



**COMPOSITE SUPPLY CUM ERECTION OF ELECTRICAL & INSTRUMENTATION WORKS  
ON ITEM RATE BASIS  
AT TALCHER FERTILIZERS LIMITED  
NIT NO. : PNP/PC-183/E/8003/NCB Dated 09.03.2023  
AMENDMENT No.: I Dated 28.03.2023**



Sl. No.	Reference of Bidding Document				Existing Clause	Amended Clause
	Vol-I/ Sec	Page No.	Clause No.	Subject / Heading		
<b>SECTION VI</b>						
<b>PROJECT DESCRIPTION &amp; SCOPE OF WORK</b>						
1	ITB	89 of 1065	Cl. 38.6	CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT ((CPS/SD)	In addition to existing specified form (i.e. Demand Draft (DD)/ Banker's Cheque/ Bank Guarantee/Letter of Credit) mentioned in tender documents for submission of EMD/ Security Deposit/ Contract Performance Security, the successful bidder can also submit the EMD/ Security Deposit/ Contract Performance Security through online banking transaction i.e. IMPS/NEFT/RTGS/SWIFT etc. For this purpose, the detail 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 " <b>EMD/ Security</b>	<b><u>The referred Para is amended as hereunder</u></b> In addition to existing specified form (i.e. Demand Draft (DD)/ Banker's Cheque/ Bank Guarantee/Letter of Credit) mentioned in tender documents for submission of <del>EMD/</del> Security Deposit/ Contract Performance Security, the successful bidder can also submit the <del>EMD/</del> Security Deposit/ Contract Performance Security through online banking transaction i.e. IMPS/NEFT/RTGS/SWIFT etc. For this purpose, the detail 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



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					<b>Deposit/ Contract Performance Security against FOA/DLOA no. __ (contractor to specify the FOA/DLOA No.)</b> 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.	immediately after receipt of FOA. While remitting such online transaction, the bidder must indicate “ <del>EMD/ Security Deposit/ Contract Performance Security against FOA/DLOA no. __ (contractor to specify the FOA/DLOA No.)</del> ” 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.
2	ITB	107 of 1065	Cl. 5.1 B of Annexure-II to Section -III	PROCESS OF EVALUATION OF PERFORMANCE OF VENDORS/ SUPPLIERS/ CONTRACTORS/ CONSULTANTS	Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant <b><u>(under clause no. 34.2.3 of GCC).</u></b>	<b><u>The referred Para is amended as hereunder</u></b> Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant <b><u>(under clause no. 32 (C) of GCC).</u></b>



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	Vol-I/ Sec	Page No.	Clause No.	Subject / Heading		
3	ITB	109 of 1065	Cl. 5.3 B of Annexu re-II to Section -III	PROCESS OF EVALUATION OF PERFORMANCE OF VENDORS/ SUPPLIERS/ CONTRACTORS/ CONSULTANTS	Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant <b><u>(under clause no. 34.2.3 of GCC).</u></b>	<b><u>The referred Para is amended as hereunder</u></b> Where Poor/Non-Performance leading to termination of contract or Offloading of contract due to poor performance attributable to Vendor/Supplier/ Contractor/Consultant <b><u>(under clause no. 32 (C) of GCC).</u></b>
4	ITB	127 of 1065	Cl. No. 37 of Annexu re- IV to Section -III	BIDDING DATA SHEET (BDS)	State of India of which stamp paper is required for Contract Agreement: Uttar Pradesh.	<b><u>The referred clause is amended as hereunder</u></b> State of India of which stamp paper is required for Contract Agreement: Uttar Pradesh/ <b><u>State where Bidder's registered office is located.</u></b>
5	ITB	152 of 1065			Blank Page	Page no 152 of 1065 to be considered as <b><u>DELETED.</u></b>
6	Section- V		Cl. 40.2	Terms of Payment		New clause added in Payment terms: <b><i>For Material supplied in "Lot": Payment shall be done on pro-rata basis as approved &amp; certified by Engineer In-charge. However, Bidder</i></b>



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	Vol-I/ Sec	Page No.	Clause No.	Subject / Heading		
						<b><i>shall submit the billing break-up for “ Lot Items” for approval of Engineer In-charge</i></b>
7	Section VI- 2.0			Technical Specification Electrical Works (Supply & Erection)		Typical SLD of MLDB attached.
8	Section VI- 2.0			Technical Specification Electrical Works (Supply & Erection)		Typical details of SS Air Termination attached.
9	Section VI- 2.0	955 of 1065		Technical Specification Electrical Works (Supply & Erection)		<b>Additional Vendors for Transformers – 11 kV &amp; Below</b> a. Atlanta Electricals Pvt. Ltd b. Esennar Transformers (P) Ltd. c. Indcoil Transformers Pvt. Ltd. d. Raychem RPG Private Limited
10	Section : VI – 5.0	967 of 1065		Vendor List		<b>Vendors for PA System</b> a. CG power and Industrial Solution Limited, India b. Philips India Limited, India c. Tata Telecom Limited, India d. Armtel LLC, Russia



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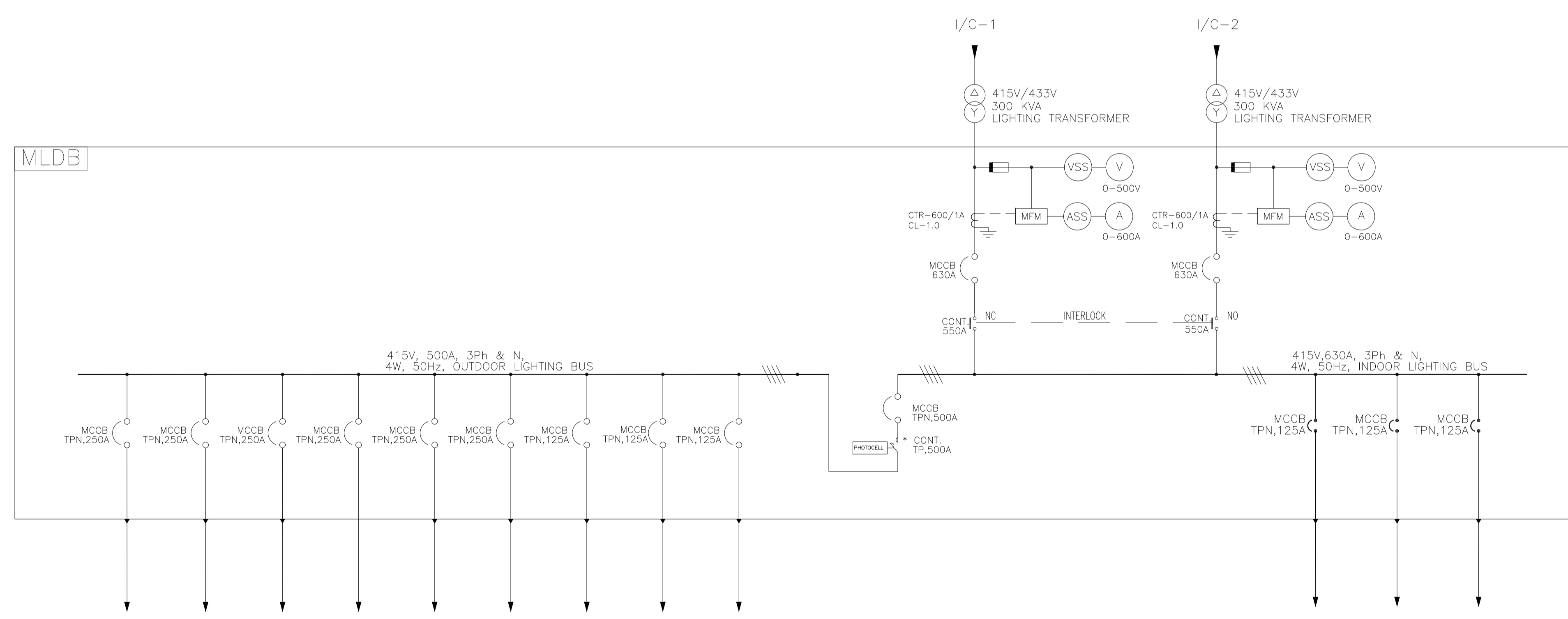
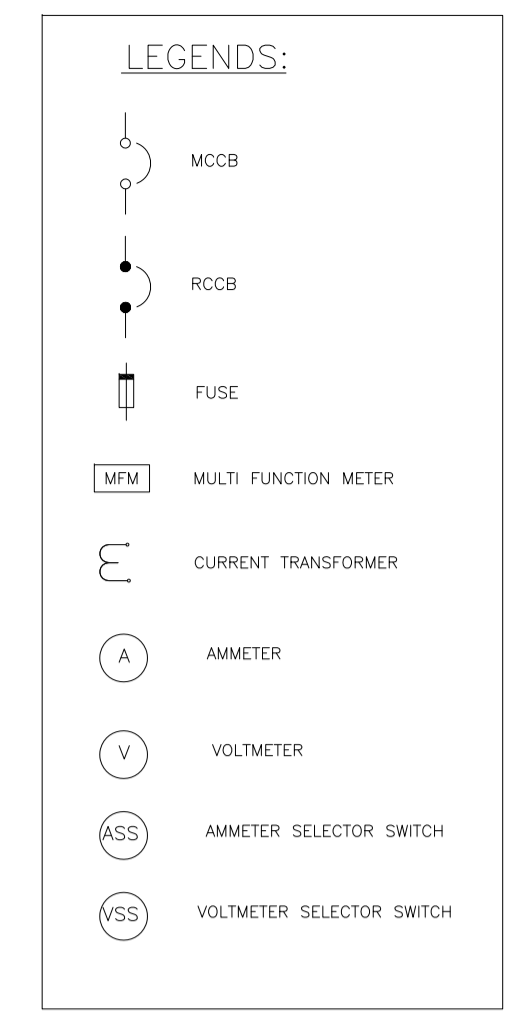
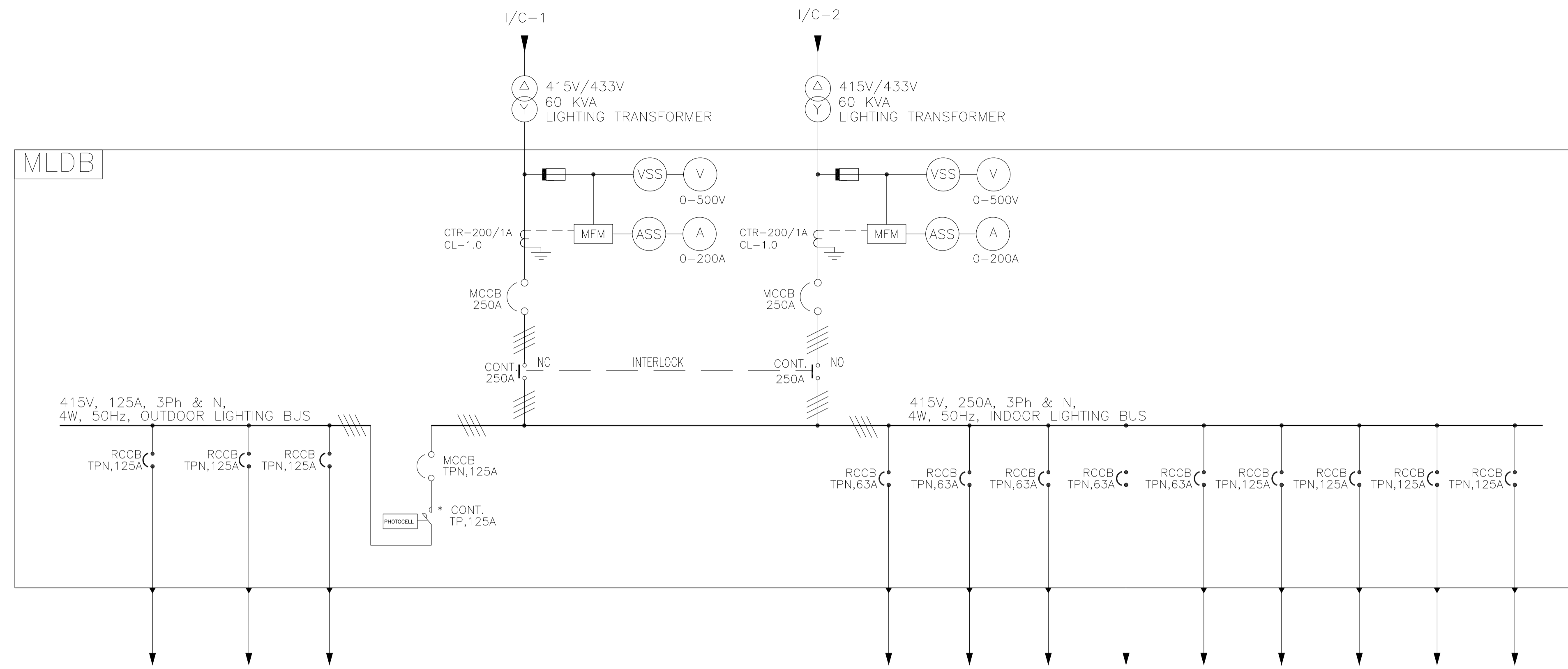
Sl. No.	Reference of Bidding Document				Existing Clause	Amended Clause
	Vol-I/ Sec	Page No.	Clause No.	Subject / Heading		
						<p>e. Control PTE Ltd., Singapore f. Neumann GmbH Elektronik, Germany g. Motorola Singapore PTE Ltd., Singapore h. GAI Tronics Srl, UK</p> <p><b>Vendors for 11 kV Switchboard</b> a. ABB Ltd., India b. Siemens Ltd., India c. BHEL (Electrical Machines Divn.), India d. Schneider Electric, India</p>
11	Section-VI	709 of 1065	5.7.8	Control cabinets, Panels/consoles, Interface with Other system	5.7.8 Interface with other third party specification including all hardware and software like CCTV system, EPBAX system, PLC system is also in bidder's scope.	Only clause 5.7.8 (Interface with other third party specification including all hardware and software like CCTV system, EPBAX system, PLC system is also in bidder's scope) Stands <b>deleted</b> .
12	Section-VI			Technical Specification (ADP Drawings )		Typical ADP drawing is attached.



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Sl. No.	Reference of Bidding Document				Existing Clause	Amended Clause
	Vol-I/ Sec	Page No.	Clause No.	Subject / Heading		
13	Section-VI			Technical Specification (OFC Cable- 12 Fiber)		Specification is attached.
14	Section-VI			Technical Specification (Supply of Pressure Gauge)		Pressure Gauge Spec is attached

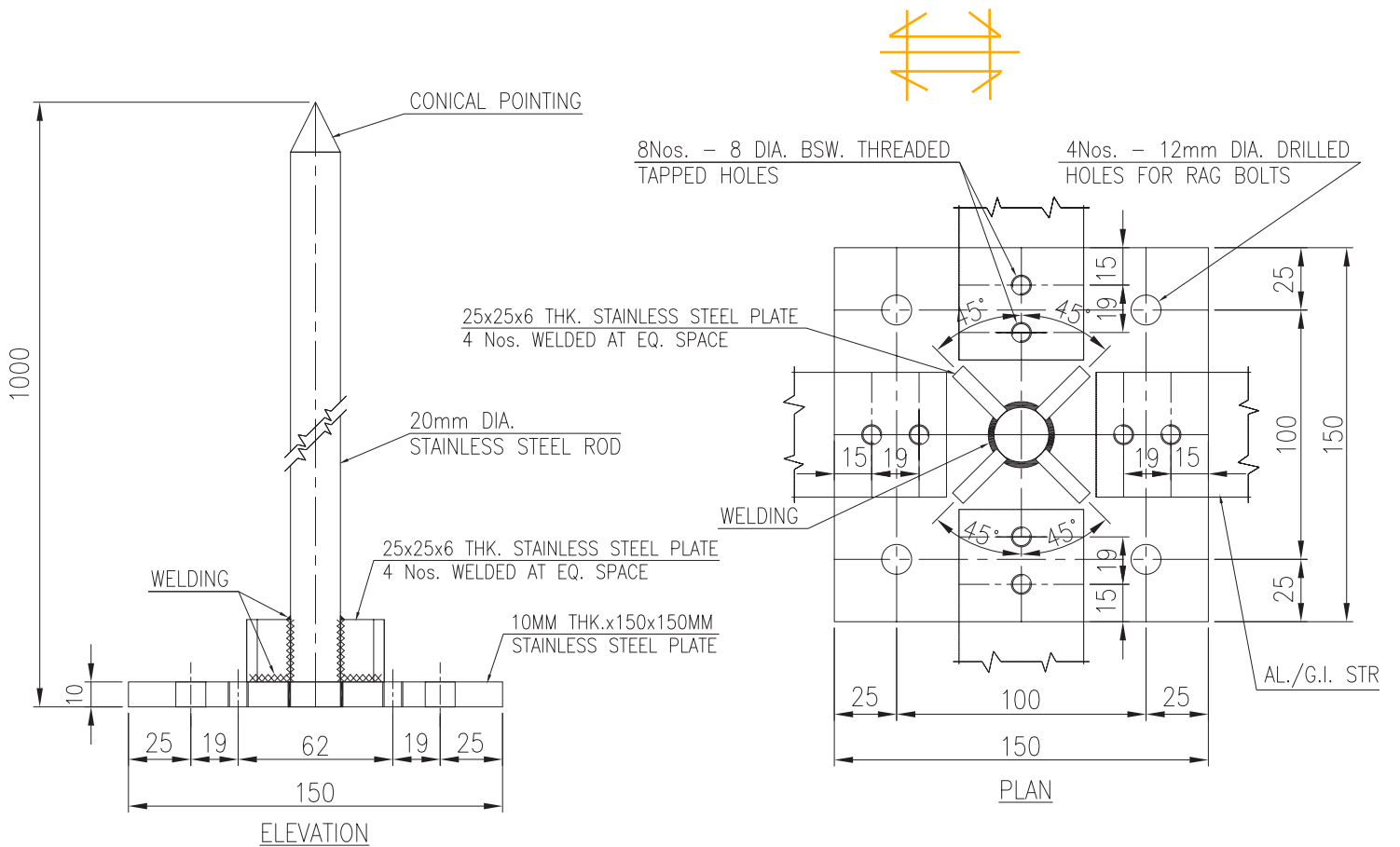


FOR TENDER PURPOSE

**GENERAL NOTES:**

1. BUSBAR MATERIAL - COPPER
2. SYSTEM VOLTAGE - 415V, 3φ N, 50HZ
3. DEGREE OF PROTECTION (IEC 60529) - IP54.
4. PAINT SHADE - RAL 7032.

0	23.03.23	ISSUED FOR TENDER	SS	SS	SKB
REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
		CLIENT:- TALCHER FERTILIZER LIMITED	REV. 0		
			SHEET 1 OF 1		
			SCALE: N.T.S.		
PROJECT:-		ELECTRICAL & INSTRUMENT SUPPLY CUM ERECTION WORKS	DRG. NO.- PC183-1253		
TITLE:-		TYPICAL SINGLE LINE DIAGRAM (MLDB)	FILE:		
		प्रोजेक्ट्स एंड डेवलपमेंट इंडिया लिमिटेड नोएडा PROJECTS & DEVELOPMENT INDIA LTD.-NOIDA			

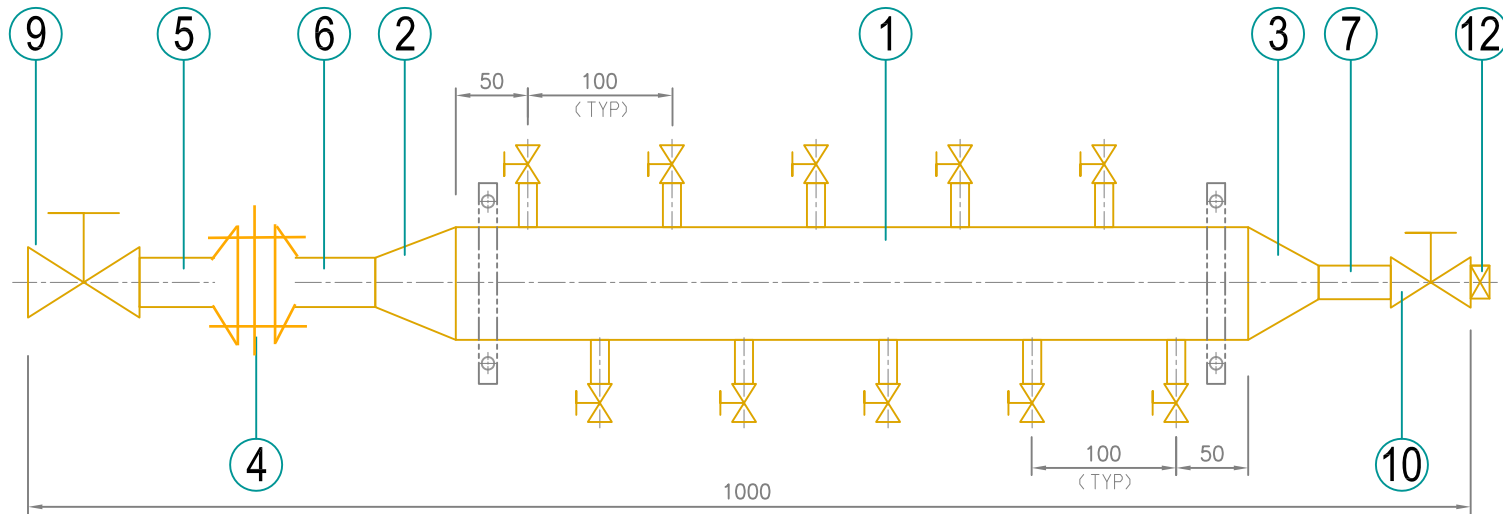


STAINLESS STEEL AIR TERMINATION ROD

NOTES :

1. MATERIAL : STAINLESS STEEL ROD 20MM DIA., PLATE 10MM THK. & 6MM THK.  
AS PER GRADE : AISI SS304.
2. FINISH : NATURAL FINISH.
3. UNLESS OTHERWISE STATED ALL DIMENSIONS ARE IN MM.





**AIR DISTRIBUTION POT**  
( 10 TAKE-OFF )

12	PLUG (1/2" NPTM)	3000#	SS 304	1 No.
	<b>DELETED</b>			
10	BALL VALVE (1/2" NPTFx NPTF)	800#	SS 304	10 No.
9	BALL VALVE (1" NPTFx NPTF)	800#	SS 304	1 No.
	<b>DELETED</b>			
7	SEAMLESS NIPPLE (1/2" NPTM xPLAIN, 75MM LG)	SCH-80s	SS 304	1 No.
6	SEAMLESS NIPPLE (1" NPTM x PLAIN, 100MM LG)	SCH-80s	SS 304	10 No.
5	SEAMLESS NIPPLE (1" NPTM x NPTM, 100MM LG)	SCH-80s	SS 304	1 No.
4	3 PIECE UNION SUITABLE FOR 1" PIPE (NPTF)	3000#	SS 304	1 No.
3	REDUCER (1 1/2" x 1/2")	3000#	SS 304	1 No.
2	REDUCER (1 1/2" x 1")	3000#	SS 304	1 No.
1	SEAMLESS PIPE (1 1/2" NB)	SCH-80s	SS 304	1 No.
PART NO.	DESCRIPTION	RATING	MATERIAL	QTY

**NOTES :**

1. ALL DIMENSIONS ARE IN MM.
2. THE LENGTH OF PART No. 5, 6 & 7 MAY BE REDUCED OR INCREASED TO MAKE THE OVERALL LENGTH OF ONE METER.
3. DRAWING NOT TO SCALE.

<b>TYPICAL SKETCH OF PIPE FITTINGS</b>	SK7240 - 00	00	AV	SKT	SKT	1 OF 1
	PDIL DRG. NO.	REV	REV DT	PREPD	REVWD	APPD SHEET

	PROJECTS & DEVELOPMENT INDIA LTD	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 1 OF 15	

**TECHNICAL SPECIFICATIONS  
FOR  
12 FIBRE OPTICAL FIBRE CABLE**

**PROJECT: TFL**

P	24.03.2023	24.03.2023	ISSUED FOR TENDER	SG	RKR	RKR
REV	REV DATE	EFF DATE	PURPOSE	PREPD	REVWD	APPD

## INDEX

- 1 Introduction
- 2 Quality Requirements
- 3 Cable Marking
- 4 Raw material
- 5 Documentation
- 6 Safety
- 7 Operating Requirement
- 8 Cable Ends
- 9 The nominal drum length
- 10 Colour coding in O.F. Cables
- 11 Specifications of Optical Fibres
- 12 Optical Fibre Cable Construction Specifications
- 13 Mechanical Characteristics and tests on OFC
- 14 Check of the quality of loose tube
- 15 Drainage Test for loose tube
- 16 List of abbreviations
- 17 List of documents referred

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 3 of 15	

## TECHNICAL SPECIFICATIONS OF METAL FREE OPTICAL FIBRE CABLE

### 1.0 INTRODUCTION

This document describes the specifications of metal free Optical Fibre Cable (multi loose tube construction design) for underground installation in ducts, The optical fibre cable shall have low weight, small volume and high flexibility. The optical fibre cable shall be suitably protected for the ingress of moisture by flooding jelly and by water sellable tape. The raw material used in the cable shall meet the requirements of the specs for the raw materials.

### 2.0 QUALITY REQUIREMENTS

The cable shall be manufactured in accordance with the international quality standards ISO 9000 series of standards for which the manufacturer should be duly accredited.

### 3.0 CABLE MARKING

- 3.1 A suitable marking which can last long shall be applied in order to identify this cable from other cables. The cable marking shall be imprinted/ indented. The marking on the cable shall be indelible of durable quality and at regular intervals of one meter length. Alternatively permanent printing with the laser (the impression shall not exceed the depth of 0.15 mm) shall also be acceptable.
- 3.2 The markings must clearly contrast with the surface. The colours used must withstand the environmental influences experienced in the field.
- 3.3 The marking shall be in black colour over the orange colour nylon jacket.
- 3.4 The accuracy of the sequential marking must be within  $-0.25\%$  to  $+0.5\%$  of the actual measured length. The sequential length markings must not rub off during normal installation. The total length of the cable and cable length / drum shall not be in negative tolerance.
- 3.5 The type of legend marking on O.F. cable shall be as follows:
  - a) Company Legend
  - b) Legend containing telephone mark & international acceptable Laser symbol.
  - c) Type of Fibre.
  - d) Number of Fibres.
  - e) Year of manufacture.
  - f) Sequential length marking at every one meter.
  - h) Drum number

### 4.0 Raw Material:

- 4.1 The HDPE Red/Black in colour used for sheath shall be UV stabilised. A test certificate from a recognized laboratory or institute may be acceptable for the UV stability of the HDPE sheath material.
- 4.2 The material used in optical fibre cable must not evolve hydrogen that will effect the fibre loss.

### 5.0 DOCUMENTATION

Complete technical literature in English with detailed cable construction diagram of various sub-components with dimensions & test data and other details of the cable shall be provided. All aspects of installation, operation, maintenance shall also be covered in the handbook.

### 6.0 SAFETY REQUIREMENT


The material used in the manufacturing of the metal free optical fibre cables shall be non toxic and dermatologically safe in its life time.

### 7.0 OPERATING REQUIREMENT

- 7.1 The design and construction of metal free optical cable shall be inherently robust and rigid under all conditions of operations, installation, adjustment, replacement, storage and transport.
- 7.2 The optical fibre cable shall be able to work in a saline atmosphere in coastal areas and should be protected against corrosion.
- 7.3 Life of cable shall be at least 25 years. Necessary statistical calculations shall be submitted by the manufacturer, based upon life of the fibre and other component parts of the cable. The cable shall meet the cable aging test requirement.
- 7.4 It shall be possible to operate and handle the metal free optical fibre cable with. Any special tool required for operating and handling the optical fibre cable, the same shall be provided along with the cable.

### 8.0 CABLE ENDS

- 8.1 Both cable ends (the beginning end and end of the cable reel) shall be sealed and readily accessible. Minimum 5 meter of the cable at the beginning end of the reel shall be accessible for testing. Both ends of the cable shall be kept inside the

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 4 of 15	

drums and shall be located so as to be easily accessible for the test. The drum should be marked to identify the direction of rotation of the drum. Both ends of cable shall be provided with cable pulling (grip) stocking and the anti twist device (free head hook).

- 8.2** An anti twist device (Free head hook) shall be provided attached to the front end of the cable pulling arrangement. The arrangement of the pulling eye and its coupling system along with the anti twist system shall withstand the prescribed tensile load applicable to the cable.

### 9.0 THE NOMINAL DRUM LENGTH

9.1 The OFC cable shall be supplied in 4 km drum with a tolerance of  $\pm 1\%$ . However, the overall OFC quantity shall be within  $+1\%$  of the ordered quantity. Measurement for the purpose of payment shall be physical length of the cable.

9.2 The fibre in cable length shall not have any joint.

9.3 The drum shall be marked with arrows to indicate the direction of rotation.

9.4 Packing list supplied with each drum shall have at least the following information:

- a) Drum No.
- b) Type of cables
- c) Physical cable length
- d) No. of fibres
- e) Length of each fibre as measured by OTDR i.e. Optical Length
- f) The cable factor – ratio of fibre length(optical length) / cable length
- g) Attenuation per Km. of each fibre at 1310, 1383 & 1550 nm.
- h) User's / Consignee's Name.
- i) Manufacturer's Name, Month, Year and Batch No.
- j) Group refractive index of fibres

### 10.0 COLOUR CODING IN O.F. CABLES

**10.1** The colorant applied to individual fibres, fibre units and binders shall be readily identifiable throughout the lifetime of the cable and shall match and confirm to the MUNSSELL COLOUR STANDARDS (FOR EIA STANDARD EIA-359A) and also IEC Publications 304 (4).

**10.2** Colour code to be adapted for individual fibres in loose tube shall be:

1. Red, White (Milky White) in loose tube No. 1
2. Blue, White (Milky White) in loose tube No. 2
3. Orange, White (Milky White) in loose tube No. 3
4. Green, White (Milky White) in loose tube No. 4
5. Brown, White (Milky White) in loose tube No. 5
6. Slate, White (Milky White) in loose tube No. 6

**10.3** Colour Code to be adapted for individual loose tubes shall be :

There shall be marking to indicate the Loose tube no. "1". The marking tube shall be in "Blue Colour". The tracing color shall be Orange. These two colour tubes shall be placed adjacent to each other. The counting shall be from Blue to Orange.

1. Loose tube No. 1 shall be of Blue colour
2. Loose tube No. 2 shall be of Orange colour
3. Loose tube No. 3 shall be of Natural/Aqua colour
4. Loose tube No. 4 shall be of Natural/Aqua colour
5. Loose tube No. 5 shall be of Natural/Aqua colour
6. Loose tube No. 6 shall be of Natural/Aqua colour

### 11.0 SPECIFICATION OF OPTICAL FIBRES

Single Mode Optical Fibre used in manufacturing optical fibre cables shall be as per ITU – T Rec. G 652 D.

The specifications of optical fibres are mentioned below:



# TECHNICAL SPECIFICATIONS FOR OFC

PC/183/E/8003/NCB


P

DOCUMENT NO

REV

SHEET 5 of 15

Type of fiber (Wavelength band optimized nominal 1310 nm):	Single mode
<b>Geometrical Characteristics</b>	
Nominal MFD For matched clad	8.8 – 9.8 $\mu\text{m}$
Nominal cladding Dia	125 $\mu\text{m} \pm 1.0 \mu\text{m}$
Cladding Non-circularity	$\leq 1\%$
Mode field concentricity error	$\leq 0.6 \mu\text{m}$
Diameter over primary coated with double UV cured acrylate (shall be measured on un-coloured fibre)	245 $\mu\text{m} \pm 10 \mu\text{m}$
<b>Transmission Characteristics</b>	
<b>Attenuation</b>	
<ul style="list-style-type: none"> <li>a) Fibre attenuation before cabling <ul style="list-style-type: none"> <li>i) At 1310 nm</li> <li>ii) Between 1285 to 1360 nm</li> <li>iii) Between 1480 to 1525 nm</li> <li>iv) At 1550 nm</li> <li>v) Between 1525 to 1625 nm</li> </ul> </li> <li>b) Water Peak Attenuation before cabling Between 1360 – 1480 nm</li> </ul>	<ul style="list-style-type: none"> <li><math>\leq 0.34 \text{ dB/Km}</math></li> <li><math>\leq 0.37 \text{ dB/Km}</math></li> <li><math>\leq 0.34 \text{ dB/Km}</math></li> <li><math>\leq 0.21 \text{ dB/Km}</math></li> <li><math>\leq 0.24 \text{ dB/Km}</math></li> </ul>
<p>Note :</p> <ol style="list-style-type: none"> <li>1. Sudden irregularity in attenuation shall be less than 0.1 dB</li> <li>2. The spectral attenuation shall be measured on un-cabled fibre.</li> <li>3. The spectral attenuation in the 1250 nm – 1625 nm band shall be measured at an interval of 10 nm and the test results shall be submitted</li> </ol>	$\leq 0.34 \text{ dB/Km}$
<ul style="list-style-type: none"> <li>a) Fibre attenuation after cabling <ul style="list-style-type: none"> <li>i) At 1310 nm</li> <li>ii) At 1550 nm</li> <li>iii) At 1625 nm</li> </ul> </li> <li>b) Water Peak Attenuation after cabling <ul style="list-style-type: none"> <li>i) At 1383 nm</li> <li>ii) Between 1360 – 1480 nm</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><math>\leq 0.36 \text{ dB/Km}</math></li> <li><math>\leq 0.23 \text{ dB/Km}</math></li> <li><math>\leq 0.26 \text{ dB/Km}</math></li> </ul>
<p>Note: Water Peak Attenuation after cabling shall be measured either at 1383 nm or between 1360 – 1480 nm.</p>	
<p><b>A) Total Dispersion</b>  In 1285 – 1330 nm band  In 1270 – 1340 nm band  At 1550 nm</p>	<ul style="list-style-type: none"> <li><math>\leq 3.5 \text{ ps/nm.Km}</math></li> <li><math>\leq 5.3 \text{ ps/nm.Km}</math></li> <li><math>\leq 18.0 \text{ ps/nm.Km}</math></li> </ul>
<p><b>B) Polarization mode dispersion at 1310 &amp; 1550 nm</b>  Fibre  Cabled Fibre</p>	<ul style="list-style-type: none"> <li><math>\leq 0.2 \text{ ps}/\sqrt{\text{Km}}</math></li> <li><math>\leq 0.3 \text{ ps}/\sqrt{\text{Km}}</math></li> </ul>
<p>Note : Measurement on un-cabled fibre may be used to generate cabled fibre statistics and correlation established</p>	

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 6 of 15	

	C) Zero Dispersion Slope D) Zero Dispersion wave length range	$\leq 0.092$ ps/(nm $\cdot$ km) 1300 - 1324 nm
	a) Cut off wavelength for fibres used in cables Note – The above cut off wave length is w.r.t 2 M sample length of fibre b) Cable Cut off wavelength	1320 nm Max  1260 nm Max
<b>Mechanical Characteristics</b>		
	<ul style="list-style-type: none"> <li>• Proof test for minimum strain level</li> <li>• Strippability force to remove primary coating of the fibre</li> </ul> Note: The force required to remove 30 mm $\pm$ 3 mm of the fibre coating shall not exceed 8.9 N and shall not be less than 1.3 N. <ul style="list-style-type: none"> <li>• Dynamic Tensile Strength</li> <li>a) Un-aged</li> <li>b) Aged</li> <li>• Dynamic Fatigue (Test method IEC-60793-1)</li> <li>• Static Fatigue (Test method IEC-60793-1)</li> </ul>	1% $1.3 \leq F \leq 8.9$ N  $\geq 550$ KPSI (3.80 Gpa) $\geq 440$ KPSI (3.00 Gpa) $\geq 20$ $\geq 20$
	Change in attenuation measured at 1550 nm when fibre is coiled with 100 turns on 30 $\pm$ 1.0 mm radius mandrel.	$\leq 0.05$ dB
	Fibre Curl (Test method as per IEC-60793-1)	$\geq 4$ meters radius of curvature
	Fibre micro bend (1 turn around 32 $\pm$ 0.5 mm diameter mandrel)	$\leq 0.5$ dB at 1550 nm
<b>MATERIAL PROPERTIES</b>		
	Fibre Materials  a) The substances of which the fibres are made.  b) Protective materials requirement  <ul style="list-style-type: none"> <li>• The physical and chemical properties of the material used for the fibre primary coating and for single jacket fibre.</li> <li>• The best way of removing protective coating material</li> </ul>	Bidder to specify           It shall meet the requirement of fibre coating stripping force as per clause no. 11.10           To be indicated by the Manufacturer.

## 12.0 OPTICAL FIBRE CABLE CONSTRUCTION SPECIFICATIONS

### 12.1 SECONDARY PROTECTION:

The primary coated fibres may be protected by loose packaging within a tube, which shall be filled with thixotropic jelly

Number of fibres: 12

Number of loose tubes: 6

Number of fibres per loose tube: 2 (two)

Material for loose tube shall be Nylon /Polybutylene terephthalate. The diameter of loose tube shall be 2.4mm + 0.2mm without any negative tolerance. The colour of fibres and loose tubes shall be as per given in clause no. 10.2 & 10.3. Bidder to specify the outer and inner diameter of the loose tube

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 7 of 15	

## 12.2 STRENGTH MEMBER:

- a) Solid FRP non-metallic strength member with a minimum diameter of 2.5 mm in the cable core shall be provided. The strength member(s) in the cable shall be for strength and flexibility of the cable and shall have anti buckling properties. These shall also keep the fibre strain within permissible values.
- b) To achieve the required tensile strength of the optical fibre cables, the manufacturer, shall use Aramid Yarn along with solid Rigid FRP Rod. The use of solid rigid FRP Rod(s) is mandatory in Optical Fibre Cable design. The Aramid yarn shall be equally distributed over the periphery of the cable core. The quantity of the Aramid yarn per km length of the cable along with its dimensions shall be indicated by the manufacturer.
- c) If bidder's cable design does not use aramid yarn in cable construction, bidder shall confirm that the tensile load requirement as per specifications shall be met without usage of aramid yarn. Cable Core Assembly: Primary coated fibres in loose tubes stranded together around a central strength member using helical or reverse lay techniques shall form the cable core. Two fibres shall be placed loosely in each loose tube.

12.3 Core Wrapping: The main cable core containing fibres shall be wrapped by a layer/layers of Polyester foil/tape. The nylon/ polyester binder thread shall be used to hold the tape.

12.4 Moisture barrier (protection): The main cable core (containing fibres & core wrapping) shall be protected by flooding compound (Jelly) having properties of non-hygroscopic dielectric material and by water swellable tape. The core wrapping shall not adhere to the secondary fibre coating.

12.5 Filling compound: The filling compound used in the loose tube and in the cable core shall be compatible to fibre, secondary protection of fibre, core wrapping etc. The drip point shall not be lower than +70 degree C. The fibre movement shall not be constrained by stickiness & shall be removable easily for splicing. Reference material test method to measure drip point shall be as per ASTM D 556. The filling and the flooding jelly compound shall be as per the TEC specs No. G/ORM-01/03 MAR 04.

12.6 Sheath: A non-metallic moisture barrier sheath may be applied over and above the cable cores. The core shall be covered with tough weather resistant High Density, Polyethylene (HDPE) sheath red/ black in colour (UV stabilized) and Colour shall conform to Munsell Colour Standards. Thickness of the sheath shall be uniform & shall not be less than 1.8 mm including the strength members if used in the sheath. The sheath shall be circular, smooth, free from pin holes, joints, mended pieces and other defects, Reference test method to measure thickness shall be as per IEC 189 para 2.2.1 and para 2.2.2.

Note: In case HDPE material black in colour is used, the material from finished product shall be subjected to following tests (on sample basis)

1. Density
2. Melt Flow Index
3. Carbon Black Content
4. Carbon Black Dispersion
5. ESCR
6. Moisture Content
7. Tensile Strength and Elongation at break

12.7 Outer Jacket: A circular Sheath / Jacket of not less than 0.65 mm thick of polyamide -12 / nylon - 12 material (orange colour), free from pin holes, scratches and other defects etc. shall be provided over and above the HDPE sheath. The nylon Jacket shall have smooth finish and hydrocarbon resistant.

12.8 Cable diameter: Bidder to specify the cable diameter. Bidder to note that the cable diameter shall be between 13-14 mm and the diameter of the finished cables shall be within  $\pm 0.5$  mm of the diameter indicated by the bidder.

12.9 RIP Cord: The suitable rip cord(s) shall be provided which shall be used to open the HDPE sheath of the cable. The rip cord(s) shall be properly waxed to avoid wicking action and shall not work as a water carrier.

## 13.0 MECHANICAL CHARACTERISTICS AND TESTS ON OPTICAL FIBRE CABLES


### 13.1 Tensile strength Test:

Objective: This measuring method applies to optical fibres cables which are tested at a particular tensile strength in order to examine the behaviour of the attenuation as a function of the load on a cable which may occur during installation.

Method : IEC 794 – 1 – E1

Test Specs.: The cable shall have sufficient strength to withstand a load of value  $T(N) = 9.81 \times 2.5 W$



	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 8 of 15	

Newtons or 2670 N whichever is higher. (Where W=mass of 1 km of cable in Kg). The load shall be sustained for 10 minutes and the strain of the fibre monitored.

Requirement: The load shall not produce a strain exceeding 0.25% in the fibre and shall not cause any Permanent physical and optical damage to any component of the cable. The attenuation shall be noted before strain and after the release of strain. The change in attenuation of each fibre after the test shall be  $\leq 0.05$  dB both for 1310 nm and 1550 nm wavelength

### 13.2 Abrasion Test:

Objective: To test the abrasion resistance of the sheath and the marking printed on the surface of the cable.

Method: IEC – 794-1-E2 or by any other international test method (ETSI).

### 13.3 Crush Test (Compressive Test):

Objective: The purpose of this test is to determine the ability of an optical fibre cable to withstand crushing.

Method: IEC 794 -1-E3.

Test Spec: The fibres and component parts of the cable shall not suffer permanent damage when subjected to a compressive load of 2000 Newtons applied between the plates of dimension 100 x 100 mm. The load shall be applied for 60 secs. The attenuation shall be noted before and after the completion of the test.

Requirement: The change in attenuation of the fibre after the test shall be  $< 0.05$  dB both for 1310 nm and 1550 nm wavelength

### 13.4 Impact Test:

Object The purpose of this test is to determine the ability of an optical fibre cable to withstand impact.

Method: IEC 794-1-E4

Test Spec.: The cable shall have sufficient strength to withstand an impact caused by a mass weight of 50 Newtons, when falls freely from a height of 0.5 meters. The radius R of the surface causing impact shall be 300 mm. Ten such impacts shall be applied at the same place. The attenuation shall be noted before and after the completion of the test.

Requirement: The change in attenuation of the fibre after the test shall be  $< 0.05$  dB both for 1310 nm and 1550 nm wavelength.

### 13.5 Repeated Bending:

Objective: The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated bending.

Method: EIA-455-104

Test Specs.: The cable sample shall be of sufficient length (5 m minimum) to permit radiant power measurements as required by this test. Longer lengths may be used if required.

#### Parameters

Weight:	5 Kg
Minimum distance from Pulley center to holding device:	216 mm
Minimum device from Wt. To Pulley center:	457 mm
Pulley Diameter (D-cable diameter):	20D
Angle of Turning:	90°
No. of cycles:	30
Time requirement for 30 cycles:	2 min

Requirement: During this test no fibre shall break and the attenuation shall be noted before and after the completion of the test. The change in attenuation of the fibre after the test shall be  $< 0.05$  dB both for 1310 nm and 1550 nm wavelength.

### 13.6 Torsion Test:

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 9 of 15	

Object: The purpose of this test is to determine the ability of an optical fibre cable to withstand torsion.

Method: IEC 794-1-E7

Test Spec.: The length of the specimen under test shall be 2 meters and the load shall be 100 N. The Sample shall be mounted in the test apparatus with cable clamped in the fixed clamp sufficiently tight to prevent the movement of cable sheath during the test. One end of the cable shall be fixed to the rotating clamp, which shall be rotated in a clockwise direction for one turn. The sample shall then be returned to the starting position and then rotated in an anti-clock wise direction for one turn and returned to the starting position. This complete movement constitutes one cycle. The cable shall withstand ten such complete cycles. The attenuation shall be noted before and after the completion of the test

Requirement: The cable shall be examined physically for any cracks, tearing on the outer sheath and for the damage to other component parts of the cable. The twist mark shall not be taken as damage. The change in attenuation of the fibre after the test shall be < 0.05 dB both for 1310 nm and 1550 nm wave length.

#### 13.7 Kink Test:

Object: The purpose of this test is to verify whether kinking of an optical fibre cable results in Breakage of any fibre, when a loop is formed of dimension small enough to induce a kink on the sheath.

Method: IEC 794-1-E10

Test Spec.: The sample length shall be 10 times the minimum bending radius of the cable. The sample is held in both hands, a loop is made of a bigger diameter and by stretching both the ends of the cable in opposite direction, the loop is made to the minimum bend radius, and no kink shall form, the cable is then normalized and attenuation reading is taken.

Requirement: The kink should disappear after normalizing the cable. The change in attenuation of the fibre after test shall be < 0.05 dB both for 1310 nm & 1550 nm wavelength.

#### 13.8 Cable Bend Test:

Objective: The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated flexing. The procedure is designed to measures optical transmittance changes and requires an assessment of any damage occurring to other cable components.

Method: IEC 794-1-E11 (Procedure –I).

Test Spec.: The fibre and the component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped 4 complete turns of 10 complete cycles around a mandrel of 20 D, where D is the diameter of the cable. The attenuation shall be noted before and after the completion of the test.

Requirement: The change is attenuation of the fibre after the test shall be < 0.05 dB both for 1310 nm and 1550 nm wavelength. Sheath shall not show any cracks visible to the naked eye when examined whilst still wrapped to the mandrel.

#### 13.9 Temperature Cycling:

Objective: To determine the stability behavior of the attenuation of a cable subjected to Temperature changes which may occur during storage, transportation and usage.

Method: IEC 794-1-F1.

Test Specs. The permissible temperature range for storage and operation will be from –20°C to +70°C. The rate of change of temperature during the test shall be 1° per minute approx.

The cable shall be subjected to temperature cycling for 12 Hrs. at each temperature as given below:

TA2 temp: - 20°C

TA1 temp: -10°C

TB1 temp: +60°C

TB2 temp: +70°C

The test shall be conducted for 2 cycles at the above temperatures.

Requirement: The change in attenuation of the fibre under test shall be < 0.05 dB for 1310 nm and 1550 nm wavelength for the entire range of temperature.

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 10 of 15	

#### 13.10 Water Penetration Test:

Objective: The aim of this test is to ensure that installed jelly filled Metal free Optical fibre cable will not allow water passage along its length.

Method: IEC 794-1-F5(Fig. B) 1992.

Test Specs. A circumferential portion of the cable end (with HDPE sheath, after removing the nylon jacket) shall face the water head. The water tight sleeve shall be applied over the cable. The cable shall be supported horizontally and two meter head of water, containing a sufficient quantity of water soluble fluorescent dye for the detection of seepage, shall be applied on the HDPE sheath for a period of 7 days at ambient temperature.

Requirement: No dye shall be detected when the end of the 3 m length is examined with ultraviolet light Detector. The cable sample under test shall be ripped open after the test and it shall be examined for seepage of water into the cable and the distance to be noted.

#### 13.11 Flexural Rigidity Test on the optical fibre cable:

Objective: To check the Flexural Rigidity of the metal free optical fibre cable.

Method: To be tested as per ASTM D-790

Test Specs. The fibre and the component parts of the cable shall not suffer permanent damage in the Cable subjected to Flexural Rigidity Test as per the above method. The attenuation shall be noted after and before the completion of the test.

Requirement: The change in attenuation of the fibre after the test shall be  $\leq 0.05$  dB both for 1310 nm and 1550 nm wavelength. The sheath shall not show any cracks visible to the naked eye.

#### 13.12 Test of Figure of 8 (eight) on the cable:

Objective: Check of easiness in formation of figure of 8 of the cable during installation in the field.

Test Method: 1000 meter of the cable shall be uncoiled from the cable reel and figure of 8 (eight) shape shall be made from the cable. The dimensions of each loop of the figure of 8 shall be maximum 2 meters.

Requirement: It shall be possible to make figure of 8 of minimum 1000 meters of the cable uncoiled from the cable reel without any difficulty. No visible damage shall occur.

#### 13.13 Cable aging Test:

Objective: To check the cable material change dimensionally as the cable ages.

Method: At the completion of temperature cycle test, the test cable shall be exposed to  $85 \pm 2$  degree C for 168 hours. The attenuation measurement at 1310 & 1550 nm wave length to be made after stabilisation of the test cable at ambient temperature for 24 hours.

Requirement: The increase in attenuation allowed:  $\leq 0.05$  dB at 1310 & 1550 nm.

Note: The attenuation changes are to be calculated with respect to the base line attenuation values measured at room temperature before temperature cycling.

#### 13.14 Static Bend test:

Objective: To check the cable under Static bends

Method: As per the clause no. 13.8 of the GR alternatively as per ASTM D790 Test Specs the cable shall be subjected to static bend test. The optical fibre cable shall be bend on a mandrel having a radius of 10 D (D- is diameter of the cable).

Requirement: The change is attenuation of the fibre after the test shall be  $\leq 0.05$  dB both for 1310 nm and 1550 nm wavelength. Sheath shall not show any cracks visible with the naked eye when examined whilst wrapped on the mandrel.

### 14.0 CHECK OF THE QUALITY OF THE LOOSE TUBE (CONTAINING OPTICAL FIBRE)

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 11 of 15	

(a) Embrittlement Test of Loose Tube

The test method is based on bending by compression and reflects embrittlement much better than the other used tensile test. The test is independent of wall thickness of the loose tube.

Sample: The minimum length of the test sample depends on the outside, diameter of the loose tube and should be 85 mm for tubes upto 2.5 mm outside dia. The length of the bigger tubes should be calculated by using the following equation:

$$L_o > 100 * \sqrt{(D_2 + d_2)/4}$$

Where  $L_o$  = Length of tube under test

$D$  = Outside dia of loose tube

$d$  = Inside dia of loose tube

Procedure: Both the ends of a buffer tube test sample may be mounted in a tool which is clamped in jaws of a tensile machine which exert a constant rate of movement. The movable jaw may move at a rate of 50 mm per minute toward the fixed jaw. Under load the tube will be bent, so that the tube is subjected to tensile and compressive stresses. The fixture for holding the tube should be designed in a manner that the tube might bend in all directions without further loading.

Requirement: The tube should not get embrittled. No kink should appear on the tube upto the safe bend dia of tube (20 D) where D is the outside diameter of the loose tube. There should not be any physical damage or mark on the tube surface.

(b) Kink Resistance Test on the loose tube

To safeguard the delicate optical fibers, the quality of the loose tube material should be such that no kink or damage to the tube occur while it is being handled during installation and in splicing operations. To check the kink resistance of the loose tube, a longer length of the loose tube is taken (with fibre and gel), a loop is made and loop is reduced to the minimum bend radius of loose tube i.e. 20 D. (where D is the outside dia of the loose tube). This test is to be repeated 4 times on the same sample length of the loose tube.

Requirement: No damage or kink should appear on the surface of the tube.

**15.0 DRAINAGE TEST FOR LOOSE TUBE**

Sample Size: 30 cm tube length.

Test Procedure

1. Cut the tube length to 40 cm
2. Fill the tube with the tube filling gel ensuring there are no air bubbles and the tube is completely full.
3. Place the filled tube in a horizontal position on a clean worktop and cut 5 cm from each end so that the finished length of the sample is 30 cm.
4. Leave the filled tube in a horizontal position at an ambient temperature for 24 hrs. (This is necessary because the gel has been sheared and the viscosity has been reduced during the filling process).
5. The sample tube is then suspended vertically in an heat oven over a weighted beaker. It is left in the oven at a temperature of 70°C for a period of 24 Hrs.
6. At the end of the 24 Hrs period the beaker is checked and weighted to see if there is any gel in then beaker.


Requirement:

1. If there is no gel or oil in the beaker the tube has PASSED the drainage test.
2. If there is gel or oil in the beaker the tube has FAILED the drainage test.

Check of easy removal of sheath:

Check of the easy removal of sheath of the optical fibre cable by using normal sheath removal tool.

(To check easy removal: The sheath shall be cut in circular way and the about 300 mm lengths of the sheath should be removed in one operation. It should be observed during sheath removal process that no undue extra force is applied and no component part of the cable is damaged. One should be able to remove the sheath easily).

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 12 of 15	

Note:-Easy removal of both the outer jacket and the inner sheath shall be checked separately.

a) Effect of aggressive media on the cable surface (Acidic and alkaline behaviour) To check the effect of the aggressive media solution of PH4 and PH10 shall be made. The two test samples of the finished cable each of 600 mm in length are taken and the ends of the samples are sealed. These test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. on the sheath and other markings of the cables.

Requirement : The sample should not show any effect of these solution on the sheath and other marking of the cable

#### LIST OF ABBREVIATIONS

ASTM -	American Society for Testing and Materials
FRP -	Fibre Reinforced Plastic
HDPE -	High Density Polyethylene
IEC -	International Electro –Technical Commission
ISO -	International Standard Organizations
ITU-T -	International Telecommunication Union- Transmission
KV -	Kilo Volt
MFD -	Mode Field Diameter
OF -	Optical Fibre
OTDR -	Optical Time Domain Reflect meter
QA -	Quality Assurance
QM -	Quality Manual
RMS -	Root Mean Square
UV -	Ultra Violet
KM -	Kilo meter
dB -	decibel
Ps/nm -	pico second/ nano meter
nm -	nanometer
µm -	micrometer
Gpa -	Gega Pascal
SMOF -	Single Mode Optical Fibre
Ps -	pico second
°C -	Degree Celsius
N -	Newton
EIA -	Electronic Industry Association
KPSI -	Kilopascal per sq. inch
F -	Force

#### LIST OF DOCUMENTS REFERRED TO:

1. Specification for environmental Testing QM 333 (Issue 1 – Sep.'90) Issued by D.O.T. QA) with latest amendments, if any
2. Specification for Optical Joint Closure TEC specs No. GR/OJC-02/02 SEPT 03 with latest amendments, if any
3. Specification Protection Sleeve TEC specs No. G/PTS-01/01 APR 94 with latest amendments, if any
4. Raw Material TEC specs No. G/ORM-01/03 MAR 04
5. Colour Standards EIA 359 –A and IEC Publication 304(4) with latest amendments, if any
6. ITU-T Recommendation G. 652 D and 654
7. Generic requirement for Optical Fibre cable. (Bell core) GR –20 – CORE July 98 with latest amendments, if any
8. Operation & handling TEC specs No. G/OFT-01/03 APR 2006
9. Test Method:  
IEC 811-5-1 IEC 794-1-E1 IEC 794-1-E2 IEC 794-1-E3  
IEC 794-1-E4 IEC 794-1-E7 IEC 794-1-E10 IEC 794-1-E11  
IEC 794-1-F1 IEC 794-1-F3 IEC 794-1-F5 IEC 455-104  
EIA / TIA – 455-181 IEC-60793-1

#### PURCHASERS NOTE

	<b>TECHNICAL SPECIFICATIONS FOR OFC</b>	PC/183/E/8003/NCB	P
		DOCUMENT NO	REV
		SHEET 13 of 15	

- (1) The bidder shall submit clause wise compliance to the tender specifications including clauses pertaining to inspection, sampling, rejection, factory acceptance testing and purchaser's note.
- (2) The bidder shall submit a copy of all the specification sheets duly signed and stamped on each page by authorized signatory
- (3) The bidder shall submit the list of the customers where the bidder has already supplied the optical fibre cable along with the performance report from the end user's. The bidder shall also furnish the record specifying the quantity of the cable supplied along with the date of supply.
- (4) Bidder shall also confirm that the ofc with multi tube construction has been manufactured and supplied in the past by the bidder. Bidder to submit the proof of the same.
- (5) The bidder shall submit approval certificate from telecommunication engineering centre (tec) for manufacturing of the optical fibre cables.
- (6) The bidder shall also submit the proof of the manufacturing capacity of the optical fibre cable. This shall be supported by the certificate from the tec.
- (7) Bidder to specify the source of the raw materials used for manufacturing of OFC and also confirm that the raw materials are approved by telecommunication engineering centre. The same shall be supported by type approval certificate from tec.
- (8) The bidder shall offer the cable as per the cross sectional drawing enclosed in the tender. Any deviation with respect to the enclose cross sectional drawing may be indicated by the bidder in his offer
- (9) The cable should undergo all the acceptance routine & optional tests as marked above to meet the purchaser's specific requirement.
- (10) All the details of manufacturing / test equipments available along with their make / type etc. Should be furnished along with the bid. Also the current order booking/ loading should be furnished by the vendor.
- (11) The cable shall be packed and supplied station wise (as per the summary of requirement) drums according to standard practice to avoid any damage during transit and handling at site.
- (12) Vendor shall supply test certificates before dispatch of the material.
- (13) The cables are subjected to purchaser's inspection at vendors works prior to dispatch.
- (14) The owner/owner's representative shall carry out the final inspection of the material. However, before final inspection by owner the vendor shall carry out the in house inspection on the finished cables and submit the results for owner's review. The tests during the in house inspection and the final inspection shall be as per the codes and procedures defined in the specifications. During inspection all the tests shall be carried out on the same sample. The vendor shall be equipped with the equipment / machinery to conducts such tests.
- (15) The internal inspection by manufacturer and final inspection by owner shall be carried out as per the inspection plan attached at annexure-i
- (16) the vendor shall submit qa/qc procedures and inspection plan for owner's review and approval before manufacturing the cables. Manufacturing by the vendor and inspection by owner shall be carried out in accordance with the approved qa/qc procedures and inspection plan.
- (17) Cable drum should be marked properly.
- (18) In case, no deviation/ exceptions to this specification are mentioned, it shall be taken as granted that vendor agrees to the customer's specification requirements.
- (19) Vendor shall offer optical fibre cable in line with the specific requirements given above

**ANNEXURE-I**

Sl. No.	Characteristic / Test	Sample for Internal Inspection by Manufacturer	Sample for Final Inspection by Owner
1.	Cut Off Wavelength	100% of ordered quantity	10% of ordered quantity
2.	Mode Field Diameter	-do-	-do-
3.	Chromatic Dispersion <ul style="list-style-type: none"> <li>• 1270 – 1340 nm</li> <li>• 1285 – 1330 nm</li> <li>• 1550nm</li> </ul>	-do- -do- -do-	-do- -do- -do-
4.	Zero Dispersion Wavelength	-do-	-do-
5.	Zero Dispersion Slope	-do-	-do-
6.	Fibre Geometry <ul style="list-style-type: none"> <li>• Clad Diameter</li> <li>• Core / Clad Concentricity Error</li> <li>• Clad Non Circularity</li> <li>• Coating Diameter</li> </ul>	-do- -do- -do- -do-	-do- -do- -do- -do-
7.	Polarization Mode Dispersion at 1310nm and 1550 nm	-do-	-do-
8.	Attenuation <ul style="list-style-type: none"> <li>• 1625 nm</li> <li>• 1550 nm</li> <li>• 1310 nm</li> <li>• Water Peak Attenuation at 1383 nm</li> <li>• Water Peak Attenuation between 1360 –1480 nm</li> </ul>	100%	100%
9.	Length	100%	10% of ordered quantity
10.	Mechanical Tests		
a.	Tensile Strength Test	100% of ordered quantity	10% of ordered quantity
b.	Abrasion Test	100% of ordered quantity	10% of ordered quantity
c.	Crush Test	-do-	-do-
d.	Impact Test	-do-	-do-
e.	Repeated Bend Test	-do-	-do-
f.	Torsion Test	-do-	-do-
g.	Kink Test	-do-	-do-
h.	Cable Bend Test	-do-	-do-
i.	Temperature Cycling Test	Nil	1 drum / batch of

Sl. No.	Characteristic / Test	Sample for Internal Inspection by Manufacturer	Sample for Final Inspection by Owner
			production
j.	Cable Ageing Test	Nil	1 drum / batch of production
k.	Flexural Rigidity Test	100% of ordered quantity	10% of ordered quantity
l.	Test of Figure of Eight	1 drum / batch of production	1 drum / batch of production
m.	Static Bend Test	100% of ordered quantity	10% of ordered quantity
n.	Check of the quality of loose tube	1 drum / batch of production	1 drum / batch of production
o.	Drainage Test for loose tube	100% of ordered quantity	10% of ordered quantity
p.	Check of easy removal of sheath	1 drum / batch of production	1 drum / batch of production
11.	Physical Dimensions	100%	10% of ordered quantity
a.	Cable Diameter	-do-	-do-
b.	Sheath Thickness	-do-	-do-
c.	Jacket Thickness	-do-	-do-
d.	FRP Diameter	-do-	-do-
12.	Water Penetration Test	-do-	-do-
13.	OTDR Traces	-do-	10% of ordered quantity

NOTE:

a. SAMPLE DRUMS SHALL BE DECIDED BY OWNER/OWNER'S REPRESENTATIVE AND THE SAME SHALL BE INTIMATED TO THE VENDOR BEFORE START OF INSPECTION.

b. IF TEST FAILS ON ANY DRUM SELECTED BY OWNER'S REPRESENTATIVE THEN 100% TEST ON ALL DRUMS SHALL BE CARRIED OUT.





**INSTRUMENT SPECIFICATION FOR  
PRESSURE GAUGE**

DOCUMENT NO.

PROJECT NO. : PC-183/E/8003/NCB  
 PROJECT : TFL  
 PLANT : AMMONIA  
 CUSTOMER : M/S TFL  
 REQ. NO. : PC-183/E/8003/NCB  
 ORDER NO. :  
 MANUFACTURER :


	VENDOR's OFFER / DEVIATION	P	24.03.2023	DRAFT ENQUIRY	SG	SG	RKR	VENDOR's OFFER / DEVIATION
<b>GENERAL</b>								
1. TYPE : Direct reading								
2. MOUNTING : Local								
3. DIAL SIZE : 150mm								
4. DIAL COLOUR : Black numerals on white background								
5. CASE MATERIAL : SS 304								
6. BEZEL RING : SS 304								
7. ELEMENT MATERIAL : Refer against Individual tag								
8. BLOW OUT PROTEC. : Required as per IS 3624								
9. LENS : Shatter Proof Glass								
10. ACCURACY : ± 1% on full scale								
11. OVER RANGE PROTEC. : Required as per IS 3624 or Latest								
12. ENCLOSURE PROTEC. : IP 66								
<b>PRESSURE ELEMENT</b>								
13. BOURDON SIZE : 110mm dia. (minimum)								
14. MOVEMENT MATL. : SS 304								
15. PROCESS CONN. : 1/2" NPT(M) Bottom								
16. POINTER TYPE : Micrometer screw type								
17. ZERO ADJUSTMENT : Required								
FACILITY								
				<b>OPTIONS</b>				
				<b>A1) PIG TAIL SYPHON</b> ASTM A 106 Gr. B, 1/2" NB				
				Seamless pipe, Sch 80, Both ends Plain with IBR				
				<b>A2) PIG TAIL SYPHON</b> ASTM A TP 304 SS, 1/2" NB				
				Sch. 80s Seamless pipe, Both ends Plain with IBR				
				<b>A3) PIG TAIL SHYPON</b> ASTM A TP 347H SS, 1/2" NB				
				Sch. 80s, Both ends Plain with IBR				
				<b>A4) PIG TAIL SYPHON</b> Specify as required				
				<b>B1) SNUBBER</b> AISI 304 SS, 1/2" NPT(F) Gauge side,				
				1/2" NPT(M) Process side, Rating & Temp. to suit service pressure,				
				Dampning : Adjustable				
				<b>B2) SNUBBER</b> Specify as required.				
				<b>C1) GAUGE SAVER</b> AISI 304, 1/2" NPT(F) Gauge side,				
				1/2" NPT(M) Process side				
				<b>C2) GAUGE SAVER</b> AISI 304L, 1/2" NPT(F) Gauge side,				
				1/2" NPT(M) Process side				
				<b>D) MOVEMENT DAMPING</b> Specify as required				
				<b>E) SAFETY PATTERN GAUGE</b>				
				<b>WITH BAFFLE WALL</b> : Required with SS Solid Front				
				<b>F) NACE CERTIFICATE</b>				
				<b>G) IBR</b>				