




<div></div>		CUSTOMER :		PROJECT		SPECIFICATION :				
QUALITY PLAN		BIDDER/ VENDOR		TITLE		NUMBER :				
SHEET 1 OF 2		SYSTEM		QUALITY PLAN		SPECIFICATION				
COMPONENT/OPERATION		CAT.		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		TITLE				
SL. NO.	CHARACTERISTICS CHECK	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION		VOLUME III	REMARKS
							AGENCY			
							P	W	V	
1	2	3	4	5	6	7	8	9	10	11
1.0 ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-
	2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./MFG. SPEC.	MFG. DRG./MFG. SPEC.	-DO-	2	-	-
	3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-
2.0 PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'R'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-
3.0 TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1	NOTE -1 & NOTE-3
	2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	NOTE -1 & NOTE-3
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								




BHEL		CUSTOMER		PROJECT		SPECIFICATION				
QUALITY PLAN		BIDDER/ VENDOR		TITLE		NUMBER				
SHEET 1 OF 9		SYSTEM		QUALITY PLAN		TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV) FORMAT OF RECORD	SECTION	VOLUME III	
										P
1	2	3	4	5	6	7	8	9	10	11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL									
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	2
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	2
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	2
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	2
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUF'R'S DRG.	MANUF'R'S DRG.	LOG BOOK	3	2
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	2
BHEL		PARTICULARS		BIDDER/VENDOR						
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		SIGNATURE								
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<div></div>		QUALITY PLAN		CUSTOMER		PROJECT		SPECIFICATION						
SHEET 2 OF 9		BIDDER/ VENDOR SYSTEM		QUALITY PLAN		TITLE		SPECIFICATION						
COMPONENT/OPERATION		CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS				
SL. NO.	2	3	4	5	6	7	8	9	P	W	V	11		
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED		
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2			
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUF'R'S DRG.	LOG BOOK	3	-	2			
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1		FOR DIA OF 55 MM & ABOVE	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'S DRG. SPEC.	-DO-	3	-	2			
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2			
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUF'R'S DRG./ SPEC.	MANUF'R'S DRG. / SPEC.	-DO-	3	-	2			
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	INSP. REPORT	-DO-	3	-	2			
BHEL		PARTICULARS		BIDDER/VENDOR										
		NAME												
		SIGNATURE												
		DATE											BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER		PROJECT		SPECIFICATION													
SHEET 3 OF 9		BIDDER/ VENDOR		TITLE		QUALITY PLAN		SPECIFICATION													
COMPONENT/OPERATION		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		REV-03		TITLE													
SL. NO.	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III													
								AGENCY	REMARKS												
1		2		3		4		5		6		7		8		9		10		11	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2										
1.8	SHEET STAMPING (PUNCHED)	2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2										
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*										
		2. ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH. TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2										
BHEL		PARTICULARS		BIDDER/VENDOR																	
		NAME																			
		SIGNATURE																			
		DATE																			
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CUSTOMER :			PROJECT		SPECIFICATION -						
QUALITY PLAN			TITLE		NUMBER						
BIDDER/ VENDOR			QUALITY PLAN		SPECIFICATION -						
SYSTEM			NUMBER PED-506-05-Q-007, REV.03		TITLE						
CAT.			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION						
TYPE/ METHOD OF CHECK			REFERENCE DOCUMENT		AGENCY						
EXTENT OF CHECK			ACCEPTANCE NORM		VOLUME III						
FORMAT OF RECORD			REMARKS								
P			W		V						
1			9		10						
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1	2	3	4	5	6	7	8	9	10	11	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	2	
		1.MAKE & TYPE	MA	VISUAL	100%	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	FREE FROM VISUAL DEFECTS	-DO-	3	2		
		3.SURFACE FINISH	MA	VISUAL	100%	-DO-	MANUF'S DRG	-DO-	3	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	MANUF'S DRG	MANUF'S DRG	-DO-	3	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	2	
		3.TEMP.WITH- STAND CAPACITY	MA	ELECT.TEST	-DO-	-DO-	MANUF'S DRG	-DO-	3	2	
		4.HV/IR	MA	-DO-	100%	MANUF'S DRG/SPECS	MANUF'S DRG/SPECS	-DO-	3	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	FREE FROM VISUAL DEFECTS	-DO-	3	2		
		2.SURFACE COND.	MA	VISUAL	100%	MANUF'S DRG	-DO-	3	2		
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	-DO-	3	2		
		BHEL		PARTICULARS		BIDDER/VENDOR					
		NAME									
		SIGNATURE									
		DATE									

SL. NO.	COMPONENT/OPERATION	QUALITY PLAN		CUSTOMER		PROJECT TITLE		SPECIFICATION : NUMBER .			
		SHEET 5 OF 9	CHARACTERISTIC CHECK	BIDDER/ VENDOR SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SPECIFICATION - TITLE	
										SECTION	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11	
2.0	IN PROCESS										
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR )	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANF'S SPEC/BHEL SPEC./ SAME AS RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-
BHEL											
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NAME											
SIGNATURE											
DATE											
											BIDDER/SAVENDORS COMPANY SEAL

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		SYSTEM		QUALITY PLAN		TITLE				
SHEET 6 OF 9		BIDDER/ VENDOR		NUMBER PED-506-00-Q-007, REV-03		TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III REMARKS		
									SECTION AGENCY	P
1	2	3	4	5	6	7	8	9	10	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUF'R'S SPEC.	MANUF'R'S SPEC.	Log Book	2	-
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1* (FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'S SPEC./BHEL SPEC.	Log Book	2	-
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	- 1
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	- 1
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	- 1 FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	- 1 THREE DIPS TO BE GIVEN
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								
						BIDDER/SAVENDORS COMPANY SEAL				



SPECIFICATION -				SPECIFICATION -						
NUMBER				NUMBER						
TITLE				TITLE						
NUMBER PED-506-00-Q-007, REV-03				NUMBER PED-506-00-Q-007, REV-03						
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)						
FORMAT OF RECORD				FORMAT OF RECORD						
SECTION				SECTION						
AGENCY				AGENCY						
P				W						
V				V						
11				11						
1	2	3	4	5	6	7	8	9	10	11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA	-DO- VISUAL	-DO- 100%	-DO- -DO-	-DO- -DO-	Log Book Log Book	2 2	- -
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR CR	-DO- MALLET TEST & UT	-DO- -DO-	-DO- -DO-	-DO- -DO-	Log Book Log Book	2 2	- 1
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE 2.SOUNDNESS OF DIE CASTING	MA CR CR	ELECT. TEST DYN. BALANCE	-DO- -DO-	-DO- -DO-	-DO- MFG SPEC./ ISO 1940	Log Book Log Book Log Book	2 2 2	1 1 1
2.10	ASSEMBLY	1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS/ TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, BTD & SPACE HEATER MOUNTING.	MA MA MA MA MA MA	MEAS. VISUAL MEAS. -DO- VISUAL VISUAL	-DO- -DO- -DO- -DO- 100%	-DO- -DO- -DO- MFG.DRG./ MFG SPEC. MFG SPEC. RELEVANT IS	-DO- -DO- -DO- MFG.DRG./ RELEVANT IS MFG SPEC. RELEVANT IS	Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2	- - - - - -
BHEL				BIDDER/VENDOR						
PARTICULARS				BIDDER/VENDOR						
NAME				BIDDER/VENDOR						
SIGNATURE				BIDDER/VENDOR						
DATE				BIDDER/VENDOR						
BIDDER'S/VENDORS COMPANY SEAL				BIDDER'S/VENDORS COMPANY SEAL						





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## 8.14 POWER AND CONTROL CABLES

### 8.14.1 General

This specification covers the design, manufacture, supply, erection, testing and commissioning of Power and Control Cables.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Should the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

### 8.14.2 Scope of work

The scope of work shall include but not limited to the following:

6.6 kV, XLPE unearthed grade power cables

1000 V, XLPE power cables

1000 V grade XLPE control cables

Special cables for excitation system etc.

Special cables for cranes, hoists, etc.

Heat resistant cables.

Fire proof cables

List of recommended spare parts as per Section-10.0, Vol:-II.

Commissioning spares.

### 8.14.3 Technical requirements

#### 8.14.3.1 Design Features

The cables shall be suitable for laying on overhead cable trays or on cable trays in trenches. Buried cables in ground may be used for small number cable runs to outlying areas of the Plant

Cables shall be adequately sized considering

- Full load current
- Short circuit current and duration
- Voltage drop during starting & running condition
- Ambient temperature
- Grouping and installation conditions
- Soil resistivity (for buried cables)
- Earth fault current (for sizing screen and armour)
- To limit the cables to some standard sizes instead of using too many sizes.

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For breaker protected circuits minimum size will be determined by short circuit rating for a duration of 0.2 sec. for 400 V and 6.6 kV feeders.

Ambient air temperature shall be considered as 50°C. Overall derating factor for cable shall be based on the above factors.

Separate cables shall be provided for circuit of different plant and auxiliaries for different voltage levels and for circuits fused separately. Power, control and instrumentation circuits shall be taken through separate cables.

XLPE insulated cables shall be suitable for continuous conductor temperature of 90°C and short circuit withstand temperature of 250°C.

Cables installed in hot areas shall be specially designed for that ambient temperature. The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be enough to withstand mechanical stresses during handling.

Cables shall be adequately sized to take care of any derating due to fire stop cable sealing/fire resistant coating.

Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop at motor terminals during starting of motors shall be limited to 15% of the rated voltage.

Voltage drop in cable from MLDB to any lighting fixture shall not exceed 3% under steady state.

All the cables shall be FRLS type. Cable outer sheath shall have following flame retardant low smoke type (FRLS) properties.

- Oxygen index of not less than 29 when tested as per ASTM D 2863.
- Smoke density of not more than 60% when tested as per ASTM D 2843.
- Acid gas emission of not more than 20% by weight when tested as per IEC-754 I.

The cables shall meet flammability test requirement as per IEEE-383 and SS 4241475 (Category F3)

Minimum size of power cables shall not be less than 2.5 sq.mm copper. Minimum size of control cables shall be not less than 2.5 sq.mm copper and maximum no. of cores shall be limited to 19. Cables upto 7 core will have atleast 1 spare conductor, 12C and 19C cables will have atleast 2 spare conductor.

All the cables PVC shall be protected against rodent and termite attack. Necessary chemicals shall be added in to the PVC compound of the outer sheath.

All the single core cables shall be provided with non magnetic Aluminum wire armour & single round wire of galvanised steel for multicore cables.

Fire survival cables with withstand rating of 3 hours at 750°C shall be provided for emergency application such as DC emergency oil pump, turning gear, Jacking oil pump, emergency control, fire fighting, interconnection of DC battery, charger, DCDB, turbine / generator protection panel, DC emergency lighting and essential communication system.

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#### 8.14.3.2 Constructional Features

##### 6.6 kV cables

These Cables shall be of single core / multicore, (class – 2 as per IEC) stranded copper conductor, XLPE insulated, extruded PVC inner sheathed conforming to multicore cables and single core cables shall have no inner sheath, armoured and extruded FRLS - PVC outer sheathed.

The 6.6 kV power cables shall be of 6000 V /10000 V grade suitable for use in 6.6 kV  $\pm$  10%, 50 Hz  $\pm$ 5%, 3 phase resistance earthed system.

The 6.6 kV cables shall be provided with both conductor and insulation screening. Insulation screen shall consist of extruded semi conducting layer as per ICEA-S – 68 –516, S-66-524 & UL-1072 and bare copper shield. The conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by 'Triple Extrusion' process to ensure perfect bonding between the layers.

##### LV Power Cables

The LV power cables shall be of 1000 V grade suitable for use in 400 V  $\pm$  10%, 3 phase, 50 Hz  $\pm$ 5%, solidly grounded system and also for 220 V DC ungrounded system.

The LV Power cables shall be of heavy duty power cables with stranded copper conductors, XLPE insulated, extruded PVC inner sheathed conforming to ST2 compound armoured and extruded FRLS – PVC outer sheathed.

##### Control Cables

The control cables shall be 1000 V grade, multicore stranded annealed copper conductor having high conductivity, XLPE insulated, cores laid up, extruded PVC inner sheathed conforming to ST-2 compound armoured and extruded FRLS – PVC outer sheathed cable.

##### Cable drum

Cable drums shall be made of good quality wood, pressure impregnated against fungal and insect attack. The ends of each length of cable shall be sealed before despatch.

#### 8.14.4 Drawings, Data & Manuals

To be submitted with the Bid

Manufacturer's catalogues giving cable construction details and characteristics

Cable current ratings for different types of installation, inclusive of derating factors for ambient temperature, grouping etc.

Write-up on Manufacturer's recommended method of splicing, jointing, termination etc. of the cables

Type test certificates on all specified cables

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To be submitted for Approval and Distribution (After award of contract)

Guaranteed cable data

Instruction Manuals for Power and Control Cables

The manuals shall clearly indicate method of installation, check-ups and tests to be carried out before commissioning of the equipment.

The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, curves, calculations and information required to fully describe the equipment offered are submitted with the bid.

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## 8.14.5 Specified Design Data

## SECTION : POWER &amp; CONTROL CABLES

## 8.14.5.1 6.6 kV cables

Voltage Grade	kV	6 / 10 kV, 90°C rating heavy duty
Core	-	Single / three
Conductor	-	Class 2 (as per IEC) standard copper
Conductor screen	-	Semiconducting compound
Insulation	-	XLPE
Insulation screen	-	
- Metallic part		Copper wire/tape
- Non metallic part		Semiconducting compound
Innersheath		Extruded PVC conforming to ST-2
Outersheath		FRLS – PVC
Armour		Galvanised round steel wire for multicore Aluminium wire for single core

## 8.14.5.2 LV Power Cables

Voltage grade	V	1000, 50 Hz. solidly earthed
Frequency , earthing system		
Core		1 / 2 / 3 / 3½ / 4 core
Conductor	-	Stranded Copper
Insulation	-	XLPE
Innersheath	-	Extruded PVC conforming to ST-2
Outersheath		FRLS – PVC
Armour		Galvanised steel for multicore Aluminium wire for single core



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**8.14.5.3 Control cables**

Voltage Grade

kV

1000

Core

Maximum 19

Conductor

-

Stranded Copper (min 2.5 mm<sup>2</sup>)

Insulation

-

XLPE

Innersheath

-

Extruded PVC conforming to ST2

Outersheath

FRLS – PVC

Armour

Galvanised steel

**8.14.5.4 FRLS Properties**

Oxygen index

-

Not less than 29

Smoke density

-

Not more than 60%

Acid gas generation

-

Not more than 20% by weight

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## 8.14.6 Technical Data by the Tenderer

## SECTION : POWER &amp; CONTROL CABLES

## CABLES

The bidder shall indicate the following for each type 6.6kV, 400V, Power, Control cables & special cables and size of cables as per the format

- Make & Country

- Type

- Applicable standard

- Voltage grade

- Suitable for system with

- Service voltage

- Maximum Conductor Temperature

- Continuous

- Short time

## Conductor

- Material

- Size

Number and diameter of wire in each conductor  
no./mm

## Screening on conductor

- Material

- Type

Thickness

Whether extruded

## Insulation

- Material

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- Type	-	
Thickness	mm	
<b>Screening on insulation</b>		
- Material	-	
- Type	-	
Thickness	-	
<b>Inner sheath</b>		
- Material	-	
- Type	-	
Thickness	mm	
Extruded	Yes/No	
Approximate outside diameter over sheath	mm	
<b>Armouring</b>	-	
- Material	-	
- Type	no x dia	
DC resistance at 20°C	ohm/km	
<b>Outer sheath</b>		
- Material	-	
- Type	-	
Thickness	mm	
Approximate overall diameter	mm	
- Standard drum length with tolerance	mm	
Net weight of cable	kg/km	
<b>Continuous current rating for standard IEC condition laid direct</b>		
- In ground	A	
- In duct	A	

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- In air	A	
Short circuit rating	-	
- Short circuit current for 1 second	kA	
- Conductor temperature allowed for the short circuit duty	°C	
Electrical parameters at maximum operating temperature,	-	
Conductor resistance	ohm/km	
Insulation resistance	ohm/km	
Reactance at 50 C/s	ohm/km	
Impedance	ohm/km	
Recommended minimum bending radius	-	
Derating factor for following ambient temperature in air/ ground at		
- 30 deg C	-	
- 35 deg C	-	
- 40 deg C	-	
- 42 deg C	-	
- 45 deg C	-	
- 50 deg C	-	
Group factor for following number of cables laid touching/ 2 x diameter centre to centre apart		
Multicore cable		
- 3 nos.	-	
- 4 nos.	-	
- 5 nos.	-	
- 6 nos.	-	
Single line to ground fault current withstand capability of screen	kA	
Single line to ground fault current withstand capability of armour	kA	
Whether type test certificates for similar type of cables enclosed with the bid ?	Yes/No	
Cable sectional details submitted ?	Yes/No	

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**FRLS Properties**

- Oxygen index
- Smoke density
- Acid gas emission

Note:- Data marked \* thus shall be filled up by the Bidder along with the offer. Completely filled data sheet are to be submitted by successful Bidder.

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## 8.15 Miscellaneous Electrical Items

### 8.15.1 General

This specification covers the design, manufacture, supply, erection, testing and commissioning of Miscellaneous Electrical Items.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Should the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

### 8.15.2 Scope of work

The scope of work shall include but not limited to the following:

- ✗ Cable Trays and Accessories (Not Applicable)
- ✗ Cable termination and jointing kits. (Not Applicable)
- ✗ Cable ties, clamps and markers (Not Applicable)
- ✓ Receptacles. (Applicable)
- ✓ Conduits and accessories. (Applicable)
- ✓ Junction boxes. (Applicable)
- ✓ Cable glands and cable lugs. (Applicable)
- ✗ Fire stop cable sealing system. (Not Applicable)
- ✓ List and supply of Maintenance tools and tackles. (Applicable)
- ✓ List of recommended spare parts as per Section 10.0, Vol. II. ~~Not Applicable~~ (Applicable)
- ✓ Commissioning spares. (Applicable)

All accessories, fittings, supports, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.

### 8.15.3 Technical Requirements

All the items shall conform to latest edition of relevant IEC standards amended upto date. Equivalent ANSI standards are also acceptable.

#### 8.15.3.1 Cable Trays and Cable Tray Supports

Cable trays shall be pre-fabricated ladder type, made of 3 mm thick sheet steel with hot dip galvanized furnished in standard lengths of not less than 2.5 m. Cable trays of tough FRP

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material may also be used especially in DM plants and corrosive chemical laden atmospheres / areas.

Cable trays shall be complete with all necessary hot dip galvanized sheet steel accessories such as coupler plates, ground continuity connections, nuts, bolts, washers, clamps etc. Also necessary horizontal/ vertical bends, horizontal/vertical Tees, Reducers, Horizontal cross pieces etc. shall be supplied to make the system complete.

Cable tray support system shall be of sheet steel prefabricated and galvanised or of site fabricated and painted type.

Sheet steel covers of minimum 2 mm. thick shall be provided for wall/column mounted vertical raceways and wherever specifically required. The width of the cover shall be same as that of the tray.

#### 8.15.3.2 Cable Termination & Jointing Kits

The cable termination and jointing kits shall be either "Heat Shrink" / "Cold Shrunk" / Push ON type. The kits shall include all insulation and sealing materials apart from conductor fittings and consumable items. Joints and terminations shall meet test requirements as per IEC/ VDE 0278. The straight through jointing kits shall be suitable for underground buried installation with uncontrolled backfill and possibility of flooding by water or overhead tray installation.

Cable ties & trefoil clamps shall be of special nylon high tensile material. Cable markers shall be of aluminium.

#### 8.15.3.3 Conduits and Accessories

Conduits shall be of rigid steel, hot-dip galvanized, furnished in standard lengths threaded at both ends. Minimum diameter of conduits shall be 20 mm. All conduits shall be heavy duty suitable for electrical installation. Sizing of conduit shall be based on maximum 40% fill criteria. Conduits shall be complete with all accessories such as bends, ties, couples, inspection box, etc.

Flexible conduits where required, near equipment terminations, shall be made with bright, cold rolled, annealed and electro-galvanized mild steel strips. In corrosive areas, epoxy coated conduits shall be provided.

#### 8.15.3.4 Receptacles

##### Industrial Receptacles

The industrial receptacles shall be heavy duty type rated for 20 A, 230V AC complete with plug and switch housed in galvanised sheet steel enclosure having degree of protection of IP 55. These shall be of three pin type with the third terminal connected to earth. Receptacles shall be provided in all the indoor and semi indoor areas such that the any point is accessible within 25m of cabling distance from the receptacle. For outdoor area also necessary receptacles shall be provided as per owners requirement to be indicated during detailed engineering. Receptacles shall be provided in all the buildings of auxiliary equipment, GTG area and Transformer yard. The receptacle shall have safety shutters and other safety interlocks for safe operation.

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### Flush type indoor receptacles

Flush type receptacles shall be provided for office rooms, control rooms and wherever false ceiling has been adopted. These shall be so located that only the plug projects outside and shall be rated for 5/15 A, 230V, AC. The receptacle shall be complete with switch housed in sheet steel enclosure.

### Welding Receptacles

The welding receptacle to be supplied shall be of 63 A, industrial heavy duty type with 5pin (with earth connection) suitable for 400V, 3 phase, 50 Hz supply. In every enclosed area, for every 50 m interval, 1 No. receptacle shall be provided. For outdoor area, necessary receptacles shall be provided as per requirement. Receptacles shall be provided in all the buildings of auxiliary equipment, GTG area and Transformer yard.

The receptacle and switch shall be housed in a sheet steel enclosure complete with gasket, cable glands etc. All receptacle enclosures shall have 2 Nos. earthing terminals.

The enclosure shall be min. 2 mm. thick galvanized sheet steel and shall conform to the degree of protection IP-55 class.

All receptacles shall be provided with matching plug tops.

In hazardous areas, receptacles shall be of flame proof type.

The receptacle and switch shall be interlocked with the plug such that it shall not be possible to remove the plug with the switch in 'ON' position.

#### 8.15.3.5 Junction Box

Junction boxes shall be conforming to degree of protection IP55. The boxes shall be of die cast aluminium (LM 6) complete with removable cover plate with gaskets, two earthing terminals, terminal blocks etc.

The boxes shall have provision for wall, column, pole or structure mounting and shall be provided with cable/conduit entry knock outs & terminal blocks.

The terminal blocks shall be mounted securely on brackets welded to the back sheet of the box. The terminals shall be 650 V grade, one piece construction complete with terminals, insulation barriers, galvanised nuts, bolts and washers and provided with identification strips of PVC. The terminals shall be made of copper alloy and shall be of box clamp type.

The terminals for junction boxes shall be suitable for terminating two (2) nos. 2.5 mm<sup>2</sup> stranded copper conductors on each side.

#### 8.15.3.6 Cable Glands

Cable glands shall be tinned brass, shrouded, double compression type, complete with necessary armour clamp and tapered washers etc. Cable glands shall match with the different cable sizes.



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**8.15.3.7 Cable Lugs**

Cable lugs shall be tinned copper lugs suitable for termination of different sizes of HT/LT/ control cables. Lugs for power cables shall be of compression type, whereas lugs for control cables shall be of insulated terminal crimping type.

**8.15.3.8 Fire Stop Cable Sealing System**

In order to restrict the propagation of cable fire and spread of toxic smoke, the cable entry below switchgear panels/ control panel, cable penetration through walls and cable shafts on the floors need to be sealed by fire seal system.

Fire stop cable sealing shall have two (2) hours fire rating. The sealing compound shall have special property to allow for thermal expansion of cables both under normal and short circuit conditions. The sealing system shall be proven type and tested as per relevant standard.

Necessary fire proof doors in cable spreader rooms shall also be provided.

If required by the fire stop sealing system to achieve the fire rating of 2 hours, cable coating shall be adopted on cables. The coating shall have minimum two hours fire protection rating. Cables at least 1 m before & after the penetration seals shall be suitably coated. Cables shall be sized to take care of any derating due to fire stop sealing.

**8.15.3.9 Name plates**

Name plates shall be furnished for identification of devices and circuits. All terminals shall have permanent and legible markings.

**8.15.4 Drawings, Data & Manuals**

To be submitted with the Bid

General arrangement drawing showing constructional features, space required in front, rear, cable entry points etc.

Typical mounting details.

Bill of materials

Technical leaflets on :-

- i) Push buttons and indication lamps
- ii) Terminal blocks
- iii) Cable glands & lugs.
- iv) Ammeters

To be submitted for Approval and Distribution (After award of contract)

General arrangement drawing showing constructional features; space required in front, rear, cable entry points etc.

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Cross-section with parts list.

Mounting details.

Consolidated bill of materials

Control Schematics

Wiring diagrams.

Any other relevant drawings, document or data necessary for satisfactory installation, operation and maintenance.

Instruction Manuals for Local Control Panel/Local Control Station/Local junction Box

The manuals shall clearly indicate method of installation, check ups and tests to be carried out before carried out before commissioning of the equipment.

The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups and information required to fully describe the equipment are submitted with his bid.

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## 8.15.5 Specified Design Data

## SECTION : MISC. ELECTRICAL ITEMS

## 8.15.5.1 Cable Trays-General

Type	-	Pre fabricated ladder type
Thickness	-	Not less than 3mm
Surface coating	-	Hot dip galvanised
For DM plant and corrosive chemical laden area	-	Tough FRP

## 8.15.5.2 Cable Terminations / joints

Type	-	Heat Shrink/ Cold shrink
------	---	--------------------------

## 8.15.5.3 Conduits

Type	-	Heavy duty
Material	-	Hot dip galvanised rigid steel

## 8.15.5.4 Fire seal system

Fire rating	-	min. 2 hours
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## 8.15.6 Technical Data by the Tenderer

## SECTION : MISC. ELECTRICAL ITEMS

## 8.15.6.1 Cable Trays – Give separately for GI/Tough FRP

Make

-

Type

-

Thickness

mm

Material

-

Standard length

m

Weight per metre

kg

Size

mm

## 8.15.6.2 Cable tray support system

Make

-

Type

-

Whether Galvanised

Yes/No

Weight / Metre

kg

Size &amp; Shape

## 8.15.6.3 Cable Terminations &amp; joining kits

Make

-

Type

-

Applicable standard

-

## 8.15.6.4 Conduits

Make

-

Type

-

Size

mm

Thickness

Mm

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Surface coating	-	
<b>8.15.6.5 Receptacles</b>		
Make	-	
Type	-	
Rating	A	
Applicable standard	-	
Voltage	V	
<b>8.15.6.6 Junction Box</b>		
Make	-	
Type	-	
Size	mm x mm	
Thickness	mm	
<b>8.15.6.7 Cable glands</b>		
Make	-	
Type	-	
Material	-	
Applicable standard	-	
Size	mm <sup>2</sup>	
<b>8.15.6.8 Cable lugs</b>		
Make	-	
Type	-	
* Material	-	
Size	mm <sup>2</sup>	
<b>8.15.6.9 Fire sealing system</b>		

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Make

Type

Fire rating

hour

Note :- Data marked \* thus shall be filled up by the Bidder along with the offer. Completely filled data sheet are to be submitted by successful Bidder.

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#### 17.4.5.0 Cabling, Wiring, Junction Boxes

##### Cabling

Single pair / 2 core cable shall be used for connection of field transmitters / switches to the respective junction boxes respectively. From junction boxes, multipair/multicore cables shall be used upto the CCR. For RTD's single triad/multi triad cables shall be used.

Screened  
control  
cable.

The cables shall be of stranded, tinned copper conductor, PVC insulated, shielding with mylar back aluminium tape with drain wire, GI round wire armoured, HRFRLS PVC inner and outer sheathing, 600V grade type.

For thermocouples, extension cables shall be used upto the temperature transmitters, where provided. However in very high temperature zones, mineral insulated cables shall be used.

The cable trays shall be fabricated from steel sheet - galvanized or coated with other corrosion resistant material. All fittings etc. shall also be of galvanized steel. The cable trays shall be sturdy in design and shall have adequate strength. The cable trays shall not have sharp edges, burrs or projections. Protective covers on trays shall be provided, wherever necessary. Space for atleast 20 percent future cables shall be kept in each tray.

Cable tray runs shall be made as straight as possible and shall avoid exposure of the cables to excessive heat, moisture, areas of strong electrical interferences and mechanical drainage. The minimum separation between parallel runs of power and signal wiring shall be 300 mm for L.T. and 1000 mm for H.T. cables.

##### ✓ Wiring

In particular, wiring within cabinets and panels shall be supported on trays or ducts and shall be segregated according to voltage level. Wiring carrying A.C. and D.C. voltage shall also be segregated.

All cabinets, panels, and racks shall be factory wired. Where desks or panels area supplied in more than one section electrical connections between the sections shall be via terminal strips.

Spare cores shall be terminated at terminal strips in such a manner as to give a maximum length of core. These shall be ferruled in a special way to indicate that they are spare cores.

Terminal strips shall be of the screw type. Screw type terminals shall have a metal insert between screw and conductor. In the Central Control Room (CCR) advanced semi-automatic connection techniques (e.g. maxi terminal point, wire - wrap) are preferred. Wire wrap and terminal point connections shall be effected with the aid of an approved semi automatic or automatic, power operated hand tool.

##### ✓ Junction Boxes

In order to simplify local collection of cables and distribution of signals and to centralize connections in the plant, junction boxes shall be provided. The junction boxes shall be designed to the protection class shall be NEMA 4X equipped with the necessary terminal strips, cable glands and attachment components for the connection of the cables. The necessary earthing terminals shall be provided for the earthing of the boxes. In any area

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subject to the danger of explosion, the necessary explosion - protected boxes shall be provided in accordance with IEC 79 and VDE 0165/170/171 or equivalent.

#### 17.4.6 Instrument Air Piping/Turbing

All pneumatic ~~turbing~~ connecting the instruments shall be in SS 316 unless otherwise agreed by the Purchaser. All instrument air header lines shall be in GI.

~~The piping ends shall be plugged prior to transportation~~

#### 17.4.7 Painting

Inside housed desks, panels, cabinets, racks and other control equipment are to be supplied with the same colour of final painting. External surfaces shall be semi-gloss.

Local mounted cabinets, housing Control & Instrumentation equipment shall be protected against rust and corrosion by a protective coating such as galvanized zinc, which shall be applied as a first factory coat.

In all cases where site erection work exposes bare metal, such as the drilling or punching out of holes for cable or pipe entry, these areas shall be protected by the immediate application of a protective first coat similar to the original.

The shade and grade of paint are to be agreed to by the Purchaser and must harmonize with the overall architectural design.

Any machined or bright faces and parts which are not painted (e.g. of valves, fittings or accessories) must be protected against corrosion by suitable agents prior to installation.

After completion of installation and commissioning but before provisional taking over the Contractor shall make good all marks, scratches and damage to the painted surface of all desks, panels and cabinets irrespective of the cause. The Contractor shall also take every reasonable precaution to prevent damage during the course of erection and commissioning. Repairs to paintwork shall be carried out in such a way so as to restore the equipment to its original factory condition and shall be to the satisfaction of the Purchaser.

#### 17.5.0 General Civil Requirements

The design specification covered in Section 10 of Vol V, establish the minimum basic requirements for all Civil structural and Architectural works. However all structures shall be designed for the satisfactory performance of the function for which the same are to be constructed.

With regard to soil and other hydrographic data furnished, it shall be clearly understood that the same are given to the bidders in good faith and as such no claim for extra payment shall be entertained by the Owner, if the actual condition met with during execution are at variance with the data given in tender. The bidder shall fully satisfy himself about the site conditions, nature of soil, ground water, contour levels, etc. prior to the submission of the bid. The bidder shall conduct his own investigations to ascertain the correctness of the data furnished.

#### 17.5.1 Design Calculations and Drawings

Detailed design calculations / design drawings shall be commenced by Contractor only after approval is obtained from the Owner to the basic design criteria submitted by the Contractor. No deviation from the approved design criteria will be permitted unless specifically approved again by the Owner in writing, prior to its adoption.



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## 8.10 EARTHING & LIGHTNING PROTECTION

### 8.10.1 General

This specification covers the design, manufacture, supply, erection, testing and commissioning of Earthing and lightning protection system.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Should the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

### 8.10.2 Scope of work

The scope of work shall include but not limited to the following:

- System earthing with buried earth mats / electrodes for complete power plant
- Equipment earthing system
- Lightning protection system for all buildings, structures & equipments
- List of recommended spare parts as per Section-10.0, Vol.-II.
- Commissioning spares.
- Interconnection with the Phase – I Plant earthing system at 4 points.

### 8.10.3 Technical Requirements

#### 8.10.3.1 Earthing System

Earthing system design shall be carried out as per ANSI / IEEE 80 and other relevant IEC standards.

For earth mat design, the size of the earthing conductor shall be arrived, considering the maximum fault current for a duration of 3 sec. and suitable corrosion factor. The spacing of the conductors shall be such that the touch and step potential are within the limits of permissible values. The earthing resistance shall be less than 1 ohm. The earthing system shall be designed for a life expectancy of atleast 30 years.

The contractor shall assess the soil quality and site conditions and design the grounding system accordingly. Necessary tests / measurements shall be carried out by the successful bidder to arrive at the actual soil resistivity.

The earthing system below ground level shall consist of interconnected mesh of copper wire rope buried at a depth of minimum 600 mm and vertical electrodes of lead coated copper rods. When the earthing conductor is laid beneath the building the depth of burial shall be increased so that sufficient earth coverage is available. The earthing conductor shall be of bare copper wire.

The earthing Grid at different areas of the power plant shall be interconnected by minimum 2 Nos. of conductors.

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For shielding towers / chimneys, the ground conductor shall be taken right upto the top along the tower / chimney structure & connected directly to the shielding mast wire / lightning mast.

All joints in the equipments shall be bonded to provide electrical continuity.

Vertical electrodes shall be of adequately sized lead coated of Copper rod, min. 3M long. Treated earth pits as required shall be provided. Vertical risers shall be provided at suitable place for connecting to equipment grounding conductors. The risers shall be bare copper wire. Equipment grounding conductors shall be copper flats (or) standard size of copper ground cable suitably sized to withstand the fault current of the system.

All electrical equipment shall be earthed by two separate and distinct earth connections with earth grid. Instrumentation DCS panels shall be earthed with two separate distinct earth connections to the two numbers exclusive earth pits.

#### 8.10.3.2 Lightning protection system

Lightning protection system shall be carried out as per IEEE / ANSI and other IEC standards.

Lightning protection shall be provided for all equipment / buildings / structures higher than 20 metres and where the calculated risk index exceeds 40, with horizontal roof conductors for lightning protection.

Lightning protection system shall comprise vertical air terminations, horizontal air terminations, down conductors, test links and earth electrodes.

Air terminations, down conductors and test links shall be made of adequately sized lead coated copper rod and earth connection below ground level shall be of copper only.

Hazardous area shall be protected by a system of aerial earth as per IEEE 142.

The portion of the copper flat / wire rope which undergone welding at site shall be coated with two (2) coats of cold galvanising anti corrosive paint after welding.

#### 8.10.4 Drawings, Data & Manual

To be submitted for Approval and Distribution (After award of Contract)

Calculation for determining the soil resistivity.

Calculation for grounding system design.

Grounding layout drawings of various plants with dimensions showing the location of main ground grid, ground electrodes, risers, grounding leads etc.

Calculation for lightning protection system design.

Layout of lightning protection system for various plants with dimensions showing location of vertical/horizontal air terminations, down conductors, risers, electrodes etc.

Details of materials and procedures for jointing/connections among various electrodes/risers/conductors.

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## 8.10.5 Specified Design Data

<b>SEC.: EARTHING &amp; LIGHTNING PROTECTION SYSTEM</b>		
<b>EARTH MAT</b>		
Fault withstand current	kA	As per system requirement
Earth fault current duration for conductor sizing	s	3 (minimum)
Conductor material	-	Copper wire rope
Ground electrode	-	Lead coated copper rod
<b>Equipment Earthing</b>		
Conductor	-	Copper flat / standard size of copper ground cable.
No. of connection / equipment	-	2
<b>Lightning Protection System</b>		
Vertical / Horizontal Air termination, Down conductor		Copper Flat

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## 8.10.6 Technical Data by the Tenderer

## SECTION : EARTHING &amp; LIGHTNING PROTECTION

## 8.10.6.1 Earthing System

## Earth mat

## \* Material

Size of conductor

mm<sup>2</sup>

Fault withstand current &amp; duration

kA, Sec.

Soil resistivity

Ohm metre

Mesh width

m x m

Total length of conductor

m

Earth resistance

Ohm

Permissible touch voltage

V

Permissible step voltage

V

Actual touch voltage

V

Actual step voltage

V

## Equipment earthing

## \* Material

## \* Size of conductor

mm<sup>2</sup>

Thickness of galvanising

## Earth electrode

## \* Material

## \* Size

mm<sup>2</sup>

Length

m


## 8.10.6.2 Lightning Protection System

Material and size of horizontal air termination

mm

Material &amp; size of vertical air termination





		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION :		
				TITLE			TITLE			NUMBER :		
				BIDDER/ VENDOR			QUALITY PLAN			SPECIFICATION :		
				SHEET 2 OF 5			NUMBER PED-507-Q-001, REV-05			TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION	AGENCY	VOLUME III	REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.6	Copper/Aluminium Rods/Wires	1. Physical Properties 2. Chemical Composition & purity 3. Electrical properties 4. Dimensions	MA	Physical Tests	-do-	IS:613, IS-5484, IS:8130 & BHEL Specification	IS:613, IS-5484, IS:8130 & BHEL Specification	-do-	3/2	-	1,2	
2.0	IN PROCESS											
2.1	Wire Drawing	1. Physical, Electrical, Finish & dimension	CR	Phy. & Elect. Tests Visual / Meas.	Sample	IS:8130 & BHEL Specn.	IS:8130 & BHEL Specn.	Log Book	2	-	1	
2.2	Stranding of wires	1. No. of wires 2. Sequence, lay length & Direction 3 Surface Finish 4. Dimension	MA	Counting	-do-	BHEL Specn, Apprd. Data Sheet & Relevant IS	BHEL Specn, Apprd. Data Sheet & Relevant IS	-do-	2	-	-	
2.3	Conductor Screening	1. Radial thickness	MA	Visual, Meas.	-do-	-do-	-do-	-do-	2	-	-	
				Visual	-do-	-do-	-do-	-do-	2	-	-	
				Measurement	-do-	-do-	-do-	-do-	2	-	-	
				-do-	Sample	BHEL Specn & Apprd. Data Sheet	BHEL Specn & Apprd. Data Sheet	Log Book	2	-	-	N.A. for LT XLPE cables
BHEL												
PARTICULARS						BIDDER/VENDOR						
NAME												
SIGNATURE												
DATE												
BIDDER'S/VENDORS COMPANY SEAL												


<div><div><div>QUALITY PLAN</div><div>SHEET 3 OF 5</div></div></div>		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :	
BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-507-00-Q-001, REV-05		SPECIFICATION : TITLE			
SYSTEM CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT	
CHARACTERISTIC CHECK		CHECK		CHECK		ACCEPTANCE NORM	
SL NO.		2		3		4	
COMPONENT/OPERATION		1. Surface finish 2. Concentricity # 3. Thickness of Insulation 4 Dia over insulation 5. Test on XLPE (Tensile & Elongation, Hot Set & Ageing Test) 6. Spark test or water immersion test (applicable for LT XLPE cables only)		1. Surface finish 2. Thickness 3 Overlap of Tape Band 4 Tightness of Tape Band		1. Surface finish 2. Concentricity # 3. Thickness of Insulation 4 Dia over insulation 5. Test on XLPE (Tensile & Elongation, Hot Set & Ageing Test) 6. Spark test or water immersion test (applicable for LT XLPE cables only)	
1		2		3		4	
2.4		Core Insulation (XLPE) (No repair permitted)		1. Surface finish 2. Concentricity # 3. Thickness of Insulation 4 Dia over insulation 5. Test on XLPE (Tensile & Elongation, Hot Set & Ageing Test) 6. Spark test or water immersion test (applicable for LT XLPE cables only)		1. Surface finish 2. Concentricity # 3. Thickness of Insulation 4 Dia over insulation 5. Test on XLPE (Tensile & Elongation, Hot Set & Ageing Test) 6. Spark test or water immersion test (applicable for LT XLPE cables only)	
2.5		Insulation Screening, (Non Metallic & Metallic )		1. Surface finish 2. Thickness 3 Overlap of Tape Band 4 Tightness of Tape Band		1. Surface finish 2. Concentricity # 3. Thickness of Insulation 4 Dia over insulation 5. Test on XLPE (Tensile & Elongation, Hot Set & Ageing Test) 6. Spark test or water immersion test (applicable for LT XLPE cables only)	
BHEL		PARTICULARS		BIDDER/VENDOR			
		NAME					
		SIGNATURE					
		DATE					








		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION :				
								NUMBER :				
								TITLE				
								VOLUME III				
SL NO.	COMPONENT/OPERATION	SHEET 5 OF 5	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS		
										P	W	V
1	2	3	4	5	6	7	8	9	10	11		
2.10	Finished Cable (INTERNAL)	1. Routine Test 2. Type Tests (Internal)	CR	Elec. & Meas.	100%	IS:7098 & BHEL spec	IS:7098 & BHEL spec	Test Report	2	-	1	
3.0	Final Inspection (EXTERNAL)	1. Finish & Length 2. Dimension 3. Armouring - Coverage No.of Wires/Strips 4. Marking & Colour Coding 5. Acceptance Tests 6. Type Tests	CR	Physical & Electrical Tests	Sample	Approved Type & acceptance test schedule	Approved Type & acceptance test schedule & approved Data Sheet	-do-	2	1		FOR HT: Type tests to be conducted on one drum/size & voltage grade/lot FOR LT: Type tests to be conducted on one drum/size/lot
			MA	Visual, Measurement	(See remark)	BHEL specn. & IS:7098	BHEL Specn./ Free from Porosity, Bulging, Burnt particles, lumps, cuts & scratches	-do-	2	1	-	One drum in each Lot
			MA	Measurement	As per IS	Apod Data Sheet/ IS:7098, IS:10810	Specn./ Apod. Data Sheet/ IS:7098, IS:10810	-do-	2	1	-	
			MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	1	-	
			MA	Visual	-do-	-do-	-do-	-do-	2	1	-	
			CR	Phy. Elect. Tests	-do-	Apod Data Sheet/ IS:7098	Apod Data Sheet/ IS:7098	-do-	2	1		1. * FOR HT: Type tests to be conducted on one size of each voltage grade/lot except FRLS (outer sheath) tests & Electrical tests which shall be conducted on every size & voltage grade of cables.
			CR	FRLS Tests	Sample *	Approved Type & acceptance test schedule	Approved Type & acceptance test schedule & approved Data Sheet	-do-	2	1		2. * FOR LT: Type tests to be conducted on one size (sample)/lot per Type (CU/ AL conductor)
				Electrical Tests								3. *Flammability test as per IEC 332, Part-3 CAT-B to be conducted on one sample only/lot
NOTES:- JOINTS IN WIRE SHALL BE AS PERMITTED BY IS / BHEL SPECIFICATION, VENDOR TO CERTIFY THE SAME. (A) NO REPAIR OF CORE INSULATION PERMITTED (B) CABLE ENDS SHALL BE SEALED AS PER VENDOR'S SPECIFICATION (C) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER. (D) FILLERS/DUMMY CORES ETC. SHALL BE AS PER APPROVED DATA SHEET (E) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS SAMPLES AND NOT DEFINED IN QP, THE SAME SHALL BE AS PER SAMPLING PLAN AGREED BY PURCHASER. (F) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER BHEL SPECIFICATION. (G) LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL 2-VENDOR 3-SUB VENDOR CHP: CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE												
BHEL												
PARTICULARS NAME SIGNATURE DATE												
BIDDER'S/VENDORS COMPANY SEAL												

<div></div>		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :			
				BIDDER/ VENDOR		TITLE		NUMBER :		SPECIFICATION	
SHEET 1 OF 5		SYSTEM		ITEM :PVC POWER & CONTROL CABLE		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
									P	W	V
1	2	3	4	5	6	7	8	9	1011		
1.0	RAW MATERIAL										
1.1	PVC Compound(for insulation and sheath)	1. Physical properties	MA	Physical Tests	Sample	IS-5831/BHEL Specification	IS-5831/BHEL Specification/appd data sheet	Log Book/ Test Cert.	3/2	-	2,1
		2. Elec.Properties	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	2,1
		3. Make & Type	MA	Visual	100%	Plant Std.	Plant Std.	-do-	2	-	-
1.2	Galvanised steel wire/strip	1. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	IS-3975 BHEL Specification	IS-3975/BHEL Specification/appd data sheet	-do-	3/2	-	2,1
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2,1
		3.Galvanization Quality	MA	Galv. Tests	-do-	-do-	-do-	-do-	3/2	-	2,1
1.3	Copper/Aluminium Rods/Wires	1. Physical Properties	MA	Physical Tests	-do-	IS-613 IS-5484 IS-8130 AND BHEL Specification	IS-613 IS-5484 IS-8130 AND BHEL Specification	-do-	3/2	-	2,1
		2. Chemical Composition & purity	MA	Chemical analysis	-do-	-do-	-do-	-do-	3/2	-	2,1
		3.Electrical properties	MA	Electrical Tests	-do-	-do-	-do-	-do-	3/2	-	2,1
		4.Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2,1
BHEL											
PARTICULARS				BIDDER/VENDOR							
NAME											
SIGNATURE											
DATE											
				BIDDER/S/VENDORS COMPANY SEAL							


<div></div>			CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :						
QUALITY PLAN			BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-507-00-Q-002, REV.03		SPECIFICATION : TITLE						
SHEET 2 OF 5			SYSTEM		ITEM :PVC POWER & CONTROL CABLE		VOLUME III						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	1011				
2.0	IN PROCESS												
2.1	Wire Drawing , Tinning and Annealing	1. Physical, Electr. Finish & dimension	CR	Phy.&Elect. Tests Visual & Meas.	Sample	BHEL Specn. IS-8130	BHEL Specn. IS-8130	Log Book	2	-	1		
		2. Chemical test for Tinning (if applicable)	CR	Chemical Test	Sample	-do-	-do-	-do-	2	-	-		
2.2	Stranding of wires	1. No.of wires	MA	Counting	Sample	Vendors/BHEL Specn. & Apprd. Data Sheet & Relevant IS	Vendors/BHEL Specn. & Apprd. Data Sheet & Relevant IS	-do-	2	-	-		
		2. Sequence, lay length & Direction	MA	Visual, Meas	Sample	-do-	-do-	-do-	2	-	-		
		3 Surface Finish	MA	Visual	Sample	-do-	-do-	-do-	2	-	-		
		4.Dimension	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-		
2.3	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & Scratches. Appd.data sheet IS-1554	-do-	2	-	1		
		2 Insulation thickness	CR	Measurement	Sample	Appd.data sheet IS-1554	Appd.data sheet IS-1554	-do-	2	-	-		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE										
					BIDDER'S/VENDORS COMPANY SEAL								

<div></div>		CUSTOMER :		PROJECT		SPECIFICATION :									
		QUALITY PLAN		TITLE		NUMBER :									
		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION :									
		SHEET 3 OF 5		NUMBER PED-507-00-Q-002, REV.03		TITLE									
COMPONENT/OPERATION		CHARACTERISTICS CHECK		CAT.		SYSTEM		ITEM :PVC POWER & CONTROL CABLE		SECTION		VOLUME III		REMARKS	
SL. NO.															
1	2	3	4	5	6	7	8	9	10	11					
		3. Concentricity #	CR	Measurement	Sample	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	Log Book	2	-	1	# To be checked at starting & finish end of Extruded Length			
		4 Dia over insulation	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-				
		5. Spark Test or Water Immersion test	CR	Electrical	100%	Mfr's Std.	Mfr's Std.	-do-	2	-	1				
		6. Core identification	MA	Visual	100%	IS-1554	IS-1554	-do-	2	-	-				
2.4	Core Laying	1. Dia over laidup core	MA	Measurement	Sample	-do-	-do-	Log Book	2	-	-				
		2.Sequence of lay, Lay length & direction for laid up core	MA	Visual & Meas.	Sample	Mfrs.Std./relevant IS	Mfrs.Std./relevant IS	-do-	2	-	-				
2.5	InnerSheath Extrusion (If applicable)	1. Surface finish	MA	Visual	100%	--	Free from bulging, burnt particles, lumps cuts & scratches.	-do-	2	-	-				
		2. Sheath thickness	MA	Measurement	Sample	IS-5831, IS-1554 data sheet	IS-5831, IS-1554 data sheet	-do-	2	-	-				
		3.Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-				
2.6	Armouring (If applicable)	1. No.of wires/Strips	MA	Counting	At the start of the process	BHEL Specn./ Appd. Data sheet	BHEL Specn./ Appd. Data sheet	-do-	2	-	-				
		2. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-				
		PARTICULARS				BIDDER/VENDOR									
BHEL		NAME													
		SIGNATURE													
		DATE													
						BIDDER/S/VENDORS COMPANY SEAL									


<div></div>		CUSTOMER :		PROJECT		SPECIFICATION :								
		QUALITY PLAN		TITLE		NUMBER :								
				QUALITY PLAN		SPECIFICATION :								
BIDDER/ VENDOR		NUMBER PED-507-00-Q-002, REV.03		ITEM :PVC POWER & CONTROL CABLE		TITLE								
SHEET 4 OF 5		SYSTEM		SECTION		VOLUME III								
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	REMARKS	
1	2	3	4	5	6	7	8	9	10	11				
2.7	Outer Sheath Extrusion	3. Lay Length	MA	Visual, Meas.	At the start of the process	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	Log Book	2	-	-	-		
		4. Coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-	2	-	-	-	
		5. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	-do-	2	-	-	-	
		1. Surface Finish	MA	Visual	100%	-	Free from Porosity, Bulging,Burnt particles, lumps, cuts & scratches	Log Book	2	-	-	-	-	
2.8	Finished Cable	2.Sheath thickness	MA	Measurement	Sample	IS-5831 & IS-1554 Data Sheet	IS-5831 & IS-1554 Data Sheet	Log Book	2	-	-	-		
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	-do-	2	-	-	-	
		4. Marking	MA	Visual	100%	IS-1554 & BHEL Specn.	IS-1554 & BHEL Specn.	IS-1554 & BHEL Specn.	Test Report	2	-	-	-	Sequential marking shall be done by printing
		1. Routine Test	CR	Elec. & Meas.	100%	IS-1554 & BHEL Specn.	IS-1554 & BHEL Specn.	IS-1554 & BHEL Specn.	Test Report	2	-	1	-	Vendor's internal testing
3.0	Final Inspection	2. Type & FRLS Tests	CR	Elec., Phy & Meas.	One Drum per size per Lot	-do-/Apprd.data sheet	-do-/Apprd.data sheet	Test Report	2	-	1	-	One drum each for Power & control cables in a Lot	
		1. Finish & Length	MA	Visual	(See remark)	BHEL specn. IS-1554	Free from Porosity, Bulging,Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	-	-	
BHEL		PARTICULARS		BIDDER/VENDOR										
		NAME												
		SIGNATURE												
		DATE												
						BIDDER'S/VENDORS COMPANY SEAL								


		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :							
		BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-507-00-Q-002, REV.03		SPECIFICATION : TITLE							
SL. NO.	COMPONENT/OPERATION	QUALITY PLAN SHEET 5 OF 5		SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY			VOLUME III REMARKS
		CHARACTERISTICS CHECK	3							4	5	6	
1	2	3	4	5	6	7	8	9	10	11			
		2. Dimension	MA	Measurement	As per IS	Appd.Data Sheet/ IS-1554 & IS-10810	Appd.Data Sheet/ IS-1554 & IS-10810	Test Report	2	1	-		
		3. Armouring - Coverage No.of Wires/Strips	MA	Visual & Meas.	As per IS	-do-	-do-	-do-	2	1	-		
		4. Marking/Colour Coding	MA	Visual	-do-	-do-	-do-	-do-	2	1	-		
		5. Acceptance Tests	CR	Phy & Elect. Tests FRLS Tests Measurement	As per IS (SEE REMARK)	-do-	-do-	-do-	2	1	-		
		6. Type & FRLS Tests	CR			BHEL Specn. Apprd.Data Sheet	BHEL Specn. Apprd.Data Sheet	-do-	2	1	-		
NOTES:- (A) JOINTS IN WIRE SHALL BE AS PERMITTED BY IS / BHEL SPECIFICATION. VENDOR TO CERTIFY THE SAME. (B) NO REPAIR OF CORE INSULATION PERMITTED (C) CABLE ENDS SHALL BE SEALED AS PER VENDOR'S SPECIFICATION. (D) PURCHASER SHALL HAVE RIGHT TO WITNESS THE SPARK TEST AT CORE STAGE (E) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER. (F) FILLERS/DUMMY CORES ETC. SHALL BE AS PER APPROVED DATA SHEET (G) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS 'SAMPLE' & NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN. (H) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER IS/ BHEL SPECIFICATION.													
LEGEND : P : PERFORMER V: VERIFIER 1- BHEL 2-VENDOR 3- SUB VENDOR CHP: CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE.													
BHEL													
NAME													
SIGNATURE													
DATE													
BIDDER'S/VENDORS COMPANY SEAL													


<div><div></div><div></div></div>		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :						
		BIDDER/ VENDOR :		QUALITY PLAN		SPECIFICATION						
QUALITY PLAN		SYSTEM		ITEM :INSTRUMENTATION CABLES		TITLE						
SHEET 1 OF 5		CAT.		TYPE/ METHOD OF CHECK		SECTION						
SL. NO.	COMPONENT/OPERATION/CHARACTERISTICS CHECK	3	4	5	6	7	8	9	VOLUME III			
						REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL											
1.1	PVC Compound(for insulation and sheath)	1. Physical properties	MA	Physical Tests	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Log Book/ Test Cert.	3/2	-	2	
		2. Elec.Properties (insulation)	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	2	
		3. FRLS Properties (outer sheath)	CR	Environmental	Sample	-do-	-do-	-do-	3/2	-	2	
1.2	Galvanised steel wire/strip	1. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	3/2	-	2	* Sample from each Batch/Lot as per IS-3975 Annexure-A
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2	
		3.Galvanization Quality	MA	Galv. Tests	-do-	-do-	-do-	-do-	3/2	-	2	
1.3	Copper Rods/ Wires (For conductor/ drain wire)	1. Physical Properties	MA	Physical Tests	-do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	3/2	-	2	
		2.Electrical properties	CR	Electrical Tests	-do-	-do-	-do-	-do-	3/2	-	2	
1.4	Fillers	1. FRLS Properties	CR	Chemical/ Environ. test	-do-	-do-	-do-	-do-	3/2	-	2	
1.5	Screen	1. Dimension	MA	Measurement	-do-	Appd. Data Sheet	Appd. Data Sheet	TC & IR	3/2	-	2	
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										
				BIDDER'S/VENDORS COMPANY SEAL								

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :			
SHEET 2 OF 5		BIDDER/ VENDOR		TITLE		NUMBER :		SPECIFICATION :			
SHEET 2 OF 5		SYSTEM		ITEM:INSTRUMENTATION CABLES		VOLUME III		REMARKS			
SL. NO.	COMPONENT/OPERATION/CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V
1	2	3	4	5	6	7	8	9	10	11	
2.0	IN PROCESS	MA	Mech test	-do-	MFRS. STD.	MFRS. STD.	TC & IR	3/2	-	2	
2.1	Wire Drawing , Tinning and Annealing	CR	Phy.&Elect. Tests Visual & Meas.	Sample	Relevant Std./ BHEL Specn.	Relevant Std./ BHEL Specn.	Log Book	2	-	1	
2.2	Stranding of wires	CR	Chemical Test (Persulphate test)	Sample	-do-	-do-	-do-	2	-	-	(Applicable only for tin-coated copper conductor and drain wire)
		MA	Counting	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		MA	Visual, Meas	Sample	Relevant Standard/ Vendor's Spec.	Relevant Standard/ Vendor's Spec.	-do-	2	-	-	
		MA	Visual	Sample	-do-	-do-	-do-	2	-	-	
		MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
2.3	Core Insulation (No repair permitted)	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & Scratches.	-do-	2	-	1	
		CR	Measurement	Sample	Appd.data sheet/ Relevant Std.	Appd.data sheet/ Relevant Std.	-do-	2	-	-	
BIDDER/VENDOR											
PARTICULARS											
BHEL											
NAME											
SIGNATURE											
DATE											
BIDDER'S/VENDORS COMPANY SEAL											



<div></div>		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :				
		BIDDER/ VENDOR		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION :				
		SYSTEM		SYSTEM		ITEM : INSTRUMENTATION CABLES		TITLE				
		SHEET 3 OF 5		SHEET 3 OF 5		ITEM : INSTRUMENTATION CABLES		TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION	VOLUME III	REMARKS	
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3. Concentricity #	CR	Measurement	Sample	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	Log Book	2	-	1	# To be checked at starting & finish end of Extruded Length
		4 Dia over insulation	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		5. Spark Test or Water Immersion test	CR	Electrical	100%	Mfr's Std.	Mfr's Std.	-do-	2	-	1	
		6. Core identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
2.4	Core pairing, screening (provision of drain wire & laying)	1. Pair identification	MA	Visual	100%	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	Log Book	2	-	-	
		2.Wire size & tape size	MA	Measurement	100%	-do-	-do-	-do-	2	-	-	
		3.Test for capacitance	CR	Elect. Test	100%	-do-	-do-	-do-	2	-	1	
		4. Sequence of lay and lay length	MA	Visual meas	Sample	BHEL Spec. & MFRs. Std.	BHEL Spec. & MFRs. Std.	-do-	2	-	-	
		5. Screen overlap & coverage	MA	Measurement	Sample	BHEL Spec.	BHEL Spec.	-do-	2	-	-	
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	<-----No Discontinuity ----->		-do-	2	-	-	
2.5	Inner/Sheath Extrusion	1. Surface finish	MA	Visual	100%	--	Free from bulging, burnt particles, lumps cuts & scratches.	-do-	2	-	-	(Applicable for armoured cables)
		2. Sheath thickness	MA	Measurement	Sample	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	-do-	2	-	-	
BHEL												
PARTICULARS												
NAME												
SIGNATURE												
DATE												
BIDDER'S/VENDORS COMPANY SEAL												

<div></div>		QUALITY PLAN	CUSTOMER :		PROJECT		SPECIFICATION :					
			BIDDER/ VENDOR :	TITLE	QUALITY PLAN	NUMBER :						
							SPECIFICATION :					
SHEET 4 OF 5		NUMBER PED-507-Q-004, REV.02		TITLE		VOLUME III						
SL. NO.	COMPONENT/OPERATION/CHARACTERISTICS CHECK	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY			REMARKS	
								P	W	V		
1	2	3	4	5	6	7	8	9	10			11
2.6	Armouring	3.Dia over inner sheath	MA	Measurement	Sample	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	-do-	2	-	-	
		1. No.of wires/Strips	MA	Counting	At the start of the process	BHEL Specn./ Appd. Data sheet	BHEL Specn./ Appd. Data sheet	-do-	2	-	-	
		2. Lay Direction	MA	V/visual	-do-	-do-	-do-	-do-	2	-	-	
		3. Lay Length	MA	V/visual, Meas.	At the start of the process	Rel. Std./ BHEL Specn./Appd. Data sheet	Rel. Std./ BHEL Specn./Appd. Data sheet	Log Book	2	-	-	
		4. Coverage	MA	Measurement	-do-	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	-do-	2	-	-	
2.7	Outer Sheath Extrusion	5. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		1. Surface Finish	MA	V/visual	100%	-	Free from Bulging Burnt particles, lumps, cuts & scratches	Log Book	2	-	-	
		2.Sheath thickness	MA	Measurement	Sample	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Log Book	2	-	-	
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
		4. Marking	MA	V/visual	100%	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	-	Sequential marking shall be done by printing
2.8	Finished Cable	1. Routine Test	CR	Elec. & Meas.	100%	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	1	
		2. Type & FRLS Tests	CR	Elec., Phy & Meas	Sample *	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	1	* One Drum/Size/Lot
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										
				BIDDER'S/VENDORS COMPANY SEAL								

		CUSTOMER :		PROJECT		SPECIFICATION :						
		TITLE		TITLE		NUMBER :						
QUALITY PLAN		BIDDER/ VENDOR :		QUALITY PLAN		SPECIFICATION :						
SHEET 5 OF 5		SYSTEM		ITEM : INSTRUMENTATION CABLES		TITLE						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
											P	W
1	2	3	4	5	6	7	8	9	10	11		
3.0	Final Inspection	1. Finish & Length	MA	Visual	(See remark)	BHEL specn./ Relevant Std	Free from Bulging Burnt particles, lumps,porosity, cuts & scratches	Test Report	2	1	-	One drum in a Lot
		2. Dimensions	MA	Measurement	Sample Lengths	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet/ test procedures	Test Report	2	1	-	
		3. Armouring - Coverage No.of Wires/Strips	MA	Visual & Meas.	Sample	-do-	-do-	-do-	2	1	-	
		4. Marking/Colour/ pair identification	MA	Visual	-do-	-do-	-do-	-do-	2	1	-	
		5. Test for screening	CR	Elect. Test	-do-	test procedures/	test procedures	-do-	2	1	-	
		6. Acceptance Tests	CR	Phy & Elect. Tests	As per IS @	-do-	-do-	-do-	2	1	-	@: As per IS 1554 part-1 except flammability test which shall be performed on one sample only.
		7. Type & FRLS Tests	CR	Measurement	Sample#	BHEL Specn./Appd. Data sheet/ appd. TTP	BHEL Specn./Appd. Data sheet/ appd. TTP	-do-	2	1	-	#1. Physical/ Electrical/ Mechanical/ standard technical parameters: One size of each type[INDI.& OVERALL/ OVERALL] per lot. 2. Flammability tests: one sample only.
<p>NOTES:-</p> <p>(A) JOINTS IN WIRE SHALL BE AS PERMITTED BY REL STD / BHEL SPECIFICATION. VENDOR TO CERTIFY THE SAME.</p> <p>(B) NO REPAIR OF CORE INSULATION PERMITTED</p> <p>(C) CABLE ENDS SHALL BE SEALED AS PER REL. STD./ BHEL SPECIFICATION</p> <p>(D) RECORD OF RAW MATERIAL, PROCESS &amp; ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.</p> <p>(E) FILLERS/DUMMY CORES ETC. SHALL BE AS PER BHEL SPECIFICATION</p> <p>(F) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS SAMPLES AND NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN AGREED BY PURCHASER</p> <p>(H) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER REL. STD./ BHEL SPECIFICATION.</p> <p>(I) TICK APPLICABLE STANDARD W.R.T TO CONTRACTUAL REQUIREMENTS VDE/IS /IEC.</p>												
LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER			1- BHEL/CUSTOMER 2-VENDOR 3 SUB VENDOR			CHP: CUSTOMER HOLD POINT						
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

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