATION PLANT	98.5 M x 161.5M	
6.	INITIAL RAIN WATER BASIN-1	15 M x 38 M	
7.	INITIAL RAIN WATER BASIN-2	17.8 M x 23.5 M	
8.	COAL WASH WATER PRE-TREATMENT	12.5M X 46.5 M	
9.	ELECTRICAL SUBSTATION FOR GASIFICATION PLANT	71.5 M x 34 M	
10.	ELECTRICAL SUBSTATION FOR COOLING WATER SYSTEM FOR GASIFICATION PLANT	27 M x 36 M	
11.	ELECTRICAL SUBSTATION FOR PURIFICATION UNIT FOR GASIFICATION PLANT	36 M x 28 M	
12	ELECTRICAL SUBSTATION FOR SOLID MATERIAL STORAGE & TRANSPORTING	31 M x 28 M	
13.	ELECTRICAL SUBSTATION FOR ASU	37 M x 28 M	
14.	GENERAL CONTROL BUILDING	40 M x 47 M	
15.	RAW COAL STORAGE	90 M x 375 M	
16.	PETCOKE/LIMESTONE STORAGE	90 M x 97 M	
17.	LABORATORY BUILDING	50.15 M x 21.35M	

TABLE-2 LSTK FACILITIES/UNITS OF AMMONIA/UREA PLANT

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	AMMONIA UNIT	100 M x 120 M	
2.	UREA UNIT	156 M x 93 M	
3.	COOLING WATER SYSTEM FOR AMMONIA	52.5 M x 125 M	
4.	COOLING WATER SYSTEM FOR UREA	59 M x 140 M	
5.	COOLING WATER SYSTEM FOR AMMONIA STORAGE	22 M x 27 M	
6.	OILY WATER TREATMENT SYSTEM FOR AMMONIA	16 M X 24 M	
7.	OILY WATER TREATMENT SYSTEM FOR UREA	29 M X 17 M	
8.	ELECTRICAL SUBSTATION FOR AMMONIA & UREA	96.5 M x 28 M	
9.	ELECTRICAL SUBSTATION FOR COOLING WATER SYSTEM FOR AMMONIA & UREA PLANT	24 M X 31 M	
10.	ELECTRICAL SUBSTATION FOR AMMONIA TANK	18 M X 42 M	
11.	DIESEL GENERATOR ROOM	22 M x 15 M	
12	GENERAL CONTROL BUILDING	52 M x 38 M	
13.	AMMONIA STORAGE TANK	100 M x 170 M	
14.	LABORATORY BUILDING	20.75 M x 21.6M	

TABLE-3 OSBL (PDIL/TFL) FACILITIES/UNITS

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	DM WATER PLANT	170 M x80 M	
2.	WATER TREATMENT PLANT	190 M x 100 M	
3.	ETP	110 M x 70 M	
4.	RAW WATER STORAGE	280 M x 270 M	
5.	BAGGING PLANT	110 M x 26 M	
6.	OSBL COOLING TOWER	30 M x 30 M	
7.	LOADING UNLOADING PLATFORM	660 M x 30 M	
8.	STEAM GENERATION PLANT	320 M x 240 M	
9.	ELECTRICAL DISTRIBUTION SYSTEM	240 M x 70 M	
10.	IN AIR / PLANT AIR	40 M x 50 M	
11.	FIRE WATER STORAGE	100 M x 50 M	
12	FIRE WATER PUMP HOUSE	65 M x 15 M	
13.	EDG	50 M x 38 M	
14.	DIESEL STORAGE	50 M x 50 M	
15.	FIRE BRIGADE BUILDING & FIRE CONTROL STATION	25 M x 60 M	
16.	FUTURE SILO	45 M x 105 M	
17.	TRUCK PARKING AREA	170 M x 100 M	
18.	ASH / SLAG POND (ASH POND)	300 M x 225 M	

TABLE-3 OSBL (PDIL/TFL) FACILITIES/UNITS

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
19.	CENTRAL STORE	71.1 M x 51.5M	EXISTING
20.	MECHANICAL WORKSHOP	73.1 M x 41.2 M	EXISTING
21.	ELECTRICAL WORKSHOP	-	EXISTING
22.	SWITCH YARD	131.3 M x 100 M	EXISTING
23.	CANTEEN	20 M x 60 M	
24.	TECHNICAL BUILDING	60 M x 40 M	EXISTING
25.	FIRE BRIGADE VEHICLE PARKING	10 M x 20 M	

TABLE-4 OSBL (PDIL/TFL) SUBSTATION

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	SUB-STATION (DM WATER PLANT)	-	PACKAGE
2.	SUB-STATION (WATER TREATMENT PLANT)	-	PACKAGE
3.	SUB-STATION (ETP)	-	PACKAGE
4.	SUB-STATION (BAGGING PLANT)	100 M x 30 M	
5.	SUB-STATION (COAL HANDLING)	-	PACKAGE
6.	SUB-STATION (STEAM GENERATION)	-	PACKAGE
7.	SUB-STATION (ASH DYKE)	40 M x 15 M	HOLD
8.	SUB-STATION (EDG BUILDING + PANEL ROOM)	40 M x 20 M	HOLD
9.	SUB-STATION (COOLING TOWER-MCC ROOM)	-	PACKAGE
10.	SUB-STATION (132-KV SWITCH YARD)	-	EXISTING
11.	SUB-STATION (MRSS-EDS)	120 M X 40 M	PACKAGE
12.	SUB-STATION (ASH HANDLING)	HOLD	PACKAGE
13.	SUB-STATION (OUSS)	-	PACKAGE
14.	SUB-STATION (SILO-MCC ROOM)	20 M X 15 M	PACKAGE

NOTES:-

1. ALL DIMENSIONS AND COORDINATES ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. REFRENCE BENCH MARK ( ) POINTS IS W.R.T GLOBAL CO-ORDINATES HAVING N-2312910.151 & E-308680.833 (GRID COORDINATES N-000.0M, E-000.0M)
3. EQUIPMENT SIZES, SUBSTATION AREA AND LOCATION ARE TENTATIVE.
4. BLOCK SIZE OF FACILITIES ARE TO BE FINALIZED AFTER GETTING VENDOR INFO.
5. PIPE RACK LOCATION & SIZES MARKED ARE SCHEMATIC.
6. CENTER LINE OF EXISTING ROAD & PERIPHERAL ROAD TO BE MAINTAINED WITH MINOR ADJUSTMENT & SAME SHALL BE ALIGNED WITH EXISTING BOUNDARY WALL.
7. INSTRUMENTS & THEIR LOCATION SHALL BE PROVIDED BY VENDOR AS PER P&ID.
8. BATTERY LIMIT PIPE SIZES ARE UNDER HOLD. SHALL BE AFTER FINALISATION BY PMC/OWNER/EPC CONTRACTOR .
9. FW ROUTING IS TENTATIVE & SHALL BE FINALISED BY FIRE FIGHTING SYSTEM (OSBL) PACKAGE VENDOR AS PER SITE CONDITIONS DURING DETAILED ENGG.
10. POWER SUPPLY TO FW PUMP HOUSE SHALL BE FROM SUB-STATION (OSBL).
11. * DENOTES HOLD.
12. PIPE ROUTING TO SUIT TO SITE.
13. WRAPPING AND COATING REQUIRED FOR U/G PIPING.
14. THIS DWG. SHALL BE READ IN CONJUCTION WITH REF. DOCS. LISTED ALONGSIDE.
15. VENDOR TO PROVIDE OUTDOOR HOSE REEL AT STRATEGIC LOCATIONS.

TOTAL PLANT AREA = 490.7 ACRE (APPROX.)
AREA FOR NEW PLANT = 326.8 ACRE (APPROX.)
TOTAL GREENBELT AREA = 163.9 ACRE (APPROX.)

LEGEND :~

PROPOSED FIRE WATER PIPELINES (OSBL)
WUHAN PIPE LINES (ISBL)
PLANT FACILITIES
GREEN BELT AREA

EARLIER FW DWG. NO. PC183-7511-0611 RENAMED & ISSUED AS PC183-4012-921-001

S.NO.	REFERENCE DRAWINGS	NUMBERS
09.	NIT FOR FIRE FIGHTING SYSTEM, OSBL-TFL	
08.	SCHEMATIC ARRANGEMENT FOR FIRE FIGHTING	PC183-7115-0046_R0
07.	WATER SUPPLY AND DRAINAGE SYSTEM	17125-361000-WSXX_REVOA
06.	WATER SUPPLY AND DRAINAGE SYSTEM	17269-362000-WSXX_REVOB
05.	TOPOGRAPHICAL & CONTOUR SURVEY DRAWING	SA/RCF/TALCHER/2017/TOPO-DWG
04.	MASTER PLAN OF MINING	FURNISHED BY CLIENT
03.	MASTER PLAN [FCI, TALCHER UNIT].	DRG. NO. 501
02.	INDEX PLAN [FCI, TALCHER UNIT].	DRG. NO. 635
01.	PLANTS LAYOUT [FCI, TALCHER UNIT].	TFU-M-GN-6341

REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
0	31.03.2022	ISSUED FOR TENDER	AM	AK/SKM	DM/AMAR

CLIENT : M/s. TALCHER FERTILIZER LIMITED

LOCATION : TALCHER, ANGUL DISTRICT, ODISHA(INDIA)

TITLE : CONCEPTUAL FIRE WATER LAYOUT OF OSBL FACILITY FOR INTEGRATED COAL BASED FERTILIZER AND CHEMICALS COMPLEX

REV. 0
SHEET 1 OF 1
SCALE :~ 1 : 2200
DRG. No.:~ PC183-4012-921-001
FILE :~ PC183-4012-921-001_R0
DRG. SIZE: A0

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PROJECTS & DEVELOPMENT INDIA LTD. NOIDA

Annexure-3

PRESSURE VESSEL SPECIFICATION

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF FLARE SYSTEM

PLANT: AMMONIA-UREA PLANT BASED ON COAL GASIFICATION

PROJECT: INTEGRATED COAL GASIFICATION BASED FERTILISER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA))

CONTENTS

SL. NO.	DESCRIPTION
1.0	DESIGN CRITERIA
2.0	MATERIAL OF CONSTRUCTION
3.0	TECHNICAL REQUIREMENT
4.0	FABRICATION
5.0	INSPECTION & TESTING
6.0	PICKLING AND PASSIVATION
7.0	PAINTING
8.0	INSULATION
9.0	SPARE PARTS
10.0	DOCUMENTATION
11.0	VENDOR LIST

LIST OF ATTACHMENTS

SL. NO.	DESCRIPTION	DOCUMENT NO.
1.	VESSEL TOLERANCE	PDS:PV-001
2.	PROJECTION OF NOZZLES	PDS:PV-002
3.	NAME PLATE FOR VESSEL & TOWER	PDS:PV-003
4.	SKIRT SUPPORT FOR VERTICAL VESSEL	PDS:PV-301
5.	LIFTING LUG	PDS:PV-302
6.	PIPE DAVIT	PDS:PV-303
7.	LUG SUPPORT FOR VERTICAL VESSEL	PDS:SR-300
8.	SUPPORT SADDLE FOR HORIZONTAL VESSEL	PDS:SR-302
9.	BRACKET SUPPORT FOR VERTICAL VESSEL	PDS:SR-304

1. 0 Design Criteria

1.1 This specification covers the requirements for the complete design (Mechanical), procurement, fabrication, construction/erection, insulation, painting ,Pickling & Passivation (for SS equipments), inspection and testing of pressure vessel for the M/s Talcher Fertilisers Limited (TFL) in accordance with this specification, standards specification, codes and other attachment etc. listed in NIT document.

1.2 The equipment shall be designed & constructed as per the latest edition of the following codes and standards:

Code	**Description**
ASME Section VIII Div 1	Rules for construction of Unfired Pressure Vessels
IBR	Indian Boiler regulations
ASME Section II A&B/ ASTM	Materials Specifications
ASME Section II PART C	Specification for welding rod, electrode & filler metal
ASME SEC II PART D	Properties
ASME Section V	Non-destructive Examination
ASME Section IX	Welding Qualification
ASME SEC X	Fiber-Reinforced Plastic Pressure Vessels
API-934-A	Materials and Fabrication of 2¼Cr-1Mo, 2¼Cr-1Mo-¼V, 3Cr-1Mo, 3Cr-1Mo-¼V Steel Heavy Wall pressure Vessels for High-temperature, High-pressure Hydrogen Service
API 934-C:	Materials and Fabrication of 1¼Cr-½Mo Steel Heavy Wall pressure Vessels for High- Pressure Hydrogen Service Operating at or Below 825 °F (441 °C)
ASME B 16.5	For Flanges
ASME B 16.47	For large diameter flanges
ASME B 16.20	For Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral Wound, and Jacketed
ANSI	Pipes, Flanges, Fittings and Valves
IS: 875/SITE DATA	For wind load consideration
IS: 1893 (Part 4) & IS: 1893 (Part 1) / SITE DATA	For seismic design consideration
IS:4682 (Part-1) with Amendment No. 3	Code of Practice for Rubber Lining of Vessels & Equipment for Chemical Process
Factory Act, 1948 BS CP 3003 (Part 1)	Factory Act & State Govt factory rules Code of Practice on lining of Vessels and equipment for Chemical Process.
NACE MR0175-94	Sulphide Stress Cracking resistant Metallic Material
NACE MR 0103	Material resistant to sulphide stress cracking in corrosive petroleum refining environment

NACE TM 0284	Evaluation of pipeline and pressure vessel steel for resistance to hydrogen induced cracking
NACE TM 0177	Laboratory testing of metals for resistance to sulphide stress cracking and stress corrosion cracking in H2S environment

1.3 Complete mechanical design of Equipment as per latest code /standard of construction shall be the responsibility of the LSTK Contractor. Strict compliance with the requirement of codes/equipment specification & any other referred document shall be ensured. In addition, all statutory rules & regulations shall also be complied with.

1.4 Design conditions for all equipment shall be as per technical Specification and Material specification. Minimum required thickness is calculated based on design parameters considering different types of loadings including effect of static head of liquid column. Equipment shall also be designed for hydrostatic condition. Final thickness is decided giving due consideration for corrosion allowance.

1.5 Design pressure shall be at the top of vertical vessel or at the highest point of horizontal vessel. The design pressure at any lower point shall be determined by adding the maximum operating liquid head and any pressure gradient within the vessel.

1.6 Wind analysis shall be performed as per IS-875 (Latest Edition).Basic wind speed is 50 m/sec. Wind forces shall be increased by 20% (over & above design code requirement) to cater the effect of piping system, platforms and ladders etc.

1.7 Seismic analysis shall be performed by Response spectrum method (RSM) considering seismic zone-IV as per IS-1893 part-1 & IS-1893 Part 4 (Latest edition).

1.8 All carbon steel (CS) & low alloy steel (LAS) pressure parts shall have 3 mm corrosion allowance unless specified otherwise.

1.9 All internals CS/ LAS parts including low temperature materials shall have at least 1.5 mm corrosion allowance on either side unless otherwise specified.

1.10 Design of supports and anchor bolts shall be performed for compressive and tensile loading. In no case shall diameter of anchor bolts be less than M24 for skirt support and M16 for other type of support. Supply of anchor bolt required as per design for equipment shall be in bidder scope.

1.11 Each Lifting lug shall be designed with shock factor 2. Lifting lugs and tailing lugs shall be designed taking account of vessel weight and lifting method, etc. Supplier shall decide location of lifting lug/tailing lugs in order to avoid interferences between lifting wires and external attachments (such as platform, ladder, and nozzles) during erection. Materials, procedures of welding them to the shell and inspection method shall also be carefully checked.

1.12 Hydro testing of equipment shall be as per UG-99b of ASME Sec VIII Div-1. In order to safeguard against the risk of brittle fracture during hydrostatic test metal temperature during hydrostatic test be maintained at least 30°F (17°C) above the minimum design metal temperature, but need not exceed 120°F (48°C). Design pressure for each nozzle shall be sum of maximum allowable working pressure and static head of corresponding nozzles.

1.12.1 Maximum Allowable Working Pressure (MAWP) is the maximum gauge pressure at the top of a completed vessel, which is obtained from the calculations for every element of the vessel based on the actual thickness in the corroded condition. Supplier shall calculate the MAWP of each

vessel, and the calculation shall be included in design calculations. MAWP shall not be assumed to be the same as the design pressure except for cases where MAWP cannot be determined by calculation to the applicable code. Accordingly calculate hydro test pressure as per UG-99b.

1.13 Bolt of size M 48 and above shall be designed and spaced so as to permit tightening with a hydraulic stud-tensioner. The bolts shall have an extra threaded length at one end of approximately 1 bolt diameter, and shall be provided with threaded protection caps. Hex nuts shall have suitable holes for manual tightening. The requisite no. of hydraulic stud-tensioner device with necessary adopters/insertions based on varying sizes of studs shall be supplied by bidder as per mechanical design of the equipment.

1.14 Orientation of longitudinal seams and position of circumferential seams shall be clearly marked in the fabrication drawing. Nozzles, support and other attachments shall be located clear of welded joints.

1.15 All process equipments shall be supplied with Nitrogen filled. In case of equipment assembled and welded at site, it shall be filled with N2 after testing at site. Dry Nitrogen shall be filled at a pressure of 0.5 Kg/cm2g and equipment shall be fitted with a pressure gauge and valve.

1.16 Contractor shall guarantee the equipment & their components against faulty design with regard to their mechanical adequacy, improper material of construction & poor workmanship for the period specified in contract.

1.17 Contractors shall stand Performance Guarantee of equipment as per respective technical specifications/Process Data sheets.

1.18 Design conditions for all equipment shall be in accordance with the process data Sheets/specification .However, in any case design pressure shall not be lower than 10% over the maximum anticipated operating pressure and design temperature should be 25°C higher than the maximum anticipated operating temperature for all equipment unless otherwise specified.

1.19 Basic allowable stresses for shell, heads and other components etc .of vessels and shell, roof, etc. of tanks shall be the values specified in the design code.
Maximum allowable “tensile stress” and “compressive stress” shall be as per UG-23 of ASME Sec VIII Div -1. These stresses may be increased by 20% for earthquake & wind combination case in line with UG-23 (d).

1.20 All blind flanges and man way covers weighing 35 kgs or more shall be fitted with handling Facilities such as davits.

1.21 As a General rule all nozzle attachment to shell/head shall be set in type.

1.22 Units
-Unless otherwise specified, SI unit shall be applied as the measurement system for the drawing and documents to be submitted.

1.23 When post weld heat treatment is required for pressure vessels, all material for pressure holding components shall be simulation tested with minimum additional two (2) heat treatment cycles. Additional two heat treatments are; one for PWHT after shop repairing and the other for future PWHT at site.

1.23.1 Steel for Hydrogen service at elevated Temperature & pressure shall be selected as per API

941& API 934 .Further strict compliance with the requirement of codes/equipment specification & any other referred document shall be ensured.

The following special requirements shall be met with for Hydrogen/Sour gas/hydrogen cyanide/H2S service e.t.c as per NACE standard.

a) All pressure parts shall be post weld heat treated.
b) All pressure retaining welds shall be 100% radiographed after final weld. However Root run Shall be liquid Penetrant tested.
c) Hardness of base metals, weld and HAZ shall not exceed 22 HRC
d) Strict compliance with the requirement of applicable NACE standard shall be ensured along with the requirement of codes/equipment specification.

1.23.2 Nozzle shall be of SRN type (Forge material) for Hydrogen/Sour gas/ hydrogen cyanide/H2S service.

1.23.3 Vessel containing lethal substance, toxic and highly inflammable shall be fully radiographed and stress relieved.

1.24 In case of conflict between this specification and other specification, codes and data sheets. It shall be referred to PDIL/ Owner for clarification and the decision of PDIL/Owner shall be final & binding on contractor without any cost & delivery implications. However, it shall be resolved considering the most stringent in the following order

- Statutory requirement
- Requirement specified in this specification
- Process data sheet/ P&ID
- Applicable codes & standards

1.25 **REGULATIONS**

Besides codes & standards, LSTK Contractor shall follow National Laws and Regulations such as Indian Boiler Regulation and Department of Explosives, Nagpur, India together with Local by Laws for the state including statutory requirements as applicable. Static and Mobile Pressure Vessel (SMPV) rules as applicable shall also be complied with.

PUBLICATIONS:

WRC Bulletin # 107	Local Stresses in Spherical & Cylindrical Shells due to External Loadings.
WRC Bulletin # 297	Local Stresses in Cylindrical Shells due to External Loadings on Nozzles

1.26 **DESIGN DOCUMENTATION**

1.26.1 Detailed design calculations considering different loadings shall be made as per code/standards and the additional requirements as mentioned below:-

1.26.2 Design of equipment inside the offsite plant complex shall be in accordance with the process licensor's data sheets and specifications.

1.26.3 LSTK Contractor shall consider the interfaces with other engineering disciplines w.r.t.

- Piping Layout/Location Drawings
- Civil / Structural Drawings
- P & ID's
- Materials
- 3D PDS Model for Piping and Equipment Layout
- Hazardous Area Classification

1.26.4 Design philosophy of other disciplines shall be observed and shall be relevant to the extent applicable.

- Civil/Structural Design Criteria
- Piping Design Criteria
- Process Design Criteria
- Electrical and Instrumentation Design Criteria

1.27 QUALITY ASSURANCE & CONTROL

1.27 1 The quality assurance shall be as per the approved procedures, test methods & facilities to be developed by the LSTK Contractor to ensure that the supplied equipment shall be of highest quality. The quality control shall mean that all the tests , measurements, checks & calibration which are to be carried out may be compared with the actual specified characteristics of the equipments/unit /system.

1.27.2 Quality Assurance (QA) shall mean the organizational set up, procedures as well as test methods and facilities developed by LSTK Contractor in order to assure that Equipment leaving LSTK Contractor's shop are of the highest possible quality i.e. either equal to or better than the requirement specified.

1.27.3 Quality Control (QC), shall mean all the tests, measurement, checks and calibration which are to be carried out in LSTK Contractor's shop in order to compare the actual characteristics of the equipment/unit/system with the specified ones, along with furnishing of the relevant documentation (certificates/records) containing the data or result of these activities.

1.27.4 LSTK Contractor shall submit a comprehensive description (manual) of QA/QC measures contemplated by him for implementation with regard to this specification. It is contractual obligation of the LSTK Contractor to develop and implement adequate QA/QC systems.
QA/QC system shall cover all products and services required for the equipment as per scope of work including job sub contracted by the LSTK Contractor.

2.0 Material of Construction

2.1 Material of construction for various equipment shall be as selected as follows for general Condition/service unless specified otherwise in respective process data sheet/design basis.

a) **Pressure Vessel (KCS/CS)**

Shell /Head plates	SA 516 Gr. 60/70
Nozzle Flange	SA350 LF2 CL2 / SA 105
Nozzle Neck (Pipe/Plate)	SA333GR-6 /SA 106 Gr. B (Nozzle size < 10"); SA 516 Gr. 60/70 (Nozzle size > 10")
Non standard forging	SA350 LF2 CL2/ SA 266 Gr 2

b) Pressure Vessel (SS)

Shell /Head plates	: SA240 Gr*
Nozzle Flange	: SA 182 Gr*
Nozzle Neck (Pipe/Plate)	: SA 312 Gr* (Nozzle size < 10"); SA 240 Gr * (Nozzle size > 10")
*SS grade as specified in datasheet	

2.2 The Additional material requirements as indicated below shall be considered by Bidder.

2.2.1 All raw materials including bought -out items, whatsoever required, to complete the supplies shall be procured and supplied with due identifiable mill material test certificates & inspection reports duly certified by third party inspection agency

2.2.2 For coarse grained and high tensile materials in carbon steel (UTS > 45 Kg/mm2) and low alloy steel, guaranteed impact strength shall be ensured at a temperature 15 degree C below envisaged hydraulic test temperature as a precaution against brittle fracture during hydraulic test.

2.2.3 Carbon steel plates shall be procured in fully killed & normalized condition. All plates above 50mm thickness shall be vacuum-degassed and examined by Ultrasonic Testing (UT) as per applicable material specification code/standard.

2.2.4 All Stainless Steel (SS) plates shall be hot rolled & solution annealed and pickled as per SA-480.

2.2.5 All forgings except for flanges as per ANSI shall be UT tested as per ASTM A 388 for the thickness greater than 50mm and shall be procured in normalized / annealed condition acceptance standards shall be as per AM 203.2 of ASME Section VIII Div. 2. In case any defect is found, no repair by welding shall be allowed.

2.2.6 All forgings including nozzle flanges shall be examined for surface defects by MP/PT testing after matching as per applicable material specification code & standard.

2.2.7 All external / internal attachments, pads/cleats for support directly welded to the equipment shall be of same materials grade as that of equipment, unless specified otherwise.

2.2.8 All nozzles up to DN 10" size shall be made of seamless pipe. For sizes above DN 10" nozzle connection shall be rolled from plates with full radiography of plates.

2.2.9 Unless otherwise specified girth flanges shall be of forged quality and ultrasonically tested.

2.2.10 Unless more restrictive prescription given by material specification the max. Content for carbon steel used for fabrication as shown by ladle analysis shall be 0.23% for plates, pipes & tubes 0.25% for forging.

2.2.11 Top portion of skirt (min. 500 mm height) welded to the bottom dished head shall be of same material as that of shell /head for LAS & SS materials.

2.2.12 Heat treatment of formed parts shall be carried out as per following:

For Carbon Steel:

a. Cold formed dished ends or knuckles up to 16 mm nominal thickness shall be stress relieved.

b. Cold formed dished ends or knuckles above 16 mm nominal thickness shall be normalised.

c. For Low alloy Steel: - Cold Formed Dish ends or Knuckles shall be stress relieved.

d. Hot formed dished ends or similar parts, which have not been uniformly heated in the normalising range in the final stages of manufacture shall be normalised.

e. When the completed vessel involves post weld heat treatment, heat treatment recommended in (a) above shall not be applicable.

f. Vessels in caustic service, Amine or Sour gas service shall be stress relieved.

g. All internal and external attachments, clips, insulation studs, name plate bracket, and the like shall be welded to the vessel before post weld heat treatment.

2.2.13 PWHT of complete vessel shall be carried out in one go in a furnace. Local stress relieving of Weld joint in piece meal shall be avoided as far as possible.

2.2.14 All Nozzle Flanges & Gaskets size, rating & type etc. shall be as per applicable piping Specifications & instrument specification as applicable enclosed with the enquiry and Selected bolting shall match with corresponding companion flanges.

2.2.15 Pressure part plates having thickness 16 mm to 50 mm (both inclusive) shall be ultrasonically Tested (UST) as per ASTM A-435. Pressure part plates having thickness above 50 mm and all Plates to be used shall be UST as per ASTM A-578 Level B. No laminations or inclusions shall be permitted.

2.2.16 Unless otherwise specified Copper & Copper alloys shall not be used. Copper content up to 0.4% are acceptable in carbon steel & 0.6% in stainless steel.

2.2.17 The extent of radiographic examination of the shell and head seams shall be spot examination, as Minimum.

3.0 Technical Requirements

3.1 Vessel

3.1.1 Design, materials, fabrication and inspection of welded pressure vessels shall comply with ASME Code Section VIII, Division 1 (latest edition) and tender requirement.

3.1.1.1 a) Tori spherical heads shall be used for Pressures up to 6.86 bar (g). For tori spherical heads, ratio of Knuckle to Inside Crown Radius shall not be less than 6%.

b) Beyond 6.86 bar g, heads shall be of ellipsoidal type having a ratio of major axis to minor axis 2:1 or hemispherical type. Alternatively, Hemispherical Heads with minimum weld joints may also be used.

3.1.2 For vessels the minimum thickness of shell & heads, including corrosion allowance shall be as indicated below:

Sr. No	Shell Diameter (mm)	Thickness (Min.) mm	
		CS / LAS	HAS
1.	ID < 500	5	3
2.	501 < ID < 1200	5	4
3.	1201 < ID <2000	6	5
4.	2001 < ID < 2600	8	6
5.	ID > 2600	10	8
CS = Carbon Steel, LAS = Low-Alloy Steel, HAS = High-Alloy Steel			

3.1.3. All nozzles above 24" NB shall comply with ASME B16.47 Series B (API 605).

3.1.4. Minimum branch nozzle thicknesses shall be Schedule Extra Strong above 2" NPS, and Schedule 160 for 2" NPS and below.

3.1.5 Stress calculations due to Local loads on vessel for external structural attachments, such as platform clips, pipe support clips and lifting lugs shall be performed.

3.1.6 Design of vessel skirt shall be based on seismic/wind/thermal considerations and fire proofing/insulation requirements.

3.1.7 Vessel skirts for carbon steel vessels shall be designed from the same material as the shell or the head. Vessel skirts for other than carbon steel vessels shall be the same material as the shell or the head for the top 500 mm.

3.1.8 Vessels with skirt support having eight or more anchor bolts shall be required to be supplied with an anchor bolt template. The template shall be an annulus 10 mm (minimum) thickness and 150 mm (minimum) wide, with bolt holes equal to bolt diameter plus 3 mm, stacked drilled with skirt base plate.

3.1.9 Maximum permissible deflection for columns when subjected to design wind loadings shall not exceed 0.005 x Vessel height.

3.1.10 Minimum man way size shall be equal to 24" nominal pipe size.

3.1.11 Manhole/hand hole/blind holes covers shall be equipped with davits or hinges to facilitate handling.

3.1.12 Horizontal vessels of large size and thin wall shell on saddle supports shall be investigated for buckling, local circumferential bending and shear stress. The method of L. P. Zick (Supplement to Welding Research, 1971) may be used for this investigation.

3.1.13 Use of structural steel shall be limited to non-pressure parts only.

3.1.14 Local vessel stress calculations for external structural attachments, such as platform clips, pipe support clips and lifting lugs shall be performed.

3.1.15 Dimensional tolerances shall be in accordance with the design codes or standards, whichever is more stringent.

3.1.16 For vessel with diameter less than 900 mm and having removal internals, shell flange shall be provided.

3.2 **Safety**

3.2.1 Safety standards and features which are inherent in the specific mechanical equipment design codes, standards and regulations are applicable.

3.2.2 Safety features to be incorporated into the design include, but are not limited to, the following features for equipment:

i) Ladder cages
ii) Safety chain across platform access
iii) Step-off platforms where necessary
iv) Platform grating
v) Toe plates

4.0 **Fabrication**

4.1 The Bidder shall comply in all respects with the provision of the applicable codes, standards and specification during fabrication with respect to tolerances, welding, fabrication, forming of heads, radiography, heat treatment, inspection, testing and quality control etc. unless & otherwise specified.

4.2 Plates of different thicknesses shall be made flush with the inner surfaces of equipment unless otherwise stated.

4.3 Larger heads which cannot be formed in one piece shall be fabricated as follows with prior approval from Principle.

a) In two pieces, with the welding seam included in the middle third and preferably on the centre line

b) In petal construction, with meridianal seams and a central cap of diameter not larger than 0.75 times the vessel outside diameter

4.4 Due provisions must be kept for venting out entrapped gases during welding of pads, flanges and liner plates etc.

4.5 All welding shall be carried out by qualified welders using approved procedures in compliance with the requirements of codes, standards & specifications and shall be duly certified by the concerned inspecting authority. All welding procedures must be got approved from authorised inspecting authority before starting any fabrication job. Welding of all parts must be completed before heat treatment.

4.6 All welds shall be full penetration welds with back chipping and re-welding from the second side. For those joints which are inaccessible for back chipping the root run shall be carried out with TIG process. Single side welding with backing strips shall are not permitted.

4.7 All parts shall be fabricated in accordance with good shop practice and in uniformity so that all corresponding parts will be inter-changeable.

4.8 All sharp corners shall be rounded off with smooth radius. Inside edge of manhole and hand hole at the internal surface shall be rounded to minimum radius 5 mm.

4.9 All flange bolts & skirt-bolts shall straddle centre line unless otherwise stated.

4.10 In case of nozzle with butt-end construction, extra length shall be provided to facilitate hydraulic testing and subsequently cutting and edge preparation to suit piping welding at site.

4.11 All nozzles less than or equal to NB 65 mm shall be stiffened with three equispaced plate ribs of the same material as that of shell.

4.12 Flange facing and thread connection shall be protected against oxidation during HT.

4.13 Longitudinal and circumferential welded seams shall not interfere with nozzle openings, reinforcement plates, saddle pads, and other attachments as far as possible.

4.14 Welding wherever specified, is to be done by qualified and approved welders using the suitable fillers and fluxes recommended for the materials in the fabrication drawings.

5.0 Inspection & Testing

5.1 Equipment shall be inspected and tested in accordance with the relevant codes, standards and specifications by TPIA. Cost of TPIA shall be under bidder scope. All equipment shall be inspected during various stages of manufacturing starting from identification of raw materials to final completion as per agreed Quality Assurance Plan (QAP) which shall be prepared by Successful Bidder after award of contract. In case of site fabricated/assembled equipment same inspection agency shall be responsible for inspection and testing at site. However all the bought-out items must be supplied with test certificate and inspection reports.

5.1.2 The equipment shall be inspected by Third party inspection agency (TPIA) (approved by owner) as defined elsewhere as inspection agency. It shall be the responsibility of the Bidder to make available to the inspector all the drawings, calculations and other documents. However the Principal shall have free access for inspection at vendor's/sub-vendor's shop and at site during project execution.

5.2. The equipment shall be considered acceptable for despatch only after final certification for acceptance is issued by concerned inspector.

5.2.1 All parent material (Primary & Secondary Components), welds and HAZ shall be impact tested at Minimum Design Metal Temperature (i.e. minimum service temperature or the temperature to be computed as per applicable codes, standards & specifications) by Bidder and shall have impact energy values as per the applicable codes, standards & specifications.

5.2.2 Production control coupons, when required as per codes & standards shall be subjected to impact test, corrosion test etc. in addition to mechanical tests as required. In case of heat treated equipment test coupons shall be given similar heat treatment as for the equipment.

5.2.3 Formed heads when fabricated in pieces shall be normalised and weld seams fully radiographed after forming.

5.2.4 Vessel containing lethal, toxic and highly inflammable substance shall be fully radiographed and stress relieved.

5.2.5 Unless otherwise stated gaskets used during testing shall be same as specified for operating conditions. However all joint gaskets shall be replaced by new gasket which will be opened after Hydro testing.

5.2.6 All nozzle reinforcing pads shall be tested pneumatically at 0.5 Kg/cm2g pressure with soap solution on attachment welds. Vent holes shall be plugged with non hardening mastic to prevent ingress of water.

5.2.7 All completed equipment shall be tested hydraulically as per the requirements of codes, standards & specifications in presence of the inspecting authority. Pneumatic test of completed equipment shall be carried out only when specially mentioned in the specification sheets. Chloride content in water used for testing shall not exceed 30 ppm for SS equipment and 40 ppm for CS and low alloy steel equipment. Duration of test shall be as per applicable codes& standards.

5.2.8 The temperature of test water shall comply with requirement of Fabrication code.

5.3 The following NDT requirements are mandatory in addition to codes, standards & specification requirements:

A) UT examination

i) All butt - welds in thickness greater than 50mm as supplement to radiograph.
ii) FPW of nozzle attachments of thickness above 50mm as supplement to radiography
iii) Clad Plates and formed heads from clad plates in all thicknesses
iv) All forgings
v) Weld overlay on tube sheet

B) MP / PT examination

i) All edges of plates and opening in shell of CS having thickness equal to & above 40mm and LAS / SS having thickness more than 25mm
ii) Root and final layer of all butt welds
iii) Fillet welds of SS
iv) All weld surfaces after PWHT
v) Each layer of weld deposit in SS overlay
vi) Knuckle surfaces of dished ends, expansion bellows and pipe bends
vii) All forgings after machining
viii) Skirt to head joint

C) Radiography:

i) All weld seams of formed head, if made in more than one segment shall be full radiographed after forming

ii) All but welds irrespective of thickness (100% radiographed) before PWHT & UT after PWHT (after Hydrotest)
iii) All nozzles fabricated from plates shall be 100% radiographed.
iv) Radiography of welds in C - 1/2 Mo & Cr - Mo - Steel to be carried out before & after PWHT.

6.0 Pickling and Passivation

6.1 All SS material shall be Pickled & Passivated as per following procedures:

6.1.1 Pickling

Aqueous pickling solution shall be as follows:

Nitric acid (Tech. grade) 10 to 25% plus Hydrofluoric acid 1 to 8% (to be used only for stabilised SS grades). Temperature 50 to 60° C for 10% Nitric acid and 20° C for 25% Nitric acid. When size and shape of product permit, total immersion in the pickling solution is preferred. Where immersion is impractical, pickling may be accomplished by wetting the surface by

i) Swabbing or spraying

ii) Partial filling the item with pickling solution and rotating or rocking so that all the surface receives the required chemical treatment.

The maximum period for which the pickling solution shall be allowed to remain on the surface is 30 minute. During pickling removal of oxides may be hastened by brushing with a hard fibre or SS wire brush. Over pickling shall be avoided.
The pickling agent shall be washed off with plenty of water so as to leave no trace behind.

6.1.2 Passivation

After pickling and water rinsing, an aqueous caustic permanganate solution containing NaOH 10 weight % and KMnO4 4 weight % shall be used for neutralising pickling solution. This shall be followed by thorough water rinsing.

Water used for pickling and washing shall not have chloride contents exceeding 30 ppm.

7.0 Painting

7.1 All CS external surfaces of shop fabricated equipment shall be primer and final painted as per Sec-14 (PC-183-E-4013-SEC-VI -14.0) listed in NIT document.

8.0 Insulation

8.1.1 The equipment shall be insulated as defined as per Sec-14 (PC-183-E-4013-SEC-VI -14.0) listed in NIT document.

9.0 Spares (Erection & commissioning, Mandatory Spares)

9.1 Erection & commissioning Spares

9.1.1 All erection & commissioning spares shall be included by LSTK Contractor in their scope of supply and shall be part of the main equipment.

8.2 Mandatory Spares

8.2.1 Mandatory Spares shall be supplied by the contractor as per Sec-19 (PC183-E-4013-SEC VI - 19.0) listed in NIT document.

10.0 Documentation

Documents shall be submitted as per "Documentation schedule" as per Sec-18 (PC183-E-4013-SEC VI-18.0) Listed in NIT document.

11.0 Vendor List

All equipment shall be procured/fabricated as per approved Sub vendor list as per Sec-20 Listed in NIT document. Any equipment for which vendor list is not enclosed, the LSTK Contractor may furnish a list of their proposed Sub vendors along with their references for supply of similar type of equipment along with bid. However all the additional proposed vendors shall have well proven track record and shall be subjected to consultant/owner's approval

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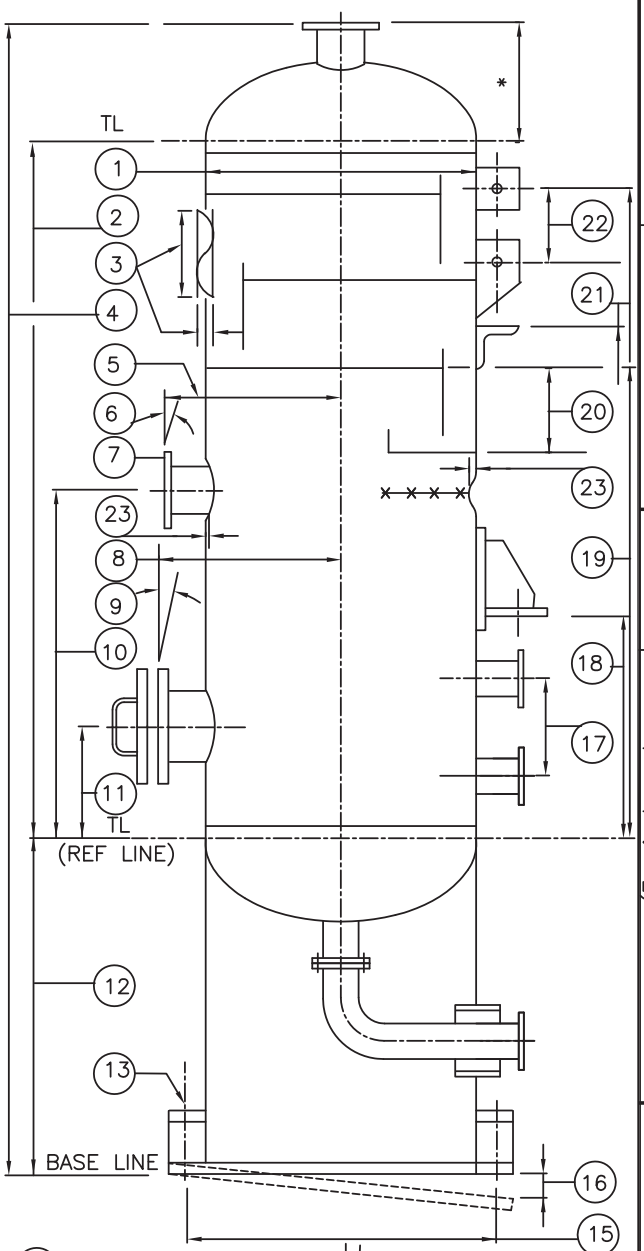
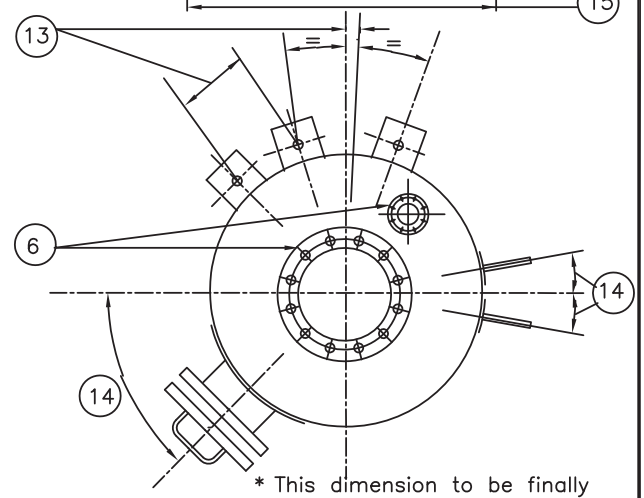
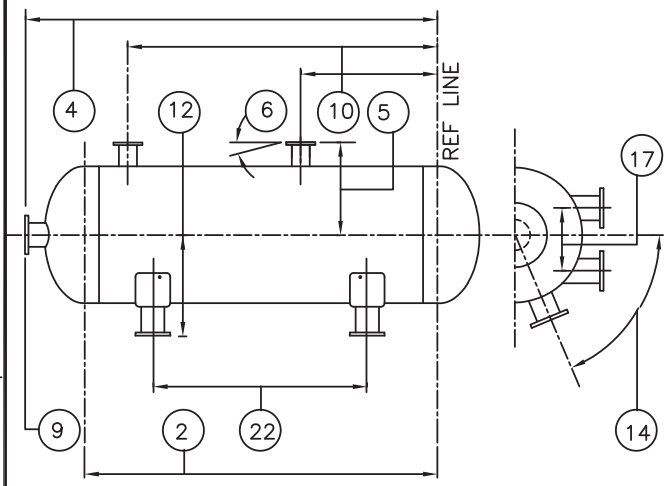
PDIL

VESSEL TOLERANCES

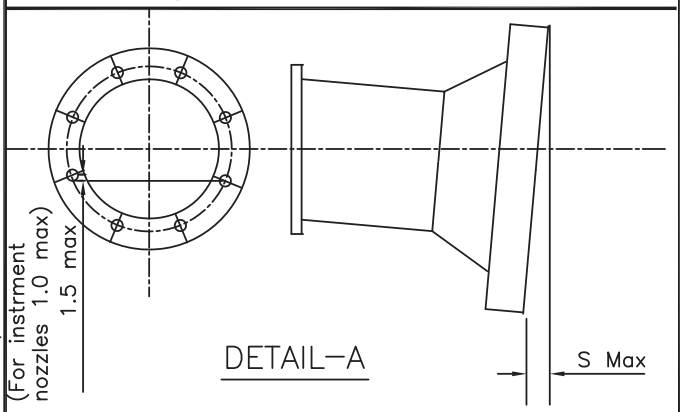




* This dimension to be finally adjusted to suit total height



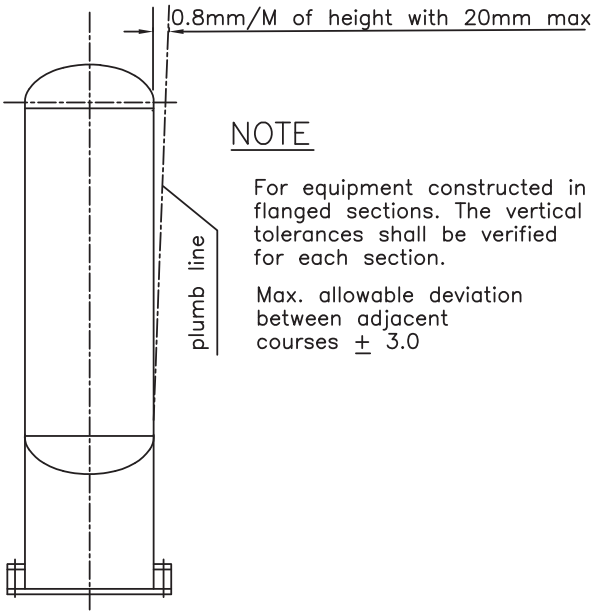
TOLERANCES FOR HORIZONTAL VESSEL



DETAIL–A

Nozzle size	S Max.
NPS ⩽ 4 INCH	1.5
6 INCH ⩽ NPS ⩽ 12 INCH	2.5
NPS > 12 INCH.	5.0

S max shall be ± 0.5mm for instrument nozzle



NOTE

For equipment constructed in flanged sections. The vertical tolerances shall be verified for each section.

Max. allowable deviation between adjacent courses ± 3.0

VERTICAL TOLERANCES AS ERECTED

DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
22–09–99	ISSUED FOR IMPLEMENTATION	ENGG. COMM.		

FILE NAME :STD/NCR/PV001

1) Shell Tolerances

Nom. vessel Diameter	Tolerance
600 & under	± 2.5
Over 600 to 1200	± 4.0
Over 1200 to 2100	± 6.0
Over 2100 to 2700	± 7.0
Over 2700	± 8.0

2) Distance between top & bottom tangent lines, ±1.5 mm/M height, max. ±12

3) Linearity of cylindrical surface, ± 3mm/6M, max. of 20

4) Height from base line to face of top nozzle, ± 5 max.

5) Face of nozzle from centre line of vessel, ± 3

6) Alignment of flange face of nozzle shall be as given in Table (Under Detail 'A')

7) Rotation of flange holes with reference to nozzle axis; 1.5 max.
(Refer Detail 'A')
In case of instrument connections this shall be 1.0 mm max.

8) Face of manhole from centre line of vessel, ± 6

9) Alignment of flange face of manhole shall be ± 6 in both vertical and transverse planes.

10) Location of shell nozzle from reference line, ± 3

11) Location of manhole from reference line , ± 12

12) Bottom of skirt base ring to the bottom tangent line of vessel, $^{+0}_{-6}$

13) Orientation of anchor bolts with respect to principal axes, ± 6

14) Tolerance in orientation of nozzles and external clips, ± 3

15) Distances of bolt holes from axis up to 2000 dia ±3 & over 2000 dia ± 6

16) Maximum deviation of skirt base

Nom. Vessel Diameter	Tolerance
1200 & under	±3
Over 1200 to 2000	±5
Over 2000	±7

17) Distance between level control nozzles, ± 1.0 mm

18) Distance between support bracket and reference line, $^{+6}_{-0}$

19) Location of tray support ring from reference line, ± 6

20) Tolerance between adjacent tray plates, ± 3

21) Location of external clips and attachments from reference line, ± 6

22) Distance between adjacent clips for platform brackets, ± 3

23) Irregularities in profile (checked by a 20° gauge) shall not exceed
$\delta \leq 0.05*e+0.002*D$ (Maximum 25 mm)

Where δ =Maximum local irregularities
e=Plate thickness
D=Shell outside diameter

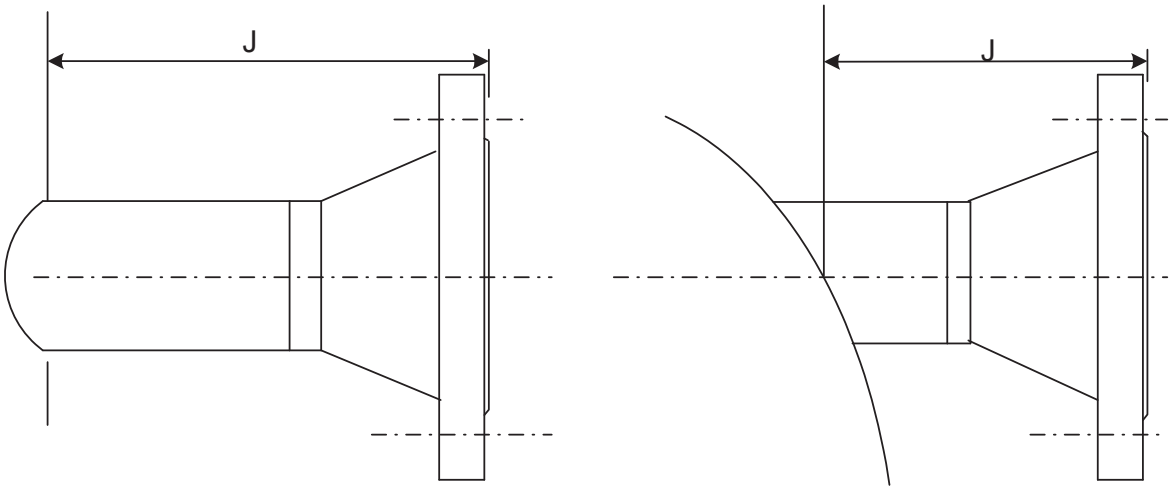
Notes :

1) In case of difference between the values tabulated here and those shown in the drawings, the latter shall govern.

2) For fabrication & assembly tolerances on vessel internals, see ES : 3105

3) For vessels fabricated from pipe– diameter and out of roundness tolerance to be in accordance with relevant pipe specification.

4) All dimensions are in mm unless otherwise specified.



VALUES OF 'J'

Nozzle Diameter NPS	Rating 150#	Rating 300#	Rating 600#	Rating 900#	Rating 1500#	Rating 2500#	Remarks
≤ 3″	200		200		200	350	
4″	200		250		250	350	
6″	200	250	250		250	350	
8″	250		300		350	550	
10″	250		300		350	550	
12″	250		300	350	350	550	
14″	250		300	350	450	--	
16″	300	350	350		450	--	
18″	300	350	350		450	--	Refer Note-4
20″	300	350	350		500	--	Refer Note-4
24″	300	350	350		500	--	Refer Note-4
26″ ≤ NPS ≤ 38″	300	350	350	--	--	--	Refer Note-6

NOTES :-

1. All dimensions are in millimeter unless otherwise shown.
2. The above projections are valid for all types of flanges.
3. However in case of forged nozzle, the projection shall be suitably increased to meet reinforcement requirement.
4. In case of manhole,projection shall be increased by the sum of 50 mm and difference of insulation thickness exceeding 50 mm.
5. Projection from vessel axis to nozzle facing shall be rounded off to 10 mm.
6. Flanges ≥ NPS 26″ will be as per ASME B 16.47 series 'B'.

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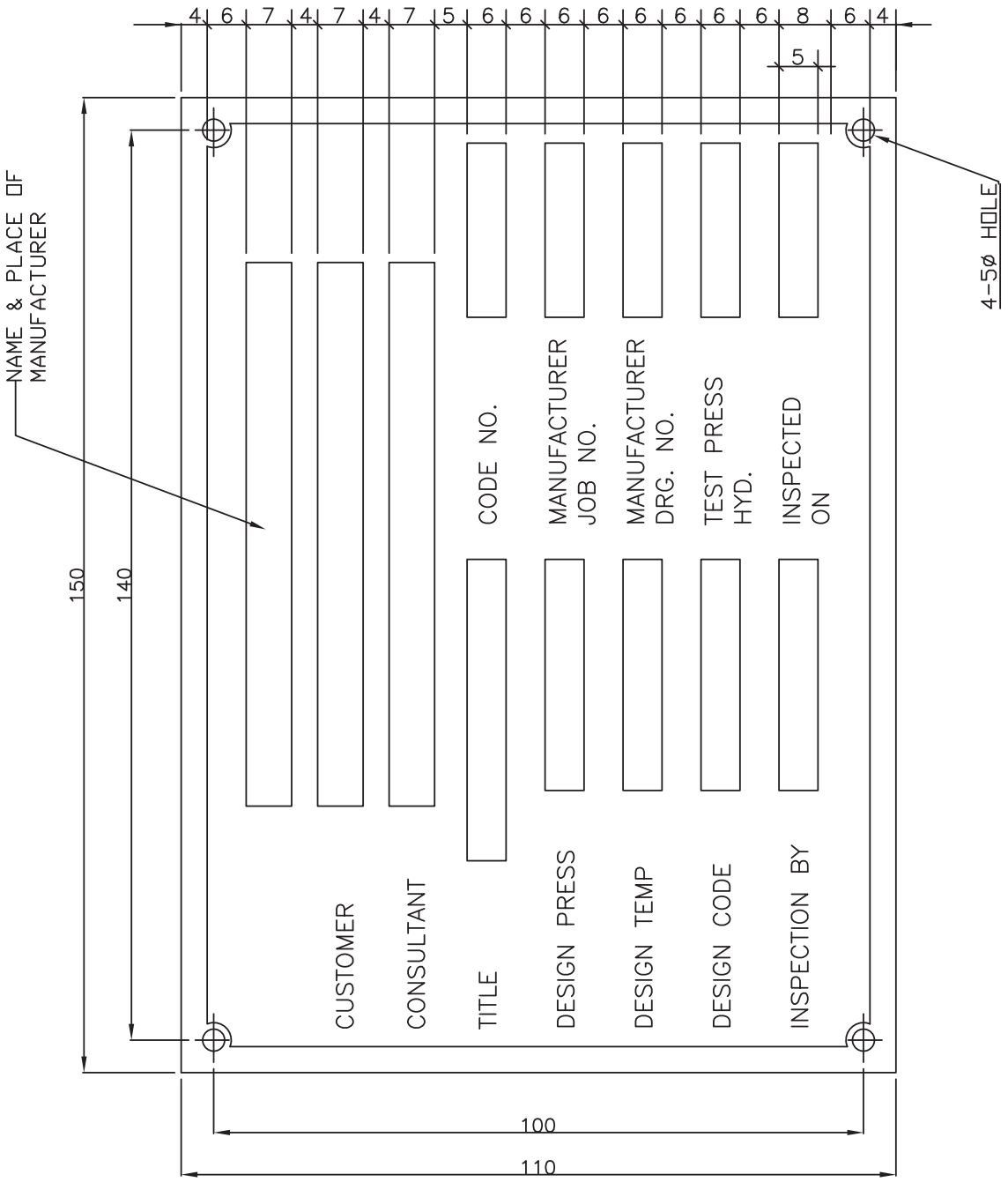
NAME PLATE FOR VESSEL & TOWER

PDS:PV 003
ISSUE: AUG. 1999
SHEET 1 OF 2



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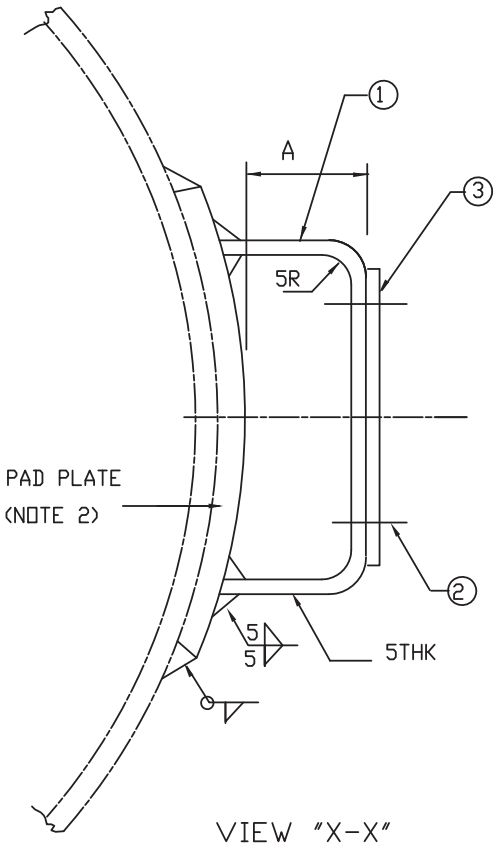
DATE	PURPOSE	PREPARED	REVIEWED	APPROVED

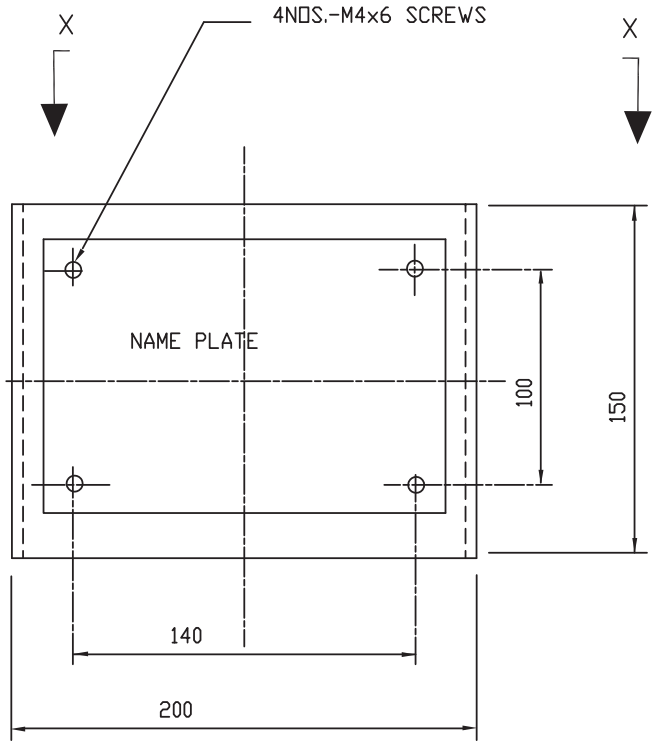
FILE NAME :STD/RCP/PV003SH1

NAME PLATE FOR VESSEL & TOWER

NAME PLATE BRACKET



VIEW "X-X"



ELEVATION

DIMENSION "A"

a) VESSELS WITHOUT INSULATION = 25 mm

b) VESSELS WITH INSULATION = INSULATION THK + 25 mm

NOTES:

1 MATERIALS:

BRACKET (1) IS 2062 Gr.A

SCREWS (2) S.S.304

NAME PLATE(3) S.S.304

2 PAD PLATE OF SIMILAR COMPOSITION AS THAT OF SHELL SHALL BE WELDED ON VESSELS OF MATERIALS OTHER THAN CARBON STEEL AND THOSE UNDER LOW TEMPERATURE SERVICE

3 ALL DATA BLOCKS AND LETTERS MUST BE CHEMICALLY ENGRAVED (0.5 m.m.)

DATE	PURPOSE	PREPARED	REVIEWED	APPROVED
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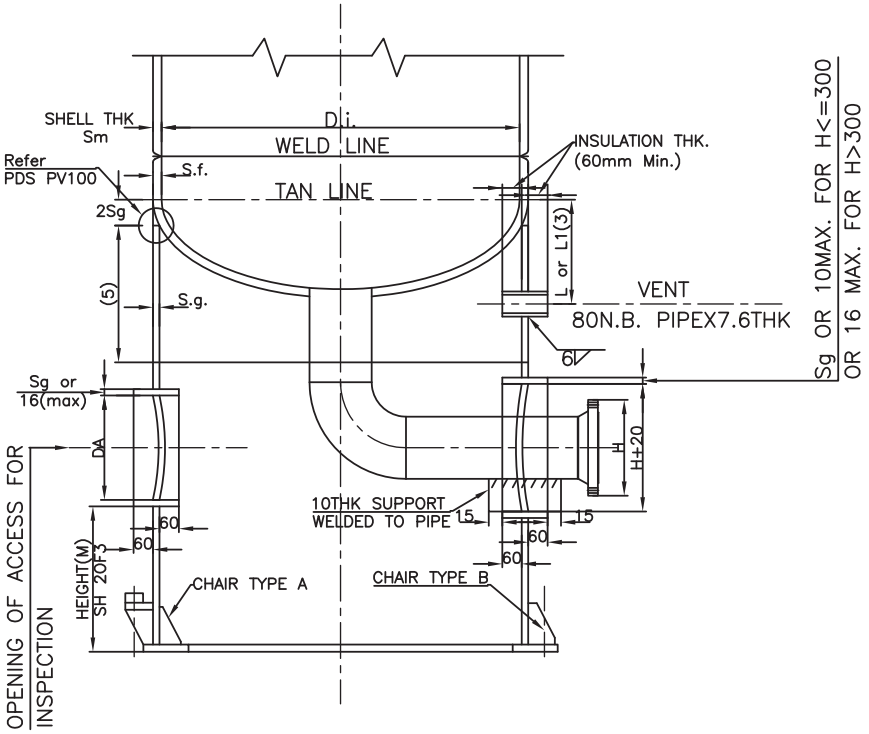

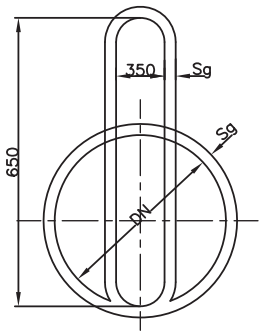

OPENING OF ACCESS

SKIRT DIAMETER DG	OPENING OF ACCESS			VENT		
	NO.	TYPE	DA	NO.	L	L1
<=700	1	CIRCULAR	250	2	260	230
701−1000	1	OVAL	350x650	2	290	250
1001−2500	1	CIRCULAR	500	4	400	360
2501−4000	2	CIRCULAR	500	8	550	450
4001−6000	2	CIRCULAR	500	12	670	560
>6000	2	CIRCULAR	500	16	700	600

NOTES :−

1. The No. dia and the type of bolt sahll be decided as per design. The bolt circle dia. 'DF' shall be fixed according to design , sheet 2 & 3 illustrate chair details (TYPE A, B & C)

2. For the skirt of conical(lapered) construction, the type and the no. of access opening and vent to be decided according to the dia. of skirt at corresponding elevation of centre line of opening.

3. The values of 'L' & 'L1' are adopted for insulation thickness<= 90mm. L for semielliptical head and 'L1' for torispherical head with r/D = 0.1. For other types of head and insulation thickness > 90mm. 'L' & 'L1' shall be decided case by case.

4. 'M' the minimum height of each opening, shall be such that it allows for mounting of nut for type 'A' and welding of gussets for type 'B' foundation bolt chairs.

5. In case the head is made of S.S. or of special material and skirt in C.S., unless otherwise specified provide the skirt length ot the same material as that of head with minimum length of 250mm. For high temperature service, the length and the material of the skirt shall be decided according to design condition.

6. Where the skirt is attached to a stress relieved vessel the skirt to shell or head weld and at least 600mm of the skirt shall be stress relieved.

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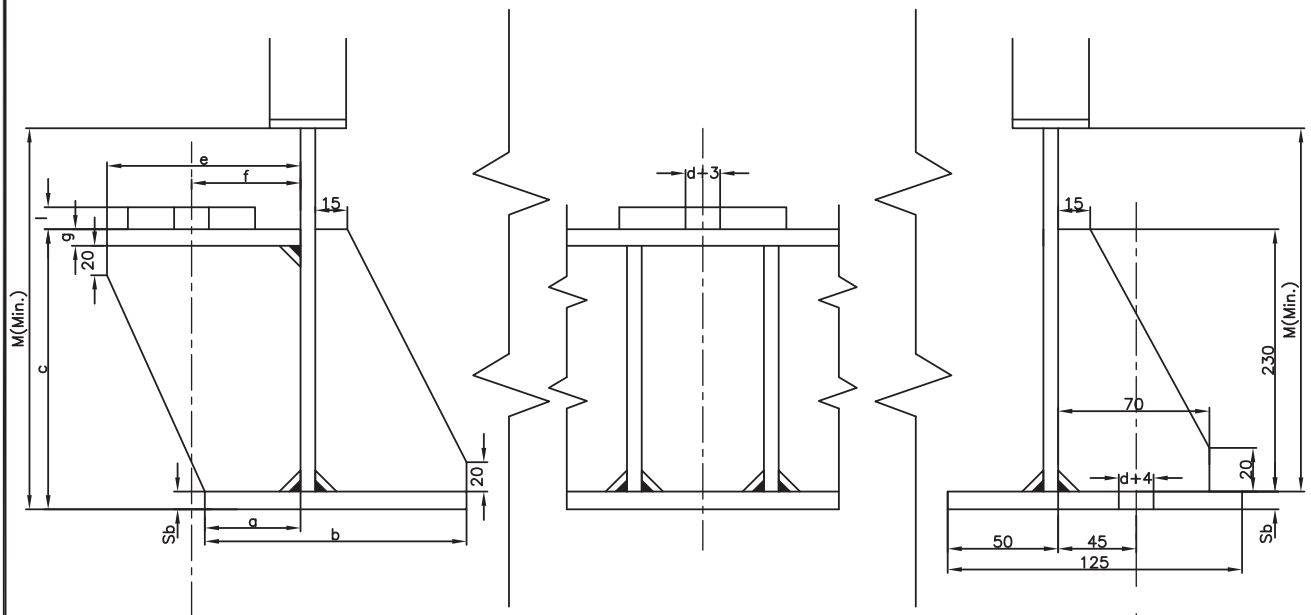
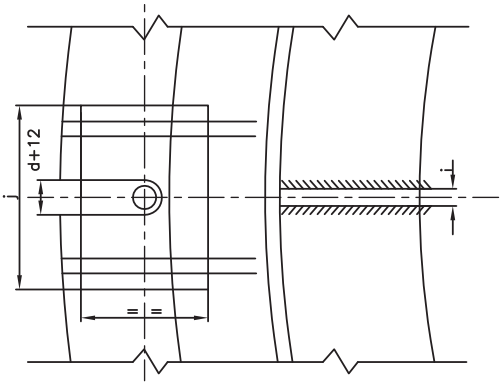
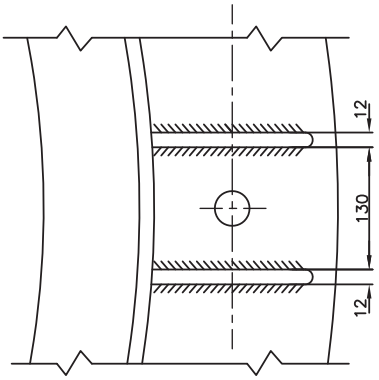




CHAIR TYPE"A"(HEAVY)



CHAIR TYPE"B"(LIGHT)

CHAIR TYPE	FOUNDATION BOLT DIA. (d)	a	b	BASE RING Different bearing capacities 25kg/cm2	35kg/cm2	45kg/cm2	CHAIR DIMENSIONS c	e	f	g	h	i	j	k	l	M (Min.)
B	M16–M27	SEE DETAIL		20	25	28	SEE DETAIL									300
A	M30	50	130	20	25	28	250	125	75	14	70	12	105	80	32	420
	M33	50	130	20	25	28	250	130	76	14	75	12	110	90	32	436
	M36	55	140	22	28	32	280	145	84	14	80	12	115	100	36	480
	M39	55	140	22	28	32	280	150	84	16	85	14	125	110	36	490
	M42	60	150	25	28	32	300	160	92	16	90	14	130	110	40	525
	M45	60	150	25	28	32	300	165	92	18	95	16	140	120	40	535
	M48	65	170	25	32	36	330	180	100	18	100	16	150	130	45	580
	M52	70	180	28	32	36	360	190	110	20	105	18	160	140	50	625
	M56	70	180	28	32	36	360	200	110	20	110	18	170	150	56	645
	M60	80	200	32	36	40	400	220	122	22	115	20	180	160	56	700
	M64	90	200	32	40	45	440	235	134	25	120	20	190	170	63	760

NOTES :–

1. The fillet size of the welding shall be equal to minimum of the thicknesses to be welded.

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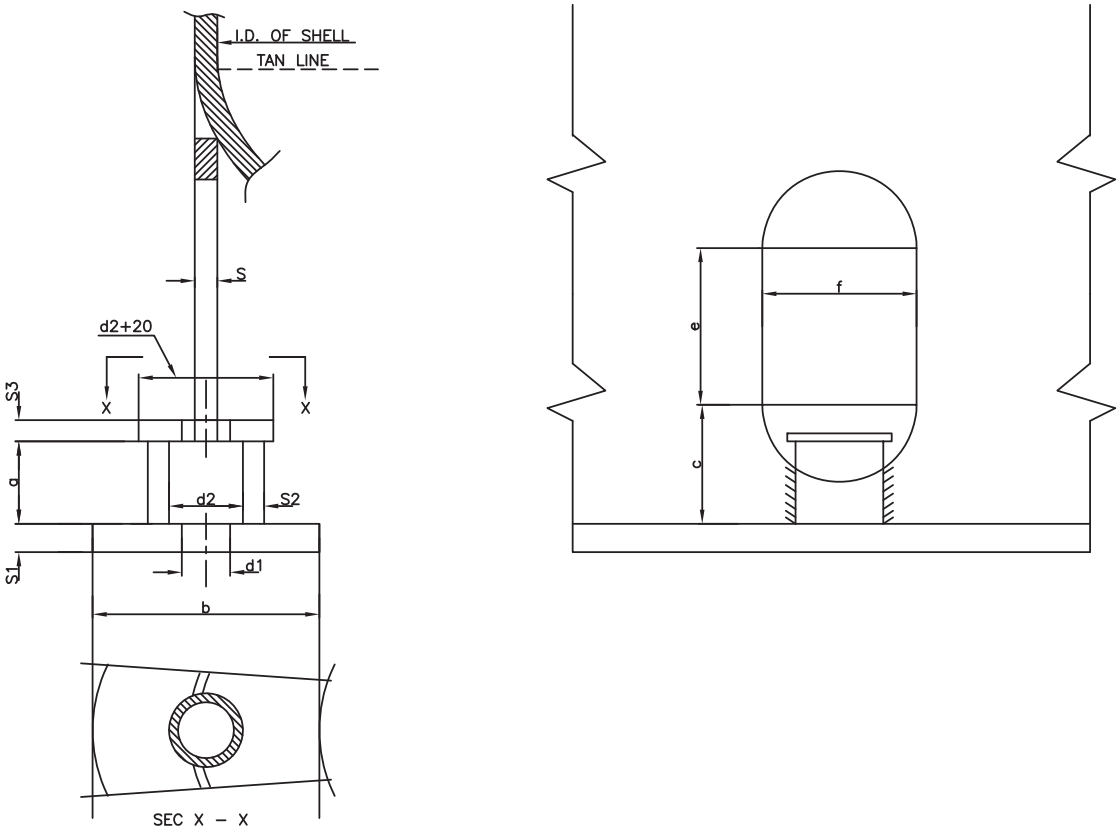
FILE NAME :STD/NCR/PV301

SKIRT SUPPORT FOR VERTICAL VESSELS



DIA. OF BOLTS	NO. OF HOLES	a	b	c	d1	d2	e	f	S1	S2	S3
20	SEE NOTE – 2	55	80	70	24	48	70	80	20	7	12
24		55	80	70	28	48	70	80	20	7	12
27		55	80	70	32	60	70	85	20	9	12
30		60	110	75	35	60	80	90	22	9	16
33		70	110	85	39	60	85	95	22	9	16
36		75	110	90	42	73	95	105	22	10	16
39		90	130	105	45	73	105	110	22	10	16
42		100	130	115	48	73	115	115	22	10	16
45		115	130	130	51	90	125	120	22	12	16
48		125	150	140	54	90	135	130	25	12	20
52		140	200	155	58	90	140	135	30	12	20

NOTES :–

1. The base ring can also be manufactured in four equal parts and the relating welding must be ground on both sides. The ring dimensions must be checked case by case on the basis of the specific loads.
2. The number of the anchor bolts shall be determined case by case and at any rate in a number multiple of four the type to be selected is a designers choice..
3. The fillet size of welding shall be minimum of the thicknesses to be welded.

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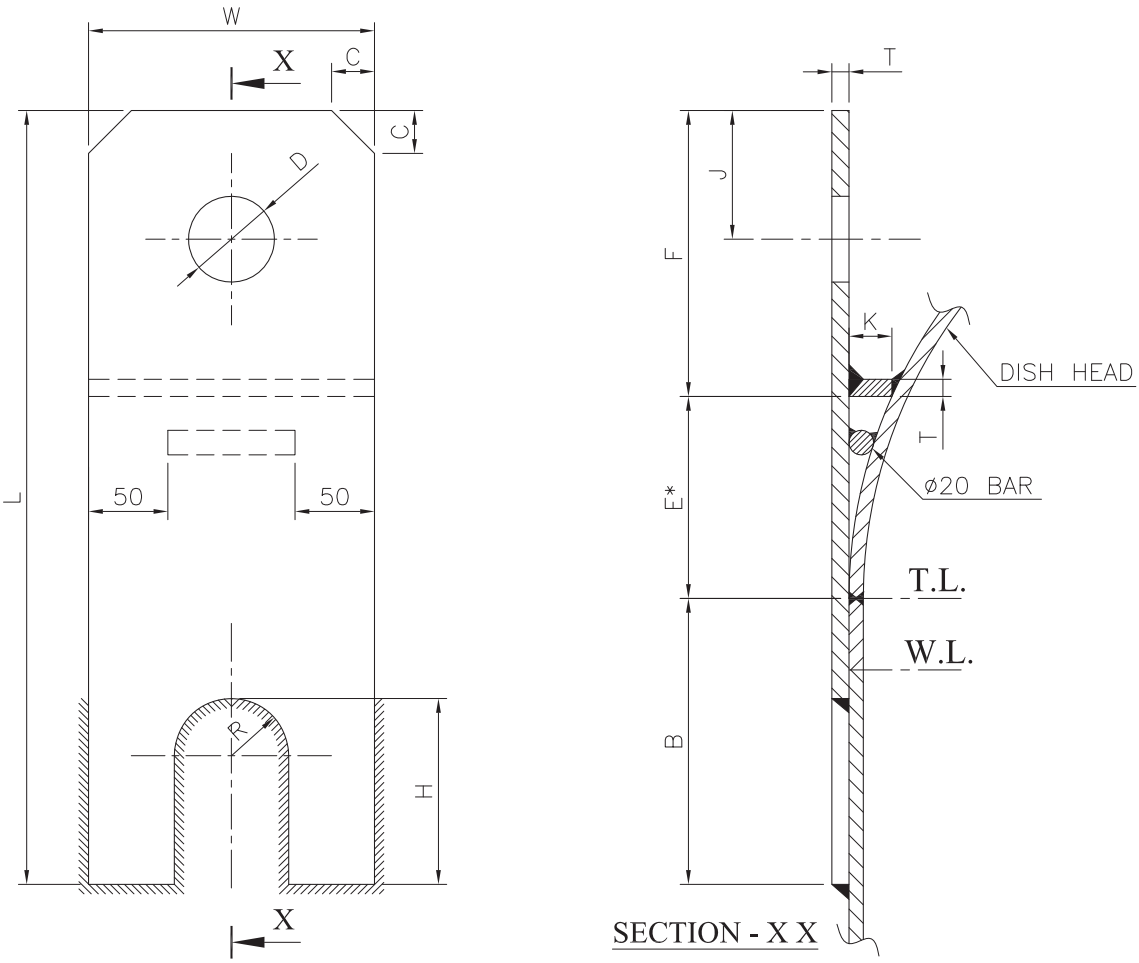
LIFTING LUG



MAX. ERECTION WT OF VESSEL (M TON)	10	25	45	90	140	180
THICKNESS OF PLATE (T)	12	28	40	50	70	80
WIDTH (W)	200	230	300	400	500	615
LENGTH (L)	400+E	460+E	580+E	750+E	900+E	1080+E
DIAMETER OF HOLE (D)	60	75	75	100	130	150
HEIGHT OF NOTCH & SIDE WELD (H)	130	130	150	200	250	300
RADIUS OF NOTCH (R)	40	40	50	75	90	100
WELD SIZE	10	14	20	30	38	46
BOTTOM OF BRACE TO TOP OF LUG (F)	200	230	300	400	500	600
BOTTOM OF BRACE TO T.L. OF HEAD (E)	see note 2*					
T.L. OF VESSEL TO END OF LUG (B)	200	230	280	350	400	480
CHAMFER (C)	30	40	50	70	90	100
TOP OF LUG TO CENTER LINE OF LUG (J)	90	90	115	150	180	230
(K)	30	40	50	70	80	100
NO. OF LUGS (T)	2	2	2	2	2	2

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.
2. DIMENSION 'E' TO BE DETERMINED BY SHAPE OF HEAD IN CONJUNCTION WITH DIMENSION 'K'.
3. DETAIL DIMENSIONS AND NOTES GIVEN IN DESIGN DRAWING TAKE PRECEDENCE OVER THOSE SHOWN HERE.

DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
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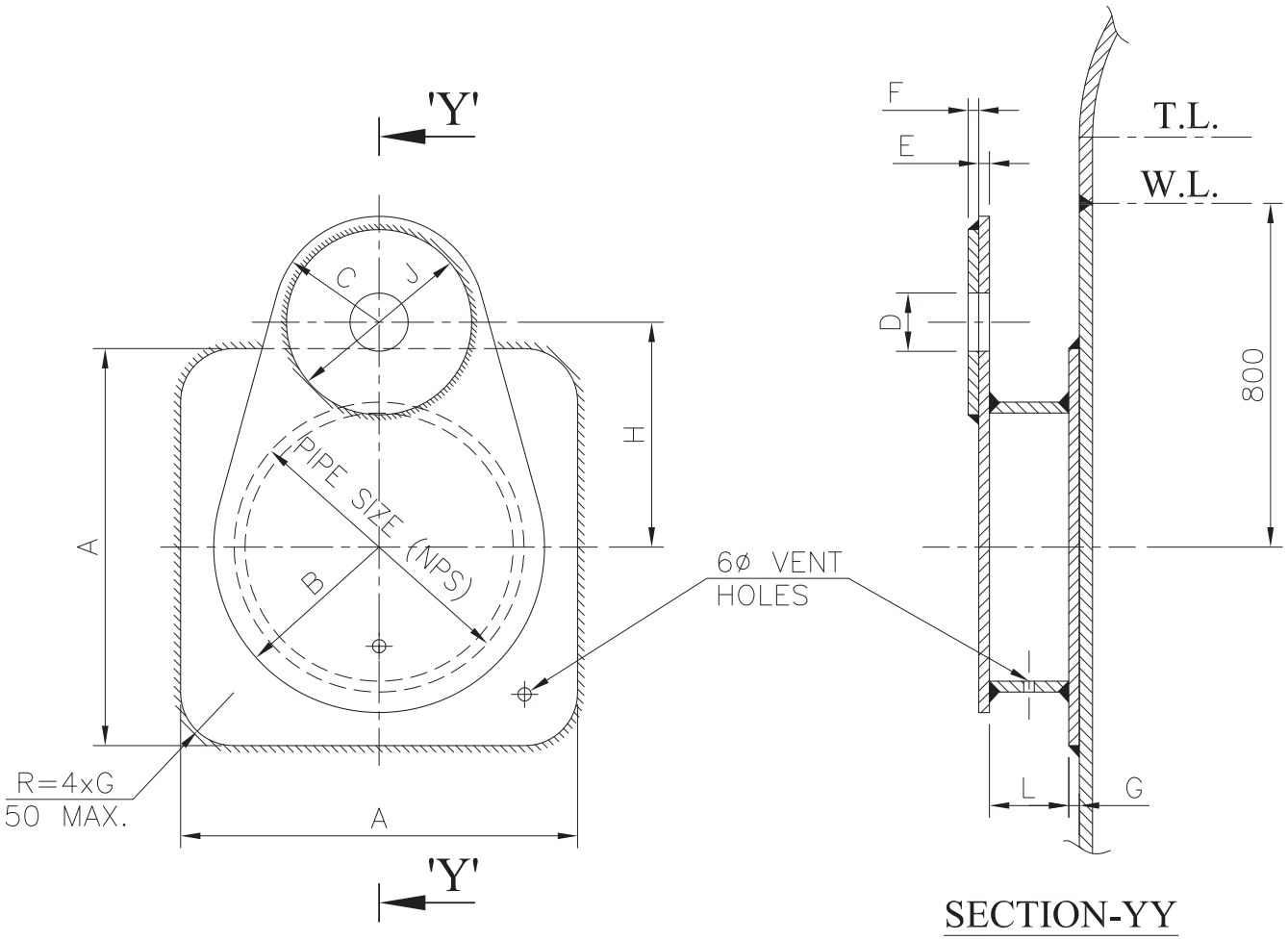

SECTION-YY

LIFTING CAPACITY PER LUG (M. TON)	PIPE			PLATE								
	NPS	MIN. THK.	L	A	B	C	D	E	F	G	H	J
<5	6"	7.11	60	25	100	50	27	8	–	8	130	–
>5 ⩽10	8"	8.18	85	300	125	80	38	8	–	8	170	–
>10 ⩽20	8"	8.18	85	300	125	80	44	10	8	10	170	140
>20 ⩽25	10"	9.27	100	350	150	120	54	12	10	12	210	220
>25 ⩽30	12"	8.38	110	400	175	160	60	12	10	10	250	300

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.
2. LIFTING CAPACITY RELATES TO PER LUG. THIS TYPE OF LUGS MAY BE USED TO LIFT UPTO 60 TONS.
3. WELDING SIZE SHALL BE 0.7 OF THICKNESS BUT NOT LESS THAN 7 MM.
4. MATERIAL PLATES–SA 516 Gr. 70 OR EQUIVALENT (SEE NOTE 5). PIPE–SA 106 Gr. B OR EQUIVALENT.
5. THE PLATE WELDED TO SHELL FOR ALLOY STEEL EQUPMENT SHALL BE OF SAME MATERIAL OF THE SHELL.

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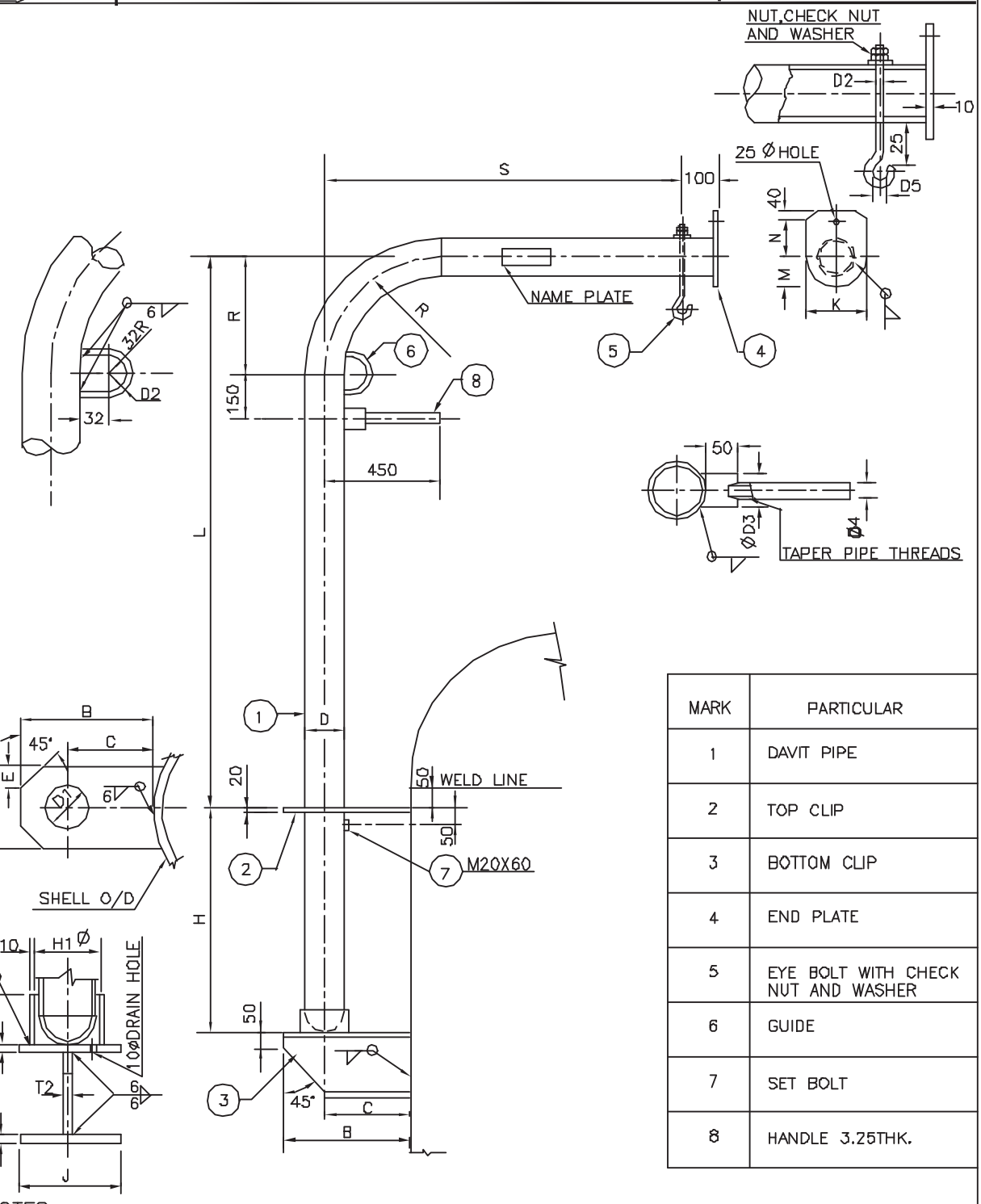
PIPE DAVIT

PDS:PV 303

ISSUE: AUG. 1999

SHEET 1 OF 2



MARK	PARTICULAR
1	DAVIT PIPE
2	TOP CLIP
3	BOTTOM CLIP
4	END PLATE
5	EYE BOLT WITH CHECK NUT AND WASHER
6	GUIDE
7	SET BOLT
8	HANDLE 3.25THK.

NOTES:

1. FABRICATOR TO INDICATE IN PARMANENT LETTERING ON THE NAME PLATE THE RATED LOAD.
2. FABRICATOR TO MAKE SURE THAT DAVIT TURNS EASILY.
3. VESSEL CLIP PLATES TO BE OF THE SAME MATERIAL AS SHELL PROPER AND TO BE WELDED TO EACH OTHER AND TO SHELL WITH 6mm FILLET WELD.
4. FOR STERSS RELIEVED VESSELS,CLIP MUST BE SHOP WELDED TO VESSELS.
5. OTHER STRUCTURAL PARTS TO IS:2062 Gr A/B.
6. PIPE THREADS TO IS:554.

DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
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Davit pipe size	A	B	C	D_1	D_3	D_4	E	F	G	H_1	J	K	M	N	T_1	T_2
DN 100	250	355	225	118	55	26.9	65	180	100	120	150	140	70	140	16	10
DN 150	300	400	250	172	70	42.4	75	200	100	175	200	190	95	160	16	10
DN 200	400	475	275	222	70	42.4	100	250	100	225	250	240	120	185	20	12

Rated load 500 kg.					Rated load 1000 kg.					S	L	H
Davit type	D DN x Tnk.	R	D_2	D_5	Davit type	D DN x Thk.	R	D_2	D_5			
1	100 x 7.9	500	16ϕ	40ϕ						600	2300	750
2	100 x 7.9	500	16 ϕ	40ϕ						700	2300	750
3	150 x 7.11	750	16 ϕ	40 ϕ	103	150 x 9.52	750	20ϕ	50 ϕ	800	2500	750
4	150 x 7.11	750	16 ϕ	40 ϕ	104	150 x 9.52	750	20ϕ	50 ϕ	900	2500	750
5	150 x 7.11	750	16 ϕ	40 ϕ	105	150 x 9.52	750	20 ϕ	50 ϕ	1000	2500	900
6	150 x 7.11	750	16 ϕ	40 ϕ	106	200 x 8.18	1000	20 ϕ	50 ϕ	1100	2500	900
7	150 x 7.11	750	16 ϕ	40 ϕ	107	200 x 8.18	1000	20 ϕ	50 ϕ	1200	2500	900
8	150 x 7.11	750	16 ϕ	40 ϕ	108	200 x 8.18	1000	20 ϕ	50 ϕ	1300	2800	1100
9	150 x 7.11	750	16 ϕ	40 ϕ	109	200 x 8.18	1000	20 ϕ	50 ϕ	1400	2800	1100
10	150 x 9.52	750	16 ϕ	40 ϕ	110	200 x 8.18	1000	20 ϕ	50 ϕ	1500	2800	1100
11	150 x 9.52	750	16 ϕ	40 ϕ	111	200 x 11.13	1000	20 ϕ	50 ϕ	1600	3000	1250
12	150 x 9.52	750	16 ϕ	40 ϕ	112	200 x 11.13	1000	20 ϕ	50 ϕ	1700	3000	1250
13	150 x 9.52	750	16 ϕ	40 ϕ	113	200 x 11.13	1000	20 ϕ	50 ϕ	1800	3000	1250
14	150 x 9.52	750	16 ϕ	40 ϕ	114	200 x 11.13	1000	20 ϕ	50 ϕ	1900	3000	1250
15	150 x 9.52	750	16 ϕ	40 ϕ	115	200 x 11.13	1000	20 ϕ	50 ϕ	2000	3000	1250
16	150 x 9.52	750	16 ϕ	40 ϕ	116	200 x 11.13	1000	20 ϕ	50 ϕ	2100	3300	1400
17	200 x 8.18	1000	16 ϕ	40 ϕ						2200	3300	1400
18	200 x 8.18	1000	16 ϕ	40 ϕ						2300	3300	1550
19	200 x 8.18	1000	16 ϕ	40 ϕ						2400	3300	1550
20	200 x 8.18	1000	16 ϕ	40 ϕ						2500	3300	1550
21	200 x 8.18	1000	16 ϕ	40 ϕ						2600	3300	1550

31/08/99	ISSUED FOR IMPLEMENTATION			
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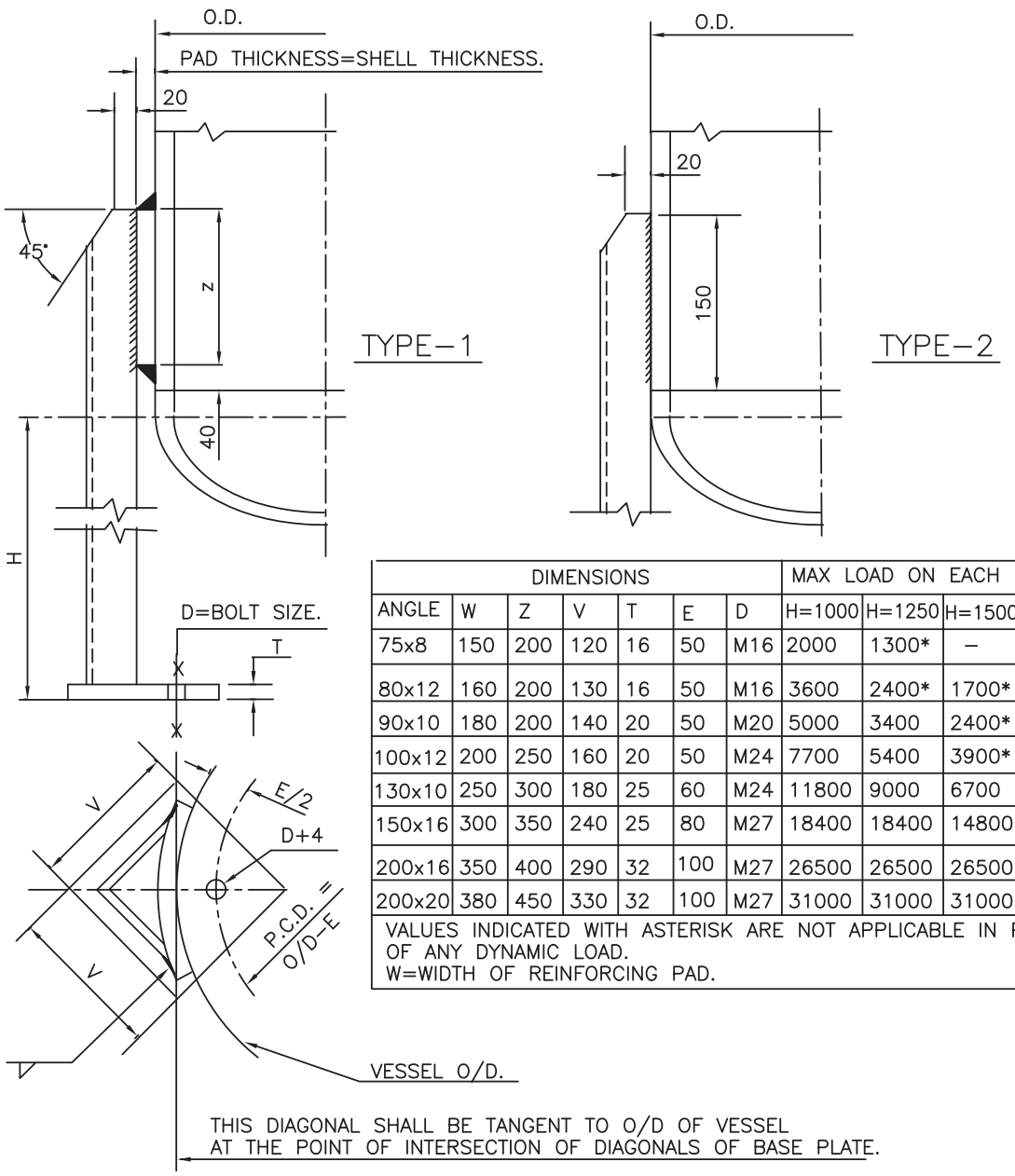

DIMENSIONS							MAX LOAD ON EACH LEG 'P' IN KG.				
ANGLE	W	Z	V	T	E	D	H=1000	H=1250	H=1500	H=1750	H=2000
75x8	150	200	120	16	50	M16	2000	1300*	–	–	–
80x12	160	200	130	16	50	M16	3600	2400*	1700*	–	–
90x10	180	200	140	20	50	M20	5000	3400	2400*	1800*	–
100x12	200	250	160	20	50	M24	7700	5400	3900*	2900*	–
130x10	250	300	180	25	60	M24	11800	9000	6700	5100	3900*
150x16	300	350	240	25	80	M27	18400	18400	14800	11600	9300
200x16	350	400	290	32	100	M27	26500	26500	26500	22000	15500
200x20	380	450	330	32	100	M27	31000	31000	31000	31000	26000

VALUES INDICATED WITH ASTERISK ARE NOT APPLICABLE IN PRESENCE OF ANY DYNAMIC LOAD.
W=WIDTH OF REINFORCING PAD.

NOTES

1. WEIGHT ON EACH LEG 'P'>=Q/N+M/C IN KG, WHERE
   Q= WT OF VESSEL FULL OF LIQUID KG.
   N=NO OF LEG SUPPORTS
   M=WIND MOMENT IN Kg cm.
   C=0.75XP.C.D OF FOUNDATION BOLTS FOR 3 LEGS IN CM.
   C=P.C.D OF FOUNDATION BOLTS FOR 4 LEGS IN CM.
2. FOR VESSELS = < 1000 O/D ADOPT 3 NO OF SUPPORTS.
   AND VESSELS >1000 O/D ADOPT MIN. 4 NO. OF SUPPORTS.
3. SUPPORT TYPE 2 SHALL BE USED ONLY FOR TANK = < 600 O/D.
4. DIMENSION 'H' AND TYPE OF SUPPORT ARE TO BE DECIDED AS PER DESIGN CONDITION.
5. REINFORCING PAD SHALL BE OF SAME MATERIAL AS THAT OF SHELL.
6. ALL CORNERS OF REINFORCING PAD SHALL BE ROUNDED TO RADIUS OF 20 MM.
   FOR CARBON AND NICKEL STEEL VESSELS OPERATING AT LOW TEMPERATURES,
   MINIMUM CORNER RADIUS SHALL BE OF 50 MM.
7. ALL WELDS SHALL BE CONTINUOUS, SIZE OF FILLET WELD SHALL BE EQUAL
   TO THE MINIMUM THICKNESS TO BE WELDED.
8. ADOPT SKIRT SUPPORT (PDS:PV 301)PREFERABLY FOR VESSEL HAVING
   HEIGHT TO DIAMETER RATIO >5.

DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
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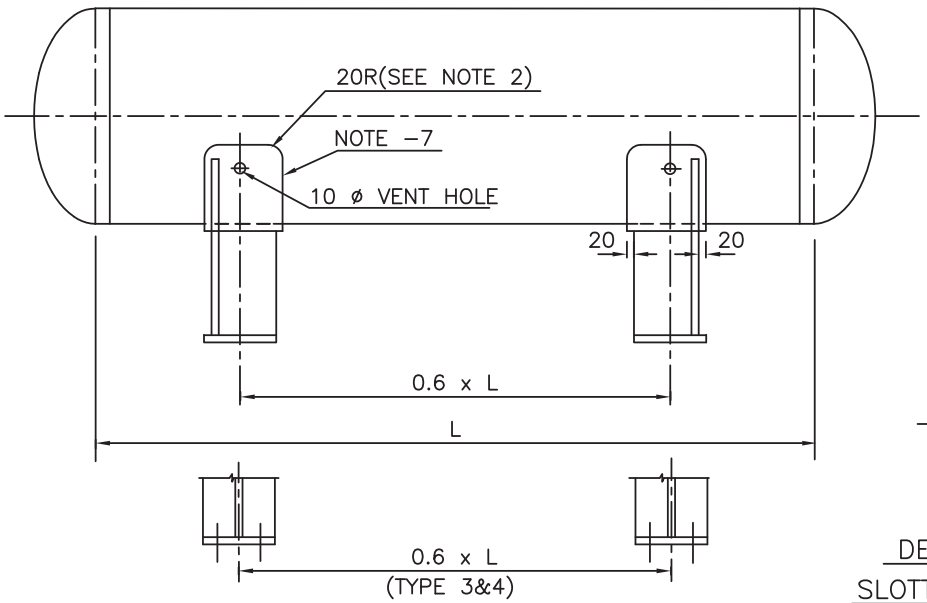
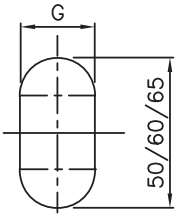
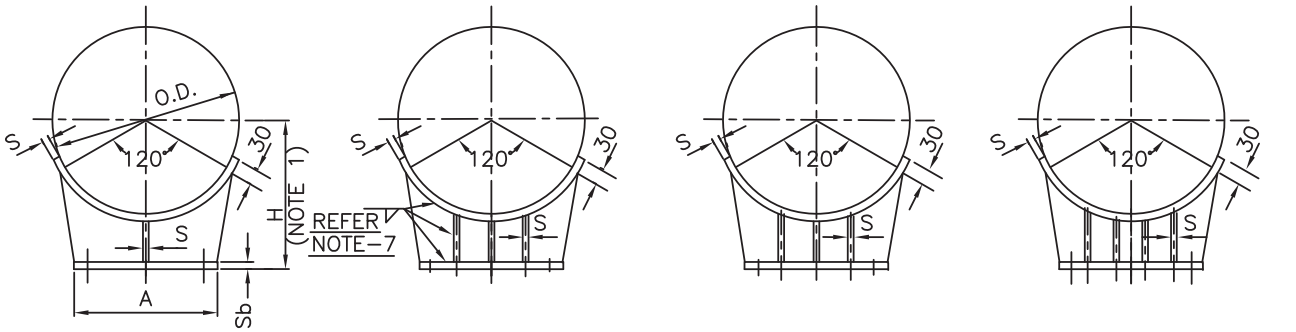
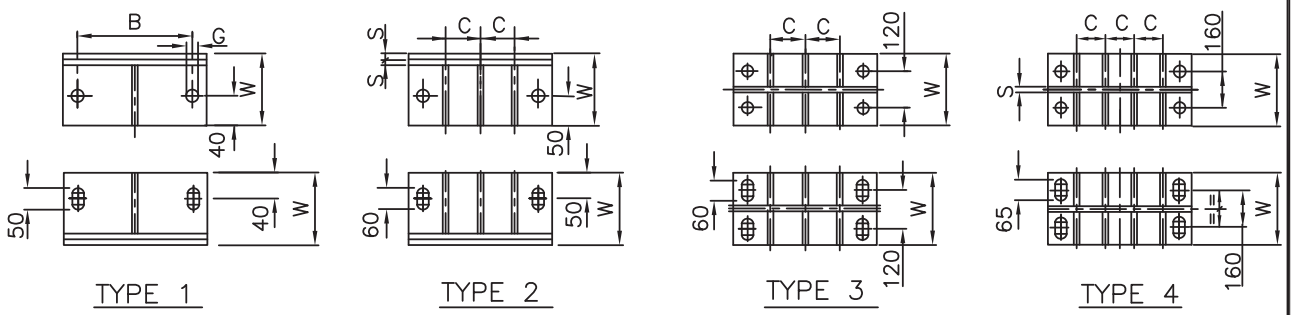




DETAIL OF SLOTTED HOLES





TYPE 1 TYPE 2 TYPE 3 TYPE 4

NOTES:

1. DIMENSION 'H' TABULATED ASSUMES A MAXIMUM PROJECTION OF ANY PART BELOW THE SHELL 250mm. WHERE ANY PART PROJECTS BEYOND 250 mm, 'H' SHALL BE EQUAL TO MAXIUM PROJECTION PLUS 50 mm.
2. FOR CARBON STEEL AND NICKEL STEEL VESSELS OPERATING AT LOW TEMP., CORNERS OF WRAPPER PLATE SHALL BE ROUNDED TO A RADIUS NOT LESS THAN 50mm.
3. IN CASE OF VESSELS OF STAINLESS STEEL OR OTHER ALLOY MATERIALS,THE WRAPPER PLATE SHALL BE OF SAME MATERIAL AS THE SHELL.
4. IN CASE OF CONFLICT BETWEEN THE DIMENSIONS GIVEN HERE AND THOSE SHOWN ON THE DRAWINGS, THE LATTER SHALL GOVERN.
5. NUTS FOR BOLTS PASSING THROUGH SLOTTED HOLES SHALL BE LEFT LOOSE.
6. SLIDE PLATE SHALL BE PROVIDED BELOW THE BASE PLATE IN CASE OF VESSELS WHERE UNUSUAL EXPANSION IS EXPECTED. OR EQUIPMENT SUPPORTED ON STEEL STRUCTURE. SIZE OF SAME SHALL BE 100 mm HIGHER IN LENGTH AND WIDTH OF BASE PLATE.
7. FILLET WELDS SHALL BE CONTINUOUS & SIZE 0.7xTHK. OF THINNER PLATE MIN. 6mm.
8. FOR INTERMEDIATE DIAMETER THE SADDLE OF SMALLER SIZE SHALL BE USED.

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SUPPORT SADDLE FOR HORIZONTAL VESSELS

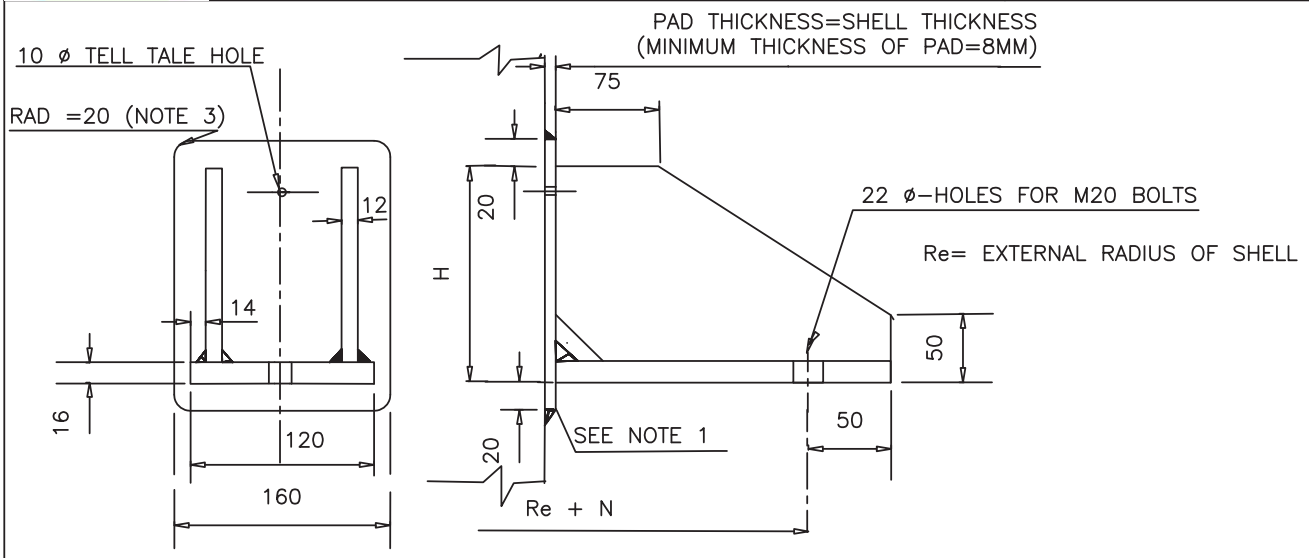
	SHELL O.D.	A	B	C	S	Sb	BOLT SIZE	G	H	W	WT. IN KG.
TYPE 1	324	290	210	–	6	10	M16	22	460	110	15
	355	320	240	–	6	10	M16	22	480	110	20
	406	360	280	–	6	10	M16	22	500	110	25
	508	450	370	–	6	10	M16	22	550	110	25
TYPE 2	600 TO 700	530	450	180	8	12	M20	26	650	130	40
	701 TO 800	620	540	210	8	12	M20	26	700	130	40
	801 TO 900	710	610	240	8	12	M20	26	750	130	50
	901 TO 1000	790	690	270	8	12	M20	26	800	130	55
	1001 TO 1100	880	780	320	10	12	M20	26	850	130	60
	1101 TO 1200	960	860	360	10	12	M20	26	900	130	70
	1201 TO 1300	1050	950	400	10	12	M20	26	950	130	70
TYPE 3	1301 TO 1400	1140	1040	440	12	16	M20	26	1000	200	125
	1401 TO 1500	1230	1130	480	12	16	M20	26	1050	200	130
	1501 TO 1600	1320	1200	520	12	16	M20	26	1100	200	135
	1601 TO 1700	1400	1280	560	12	16	M20	26	1150	200	145
	1701 TO 1800	1490	1370	600	12	16	M20	26	1200	200	155
	1801 TO 1900	1570	1450	630	12	16	M20	26	1250	200	160
	1901 TO 2000	1660	1520	660	12	16	M20	26	1300	200	170
TYPE 4	2001 TO 2100	1750	1610	480	12	16	M24	30	1350	250	275
	2101 TO 2200	1840	1700	510	12	16	M24	30	1400	250	285
	2201 TO 2300	1930	1790	540	12	16	M24	30	1450	250	300
	2301 TO 2400	2020	1880	570	14	20	M24	30	1500	250	310
	2401 TO 2500	2100	1960	600	14	20	M24	30	1550	250	320
	2501 TO 2600	2190	2050	620	14	20	M24	30	1600	250	390
	2601 TO 2700	2270	2130	650	14	20	M24	30	1650	250	400
	2701 TO 2800	2360	2200	670	14	20	M24	30	1700	250	415
	2801 TO 2900	2450	2290	700	14	20	M24	30	1750	250	430
	2901 TO 3000	2540	2330	720	14	20	M24	30	1800	250	440
	3001 TO 3100	2620	2460	740	16	20	M24	30	1850	250	450
	3101 TO 3200	2710	2550	770	16	20	M24	30	1900	250	470
	3201 TO 3300	2800	2640	800	16	20	M24	30	1950	250	485
	3301 TO 3400	2880	2700	820	16	20	M24	30	2000	250	500
	3401 TO 3500	2970	2780	840	16	20	M24	30	2050	250	510
	3501 TO 3600	3060	2870	870	16	20	M24	30	2100	250	520
	3601 TO 3700	3140	2950	900	16	20	M24	30	2150	250	540

DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
SEP. 2014	ISSUED FOR IMPLEMENTATION			

FILE NAME :STD/PPS/SR302

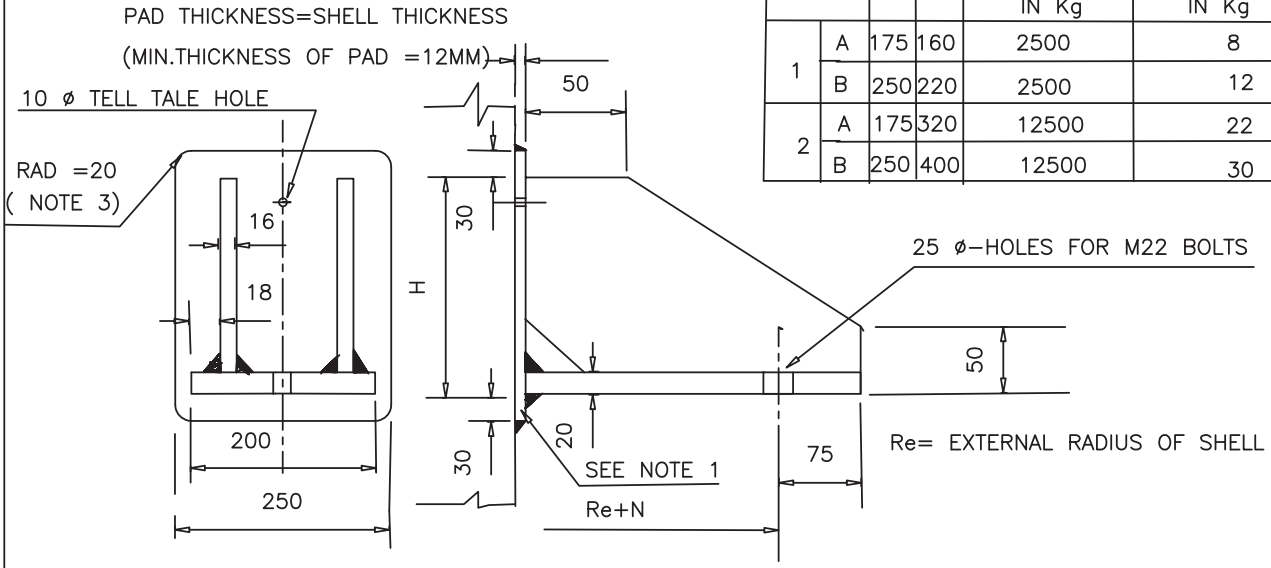
BRACKET SUPPORT FOR VERTICAL VESSEL

PDS:SR 304	0
DOCUMENT NO.	REV
SHEET 1 OF 1	



TYPE–1

TYPE OF BRACKET		N	H	MAX.LOAD FOR EACH BRACKET IN Kg	WEIGHT OF EACH BRACKET IN Kg
1	A	175	160	2500	8
	B	250	220	2500	12
2	A	175	320	12500	22
	B	250	400	12500	30



TYPE–2

NOTES

1) IF THE SHELL IS MADE OF S.S. OR OF SPECIAL MATERIAL, PROVIDE A REINFORCING PAD OF THE SAME MATERIAL AS THAT OF SHELL.
2) ALL THE WELDS SHALL BE CONTINUOUS.THE FILLET SIZE SHALL BE EQUAL TO THE MINIMUM OF THE THICKNESSES TO BE WELDED.
3) FOR CARBON AND NICKEL STEEL VESSELS OPERATING AT LOW TEMPERATURES,MINIUM CORNER RADIUS SHALL BE 50MM.

RECOMENDATION FOR USE

–IN GENERAL,THE BRACKET TYPE 1 SHOULD BE USED FOR VESSEL OF DIA < = 1000MM.
–FOR LARGER DIA, USE BRACKET TYPE 2.
–A OR B IS TO BE SELECTED DEPENDING UPON OBSTRUCTIONS (SUCH AS INSULATION,EXPANSION JOINT, STUB PIPE, ETC)
–HOWEVER,THE TYPE AND NO.OF BRACKET SHALL BE DECIDED AS PER DESIGN.
–VESSELS>600 O.D. SHALL HAVE MINIMUM 4 NO. OF BRACKETS.

REV	DATE	PURPOSE	PREPARED	REVIEWED	APP'D.BY:
0		ISSUED FOR IMPLEMENTATION			

FILE NAME :STD/RPAL/SR304

DESIGN PHILOSOPHY – CIVIL & STRUCTURAL WORKS

FOR

SUPPLY, INSTALLATION, TESTING & COMMISSIONING

OF

FLARE SYSTEM

CONTENTS

SL.NO.	DESCRIPTION	DOCUMENT NO.
1	DESIGN PHILOSOPHY FOR CIVIL & STRUCTURAL WORKS	PC183-E-4013-SEC VI- ANNEXURE 4- CIVIL SPECIFICATION
2	TECHNICAL SPECIFICATION FOR CIVIL, STRUCTURAL & ALLIED WORKS	PC183-E-4013-SEC VI- ANNEXURE 4.1- CIVIL SPECIFICATION
3	VENDOR LIST (CIVIL)	-
ATTACHMENTS		
4	LAYOUT PLAN FOR LAND DEVELOPMENT WORKS	-
5	TENDER DRAWINGS FOR PLATFORM LADDER & GRATING	-
6	SOIL DATA OF NEAR BY FOR REFERENCE	

1.0 GENERAL:

1.1 SCOPE:

All Civil, Structural and Allied works required for completion of Supply & Installation of Flare stack shall be under LSTK Contractor scope i.e. Basic Design, Detailed Engineering, Procurement, Supply, Fabrication, Transportation of all materials to site including Loading, Unloading, Storage, Maintenance, Construction and Erection of all Civil & structure and getting approval of drawing /documents by Owner/PMC.

Detailed description of Scope of work is mentioned as under but not limited to the following:-

- Design and construction of structural steel Derrick type Flare stack (triangular) including stack, support structure, pipe supports/sleepers, pipe racks, pits and including foundation and super structure.
- Paving to be provided 3m all around Derick type flare stack and under the pipe racks and 2m around equipment foundations also. (Minimum 150 mm thick with M15 PCC).
- Design and construction of Chain link fencing with gate at one side (approx. 1.5 heights) shall also be provided all around the sterile radius.

- Design and construction of approach roads (RCC or WMM) is in Contractor's scope including inter-connection with already constructed peripheral unit roads as well as drains. Location of approach road shall be decided during detail engg stage.

- Soil investigation report of flare stack area is not available. Recommendations of soil investigation for nearby area is attached herewith only for reference purpose to the bidders. The bidder is advised to do preliminary assessment of soil conditions prior to bidding. Please note that successful bidder has to conduct soil investigation afresh for design and execution purpose.

- The CONTRACTOR shall adopt foundation per requirements of structure, loads, settlement & other design criteria. The CONTRACTOR shall design and construct all foundations, pile etc as per requirements of fresh soil investigation report with no extra cost to OWNER / Project Management Consultant (PMC).
- At bidding stage, the CONTRACTOR is advised to visit the site and study the existing site conditions & existing structures if any.

- Fairly Graded land shall be provided to the CONTRACTOR. However, micro-grading up to approx. up to 300 mm (as required) shall be done by the bidders in their respective areas.

Land development Plan of plant area showing various graded levels is attached with the Tender for reference.

- The CONTRACTOR shall dispose-off all surplus and unserviceable earth (if any), outside the plant in accordance to local Governing authority, at his own cost. Disposal shall be done at a place outside the plant, with the consent of the OWNER. Location of disposal area shall be decided by the CONTRACTOR and the required necessary approvals from the local bodies shall be the CONTRACTOR‘s responsibility. **I**t is Bidder's responsibility to visit the site for getting all such information.

- During construction and on completion of construction (inclusive all internal and external finishes), cleaning all the debris, waste materials scattered in and around the site and disposal of the same shall be in the scope of the CONTRACTOR with the consent of the OWNER.
- Preparation of detailed design, drawings, and fabrication drawings, supply of materials and construction of all civil and structural works shall be in the scope of work. The Contractor shall submit the detail drawings along with calculations in excel file (and Staad analysis) for information and review to the Owner/PMC.
- All the facilities shall conform to all Local Rules and Regulations, Factory Inspector, Rules, TAC rules etc. whichever is more stringent. Getting the approval of the various documents through the various authorities shall be in the Contractor’s scope at no extra cost to OWNER / PMC.
- The CONTRACTOR shall keep the OWNER / PMC informed of any major design revisions simultaneously in progress.
- Construction of all civil and structural works including all material, labor, Supervision, tools and tackles etc. shall be carried out by the CONTRACTOR.
- Procurement and supply of all materials viz. cement, reinforcement, structural steel etc. shall be in the scope of CONTRACTOR.
- All materials shall be procured in consultation with the Owner or as per the approved vendor list given elsewhere in this document. All materials of construction must be of ISI approved brand.
- All materials and construction shall confirm to the specification given elsewhere in this document.

- The CONTRACTOR shall be responsible for obtaining the statutory approval from local authorities such as Inspector of Factories, Development Authorities, Municipal Corporation and other concerned authorities before starting the work.
- The CONTRACTOR shall ensure that the facilities are constructed in accordance with the APPROVED FOR CONSTRUCTION drawings and specifications.
- The CONTRACTOR shall maintain and operate an adequate system of control of availability of latest drawings and specifications, at all the places where work is performed.
- Construction shall include excavation in all types of soils / rock inclusive of necessary dewatering as applicable.
- The CONTRACTOR shall redo / repair all the existing facilities viz. roads, paving, drainage etc. which are damaged during transportation, construction and erection activities performed by him.
- The scope of work mentioned in the contract/NIT is not the comprehensive one, but gives total idea/outline of the scope of work; however contractor shall be responsible for completeness of the job for the purpose indicated elsewhere to make the system fully functional and operational.
- In case there is any conflict in the specifications appearing in different contractual documents then the specification whichever is stringent shall be applicable without any technical or commercial implications.
- The work furnished shall be complete in every respect with all mounting, fittings, fixtures and standard accessories etc. normally provided for such item/equipment and or needed/required for erection, completion and safe operation of the item/equipment/system as required by applicable codes though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.
- Any additional items and materials which are not specifically mentioned but are required to complete the system offered, in every respect in accordance with the technical specifications and required for safe operation and guaranteed performance shall also be deemed as included in the scope of work of this tender. Contractor shall not be eligible for any extra payment in respect of such mountings,fittings,fixtures,accessories etc.which are needed/required for safe operation of the item/ equipment/system, as required by applicable codes of the country though they may not have been explicitly spelt out in the NIT/Contract.

- Contractor shall ensure the quality of civil works by strict supervision /inspection and provide test results to Owner/PMC for information.

1.2 Units of Measurement

Units of measurement in design shall be in metric system.

1.3 Definitions

1	CCE	Chief Controller of Explosives
2	TAC	Tariff Advisory Committee
3	NFPA	National Fire Protection Association
4	IS	Indian Standards

1.4 Codes and Standards

The design shall be in accordance with established codes, sound engineering practices and shall conform to the statutory regulations applicable to the country.

The main codes and standards and statutory regulations considered as minimum requirements are as follows Latest revision of these shall be followed:

IS:456	Code of practice for plain & reinforced concrete
IS:800	Code of practice for general construction in steel
IS 801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
IS:802	Code of practice for use of structural steel in overhead transmission line towers
IS:806	Code of practice for use of steel tubes in general building construction
IS:816	Code of practice for use of metal arc welding for general construction
IS:875	Code of practice for design loads
IS:1080	Code of practice for design & construction of shallow foundations on soil
IS:1161	Specification for steel tubes for structural purpose
IS:1597	Code of practice for construction of stone masonry
IS:1838	Filters for expansion joints
IS:1893	Criteria for earth quake resistant design of structures
IS:1904	Code of practice for design and construction of foundations in soils, General requirements

IS:1905	Code of practice for structural use of un-reinforced masonry
IS:2185	Concrete masonry units
IS:2629	Recommended practice for hot dip galvanizing of iron and steel
IS:2633	Methods for testing uniformity of coating of zinc coated articles
IS:2911	Code of practice for design and construction of pile foundations
IS:2950	Code of practice for design & construction of raft foundations
IS:2974	Code of practice for design & construction of machine foundations
IS:4091	Code of practice for design and construction of foundation for transmission line tower and poles
IS:4326	Code of practice for earthquake resistant design and construction of buildings
IS:4925	Specification for Concrete Batching and Mixing Plant
IS:4991	Criteria for blast resistant design of structures for explosions above ground
IS:5249	Determination of dynamic properties of soil
IS:6403	Code of practice for determination of bearing capacity of shallow foundations
IS:6533	Code of practice for design and construction of steel chimneys
IS:6745	Method for determination of mass of zinc coating
IS:8009	Code practice for calculation of settlements of foundations
IS:8944	Chlorpyrifos emulsifiable concentrates
IS:9595	Recommendations for metal arc welding of carbon and carbon manganese steel
IS:11089	Code of practice for design and construction of ring foundation
IS:12118	Two parts polysulphide based sealant
IS:13920	Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.
	National Building Code
	Factory Rules

In case of any difference between Codal provision and this design basis, the stringent one should govern the design.

In case of any conflict / deviations amongst various documents, the order of precedence shall be as follows:

1. Statutory Regulations
1. Job Specifications
2. Engineering Design Basis
3. Standard Specifications

2.0 Design Loads

The following design loadings shall be considered:

1. Dead loads including self weight
2. Live load
3. Wind load
4. Seismic load
5. Equipment load
6. Dynamic load
7. Load from lifting appliances
8. Erection loads / maintenance loads
9. Thermal load
10. Earth pressure / Hydrostatic Loads
11. Any other load not mentioned above, but applicable

These loadings shall be applicable to all structures irrespective of the material employed for construction.

2.1 Dead Loads

Dead load shall comprise of the weight of all permanent construction including walls, fire proofing, floors, roofs, partitions, stairways and fixed services.

2.2 Equipment Loads

The empty / operating / test weight of process equipment including all fixtures, platforms, ladders and attached piping but excluding contents, shall be considered. If piping weight is not indicated separately or not included in the weight of the equipment, the same shall be taken as 10% of the weight of the equipment.

2.3 Special Considerations

a. Bundle Pull

Bundle pull forces for different types of exchangers shall be taken as under:

Fixed type	-	Nil
Kettle type	-	0.30 × Bundle weight
All other types	-	0.86 × Bundle weight or 30 N/mm of diameter Whichever is greater

Total Bundles Pull shall be considered on fixed pedestal alone

b. Thermal Expansion

Horizontal force due to thermal expansion of horizontal vessels / exchangers shall be relieved by using slotted holes and slide plates and remaining force derived from the product of the sliding saddle 'gravity load' and the coefficient of friction shall be applied to each support. The coefficient of friction shall be taken as under:

a. teflon to teflon	:	0.08
b. stainless steel to teflon	:	0.10
c. steel to steel	:	0.30
d. steel to concrete	:	0.45

c. Non-Static Loading

Foundations and structures supporting vessels subject to surge loading, such as Deaerators shall be designed with sufficient stiffness and rigidity to resist a notional horizontal forces of 10% of those derived from the Vessel's operating weight or the given surge load whichever is greater. The forces shall be applied at the vessel's centre of gravity and act longitudinally or transversely. Consideration shall be given to bracing these structures.

The design of foundations and structures supporting agitated vessels, centrifuges, reactors and other variable load equipment shall take full account of all the loading data provided by the equipment vendors. Where no loads are available, consideration shall be given to applying force at 10% of operating weight. In addition, for dynamic effect loads will be increased by 50% of steam agitated equipment and 25% for mechanical agitated vessels.

Where two or more similar items of such equipment are supported on a common foundation or structure, the design must be based on the assumption that these items will resonate in phase.

2.4 Rotating Equipment

Comprehensive loading data of mechanical equipment, such as, fans, blowers, pumps, compressors, D.G. Sets, turbines, motors engines etc., as furnished by the equipment vendor shall be considered

2.5 Live Loads

Live loads shall, in general, be as per IS:875. However, the following minimum live loads shall be considered in the design of structures to account for maintenance and erection phases; if equipment layout / vendor drawings indicate loads of greater magnitude, the same shall be adopted.

1. Process Building / Technological Structure (Open / Enclosed type)

Operating area	-	5.0 kN/m²
Maintenance area	-	7.5 kN/m²
Ground floor	-	10.0 kN/m²

2. Compressor House/TG House

Operating area	-	7.5 kN/m²
Maintenance area	-	7.5 kN/m²

Ground floor	-	10.0 kN/m²

3. Service Platform

Vessel / Tower	-	3.0 kN/m²
Isolated platform (for valve operation)	-	2.5 kN/m²
Access way	-	2.5 kN/m²
Cross over	-	2.0 kN/m²
Piperack walkways	-	2.5 kN/m²
Gantry girder walkway	-	3.0 kN/m²
Upper floors	-	4.0 kN/m²
Ground floor	-	5.0 kN/m²

4. Staircase

Process Building	-	5.0 kN/m²
Technological structure	-	5.0 kN/m²
Office	-	5.0 kN/m²
Substation/Control Room	-	3.0 kN/m²
Laboratory	-	4.0 kN/m²
Service platform	-	2.5 kN/m²

Loads on account of equipment and incidental loads shall be taken over and above the loads indicated in the table.

For all other buildings not covered in above Table, the imposed loads shall be taken as specified in IS:875 (Part II)

1 kN/m² allowance shall be made for services supported from below the floor.

Live load on various types of roofs shall be as per the requirements given in IS:875.

2.6 Wind Loads

Wind loads for structural design shall be as per IS-875 (Part-3) except for switchyard structures and transmission towers for which IS:802 shall be applicable.

Basic wind speed shall be taken as 50 m/s. Other design criteria shall be as per IS codes.

Definition of basic wind speed shall be peak gust velocity averaged over 3 second time interval at 10 m height above mean ground level with 50 years mean return period. The design life span of all structures, except temporary structures, and boundary wall shall be taken as 50 years. Life span of temporary structures and boundary wall can be lesser and shall be as per IS:875.

To account for surface area of piping, platforms and other attachments fixed to the equipment, the surface area of the equipment (vessel/column) exposed to wind shall be increased by 20% or as specified in the mechanical data sheets of the equipment

2.7 Seismic Loads

Seismic zone is III to be considered.

Seismic loads shall be as per IS: 1893 (Latest Revision).

2.8 Impact and Vibratory Loads

Structures subjected to impact or vibratory loads shall be designed as per the provision of IS:875 & IS:2974. Requirements for monorails and overhead cranes shall be as per IS:800, IS:875 or manufacturer's data, whichever is more stringent.

2.9 Contingency Loads

Contingency loads are to be applied in the absence of actual loads from vendor data equipments. For walkways/ operating platforms/ slabs, such loadings shall be considered as per the established engineering practices. Design shall be according to IS codes.

2.9.1 RCC Structures

All floor slabs and beams shall be designed for a concentrated load of 10 KN acting simultaneously with the uniform live load, but not with actual concentrated loads from equipment, piping etc. This load shall be placed to result in maximum moment and / or maximum shear.

This load shall not be considered for the design of columns, foundations and in overall frame analysis. For floor slabs, the load shall be considered to be distributed over an area of 0.75 m x 0.75 m.

2.9.2 Structural Steel

For process plants, the following contingency additional loading shall be applied to individual beam elements, these shall be applied as point loads to produce worst shear and bending stresses:

1. Platform Walkways 3 kN
2. Secondary Floor Trimmers 5 kN
3. Primary / Grid beams 10 Kn

2.10 Miscellaneous Loads

Apart from the specified live loads, possible overloading during construction / hydro-test maintenance / erection shall also be considered in the design Job specifications and shall also be referred to, for any specific loading.

Hydrostatic pressure shall be adequately accounted for, in the design of structures, below ground water table.

All the handrails, parapets, parapet walls, balustrades shall be designed for horizontal load mentioned in Table 3 of IS-875 (Part-2).

2.11 Load Combinations

Load combinations shall be as latest IS code.

3.0 DESIGN CRITERIA FOR FOUNDATIONS

3.1 General

Foundation sizing shall be based on working loads without any factor.
Construction of all major foundation may be carried out after considering the soil strata as per Soil investigation report which shall be conducted by the successful bidder.

3.2 Shallow Foundations

3.2.1 For gravity loading, allowable net bearing capacity of soil shall be based on the following settlement criteria:

Foundation Type	Allowable Settlement(mm)
– Foundations in unit areas, utility areas and Foundations for plant buildings including substation, Compressor house, control room, technological structures	25
– Machine foundations and critical equipment with interconnected piping	25
– Foundations supporting non-plant buildings	40

3.2.2 For transient loadings, such as wind / seismic, allowable net bearing capacity based on shear criteria may be considered.

3.2.3 For load combinations including wind/Earthquake, the Safe Soil Bearing Pressure may be increased by 25%.

3.2.4 Allowable Loss of contact area between underside of foundation and soil (due to resultant Overturning Moment) under different loading conditions shall be as given below.

Load Combination description		Allowable % Loss of Contact Area
A.	Operating Load case (Plant operating, with or without Live Loads, for worst cases)	0 % to 10%
	Operating Load Case with Wind or Earthquake (with or without Live Loads, for worst cases)	up to 25%
B.	Operating Load case (Plant operating, with or without Live Loads, for worst cases)	0 % to 20%
	Operating Load Case with Wind or Earthquake (with or without Live Loads, for worst cases)	up to 30%

Where A = Foundations on Soil , B = Foundations on Rock

3.2.5 Stability of foundations

Foundations shall be checked for stability against overturning, sliding & uplift. While checking against uplift, the following shall be considered.

Foundation Design – Factors of Safety

Type of Structures	Minimum factor of safety against overturning		Minimum factor of safety against Sliding		% Weight of Overburden over projected plan area of footing
	With wind or seismic	Without wind or seismic	With wind or seismic	Without wind or seismic	
All Buildings/ Structures / Eqpt. In Units	1.5	2.0	1.5	1.5	100
Pipe Rack	1.5	2.0	1.5	1.5	50

3.3 Machine Foundations

Machine / Mechanical equipment foundations shall satisfy the requirements of IS:2974 and any other parameters as per machine vendors.

Generally, of the equipment. Further for major rotating machinery such as main compressor, the amplitude of foundation of structure during normal operation shall not exceed the allowable amplitude specified by the equipment manufacturer. The above consideration may be omitted for centrifugal pumps and fans and other minor rotating equipment weighing less than 1 ton or if the mass of the rotating parts are less than 1/100th of the mass of foundation installed directly on concrete provided that the weight of foundation is not less than 3 times of the equipment weight. In such cases, dynamic analysis is not necessary.

When dynamic analysis is called for, the combined centre of gravity of the machine and foundation system shall, as far as possible, pass through the centre of area of the foundation raft or centroid of the pile group. Wherever unavoidable, eccentricity shall be less than 5% for block foundations and 3% for frame foundations. However, in highly compressible soils, no eccentricity shall be permitted.

Foundations shall be so designed that natural frequency of the foundation system shall not resonate with the following:

foundations and structures supporting rotating machinery shall be so proportioned that their natural frequency shall not fall within the range of 0.8 to 1.2 of normal operating speed Operating speed of the motor / turbine

a) Operating speed of the machine
b) 2 x Operating speed of the machine

c) Critical speed of the machine (for centrifugal machines)

It shall be ensured that there is no transfer of vibrations from machine foundations to any part of the adjoining structures. In case such machine are sitting on building floors, approved damping pads shall be used with prior approval of the Owner / Consultant.

Where deviations (resulting from inaccuracies in soil parameter measurements, approximations in design method, etc.) from calculated natural frequencies, leading to amplitudes in excess of specified limits are foreseen, provision for increasing the foundation mass without removal of the machine and without affecting surrounding space availability or connected piping shall be made, if possible.

3.4 Foundation Bolts

All holding down bolts or threaded rods for non-post tensioned applications shall be out of Mild Carbon steel conforming to IS: 2062 with Fy = 250 MPa unless Noted Otherwise. For scrubbing section and acid storage section, holding down bolts should conform to SS 316.

3.4.1 Minimum cover to Foundation Bolts

Minimum distance from the centre line of foundation anchor bolt to edge of pedestal shall 6d (d = dia of bolt).

3.4.2 All equipment foundation bolts / templates shall be designed and supplied by equipment vendor.

Foundation bolts for steel structures shall be designed and supplied by contractor as per standard drawings or approved equivalent.

3.5 Pedestal Heights

Pedestals for structural columns:

Open paved area	: 500 mm (min.) OR as indicated in Equipment layout drawing
Open unpaved area	: 300 mm below existing road crown
Covered area (building etc.)	: 500 mm (min.) OR as indicate in drawing
Storage tank foundation	: As per equipment layout

All equipment supporting foundations / pedestals

Open area	: As required but not less than 300 mm
Covered area	: As required but not less than 150 mm
Stair Pedestals	: 300 mm (min.) OR as indicated in equipment Layout drawing.
Ladder pedestals	: 300 mm

4.0 DESIGN CRITERIA FOR REINFORCED CONCRETE STRUCTURES

4.1 General

1) All buildings, structures retaining storage structures, trenches, pits etc. shall be of RCC and designed based on the following IS codes (latest revision with all amendments, issued there to) in general, and other relevant IS codes applicable : IS:456, 875, 1893, 1904, 2911, 2950, 2974, 3370, 4326, 4991, 4998, 5249, 6403, 8009, 13920.

2) Only limit state method as per IS: 456 shall be followed for the design unless otherwise specified elsewhere in this document for special structures. All water retaining structures / structures in contact with water shall be designed for un-cracked section with working stress method.

3) All skeletal structures shall be of frame type construction, and detailing shall be as per provision of IS: 13920.

4) Where the specified design depth of groundwater table so warrants, all underground pits, tunnels, basements, etc. shall be leak-proof R.C.C. construction using water proofing compounds.

4.2 Concrete Grade

43/53 GRADE Ordinary Portland Cement should be used in foundation and superstructure.

The minimum grade of concrete shall be M25 grade for reinforced cement concrete works for all structures and foundations except for grade slabs / paving for which M20/M15 may be used. For Compressor foundations, M30 grade reinforced concrete shall be used. From durability consideration, the minimum cement content and maximum water-cement ratio shall be as per the IS code. Following table can be used for reference purpose only:

Type of Cement	Plain concrete		Reinforced concrete		Remarks Exposure Condition
	Minimum cement content (kg/m³)	Maximum water-cement ratio	Minimum cement content (kg/m³)	Maximum water-cement ratio	
43/53 Grade-OPC	240	0.55	330 (M20) 350(M25) 400(M30)	0.45	Moderate

Cement should be properly selected taking into consideration of soil investigation and water properties below grade level prior to concreting.

75 mm thick lean concrete of grade M10 (nominal mix) shall be provided under all RCC foundations except under base slab of liquid retaining structures where 100 thick concrete of mix M10 (nominal mix) shall be used. The lean concrete shall extend 75 mm beyond the foundation for normal foundations and 100 mm under liquid retaining structures.

Concrete for encasing shall be M20 with 10 mm down aggregate.

Plain cement concrete (PCC) of grade M15 (nominal mix) of minimum 150 mm thickness shall be provided under all masonry wall foundations.

Plain cement concrete of grade M20 of minimum 40 mm thickness shall be provided as damp proof course, at plinth level of all masonry walls and to be coated with 3 mm thick bitumen emulsion.

4.3 Reinforcement Bars

All reinforcement bars for RCC works should be High yield strength deformed steel bars of grade Fe500D conforming to IS: 1786. CRS (Corrosion Resistant steel) of yield strength Fe500 D shall be used for all water retaining structures, sub-structures/underground structures and all the foundations.

4.4 Minimum Cover to Reinforcement

Minimum clear cover shall be provided to all steel reinforcement as per IS: 456 & IS: 3370.

4.5 Expansion Joints

Concrete structures
Expansion points in concrete structures shall be provided at 30-35 m centers. The expansion joint shall be provided preferably by way of twin columns on a common foundation. Sliding joints shall be avoided as far as possible.

4.6 Deflections

4.6.1 Deflections in concrete structures shall in general be limited by adherence to the limits on span by depth ratio for beams and slabs and length to lateral dimension ratios for columns as prescribed in IS: 456. Where special functional / serviceability requirements or large spans demand actual deflections and / or crack widths shall be calculated and the following limits adhered to:

- Total vertical deflection due to all loads including the Effects of temperature creep and shrinkage : Span/250
- Total horizontal deflection between two floors : Storey height/200
- Crack width (for non-liquid retaining structures) : 0.3 mm

5.0 DESIGN CRITERIA FOR STEEL STRUCTURES

5.1 General / Design Methods

Design, fabrication and erection of the above work shall be carried out in accordance with the following IS Codes as applicable to the specific structures, viz, IS:800, 801, 802, 806, 814, 816, 875, 1893, 6533, 9595, etc. Basic consideration of structural frame work shall primarily be stability, ease of fabrication/erection and overall economy, satisfying relevant Indian Standard Codes of Practice. Steel structures adequately braced in vertical and horizontal planes, consistent with functional requirements, shall be preferred over structure having moment

connections. Moment connections, if adopted, shall be fully rigid as per IS:800. Where fully rigid joints are adopted they shall generally be confined to the major axis of the column member. Flare stack supporting structure shall be adequately braced on all four faces.
Structural elements, continuously exposed to temperatures above 200º C, shall be designed for reduced stress as per Table-4 of IS: 6533 (Part-2). The expected temperature of steel components shall not be allowed to exceed 400 º C. The structures connected to column, heater vessels working at high temperatures shall not be rigidly connected with staircase and adjoining structures, which are on ambient temperatures.

Crane gantry girders shall generally be of welded construction and of single span length. GI grating shall be used for gantry girder walkway flooring.

Steel staircases shall have channels provided as stringers with minimum clear width of 1000 mm. The vertical height between successive landings shall not exceed 4.0 meters. Treads shall be minimum 250 m wide made of grating (with curved chequered plate nosing) spaced equally so as to restrict the rise to maximum 150 mm. If relevant local by-laws or applicable Factory Act Rules stipulates more stringent requirements in this regard, the same shall be adhered to.

Electro-forged galvanized MS gratings shall be minimum 30 mm deep. The maximum size of voids in the grating shall be limited to 34 mm x 65 mm. The minimum thickness of galvanizing shall be 86 microns. Gratings shall be suitable for the operation and maintenance loads for the floors.

Bolted connections shall be adopted as far as practicable, except for cases where welded connections are required viz. (Galvanized) electrical switchyard structures and transmission towers. Structural connections shall have minimum two bolts of 16 mm dia. unless otherwise limited by the size of members

Lock nuts shall be provided for anchor bolts of tall structures, tall process columns, vibrating equipment, etc.

Minimum two nuts shall used for all anchor bolts except for ladder, stair and hand rail.

For design of steel structures including anchor bolts, 1mm corrosion margin should be kept.

All floor and platform shall be of grating floor.(As far as possible welding & cutting of grating should be avoided & grating should be fixed with help of clamps/nut-bolts)

5.2 Expansion Joints

Expansion joints shall be provided at 80 – 100 m centres, where possible, column bracing shall be provided at the centre of a longitudinal frame, rather than at the ends so as to avoid constraints on free expansion.

5.3 Steel Grade

Structural steel shall be of yield stress of 250 Mpa conforming to grade B of IS: 2062. Tubular steel shall conforming to minimum Yst 310 (as per IS: 1161 & 4 IS: 4923). Use of E350 grade steel for larger diameter Rolled Tubular (tube made by rolling plates) may be allowed.

5.4 Limiting Permissible Stresses

Permissible stresses in structural members shall be as specified in various codes.

IS:800 - Hot rolled sections (excluding transmission towers and Switchyard structures).

IS:801 - Cold formed light gauge sections

IS:802 - Transmission towers & switchyard structures

IS:806 - Tubular Structures

Permissible stresses in bolts shall be as specified in:

IS:800 - Hot rolled sections

IS:801 - Cold formed light gauge sections

IS:802 - Transmission towers & switchyard structures

IS:806 - Tubular Structures

Permissible stresses in welds shall be as specified in:

IS:801 - Cold formed light gauge sections

IS:806 - Metal Arc Welding

5.5 Limiting Deflection

The limiting permissible vertical deflection for structural steel members shall be as specified below :-

• Gantry girder for electric overhead crane (Capacity up to 50T)	:	L/750
• Gantry girder for electric overhead crane (Capacity over 50T)	:	L/1000
• Gantry girder for manually operated crane	:	L/500
• Girder beam for supporting dynamic equipment/hoist	:	L/450
• Grating / Chequered plate	:	L/200 or 6mm Whichever is less
• Purlins supporting any type of roofing material	:	L/200
• Under (dead load + live load) or (dead load + wind Load) conditions	:	
• Other structural components	:	As specified in relevant IS, Where “L” represents the span

• The limiting permissible horizontal deflection for multistoried steel structure/ building including flare stack	:	Height/325

6.0 DESIGN CRITERIA –GENERAL

6.1 Site Grading

6.1.1 The grading of the area shall be done by cutting and filling with the following:

1. Cutting Area : Thoroughly rolled and compacted.
2. Filling Area : Compacted in layers not exceeding 20cm to achieve minimum 95% of maximum dry density.

6.1.2 Site grading philosophy shall be based on following:

Finished Ground Levels (FGL) shall be provided to the bidder. Highest Point of Paving (HPP) shall be finalised by CONTRACTOR, in consultation with OWNER / PMC, based on contour survey of the Unit, levels of adjacent units and levels of adjacent Roads.

6.1.3 Slope in Graded Areas (Between various grades)

1. General Site Grading : 1 in 500 to 1 in 1000
2. Micro grading, after completion of major Construction (for road corridors) : 1 in 200

7.0 DETAILED ENGINEERING

General

7.1.1 The CONTRACTOR shall carryout Analysis and Design of the structures required for this document and shall prepare all the required Architectural, Civil and Structural drawings needed for correct and accurate construction as per the Design Specifications given in this document.

7.1.2 The CONTRACTOR shall submit a Detailed Schedule for release of documents and drawings for review / approval to PMC/CLIENT, within 2 weeks/or mutually agreed period of date of award of the Contract. Such a schedule shall be made in line with the overall Project Schedule given in the document. The CONTRACTOR shall strictly adhere to the approved schedule.

The Format of Submission of the above mentioned schedule shall be mutually discussed and finalized after award of the job.

7.1.3 Construction of various structures / facilities, whose designs and / or drawings are specially identified in the document submission requirements for approval by PMC, shall not be taken up for construction at site till they are approved by PMC and comments given by PMC are incorporated.

For other structures / facilities, the CONTRACTOR shall directly submit the Approved for Construction (AFC) drawings to PMC for information before, taking up construction.

7.1.4 It shall be the responsibility of the CONTRACTOR to accommodate all the functional requirements such as access, cut-outs, clearances, interference etc. while designing / detailing of various structures / facilities.

7.1.5 Complete analysis, design and all drawings of each independent structure / facility shall be submitted in one lot so as to facilitate overall systematic review by PMC.

7.1.6 Only after the necessary architectural drawings are approved by the OWNER / PMC to their satisfaction, then the design drawings shall be reviewed and approved by PMC.

7.1.7 The CONTRACTOR shall keep the OWNER / PMC informed of any major design revisions simultaneously in progress.

7.2 Design calculations

The CONTRACTOR shall prepare the design calculations based on the standard accepted practice and guidelines from PMC / OWNER.

All design calculations shall be written systematically, legibly and submitted in Staad files, excel sheets as well as pdf for approval.

For structures, analysis and design shall be done on latest version of STAAD-PRO SOFTWARE.

For other miscellaneous works, Excel and Word shall be used. Design calculations shall be done on A4 size sheet only.

7.3 Drawings

The CONTRACTOR shall prepare

- Civil & structural design & construction drawings, architectural drawings based on the standard accepted practice and guidelines from PMC / OWNER.
- Bar bending schedules.
- Fabrication drawings.
- As-built drawings.
- Detailing / drafting shall be done on AUTOCAD Latest Version only. Drawing size used shall be preferably of A1 size only. For foundation layout, drainage plans and paving plans, A0 size drawings can be used if necessary.

8.0 CONSTRUCTION

8.1 General

8.1.1 Construction of all civil and structural works including all material, labour, Supervision, tools and tackles etc. shall be carried out by the CONTRACTOR

8.1.2 Procurement and supply of all materials viz. cement, reinforcement, structural steel etc. shall be in the scope of CONTRACTOR.

8.1.3 All materials shall be procured in consultation with the Owner or as per the approved vendor list given elsewhere in this document. All materials of construction must be of ISI approved brand.

8.1.4 All materials and construction shall confirm to the specification given elsewhere in this document.

8.1.5 Materials of construction, construction methodology etc. shall be such, so as to protect the structures and foundations against the harmful effect of chemical, fumes etc. present in the plant, its vicinity, in ground and / or subsoil water.

8.1.6 The CONTRACTOR shall be responsible for obtaining the statutory approval from local authorities such as Inspector of Factories, Development Authorities, Municipal Corporation and other concerned authorities before starting the work.

8.1.7 The CONTRACTOR shall ensure that the facilities are constructed in accordance with the APPROVED FOR CONSTRUCTION drawings and specifications.

8.1.8 The CONTRACTOR shall maintain and operate an adequate system of control of availability of latest drawings and specifications, at all the places where work is performed.

8.1.9 Construction shall include excavation in all types of soils / rock inclusive of necessary dewatering as applicable.

8.1.10 The CONTRACTOR shall redo / repair all the existing facilities viz. roads, paving, drainage etc. which are damaged during transportation, construction and erection activities performed by him.

9.0 Quality Assurance Plan

Contractor shall ensure the quality of civil works by supervision /inspection and provide test reports to Owner/PMC for information.

10.0 COMPLETENESS OF WORK / CONTRACT

10.1 The scope of work mentioned in the contract/NIT is not the comprehensive one, but gives total idea/outline of the scope of work; however contractor shall be responsible for completeness of the job for the purpose indicated elsewhere to make the system fully functional and operational.

10.2 In case there is any conflict in the specifications appearing in different contractual documents then the specification whichever is stringent shall be applicable without any technical or commercial implications.

10.3 The work furnished shall be complete in every respect with all mounting, fittings, fixtures and standard accessories etc. normally provided for such item/equipment and or needed/required for erection, completion and safe operation of the item/equipment/system as required by applicable codes though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

10.4 Any additional items and materials which are not specifically mentioned but are required to complete the system offered, in every respect in accordance with the technical specifications and required for safe operation and guaranteed performance shall also be deemed as included in the scope of work of this tender. Contractor shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures, accessories etc. which are needed/required for safe operation of the item/ equipment/system, as required by applicable codes of the country though they may not have been explicitly spelt out in the NIT/Contract.

TECHNICAL SPECIFICATIONS

FOR

CIVIL, STRUCTURAL

AND

OTHER ALLIED WORKS

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18.	CULVERT WORK

1.0 GENERAL

1.1 Specifications of materials and workmanship shall be as described in the Central Public Works Department Specifications Vol. I & II (latest) include latest amendments, unless otherwise specified. These CPWD Specifications shall be deemed to form part of this contract. The **CONTRACTOR** shall procure and maintain copies of the latest CPWD Specifications at site for reference.

1.2 These technical Specifications shall be supplementary to the specifications contained in the CPWD specifications, wherever at variance, these Particular Specifications shall take precedence over the provisions in the CPWD Specifications.

2.0 REFERENCE CODES & STANDARDS

2.1 Wherever reference of IS Specifications/ or IS Codes of Practice are made in the Specifications/ Schedule of Rates or Preambles, reference shall be to the latest edition of IS (Bureau of Indian Standards).

IS - 383	Coarse & Fine aggregates from natural sources for concrete.
IS - 427	Distemper, dry, colour as required.
IS - 432	Mild Steel & Medium tensile steel bars.
IS - 456	Code of Practice for Plain and Reinforced Concrete.
IS - 515	Natural and Manufactured aggregates for use in mass concrete
IS - 730	Hook bolts for corrugated sheet roofing
IS - 800	Code of Practice for General Construction in Steel
IS - 1079	Hot rolled carbon steel sheets & strips
IS - 1081	Code of practice for fixing and glazing of metal (steel & aluminium) doors, windows and ventilators.
IS - 1161	Steel tubes for structural purposes.
IS - 1285	Wrought aluminium & aluminium alloy extruded round tube and hollow sections

IS - 1361	Steel windows for Industrial Buildings.
IS - 1363	Hexagon head bolts, screws & nuts of product grade C : Part - I Hexagon head bolts (size range M5 to M64)
IS - 1367	Technical supply conditions for threaded steel fasteners
IS - 1566	Hard - Drawn steel wire fabric for concrete reinforcement.
IS - 1786	High strength deformed steel bars & wires for concrete reinforcement.
IS - 2062	Steel for general structural purposes.
IS - 2116	Sand for masonry mortars.
IS - 2212	Code of practice for brickwork.
IS - 2386	Methods of test for aggregates.
IS - 2835	Flat transparent sheet glass
IS - 4021	Timber door, window and ventilator frames
IS - 4923	Hollow Steel sections for structural use.
IS - 4925	Concrete batching and mixing plant.
IS - 5410	Cement Paint
IS - 6477	Dimensions for wrought aluminium & aluminium alloys, extruded hollow sections.
IS - 7318	Fusion welding of steel.
IS - 10262	Recommended guidelines for concrete mix design.
IS - 14871	Products in Fibre Reinforced Cement – Long Corrugated or Asymmetrical Section Sheets and Fittings for Roofing and Cladding - Specification

3.0 EARTHWORK

3.1 Excavation

3.1.1 Excavation shall be carried out in soil of any nature and consistency, in the presence of water or in the dry, met on the site to the lines, levels and contours shown on the detailed drawings and **CONTRACTOR** shall remove all excavated materials to soil heaps on site or transport for use in filling on the site or stack them for reuse as directed by the Engineer-in-Charge.

3.1.2 Surface dressing shall be carried out on the entire area occupied by the buildings including plinth protection as directed without any extra cost. The depths of excavation shown on the drawings are the depths after surface dressing.

3.1.3 The site around all buildings and structures to a width of 3 metres beyond the edge of plinth protection, ramps, steps, etc. shall be dressed and sloped away from the buildings.

3.1.4 Black cotton soil, and other expansive or unsuitable soils excavated shall not be used for filling in foundations, and plinths of buildings or in other structures including manholes, septic tanks etc. and shall be disposed off within the contract area marked on the drawings, as directed, levelled and neatly dressed.

3.1.5 In case of trenches exceeding 2 metres depth or where soil is soft or slushy, the sides of trenches shall be protected by timbering and shoring. The **CONTRACTOR** shall be responsible to take all necessary steps to prevent the sides of trenches from caving in or collapsing. The extent and type of timbering and shoring shall be as directed by the **Engineer-in-Charge.**

3.1.6 Where the excavation is to be carried out below the foundation level of adjacent structure, the precautions to be taken such as under pinning, shoring and strutting etc. shall be determined by **Engineer-in-Charge**. No excavation shall be done unless such precautionary measures are carried out as per directions of **Engineer-in-Charge.**

3.1.7 Specification for Earth work shall also apply to excavation in rock in general. The excavation in rock shall be done such that extra excavation beyond the required width and depth as shown in drawings is not made. If the excavation done in depth greater

than required /ordered. The **CONTRACTOR** shall fill the extra excavation with concrete of mix 1:5:10 as the foundation concrete at his own cost.

3.1.8 **CONTRACTOR** shall make all necessary arrangements for dewatering / defiling as required to carry out proper excavation work by bailing or pumping out water, which may accumulate in the excavation pit from any cause/ source whatsoever. In addition to this, if required, contractor shall also install continuous dewatering pump-sets to lower the ground water table below the working level to make the area fit and safe for working.

3.1.9 **CONTRACTOR** shall provide suitable draining arrangements at his own cost to prevent surface water entering the foundation pits from any source.

3.1.10 The **CONTRACTOR** is forbidden to commence the construction of structures or to carry out concreting before **Engineer-in-Charge** has inspected, accepted and permitted the excavation bottom.

3.1.11 Excavation in disintegrated rock means rock or Boulders including brickbats which may be quarried or split with crow bars. This will also include laterite and hard conglomerate.

3.1.12 Excavations in hard rock - meant excavation made in hard rock to be done manually, or by blasting using only explosives and / or pneumatic hammers. In case of blasting, control blasting should be adopted depending on site conditions. For using explosives **CONTRACTOR** shall follow all provisions of Indian Explosives Act / Rules 1983, corrected / revised up to date.

3.1.13 In case of hard rock excavation to be carried out using explosives the, **CONTRACTOR** shall obtain the written approval in advance.

3.1.14 The measurements for excavations shall be restricted and limited to minimum excavation line as per drawing for payment purposes.

3.1.15 Adequate protective measures shall be taken to see that the excavation does not affect or damage adjoining structures. The **CONTRACTOR** shall take all measures required for ensuring stability of the excavation and safety of property and people in the vicinity. The **CONTRACTOR** shall erect and maintain during progress of work, temporary fences around dangerous excavations at no extra cost.

3.1.16 Excavation in ordinary soil means excavation in ordinary hard soil including stiff

heavy clay, hard shale, or compact moorum, or any materials, which can be removed by the ordinary application of spades, shovels, picks and pick axes. This shall also include removal of isolated boulders each having a volume not more than 0.50m³.

3.1.17 Excavation in soft rock includes limestone, sandstone, laterite, hard conglomerates, etc. or other rock which can be quarried or split with crowbars or wedges. This shall also include excavation of tarred pavements, masonry work and rock boulders each having a volume of not more than 0.25m³.

3.1.18 Excavation in hard rock includes any rock bound in ledges or masses in its original form or cement concrete for which in the opinion of the Engineer-in-Charge, requires the use of compressed air, equipment, sledge hammer and blasting or non-explosive materials viz. Acconex manufactured by A.C.C. Ltd. Specifications and instructions for use shall be as per manufacturer.

3.1.19 In case of any difficulty concerning the interpretation of type of soil as mentioned above, the Engineer-in-Charge shall decide whether the excavation in a particular material is in ordinary soil, soft rock or hard rock and his decision in this matter shall be final and binding on the CONTRACTOR and without appeal.

3.2 **Filling**

3.2.1 Back filling of excavations in trenches, foundations and elsewhere shall consist of one of the following materials approved by **Engineer-in-Charge.**

Soil

Sand

Moorum

Hard-core

Stone/gravel

All back filling material shall be approved by the **Engineer-in-Charge.**

3.2.2 Soil filling - Soil material shall be free from rubbish, roots, hard lumps and any other foreign organic material. Filling shall be done in regular horizontal layers each not exceeding 20 cm. depth.

3.2.3 Back filling around completed foundations, structures, trenches and in plinth shall be done to the lines and levels shown on the drawings.

3.2.4 Back filling around pipes in the trench shall be done after hydro testing is done.

3.2.5 Back filling around liquid retaining structures shall be done only after leakage testing is completed and approval of **Engineer-in-Charge** is obtained.

3.2.6 Sand used for filling under foundation concrete, around foundation and in plinth etc. shall be fine/ coarse, strong, clean, free from dust, organic and deleterious matter. The sand filling under foundation shall be rammed with Mech. compactor. Sand material shall be approved by **Engineer-in-Charge**.

3.2.7 Moorum for filling, where ordered, shall be obtained from approved pits and quarries which contain siliceous material and natural mixture of clay. Moorum shall not contain any admixture of ordinary earth. Size of moorum shall vary from dust to 10 mm.

3.2.8 Hard-core shall be of broken stone of 90 mm to 10 mm size suitable for providing a dense and compact sub grade. Stones shall be sound, free from flakes, dust and other impurities. Hard core filling shall be spread and levelled in layers, 15 cm thick, watered and well compacted with ramming or with mechanical / hand compacts including hand packing wherever required.

3.2.9 If any selected fill material is required to be borrowed, **CONTRACTOR** shall make arrangements and procure such material from outside borrow pits after obtaining all necessary permissions from statutory authorities. The material of source shall be subject to prior approval of **Engineer-in-Charge**. **CONTRACTOR** shall make necessary access roads to borrow areas and maintain the same, if such access roads do not exist, at no extra cost.

3.2.10 Plinth filling shall be carried out with approved material as described earlier, in layers not exceeding 200 mm, watered and compacted with mechanical compaction machines. **Engineer-in-Charge** may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at later stage. The finished level of the filling shall be trimmed to the level specified. Compacted surface shall have at

least 95% of laboratory maximum dry density. A minimum of one test per 250 sq. meters of compacted area shall be done.

3.2.11 Whenever the fill material (earth or soil) is purchased, **CONTRACTOR** shall get the approval of Engineer-in-Charge. The CONTRACTOR shall arrange to determine the following properties of the soil (at outside NABL accredited laboratory without any cost to owner) and shall get the approval of **Engineer-in-Charge**.

1. Clay content : 15% to 20%
2. Laboratory dry density (MDD) : Not less than 1600 kg/m³
3. Plasticity Index : Not more than 20
4. Optimum Moisture Content (OMC) : 8% to 12%

3.2.12 The fill shall be compacted using a vibrating compactor of not less than 1.5 tonne. The fill shall be thoroughly compacted in layers as directed but not more than 200 mm thick. Adequate water shall be used for compaction and the density after compaction shall be not less than maximum dry density obtained in test of IS: 2720 Part-8. Compacted surface shall have at least 95% of laboratory maximum dry density. A minimum of one test per 250 sq. meters of compacted area shall be done for each layer.

3.2.13 The Gravel fill shall be non plastic granular material, well graded, strong, with maximum particle size of 50 mm, with not more than 15% passing a 4.75 mm IS sieve, free of all debris, vegetable matter and chemical impurities.

3.2.14 All clods, lumps etc. shall be broken before compaction.

3.2.15 In case of grading/banking successive layers of filling shall not be placed, until the layer below has been thoroughly compacted to satisfy the requirements laid down in this specification.

Prior to rolling, the moisture content of material shall be brought to within +/-2% of the optimum moisture content as described in IS 2720 Part-7. The moisture content shall preferably be on the wet side for potentially expansive soil.

After adjusting the moisture content as described, the layers shall be thoroughly compacted by means approved by Engineer-in-Charge, till the specified maximum

laboratory dry density is obtained.

General, fill shall be placed in layers not exceeding 200 mm thickness and shall be thoroughly compacted to achieve a compaction of at least 95% of laboratory maximum dry density up to entire depth of filling. Final fill of 600 mm thickness shall consist of preferably natural material in, as dug condition except that stones larger than 100 mm shall be removed. It shall be placed in layers not exceeding 200 mm thickness and compacted to achieve of at least 95% of laboratory maximum dry density. Each layer shall be tested in field for density and accepted by Engineer-in-Charge, subject to achieving the required density before laying the next layer. A minimum of one test per 250 sq meters for each layer shall be conducted.

If the layer fails to meet the required density, it shall be reworked or the material shall be replaced and method of construction altered as directed by Engineer-in-Charge to obtain the required density.

The filling shall be finished in conformity with the alignment, levels, cross-section and dimensions as shown in the drawing.

Extra material shall be removed and disposed off as directed by the **Engineer-in-Charge.**

4.0 PLAIN AND REINFORCED CONCRETE WORK

This specifications deals with cement concrete, plain or reinforced, for general use, and covers the requirements for concrete materials, their storage, grading, mix design, strength & quality requirements, pouring at all levels, reinforcements, protection, curing, form work, finishing, painting, admixtures, inserts and other miscellaneous works.

4.1 Materials

4.1.1 Cement: Any of the following cements may be used as required.

IS - 8112	43/53 Grade ordinary Portland cement

4.1.2 Water: Water used for mixing and curing concrete and mortar shall conform to the requirements as laid down in IS: 456. Sea water shall not be used for concrete work.

4.1.3 Aggregates: Coarse and fine aggregates for cement concrete plain and reinforced shall conform to the requirements of IS 383 and / or IS 515. Before using, the aggregates

shall be tested (at outside NABL accredited laboratory without any cost to owner) as per IS: 2386.

Coarse aggregate: Coarse aggregate for all cement concrete work shall be broken or crushed hard stone, black trap stone obtained from approved Quarries or gravel.

Sand: Fine aggregate for concrete work shall be coarse sand from approved sources. Grading of coarse sand shall be within grading zones I, II or III laid down in IS: 383, table 4. If required the aggregates (both fine and coarse) shall have to be thoroughly washed and graded as per direction of **Engineer-in-Charge**.

4.2 **Mixing**

All cement concrete plain or reinforced shall be machine mixed. Mixing by hand may be employed where quantity of concrete involved is small, with the specific prior permission of the **Engineer-in-Charge**. 10% extra cement shall be added in case of hand mixing as stipulated in IS-456.

For large and medium project sites the concrete shall be sourced from ready- mixed concrete plants or from on site or off site batching and mixing plants (IS 4926)

4.3 **Water Cement Ratio, Laying & Curing**

Water Cement Ratio, Laying & Curing shall be done as per IS:456.

4.4 **Grades of Concrete**

4.4.1 Grades lower than M 25 shall not be used in reinforced concrete.

4.4.2 A sieve analysis test of aggregates shall be carried out (at outside NABL accredited laboratory without any cost to owner) as and when the source of supply is changed without extra charge notwithstanding the mandatory test required to be carried out as per CPWD specification.

4.4.5 All tests in support of mix design shall be maintained as a part of records of the contract. Test cubes for mix design shall be prepared by the CONTRACTOR under his own arrangements and at his costs, but under the supervision of the **Engineer-in-Charge**.

4.5 **Design Mix Concrete**

4.5.1 Design mix shall be allowed for major works where it is contemplated to be used by installing weigh batch mixing plant as per IS 4925. At the time of tendering, the CONTRACTOR, after taking into account the type of aggregates, plant and method of laying he intends to use, shall allow in his tender for the design mix i.e., aggregate/cement and water/cement ratios which he considers will achieve the strength requirements specified, and workability for concrete to be properly finished.

4.5.2 Before commencement of concreting, **CONTRACTOR** shall carry out preliminary tests (at outside NABL accredited laboratory without any cost to owner) for design mix on trial mixes proposed by him in design of mix to satisfy the **Engineer-in-Charge** that the characteristic strength is obtained. In this regard, CONTRACTOR may consult govt. approved/reputed institute to get design mix done as per IS 10262 at his own cost. The concrete mix to be actually used shall be approved by the **Engineer-in-Charge**.

4.5.3 Notwithstanding the above, the following shall be the maximum combined weight of coarse and fine aggregate per 50 kg of cement.

Grade of Concrete		Maximum weight of fine & coarse aggregates together per 50 kg of cement (for nominal mix only)
1.	M - 10	480 kg
2.	M - 15	350 kg
3.	M - 20	250 kg

4.5.4 The workability of concrete produced shall be adequate, so that the concrete can be properly placed and compacted. The slump shall be as per IS 456.

4.6 **Testing of Concrete**

4.6.1 Testing of concrete, sampling and acceptance criteria shall be in accordance with IS 456.

4.7 **Proportioning**

Mixes of cement concrete shall be as ordered. Where the concrete is specified by grade, it shall be prepared by mixing cement, sand and coarse aggregate by weight as per mix design. In case the concrete is specified as volumetric mix, then dry volume batching shall be done, making proper allowances for dampness in aggregates and bulking in sand. Equivalent volume batching for concrete specified by grade may however be allowed by the **Engineer-in-Charge** at his discretion.

4.8 **Pre Cast Concrete**

The specifications for pre cast concrete will be similar as for the cast in situ concrete. All pre cast work shall be carried out in a yard made for the purpose. This yard shall be dry, properly levelled and having a hard and even surface. If the ground is to be used as a soft former of the units, shall be paved with concrete or masonry and provided with a layer of plaster (1:2 proportion) with smooth neat cement finish or a layer of MS sheeting. The casting shall be over suitable vibrating tables or by using form vibrators as per directions of **Engineer-in-Charge**.

The yard, lifting equipment, curing tank, finished material storage space etc. shall be designed such that the units are not lifted from the mould before 7 (seven) days of curing and can be removed for erection after 28 (Twenty Eight) days of curing. The moulds shall preferably be of steel or of timber lined with G.I .sheet metal. The yard shall preferably be fenced.

Lifting hooks, wherever necessary or as directed by **Engineer-in-Charge** shall be embedded in correct position of the units to facilitate erection, even though they may not be shown on the drgs. and shall be burnt off and finished after erection.

Pre cast concrete units, when ready shall be transported to site by suitable means approved by **Engineer-in-Charge**. Care shall be taken to ensure that no damage occurs during transportation. All adjustments, levelling and plumbing shall be done as per the instructions of the **Engineer-in-Charge**. The CONTRACTOR shall render all help with instruments, materials and staff to the **Engineer-in-Charge** for checking the proper erection of the pre cast units.

After erection and alignment the joints shall be filled with grout or concrete as directed by **Engineer-in-Charge**. If shuttering has to be used for supporting the pre cast unit

they shall not be removed until the joints has attained sufficient strength and in no case before 14 (fourteen) days. The joint between pre cast roof planks shall be pointed with 1:2 (1 cement : 2 sand) mortar.

5.0 STEEL REINFORCEMENT

5.1 Steel reinforcement shall comprise:

Mild steel bars conforming to IS : 432 Part-I.

Cold twisted bars conforming to IS: 1786

CRS bars

TMT bars

Hard drawn steel wire fabric conforming to IS: 1566

5.2 All joints in reinforcement shall be lapped adequately to develop the full strength of the reinforcement as per provision of IS: 456 or as per instruction of **Engineer-in-Charge**.

6.0 FORM WORK

6.1 The shuttering or form work shall conform to the shape, lines and dimensions as shown on the drawings and be so constructed as to remain sufficiently rigid during placing and compacting of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete. The surface that becomes exposed on the removal of forms shall be examined by **Engineer-in-Charge** or his authorized representative before any defects are made good. Work that has sagged or bulged out, or contains honey combing, shall be rejected. All shuttering shall be steel shuttering.

6.2 The **CONTRACTOR** shall be responsible for sufficiency and adequacy of all form work. Centering and form work shall be designed & detailed in accordance with IS 14687 and approved by the **Engineer-in-Charge**, before placing of reinforcement and concreting.

6.3 **Stripping Time**

Forms shall not be struck until the concrete has reached strength at least twice the stress to which the concrete may be subjected at the time of removal of form work. The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions and cured under conditions of temperature and moisture

similar to those existing on the work. Where possible, the form work shall be left longer as it would assist the curing.

Note 1: In normal circumstances and where ordinary Portland Cement is used, forms may generally be removed after the expiry of the following periods:

1.	Walls, columns and vertical faces of all structural members	24 to 48 hours as may be decided by the **Engineer-in-Charge**
2.	Slabs (props left under)	3 days
3.	Beam soffits (Props left under)	7 days
4.	Removal of props under slabs 1. Spanning up to 4.5 m 2. Spanning over 4.5 m	 7 days 14 days
5.	Removal of props under beams & arches: 1. Spanning up to 6 m 2. Spanning over 6m	 14 days 21 days

For other types of cements, the stripling time recommended for ordinary Portland Cement may be suitably modified.

Note 2: The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

7.0 CEMENT CONCRETE BLOCK

Cement concrete block shall be machined made in the proportion of such that mix shall not be leaner than one cement to twelve combined aggregates (by volume) but having minimum strength of 7.5 MPa. Combined aggregate shall be graded as near as possible to IS: 383. The fineness modules of combined aggregate shall be between 3.6 and 4. The concrete block shall be properly cured as per IS-456. The surface of conc. block shall have even face without any honeycomb and free from cracks.

7.1 **Mortar**

Cement and water shall confirm to the requirements laid down for cement concrete work.

7.1.1 Sand for concrete block masonry mortars shall be coarse sand generally conforming to IS: 2116. Maximum quantities of clay, fine dust, shall not be more than 5% by weight. Organic impurities shall not exceed the limits laid down in IS: 2116.

7.1.2 Mix of mortar for building concrete block shall be as specified in the item of work.

7.1.3 Mixing of the mortar shall be done in a mechanical mixer. When quantity involved is small hand mixing may be permitted by **Engineer-in-Charge**. Any mortar remaining unused for more than 30 minutes after mixing shall be rejected.

7.2 **Concrete Block Masonry**

The thickness of joints shall be 10 mm +- 3mm. Thickness of joints shall be kept uniform. In case of foundation and manholes etc. joints up to 15 mm may be accepted.

7.3 **Half Concrete Block**

All courses shall be laid with stretchers. Reinforcement comprising 2 nos. 6 mm dia MS bars shall be provided over the top of the first course and thereafter at every fourth course.

7.4 **Fixtures**

All iron fixtures, pipes spouts, hold fasts of doors and windows which are required to be built into the wall shall be embedded in cement concrete blocks 1:2:4 mix (1 cement :2 coarse sand :4 graded stone aggregate. 20 mm nominal size) of size indicated in the item.

7.5 **Curing**

Concrete block masonry shall be protected from rain by suitable covering when mortar is green. Masonry work shall be kept constantly moist on all faces for a minimum period of seven days.

8.0 STRUCTURAL STEEL WORK

This specification covers the technical requirements for the preparation of shop drawings, supply, fabrication, protective coating, painting and erection of all structural steel rolled sections, built up sections, plates and miscellaneous steel required for the completion of the work.

Steel

All structural steel used in construction within the purview of this contract shall, comply with one of the following Bureau of Indian Standard Specifications, whichever, is appropriate or as specified.

IS – 2062 Hot rolled sections and plates

IS – 1079 Cold formed light gauge sections

IS – 1161 Tubular sections

IS – 4923 Hollow sections (rectangular or square)

Fabrication

Fabrication of steel structure shall be carried out in conformity with the best modern practices and with due regard to speed with economy in fabrication and erection and shall conform to IS-800. All members shall be so fabricated as to assemble the members accurately on site and erect them in correct positions. Before dispatch to site the components shall be assembled at shop and any defect found rectified. All members shall be free from kink, twist, buckle, bend, open joints etc. and shall be rectified before erecting in position. Failure in this respect will subject the defective members to rejection.

Fabrication Drawings:

Development of Fabrication drawings shall be in contractor's scope. Connections, splices and other details shall be suitably designed based on good Engineering practice.

Electrodes:

Electrodes used for welding shall comply with IS-814 or IS - 815.

8.1 **MS Black/High Strength Bolts and Nuts**

M.S.Black or high strength bolts, nuts and washers etc. shall be as per IS-800, IS-1363 and IS-1367. Manufacturer's test certificate shall be made available to the **Engineer-in-Charge**. For bolted joints, shanks and threaded bolts are to be used to ensure that threaded length do not encroach within the thickness of connected members of dimension beyond the following limit:-

1. 1.5 mm for connected members of thickness below 12 mm and
2. 2.5 mm for connected member of thickness 12 mm and above and that adequate shearing and bearing values required as per design are achieved.

Every portion work shall have its erection mark or numbers stencilled on the member for guidance in erection and bear all necessary marks of erections as directed by the Owner / Consultant.

8.2 No part of the work is to be oiled, painted (except contact surfaces) packed, bundled, crated or dispatched until it has been finally inspected and approved by the Owner / Consultant or his authorized representative. The whole steel work before being dispatched from the Contractor's shop shall be dry and after being thoroughly cleaned from dust, mills scale, rust etc., and shall be given two coats of primer and one coat of final paint as per painting specification attached in this enquiry. Unless otherwise specified, all surfaces inaccessible after welding shall be given two coats of primer and two coats of paints as per painting specification attached in this enquiry.

8.3 The Owner / Consultant or his authorized representative shall have free access at all reasonable time to all places where the work is being carried out, and shall be provided by the Contractor at his own expenses all necessary facilities for inspection during fabrication and erection. The Owner / Consultant or his authorized representative shall be at liberty to reject the work in whole or in part if the workmanship or materials do not conform to the terms of the specifications mentioned herein. The Contractor shall remove, replace or alter any part of the work as ordered by the Owner / Consultant or his authorized representative.

9.0 PAINTING ON STRUCTURAL STEEL

Painting on steel structures can be referred in TS2001-Painting Specification provided elsewhere in NIT.

On Minor Structural Steel Sections/Structures such as fencing, concertina coil etc.

Painting on Structural Steel on minor structures shall be with synthetic enamel paint of approved brand and manufacture to give an even shade: Two or more coats on new work after necessary primer coat.

10.0 STEEL / ALUMINIUM DOORS, WINDOWS AND VENTILATORS

10.1 The Steel doors, windows and ventilators shall be of the size and type as per IS-1361 and IS-1038. Fixing and glazing shall be done as per IS-1081 and as per manufacturer's instructions. The putty of approved make such as special gold size or equivalent conforming to IS-419 shall be used.

10.2 Aluminium doors, windows and ventilators shall be manufactured from wrought aluminium and aluminium alloy extruded round tube and / or hollow rectangular / square sections conforming to IS: 1285 & IS : 6477 or equivalent as approved by **Engineer-in-Charge**.

11.0 ROOFING & CLADDING

For roofing & cladding Non-asbestos high impact Polypropylene reinforced cement 6mm thick corrugated sheets (as per IS:14871) roofing up to any pitch and fixing with polymer coated J or L hooks, bolts and nuts 8mm dia. G.I. plain and bitumen washers or with self drilling fastener and EPDM washer.

12.0 FLOORING AND PAVING

12.1 Sub Base of floor

12.1.1 The area to be paved shall be divided into suitable panels. Form work shall be provided. The boarding / battens shall be fixed in position with their toe at proper level, giving slope where required. Alternatively base concrete may be deposited in the whole area at a stretch.

12.1.2 Before placing the base concrete the sub-base shall be properly wetted and rammed. The concrete of the specified mix shall then be deposited between the forms where provided, thoroughly tamped and the surface finished level with the top edge of the forms. The surface of base concrete shall be spreader uniformly. The surface shall be finished rough to provide adequate bond for the topping. Two or three hours after concrete has been laid the surface shall be brushed with wire brush to remove any scum or Latinate and swept clean so that coarse aggregate is exposed.

12.2 **Cement Concrete Floor Finishes**

12.2.1 The surface of base concrete shall be thoroughly cleaned by scrubbing with coir or steel wire brush. Before laying the toping, the surface shall be soaked with water at least for 12 hours and surplus water mopped up immediately before the toping is laid.

12.2.2 The forms shall be fixed over the base concrete dividing into suitable panels. Where glass dividing strips are provided, thickness of glass dividing strips shall be 4 or as indicated. Before placing the concrete toping, neat cement slurry at the rate of 2 kg/sq.m shall be then thoroughly brushed into the base concrete just ahead of the finish. The topping shall then be laid, thoroughly compacted by using screed board/plate vibrator. The surface floated with a wooden float to a fair and even surface shall be left for some time till moisture disappears from it. Junctions with skirting / dado or wall surfaces shall be rounded off using cement mortar 1:2 curing shall be carried out for a minimum of 7 days.

13.0 PLASTERING

13.1 Sand for plastering shall be 50% fine sand and 50% coarse sand from approved sources.

13.2 Preparation of surface shall be done as per CPWD specifications.

13.3 Cement mortar shall be of the mix as indicated in the items and shall be mixed as specified in the CPWD specifications.

13.4 Joints in walls etc. shall be raked to a depth of 12 mm, brushed clean with wire brushes dusted and thoroughly washed before starting the plaster work.

13.5 The surface shall be thoroughly washed with water cleaned and kept wet to saturation point before plastering is commenced.

13.6 Cement mortar as indicated, shall be firmly applied to the masonry walls in a uniform layer to the thickness specified and will be pressed into the joints. On concrete surfaces rendering shall be dashed to the roughened surface to ensure adequate bond. The surface shall be finished even and smooth. Hectoring wherever required shall be done as per directions of **Engineer-in-Charge.** Nothing extra shall be paid on this account.

13.7 All plaster work shall be cured for at least 7 days.

13.8 Integral water proofing compound shall be mixed with cement in the proportion recommended by the manufacturer. Care shall be taken to ensure that the water proofing material gets well and integrally mixed with cement. All other operations are the same as for general plaster work.

13.9 For sand face plaster undercoat of cement plaster 1:4 (1 cement : 4 sand) of thickness not less than 12 mm shall be applied similar to one coat plaster work. Before the under coat hardens the surface shall be scared to provide for the top coat. The top coat also of cement mortar 1:4 shall be applied to a thickness not less than 8 mm and brought to an even surface with a wooden float. The surface shall then be tapped gently with a wooden float lined with cork to retain a coarse surface texture, care being taken that the tapping is even and uniform.

14.0 EXTERIOR PAINTING

14.1 Exterior painting shall be Acrylic smooth exterior.

14.2 Where shown on drawings for external surfaces of sand faced plaster, or any other surface, two coats of cement paint shall be applied of tint and shade as approved by the **Engineer-in-Charge**.

14.3 The surfaces shall be prepared as specified for white washing. Before applying cement paint the surface shall be thoroughly wetted to control surface suction. The surface shall be moist but not dripping wet, when the paint is applied. Not less than 24 hours shall be allowed between the two coats. In hot weather the first coat shall be slightly moistened before applying the second coat.

14.4 On external plastered surfaces (one coat primer + minimum 3 coat of paints), sand faced or plain plastered and concrete surfaces, apex weather proof paint shall be

vigorously scrubbed on to work the paint into the voids and provide a continuous paint film free from pin holes and other openings

15.0 GLAZING

15.1 Sheet glass glazing of doors, windows etc. shall be of selected quality glass conforming to IS: 2835. Toughened splinter proof industrial safety glass shall confirm to IS: 2553. No cracked chipped or disfigured glass shall be accepted Glass shall be in one piece for each pan.

15.2 Glazing shall be fixed with timber or steel / aluminium beading as called for. Glass shall be back puttied and fixed with beading for a water tight and rattle free installation. Sizes of timber/ steel / aluminium beading shall be as directed.

16. PROTECTIVE COATING AND LINING SYSTEM

16.1 EPOXY COATING

Characteristics of coated surfaces (after application)

- Compressive strength : min. 90 N/mm2
- Tensile strength : min. 10 N/mm2
- Abrasion resistance : as per Amsler 1.5 mm after 3000 revol.
- Bonding (joining) factor : 1
- Adhesion with concrete : min. 2.5 N/mm2
- Elongation : 15%

APPLICATION:

A) ON FLOOR

1. For Chemical resistant flooring

SL. NO	DESCRIPTION
1.	Surface preparation- in this case concrete columns, beams, sofitt slabs, floors & plastered brick masonry walls (for receiving IMPREGNATION, BOND COATS, COATINGS etc) with hand wire brushes or rotary wire brushes etc and removing all the dust , dirt etc complete.

SL. NO	DESCRIPTION
2.	Impregnation with monomer (5 cps viscosity) to be applied by brush with a consumption of minimum 0.25 kg/m2
3.	Providing and applying structural grade Epoxy Bonding agent, (with bond strength of 3 N/mm2) over concrete prior to screed concrete. Bonding agent to be used as per application procedure of manufacturer.
4.	Self levelling cemetious screed avg. 25mm thick, using proportion 1:1:0.5 cement: sand : 8 mm down aggregates (by weight) with addition of suitable free flow and performance improving additives namely micro silica, shrinkage compensating admixtures, polymers, high range super plasticizers. W/C ratio not to exceed 0.4. Compressive strength of the screed to be 37.5 N/mm2 after 28 days over bonding agent.
5.	Providing and applying structural grade Epoxy Bonding agent, (with bond strength of 3 N/mm2) over screed concrete. Bonding agent to be used as per application procedure of manufacturer.
6.	Self levelling epoxy phenolic IPN (inter penetrating polymer network) screed (min 3mm thick, solvent free resin in proportion of 1 resin hardener mix : 2 sharp silica sand 600 micron down) on dry and clean surface of the self levelling cementitious screed done earlier, using special fork type leveller tool and allowing the scred to sure for 48 hours.

2. For Anti-static epoxy flooring system–

The switch gear room in the substation shall be provided with electrostatic discharge flooring (ESD flooring- 2MM thick Anti-static epoxy flooring system)

Sr. No.	Specification
	Base Surface Requirement: Base floor substrate should be minimum M20 grade reinforced concrete surface, clean dry (moisture below 5%),sound and finished smooth and levelled.
1	Surface Preparation: Clean the surface thoroughly by mechanical means preferably using vacuum assisted mechanical grinders to remove loose particles, dust, dirt, laitance, etc. All the stickers on the floor shall be removed and the area cleaned thoroughly. Any cracks above 1mm should be grove cut, cold/construction joints to be given suitable treatment. (Expansion /Isolation

	joints to be provided with flexible PU sealant and will be in the scope of contractor)
2	Primer Application : Providing & Applying two component epoxy based penetrating primer, having a volumetric mixing ratio of resin and hardener as per manufacturer guidelines, to a thickness of 100 microns which has excellent bond with concrete substrate by Brush / Roller and broadcasting of chemically treated silica and allow for 5-6 hours curing.
3	Sealer Application Providing & applying two components epoxy mortar of homogeneous mix and levelled by trowel to form a monolithic layer to a thickness of 800 microns and allow curing for 4-5 hours.
4	Conductive Coat: The self adhesive copper grid shall be provided across the area with 10 mtr spacing. The copper stripe shall be taken out at few points to connect the same to earth pit. (Connecting to earthing strip and making earthing pit will be in the scope of contractor)
5	Conductive Base Coat: Providing & applying of epoxy ESD, at a specified ratio as per manufacturer guidelines to a thickness of 100 microns by Brush / Roller and broadcasting of chemically treated silica and allow for 12 hours curing. This layer forms the electrical plane through which static charges are dissipated.
6	Topcoat Application: Providing & applying of STAT GUARD ESD at a specified ratio and levelled by trowel to a thickness of 1000 microns and spike roller is applied for de-aeration. This can be given in any colour. The entire top coat has to be dried for 24 hours before loading. Final finished floor shall be levelled smooth surface, clean and dust free. The surface resistivity of the total system shall be in the range of 1x10^6 Ohms to 1x10^9 Ohms as per the ASTM F 150, EOS/ESD Standard 7.1 or NFPA 99 A guidelines.

B) ON WALLS, SLAB, SOFFITS, BEAMS, COLUMN

SL. NO	DESCRIPTION
1.	Surface preparation- in this case concrete columns, beams, sofitt slabs, floors & plastered brick masonry walls (for receiving IMPREGNATION, BOND COATS, COATINGS etc) with

SL. NO	DESCRIPTION
	hand wire brushes or rotary wire brushes etc and removing all the dust , dirt etc complete.
2.	Impregnation with monomer (5 cps viscosity) to be applied by brush with a consumption of minimum 0.25 kg/m2
3.	Impregnation of prepared concrete surface (internal walls, slab, soffits, beams, column and cut outs) with polymethyl methacrylate monomer (viscosity 5cps), brush applied @ 0.25kg/m². Three coat epoxy phenolic IPN solvent containing protective coating with one non pigmented primer coat and two subsequent colour coats with approved shades giving total dry film thickness of 225 +/- 10 microns over impregnated and cleaned surface.

16.2 **ACID PROOF TILES:**

MATERIAL

1) TILES

These tiles shall be made of clays, feldspar, quartz, talc and vitrified at high temperature in ceramic kilns and kept unglazed so as to prevent from slipperiness. Tiles shall not absorb more than 2% of their own dry weight when soaked in water. Compression strength: 700 Kg/cm2 Min. & Flexural strength: 200 Kg/cm2 Min. It shall not lose more than 1.5% of it weight when soaked in acid.

Chemical compositions of tiles:

- Al_2O_3 : 22-24%
- SiO_2 : 60-65%
- Fe_2O_3 : 1.0-2.0%
- Alkalise : 10-12%

2) K-BASED SILICATE MORTAR

Acid Proof cement KSC is a potassium silicate based corrosion cement. Acid tile linings carried out with KSC cement are not subject to crystal formation in the pores of cement. Besides Bitumastic surface is joint-less, hence there is no danger of Acids percolating through the surface.

Characteristics of K-based Silicate mortar:

- Colour : White
- Density (lbs/Cub. ft.) : 130
- Water Absorption : 2-5 %
- Tensile Strength (Psi) : 400
- Compressive strength (Psi) : 2800
- Bond Strength (Psi) : 180
- Coefficient of thermal expansion : 6.0 x 10^{-6}

3) BITUMASTIC MORTAR

It shall consist of an acid proof inorganic filler and blended bitumen. It shall be trowelled to concrete having total thickness of 10 mm.

Characteristics of Bituminous compounds:

- Density (Kg/m^3) : 2200
- Water content by mass percent (max) : 0.5
- Flash point °C ,min. : 35

Consistency

a) Before setting (test after 1 hr) min. : 100

b) After setting (test after 24 hr) min. : 80

Mastic shall be heated to 150-300^{o}C and shall be applied in 5 mm layers after surface is cleaned and dried.

4) BITUMINOUS PAINT

This is generally of heavy grade bituminous corrosion resisting paint. 2 coats of the paint shall be given, and drying time between the 2 coats shall not be less than 5 hours. Also, its drying time after second coat shall not be more than 8 hours. Its finish shall be smooth, glossy and elastic.

The primer shall confirm to the following requirements:

- Viscosity by standard tar viscometer, 4mm orifice at 25°C: 4 to 24
- Penetration at 25°C, 100g, 5sec in 1/100 cm : 20 to 50
- Water content percent (max) : 0.2

APPLICATION

SL. NO.	DESCRIPTION	ITEM OR AREA
1.	Bituminous Paint (Primer)	Concrete surface
2.	10mm Bitumastic Laying in two layers each shall not be more than 5mm thick	Over Bituminous Paint
3.	One layer, 5mm Acid, K-based Silicate Type mortar	#
4.	10 mm thick Acid proof tiling	Over K-based Silicate

- Tiles should be fixed on bitumastic surface with the help of 5mm K-based silicate mortar.

16.3 ACID RESISTANT BRICK LINING

A. MATERIAL

These bricks are made of raw materials such as clay or shale of suitable composition with low lime and iron content, feldspar, flint or sand and vitrified at high temperature in ceramic kilns. Bricks shall not absorb more than 2% of their own wt. when soaked in water. Compression strength: > 700 Kg/cm^2. Bricks shall not lose more than 1.5% at their own weight when tested for acid resistance.

Chemical compositions of bricks are

a) Al_2O_3 22-24%

b) SiO_2 60-65%

c) Fe_2O_3 1.0-2.0%

d) Alkalies 10-12%

1) K-BASED SILICATE MORTAR

Acid Proof cement KSC is a potassium silicate based corrosion cement. Acid brick linings carried out with KSC cement are not subject to crystal formation in the pores of cement. Besides Bitumastic surface is joint-less, hence there is no danger of Acids percolating through the surface.

Characteristics of K-based Silicate mortar:

Colour	: White
Density (lbs/Cub. ft.)	: 130
Water Absorption	: 2-5 %
Tensile Strength (Psi)	: 400
Compressive strength (Psi)	: 2800
Bond Strength (Psi)	: 180
Coefficient of thermal expansion	: 6.0 x 10^{-6}

2) BITUMASTIC MORTAR

It shall consist of an acid proof inorganic filler and blended bitumen. It shall be trowelled to concrete having total thickness of 10 mm.

Characteristics of Bituminous compounds:

Density (Kg/m^3)	: 2200
Water content by mass percent (max)	: 0.5
Flash point °C ,min.	: 35

Consistency

c) Before setting (test after 1 hr) min.	: 100
d) After setting (test after 24 hr) min.	: 80

Mastic shall be heated to 150-300^{o}C and shall be applied in 5 mm layers after surface is cleaned & dried.

3) BITUMINOUS PAINT(PRIMER)

This is generally of heavy grade bituminous corrosion resisting paint. 2 coats of the paint shall be given, and drying time between the 2 coats shall not be less than 5 hours. Also, its drying time after second coat shall not be more than 8 hours. Its finish shall be smooth, glossy and elastic.

The primer shall confirm to the following requirements:

Viscosity by standard tar viscometer, 4mm orifice at 25°C : 4 to 24

Penetration at 25°C, 100g, 5sec in 1/100 cm : 20 to 50

Water content percent (max) : 0.2

APPLICATION

SL. NO.	DESCRIPTION	ITEM OR AREA
.	Bituminous Paint (Primer)	Concrete surface
.	10mm Bitumastic Laying in two layers each shall not be more than 5 mm thick	Over Bituminous Paint
3.	One layer, 5mm Acid, K-based Silicate Type mortar	#
4.	One layer, 40mm Acid resistant Brick lining	Over K-based Silicate

#:- K-based Silicate mortar should be buttered on all sides of acid-resistant brick except the side facing the surface to be exposed to corrosives

17. POLYURETHANE WATERPROOFING

17.1 MATERIALS

The two component Solvent free Polyurethane coat shall have the following properties –

1. Solid content ASTM D 2369- ≥ 90%

2. Mixing ratio - 8:1

3. Elongation ASTM D 638 - 700-900%

4. Tensile strength ASTM D 638- 1-2 MPa

The coating shall be applied to a minimum thickness of 600 microns (300µX2) thickness with separate wearing course (as per ASTM C 898 & 836) over application of 2 component, solvent free Epoxy Primer of 200 microns with tensile of 20-30 MPa and elongation of 4-5% for smooth surface and act as primer coat at all elevations in vertical and horizontal surface

It shall be perfectly smooth, dust free and shall retain glossy finish at least up to 3 years It shall be resistant to acid, alkalis and have a very low water absorption rate of 0.5% maximum at ambient temperature after 7 days.

The packs shall not be older than 9 months after the date of manufacture and packing.

17.2 Workmanship

17.2.1 Preparation of surface

The roof surface shall be thoroughly cleaned with a wire brush and all foreign matter etc shall be removed. Well defined cracks on the surface shall be cut to "V" section, cleaned and filled up flush with a paste of 2 component polyurethane based crack filling compound and white cement in a ratio of 1:2.

17.2.2 Primer Coat

Primer coat shall be mixed in the ratio as per manufacturer's specification A single coat of this primer shall be applied by brush over the prepared bed as an adhesion coat.

The primer shall be allowed to dry for minimum of 8 hours before the successive finishing coats of Polyurethane are applied.

17.2.3 Finishing coats

The finishing coats shall consist of three successive pigmented seating coats each of

2 pack polyurethane, mixed in the ratio as per manufacturer's specifications. Application shall be with brush, to a smooth and even finish. The overall dry film thickness shall be

Ambient temperature at the time of application shall not be less than 5°C and not more than 40°C.

Each coat shall be allowed to dry for minimum 8 hours or as per manufacturer's specification before applying next coat. Care shall be taken for quick application after mixing the 2 pack primer in view of short pot life of the mix and shall be fully consumed within the stipulated period as per manufacturer's specification. (Maximum 60 minutes

at 30°C.

Polyurethane coating shall be continued up the parapets/ walls for a minimum of

150mm over the finished roof surface. It shall be continued into rain water pipes by at least 100mm.

Treated surface should be allowed to cure for minimum 72 hours.

17.2.4 Cement Screed

The final coat of polyurethane, when tacky shall be sprinkled with 300 micron layer of clean sand. Plain cement concrete (1:2:4) of 25mm minimum thickness with 24 SWG chicken wire mesh shall be then laid to slope in panels not exceeding 6 M2 area per

panel The joints between panels shall be raked out neatly to a minimum 6mm x 6mm V-groove and filled up with an approved quality elastomeric compound sealant. Drain outlet shall be provided for all spouts/rain water pipes by suitable rounding, filling and skoping of PCC as per drawing. At the junction of the roof and parapet or any other vertical surface, a fillet of 75mm radius shall be formed in cement mortar 1 cement 4 coarse sand.

17.3 Guarantee

The agency for waterproofing shall furnish a guarantee, which shall be agreed upon in the Contract to ensure the successful performance of the Contract. The guarantee shall be for a period of 10 years Any work required to be carried out as a result of any defects in workmanship during the period of the guarantee shall be carried out by CONTRACTOR at his cost.

18.0 CULVERT WORK

18.1 Pipe Culverts

18.1.1 Reinforced concrete pipes shall be provided between the drain pits of storm water drains to cross the roads. These pipes shall be non-pressure type conforming to IS: 458 and class as specified in the nomenclature of the item. The pipes shall be laid between the drain pits with a uniform slope and with proper bedding, if required, as per approved drawings. The reinforced concrete pipes shall be manufactured by centrifugal process. All pipes shall be true to shape, perfectly straight, sound and free from cracks. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

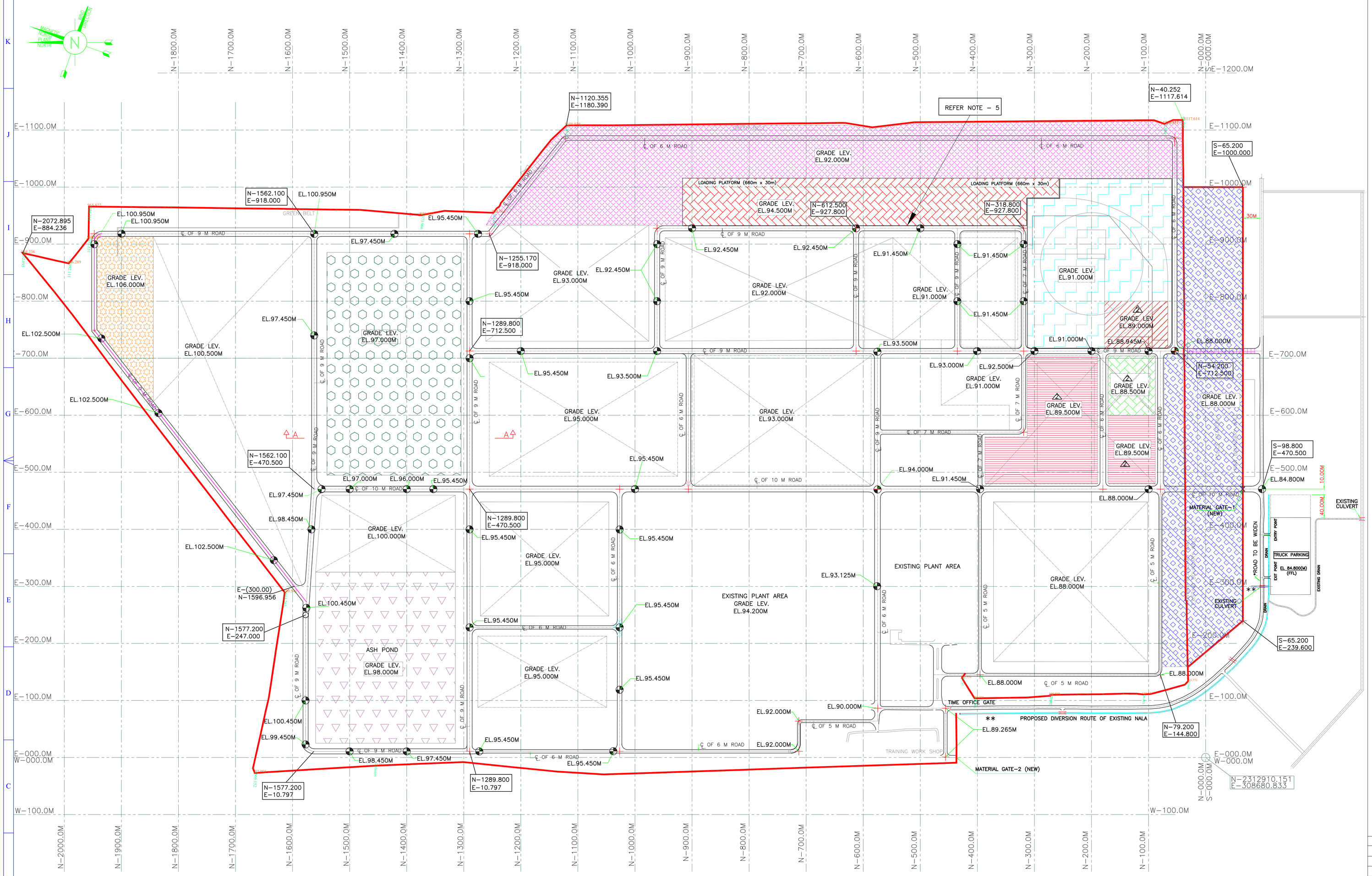
18.1.2 Reinforced concrete pipes shall be laid, jointed and tested as per IS: 783. Pipes shall be laid true to alignment and gradients over cement concrete bed of 1:2:4 mix and / or encased, if required, as per approved drawings or as directed by Engineer-in-Charge. No deviations from the lines, depths of cuttings or gradients shall be permitted without approval in writing by Engineer-in-Charge. The joint between concrete drain pit wall and concrete pipe shall be done properly to make it water-tight. The pipe joints shall be spigot and socket joint (rigid type) for pipes of 600 mm. diameter and below and collar joint (rigid type) for pipes over 600 mm. diameter. For both types of joints, the annular space shall be filled up with cement and sand mortar 1:2 mix which shall be rammed with caulking tools. After the day's work, any extraneous matter shall be removed from

inside of the pipes. Joints shall be cured properly as per IS: 783. Reinforced concrete pipes shall be tested hydraulically as per IS: 783. Refilling of trenches shall not be commenced until the entire length of the pipe has been tested and approved. The excavation of earth in trenches for laying the concrete pipes and refilling shall be done as per IS: 783.

18.2 **Box Culverts**

18.2.1 The box-culverts are to be provided across the roads joining the storm water drains on both sides of the road. These box-culverts shall be of either complete reinforced cement concrete construction or brick masonry and reinforced cement concrete construction as specified in the schedule of items. The box-culvert construction shall be carried out as per the approved drawings.

S.NO.	REFERENCE DRG.	DRAWING NO.
1.	PLOT PLAN OF PROPOSED INTEGRATED COAL BASED FERTILIZER AND CHEMICALS COMPLEX	PC183-0000-0001

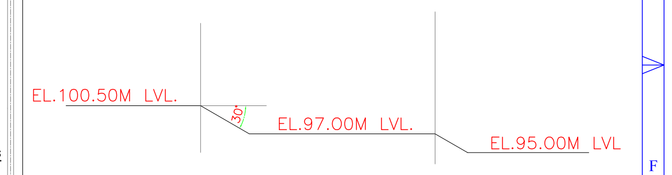


LAYOUT PLAN FOR BALANCE LAND DEVELOPMENT

(SCALE : NTS)

LEGEND:–

- EL.106.000M LVL.
- EL.98.000M LVL.
- EL.97.000M LVL.
- EL.94.500M LVL.
- EL.92.000M LVL.
- EL.91.000M LVL.
- EL.88.000M LVL. (REF. NOTE–7)
- EL.88.500M LVL.
- EL.89.500M LVL.
- EL.89.000M LVL.



SECTION A–A

GENERAL NOTES:– 2

1. ALL DIMENSIONS ARE IN MM AND LEVELS IN M. UNLESS NOTED OTHERWISE.
2. THE DRAWING SHOULD NOT BE SCALED,ONLY FIGURE DIMENSION ARE TO BE FOLLOWED.
3. THE RESPECTIVE RLS. SHALL BE RECKONED FROM THE PERMANENT BENCH MARK.
4. MINIMUM SLOPE OF 1 VERTICAL AND 2 HORIZONTAL SHALL BE PROVIDED ON BOTH SIDE OF ROADS IF REQUIRED.
5. CONSIDERING ELEVATION DIFFERENCE, PROPER SLOPE IS TO BE PROVIDED BETWEEN BAGGING BUILDING ZONE AND WUHUAN BATTERY LIMIT, AS DECIDED BY EIC.
6. AS PER DPR PRODUCED BY RITES – THE DIFFERENCE IN LEVEL BETWEEN TFL BENCH MARK AND RAILWAYS MOTHER BENCH MARK IS 921MM. RAILWAY MOTHER BENCH MARK IS HIGHER". SITE TEAM TO VERIFY AND TAKE CARE ACCORDINGLY.
7. LAND GRADING WORKS IN RAILWAY SIDING AREA (TOWARDS SOUTH SIDE) SHALL CONSIST OF CLEANING AND REMOVAL OF TREE/BUSHES/VEGETATION ALONG WITH REMOVAL OF ASH/DEBRIS ETC. THEN CONTRACTOR SHALL INFORM PDIL/TFL FOR GETTING FURTHER ORDERS REGARDING CUTTING OR FILLING WORKS.
8. CONTRACTOR TO PROVIDE SUITABLE SLOPE WITH PROPER COMPACTION TO PLANT DRAINS WHILE PERFORMING LAND GRADING ACTIVITIES IN ALL AREAS SPECIALLY IN WTP/ETP/STP AREA AS PER DIRECTION OF TFL/PDIL EIC.
9. CONTRACTOR TO PROVIDE HORTICULTURE AS SUITED SITE AS PER DIRECTION OF TFL/PDIL EIC.

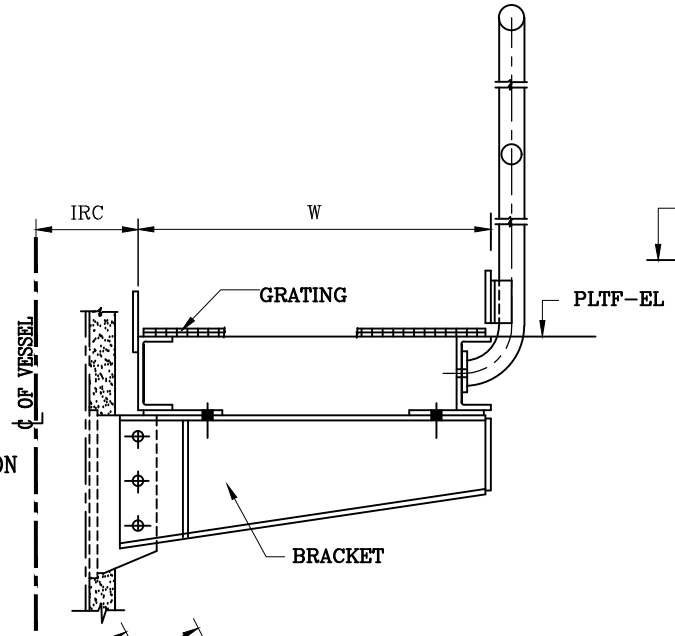
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
2	23.05.22	REVISED AS MARKED 2	JPR	SS	RNS
1	30.03.22	ISSUED FOR CONSTRUCTION	JPR	SS	RNS
0	16.02.22	ISSUED FOR CONSTRUCTION	JPR	SS	RNS

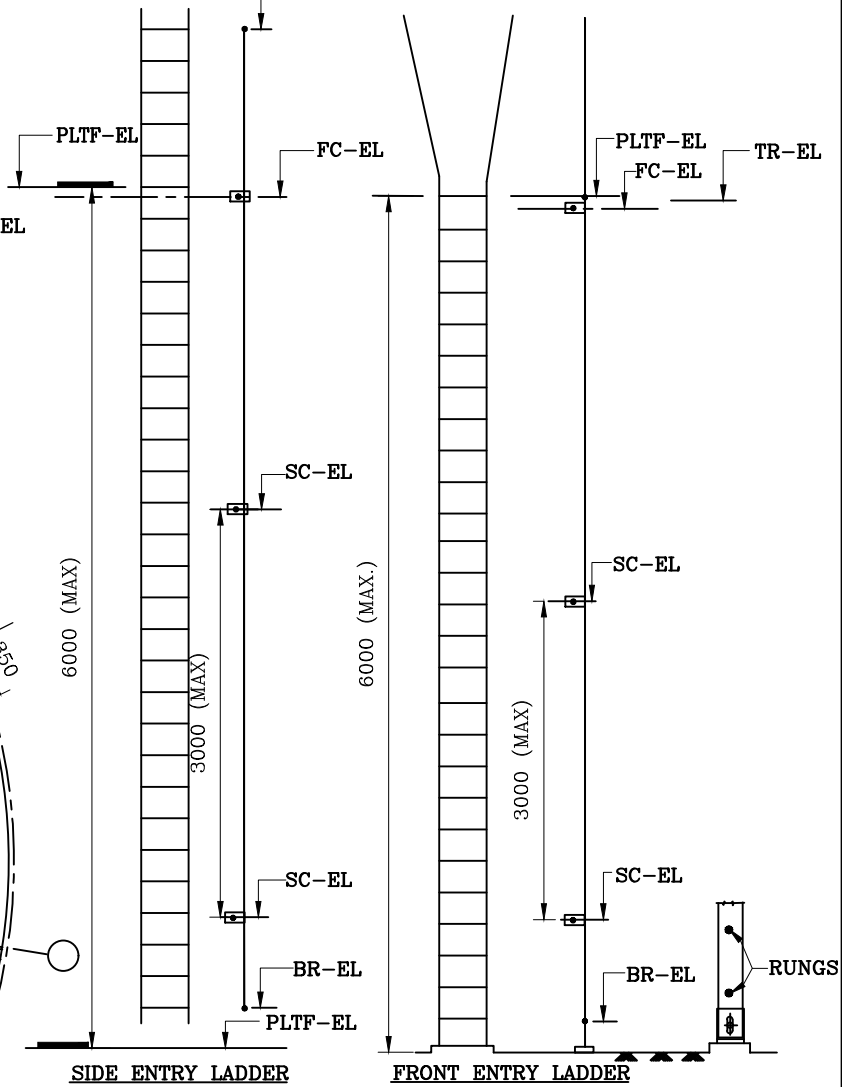
Talcher Fertilizers	M/S TALCHER FERTILIZER LIMITED	REV. 0 1 2; SHEET 1 OF 1
LOCATION	TALCHER, ANGUL DISTRICT, ODISHA (INDIA)	SCALE:–NTS
TITLE	LAYOUT PLAN FOR BALANCE LAND DEVELOPMENT WORKS	DRG. NO.– PC183–0000–205; FILE.– PC183–0000–205_R2
PDIL	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

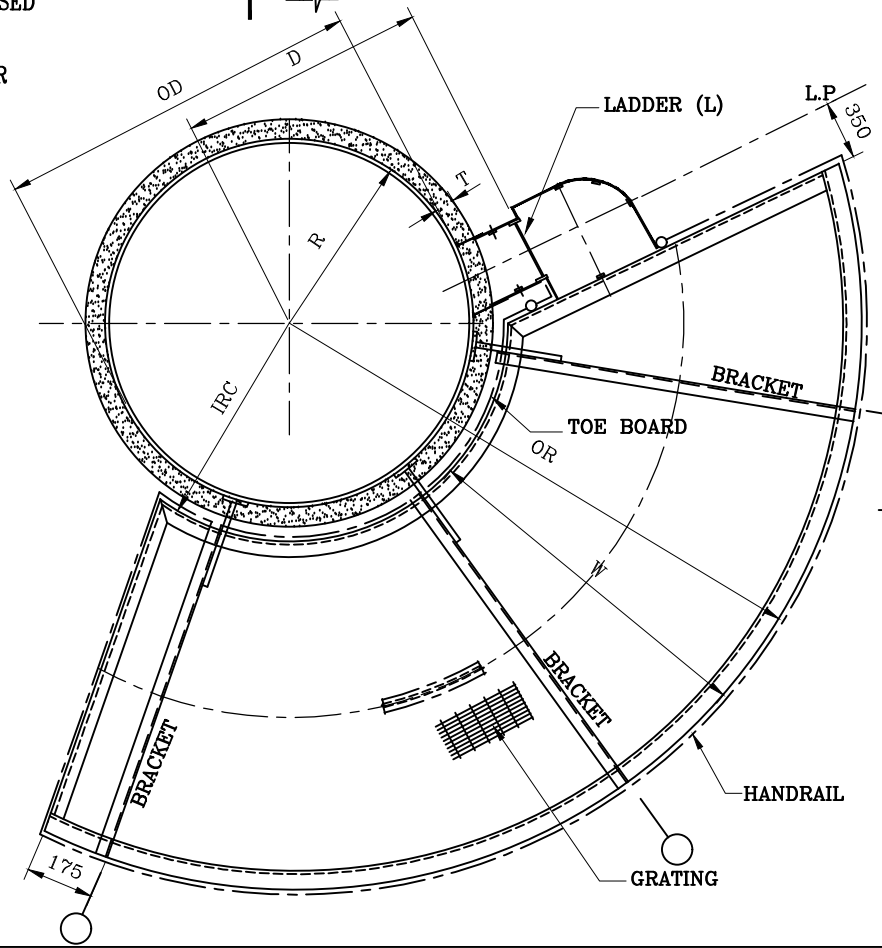
SYMBOLS

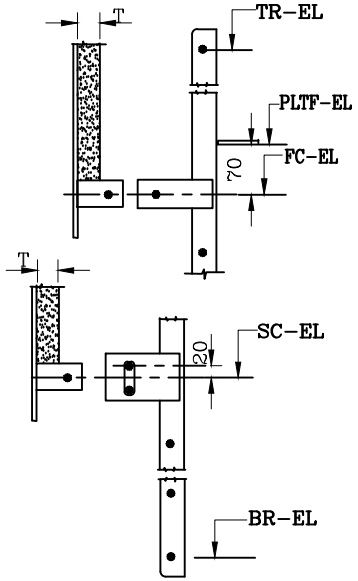
EL	ELEVATION
PLTF	PLATFORM
L	LADDER
TL	TANGENT LINE
OD	OUTSIDE DIAMATER OF VESSEL EXCLUDING THERMAL INSULATION
FC	REFERENCE LEV. OF THE FIXED CONNECTION OF LADDER
SC	REFERENCE LEV. OF THE SLIDING CONNECTION OF LADDER
BR	THE LOWEST RUNG OF THE LADDER
TR	THE HIGHEST RUNG OF THE LADDER
D	DISTANCE OF LADDER FROM VESSEL CENTRE
R	OUTSIDE RADIUS OF VESSEL EXCLUDING THERMAL INSULATION
T	THICKNESS OF THERMAL INSULATION
IRC.	INSIDE RADIUS OF PLATFORM
OR	OUTSIDE RADIUS OF PLATFORM
—o	MARK OF THE BRACKET TYPE TO BE USED
W	WIDTH OF PLATFORM
LP	LOCATION OF PLATFORM ACCESS LADDER

REFERENCE DRG.	NO.





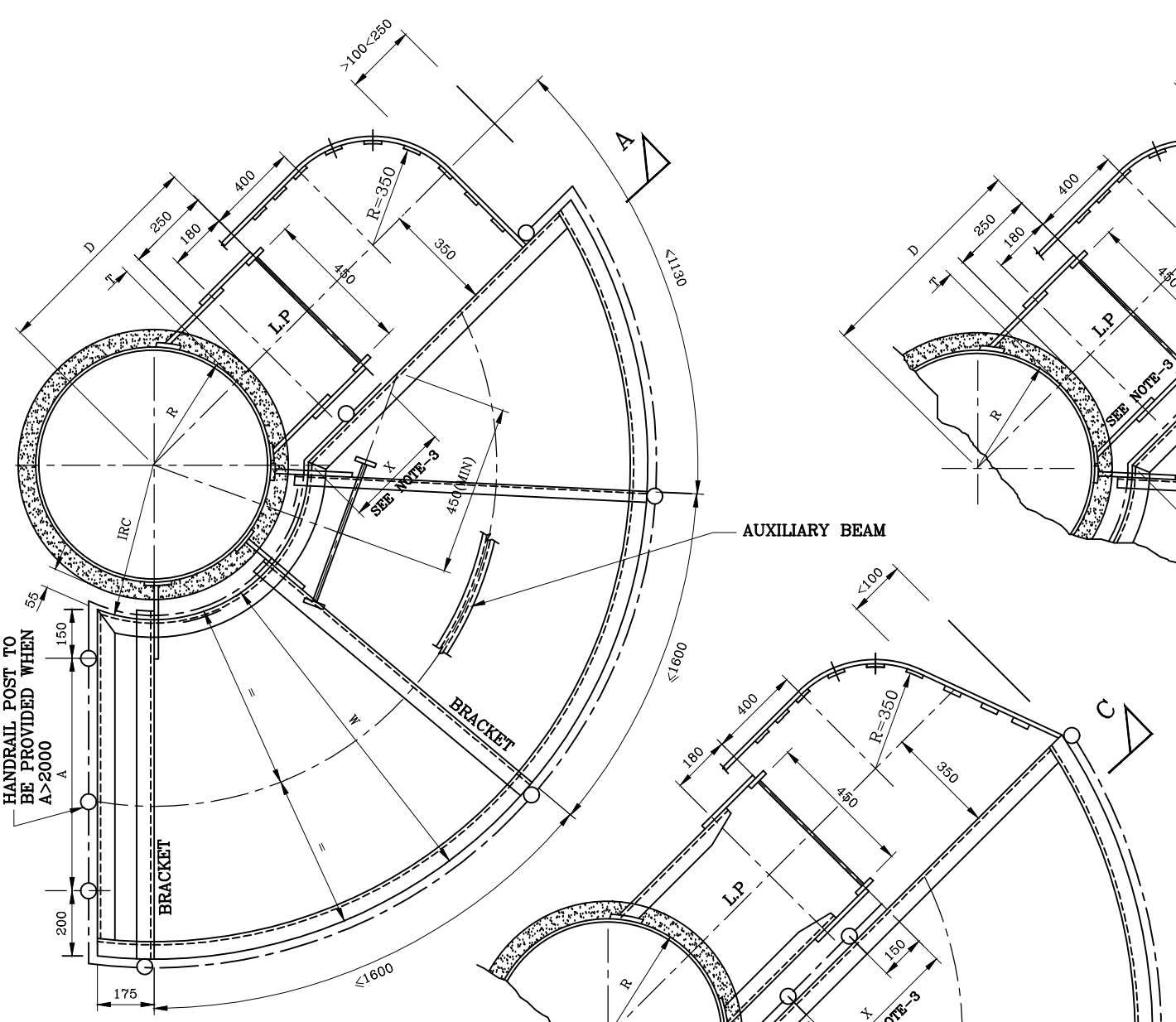


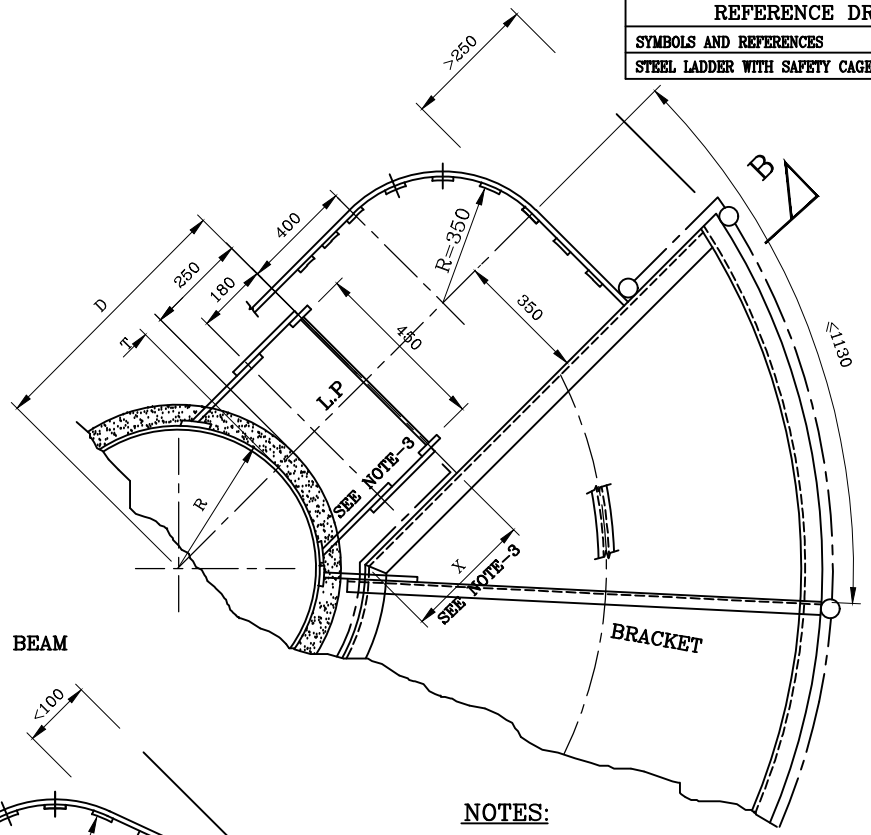


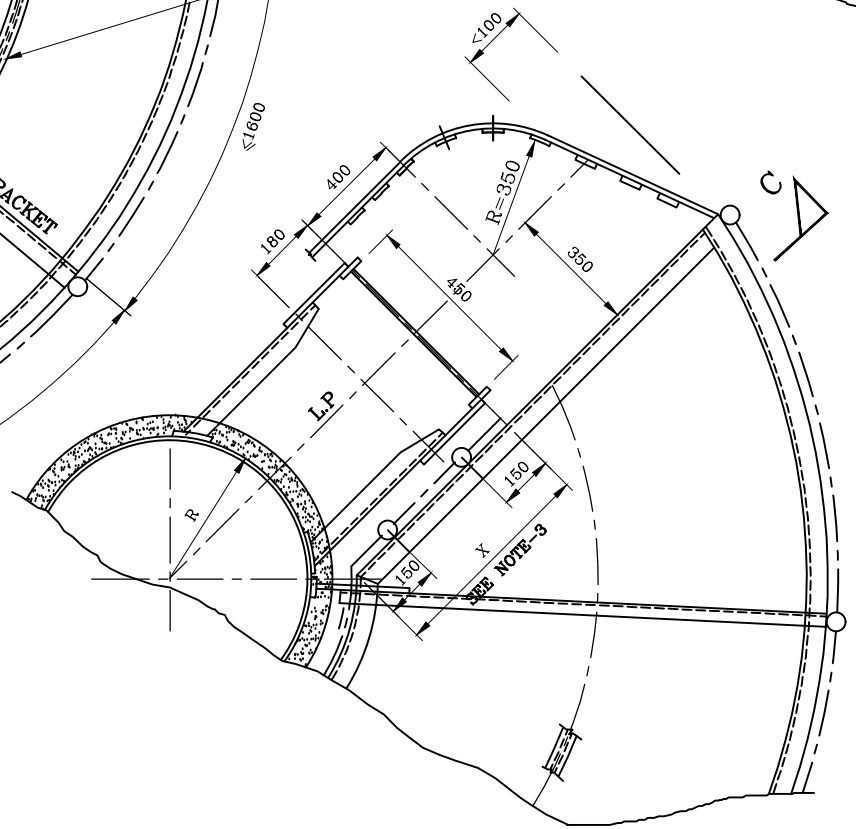
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0
		SHEET 1 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:–
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL SYMBOLS AND REFERENCES	DRG. NO.– PC183–0000–0000
		FILE.– PC183–0000–0000_R0
	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

REFERENCE DRG.	NO.
SYMBOLS AND REFERENCES	PC183-0000-0000(SH 1 OF 10)
STEEL LADDER WITH SAFETY CAGE	PC183-0000-0000(SH 5 OF 10)







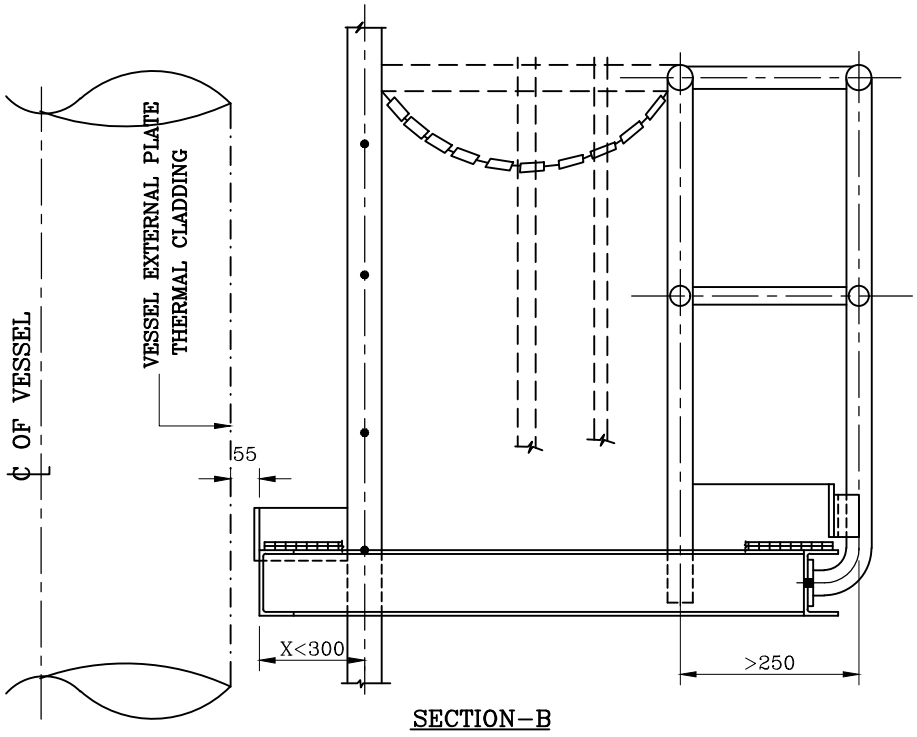
NOTES:

1. INCASE OF DIFERENCE BETWEEN THIS DRAWING AND DESIGN DRAWING THE LATTER SHALL GOVERN.
2. SECURITY CHAINS AND SAFETY HOOKS HAVE TO BE PROVIDED AT ALL PLATFORM ENTRANCES.
3. FOR X<300mm, EXTEND THE TOE BOARD ONLY (SEE SEC-B IN DRG. NO: EM184-0000-0206, SHEET 3 OF 10)
   FOR X>300<600mm PROVIDE HAND RAIL WITH CENTER POST (SEE SECTION-A IN DRG. NO: EM184-0000-0206, SHEET 3 OF 10)
   FOR X>600mm PROVIDE HANDRAIL WITH TWO POSTS. (SEE SECTION-C IN DRG NO: EM184-0000-0206,SHEET 3 OF 10)
4. THE SUPPORTING AUXILIARY BEAM SHALL BE PROVIDED ON PLATFORM WHERE W>1500

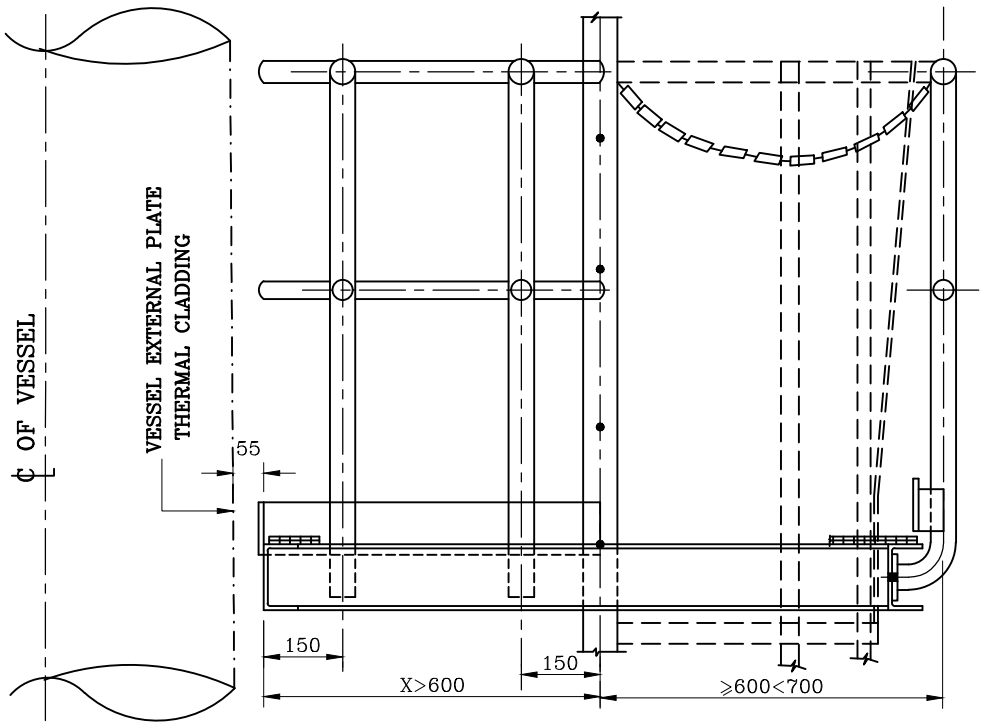
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0 SHEET 2 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:-
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL CIRCULAR PLATFORMS FOR VESSELS	DRG. NO.- PC183-0000-0000 FILE.- PC183-0000-0000_R0
	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

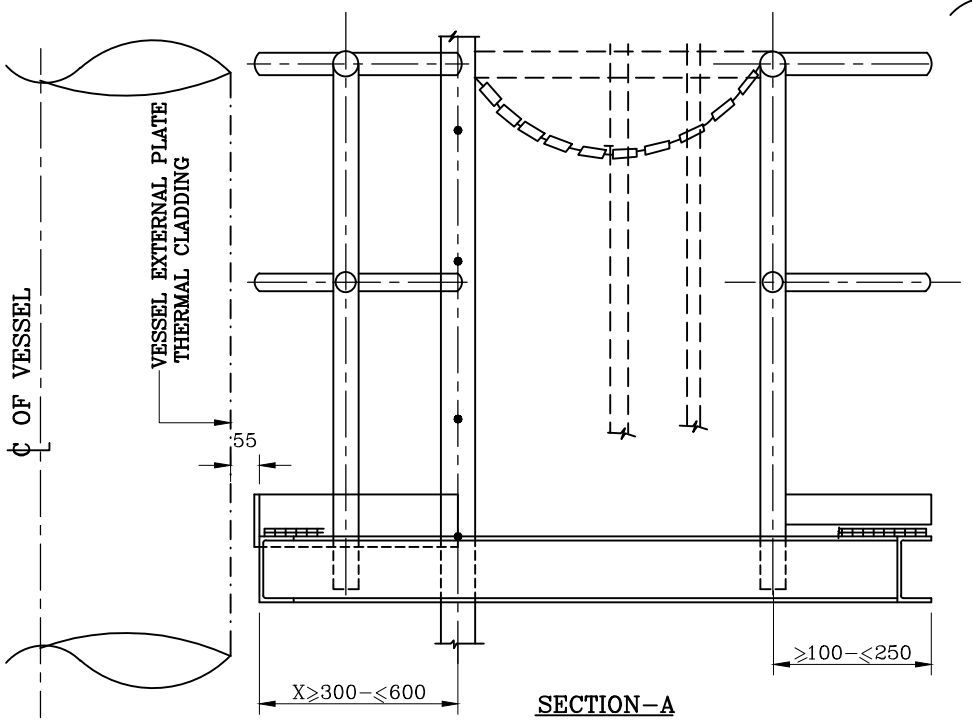
REFERENCE DRG.	NO.



SECTION–B



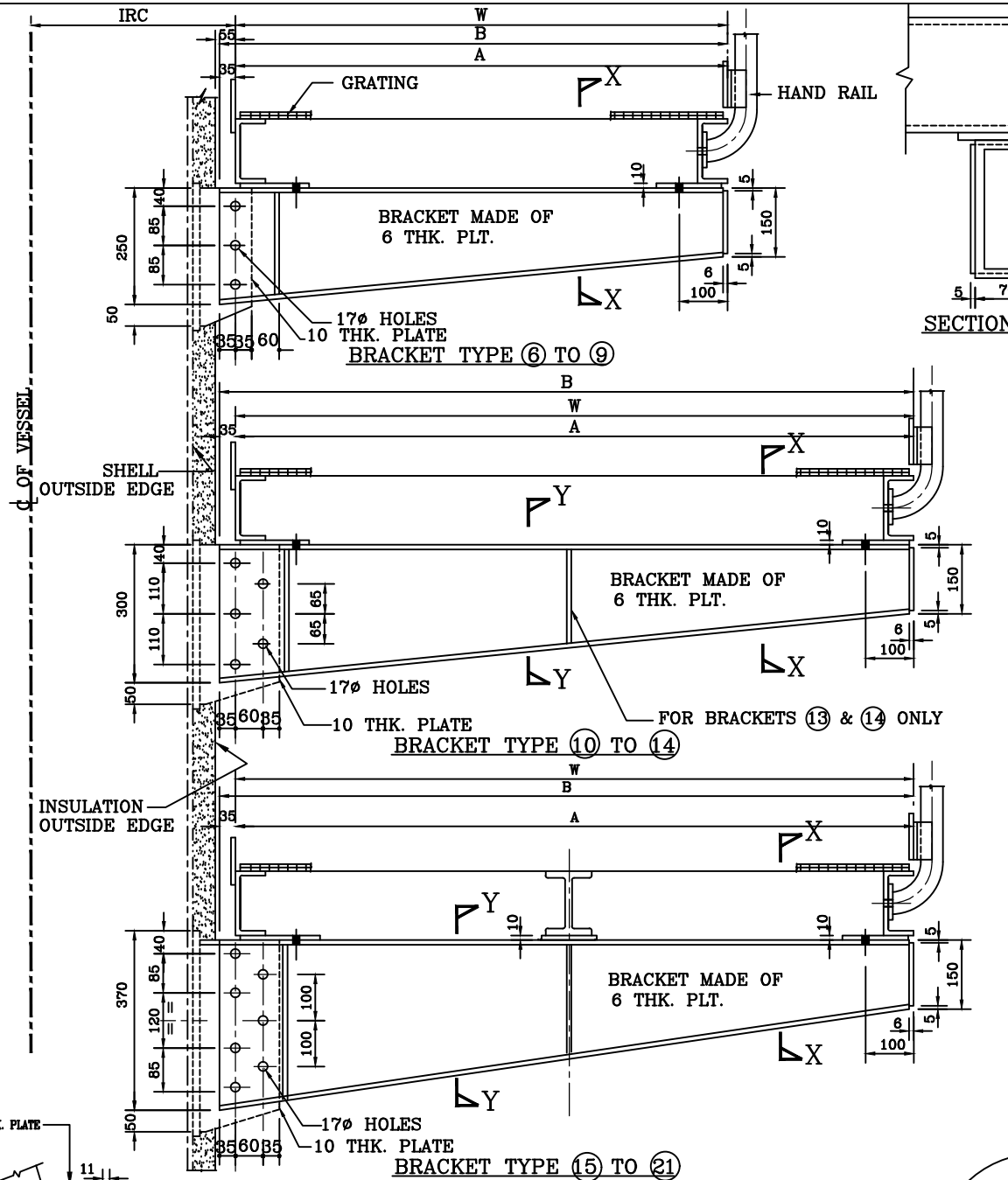
SECTION–C

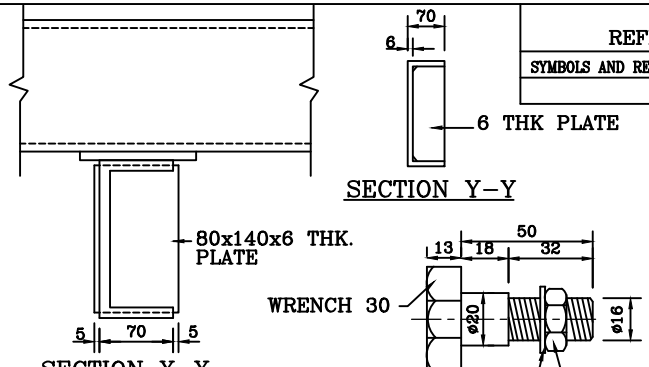


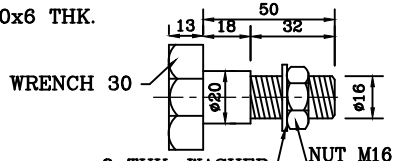
SECTION–A

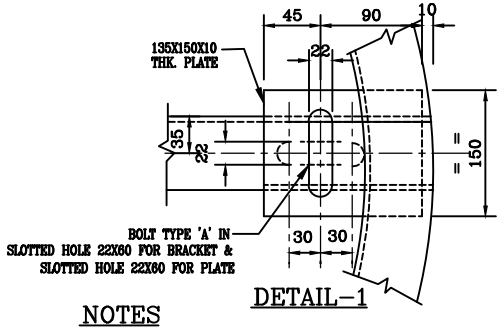
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

Talcher Fertilizers	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0 SHEET 3 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:–
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL CIRCULAR PLATFORMS FOR VESSELS (SECTIONS & DETAILS)	DRG. NO.– PC183–0000–0000 FILE.– PC183–0000–0000_R0
PDIL	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	





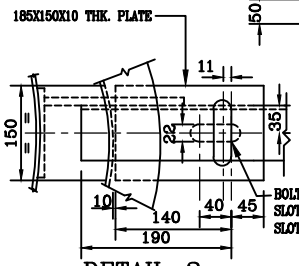


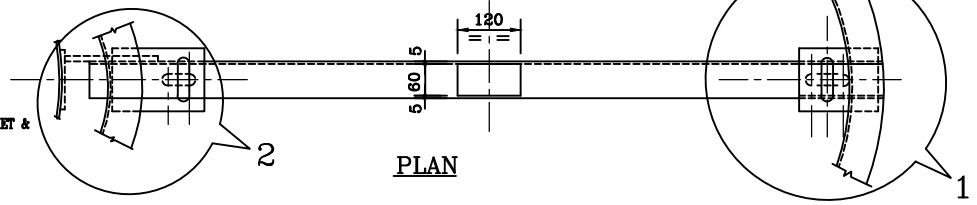


TYPES OF BRACKETS	A	B	HOLE DIA.	BOLT DIA.
6	600	635	17	16
7	700	735	17	16
8	800	835	17	16
9	900	935	17	16
10	1000	1035	17	16
11	1100	1135	17	16
12	1200	1235	17	16
13	1300	1335	17	16
14	1400	1435	17	16
15	1500	1535	17	16
16	1600	1635	17	16
17	1700	1735	17	16
18	1800	1835	17	16
19	1900	1935	17	16
20	2000	2035	17	16
21	2100	2135	17	16

NOTES

1. BRACKETS SHALL BE MADE OUT OF SINGLE PIECE PLATE OF 6mm THICKNESS.
2. REINFORCEMENT PLATES FOR BRACKETS SHELL CONNECTIONS SHALL BE APPLIED ONLY FOR SHELL THICKNESS <15mm.
3. BRACKET ATTACHMENT PLATES ARE EXCLUDED FROM STRUCTURAL STEEL SUPPLY
4. UNLESS OTHERWISE INDICATED THE BOLTS TO BE USED SHALL CONFORM TO IS: 1367 CLASS 4.6
   THE THREADED PORTION SHALL NEVER BE INSIDE THE PLATES TO BE CONNECTED
   THE BOLTS SHALL BE PROVIDED WITH 8mm. THK. FLAT WASHER
5. INCASE OF DIFFERENCE BETWEEN THIS DRG. AND DESIGN DRAWING THE LATTER DRAWING SHALL GOVERN.
6. BOLTS FOR CONNECTIONS TO BE SUPPLIED BY STRUCTURAL STEEL CONTRACTOR
7. CLEATS SHOWN IN DOTTED LINES TO BE SUPPLIED BY EQUIPMENT SUPPLIER REST PORTION TO BE SUPPLIED BY STRUCTURAL STEEL CONTRACTOR.





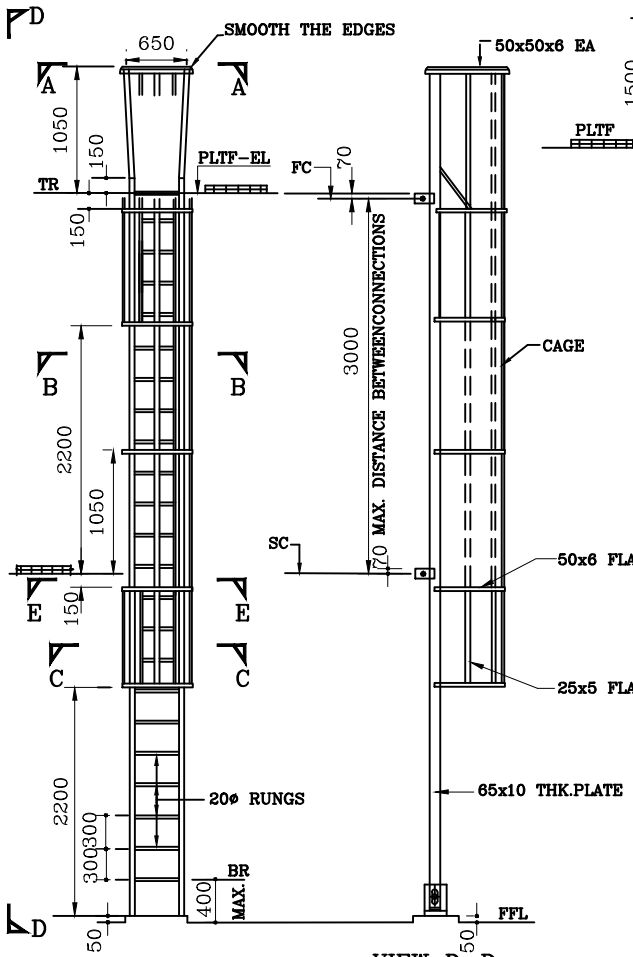
REFERENCE DRG.	NO.
SYMBOLS AND REFERENCES	PC183-0000-0000(SH 1 OF 10)

REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

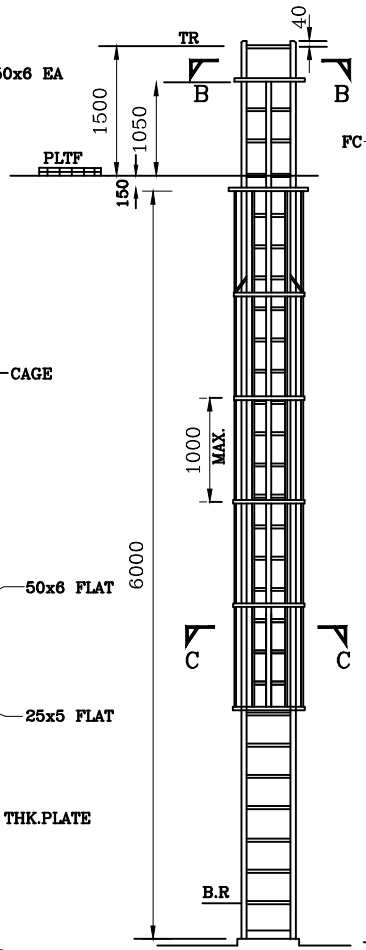
	TALCHER FERTILIZERS LTD. (ODISHA)
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL BRACKETS FOR CIRCULAR PLATFORMS
REV.	0
SHEET	4 OF 10
SCALE:–	
DRG. NO.–	PC183-0000-0000
FILE.–	PC183-0000-0000_R0

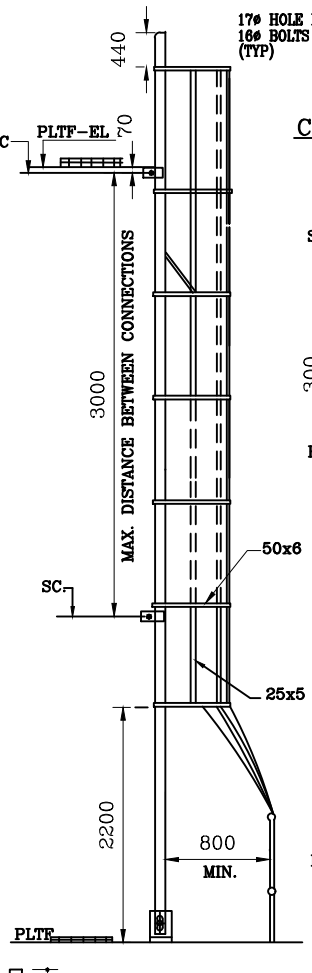
PROJECTS & DEVELOPMENT INDIA LIMITED
NOIDA

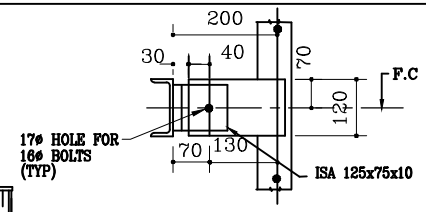
REFERENCE DRG.	NO.



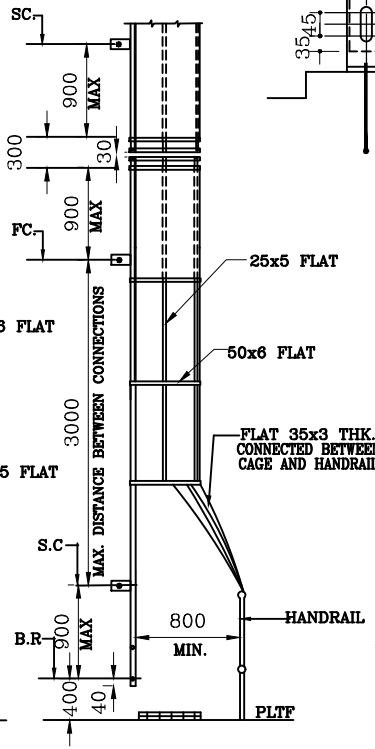
VIEW D–D

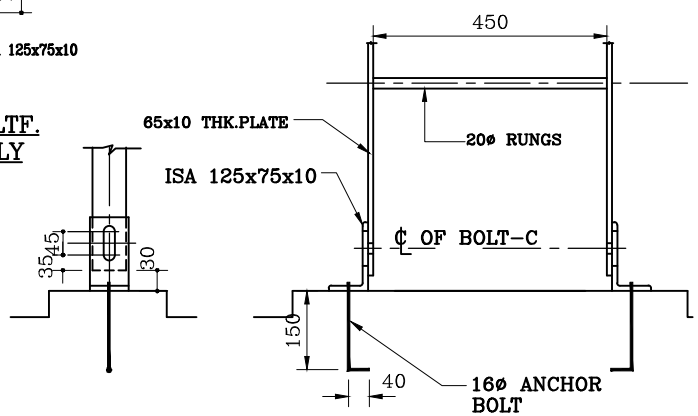


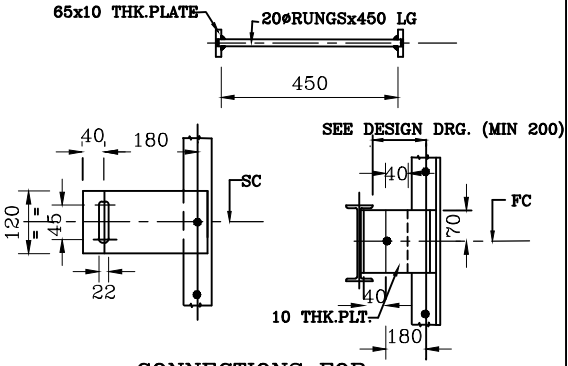




CONNECTION FOR PLTF.
OVER VESSELS ONLY



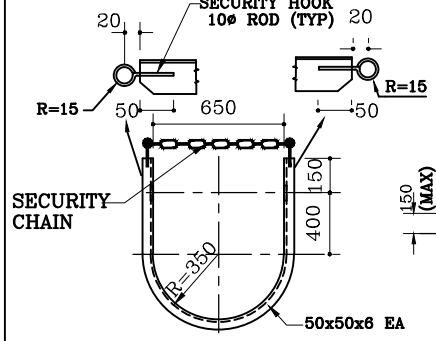




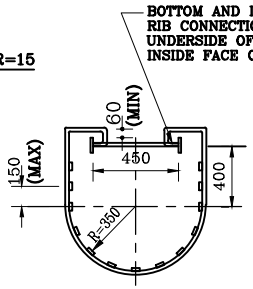
CONNECTIONS FOR
STRUCTURES

NOTE

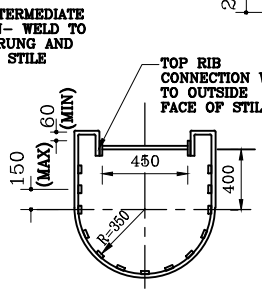
1. BOLTS FOR CONNECTIONS TO BE SUPPLIED BY STRUCT. STEEL CONTRACTOR
2. SECURITY CHAINS AND SAFETY HOOKS TO BE PROVIDED AT ALL PLATFORM ENTRANCES.
3. INCASE OF DIFFERENCE BETWEEN THIS DRG AND DESIGN DRAWING THE LATTER DRAWING SHALL GOVERN.



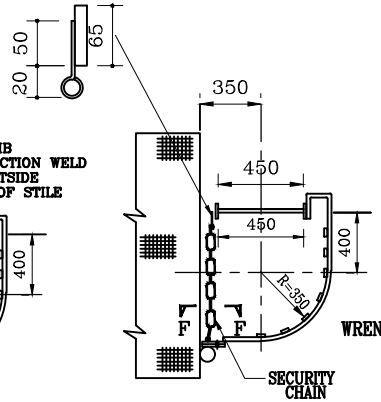
VIEW A–A



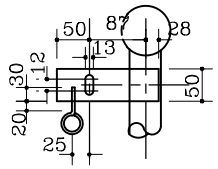
SEC C–C



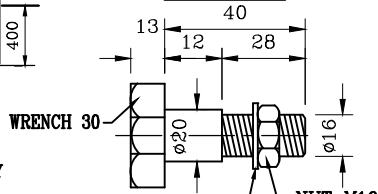
SEC E–E



SEC B–B



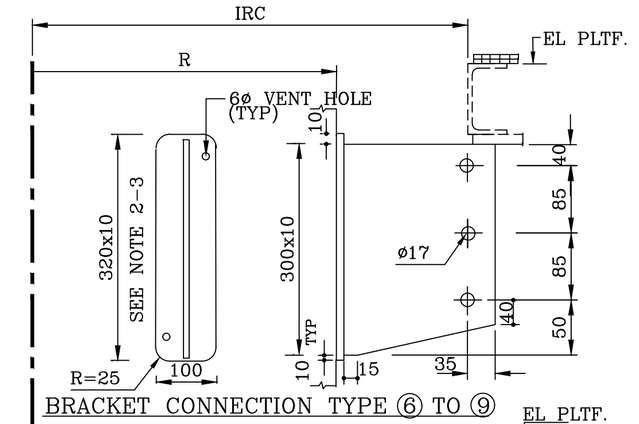
VIEW F–F



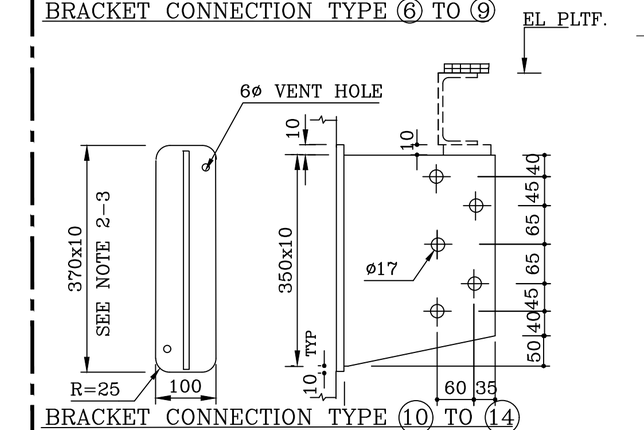
BOLT TYPE–C

0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
Talcher Fertilizers		TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0		
			SHEET 5 OF 10		
PROJECT		INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:–		
TITLE		STANDARD FOR PLATFORM, LADDER & HANDRAIL STEEL LADDER WITH SAFETY CAGE	DRG. NO.– PC183–0000–0000		
			FILE.– PC183–0000–0000_R0		
PDIL		PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA			

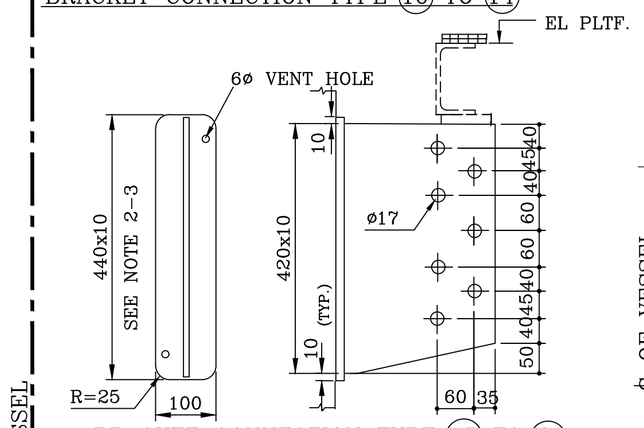
REFERENCE DRG.	NO.
SYMBOLS AND REFERENCES	PC183-0000-0000(SH 1 OF 10)
BRACKETS FOR CIRCULAR PLATFORMS	PC183-0000-0000(SH 4 OF 10)
STEEL LADDER WITH SAFETY CAGE	PC183-0000-0000(SH 5 OF 10)



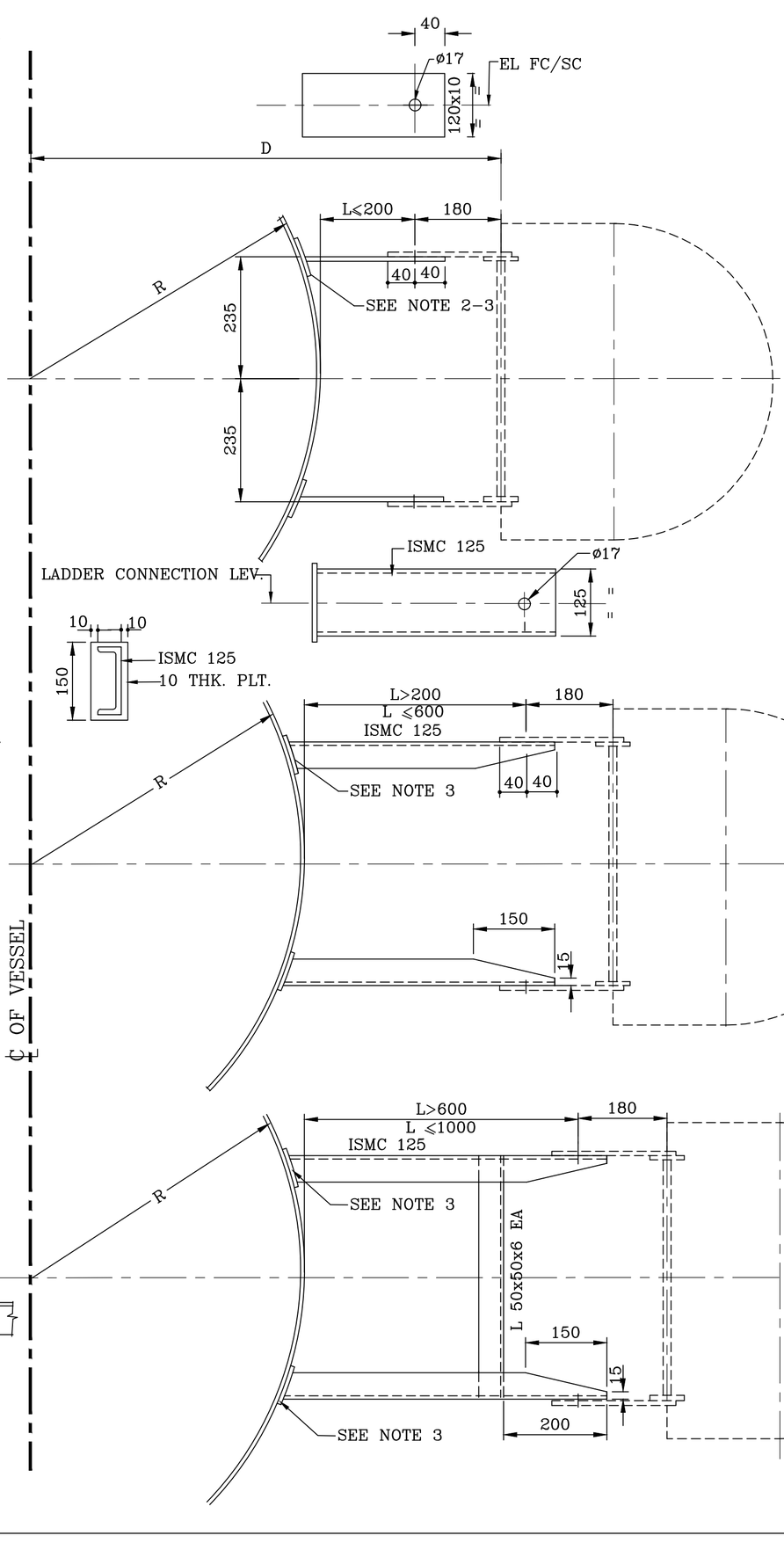
BRACKET CONNECTION TYPE ⑥ TO ⑨



BRACKET CONNECTION TYPE ⑩ TO ⑭



BRACKET CONNECTION TYPE ⑮ TO ㉑



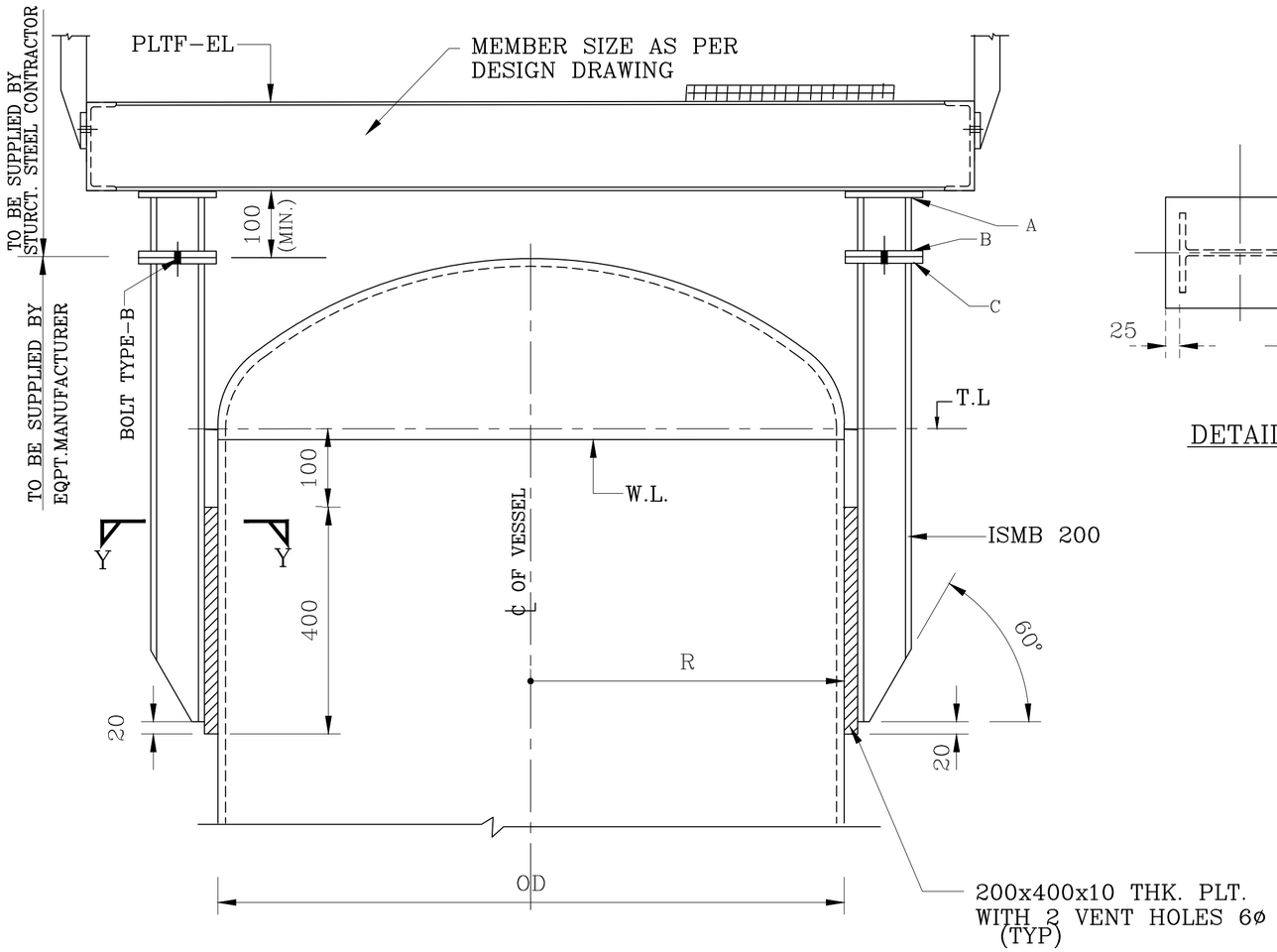
NOTES

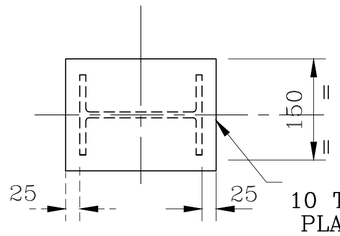
1. REINFORCEMENT PLATES FOR BRACKET CONNECTIONS ARE TO BE INSTALLED ONLY ON SHELLS ⩽ 15mm. THICK.
2. MATERIALS OF PLATES WELDED ON SHELL MUST BE SAME AS OR EQUIVALENT TO SHELL MATERIAL.
3. PROVIDE HALF HOLE, 25mm.RADIUS ON CONNECTIONS WHICH INTERFERE WITH CIRCUMFERENTIAL JOINT OF THE VESSEL.
4. GRIND AND X-RAY THE VERTICAL AND CIRCUMFERENTIAL JOINT SECTIONS OF THE VESSEL WHICH INTERFERE WITH REINFORCING PLATES AND DO NOT WELD THESE PLATES FOR A 50mm SECTION ASTRIDE THE JOINTS.
5. FIT THE CONNECTION OR THE REINFORCING PLATE IN CASE OF INTERFERENCE WITH OTHER PLATES OF STIFFENING RINGS OF THE VESSEL.
6. ALL WELDINGS HAVE TO BE CARRIED OUT AT WORKSHOP BY MANUFACTURER AND MUST COMPLY WITH VESSEL MANUFACTURING STANDARD.
7. INCASE OF DIFFERENCE BETWEEN THIS DRG. AND DESIGN DRAWING THE LATTER DRAWING SHALL GOVERN.
8. THE PLATES FOR ATTACHMENT OF STAIRS, PLATFORMS AND STEEL STRUCTURE IN GENERAL WELDED ON THE EQUIPMENT [COLUMN,HEAT EXCHANGER,ETC.] SHALL BE SUPPLIED BY EQUIPMENT MANUFACTURER IN ACCORDANCE WITH PDIL DESIGN DRAWING.
9. CLEATS SHOWN IN FIRM LINES TO BE SUPPLIED BY EQUIPMENT SUPPLIER.

REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

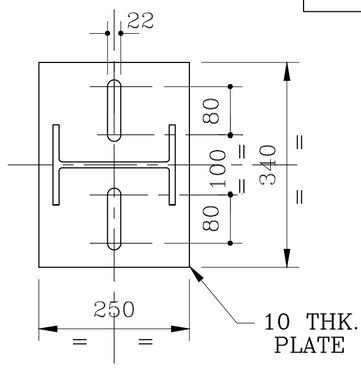
	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0 SHEET 6 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:-
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL PLATFORM AND LADDER CLEATS FOR VESSELS	DRG. NO.- PC183-0000-0000 FILE.- PC183-0000-0000_R0
	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

REFERENCE DRG.	NO.
SYMBOLS AND REFERENCES	PC183-0000-0000(SH 1 OF 10)

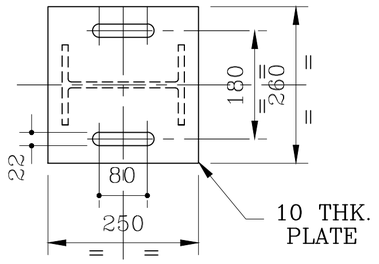




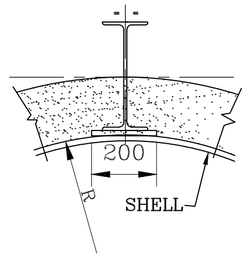
DETAIL-A



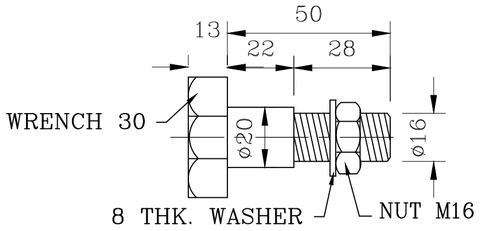
DETAIL-B



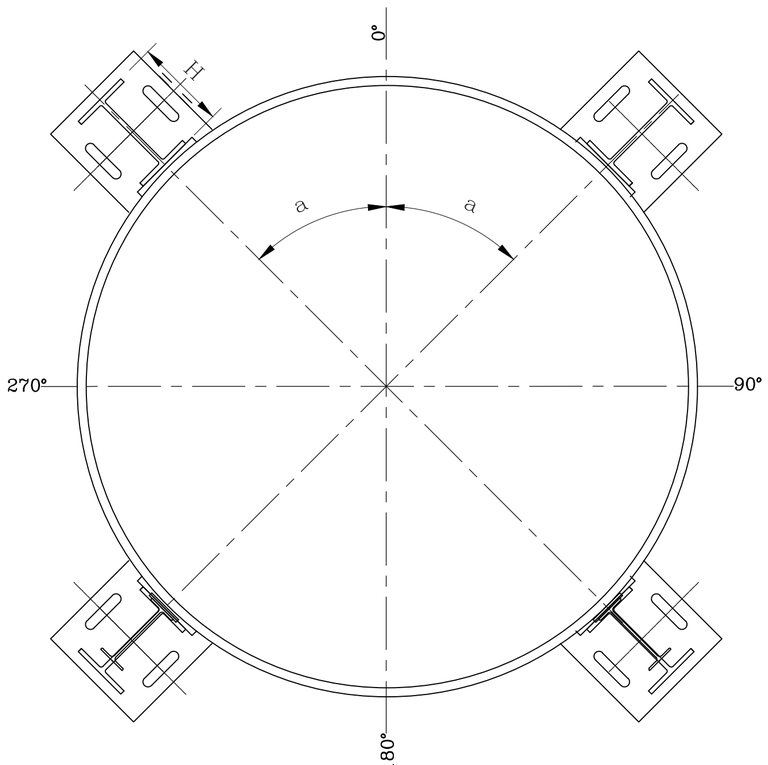
DETAIL-C



SECTION Y-Y



BOLT TYPE-B



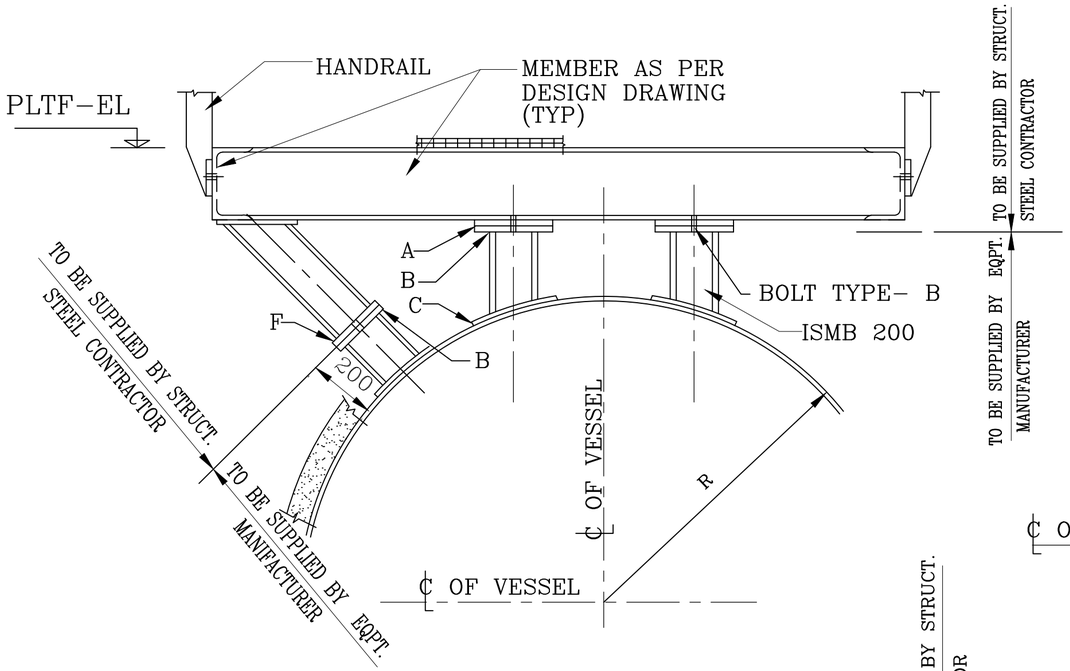
NOTES:-

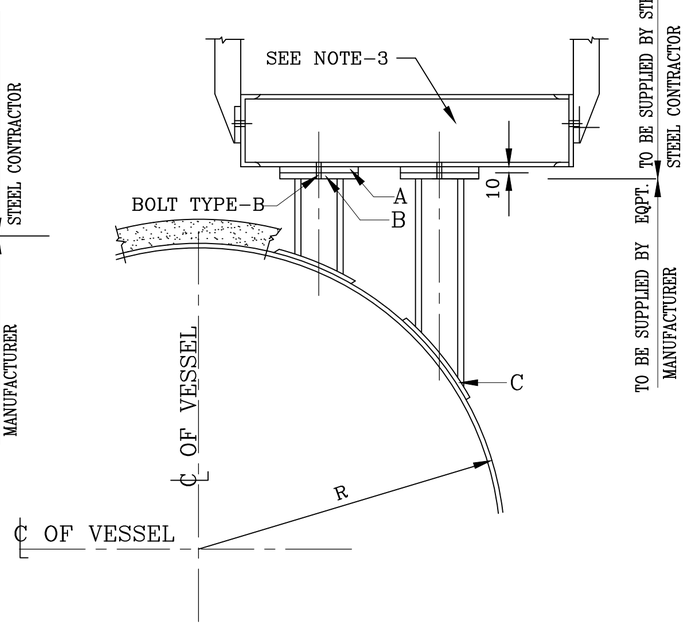
1. REINFORCEMENT PLATES FOR ATTACHMENT OF STAIRS, PLATFORMS AND STEEL STRUCTURE SHALL GENERALLY BE WELDED ON THE EQUIPMENTS AND SHALL BE SUPPLIED BY THE EQUIPMENT MANIFACTURER IN ACCORDANCE WITH THE DESIGN DRAWING. THE PLATE MATERIAL SHALL BE SAME AS OR EQUIVALENT TO SHELL MATERIAL.
2. BOLTS FOR STRUCTURAL CONNECTIONS SHALL BE SUPPLIED BY STRUCTURAL STEEL CONTRACTOR
3. INCASE OF DIFFERENCE BETWEEN THIS DRAWING AND THE DESIGN DRAWING THE LATTER SHALL GOVERN.

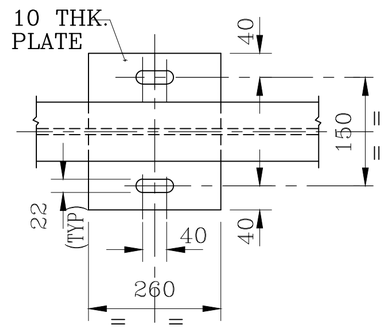
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0
		SHEET 7 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:-
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL CONNECTION DETAILS OF PLATFORMS FOR VERTICAL VESSELS	DRG. NO.- PC183-0000-0000 FILE.- PC183-0000-0000_R0
	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

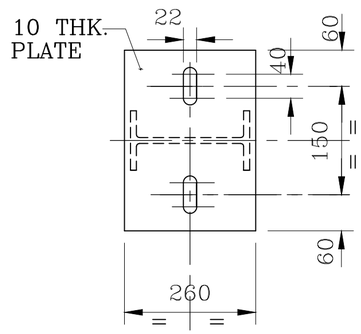
REFERENCE DRG.	NO.
SYMBOLS AND REFERENCES	PC183-0000-0000(SH 1 OF 10)
STEEL LADDER WITH SAFETY CAGE	PC183-0000-0000(SH 5 OF 10)



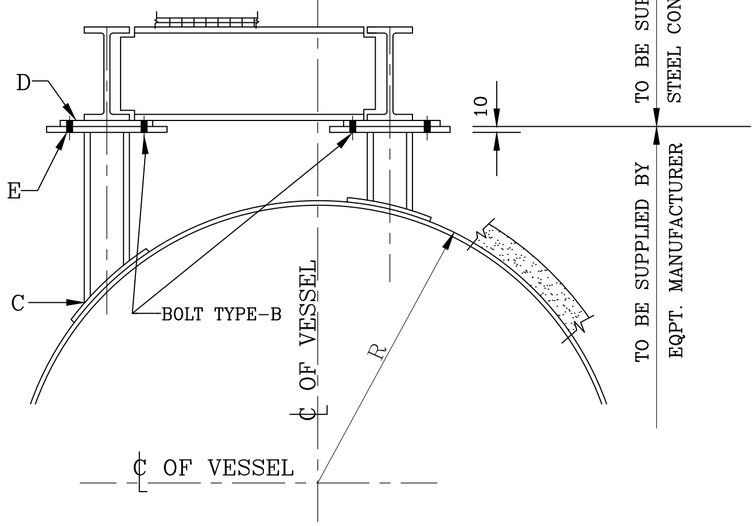


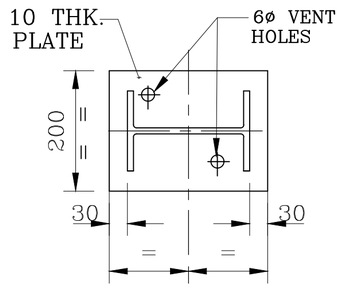


DETAIL-A

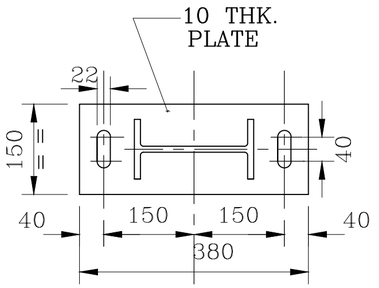


DETAIL-B

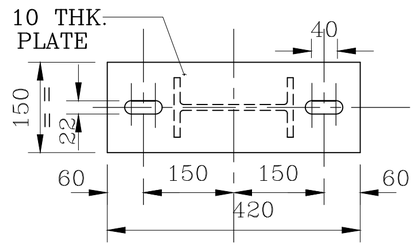




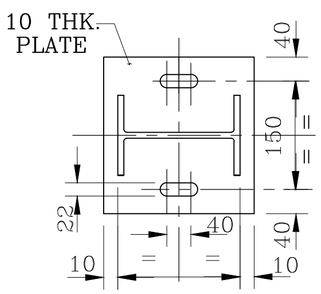
DETAIL-C



DETAIL-D



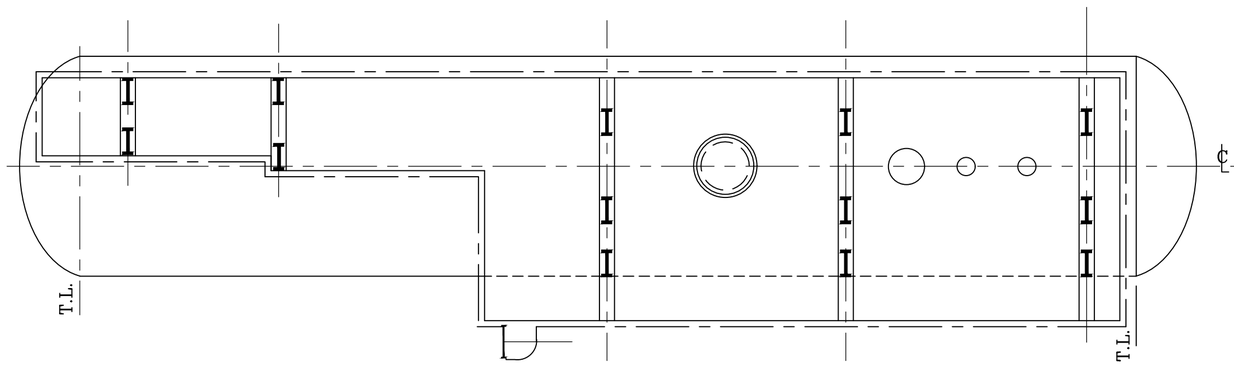
DETAIL-E

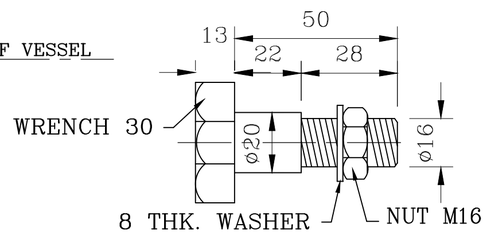


DETAIL-F

NOTES:-

1. REINFORCEMENT PLATES FOR ATTACHMENT OF STAIRS, PLATFORMS AND STEEL STRUCTURE SHALL GENERALLY BE WELDED ON THE EQUIPMENTS AND SHALL BE SUPPLIED BY THE EQUIPMENT MANIFACTURER IN ACCORDANCE WITH THE DESIGN DRAWING. THE PLATE MATERIAL SHALL BE SAME AS OR EQUIVALENT TO THE SHELL MATERIAL.
2. BOLTS FOR STRUCTURAL CONNECTIONS SHALL BE SUPPLIED BY STRUCTURAL STEEL CONTRACTOR.
3. INCASE OF DIFFERENCE BETWEEN THIS DRAWING AND THE DESIGN DRAWING THE LATTER SHALL GOVERN.



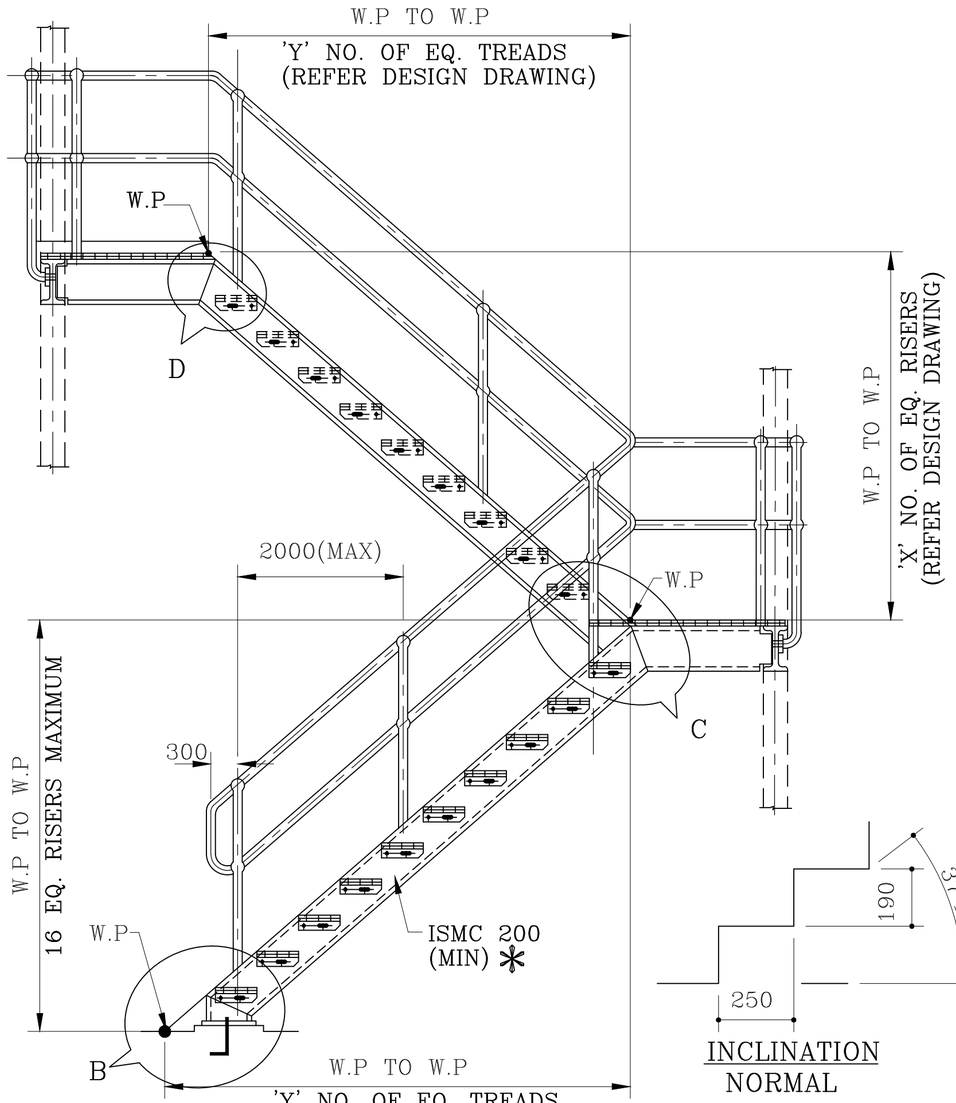


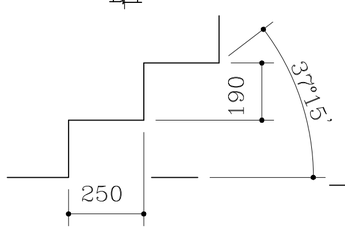
BOLT TYPE-B

REV	DATE	DESCRIPTION	BY	CHKD	APPD.
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT

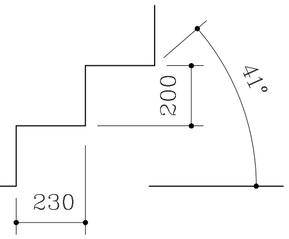
	TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0
		SHEET 8 OF 10
PROJECT	INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:-
TITLE	STANDARD FOR PLATFORM, LADDER & HANDRAIL	DRG. NO.- PC183-0000-0000
	CONNECTION DETAIL OF PLATFORM FOR HORIZONTAL VESSELS	FILE.- PC183-0000-0000_R0
	PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA	

REFERENCE DRG.	NO.
HANDRAILING SYSTEM	PC183-0000-0000(SH 10 OF 10)

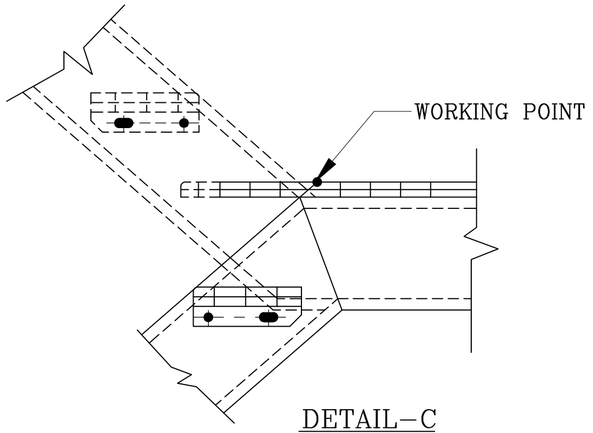




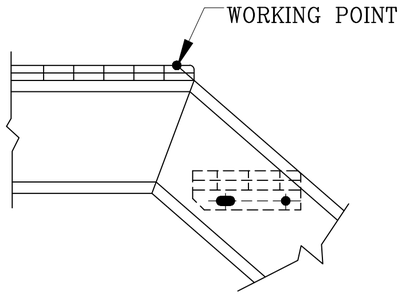
INCLINATION
NORMAL



INCLINATION
MAXIMUM



DETAIL-C

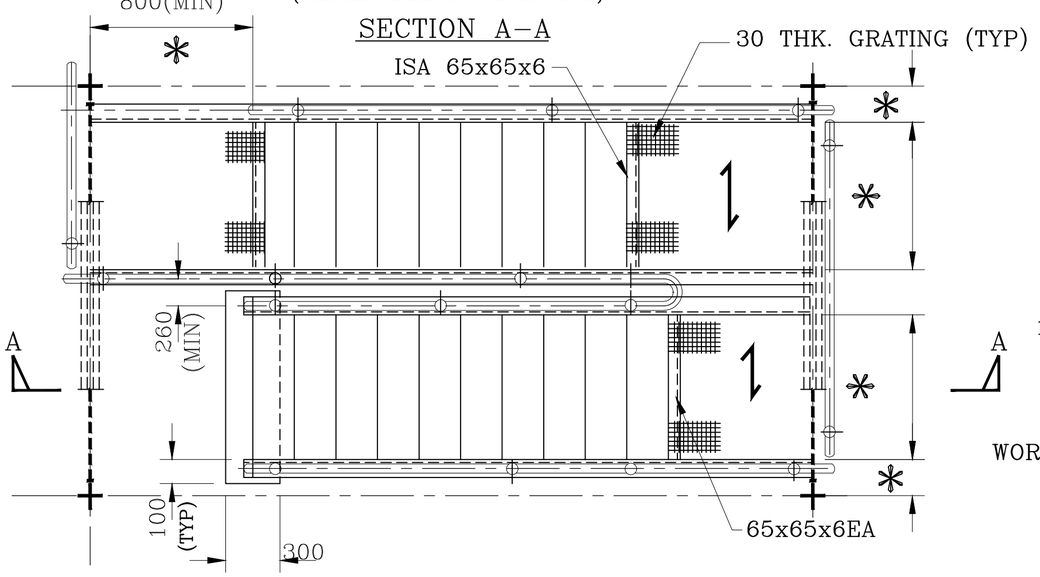


DETAIL-D

NOTES:-

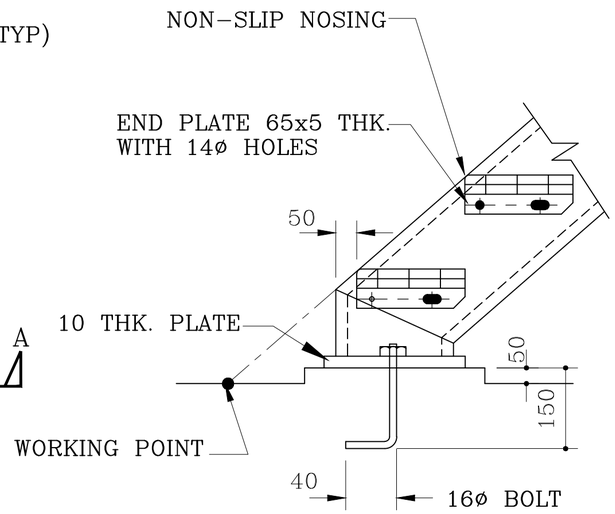
1. INCASE OF DIFFERENCE BETWEEN THIS DRAWING AND THE DESIGN DRAWING THE LATTER SHALL GOVERN.
2. STAIR W.P SHALL BE AT THE INTERSECTION OF THE NOSING LINE AND THE TOP OF THE FLOOR OR TREAD.
3. NON-SLIP NOSING SHALL BE PROVIDED ON THE STAIR CASE STEPS AND LANDINGS.

*-REFER DESIGN DRAWING



PLAN

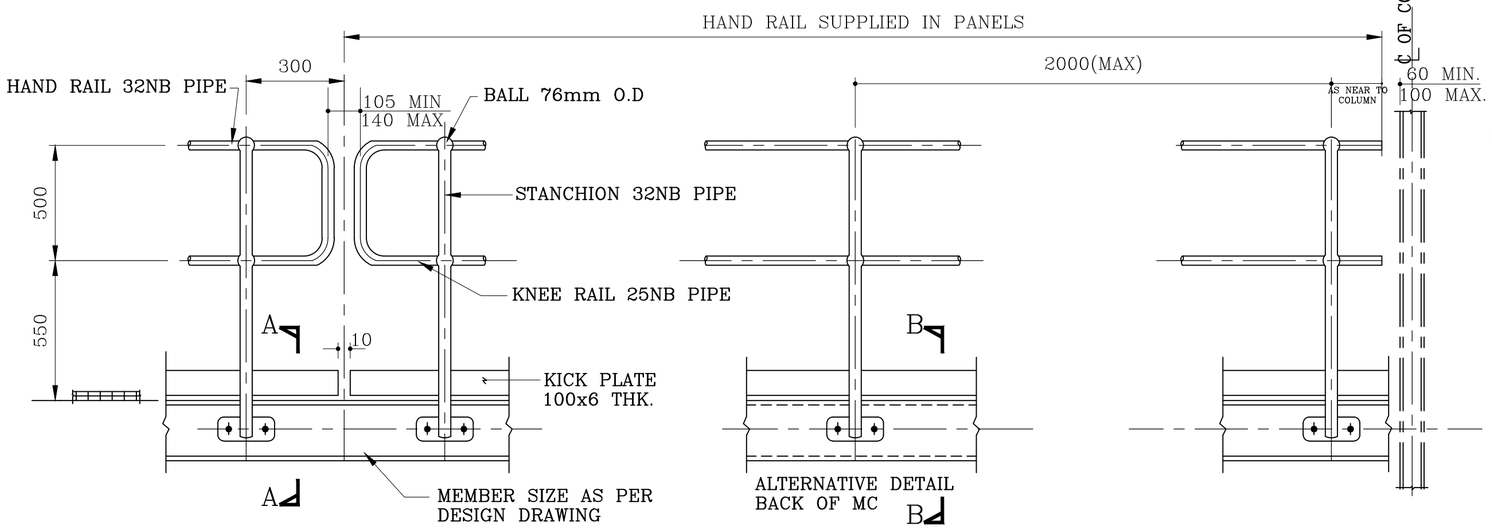
SECTION A-A



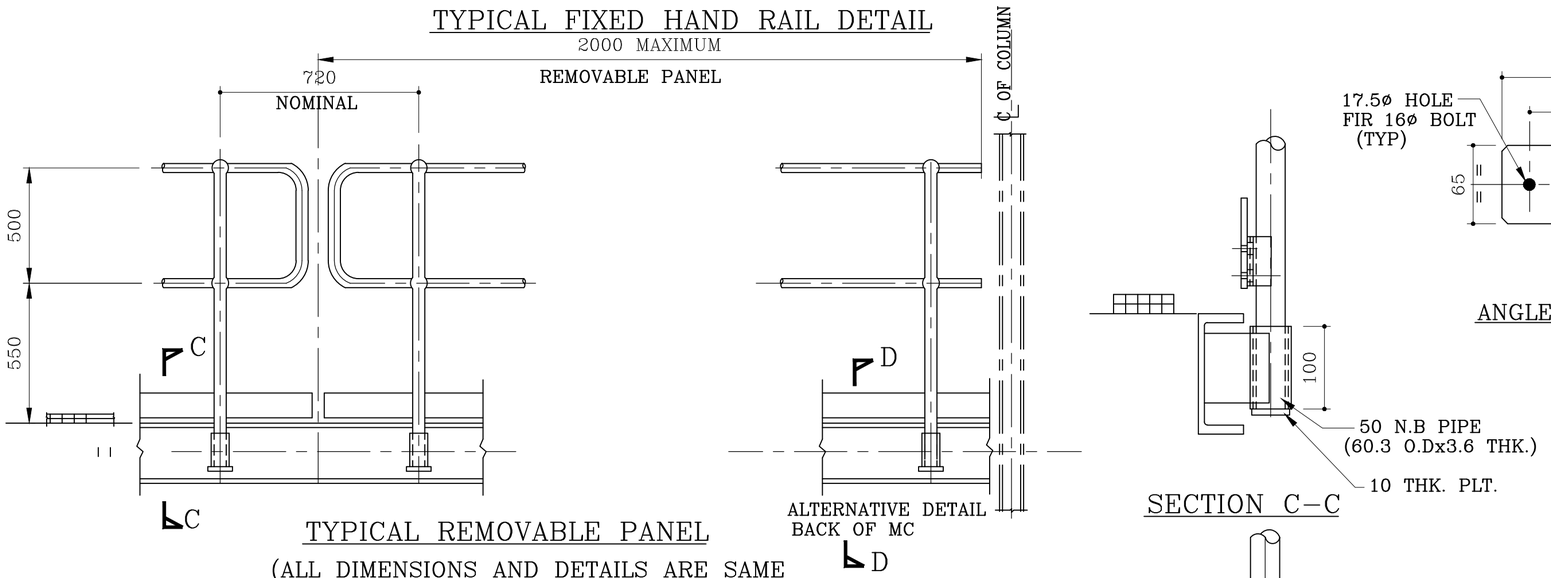
DETAIL-B

0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
Talcher Fertilizers		TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0		
			SHEET 9 OF 10		
PROJECT		INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:-		
TITLE		STANDARD FOR PLATFORM, LADDER & HANDRAIL STAIRS	DRG. NO.- PC183-0000-0000		
			FILE.- PC183-0000-0000_R0		
पी डी आई एल PDIL		PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA			

REFERENCE DRG.	NO.



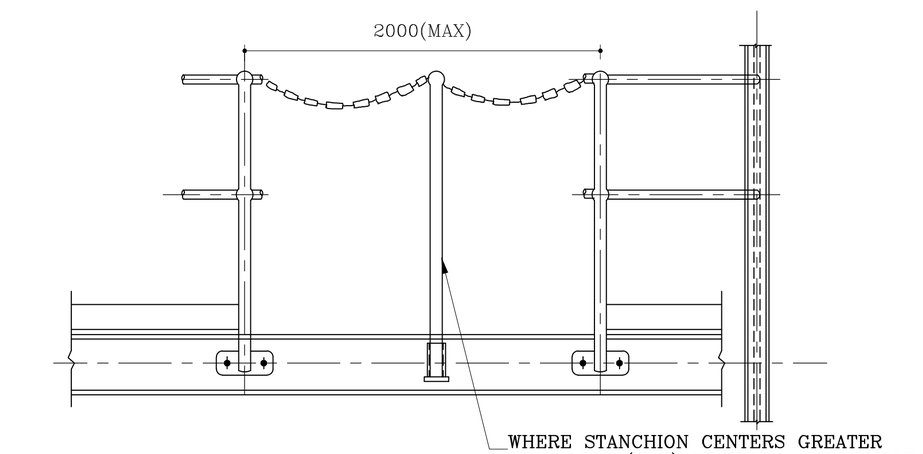
TYPICAL FIXED HAND RAIL DETAIL



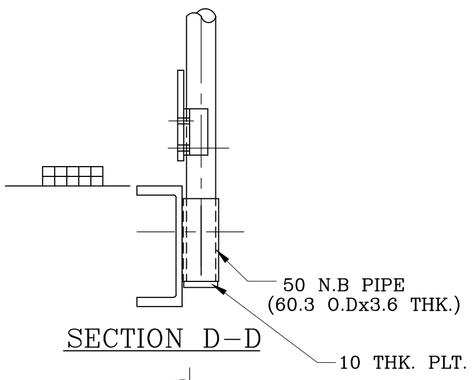
TYPICAL REMOVABLE PANEL

(ALL DIMENSIONS AND DETAILS ARE SAME AS FIXED HAND RAIL DETAIL)

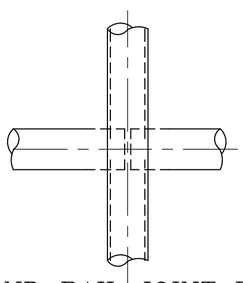
SECTION C–C



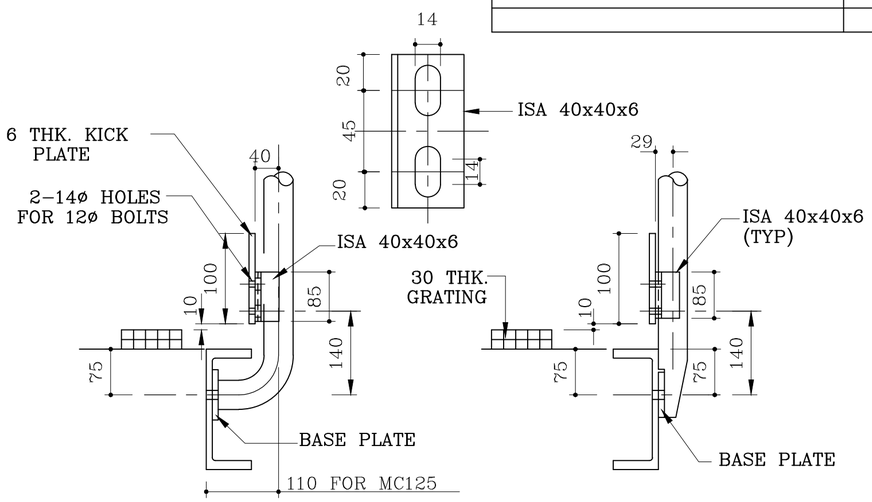
TYPICAL REMOVABLE SAFETY CHAIN & RAIL OR COLUMN CONNECTION DETAILS



SECTION D–D

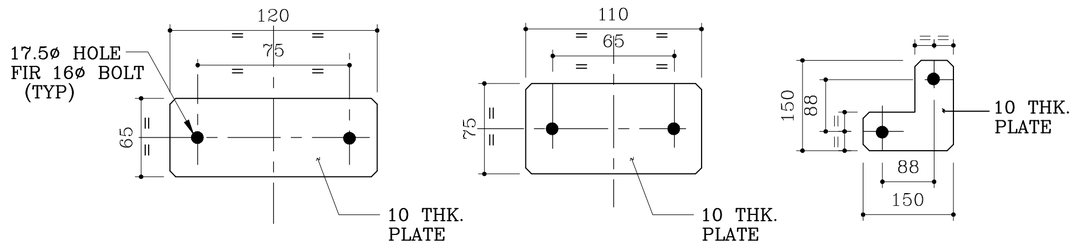


HAND RAIL JOINT DETAIL



SECTION A–A

SECTION B–B



ANGLE MOUNTED STANDARD CORNER

STANCHION BASE PLATE DETAIL

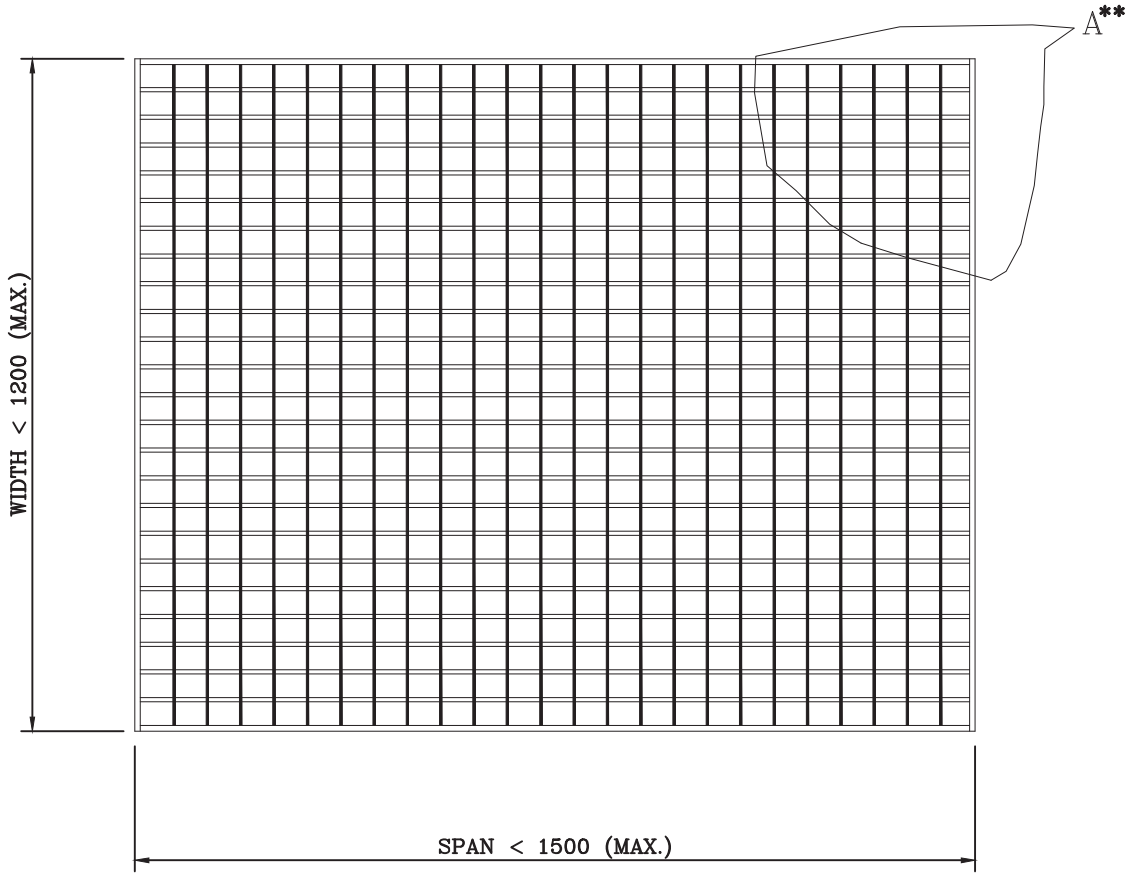
NOTE:

1. PAINTING AS PER PAINTING SPECIFICATION.

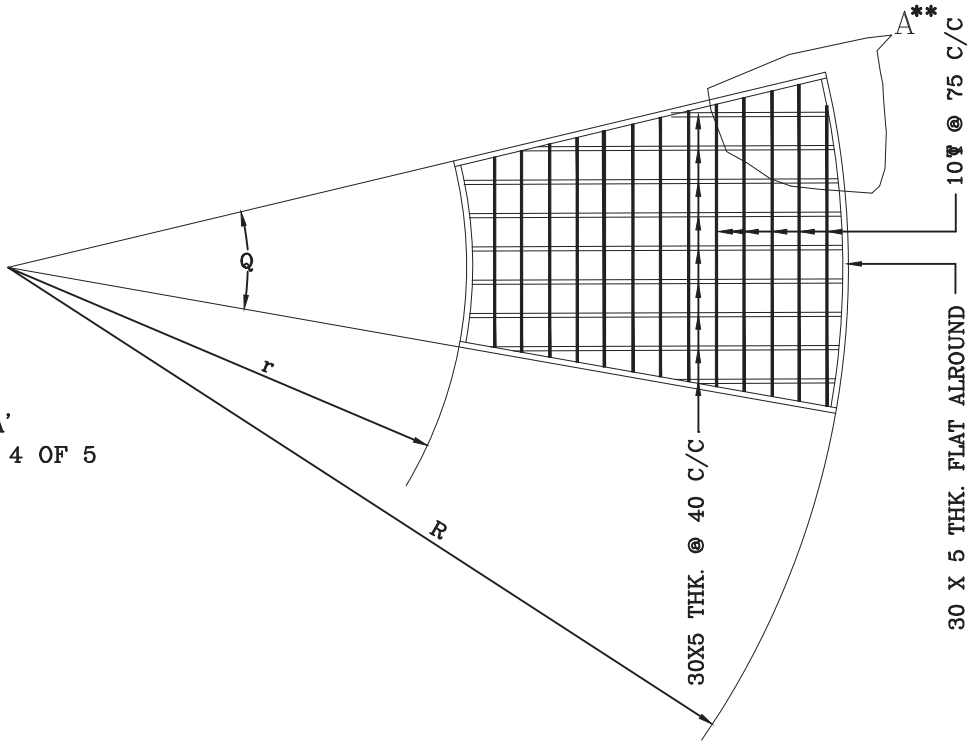
0	10.02.21	ISSUED FOR TENDER	JPR	SS	UPT
REV	DATE	DESCRIPTION	BY	CHKD	APPD.
Talcher Fertilizers		TALCHER FERTILIZERS LTD. (ODISHA)	REV. 0		
			SHEET 10 OF 10		
PROJECT		INSTALLATION OF FLARE STACK AT TALCHER, ODISHA	SCALE:–		
TITLE		STANDARD FOR PLATFORM, LADDER & HANDRAIL HAND RAILING SYSTEM	DRG. NO.– PC183–0000–0000		
			FILE.– PC183–0000–0000_R0		
PDIL		PROJECTS & DEVELOPMENT INDIA LIMITED NOIDA			

STANDARD FOR GRATINGS

REV.	DATE	PURPOSE	PREPARED	REVIEWED	APPROVED
0	10.02.21	ISSUED FOR IMPLEMENTATION	JPR	SS	UPT

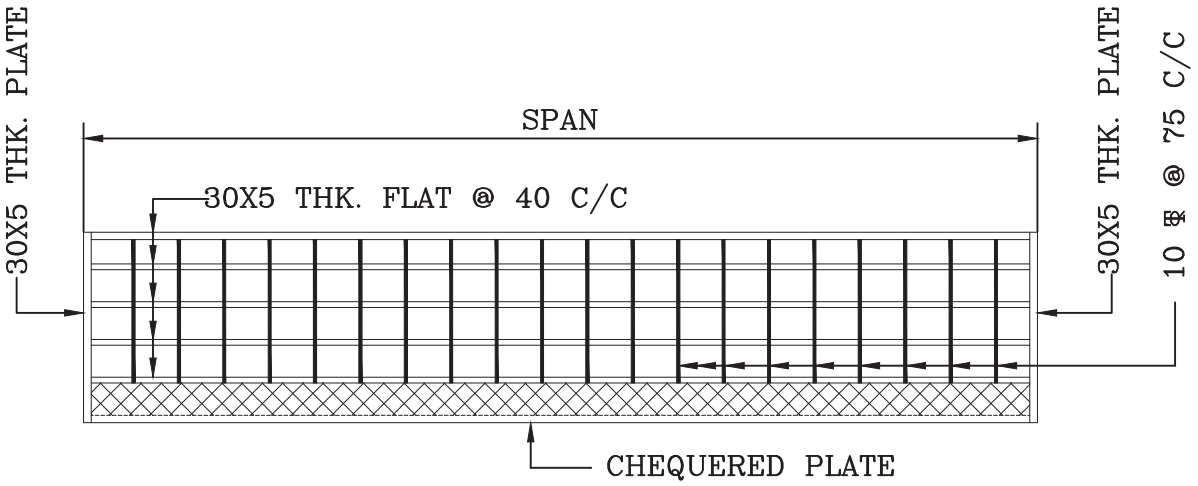


TYPICAL PLAN OF GRATING PLANK

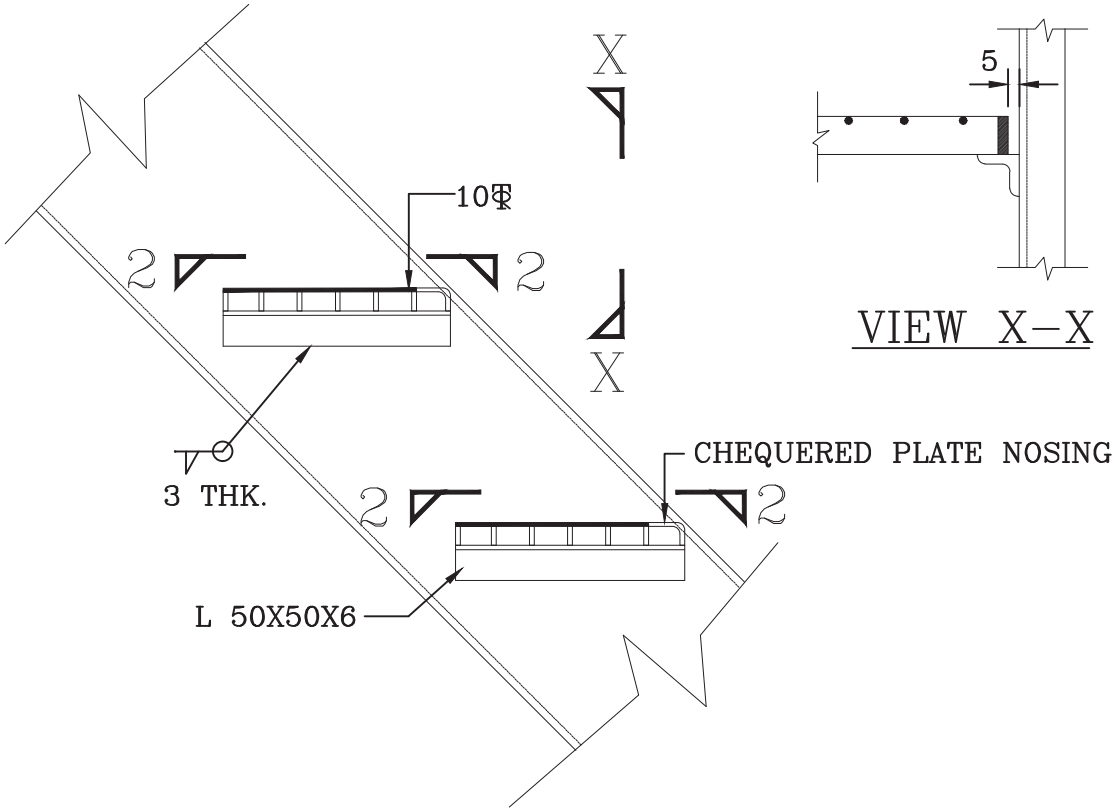


** FOR DETAIL 'A' REFER SHEET 4 OF 5

TYPICAL DETAIL OF PLANK AROUND TOWER

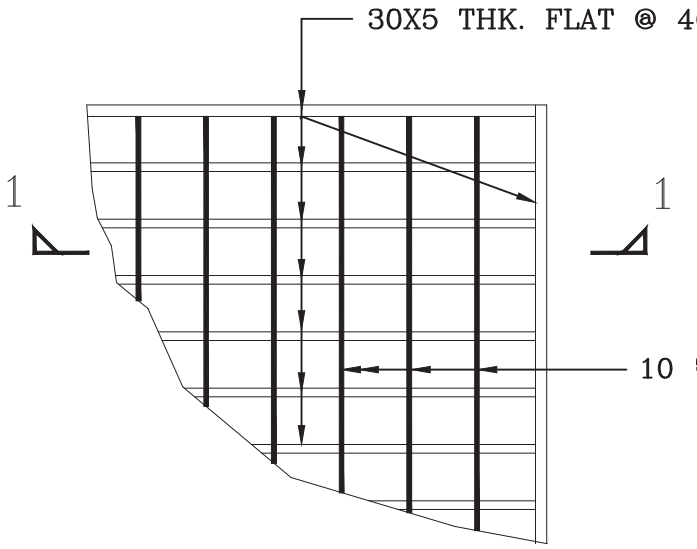


PLAN AT 2-2

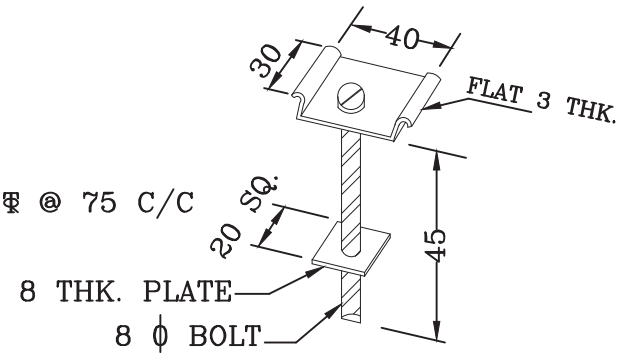


TYPICAL DETAIL OF GRATING FOR TREADS

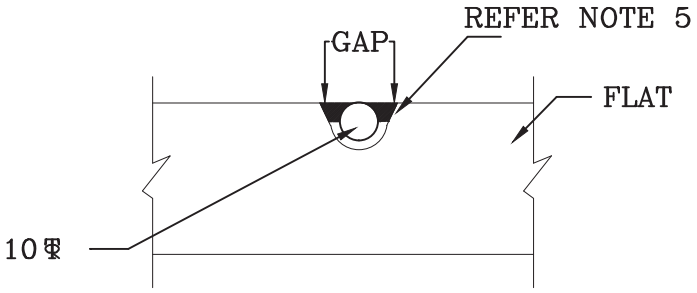
(TREADS ARE TO FIXED TO ANGLE CLEATS THROUGH TWO NOS. G.I. CLAMPS ON EACH SIDE)

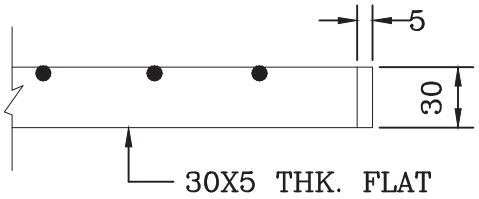


DETAIL A

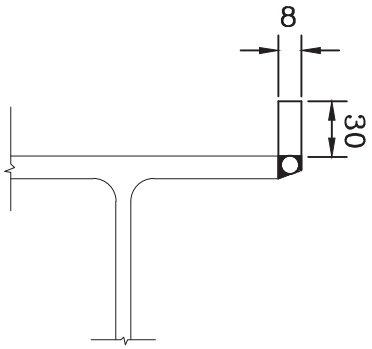


TYPE OF CLAMP

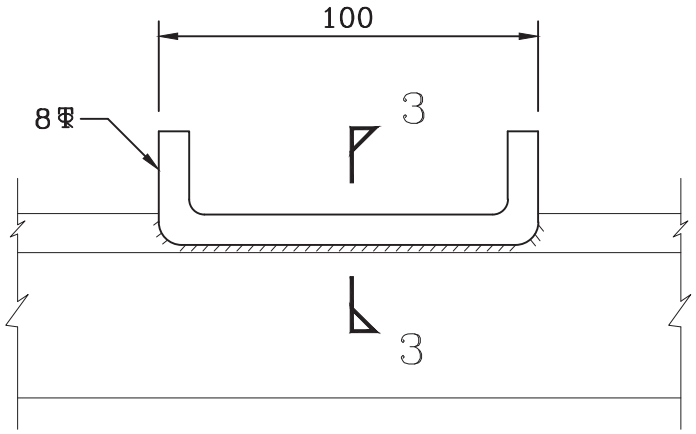




SECTION 1-1



SECTION 3-3



DETAIL OF STOP HOOK

NOTES:-

1. THIS DRAWING MUST BE READ IN CONJUCTION WITH TECHNICAL SPECIFICATIONS.

2. THE GRATING PLANKS SHALL BE FABRICATED AS PER IS:800, IS:813, IS:816 & APPROVED FABRICATION DRAWINGS ONLY.

3. GRATING PLANKS SHALL BE GALVANIZED.

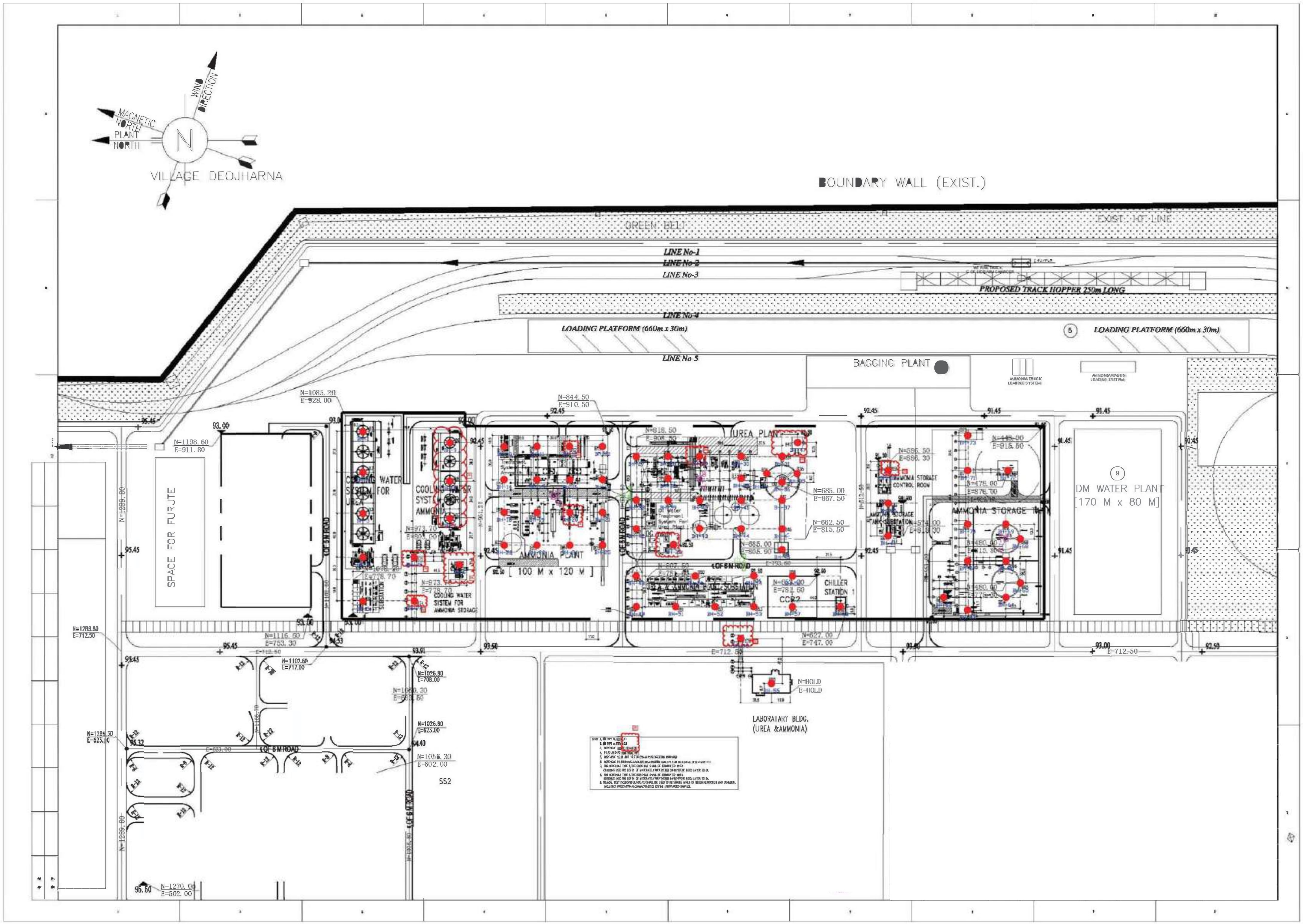
4. GRATING HAS BEEN DESIGNED FOR LIVE LOAD OF 500 KG/SQ.M (MAXIMUM).

5. GAP BETWEEN FLATS AND RODS IS TO BE TACK WELDED.

6. TACK WELDING SHALL BE DONE ALONG THE PERIPHERY OF RODS.

7. HOLES ARE DRILLED IN BEAMS TO SUIT 8 ϕ SCREW HEADED BOLTS . NUTS ARE TIGHTENED FROM BOTTOM OF BEAM FLANGE.

8. EACH PLANK MUST BE HELD BY AT LEAST TWO CLAMPS AND ONE STOP HOOK ON EACH SIDE.


MAGNETIC NORTH
PLANT NORTH
WIND DIRECTION
N
VILLAGE DEOJHARNA
BOUNDARY WALL (EXIST.)
GREEN BELT
EXIST. HT LINE
LINE No-1
LINE No-2
LINE No-3
PROPOSED TRACK HOPPER 250m LONG
LINE No-4
LOADING PLATFORM (660m x 30m)
LOADING PLATFORM (660m x 30m)
LINE No-5
BAGGING PLANT
AMMONIA TRUCK LOADING SYSTEM
AMMONIA WAGON LOADING SYSTEM
SPACE FOR FURUTE
COOLING WATER SYSTEM FOR UREA
COOLING WATER SYSTEM FOR AMMONIA
COOLING WATER SYSTEM FOR AMMONIA STORAGE
AMMONIA PLANT
[100 M x 120 M]
UREA PLANT
AMMONIA STORAGE CONTROL ROOM
AMMONIA STORAGE
DM WATER PLANT
[170 M x 80 M]
CHILLER STATION 1
CCR2
LABORATARY BLDG. (UREA &AMMONIA)
N=HOLD
E=HOLD
SS2
N=1085.20
E=928.00
N=844.50
E=910.50
N=1198.60
E=911.80
N=685.00
E=867.50
N=662.50
E=815.50
N=1289.80
E=712.50
N=1116.60
E=753.30
N=1102.60
E=717.00
N=1026.80
E=708.00
N=1026.80
E=623.00
N=1056.30
E=602.00
N=1285.30
E=623.00
N=1270.00
E=502.00
N=627.00
E=747.00
E=712.50
96.50

SL No.	Location	Type of BH	BH No.	DOS	DOC	Depth of BH (mtr.)	PLANT Coordinates		RL (mtr.)	GWT (mtr.)
							Easting	Northing		
54.	Ammonia & urea Area	A	BH-54	25.08.20	26.08.20	19.10	781.849	710.723	92.520	0.00
55.		B	BH-55	30.80.20	31.08.20	18.85	683.432	694.547	95.800	4.30
56.		A	BH-56	26.07.20	29.07.20	18.41	781.593	675.304	92.530	1.35
57.		B	BH-57	29.07.20	31.07.20	15.25	753.688	675.367	92.730	1.90
58.		B	BH-58	30.07.20	31.07.20	15.40	753.670	631.427	92.680	1.95
59.		B	BH-59	06.07.20	07.07.20	10.50	878.218	587.685	91.841	1.60
60.		A	BH-60	09.07.20	10.07.20	15.70	848.241	587.720	92.810	1.20
61.		B	BH-61	08.07.20	09.07.20	13.70	818.361	587.816	92.600	1.20
62.		B	BH-62	31.07.20	01.08.20	16.10	762.042	536.971	92.176	1.90
63.		A	BH-63	29.07.20	31.07.20	15.53	750.527	515.026	91.700	1.95
64.		A	BH-64	28.07.20	29.07.20	18.22	762.094	479.870	91.850	1.90
65.		B	BH-65	27.07.20	28.07.20	15.10	775.302	466.659	91.300	1.40
66.		A	BH-66	25.07.20	26.07.20	18.20	795.437	479.903	91.310	1.67
67.		B	BH-67	21.07.20	22.07.20	12.81	795.383	515.013	91.711	1.10
68.		B	BH-68	22.07.20	23.07.20	12.20	815.591	466.819	91.340	1.80
69.		B	BH-69	23.07.20	24.07.20	14.75	829.173	480.074	91.420	1.50
70.		B	BH-70	20.07.20	21.07.20	12.41	829.077	514.989	91.920	1.60
71.		B	BH-71	11.07.20	12.07.20	12.14	878.107	514.985	91.230	1.10
72.		A	BH-72	12.07.20	19.07.20	15.45	878.087	477.994	91.300	1.20
73.		B	BH-73	10.07.20	11.07.20	12.45	909.996	514.931	91.610	1.30
74.		B	BH-74	03.09.20	04.09.20	19.50	759.011	1021.412	93.430	1.60
75.		A	BH-75	02.09.20	03.09.20	21.10	798.743	1021.418	92.460	1.95
76.		B	BH-76	02.09.20	03.09.20	18.75	724.495	722.626	93.510	1.50

SL No.	Location	Type of BH	BH No.	DOS	DOC	Depth of BH (mtr.)	PLANT Coordinates		RL (mtr.)	GWT (mtr.)
							Easting	Northing		
77.	Ammonia & urea Area	-	PLT-01	15.09.20	15.09.20	1.60	854.691	893.957	92.278	1.50
78.		-	PLT-02	13.09.20	13.09.20	1.60	870.888	760.172	92.356	1.20
79.		-	PLT-03	11.09.20	11.09.20	1.50	815.974	479.852	91.360	0.80
80.		-	FCBR-01	17.09.20	17.09.20	-	795.220	725.843	92.250	-
81.		-	FCBR-02	17.09.20	17.09.20	-	855.441	830.791	92.132	-
82.		-	ERT-01	01.09.20	01.09.20	-	798.776	1068.403	91.924	-
83.		-	ERT-02	01.09.20	01.09.20	-	792.182	980.203	92.028	-
84.		-	ERT-03	01.09.20	01.09.20	-	899.755	939.124	92.214	-
85.		-	ERT-04	03.09.20	03.09.20	-	810.023	849.125	93.075	-
86.		-	ERT-05	03.09.20	03.09.20	-	810.381	784.124	91.990	-
87.		-	ERT-06	03.09.20	03.09.20	-	890.790	818.186	92.095	-
88.		-	ERT-07	03.09.20	03.09.20	-	824.849	760.254	93.001	-
89.		-	ERT-08	04.09.20	04.09.20	-	824.783	684.671	92.895	-
90.		-	ERT-09	04.09.20	04.09.20	-	762.042	536.971	93.016	-
91.		-	ERT-10	04.09.20	04.09.20	-	878.107	514.985	92.658	-
92.		-	CHT-01	10.10.20	10.10.20	-	869.913	909.124	92.200	-
93.		-	CHT-02	10.10.20	10.10.20	-	869.825	878.975	92.270	-
94.		-	CHT-03	10.10.20	10.10.20	-	869.913	909.124	92.200	-

* RL – Reduced Level, which also refers Natural Ground Level (NGL) of particular position?

*GWT–Ground Water Table.

* DOS – Date of Start.

* DOC – Date of Completion

DESIGN PARAMETERS

BH-59

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 4.50	100	4.50	0.04	19	-	2.17
2	Sand Stone	4.50 to 10.50	>100	6.00	Completely Weathered (Sedimentary Rock)			

Ammonia Storage Tank Substation

BH-60 to 61

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 4.35	76 to >100	4.35	0.03	20	-	2.15
2	Filledup concrete Boulder	4.35 to 6.10	>100	1.75	-	-	-	-
3	Sand Stone	6.10 to 14.71	>100	8.61	Completely to Highly Weathered (Sedimentary Rock)			

Ammonia Storage Area

For Ammonia Storage area boreholes grouped into Five zones viz., Zone-01 (BH-62, 63, 66, 68 & 70), Zone-02 (BH-64), Zone-03 (BH-65 & 69), Zone-04 (BH-67 & Zone-05 (BH-71 to BH-73).

Zone-01 (BH-62, 63, 66, 68 & 70)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 5.58	>100	5.58	0.04	19	-	2.17
2	Clay Stone	5.58 to 7.14	>100	1.56	Completely Weathered (Sedimentary Rock)			
3	Sand Stone	7.14 to 14.89	>100	7.75	Completely to Highly Weathered (Sedimentary Rock)			

Zone-02 (BH-64)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 3.90	>100	3.90	0.03	19	-	2.16
2	Compacted Sand mix Clay	3.90 to 6.10	>100	2.20	0.13	22	30	1.86
3	Clay Stone	6.10 to 7.40	>100	1.30	Completely Weathered (Sedimentary Rock)			
4	Sand Stone	7.40 to 18.22	>100	10.82	Completely to Highly Weathered (Sedimentary Rock)			

Zone-03 (BH-65 & 69)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 2.70	>100	2.70	0.03	20	-	2.18
2	Filledup Concrete Mix Boulder	2.70 to 5.85	>100	3.15	-	-	-	-
3	Clay Stone	5.85 to 7.15	>100	1.30	Completely Weathered (Sedimentary Rock)			
4	Sand Stone	7.15 to 14.93	>100	7.78	Completely Weathered (Sedimentary Rock)			

Zone-04 (BH-67)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 4.70	>100	4.70	0.02	20	-	2.17
2	Filledup Concrete Mix Boulder	4.70 to 6.70	>100	2.00	-	-	-	-
3	Clay Stone	6.70 to 12.81	>100	6.11	Completely Weathered (Sedimentary Rock)			

Zone-05 (BH-71 to BH-73)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 5.60	100	5.60	0.04	19	-	2.17
2	Sand Stone	5.60 to 13.35	>100	7.75	Completely to Highly Weathered (Sedimentary Rock)			

* Table 1.26

Conveyor Belt for Ammonia area.

(BH-74 & 75)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 2.30	>100	2.30	0.04	19	-	2.17
2	Compacted Sand mix Clay	2.30 to 6.80	>100	4.50	0.10	25	30	1.90
3	Sand Stone	6.80 to 20.30	>100	13.50	Completely to Highly Weathered (Sedimentary Rock)			

* Table 1.27

Conveyor Belt.

(BH-76)

Layer No.	Stratum Description	Depth in (m)	Average 'N' Value	Thickness of Stratum (m)	Shear Parameters		Liquid Limit	Density Y_b (gm/cc)
					C (kg/cm^2)	Ø°		
1	Filledup Coal Mix Boulder	NGL to 4.20	>100	4.20	0.02	21	-	2.17
2	Clay Stone	4.20 to 7.00	>100	2.80	Completely Weathered (Sedimentary Rock)			
3	Sand Stone	7.00 to 18.75	>100	11.75	Completely to Highly Weathered (Sedimentary Rock)			

* Table 1.28

Note:

Rock classification is based on RQD % of rock.

ANALYSIS OF STRATUM

Ammonia Storage Control Room

(BH-59)

Stratum	Average Depth Range (max10.50m)	'N' Value	Type of soil	State
I	0.00-4.50	100	Filledup Coal mix Boulder	Very Dense
II	4.50-10.50	>100	Sand stone	Sedimentary Rock

Ammonia Storage Tank Substation

(BH-60 to 61)

Stratum	Average Depth Range (max14.71m)	'N' Value	Type of soil	State
I	0.00-4.35	100	Filledup Coal mix Boulder	Very Dense
II	4.35-6.10	>100	Filledup Concrete Boulder	Very Dense
III	6.10-14.71	>100	Sand stone	Sedimentary Rock

Ammonia Storage Area

Zone-01: (BH-62, 63, 66, 68 & 70)

Stratum	Average Depth Range (max14.89m)	'N' Value	Type of soil	State
I	0.00-5.58	>100	Filledup Coal mix Boulder	Very Dense
II	5.58-7.14	>100	Clay stone	Sedimentary Rock
III	7.14-14.89	>100	Sand stone	Sedimentary Rock

Zone-02: (BH-64)

Stratum	Average Depth Range (max18.22m)	'N' Value	Type of soil	State
I	0.00-3.90	>100	Filledup Coal mix Boulder	Very Dense
II	3.90-6.10	>100	Compacted sand mix clay	Very Dense
III	6.10-7.40	>100	Clay stone	Sedimentary Rock
IV	7.40-18.22	>100	Sand stone	Sedimentary Rock

Zone-03: (BH-65 & 69)

Stratum	Average Depth Range (max14.93m)	'N' Value	Type of soil	State
I	0.00-2.70	>100	Filledup Coal mix Boulder	Very Dense
II	2.70-5.85	>100	Filledup Concrete mix Boulder	Very Dense
III	5.85-7.15	>100	Clay stone	Sedimentary Rock
IV	7.15-14.93	>100	Sand stone	Sedimentary Rock

Zone-04: (BH-67)

Stratum	Average Depth Range (max12.81m)	'N' Value	Type of soil	State
I	0.00-4.70	>100	Filledup Coal mix Boulder	Very Dense
IV	4.70-6.70	>100	Filledup Concrete mix Boulder	Very Dense
V	6.70-12.81	>100	Clay stone	Sedimentary Rock

Zone-05: (BH-71 to 73)

Stratum	Average Depth Range (max13.35m)	'N' Value	Type of soil	State
I	0.00-5.60	>100	Filledup Coal mix Boulder	-
IV	5.60-13.35	>100	Sand stone	Sedimentary Rock

Conveyor Belt for Ammonia Area

(BH-74 & 75)

Stratum	Average Depth Range (max20.30m)	'N' Value	Type of soil	State
I	0.00-2.30	>100	Filledup Coal mix Boulder	Very Dense
II	2.30-6.80	>100	Compacted sand mix clay	Very Dense
III	6.80-20.30	>100	Sand stone	Sedimentary Rock

Conveyor Belt

(BH-76)

Stratum	Average Depth Range (max18.75m)	'N' Value	Type of soil	State
I	0.00-4.20	>100	Filledup Coal mix Boulder	Very Dense
II	4.20-7.00	>100	Clay stone	Sedimentary Rock
III	7.00-18.75	>100	Sand stone	Sedimentary Rock

COEFFICIENT FRICTION BETWEEN SOIL AND CONCRETE FOUNDATION:

(Ammonia Storage Control Room Area)

(BH-59)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Sand stone	0.65	0.70

(Ammonia Storage Tank Substation Area)

(BH-60 to BH-61)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Filledup Concrete Boulder	-	-
Sand stone	0.65	0.70

(Ammonia Storage Room)

Zone-01(BH-62, 63, 66, 68 & 70)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Clay stone/Sand stone	0.65	0.70

Zone-02(BH-64)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Compacted sand mix clay	0.35	0.45
Clay stone/Sand stone	0.65	0.70

Zone-03(BH-65 & 69)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Filledup Concrete Boulder	-	-
Clay stone/Sand stone	0.65	0.70

Zone-04 (BH-67)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Filledup Concrete Boulder	-	-
Clay stone	0.65	0.70

Zone-05(BH-71 to 73)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Sand stone	0.65	0.70

Conveyor Belt for Ammonia Area)

(BH-74 & 75)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Compacted sand mix clay	0.35	0.45
Sand stone	0.65	0.70

Conveyor Belt for Ammonia Area)

(BH-76)

Description of Strata	Coefficient of friction (μ)	
	Minimum	Maximum
Filledup Coal mix Boulder	-	-
Clay stone/Sand stone	0.65	0.70

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.20 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 59)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	Up to 3.0	13.92	50.98	81.57
		>3.0 to <6.0	15.33	46.36	74.18
	2.00	Up to 3.0	16.91	47.47	75.95
		>3.0 to <6.0	18.17	42.99	68.79
	3.00	Up to 3.0	23.16	41.40	66.23
		>3.0 to <6.0	23.99	37.03	59.25
	4.00	Up to 3.0	29.74	54.83	87.72
		>3.0 to <6.0	30.02	53.07	84.91
	5.00	Up to 3.0	68.08	155.46	248.73
		>3.0 to <6.0	66.64	154.16	246.66

* Table No. 2.58

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.20 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 59)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Control Room	1.50	5 x 1	11.49	58.65	93.84	175.95
		10 x 2	11.72	49.61	79.38	148.84
		15 x 3	12.50	45.96	73.53	137.87
		20 x 4	13.41	44.72	71.56	134.17
		25 x 5	14.38	43.99	70.38	131.96
		30 x 6	15.38	54.55	87.28	163.64
	2.00	5 x 1	14.64	55.78	89.26	167.35
		10 x 2	14.39	45.17	72.28	135.52
		15 x 3	15.00	41.42	66.28	124.27
		20 x 4	15.84	40.30	64.49	120.91
		25 x 5	16.76	39.56	63.30	118.68
		30 x 6	17.72	48.94	78.31	146.83
	3.00	5 x 1	21.58	44.22	70.74	132.65
		10 x 2	20.04	38.18	61.08	114.53
		15 x 3	20.23	35.38	56.61	106.14
		20 x 4	20.85	33.96	54.34	101.89
		25 x 5	21.64	33.07	52.91	99.20
		30 x 6	22.52	40.71	65.14	122.13
	4.00	5 x 1	29.37	48.55	77.67	145.64
		10 x 2	26.12	50.50	80.80	151.50
		15 x 3	25.74	48.84	78.14	146.51
		20 x 4	26.07	47.26	75.61	141.78
		25 x 5	26.69	45.56	72.90	136.69
		30 x 6	27.45	55.41	88.66	166.24
	5.00	5 x 1	75.24	77.08	123.33	231.25
		10 x 2	69.87	119.85	191.76	359.56
		15 x 3	68.08	147.31	235.70	441.93
		20 x 4	67.18	136.67	218.67	410.01
		25 x 5	66.64	131.76	210.81	395.27
		30 x 6	66.29	159.39	255.02	478.17

Table No. 2.59

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 59)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	6 x 6	16.10	56.97	91.15
		10 x 10	19.33	54.96	87.94
		15 x 15	23.47	53.84	86.14
		20 x 20	27.64	53.29	85.26
		25 x 25	31.82	52.85	84.56
		30 x 30	36.01	52.47	83.96
		12 x 6	14.58	55.66	89.05
		20 x 10	16.97	54.22	86.76
		30 x 15	20.05	53.52	85.63
		40 x 20	23.17	53.05	84.88
		50 x 25	26.31	52.67	84.26
		60 x 30	29.45	52.32	83.71
	2.00	6 x 6	18.90	52.11	83.37
		10 x 10	22.05	49.54	79.26
		15 x 15	26.14	48.28	77.24
		20 x 20	30.29	47.55	76.09
		25 x 25	34.46	47.13	75.41
		30 x 30	38.65	46.78	74.85
		12 x 6	17.36	50.30	80.48
		20 x 10	19.67	48.64	77.82
		30 x 15	22.72	47.73	76.37
		40 x 20	25.82	47.27	75.63
		50 x 25	28.94	46.91	75.05
		60 x 30	32.07	46.59	74.55
	3.00	6 x 6	24.62	45.16	72.26
		10 x 10	27.56	41.58	66.52
		15 x 15	31.55	40.09	64.14
		20 x 20	35.65	39.29	62.86
		25 x 25	39.79	38.76	62.01
		30 x 30	43.95	38.35	61.36
		12 x 6	23.05	42.72	68.35
		20 x 10	25.16	40.42	64.67
		30 x 15	28.10	39.36	62.97
		40 x 20	31.15	38.76	62.02
		50 x 25	34.24	38.40	61.44
		60 x 30	37.35	38.12	61.00

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 59)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	4.00	6 x 6	30.51	63.50	101.60
		10 x 10	33.17	57.66	92.26
		15 x 15	37.02	54.21	86.73
		20 x 20	41.05	52.72	84.35
		25 x 25	45.15	51.73	82.76
		30 x 30	49.28	50.97	81.55
		12 x 6	28.91	59.42	95.06
		20 x 10	30.74	54.85	87.76
		30 x 15	33.55	52.87	84.60
		40 x 20	36.53	51.76	82.82
		50 x 25	39.58	50.98	81.57
		60 x 30	42.66	50.39	80.62
	5.00	6 x 6	66.26	186.03	297.65
		10 x 10	65.57	164.33	262.93
		15 x 15	65.21	150.97	241.55
		20 x 20	65.03	143.52	229.62
		25 x 25	64.92	138.53	221.64
		30 x 30	64.85	134.49	215.18
		12 x 6	65.39	170.65	273.04
		20 x 10	65.03	155.44	248.71
		30 x 15	64.85	145.73	233.16
		40 x 20	64.76	140.22	224.35
		50 x 25	64.71	136.01	217.62
		60 x 30	64.67	132.47	211.95

* Table No. 2.60

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.21 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 60 to 61)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Tank Substation	1.50	Up to 3.0	14.25	71.01	113.61
		>3.0 to <6.0	15.84	66.21	105.94
	2.00	Up to 3.0	17.48	68.24	109.19
		>3.0 to <6.0	18.92	62.99	100.78
	3.00	Up to 3.0	24.23	59.86	95.78
		>3.0 to <6.0	25.23	54.18	86.68
	4.00	Up to 3.0	31.35	47.70	76.32
		>3.0 to <6.0	31.77	46.74	74.79
	5.00	Up to 3.0	38.84	43.12	69.00
		>3.0 to <6.0	38.53	44.10	70.56

* Table No. 2.61

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.21 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 60 to 61)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Tank Substation	1.50	5 x 1	11.66	81.81	130.90	245.44
		10 x 2	12.03	72.41	115.85	217.22
		15 x 3	12.93	64.01	102.42	192.03
		20 x 4	13.95	63.16	101.05	189.47
		25 x 5	15.03	62.82	100.51	188.45
		30 x 6	16.14	78.37	125.40	235.12
	2.00	5 x 1	15.03	79.30	126.89	237.91
		10 x 2	14.91	68.80	110.08	206.39
		15 x 3	15.64	59.55	95.28	178.66
		20 x 4	16.58	58.45	93.52	175.35
		25 x 5	17.61	57.96	92.74	173.89
		30 x 6	18.69	72.17	115.47	216.51
	3.00	5 x 1	22.47	65.00	104.00	195.00
		10 x 2	21.00	54.91	87.85	164.72
		15 x 3	21.29	51.16	81.86	153.49
		20 x 4	22.01	49.29	78.86	147.86
		25 x 5	22.91	48.38	77.40	145.13
		30 x 6	23.89	59.62	95.40	178.87
	4.00	5 x 1	30.83	51.80	82.88	155.39
		10 x 2	27.56	46.43	74.29	139.30
		15 x 3	27.25	42.49	67.99	127.48
		20 x 4	27.67	41.21	65.93	123.63
		25 x 5	28.39	40.13	64.20	120.38
		30 x 6	29.25	48.50	77.61	145.51
	5.00	5 x 1	40.12	41.08	65.73	123.24
		10 x 2	34.59	42.13	67.41	126.40
		15 x 3	33.52	40.86	65.38	122.59
		20 x 4	33.56	38.71	61.93	116.12
		25 x 5	34.05	37.69	60.31	113.08
		30 x 6	34.77	45.14	72.23	135.42

Table No. 2.62

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 60 to 61)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Tank Substation	1.50	6 x 6	16.70	81.85	130.96
		10 x 10	20.28	76.45	122.33
		15 x 15	24.85	71.70	114.71
		20 x 20	29.46	68.09	108.94
		25 x 25	34.07	64.93	103.88
		30 x 30	38.69	62.09	99.35
		12 x 6	15.09	79.97	127.95
		20 x 10	17.75	75.42	120.68
		30 x 15	21.16	71.27	114.03
		40 x 20	24.60	67.78	108.45
		50 x 25	28.06	64.70	103.51
		60 x 30	31.53	61.91	99.06
	2.00	6 x 6	19.74	76.84	122.94
		10 x 10	23.24	70.44	112.70
		15 x 15	27.77	65.66	105.06
		20 x 20	32.35	62.00	99.20
		25 x 25	36.95	59.04	94.46
		30 x 30	41.57	56.40	90.23
		12 x 6	18.11	74.17	118.67
		20 x 10	20.69	69.16	110.65
		30 x 15	24.06	64.91	103.86
		40 x 20	27.49	61.63	98.61
		50 x 25	30.93	58.76	94.01
		60 x 30	34.39	56.17	89.88
	3.00	6 x 6	25.94	66.14	105.82
		10 x 10	29.23	58.57	93.71
		15 x 15	33.65	53.92	86.28
		20 x 20	38.18	50.59	80.94
		25 x 25	42.75	47.87	76.59
		30 x 30	47.34	45.53	72.85
		12 x 6	24.29	62.56	100.10
		20 x 10	26.65	56.94	91.10
		30 x 15	29.92	52.94	84.71
		40 x 20	33.29	49.91	79.85
		50 x 25	36.70	47.43	75.89
		60 x 30	40.14	45.26	72.42

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 60 to 61)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Tank Substation	4.00	6 x 6	32.34	55.58	88.93
		10 x 10	35.33	48.54	77.66
		15 x 15	39.60	43.56	69.70
		20 x 20	44.06	40.56	64.90
		25 x 25	48.59	38.19	61.10
		30 x 30	53.15	36.18	57.89
		12 x 6	30.65	52.01	83.21
		20 x 10	32.72	46.17	73.87
		30 x 15	35.85	42.49	67.99
		40 x 20	39.15	39.82	63.72
		50 x 25	42.52	37.64	60.22
		60 x 30	45.92	35.77	57.23
	5.00	6 x 6	38.91	52.69	84.30
		10 x 10	41.54	44.78	71.65
		15 x 15	45.63	39.35	62.96
		20 x 20	50.00	35.91	57.45
		25 x 25	54.47	33.37	53.39
		30 x 30	59.00	31.28	50.05
		12 x 6	37.20	48.33	77.33
		20 x 10	38.91	42.36	67.78
		30 x 15	41.85	37.98	60.77
		40 x 20	45.06	35.08	56.13
		50 x 25	48.38	32.76	52.42
		60 x 30	51.75	30.81	49.29

* Table No. 2.63

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.22 the following are the analysis of safe bearing capacity in open foundation:

Zone:-01 (BH No: 62, 63, 66, 68 & 70)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	Up to 3.0	13.92	60.53	96.85
		>3.0 to <6.0	15.33	53.30	85.28
	2.00	Up to 3.0	16.91	57.26	91.62
		>3.0 to <6.0	18.17	49.60	79.36
	3.00	Up to 3.0	23.16	48.33	77.32
		>3.0 to <6.0	23.99	40.30	64.49
	4.00	Up to 3.0	29.74	37.09	59.35
		>3.0 to <6.0	30.02	32.26	51.61
	5.00	Up to 3.0	36.66	34.42	55.07
		>3.0 to <6.0	36.25	27.17	43.47
	6.00	Up to 3.0	43.76	25.76	41.21
		>3.0 to <6.0	42.84	15.88	25.40

* Table No. 2.64

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.22 the following are the analysis of safe bearing capacity in open foundation:

Zone-01: (BH No: 62, 63, 66, 68 & 70)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Room	1.50	5 x 1	11.49	74.34	118.94	223.01
		10 x 2	11.72	65.79	105.26	197.37
		15 x 3	12.50	54.57	87.31	163.70
		20 x 4	13.41	52.30	83.67	156.89
		25 x 5	14.38	50.57	80.91	151.70
		30 x 6	15.38	61.39	98.22	184.16
	2.00	5 x 1	14.64	71.52	114.43	214.56
		10 x 2	14.39	56.89	91.03	170.68
		15 x 3	15.00	49.97	79.95	149.91
		20 x 4	15.84	47.48	75.98	142.45
		25 x 5	16.76	45.64	73.03	136.92
		30 x 6	17.72	55.14	88.23	165.43
	3.00	5 x 1	21.58	57.93	92.69	173.80
		10 x 2	20.04	48.84	78.14	146.51
		15 x 3	20.23	41.30	66.09	123.91
		20 x 4	20.85	38.16	61.05	114.47
		25 x 5	21.64	35.99	57.58	107.97
		30 x 6	22.52	42.94	68.70	128.81
	4.00	5 x 1	29.37	42.42	67.87	127.26
		10 x 2	26.12	38.60	61.76	115.80
		15 x 3	25.74	33.04	52.87	99.13
		20 x 4	26.07	30.12	48.20	90.37
		25 x 5	26.69	27.69	44.31	83.08
		30 x 6	27.45	32.01	51.22	96.03
	5.00	5 x 1	38.02	50.90	81.44	152.69
		10 x 2	32.63	39.62	63.39	118.86
		15 x 3	31.53	32.61	52.18	97.84
		20 x 4	31.51	26.84	42.94	80.51
		25 x 5	31.91	23.22	37.15	69.66
		30 x 6	32.53	25.25	40.39	75.74
	6.00	5 x 1	48.37	64.67	103.47	194.00
		10 x 2	44.91	36.87	59.00	110.62
		15 x 3	43.67	25.38	40.60	76.13
		20 x 4	43.18	18.21	29.14	54.64
		25 x 5	42.84	13.94	22.31	41.83
		30 x 6	42.61	14.13	22.61	42.40

Table No. 2.65

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-01: (BH No: 62, 63, 66, 68 & 70)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	6 x 6	16.10	64.11	102.57
		10 x 10	19.33	55.49	88.78
		15 x 15	23.47	47.90	76.65
		20 x 20	27.64	42.43	67.89
		25 x 25	31.82	38.12	60.99
		30 x 30	36.01	34.62	55.39
		12 x 6	14.58	62.64	100.22
		20 x 10	16.97	54.74	87.58
		30 x 15	20.05	47.62	76.19
		40 x 20	23.17	42.24	67.59
		50 x 25	26.31	37.98	60.77
		60 x 30	29.45	34.52	55.23
	2.00	6 x 6	18.90	58.71	93.93
		10 x 10	22.05	49.53	79.25
		15 x 15	26.14	42.19	67.51
		20 x 20	30.29	36.95	59.13
		25 x 25	34.46	33.00	52.80
		30 x 30	38.65	29.83	47.73
		12 x 6	17.36	56.67	90.67
		20 x 10	19.67	48.63	77.81
		30 x 15	22.72	41.72	66.74
		40 x 20	25.82	36.73	58.77
		50 x 25	28.94	32.85	52.55
		60 x 30	32.07	29.71	47.54
	3.00	6 x 6	24.62	47.63	76.21
		10 x 10	27.56	37.84	60.54
		15 x 15	31.55	31.18	49.89
		20 x 20	35.65	26.71	42.74
		25 x 25	39.79	23.43	37.48
		30 x 30	43.95	20.88	33.41
		12 x 6	23.05	45.05	72.09
		20 x 10	25.16	36.78	58.85
		30 x 15	28.10	30.61	48.98
		40 x 20	31.15	26.35	42.16
		50 x 25	34.24	23.21	37.14
		60 x 30	37.35	20.76	33.22

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ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-01: (BH No: 62, 63, 66, 68 & 70)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	4.00	6 x 6	30.51	36.68	58.69
		10 x 10	33.17	27.45	43.91
		15 x 15	37.02	21.19	33.91
		20 x 20	41.05	17.52	28.04
		25 x 25	45.15	14.98	23.96
		30 x 30	49.28	13.09	20.95
		12 x 6	28.91	34.32	54.91
		20 x 10	30.74	26.11	41.77
		30 x 15	33.55	20.67	33.08
		40 x 20	36.53	17.20	27.53
		50 x 25	39.58	14.76	23.62
		60 x 30	42.66	12.94	20.71
	5.00	6 x 6	36.57	29.47	47.15
		10 x 10	38.89	18.64	29.82
		15 x 15	42.57	12.76	20.41
		20 x 20	46.51	9.74	15.59
		25 x 25	50.55	7.91	12.65
		30 x 30	54.65	6.66	10.65
		12 x 6	34.94	27.03	43.25
		20 x 10	36.43	17.63	28.21
		30 x 15	39.07	12.31	19.70
		40 x 20	41.96	9.52	15.23
		50 x 25	44.96	7.76	12.42
		60 x 30	48.01	6.56	10.49
	6.00	6 x 6	42.61	42.65	65.82
		10 x 10	42.15	27.82	52.34
		15 x 15	41.92	23.54	44.26
		20 x 20	41.80	19.68	26.58
		25 x 25	41.73	13.45	21.02
		30 x 30	41.69	11.26	19.36
		12 x 6	42.03	39.68	61.58
		20 x 10	41.80	23.54	49.76
		30 x 15	41.69	16.78	41.35
		40 x 20	41.63	11.32	22.43
		50 x 25	41.59	9.98	17.02
		60 x 30	41.57	8.67	14.23

* Table No. 2.66

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.23 the following are the analysis of safe bearing capacity in open foundation:

Zone-02: (BH No: 64)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	Up to 3.0	13.07	38.04	60.86
		>3.0 to <6.0	14.50	33.60	53.76
	2.00	Up to 3.0	16.02	35.01	56.02
		>3.0 to <6.0	17.31	30.42	48.68
	3.00	Up to 3.0	22.19	31.10	49.77
		>3.0 to <6.0	23.08	25.80	41.29
	4.00	Up to 3.0	47.31	30.47	48.75
		>3.0 to <6.0	46.97	25.39	40.63
	5.00	Up to 3.0	56.44	30.82	49.31
		>3.0 to <6.0	55.03	26.56	42.49

* Table No. 2.67

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.23 the following are the analysis of safe bearing capacity in open foundation:

Zone-02: (BH No: 64)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Room	1.50	5 x 1	10.71	51.19	81.91	153.58
		10 x 2	11.03	45.31	72.49	135.92
		15 x 3	11.83	34.29	54.87	102.87
		20 x 4	12.76	32.93	52.69	98.80
		25 x 5	13.73	31.88	51.01	95.64
		30 x 6	14.73	38.72	61.95	116.17
	2.00	5 x 1	13.80	49.13	78.61	147.39
		10 x 2	13.66	42.62	68.19	127.86
		15 x 3	14.31	30.55	48.89	91.66
		20 x 4	29.09	46.55	87.28	29.09
		25 x 5	16.09	28.00	44.79	83.99
		30 x 6	17.05	33.84	54.15	101.53
	3.00	5 x 1	20.60	50.62	80.99	151.85
		10 x 2	19.23	30.81	49.29	92.42
		15 x 3	19.47	26.58	42.53	79.75
		20 x 4	20.12	24.50	39.21	73.51
		25 x 5	20.92	23.04	36.87	69.13
		30 x 6	21.81	27.41	43.86	82.24
	4.00	5 x 1	52.74	36.84	60.75	106.32
		10 x 2	45.90	32.41	51.86	97.24
		15 x 3	44.72	27.14	43.43	81.42
		20 x 4	44.94	24.21	38.73	72.62
		25 x 5	45.73	21.80	34.88	65.40
		30 x 6	46.81	24.85	39.76	74.55
	5.00	5 x 1	66.35	38.13	61.01	114.38
		10 x 2	55.86	33.51	53.61	100.52
		15 x 3	53.45	29.20	46.72	87.61
		20 x 4	53.07	25.19	40.31	75.58
		25 x 5	53.49	22.70	36.32	68.09
		30 x 6	54.32	25.77	41.23	77.31

Table No. 2.68

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-02: (BH No: 64)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	6 x 6	15.28	40.44	64.70
		10 x 10	18.50	33.94	54.31
		15 x 15	22.63	29.18	46.69
		20 x 20	26.78	25.76	41.22
		25 x 25	30.95	23.08	36.93
		30 x 30	35.12	20.92	33.47
		12 x 6	13.81	39.51	63.22
		20 x 10	16.21	33.49	53.58
		30 x 15	19.29	29.01	46.41
		40 x 20	22.39	25.65	41.03
		50 x 25	25.51	23.00	36.80
		60 x 30	28.64	20.85	33.37
	2.00	6 x 6	18.05	36.03	57.65
		10 x 10	21.20	29.62	47.40
		15 x 15	25.29	25.18	40.28
		20 x 20	29.42	22.01	35.22
		25 x 25	33.58	19.63	31.40
		30 x 30	37.74	17.72	28.35
		12 x 6	16.57	34.78	55.65
		20 x 10	18.89	29.09	46.54
		30 x 15	21.93	24.89	39.83
		40 x 20	25.02	21.88	35.01
		50 x 25	28.13	19.53	31.26
		60 x 30	31.25	17.65	28.24
	3.00	6 x 6	23.72	30.41	48.65
		10 x 10	26.67	23.35	37.36
		15 x 15	30.66	18.99	30.38
		20 x 20	34.74	16.11	25.77
		25 x 25	38.87	14.02	22.44
		30 x 30	43.01	12.43	19.88
		12 x 6	22.21	28.76	46.02
		20 x 10	24.34	22.70	36.32
		30 x 15	27.28	18.64	29.83
		40 x 20	30.32	15.89	25.43
		50 x 25	33.40	13.89	22.23
		60 x 30	36.50	12.35	19.77

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-02: (BH No: 64)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	4.00	6 x 6	52.98	28.47	45.56
		10 x 10	56.82	19.59	31.35
		15 x 15	62.68	14.40	23.04
		20 x 20	68.88	11.52	18.44
		25 x 25	75.22	9.62	15.40
		30 x 30	81.64	8.27	13.23
		12 x 6	49.87	26.64	42.63
		20 x 10	52.45	18.63	29.82
		30 x 15	56.69	14.05	22.47
		40 x 20	61.26	11.31	18.10
		50 x 25	65.98	9.49	15.18
		60 x 30	70.76	8.17	13.08
	5.00	6 x 6	61.97	30.08	48.12
		10 x 10	65.21	20.39	32.63
		15 x 15	70.77	14.86	23.78
		20 x 20	76.82	11.79	18.86
		25 x 25	83.08	9.82	15.71
		30 x 30	89.43	8.42	13.47
		12 x 6	58.80	27.59	44.15
		20 x 10	60.79	19.29	30.86
		30 x 15	64.74	14.35	22.96
		40 x 20	69.17	11.52	18.43
		50 x 25	73.79	9.64	15.42
		60 x 30	78.51	8.29	13.27

* Table No. 2.69

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.24 the following are the analysis of safe bearing capacity in open foundation:

Zone-03: (BH No: 65 & 69)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	Up to 3.0	14.41	70.20	112.32
		>3.0 to <6.0	16.03	64.42	103.07
	2.00	Up to 3.0	17.69	66.95	107.11
		>3.0 to <6.0	19.14	60.71	97.14
	3.00	Up to 3.0	24.53	57.59	92.15
		>3.0 to <6.0	25.55	51.03	81.65
	4.00	Up to 3.0	31.74	44.98	71.97
		>3.0 to <6.0	32.17	42.98	68.77
	5.00	Up to 3.0	39.34	41.66	66.66
		>3.0 to <6.0	39.03	41.39	66.22
	6.00	Up to 3.0	42.57	70.11	112.18
		>3.0 to <6.0	41.70	69.15	110.65

* Table No. 2.70

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ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.24 the following are the analysis of safe bearing capacity in open foundation:

Zone-02: (BH No: 65 & 69)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Room	1.50	5 x 1	11.79	78.20	125.12	234.61
		10 x 2	12.17	69.21	110.74	207.63
		15 x 3	13.08	63.28	101.25	189.85
		20 x 4	14.12	61.97	99.15	185.90
		25 x 5	15.22	61.12	97.79	183.35
		30 x 6	16.34	75.61	120.98	226.84
	2.00	5 x 1	15.21	75.53	120.85	226.60
		10 x 2	15.08	65.09	104.14	195.27
		15 x 3	15.83	58.42	93.47	175.26
		20 x 4	16.79	56.85	90.95	170.54
		25 x 5	17.83	55.86	89.38	167.59
		30 x 6	18.92	68.96	110.33	206.87
	3.00	5 x 1	22.74	61.52	98.43	184.55
		10 x 2	21.26	53.89	86.23	161.68
		15 x 3	21.56	49.22	78.76	147.67
		20 x 4	22.29	46.90	75.05	140.71
		25 x 5	23.20	45.57	72.91	136.71
		30 x 6	24.20	55.98	89.56	167.93
	4.00	5 x 1	31.22	48.60	77.77	145.81
		10 x 2	27.91	44.45	71.12	133.34
		15 x 3	27.60	40.07	64.11	120.21
		20 x 4	28.03	38.33	61.34	115.00
		25 x 5	28.75	36.90	59.04	110.70
		30 x 6	29.63	44.81	71.69	134.43
	5.00	5 x 1	40.63	42.37	67.79	127.11
		10 x 2	35.04	41.80	66.88	125.40
		15 x 3	33.95	39.48	63.17	118.44
		20 x 4	34.00	36.66	58.66	109.98
		25 x 5	34.50	35.37	56.60	106.12
		30 x 6	35.22	42.83	68.53	128.49
	6.00	5 x 1	46.88	71.10	113.76	213.30
		10 x 2	43.64	70.60	112.97	211.81
		15 x 3	42.57	69.08	110.52	207.23
		20 x 4	42.03	64.27	102.84	192.82
		25 x 5	41.70	60.73	97.17	182.18
		30 x 6	41.49	73.38	117.40	220.13

Table No. 2.71

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-02: (BH No: 65 & 69)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	1.50	6 x 6	16.90	78.97	126.35
		10 x 10	20.53	75.50	120.79
		15 x 15	25.17	73.12	117.00
		20 x 20	29.83	71.58	114.53
		25 x 25	34.51	70.24	112.38
		30 x 30	39.20	69.00	110.40
		12 x 6	15.27	77.15	123.45
		20 x 10	17.96	74.48	119.16
		30 x 15	21.42	72.69	116.30
		40 x 20	24.92	71.27	114.02
		50 x 25	28.42	69.99	111.98
		60 x 30	31.94	68.80	110.08
	2.00	6 x 6	19.98	73.41	117.46
		10 x 10	23.53	69.16	110.65
		15 x 15	28.12	66.65	106.64
		20 x 20	32.77	64.93	103.89
		25 x 25	37.44	63.67	101.87
		30 x 30	42.11	62.53	100.05
		12 x 6	18.33	70.86	113.38
		20 x 10	20.94	67.90	108.64
		30 x 15	24.37	65.89	105.43
		40 x 20	27.84	64.55	103.28
		50 x 25	31.33	63.37	101.39
		60 x 30	34.84	62.28	99.65
	3.00	6 x 6	26.27	62.10	99.35
		10 x 10	29.60	56.67	90.68
		15 x 15	34.08	54.06	86.50
		20 x 20	38.68	52.43	83.90
		25 x 25	43.31	51.19	81.91
		30 x 30	47.97	50.15	80.24
		12 x 6	24.59	58.74	93.98
		20 x 10	26.99	55.09	88.15
		30 x 15	30.30	53.08	84.93
		40 x 20	33.72	51.73	82.76
		50 x 25	37.18	50.72	81.16
		60 x 30	40.67	49.85	79.76

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ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

Zone-02: (BH No: 65 & 69)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Room	4.00	6 x 6	32.75	51.35	82.16
		10 x 10	35.78	46.34	74.14
		15 x 15	40.12	43.23	69.17
		20 x 20	44.64	41.73	66.77
		25 x 25	49.23	40.65	65.03
		30 x 30	53.86	39.77	63.63
		12 x 6	31.04	48.04	76.87
		20 x 10	33.15	44.08	70.52
		30 x 15	36.32	42.17	67.47
		40 x 20	39.66	40.97	65.56
		50 x 25	43.08	40.06	64.10
		60 x 30	46.53	39.31	62.90
	5.00	6 x 6	39.42	49.99	79.98
		10 x 10	42.08	44.31	70.90
		15 x 15	46.24	40.88	65.42
		20 x 20	50.66	39.03	62.44
		25 x 25	55.20	37.82	60.51
		30 x 30	59.79	36.86	58.97
		12 x 6	37.68	45.86	73.37
		20 x 10	39.42	41.92	67.07
		30 x 15	42.40	39.46	63.14
		40 x 20	45.66	38.13	61.01
		50 x 25	49.02	37.13	59.41
		60 x 30	52.44	36.30	58.09
	6.00	6 x 6	41.49	85.85	137.37
		10 x 10	41.06	74.52	119.23
		15 x 15	40.84	68.03	108.85
		20 x 20	40.73	63.05	100.89
		25 x 25	40.67	59.98	95.97
		30 x 30	40.63	57.49	91.99
		12 x 6	40.95	80.57	128.90
		20 x 10	40.73	70.87	113.39
		30 x 15	40.63	64.71	103.54
		40 x 20	40.57	61.30	98.08
		50 x 25	40.54	58.66	93.86
		60 x 30	40.52	56.45	90.32

* Table No. 2.72

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.25 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 67)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	Up to 3.0	13.51	51.51	82.42
		>3.0 to <6.0	15.15	47.81	76.50
	2.00	Up to 3.0	16.75	48.26	77.22
		>3.0 to <6.0	18.24	44.30	70.88
	3.00	Up to 3.0	23.50	41.16	65.86
		>3.0 to <6.0	24.58	36.89	59.03
	4.00	Up to 3.0	30.64	41.06	65.69
		>3.0 to <6.0	31.14	39.50	63.20
	5.00	Up to 3.0	65.30	64.52	103.23
		>3.0 to <6.0	65.73	63.62	101.79

* Table No. 2.73

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.25 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 67)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Control Room	1.50	5 x 1	10.98	61.50	98.40	184.49
		10 x 2	11.44	52.50	84.00	157.50
		15 x 3	12.38	46.44	74.30	139.31
		20 x 4	13.43	45.71	73.14	137.13
		25 x 5	14.53	45.36	72.58	136.08
		30 x 6	15.65	56.16	89.85	168.47
	2.00	5 x 1	14.32	58.54	93.67	175.63
		10 x 2	14.31	47.86	76.58	143.58
		15 x 3	15.09	42.12	67.39	126.35
		20 x 4	16.06	41.22	65.95	123.66
		25 x 5	17.12	40.77	65.23	122.30
		30 x 6	18.21	50.22	80.36	150.67
	3.00	5 x 1	21.70	46.58	74.53	139.75
		10 x 2	20.41	37.91	60.66	113.74
		15 x 3	20.75	35.18	56.29	105.54
		20 x 4	21.51	33.75	54.01	101.26
		25 x 5	22.44	32.94	52.71	98.83
		30 x 6	23.44	40.25	64.40	120.75
	4.00	5 x 1	30.02	44.05	70.48	132.16
		10 x 2	26.97	40.20	64.31	120.59
		15 x 3	26.73	36.57	58.52	109.72
		20 x 4	27.20	35.32	56.52	105.97
		25 x 5	27.94	33.91	54.26	101.73
		30 x 6	28.83	40.83	65.32	122.48
	5.00	5 x 1	58.30	63.12	100.99	189.35
		10 x 2	58.30	63.12	100.99	189.35
		15 x 3	57.17	61.14	97.82	183.41
		20 x 4	59.10	54.37	86.99	163.12
		25 x 5	59.10	54.37	86.99	163.12
		30 x 6	60.77	64.38	103.02	193.15

Table No. 2.74

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 67)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	6 x 6	16.03	58.65	93.84
		10 x 10	19.65	55.00	88.00
		15 x 15	24.28	52.07	83.32
		20 x 20	28.92	49.89	79.82
		25 x 25	33.59	47.96	76.73
		30 x 30	38.25	46.21	73.93
		12 x 6	14.46	57.30	91.68
		20 x 10	17.16	54.26	86.82
		30 x 15	20.61	51.76	82.82
		40 x 20	24.09	49.67	79.47
		50 x 25	27.58	47.79	76.46
		60 x 30	31.08	46.07	73.71
	2.00	6 x 6	19.08	53.47	85.55
		10 x 10	22.63	49.40	79.04
		15 x 15	27.21	46.52	74.43
		20 x 20	31.84	44.34	70.95
		25 x 25	36.49	42.58	68.14
		30 x 30	41.15	41.01	65.61
		12 x 6	17.50	51.61	82.58
		20 x 10	20.12	48.50	77.60
		30 x 15	23.53	45.99	73.59
		40 x 20	26.99	44.08	70.52
		50 x 25	30.48	42.38	67.81
		60 x 30	33.97	40.84	65.35
	3.00	6 x 6	25.31	44.65	71.44
		10 x 10	28.66	39.90	63.85
		15 x 15	33.14	37.13	59.40
		20 x 20	37.71	35.17	56.27
		25 x 25	42.33	33.58	53.72
		30 x 30	46.97	32.20	51.52
		12 x 6	23.71	42.23	67.58
		20 x 10	26.12	38.79	62.07
		30 x 15	29.43	36.45	58.32
		40 x 20	32.84	34.70	55.51
		50 x 25	36.29	33.27	53.23
		60 x 30	39.76	32.01	51.21

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 67)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	4.00	6 x 6	31.74	46.78	74.85
		10 x 10	34.80	40.84	65.35
		15 x 15	39.14	36.65	58.64
		20 x 20	43.65	34.11	54.58
		25 x 25	48.22	32.11	51.37
		30 x 30	52.83	30.42	48.67
		12 x 6	30.11	43.77	70.04
		20 x 10	32.24	38.85	62.16
		30 x 15	35.41	35.75	57.20
		40 x 20	38.75	33.49	53.59
		50 x 25	42.16	31.64	50.63
		60 x 30	45.60	30.07	48.11
	5.00	6 x 6	66.78	75.15	120.24
		10 x 10	72.66	61.30	98.08
		15 x 15	81.27	51.56	82.50
		20 x 20	90.29	45.34	72.55
		25 x 25	99.48	40.82	65.32
		30 x 30	108.76	37.22	59.56
		12 x 6	63.71	68.93	110.29
		20 x 10	67.70	57.99	92.78
		30 x 15	73.95	49.77	79.64
		40 x 20	80.61	44.30	70.88
		50 x 25	87.44	40.08	64.13
		60 x 30	94.36	36.66	58.66

* Table No. 2.75

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.26 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 71 to 73)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	Up to 3.0	13.92	66.60	106.56
		>3.0 to <6.0	15.33	59.66	95.46
	2.00	Up to 3.0	16.91	62.70	100.32
		>3.0 to <6.0	18.17	56.01	89.62
	3.00	Up to 3.0	23.16	52.97	84.75
		>3.0 to <6.0	23.99	47.12	75.39
	4.00	Up to 3.0	29.74	42.09	67.34
		>3.0 to <6.0	30.02	40.99	65.58
	5.00	Up to 3.0	36.66	49.89	79.83
		>3.0 to <6.0	36.25	52.06	83.29

* Table No. 2.76

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.26 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 71 to 73)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Ammonia Storage Control Room	1.50	5 x 1	11.49	74.46	119.14	223.38
		10 x 2	11.72	65.90	105.44	197.70
		15 x 3	12.50	60.04	96.06	180.11
		20 x 4	13.41	57.68	92.29	173.05
		25 x 5	14.38	56.60	90.56	169.81
		30 x 6	15.38	69.77	111.63	209.30
	2.00	5 x 1	14.64	71.66	114.66	214.98
		10 x 2	14.39	61.06	97.70	183.19
		15 x 3	15.00	54.72	87.55	164.15
		20 x 4	15.84	52.53	84.05	157.60
		25 x 5	16.76	51.54	82.47	154.63
		30 x 6	17.72	63.52	101.64	190.57
	3.00	5 x 1	21.58	58.07	92.91	174.20
		10 x 2	20.04	50.27	80.43	150.81
		15 x 3	20.23	45.27	72.43	135.81
		20 x 4	20.85	43.07	68.91	129.21
		25 x 5	21.64	42.07	67.32	126.22
		30 x 6	22.52	51.68	82.69	155.03
	4.00	5 x 1	29.37	45.38	72.61	136.13
		10 x 2	26.12	41.56	66.49	124.67
		15 x 3	25.74	37.49	59.99	112.48
		20 x 4	26.07	36.30	58.08	108.90
		25 x 5	26.69	35.19	56.30	105.57
		30 x 6	27.45	42.83	68.53	128.49
	5.00	5 x 1	38.02	45.96	73.53	137.88
		10 x 2	32.63	47.32	75.72	141.97
		15 x 3	31.53	47.28	75.65	141.84
		20 x 4	31.51	45.87	73.39	137.60
		25 x 5	31.91	44.49	71.19	133.48
		30 x 6	32.53	54.01	86.41	162.03

Table No. 2.77

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ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 71 to 73)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	1.50	6 x 6	16.10	72.86	116.58
		10 x 10	19.33	70.37	112.59
		15 x 15	23.47	69.01	110.42
		20 x 20	27.64	68.39	109.42
		25 x 25	31.82	67.91	108.66
		30 x 30	36.01	67.50	108.01
		12 x 6	14.58	71.19	113.90
		20 x 10	16.97	69.42	111.07
		30 x 15	20.05	68.60	109.77
		40 x 20	23.17	68.09	108.94
		50 x 25	26.31	67.67	108.27
		60 x 30	29.45	67.30	107.69
	2.00	6 x 6	18.90	67.63	108.21
		10 x 10	22.05	64.35	102.96
		15 x 15	26.14	62.79	100.46
		20 x 20	30.29	61.91	99.06
		25 x 25	34.46	61.43	98.29
		30 x 30	38.65	61.04	97.66
		12 x 6	17.36	65.28	104.45
		20 x 10	19.67	63.18	101.09
		30 x 15	22.72	62.07	99.32
		40 x 20	25.82	61.55	98.47
		50 x 25	28.94	61.14	97.82
		60 x 30	32.07	60.80	97.27
	3.00	6 x 6	24.62	57.33	91.72
		10 x 10	27.56	52.83	84.52
		15 x 15	31.55	50.99	81.59
		20 x 20	35.65	50.04	80.06
		25 x 25	39.79	49.42	79.07
		30 x 30	43.95	48.96	78.33
		12 x 6	23.05	54.23	86.77
		20 x 10	25.16	51.36	82.17
		30 x 15	28.10	50.07	80.11
		40 x 20	31.15	49.36	78.98
		50 x 25	34.24	48.96	78.34
		60 x 30	37.35	48.66	77.86

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 71 to 73)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Ammonia Storage Control Room	4.00	6 x 6	30.51	49.08	78.53
		10 x 10	33.17	44.70	71.52
		15 x 15	37.02	42.18	67.48
		20 x 20	41.05	41.17	65.87
		25 x 25	45.15	40.54	64.87
		30 x 30	49.28	40.09	64.15
		12 x 6	28.91	45.92	73.48
		20 x 10	30.74	42.52	68.03
		30 x 15	33.55	41.14	65.83
		40 x 20	36.53	40.42	64.68
		50 x 25	39.58	39.96	63.93
		60 x 30	42.66	39.64	63.42
	5.00	6 x 6	36.57	63.04	100.86
		10 x 10	38.89	56.44	90.30
		15 x 15	42.57	52.71	84.33
		20 x 20	46.51	50.91	81.46
		25 x 25	50.55	49.92	79.87
		30 x 30	54.65	49.21	78.74
		12 x 6	34.94	57.82	92.52
		20 x 10	36.43	53.38	85.42
		30 x 15	39.07	50.88	81.40
		40 x 20	41.96	49.75	79.59
		50 x 25	44.96	49.01	78.42
		60 x 30	48.01	48.48	77.56

* Table No. 2.78

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.27 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 74 to 75)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt for Ammonia area	1.50	Up to 3.0	13.92	32.97	52.75
		>3.0 to <6.0	15.33	30.54	48.87
	2.00	Up to 3.0	16.91	48.11	76.97
		>3.0 to <6.0	18.17	44.15	70.63
	3.00	Up to 3.0	52.37	66.40	106.25
		>3.0 to <6.0	54.08	59.89	95.82
	4.00	Up to 3.0	65.68	53.26	85.22
		>3.0 to <6.0	66.17	51.97	83.16
	5.00	Up to 3.0	79.67	42.83	68.54
		>3.0 to <6.0	78.66	43.70	69.92

* Table No. 2.79

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.27 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 74 to 75)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Conveyor Belt for Ammonia area	1.50	5 x 1	11.49	35.28	56.45	105.84
		10 x 2	11.72	30.99	49.58	92.96
		15 x 3	12.50	29.72	47.55	89.16
		20 x 4	13.41	29.23	46.77	87.70
		25 x 5	14.38	28.98	46.36	86.93
		30 x 6	15.38	36.04	57.66	108.11
	2.00	5 x 1	14.64	42.80	68.48	128.40
		10 x 2	14.39	43.94	70.30	131.82
		15 x 3	15.00	41.98	67.17	125.94
		20 x 4	15.84	41.08	65.73	123.24
		25 x 5	16.76	40.62	64.99	121.86
		30 x 6	17.72	50.45	80.73	151.36
	3.00	5 x 1	49.03	48.11	76.98	144.34
		10 x 2	45.13	61.10	97.76	183.31
		15 x 3	45.41	56.75	90.80	170.26
		20 x 4	46.73	54.56	87.29	163.67
		25 x 5	48.46	53.48	85.56	160.43
		30 x 6	50.41	66.25	106.00	198.75
	4.00	5 x 1	65.17	48.11	76.98	144.34
		10 x 2	57.51	52.08	83.33	156.25
		15 x 3	56.54	47.44	75.91	142.33
		20 x 4	57.23	45.89	73.43	137.67
		25 x 5	58.59	44.62	71.39	133.86
		30 x 6	60.28	54.67	87.47	164.01
	5.00	5 x 1	82.98	41.90	67.05	125.71
		10 x 2	70.73	42.26	67.61	126.77
		15 x 3	68.22	40.59	64.94	121.77
		20 x 4	68.15	38.24	61.19	114.73
		25 x 5	69.05	37.35	59.75	112.04
		30 x 6	70.43	45.68	73.09	137.04

Table No. 2.80

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 74 to 75)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt for Ammonia area	1.50	6 x 6	16.10	37.63	60.21
		10 x 10	19.33	36.58	58.53
		15 x 15	23.47	35.58	56.93
		20 x 20	27.64	34.98	55.96
		25 x 25	31.82	34.45	55.12
		30 x 30	36.01	33.98	54.36
		12 x 6	14.58	36.77	58.83
		20 x 10	16.97	36.09	57.75
		30 x 15	20.05	35.37	56.60
		40 x 20	23.17	34.82	55.71
		50 x 25	26.31	34.33	54.93
		60 x 30	29.45	33.88	54.20
	2.00	6 x 6	18.90	53.72	85.95
		10 x 10	22.05	51.47	82.35
		15 x 15	26.14	49.48	79.18
		20 x 20	30.29	48.10	76.96
		25 x 25	34.46	47.06	75.29
		30 x 30	38.65	46.12	73.79
		12 x 6	17.36	51.85	82.96
		20 x 10	19.67	50.53	80.85
		30 x 15	22.72	48.92	78.28
		40 x 20	25.82	47.81	76.50
		50 x 25	28.94	46.84	74.94
		60 x 30	32.07	45.94	73.50
	3.00	6 x 6	49.62	73.49	117.59
		10 x 10	55.21	68.08	108.92
		15 x 15	62.92	64.10	102.56
		20 x 20	70.86	61.40	98.24
		25 x 25	78.90	59.24	94.78
		30 x 30	86.99	57.37	91.79
		12 x 6	46.13	69.52	111.23
		20 x 10	50.12	66.18	105.89
		30 x 15	55.80	62.94	100.70
		40 x 20	61.71	60.58	96.92
		50 x 25	67.70	58.69	93.91
		60 x 30	73.75	57.03	91.25

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 74 to 75)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt for Ammonia area	4.00	6 x 6	59.88	62.65	100.24
		10 x 10	64.92	57.12	91.40
		15 x 15	72.35	52.59	84.15
		20 x 20	80.16	50.13	80.21
		25 x 25	88.11	48.23	77.17
		30 x 30	96.14	46.64	74.62
		12 x 6	56.32	58.62	93.79
		20 x 10	59.77	54.34	86.94
		30 x 15	65.18	51.30	82.08
		40 x 20	70.95	49.22	78.75
		50 x 25	76.87	47.54	76.06
		60 x 30	82.86	46.11	73.77
	5.00	6 x 6	70.42	53.32	85.31
		10 x 10	74.80	47.63	76.21
		15 x 15	81.90	43.44	69.51
		20 x 20	89.54	41.02	65.63
		25 x 25	97.39	39.33	62.93
		30 x 30	105.36	37.95	60.72
		12 x 6	66.80	48.91	78.25
		20 x 10	69.59	45.05	72.09
		30 x 15	74.67	41.94	67.10
		40 x 20	80.28	40.08	64.12
		50 x 25	86.10	38.62	61.79
		60 x 30	92.02	37.38	59.81

* Table No. 2.81

ALLOWABLE BEARING CAPACITY OF SQUARE FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.28 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 76)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt	1.50	Up to 3.0	15.64	45.87	73.39
		>3.0 to <6.0	17.63	42.48	67.97
	2.00	Up to 3.0	19.39	42.84	68.55
		>3.0 to <6.0	21.20	39.23	62.77
	3.00	Up to 3.0	27.21	38.84	62.14
		>3.0 to <6.0	28.55	34.79	55.66
	4.00	Up to 3.0	35.46	64.54	103.27
		>3.0 to <6.0	36.15	62.81	100.50
	5.00	Up to 3.0	41.87	70.24	112.39
		>3.0 to <6.0	40.95	71.83	114.93

* Table No. 2.82

ALLOWABLE BEARING CAPACITY OF STRIP FOOTING FROM SHEAR PARAMETER

* Based on the design parameters tabulated in Table 1.28 the following are the analysis of safe bearing capacity in open foundation:

(BH No: 76)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)			
			Shear Consideration	Allowable Settlement		
				25mm	40mm	75mm
Conveyor Belt	1.50	5 x 1	12.65	54.74	87.58	164.21
		10 x 2	13.25	45.66	73.05	136.97
		15 x 3	14.40	41.35	66.15	124.04
		20 x 4	15.67	40.66	65.06	121.99
		25 x 5	17.00	40.30	64.49	120.91
		30 x 6	18.35	50.12	80.19	150.36
	2.00	5 x 1	16.51	52.14	83.42	156.42
		10 x 2	16.58	41.59	66.54	124.77
		15 x 3	17.54	37.39	59.82	112.16
		20 x 4	18.72	36.55	58.48	109.65
		25 x 5	20.00	36.10	57.76	108.30
		30 x 6	21.31	44.79	71.66	134.37
	3.00	5 x 1	25.04	42.00	67.19	125.99
		10 x 2	23.63	37.02	59.24	111.07
		15 x 3	24.09	33.19	53.11	99.58
		20 x 4	25.03	31.80	50.88	95.40
		25 x 5	26.16	31.06	49.70	93.19
		30 x 6	27.38	38.36	61.37	115.07
	4.00	5 x 1	34.66	62.48	99.98	187.45
		10 x 2	31.22	63.23	101.16	189.68
		15 x 3	31.01	57.49	91.99	172.47
		20 x 4	31.61	55.53	88.84	166.58
		25 x 5	32.53	53.92	86.28	161.77
		30 x 6	33.62	66.01	105.61	198.03
	5.00	5 x 1	46.44	77.08	123.33	231.25
		10 x 2	43.01	69.25	110.80	207.74
		15 x 3	41.87	66.56	106.50	199.69
		20 x 4	41.30	62.79	100.46	188.36
		25 x 5	40.95	61.39	98.22	184.17
		30 x 6	40.72	75.17	120.27	225.50

Table No. 2.83

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 76)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt	1.50	6 x 6	18.69	52.34	83.75
		10 x 10	23.07	50.68	81.09
		15 x 15	28.63	49.19	78.70
		20 x 20	34.23	48.24	77.19
		25 x 25	39.84	47.42	75.88
		30 x 30	45.46	46.67	74.68
		12 x 6	16.83	51.14	81.83
		20 x 10	50.00	79.99	50.00
		30 x 15	24.24	48.89	78.23
		40 x 20	28.43	48.03	76.84
		50 x 25	32.63	47.26	75.61
		60 x 30	36.84	46.54	74.46
	2.00	6 x 6	22.22	47.69	76.30
		10 x 10	26.51	45.44	72.71
		15 x 15	32.03	43.89	70.22
		20 x 20	37.61	42.85	68.56
		25 x 25	43.21	42.10	67.36
		30 x 30	48.82	41.42	66.28
		12 x 6	20.34	46.03	73.65
		20 x 10	23.50	44.62	71.39
		30 x 15	27.62	43.39	69.42
		40 x 20	31.79	42.59	68.15
		50 x 25	35.98	41.90	67.04
		60 x 30	40.18	41.26	66.02
	3.00	6 x 6	29.44	42.55	68.08
		10 x 10	33.49	39.19	62.70
		15 x 15	38.90	37.42	59.87
		20 x 20	44.41	36.33	58.13
		25 x 25	49.98	35.51	56.81
		30 x 30	55.56	34.82	55.71
		12 x 6	27.53	40.25	64.40
		20 x 10	30.46	38.10	60.95
		30 x 15	34.45	36.74	58.78
		40 x 20	38.56	35.84	57.35
		50 x 25	42.72	35.18	56.29
		60 x 30	46.90	34.61	55.37

ALLOWABLE BEARING CAPACITY OF MAT FOOTING FROM SHEAR PARAMETER

(BH No: 76)

Location	Depth in 'm'	Width of Footing in 'm' (L x B)	Net Safe Bearing Capacity (t/m^2)		
			Shear Consideration	Allowable Settlement	
				25mm	40mm
Conveyor Belt	4.00	6 x 6	36.88	75.64	121.03
		10 x 10	40.61	68.32	109.31
		15 x 15	45.85	62.82	100.52
		20 x 20	51.28	59.81	95.70
		25 x 25	56.80	57.49	91.98
		30 x 30	62.35	55.53	88.84
		12 x 6	34.94	70.77	113.24
		20 x 10	37.54	64.99	103.98
		30 x 15	41.37	61.28	98.05
		40 x 20	45.40	58.72	93.96
		50 x 25	49.51	56.66	90.65
		60 x 30	53.66	54.90	87.83
	5.00	6 x 6	40.72	87.73	140.37
		10 x 10	40.27	77.17	123.47
		15 x 15	40.04	69.56	111.29
		20 x 20	39.92	64.95	103.92
		25 x 25	39.85	61.64	98.62
		30 x 30	39.81	58.89	94.23
		12 x 6	40.15	80.48	128.76
		20 x 10	39.92	73.00	116.79
		30 x 15	39.81	67.14	107.43
		40 x 20	39.75	63.46	101.54
		50 x 25	39.72	60.52	96.83
		60 x 30	39.69	58.01	92.81

* Table No. 2.84

ALLOWABLE BEARING CAPACITY FROM PLATE LOAD TEST

Location	PLT No	Depth in (m)	Plate Size (m)	Footing size (m)	Allowable pressure from PLT graph(when st=25mm)
					For 25mm
Ammonia & Urea Area	01	1.60	0.50	1	28.18
				2	26.53
				3	23.82
				4	22.17
				5	22.02
	02	1.60	0.50	1	15.53
				2	14.32
				3	13.63
				4	13.29
				5	13.14
	03	1.50	0.50	1	27.75
				2	25.68
				3	22.06
				4	21.24
				5	20.08

* T able No. 2.79

- For PLT-01 The Recommended value for the foundation at a depth 1.60 m depth footing size 3 x 3 is 23.82 T/m^2 for 25 mm settlement.
- For PLT-02 The Recommended value for the foundation at a depth 1.60 m depth footing size 3 x 3 is 13.63 T/m^2 for 25 mm settlement.
- For PLT-03 The Recommended value for the foundation at a depth 1.60 m depth footing size 3 x 3 is 22.06 T/m^2 for 25 mm settlement.

As per Client required

For PLT-01 at 2.00 m depth footing size 3 x 3 is 29.78 T/m^2 for 25 mm settlement
2.50 m depth footing size 3 x 3 is 37.22 T/m^2 for 25 mm settlement

For PLT-02 at 2.00 m depth footing size 3 x 3 is 17.04 T/m^2 for 25 mm settlement
2.50 m depth footing size 3 x 3 is 21.30 T/m^2 for 25 mm settlement

For PLT-03 at 2.00 m depth footing size 3 x 3 is 27.58 T/m^2 for 25 mm settlement
2.50 m depth footing size 3 x 3 is 34.47 T/m^2 for 25 mm settlement

ANALYSIS OF LOAD CAPACITIES IN PILE FOUNDATION

BORED CAST IN-SITU PILE:

- The recommended Pile Capacity of bored cast-in-situ RCC Piles for different length and diameters shall be as follows:
- Pile cut-off level is considered as 2.00m below Natural Ground Level (NGL)

ANALYSIS OF LOAD CAPACITIES IN PILE FOUNDATION

Location: - Ammonia Storage Control Room
(BH-59)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	8.50	259.56	224.86	11.15
0.50		292.94	250.10	13.20
0.60		362.42	300.73	17.67
0.75		473.45	377.06	25.26
0.80		512.28	402.60	28.01

* Table No. 3.20

Location: - Ammonia Storage Tank substation
(BH-60 to 61)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	11.00	265.31	235.00	11.50
0.50		298.87	261.44	13.62
0.60		368.41	314.52	18.23
0.75		478.85	394.64	26.05
0.80		517.29	421.48	28.88

* Table No. 3.21

Location: - Ammonia Storage Room
Zone-01: (BH-62 & 66)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	11.50	257.92	225.03	12.18
0.50		290.98	250.38	14.42
0.60		359.75	301.29	19.30
0.75		469.51	378.17	27.58
0.80		507.86	403.93	30.58

* Table No. 3.22

Location: - Ammonia Storage Room
Zone-02: (BH-63, 65, 67, 69 & 70)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	13.00	266.83	233.67	12.18
0.50		300.96	260.02	14.42
0.60		371.91	312.97	19.30
0.75		485.07	392.97	27.58
0.80		524.58	419.79	30.58

* Table No. 3.23

Location: - Ammonia Storage Room
Zone-03: (BH-64)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	12.50	265.23	236.84	12.18
0.50		298.58	263.53	14.42
0.60		367.61	317.13	19.30
0.75		476.97	398.11	27.58
0.80		514.98	425.25	30.58

* Table No. 3.24

Location: - Ammonia Storage Room
Zone-04: (BH-68)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	10.00	234.45	198.07	12.18
0.50		265.30	220.38	14.42
0.60		329.68	265.18	19.30
0.75		433.88	332.82	27.58
0.80		470.48	355.49	30.58

* Table No. 3.25

Location: - Ammonia Storage Room
Zone-05: (BH-71 to 73)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	11.00	269.38	237.59	12.18
0.50		303.57	264.32	14.42
0.60		374.50	317.98	19.30
0.75		487.27	398.96	27.58
0.80		526.56	426.08	30.58

* Table No. 3.26

Location: - Conveyor Belt for Ammonia Area
(BH-74 to 75)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	12.50	267.33	236.98	11.50
0.50		301.15	263.69	13.62
0.60		371.28	317.33	18.23
0.75		482.65	398.35	26.05
0.80		521.42	425.51	28.88

* Table No. 3.27

Location: - Conveyor Belt
(BH-76)

Pile Diameter (m)	Length of Pile below Cut-Off Level (m)	Safe Load Carrying Capacity of Pile (MT)		
		Compression	Uplift / Tension	Lateral Capacity
0.45	12.50	271.43	241.13	11.15
0.50		305.70	268.30	13.20
0.60		376.72	322.86	17.67
0.75		489.43	405.26	25.26
0.80		528.64	432.88	28.01

* Table No. 3.28

DISCUSSION AND CONCLUSION

Based on the field and laboratory test results and the given recommendations the following are summarized:

- Since the project AMMONIA & UREA Area site is having uniform Sub-Soil stratification, boreholes has been grouped in 26 zones (according area wise)
    - BH-01 to BH-04- Cooling Water system for Urea area.
    - BH-05- Substation.
    - BH-06 to BH-09- Cooling Water system for Ammonia area.
    - BH-10 to BH-25- Ammonia Plant. Zone-01 (BH-10 to 13, 15, 17, 19 & 21 to 25) & Zone-02 (BH-14, 16, 18 & 20)
    - BH-26 to BH-47- Urea Plant. Zone-01 (BH-26, 27, 38 & 42), Zone-02 (BH-28 to 30, 33, 39 & 43), Zone-03 (BH-31, 35 & 46), Zone-04 (BH-32), Zone-05 (BH-34 & 44), Zone-06 (BH-36, 37 & 45), Zone-07 (BH-40), Zone-08 (BH-41) & Zone-09 (BH-47).
    - BH-48 to BH-54- Ammonia Plant Substation. Zone-01 (BH-48 to 49 & 51 to 52), Zone-02 (BH-50) & Zone-03 (BH-53 to 54),
    - BH-55- Laboratory Building for Ammonia & Urea area.
    - BH-56 to BH-58- Chiller Station.
    - BH-59- Ammonia Storage Control Room.
    - BH-60 to BH-61- Ammonia Storage Tank Substation.
    - BH-62 to BH-73- Ammonia Storage Room. Zone-01 (BH-62 & 66), Zone-02 (BH-63, 65, 67, 69 & 70), Zone-03 (BH-64), Zone-04 (BH-68) & Zone-05 (BH-71 to 73)
    - BH-74 & BH-75- Conveyor Belt for Ammonia Area
    - BH-76- Conveyor Belt

  Based on bore logs, Field & Laboratory Test results, the following Design Soil Profile has been used for the analysis of Open Foundation and Pile Foundations.

General Observation opinion:

- For AMMONIA & UREA area overally the top surface layer consists of Clayey sand & filledup layer which is dense to very dense in condition and followed by Sand stone & Clay stone.
- Difference in soil strata w.r.to ground levels and water table has been represented in a profile manner (please refer sub-soil profile).
- At project site, it is observed that Sedimentary Rocks composition of Clay stone and Sandstone at deeper depths is present.
- From the analysis of rock tests, it is noted that moderate weathering is formed at entire area with sandstone (fine grained) followed by clay stone.
- Details of rock test details have been given in Annexure-B of the report.

Recommendations for Foundation consideration:

- For lightly loaded structures Shallow/Open foundation of footing size 3.0 x 3.0 m upto 3.00m depth may be considered, please refer TABLE:- 2.01 to 2.84
- For heavy loaded structures i.e. Pile foundation please refer TABLE:- 3.01 & 3.26
- From the test results being performed (in-situ and laboratory), it is clear that there is no requirement of soil improvement in the site location Moreover, the project site is not prone to liquefaction zone.

Suitability of the soils to be used as fill material:

- As per the laboratory test results the soil present at site location is clayey sand with slight plasticity. So it is recommended to use excavated soil as back filling material followed with layer to layer compaction upto maximum density.
- Since they will exhibit slight to no plasticity the soils can be compacted to fairly good compaction and provides good backfill and foundation support.

Ground Water Table

- Cooling Water System for Urea Area the natural ground water table is available at minimum depth of 0.50m to maximum 1.50m.
- Substation Area the natural ground water table is available at minimum depth of 0.50m to maximum 1.50m.
- Cooling Water System for Ammonia Area the natural ground water table is available at minimum depth of 0.00m to maximum 1.00m.
- Ammonia Plant Area the natural ground water table is available at minimum depth of 0.50m to maximum 1.50m.

- Urea Plant Area the natural ground water table is available at minimum depth of 0.0m to maximum 2.50m.
- Ammonia Plant Substation Area the natural ground water table is available at minimum depth of 0.00m to maximum 1.50m.
- Laboratory Building for Ammonia & Urea Area the natural ground water table is available at minimum depth of 4.00m to maximum 5.00m.
- Chiller station Area the natural ground water table is available at minimum depth of 1.00m to maximum 2.00m.
- Ammonia Storage Control Room Area the natural ground water table is available at minimum depth of 1.50m to maximum 2.50m.
- Ammonia Storage Tank Substation Area the natural ground water table is available at minimum depth of 1.00m to maximum 2.00m.
- Ammonia Storage Room Area the natural ground water table is available at minimum depth of 1.00m to maximum 2.00m.
- Conveyor Belt for Ammonia Area the natural ground water table is available at minimum depth of 1.50m to maximum 2.50m.
- Conveyor Belt Area the natural ground water table is available at minimum depth of 1.00m to maximum 2.00m.

NOTES:-

1. LPG CYLINDER MANIFOLD TO BE LOCATED NEAR TO FLAME FRONT GENERATOR (FFG) FOR ALL THE DEDICATED FLARE STACKS (SHALL BE PROVIDED BY VENDOR).
2. ALL FLARE STACKS ARE LOCATED IN A COMMON DERRICK STRUCTURE.
3. ALL TEMPERATURE ELEMENT SHALL BE K TYPE & DUPLEX.
4. LEVEL TRANSMITTER SHALL BE DIAPHRAGM SEAL TYPE.
5. PROVISION FOR ALTERNATE FUEL ARRANGEMENT FOR IGNITING PILOT BURNERS.
6. ASSIST GAS REQUIREMENT SHALL BE CONFIRMED / FINALIZED BY PKG. VENDOR DURING DETAIL ENGG.
7. LP STEAM SHALL BE PROVIDED FOR STEAM COIL TO VAPORIZE ANY LIQUID ACCUMULATION AND FOR STEAM TRACING PURPOSE, IF ANY.
8. THE IGNITION PANEL SHALL BE LOCATED AT GROUND LEVEL, IN SAFE AREA. PILOT BURNERS SHALL BE EQUIPPED WITH A DEDICATED FLAME DETECTOR COMPLETE WITH RELEVENT SIGNAL LAMPS.
9. EMERGENCY POWER / REDUNDANT POWER SUPPLY SHALL BE PROVIDED FOR FLAME FRONT GENERATOR (VENDOR'S SCOPE).
10. ULTRASONIC FLOW TRANSMITTER TO BE GIVEN BY VENDOR, WHICH SHALL BE INTEGRATED WITH DCS & IN VENDOR'S SCOPE.
11. MINIMUM REQUIRED CONTINUOUS PURGE STREAM FOR MOLECULAR SEAL, SHALL BE PROVIDED BY VENDOR.
12. INSTRUMENTS, CV ETC., SHOWN IN P&ID (FOR SINGLE FLARE) ARE TENTATIVE. ALL REQUIRED INSTRUMENTATION, CONNECTION WITH DCS / LOGIC REQUIRED FOR SAFE OPERATION & MAINTENANCE SHALL BE IN PACKAGE VENDOR'S SCOPE.
13. VENDOR TO PROVIDE KOD, WHEREVER REQUIRED AS PER THEIR CALCULATION.
14. WHEREVER THERE IS APPROACH OR MAINTENANCE IS REQUIRED, PERSONAL PROTECTION INSULATION SHALL BE PROVIDED BY BIDDER.
15. CONNECTION FOR IGNITION PANEL (UNDER VENDOR'S SCOPE). INSTRUMENT AIR SUPPLIED BY PDIL / OWNER.
16. MOC SHALL BE LTCS / KCS.
17. ARRANGEMENT OF TEMPURGE SHALL BE PROVIDED BY VENDOR AS PER BEST ENGINEERING PRACTICE & REQUIRED INSTRUMENTATION (INCLUDING TT, PT ETC.) ALONG WITH REQUIRED LOGIC SHALL BE IN VENDOR'S SCOPE. SUPPLY & INSTALLATION OF ALL THE INSTRUMENTS SHALL BE IN VENDOR'S SCOPE.
18. HEIGHT / DEPTH OF SEAL SHOULD BE DESIGNED FOR A MINIMUM OF 175% OF THE KOD's MAXIMUM OPERATING PRESSURE.
19. TOP OF LIQUID SEAL PIPE ELEVATION TO BE SAME AS NO LIQUID LEVEL IN KOD.
20. CONNECTION LOCATION IN STACK IS ONLY INDICATIVE. VENDOR TO CONNECT AS PER THEIR ENGINEERING.
21. HEIGHT / DEPTH OF SEAL SHOULD BE DESIGNED FOR A MINIMUM OF 175% OF THE STACK's MAXIMUM OPERATING PRESSURE.
22. TOP OF LIQUID SEAL PIPE ELEVATION TO BE BELOW STACK DRAIN CONNECTION.

FITTING LEGENDS:-

SR. NO.	SYMBOL	DESCRIPTION
1		GATE VALVE
2		GLOBE VALVE
3		NON RETURNING VALVE
4		SPECTACLE BLIND
5		SELF OPERATING PRESSURE REDUCING VALVE
6		PNEUMATIC OPERATED VALVE
7	RO	RESTRICTION ORIFICE
8		REDUCER / EXPANDER
9		STEAM COIL
10	T	STEAM TRAP

LINE LEGENDS:-

SR. NO.	SYMBOL	DESCRIPTION
1	---·—·---	BY VENDOR
2	— — —	ELECTRICAL SUPPLY
3	- - - - - -	STEAM TRACING

REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
0	08.09.22	FOR TENDER PURPOSE	KC/SNS	DSC	AKG

CLIENT: TALCHER FERTILIZERS LIMITED

REV. 0

SHEET : 1 OF 1

SCALE : N.T.S.

TITLE: SCHEMATIC ARRANGEMENT FOR FLARE SYSTEM PACKAGE (OSBL)

DWG. NO : PC183–7517–0046

PROJECT: INTEGRATED COAL BASED FERTILIZER COMPLEX AT TALCHER, ANGUL DISTRICT, ODISHA (INDIA)

FILE. NO :

PROJECTS AND DEVELOPMENT INDIA LTD, NOIDA