

	<p>MRPL Marketing Terminal Project at Devangonhi, Bangalore Marketing Infrastructure Projects, MRPL.</p> <hr/> <p>ELECTRICAL CONSTRUCTION WORKS PACKAGE FOR MRPL MARKETING TERMINAL PROJECT, DEVANGONTHI, BANGALORE CORRIGENDUM 02</p>	
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CORRIGENDUM 01

To

MRPL Tender No. 3200000591 dated 01.10.2022

ELECTRICAL CONSTRUCTION WORKS PACKAGE FOR MRPL MARKETING TERMINAL PROJECT, DEVANGONTHI, BANGALORE, MARKETING INFRASTRUCTURE PROJECTS, MRPL

With reference to the above tender, Corrigendum 1, Bidders are requested to note the following:



The items, conditions, specification and stipulations of the Bidding Documents are modified to the extent indicated as follows

- a. Annexure 01 - Commercial Corrigendum.**
- b. Annexure 02 - Technical Corrigendum**

The implications of the same, elsewhere in the tender shall be taken care of appropriately by the bidders. All other terms and conditions, stipulations and specifications of tender shall remain unaltered.



Note:

Bidders shall upload the copy of these documents along with the technical- commercial bid, **Digitally Signed,** as a token of having read and understood the same.

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ANNEXURE 01 – COMMERCIAL CORRIGENDUM



Sl. No.	Volume	Section No./Clause No.	Page No.	Existing Tender Clause	Addition / Deletion / Modification
1.	Annexure 01 - Commercial Corrigendum	Corrigendum 1 / SL No 4	2 to 44	Last Date and time of Online submission of Bids (Bid Due Date) Up to 15:00 Hrs. (IST) on 31.10.2022	<u>Modification</u> Last Date and time of Online submission of Bids (Bid Due Date) Up to 15:00 Hrs. (IST) on 07.11.2022.
2.	Annexure 01 - Commercial Corrigendum	Corrigendum 1 / SL No 5	3 to 44	Online Opening of Techno-commercial Unpriced Bid 15:30 Hrs. (IST) on 31.10.2022	<u>Modification</u> Online Opening of Techno-commercial Unpriced Bid 15:30 Hrs. (IST) on 07.11.2022.
3.	Volume 1 – Commercial section	PART I : Techno-Commercial Part / SI No 25	7 of 988	Contact details - Technical Queries Project Manager Email Id: pm.mrpl@nauvata.com Ph. No. +91-080-67209100 (extn:131) Mobile : +91 9113904331	<u>Modification</u> Contact details - Technical Queries Project Manager Email Id: pm.mrpl@nauvata.com Ph. No. +91-080-67209100 (extn:131) Mobile : +91 6364469797

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Sl. No.	Volume	Section No./Clause No.	Page No.	Existing Tender Clause	Addition / Deletion / Modification
4.	Volume 1 – Commercial section	PART I : Techno-Commercial Part / SI No 26	7 of 988	Commercial Queries bid closing extension etc. Project Manager Email Id: pm.mrpl@nauvata.com Ph. No. +91-080-67209100 (extn:131) Mobile : +91 9113904331	<u>Modification</u> Contact details - Technical Queries Project Manager Email Id: pm.mrpl@nauvata.com Ph. No. +91-080-67209100 (extn:131) Mobile : +91 6364469797

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ANNEXURE 02 – TECHNICAL CORRIGENDUM

Sl. No.	Volume	Section No./Clause No.	Page No.	Existing Tender Clause	Addition / Deletion / Modification
1.	Volume II : Technical Section	-	-	-	<u>Addition</u> Telecom Bulk Material Specification attached

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INSTRUMENTATION SPECIFICATIONS

TELECOM BULK MATERIAL SPECIFICATION



MRPL Marketing Terminal Project at Devangonhi, Bangalore

PROJECT: Marketing Infrastructure Projects, MRPL



OWNER : MANGALORE REFINERY AND PETROCHEMICALS LTD

JOB NO. : JBGC20005



0	3-Sep-2022	Issued for Information	APG	MGV	MGV
Rev. No	Date	Purpose	Prepared By	Checked By	Approved By

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SI.No	DESCRIPTION
1.	SIGNAL, CONTROL, TRIAD & COMMUNICATION CABLES SPECIFICATIONS / REQUIREMENTS
2.	POWER CABLE SPECIFICATIONS / REQUIREMENTS
3.	FIRE SURVIVAL CABLE (SIGNAL)
4.	FIRE SURVIVAL CABLE (CONTROL)
5.	FIRE RESISTANT TRIAD CABLE
6.	FS POWER CABLE
7.	FIBER OPTIC CABLE
8.	EARTH CABLE
9.	CAT 6 ETHERNET CABLES (ARMOUR)
10.	CAT 6 ETHERNET CABLES (NON-ARMOUR)
11.	JUNCTION BOX
12.	CABLE GLANDS
13.	CABLE TRAY WITH COVER
14.	EARTHING SYSTEM DESIGN & SPECIFICATION
15.	DUCT SPECIFICATION
16.	MODULAR COMPRESSION TRANSIT (MCT) BLOCK
17.	FIREWALL
18.	CANOPY & SUNSHADE

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Sr.No.	1. SIGNAL, CONTROL, TRIAD& COMMUNICATION CABLES PECIFICATIONS / REQUIREMENTS	
1.	Type of cable	<p>Low toxic, low halogen FRLS type (both Inner and Outer Sheath) with water and chemical resistivity. Single Pair/ Duplex Triad/ Multicore/ Multi-pair/ Multi-triadshielded copper cable.</p> <p>6 pair / 12 pair shall be used for Multi-pair for main runs Duplex triad shall be used for RTD signals to temperature transmitter Single Triad shall be used for HC detectors 6T/8T shall be used for main runs (HC Detectors)</p>
2.	Construction	Multi strand annealed electrolytic copper
3.	Tolerance	<p>+/- 1% (of total ordered length)</p> <p>Note: if for a particular location /consignee for a particular type of cable, there are 10 drums, then vendor shall have a flexibility of +/-5% in first 9 drums, however the surplus or short quantity (in 9 drums) shall be covered in the last drum so as to make the overall tolerance of +/-1% for that particular quantity/ type of cable.</p>
4.	Conductor	<p>1.5 sq. mm or 2.5 sq. mm, Made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia for 1.5 sqmm. 0.67 mm dia for 2.5 sqmm.</p>
5.	Primary insulation	XLPE conforming to BS-5308 / IS-7098. Thickness shall be 0.6 mm (Min)
6.	Pair twist	The cores of the pair/triad shall be twisted. 10 number of twist per meter shall be minimum.
7.	Voltage Rating	Up to and including 1100 volts as per IS 1554 Part 1.
8.	Shield (Individual Pair)	<p>Each pair shall be shielded with aluminum backed mylar tape with 100 %coverage and minimum 25 % overlap along with drain wire.</p> <p>The overall shield shall be of aluminum backed mylar tape with 100 %coverage and minimum 25 % overlap along with drain wire.</p>
9.	Shield (Multipair)	Each pair shall be shielded with aluminum backed mylar tape with 100 % coverage and minimum 25 % overlap. Also the overall shield shall be of aluminum backed mylar tape with 100 % coverage and minimum 25 % overlap
10.	Shield thickness	Min. 0.05 mm for individual and Min. 0.075 mm for overall shielding
11.	Inner Jacket / Sheath	<p>Fire retardant, Low smoke, Low toxic, PVC type ST2 (90 Deg C) as per IS 5831.</p> <p>Min. thickness 0.3 mm for cable size 1.5 & 2.5 sqmm, the Inner Sheath: Min. thickness shall be as per Table 4 of IS 1554 Part (I).</p>



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		<p>Min. Oxygen Index of PVC: 30 at 27DegC (+/-) 2 DegC Temp. Index: Over 250DegC.</p> <p>The sheath shall be heat resistant, oil resistant and flame retardant material as per IS 5831. for size 1.5 & 2.5 sqmm, the Inner Sheath: shall be FR</p> <p>Rip Cord: shall be provided</p>
12.	Outer Jacket / Sheath	<p>Fire retardant, Low smoke, Low toxic, PVC type ST2 (90 Deg C) as per IS 5831.</p> <p>Min. thickness 1.4 mm for cable size 1.5 & 2.5 sqmm, the Outer Sheath/ Insulation : Min. thickness shall be as per Table 7 of IS 1554 Part (I)</p>
		<ul style="list-style-type: none"> ➤ Min. Oxygen Index of PVC : 30 at 27 DegC (+/-) 2DegC ➤ Temp. Index : Over 250DegC ➤ Flame retardant requirements as per IS 10810 (Part 62) category AF or IEC 60332 category A. ➤ Acid generation shall be maximum 20% by weight as per IEC 60754 ➤ Smoke density rating shall not exceed 60% as per ASTM D 2843 ➤ The sheath shall be of low smoke, heat resistant, oil resistant and flame retardant material as per IEC 60332. for size 1.5 & 2.5 sqmm, the Outer Sheath: shall be FRLS ➤ Suitable protection against rodent and termite attack. Colour – IS cables shall be Blue & Non-IS cables shall be black. ➤ In order to avoid spread of fire due to cables, the outer PVC sheath of all cables used inside the dyke shall be fire retardant confirming to category AF as per IS: 10810. ➤ All Power and control cables shall have extruded inner and outer sheaths. Cables should be Aluminium/Copper Conductor, PVC/XLPE insulated, PVC sheathed, armoured type ➤ Instrument and signal communication cables shall not be laid in the same trench/tray along with the electrical cables. The Overall cable layouts shall be designed for minimum interface between signal and power cables. ➤ Cable route markers shall be installed at every 30 meters intervals all along the cable routes and also at cable joints and locations where the direction of cable trench changes.
13.	Identification	<p>Pair identification number shall be provided at distance of not more than 1 meter.</p> <p>Sequential marking for the length of the cable at every 1 mtr on the outer sheath.</p> <p>Multipair / Multitriad cables : Colour code as per BS 5308 /</p>



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		IEC 60189-2 / equivalent - Pair / Triad cables : Colour code as per BS 5308 / IEC 60189-2 / equivalent
14.	Drain wire	0.5 sq.mm multistrand bare tinned copper conductor in a continuous contact with aluminum side of the shield shall be provided
15.	Armour	Armour over inner jacket shall be of Galvanised steel wire as per IS 1554 Part – I. (1.4 mm. Wire for 1-pair and 4x0.8mm strip for multipair) Note: if the calculated inner dia (below the armouring) is less than 13mm the armour shall consist galvanized steel wire. if the calculated inner dia (below the armouring) is more than 13mm the armour shall consist galvanized steel strip.
16.	Electrical characteristics	Maximum resistance of the conductor of the complete cable shall not exceed - 12.3 ohm/Km at 20-deg. C for 1.5 sqmm - 7.41 ohm/Km at 20-deg. C for 2.5 sqmm Mutual capacitance of the adj. cores or pair/triad shall not exceed a Max. Of 250 pF/mtrs at a frequency of 1 kHz. Capacitance between any core and screen shall not exceed 400 pF/mtr at a frequency of 1 kHz. The drain wire resistance including shield shall not exceed 30 ohms/km. Electrostatic noise rejection ratio shall be over 76 dB. L/R ratio shall be - For cables Upto 1 sqmm L/R Ratio <25 $\mu\text{H}/\Omega$ - for cables of 1.5 sqmm L/R Ratio <40 $\mu\text{H}/\Omega$ - for cables of 2.5 sqmm L/R Ratio <60 $\mu\text{H}/\Omega$.

Sr. No.	2. POWER CABLE SPECIFICATIONS / REQUIREMENTS	
1.	Type of cable	Low toxic, low halogen FRLS type (both Inner and Outer Sheath) with water and chemical resistivity. Multicore shielded copper cable
2.	Conductor / Construction (As Applicable)	1.5 sq. mm Size, multi stranded annealed bare electrolytic grade copper conductor. Or 2.5 sq. mm Size, multi stranded annealed bare electrolytic grade copper conductor.



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3.	Tolerance	<p>+/- 1% (of total ordered length)</p> <p>Note: If for a particular location /consignee for a particular type of cable, there are 10 drums, then vendor shall have a flexibility of +/-5% in first 9 drums, however the surplus or short quantity (in 9 drums) shall be covered in the last drum so as to make the overall tolerance of +/-1% for that particular quantity/ type of cable.</p>
4.	Voltage Rating	Up to and including 1100 volts
5.	Primary insulation	XLPE conforming to BS-5308 / IS 7098.
6.	Inner Sheath	<p>Fire retardant, Low smoke, Low toxic, PVC type ST2 (90 Deg C) as per IS 5831.min thickness as per table 4 of IS 1554 Part (I)</p> <ul style="list-style-type: none"> ➤ Min. Oxygen Index of PVC : 30 at 27 DegC (+/-) 2DegC ➤ Temp. Index : Over 250DegC ➤ Flame retardant requirements as per IS 10810 (Part 62) category AF or IEC 60332 category A. ➤ Acid generation shall be maximum 20% by weight as per IEC 60754 ➤ Smoke density rating shall not exceed 60% as per ASTM D 2843 ➤ The sheath shall be of low smoke, heat resistant, oil resistant and flame retardant material as per IEC 60332.
7.	Outer Sheath	<p>Fire retardant, Low smoke, Low toxic, PVC type ST2 (90 Deg C) as per IS 5831. The outer PVC sheath of all cables used inside the dyke shall be fire retardant type conforming to category AF as per IS: 10810.</p> <ul style="list-style-type: none"> ➤ min thickness as per table 7 of IS 1554 Part (I) ➤ Min. Oxygen Index of PVC : 29 at 27DegC (+/-) 2DegC ➤ Temp. Index : Over 250 DegC ➤ Flame retardant requirements as per IS 10810 (Part 62) category AF or IEC 60332 category A. ➤ Acid generation shall be maximum 20% by weight as per IEC 60754 ➤ Smoke density rating shall not exceed 60% as per ASTM D 2843 ➤ The sheath shall be of low smoke, heat resistant, oil resistant and flame retardant material as per IEC 60332.
8.	Armour over inner sheath	Galvanized steel wire for UAD less than 13 mm, Galvanized steel strip for UAD greater than 13 mm Dimensions as per table 5 of IS 1554 Part 1
9.	Core identification	<p>2 Core : Red & Black</p> <p>3 Core : Red, Yellow & Blue</p> <p>Sequential marking for the length of the cable at every 1 mtr</p>



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		on the outer sheath. Multi-core cable shall be identified by core numbers marked at regular interval of 1mtr. (refer clause 10.3.1 "Arrangement of Marking" of IS1554/I/88.)
10.	Electrical characteristics	Max. resistance of the conductor of the complete cable shall not exceed 7ohm/km at 20 deg. C

3. FIRE SURVIVAL CABLE (SIGNAL)		
1.	Description	Signal Cable
2.	Type	Single/Multi Pair/ Traid Shielded Copper Signal cable
3.	Construction	Twisted, Screened & Armoured
4.	Size of cable	NP x 1.5 sq mm / NT x 1.5 sq mm
5.	Make	As per approved vendors list
6.	Reference standards	IEC-60331 and IEC-6032, IEC 60794-3/ISO 11801-2/ EN 50 173-1
7.	Rated Voltage	500V Grade
CONDUCTOR		
8.	Material	Annealed Tinned Electrolytic Copper IS: 8130 '84
9.	Size	1.5 Sq.mm
10.	No. of Strands / Strand size mm	7/0.53
11.	Shape of conductor	Stranded Circular
PRIMARY INSULATION		
12.	Material	XLPE (as per IS 7098 part 1)
13.	Type	Extruded
14.	Thickness (nom.) in mm	0.7mm Thickness shall vary with no. of pairs as per IEC 60092
15.	Colour Scheme	Black & Blue, no. shall be printed on blue core for multipair or color code as per BS 5308 Part 1
16.	Insulation shall withstand conductor operating temperature	90 Deg C
17.	Insulation Voltage Grade	1100 V
FIRE BARRIER		
18.	Cores shall be twisted	Yes
18.	No. of twists (pair)	Min. 10 twists/meter
19.	Material	Mica tape helically wrapped over conductor
20.	Thickness	0.1
21.	Coverage	100%
INDIVIDUAL PAIR SHIELD		
22.	Polyester tape	Required, thickness - 0.023, 100 % coverage & 20% overlap
23.	Material	Aluminium Mylar tape/PETP – black

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24.	Type	Helical
25.	Thickness (nom.) in mm	0.075(Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IEC 60092
26.	Overlap	20%.
27.	Coverage	100%.
28.	Drain wire type / Size / No. of strands / Formation	Annealed tinned copper / 0.5 mm ² / 7 strands / in contact with the shield
OVERALL SHIELD		
29.	Polyester tape	Required, thickness - 0.023, 100 % coverage & 20% overlap
30.	Material	Aluminium Mylar tape/PETP – black
31.	Type	Helical
32.	Thickness (nom.) in mm	0.075 (Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IEC 60092
33.	Overlap	20%.
34.	Coverage	100%.
35.	Drain wire type / Size / No. of strands / Formation	Annealed tinned copper / 0.5 mm ² / 7 strands / in contact with the shield
36.	Filler	Flame retardant, Non Hygroscopic, moisture resistant suitable for operating temperature
INNER SHEATH		
37.	Material	LSZH compound as per BS 7655 Sec 6.1
38.	Type	Extruded
39.	Thickness (nom.) in mm	0.3 (Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IEC 60092
40.	Colour Scheme	Orange
41.	Dia over sheath	VTS
ARMOUR		
42.	Material	Single layer Gal. round steel wire
43.	Size in mm	1.4 Thickness shall vary with no. of pairs as per IS 1554
44.	Dia over armour	VTS
OUTER SHEATH		
45.	Material	LSZH compound as per BS 7655 Sec 6.1
46.	Type	Extruded
47.	Thickness (nom.) in mm	1.24(Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IEC 60092
48.	Overall diameter	VTS
49.	Tolerance on overall diameter	± 3%
50.	Colour Scheme	Black with Orange Stripes (for Non-IS signals) Stripes (for Non-IS) Blue with Orange Stripes (for IS Signals).
51.	Rip cord	Non-metallic under inner sheath
ELETRICAL PARAMETERS		

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52.	Conductor Resistance (max)	VTS at 20 Deg.C
53.	Drain wire resistance with shield	VTS at 20 Deg.C
54.	Insulation Resistance of cable	VTS at 20 Deg.C
55.	Mutual capacitance: core-core	VTS at 1 khz
56.	Mutual capacitance: core-screen	VTS at 1 khz
57.	Mutual inductance	VTS
58.	L/R ratio	VTS
59.	High Voltage Test	VTS
TEST & INSPECTION		
60.	General	According to IS:1554 (Part I) '88
61.	Insulation	As per IS 7098 Part 1
62.	Armour	IS: 3975 '79
63.	Armour galvanisation	IS: 2633
64.	Acid generation test	As per IEC 60754
65.	Smoke density test	ASTM D 2843/IS 10810 part 63
66.	Oxygen index, According to ASTM D 2863	34 at 36
67.	Temp. index @ oxygen index 21% as per ASTM 2863	>300
68.	Visibility during burning as per ASTM C 2863	> 95%
69.	Halogen content	<0.5 %
70.	circuit Integrity test at 950 Deg C for 3 hrs (IEC 331 / BS 6387)	Required
71.	toxic index	NEC 713
72.	Carbon mono oxide %	Low
73.	Maximum smoke density rating as per ASTM D 2843	20%
74.	Maximum acid gas generation by wt% of outer sheath as per IEC 754-1	0.5%
75.	Drum length / No. of drums	VTS
76.	Total length	VTS
77.	Meter marking	VTS
78.	Possible variation in length	±5% for length < 5 km ±2% for length > 5 km

4. FIRE SURVIVAL CABLE (CONTROL)



1.	Description	Control Cable
2.	Type	Twisted, Screened & Armoured
3.	Size (pair)	3 / 7 / 10 / 12 / 15
4.	Make	As per approved vendor list
5.	Reference standards	IEC-60331 and IEC-6032, IEC 60794-3/ISO 11801-2/ EN 50 173-1

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6.	Rated Voltage	1100 Volts
CONDUCTOR		
7.	Material	Annealed Tinned Electrolytic Copper IS: 8130 '84
8.	Size	1.5 Sq.mm
9.	No. of Strands / Strand size mm	7/0.53
10.	Shape of conductor	Stranded Circular
PRIMARY INSULATION		
11.	Material	XLPE (as per IS 7098 part 1)
12.	Type	Extruded
13.	Thickness (nom.) in mm	0.7mm Thickness shall vary with no. of cores as per IS
14.	Colour Scheme	Red, Yellow & Blue
15.	Insulation shall withstand conductor operating temperature	90 Deg C
16.	Insulation Voltage Grade	1100 V
FIRE BARRIER		
17.	Cores shall be twisted	Yes
18.	No. of twists (pair)	Min. 10 twists/meter
19.	Material	Mica tape helically wrapped over conductor
20.	Thickness	0.1
21.	Coverage	100%
OVERALL SHIELD		
22.	Polyester tape	Required, thickness - 0.023, 100 % coverage & 20% overlap
23.	Material	Aluminium Mylar tape – black
24.	Type	Helical
25.	Thickness (nom.) in mm	0.075(Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IS
26.	Overlap	20%.
27.	Coverage	100%.
28.	Drain wire type / Size / No. of strands / Formation	Annealed tinned copper / 0.5 mm ² / 7 strands / in contact with the shield
29.	Filler	Flame retardant, Non Hygroscopic, moisture resistant suitable for operating temperature
INNER SHEATH		
30.	Material	LSZH compound as per BS 7655 Sec 6.1
31.	Type	Extruded
32.	Thickness (nom.) in mm	0.3 (Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of pairs as per IS
33.	Colour Scheme	Black

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34.	Dia over sheath	VTS
ARMOUR		
35.	Material	Single layer Gal. round steel wire
36.	Size in mm	1.4, Thickness shall vary with no. of cores as per IS
37.	Dia over armour	VTS
OUTER SHEATH		
38.	Material	LSZH compound as per BS 7655 Sec 6.1
39.	Type	Extruded
40.	Thickness (nom.) in mm	1.24(Suitable for 1100V as per IS 1554 Part 1) Thickness shall vary with no. of cores as per IS
41.	Overall diameter	VTS
42.	Tolerance on overall diameter	± 3%
43.	Colour Scheme	Light Blue
44.	Rip cord	Non-metallic under inner sheath
ELECTRICAL PARAMETERS		
45.	Conductor Resistance (max)	VTS at 20 Deg.C
46.	Drain wire resistance with shield	VTS at 20 Deg.C
47.	Insulation Resistance of cable	VTS at 20 Deg.C
48.	Mutual capacitance: core-core	VTS at 1 khz
49.	Mutual capacitance: core-screen	VTS at 1 khz
50.	Mutual inductance	VTS
51.	L/R ratio	VTS
52.	High Voltage Test	VTS
TEST & INSPECTION		
53.	General	According to IS:1554 (Part I) '88
54.	Insulation	As per IS 7098 Part 1
55.	Armour	IS: 3975 '79
56.	Armourgalvanisation	IS: 2633
LSZH PROPERTY		

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57.	Oxygen index, According to ASTM D 2863	34 at 36
58.	Temp. index @ oxygen index 21% as per ASTM 2863	>300
59.	Visibility during burning as per ASTM C 2863	> 95%
60.	Halogen content	<0.5 %
61.	Circuit Integrity test at 950 Deg C for 3 hrs	Required, as per IEC 331 / BS 6387
62.	Toxic index as per NEC 713	<3
63.	Carbon mono oxide %	Low
64.	Maximum smoke density rating as per ASTM D 2843	20%
65.	Maximum acid gas generation by wt% of outer sheath as per IEC 754-1	0.5%
OTHERS		
66.	Drum length / No. of drums	VTS
67.	Total length	VTS
68.	Meter marking	VTS
69.	Possible variation in length	±5% for length < 5 km ±2% for length > 5 km

The following information shall be stenciled on each cable drum:



1. Name of manufacturer
2. Nominal cross-sectional area of conductor
3. Type of cable(Pair/Core cable)
4. Number of Pairs/cores
5. Length of cable on the drum
6. Cable code
7. Length of cable on the drum
8. Drum number
9. Job number
10. Country of manufacture
11. Year of manufacture
12. Approx. gross weight

5. FIRE RESISTANT TRAIID CABLE

S.NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
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1	Type of Cable	Triad Shielded Copper Signal cable	
2	Voltage Class	500V Grade	
3	Size of Cable	NT x 1.5 sq mm (N=1 and 8)	
4	Applicable Standards	BS EN 50288 - 7	
CONDUCTOR			
5	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7	
6	Size	1.5 Sq. mm	
7	No of Strand	7	
8	Diameter of Strand	0.53 mm	
INSULATION			
9	Material	PVC Type TI53 to BS EN 50290-2-21	
10	Type	Extruded	
11	Thickness (Minimum)	0.44mm as per Table 1 of BS EN 50288 - 7	
12	Colour Scheme of Triad	BLACK / WHITE / RED	
13	Triad Identification	One core of each triad will be number printed at an interval of 250 mm (in case Of Multitriad)	
INDIVIDUAL TRAIID & OVERALL SHIELD			
14	Material	Triad and over all Shield with Al mylar tape	
15	Type	Helical	
16	Thickness(Min)	0.05 mm	
17	Coverage	25% overlap on either side & 100% Coverage	
18	Triad twist	10~15 twists / mtr uniformly	
19	Drain wire Material	Annealed tinned Copper in continuous contact with Aluminum side	
20	Drain wire Resistant	size	30 Ohm/Km / 0.5 sq mm 7 strands/0.3 mm
INNER SHEATH			
21	Material	PVC Type TM53 to BS EN 50290-2-22	
22	Type	Extruded	
23	Thickness (Nominal)	As per BS EN 50288 - 7	
24	Rip cord	Required, Non metallic type below inner sheath	
SL NO	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT	
ARMOUR			
25	Material	0.9mm Galvanised round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4mm x 0.8 mm Galvanised steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1	
OUTER SHEATH			
26	Material	FRLS PVC Type TM53 to BS EN 50290-2-22	
27	Type	Extruded	
28	Thickness (Nominal)	As per BS EN 50288 - 7	
29	Colour	Blue	
30	Marking on outer sheath	By embossing/printing Make, Year of Manufacture, Voltage grade and Size of cable	



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31	Sequential length marking	At every interval of 1 meter
32	Rodent and Termite attack protection	Yes
33	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
34	Temperature Index	Min 250 Deg C to ASTM D 2863
35	HCL Emission	Max 20% by weight to IEC 754-1
36	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
ELECTRICAL PARAMENTERS		
37	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
38	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
39	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
40	L/R Ratio	Better than 40 microH/ohm
41	Electrostatic noise rejection ratio	over 76 dB
42	HV Test Core to Core & Core to Screen	1.0 KV for 1 minute

6. FS POWER CABLE					
SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
1	Make	As per Recommended Vendor List			
2	Quantity	As required			
3	Type of Cable	3 core, 4 core Copper cable			
4	Voltage Class	1100 VAC grade			
5	Size of Cable	2.5s qmm, 4 sqmm, 6 sqmm, 10 sqmm			
CONDUCTOR					
6	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130			
7	No of Strand	7			
8	Size (sq mm)	2.5	4	6	10
9	Diameter of Strand (mm)	0.67	0.85	1.02	1.35
INSULATION					
10	Material	Mica Glass+EPR / XLPE or Silicon			
11	Type	Extruded			
12	Thickness(Min)	0.7 for 2.5 sq. mm & 4 sq.mm, 0.82 mm for 6 sq. mm & 10 sq. mm			
13	Color Scheme	As per IS 1554 (Part-1)			

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		3 core Red, Yellow & Blue
		4 core Red, Yellow, Blue & Black
INNER SHEATH		
14	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26
15	Type	Extruded
16	Thickness	1.0 mm Nom and 0.8 mm Min
ARMOUR		
17	Material	Galvanized round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanized steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1
18	Size	As per Table 5 of IS 1554 (Part-1)
19	Armour Resistance	As per Table 6 of IS 1554 (Part-1)
20	Galvanization	Shall be as per IS 3975 and IS 10810 (Part 41)
OUTER SHEATH		
21	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26
22	Type	Extruded
23	Thickness	As per Table 7 of IS 1554 (Part-1)
24	Marking on outer sheath	By embossing/printing Make, Year of Manufacture, Voltage grade and Size of cable
25	Sequential length marking	At every interval of 1 meter
26	Color	Black
27	Rodent and Termite attack protection	Yes
28	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863
29	Temperature Index	Min 275 Deg C to ASTM D 2863
30	HCL Emission	Max 2 % by weight to IEC 754-1
31	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
32	Fire Survival test	As per IEC 60331-1 Flame at 750 deg C for 90 minutes
ELECTRICAL PARAMENTERS		
1.	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
2.	Minimum volume resistivity	1 x 10 e13 @ 27 deg.C



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	(for insulation)	1×10^{10} @ 85 deg.C As per IS 5831 – 1984
3.	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour



NOTES

1. For XLPE insulation - applicable standard shall be IS-7098.
2. For EPR and silicon insulated cables- applicable standard shall be IS-9968.
3. Cable weight and Conductor weight per meter shall be provided.
4. Rip cord to be provided below the inner sheath.
5. Fire Barrier tape to be provided.

7. FIBER OPTIC CABLE		
1.	Standard	The fibres shall fulfil latest ITU-T Recommendation G-652 & IEC 60793-2-50, ITU G.652 for singlemode optical fibres.
2.	Type	Single-mode Germanium doped silica 9/125 μ m. Multitude
3.	Number of fibre	Eight (8)
4.	Geometrical & physical characteristics	
5.	Mode field diameter	8.6 to 9.5 μ m 5% at 1310nm and At 1550 nm- Any value from (9.0 to 11.0) μ m
6.	Cladding diameter	125 μ m \pm 1 μ m
7.	Mode field concentricity error	≤ 1 μ m
8.	Cladding non circularity	$\leq 1\%$
9.	Protective materials /coatings	Optical fibres shall be coated with UV cured double Acrylate Resin. It should not have any reaction with cladding or core material. The coatings should provide maximum resistance to micro bending & abrasion and ensure mechanical & optical strength. The coatings shall be easily stripped with mechanical tools.
10.	Nominal Overall Thickness	250 μ m /15 μ m



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11.	Fibre Identification	The coatings shall be in various colours in order to facilitate fibre identification. The colours shall correspond with standard colours and shall readily be identifiable and shall be durable. The colours should have good colour fast properties also in the presence of other materials during the lifetime of cable. The coating and the colour shall not react with surrounding jelly. Each fibre and tube shall be identifiable throughout the length of the cable as per ITU-T-652. The colour scheme of the fibres shall be as per EIA/TIA 598A
12.	Transmission characteristics	
13.	Attenuation	The cabled fibre shall have the following attenuation coefficient. 0.38 dB/km maximum at 1310nm wavelength region. 0.22 dB/km maximum at 1550nm wavelength region.
14.	Chromatic dispersion	<=3.5 ps/nm.km at 1285 to 1330 nm. <=5.3 ps/nm.km at 1270 to 1340 nm. <=18 ps/nm.km at 1550 nm.
15.	Zero dispersion slope	<= 0.093 ps/nm ² .km
16.	Polarization mode dispersion coefficient	<=0. 5 ps/0.km.
17.	Construction details of cable	
18.	Central Strength member	FRP Rod
19.	Loose Tube & filling of Core	The tubes shall be filled with moisture resistant non-hygroscopic jelly, which should be compatible with the coated fibre and the surroundings. The jelly shall also be flooded over the stranded tubes to ensure ingress protection.
20.	Number of fibres per tube	4
21.	Moisture barrier	Polymer coated Aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 10% minimum.
22.	Inner sheath	Polyethylene sheath
23.	Thickness of inner sheath	1.50 mm minimum
24.	Armouring (for direct burial)	Burial - (or) SWA – double Steel Wire Armoured (SWA to BS-5308)
25.	Thickness of steel tape	0.15 mm minimum
26.	Thickness of each polymer layer	0.04 mm minimum
27.	2nd PE sheath	Polyethylene sheath
28.	Thickness of 2nd PE sheath	1.50 mm minimum

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29.	Outer Sheath /Jacket	FRLS Black LSZH (Low Smoke Zero Halogen)HDPE
30.	Thickness of outer sheath	0.65 mm minimum
31.	Overall diameter of cable	VTs
32.	Cable weight in kg/km	VTs
33.	Protection required	The cable shall have protection against damages from termite, rodent, chemicals (such as oil, natural gas and other petroleum products), moisture and water, over the lifetime of the cable. The cable shall also be flameretardant to IEC 60332
34.	Cable identification	<p>The outer surface of the cable shall be permanently & legibly marked with colour in contrast to the outer sheath at regular intervals not exceeding one meter with</p> <ul style="list-style-type: none"> ➤ Legend containing FO mark and laser symbol ➤ Number and type of fibre eg. (36F OFC G.652) ➤ Month & year of manufacture ➤ Manufacture batch ID or job no. ➤ Country of origin ➤ Cable ID number ➤ Sequentially numbered metric length markers spaced at regular intervals of one meter. ➤ Cables shall also meet EDB-005 requirements

8.EARTH CABLE		
S.NO	DESCRIPTION	MINIMUM REQUIREMENT
1	Voltage Grade	1.1 KV
2	Standard Applicable	IS:1554 part-1 with latest Ammendments
3	Conductor	
A	Material	Annealed bare copper of EC Grade as per Class-2 of IS:8130
B	Effective Cross Section Area	4/6/10/16/25/35 Sq. MM
4	Max. DC resistance @ 20 Degree C	As per IS:8130 Table-2
5	Max, Conductor Temperature	
A	Rated	70 Degree C
B	During Short Circuit	160 Degree C
6	Insulation	
A	Material	Extruded PVC Type C as per IS:5831
B	Thickness (Nominal)	As per Table 2 of IS 1554 (Part-1)
C	Rodent and Termite	Yes

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	attack protection	
7	Outer Sheath	
A	Material	Extruded FRLS PVC Type ST-2 as per IS:5831
B	Thickness of Outer Sheath	The average thickness of PVC outer sheath shall be not less than the nominal value specified under col 3 of Table 7 and the smallest of the measured values shall not be less than the minimum value specified in co1 4 of Table 7.
C	Outer Sheath Colour	Green
8	FRLS Properties	
A	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
B	Temperature Index	Min 250 Deg C to ASTM D 2863
C	HCL Emission	Max 20% by weight to IEC 754-1
D	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
E	Flamability Test	As per IEC:332-1

NOTE:

All the instruments and Junction Boxes to be earthed using 1C X 6 Sq. mm Flexible copper insulated green wire.

9. CAT 6 ETHERNET CABLES (ARMOUR)



S. NO.	DESCRIPTION	MINIMUM REQUIREMENT
1	Type of Cable	Armoured CAT 6 cable Pair-shielded 100 Ohm installation cable with overall braided screen, suitable for transmission frequencies of up to 650 MHz, 4 x 2 x 0.56 mm.
2	Conductor	4 pair STP cable 23 AWG Annealed bare stranded copper
3	Primary insulation	Polyethylene insulation
4	Outer Sheath	Low-smoke in acc. with IEC 61034, flame-retardant in acc. with IEC 60332-1 and halogen-free in acc. with IEC 60754-2. Cable jacket material LSZH Cable jacket characteristics cable, metal-free
5	Armour over inner sheath	Required
6	Shielding	Screened to ensure protection against EMI and for cross talk compliance.
7	Application standard	ISO / IEC 11801 2nd Ed., EN 50173-1 May 2007 (DIN EN 50173-1), DIN 44332-5, IEC 61156-5 2nd Ed., EN 50288 x-1, 10GBase T in acc. with IEEE 802.3, tested and certified by independent laboratory. TIA/EIA 568.B

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8	Application	Indoor / outdoor installation Maximum permissible – 70 mtrs for one point to another.
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10. CAT 6 ETHERNET CABLES (NON-ARMOUR)		
S. NO.	DESCRIPTION	MINIMUM REQUIREMENT
1.	Type of Cable	Shielded twisted pairs
2.	Conductor	4 unshielded twisted pair, 23 AWG annealed bare stranded copper
3.	Transmission frequencies	Up to 250 MHz
4.	Characteristic impedance	100 (+/-3) ohms 250 MHz
5.	Armour over inner sheath	Required
6.	Primary insulation	Polyethylene insulation
7.	Inner sheath	Extruded FRLS PVC Type ST-2 as per IS:5831
8.	Outer sheath	Extruded FRLS PVC Type ST-2 as per IS:5831
9.	Application standard	ISO/IEC 11801 2nd Ed., EN 50173-1 May 2007 (DIN EN 50173-1), DIN 44332-5, IEC 61156-5 2nd Ed., EN 50288 x-1, 10GBase T in acc. with IEEE 802.3, tested and certified by independent laboratory. TIA/EIA 568.B
10.	Application	Indoor / outdoor installation Maximum permissible – 70 mtrs for one point to another.

11. JUNCTION BOX		
SR. NO.	DESCRIPTION	MINIMUM REQUIREMENT
1	Body & Cover	Die cast Aluminum Alloy (LM-6)/Polished Stainless steel with Minimum 5mm thickness
2	Gasket	Neoprene rubber
3	Terminals	Clip on type, block locked at both ends suitable for up to 2.5 mm ² conductor.
4	Tag nameplate	to be provided
5	Paint	Anti-corrosive epoxy paint, shade light gray
6	Protection class	Suitable for area classified as zone-I, IIA & IIB, T6 as per IS2148 IP – 65 or better as per IS – 2147
7	Housing	Suitable for hazardous area and explosion proof, Flame proof Ex-d to IEC 60529 / IEC 60079 and weather Proof

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		IP65 As per IEC 60529 / IEC 60079
8	Cable Entry	From Bottom only with Metric thread. Screws :High Tensile steel, cadmium / nickel plated Stainless steel of grade, Allen Screws
9	Other	<p>Explosion proof junction boxes shall have detachable cover, which is fixed, to the box by means of cadmium plated hexagonal head screws. Terminal shall be spring loaded, vibration proof, clip-on type, mounted on nickel plated steel rails complete with end cover and clamps for each row.</p> <p>Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines</p> <p>50 to 60 mm between terminals and sides of box parallel to terminals strip for up to 50 terminals and additional 25 mm for each additional 25 terminals.</p> <p>100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals.</p> <p>All junction boxes shall be provided with external earthing lugs</p> <p>All junction boxes shall be provided with 20% spare cable entries and terminals. Each junction boxes shall have a minimum of 10% or 2 Nos. whichever is higher, spare entries. All spare entries shall be with EXD plugs.</p> <p>All cable glands and plugs shall be of nickel-plated brass material. All the cable glands shall be preferably NPT with PVC hoods unless otherwise specified.</p> <p>Double compression type cable glands shall be used for armoured cable.</p>

12. CABLE GLAND		
SR NO	DESCRIPTION	MINIMUM REQUIREMENT
1.	Type of protection	Explosion proof suitable for zone 1,group IIA & II B as per IEC 60529 / IEC 60079
2.	Compression	Double compression type
3.	Bushes	Neoprene



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4.	Threading type	NPT Threads shall be provided. ET threads will be permitted only if any equipment does not have provision for NPT threads
5.	Thread Engagement	As per IS -2148
6.	Material of Construction	SS316
7.	Tag plate	Shall be provided
8.	Mounting	Suitable for area classified as zone- I, group IIA and IIB
9.	Protection class	IP-65
10.	Gland Size	As per detailed engineering

13. CABLE TRAY WITH COVER		
NO	FEATURES	PARAMETERS
1	Type	GI Ladder cable tray with cover
2	Width	50 mm/ 100 mm/ 150 mm/ 300 mm/ 600 mm
3	Edge height	25 mm for 50 mm 25 mm for 100 mm 25 mm for 150 mm 50 mm for 300 mm 50 mm for 600 mm
4	Thickness	2.5 mm
5	Clamps (for cable tray cover with cable tray)	GI C Clamp with SS 304 hardware
6	Tray Material	GI
7	Tray cover height	10 mm
8	Tray cover thickness	1.5 mm
9	Single tray unit length	Minimum 2.44 metre
10	Surface Coating	Anodized: 8 to 10 microns as per IS1868
11	Hardware & Fasteners	Coupler plate & SS Nut, Bolt

Notes:

1. Cable trays shall be fabricated out of 2.5mm thick mild steel sheet free from any flaws conforming to the relevant Indian standards or equivalent IEC standards.
2. The perforated type cable trays shall be fabricated out of single MS sheet of 2.5mm thickness.
3. All fittings such as elbows, tees, crosses etc. shall be of 2.5mm thickness.
4. The sections shall be supplied in 2.5mts in length. The side rails shall have four holes of 10mm diameter at each end of straight section, elbows, tees, crosses etc. for side couplers.
5. Side coupler plates are suitable for couple each 2.5mts in length section of the cable trays and each elbows, trees, crosses etc. and associated SS-316machined bolts, nuts and washers. The side coupler shall consist of 2.5mmthick sheet steel plates



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with circular holes and elliptical holes. The dimensions of the plates, spacing of holes, nuts and bolts shall be as required.

6. The tray covers shall be used to cover the trays directly exposing to sun to avoid heating of cables from sun. The covers shall be fabricated out of 2.5mm thick sheet steel. The tray covers shall be plain type. The width of the covers shall be 5mm more than the width of the tray and the collar height of the cover shall be 20mm. Suitable bolting arrangement shall be supplied for attaching the covers to the cable trays, elbows, reducers, tees, etc.
7. All Cable trays, covers, angles, accessories shall be hot dip galvanized after fabrication according to IS: 2629. The galvanizing shall be uniform clean smooth, continuous and free from acid.

14. EARTHING SYSTEM DESIGN & SPECIFICATION



- 14.1 All junction boxes, local cabinets, field mounted instruments shall be connected to the nearby earth bus bar / earth pit through minimum 6 mm² Insulated copper conductor.
- 14.2 All joints in the pipeline, valves and associated equipment shall be made electrically continuous by bonding. The resistance value between each joint shall not exceed 1 ohm.
- 14.3 Earthing network shall be realized with earth electrodes and / or buried bare conductors.
Two types of earthing system shall be envisaged –
 - Main earthing system (ME)
 - Electronic earthing system (EE)
- 14.4 In general, the following rules shall apply for earthing
 - The metallic housing of electronic equipment / junction box / panel shall be connected to the main earthing system (ME).
 - All armours of armoured cables shall be connected to the earth (ME) at both ends.
 - The shield of the shielded cable shall be earthed with electronic earth at one end only i.e. at control room end.

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- 14.5 The main Earthing System (ME) and Electronic Earthing system shall be in separate loop and not to be interconnected.
- 14.6 In general, the earth conductor between cabinets / instruments / junction box up to the local earth bus of ME shall be 6 mm² insulated copper conductor.
- 14.7 The entire earth pits (ME) shall be connected to form a grid using 50 X 6 mm² GI strips and the same to be connected to existing grid. All branch earth conductors from each field unit shall be connected in loop the main grid. Double earthing is to be provided for all electrical actuators and other instruments as per OEMs recommendations.

14.8 EARTH PITS

- 14.8.1 Separate earth pits shall be provided for system earth, IS earth, power earth, and general body earth for instruments, equipments, junction box body etc. These earth pits shall be separate and isolated from electrical earth pits. Individual Earth pits resistance and grid resistance shall be as standard codes and accordingly nos. Of earth pits / electrodes shall be considered. For system earth redundant earth pits shall be provided and to be connected form ring loop. Earth pit (ME), earth electrodes, earthing connection etc. shall be as per IS – 3043 standards with electrode length 3m and dia. 100 mm. Maintenance free earth electrodes of minimum 3m length and 100 mm dia. can also be used.
- 14.8.2 The earth electrode(s) for EE shall be of the same type as those for the ME, but in addition shall be placed in a galvanized steel pipeline for a depth of 4m to shield the electrode from surface earth stray currents, which may cause unwanted interference.
- 14.8.3 Instrument Grounding System
- 14.8.3.1 In principle, grounding earth for instruments shall be provided in compliance with instrument manufacturer's recommendation. However, two independent earth pits shall be provided for following.
- 14.8.3.2 Signal Earth Low voltage / IS signals (Shield) etc. shall be connected to this earth. Grounding shall have 1 ohms or less than 1 ohms earth resistance unless otherwise recommended by System manufacture. When recommended by system manufacturer for independent earth pit it shall be provided as specified.
- 14.8.3.3 Power Earth The frame of Panels / cabinets / junction boxes, instrument body etc. shall be connected to this earth. Power earth for high voltage level of 240 / 110 VAC

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shall be connected to this grounding. Earth resistance shall be 5 ohms or less than 5 ohms for standard electrical earth pits in this project.

- 14.8.3.4 TT body earthing: Separate redundant earth pit to be provided for TT earthing through earthing device / grounding units. The earthing cable/ strip should not touch the TLF structure.

14.8.5 Earthing

- 14.8.5.1 Each panel, cabinet, console and other equipment in control room shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.

88 Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring. Suitable distance shall be maintained between various earth pits (minimum 3 meters) as per guidelines of API RP550.

- 14.8.5.2 Separate earth-pit networks are desirable for various instrumentation sub-systems like PLC earth, cable-screen earth, chassis earth, power earth etc. so that the problem in one system is not affecting the other system

- 14.8.5.3 All circuit grounds of electronic instruments, shields and drain wires of signal cables shall be connected to instrument ground bus which is electrically isolated from the AC mains earthing bus. This bus shall be typically 25mm wide and 6 mm thick of copper or 50 x 6 GI strip.



- 14.8.5.4 The instrument ground bus is connected to independent instrument system ground buses through insulated wires.

- 14.8.5.5 Earth-pit head must be covered properly, and clearly visible identification tags indicating earth pit no, Earth pit resistance and date of testing etc. as per direction of site in-charge.

- 14.8.5.6 Periodic checks of each earth pit shall be carried out and maintenance record must be kept.

- 14.8.5.7 The earthing cables from the earth-pit to the respective systems shall be insulated and use of bare cable / strips shall be avoided. Such cable shall be laid away from power cables etc.

15. DUCT SPECIFICATIONS



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- 15.1 Minimum straight length of duct and cover shall be 2500 mm as standard. Duct shall be fabricated out of standard size of angles, flats, rods and sheets / plates. Material for coupler plates, bolts, nuts and washers used in the GI duct shall be ss. Straight portion of duct shall be pre-fabricated. However sections like tees, bends reducers etc. may be site fabricated as per actual site conditions, meeting the requirement of galvanising.
- 15.2 Galvanising shall be carried out only after completion of drilling, welding and any other fabrication work. no welding and drilling is allowed after galvanisation. Galvanising as per is 4759/1984.
For sheet thickness upto smm, 66 p /460 g/m2,
For sheet thickness smm and above, 86 pm/610 g/m2.
- 15.3 Duct shall be free of any burrs / sharp edges and welding shall be of good quality. All members, sheets and other material shall be galvanised only. Except coupler plates, bolts, nuts and washers.
- Note:**
Within the duct, the partition height shall be up to the duct cover, providing bottom support to the cover to prevent sagging.

16. MODULAR COMPRESSION TRANSIT (MCT) BLOCK

16.1 GENERAL

- 16.1.1 MCT shall be used for cable entry to control rooms, Planning/ Invoice room and Security room (2 Nos).
- 16.1.2 MCT shall be sized, supplied and installed at site by the vendor. Multiple MCT blocks of Multidiameter type shall be provided for cable entry, suitable cut out and structural supports for installation of MCT frames on the walls / floor of control rooms shall be in scope of vendor.
- 16.1.3 The MCT Block system should have only few components for facilitating simple, easy and quick assembly. The Multidiameter based cable transits shall be repeatedly re-openable and re-usable without the need of special tools and discarding the modules in normal operation.
- 16.1.4 The MCT frame shall be standard type of stainless steel construction. The supply shall be complete with multi diameter blocks with center core in all / stay-plates / single piece compression wedge with stainless steel bolts. Solid blocks and insert blocks should not be used.
- 16.1.5 Contractor shall size the MCT considering approximate 50% spare for each cable size /O.D. All these spares blocks shall be available on the frame as usable

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Multidiameter blocks / add blocks with center plug, so that these spares blocks in future can be used for wide range of cables also, solid blocks should not be used at all on frame. Apart from spare if there is any additional uncovered space left on frame then this uncovered space should also be filled only with usable Multidiameter blocks with center plug only.

- 16.1.6 The Multi Cable & Pipe Transits should have been tested for water tightness-4 Bar pressure, gas tightness-2.5 Bar pressure, Blast Load-3 Psi minimum as per OISD 163, 3 Hrs fire tests as per UL 1479, EI-120 as per BS476 & ASTM E814, IP68 as per IEC60529, and rodents.
- 16.1.7 Wherever MCT Blocks are to be provided in Hazardous area, necessary ATEX certification should be provided.

16.2 FRAMES

- 16.2.1 The frames shall be GH Type with 100/60 mm Flange with holes suitable for bolting installation and sized according to the construction and cables passing through each penetration. Frame material shall be of stainless steel.

16.3 BLOCKS



- 16.3.1 Multidiameter type Cable Transits are to be installed wherever the power or control or any other cables are to be routed through concrete floor/roof or the walls or to the kiosks / panels. The Cable Transit needs to be installed in the roof or wall using Multidiameter modules with centre core so as to provide the flexibility using same module for a wider range of cables with different diameters as given below for any future reconfigurations while retaining fire stop, water tight and gas tight requirements. The Multidiameter modules with peelable/tearable layers and central core should be made of super resistant Roxylon/ Lycron – Halogen free EPDM with low smoke index-F1 Classification as per NF16-101 & NF16-102, Heat Radiation test in compliance with M2/M1 classification, UV Ageing Test as per ISO-4892-2:2006 & ISO-815-1:2008, Oxygen Index Test as per ASTM D 2863-00, Shock & Vibration Test as per NES 510.
- 16.3.2 Spare blocks or the blocks used for filling space on frame shall be Multidiameter modules and central core, so that in case of any possible expansion these Multidiameter modules and central core can be used, insert blocks and solid blocks are not required to be provided. 3.2.1 20: Range (Start From 4.0 mm – Min 10 mm range or higher)

Range (Start From 11.0 mm – Min 10 mm range or higher)

Range (Start From 21 mm – Min 10 mm range or higher)

Range (Start From 32 mm – Min 10 mm range or higher)

Range (Start From 49.5 mm – Min 10 mm range or higher)



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- Range (Start From 71.5 mm – Min 10 mm range or higher)
- 16.3.3 The Wedge should be in single piece to be made of super resistant Roxylon/ Lycron – halogen free EPDM with low smoke index having stainless steel bolts. It will be used to compress the modules in the frame. The wedge should be such that it should not require any special tool to install / uninstall. The wedge should be such that it can be used at any position within the frame openings.
- 16.3.4 Stayplates for separating the module layers. Material of the stay plate should be stainless steel. Single Piece Compression Wedge.

17. FIREWALL

The minimum requirement for Firewall shall be as follows:

Firewall
Hardware Specifications
The Firewall must be an appliance based firewall
Firewall should have minimum 6 x 100/1000 interfaces
Performance Specifications
Firewall should be with at least 300mbps throughput with Application visibility and control.
Firewall must have IPS performance of atleast 100 Mbps
Firewall Features
Firewall must have integrated IPS
Firewall must be able to define IPS custom signatures including SCADA protocols with granularity of SCADA-specific commands like BACnet,DNP3,EtherCat, IEC 60870-5-104,IEC 60870-6 (ICCP), Modbus,OPC, Profinet etc.
Firewall must have Active/Passive and Active / Active support
Firewall must support Statefull Failover of Firewall
Firewall must support IP monitoring with route and interface failover
Routing Support
Firewall must support routing protocols like RIP,OSPF,BGP, MPLS, IS-IS
Firewall must support Policy based Routing and per packet load balancing
Should support Multicast routing including IGMP,PIM-SM,PIM-DM
Firewall Management
Firewall must support Web based (HTTP and HTTPS) configuration and management.
Firewall must support Command Line Interface using console, Telnet and SSH
Logging
Firewall must support Syslog server logging

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Firewall must support for SNMP V1, V2 and V3

18. CANOPY AND SUNSHADE

Sunshades / Canopy shall be provided to all field mounted instruments like MCPs, Push button stations outside dyke, tank side indicator, Bay queue display board, electronic equipments having display units (TT, DT, PT) and any other equipments which are directly exposed to sunlight and rain and requires protection as per OEM's recommendations. Canopy shall be designed such that shape allow rain run-off easily. Large lateral surface shall be provided for protection from the sun rays, especially in case of low sun rays angles.

Canopy / sunshade shall be of Aluminium with minimum 2 mm thick and to be installed along with structural support of suitable strength. The overall canopy shall have aesthetic look. MS Structural supports are to be painted to prevent corrosions / rusting.