





**BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI
CONTROLS AND INSTRUMENTATION/QA/FB**

**STANDARD QUALITY PLAN
FOR
ELECTRICAL PANEL ACCESSORIES**

REV	DATE	PREPARED	REVIEWED	APPROVED		REVISION HISTORY
				ENGG.	QUALITY	
00	16.06.97	-Sd-	-Sd-	-Sd-	-Sd-	Initial release
01	22.02.99	-Sd-	-Sd-	-Sd-	-Sd-	New Vendors Added
02	21.03.02	-Sd-	-Sd-	-Sd-	-Sd-	Dept. name changed & General revision-Based on Engg. discussion.
03	08.01.04	-Sd-	-Sd-	-Sd-	-Sd-	Revised to include the comments /Feedback of internal discussion
04	07.12.07	RM. VAIRAVAN 	N.SRIDHAR 	L.A.E.Fernandez 	S.SOMASUNDARAM 	Vendor list updated. Inputs considered are: <ul style="list-style-type: none"> • TCE approved List for Jojobera • NTPC approved list for BAP(Sipat). • NTPC approved list for Korba-III. • NTPC approved list for Barh STPP. • Feedbacks obtained during discussion

SL.NO	PRODUCT	APPROVED VENDORS
01	Air Circuit Breaker.	L&T / GEPC / SIEMENS / CONTROLS & SWITCHGEAR Co.LTD / SCHNEIDER-MERLIN GERIN ENERPACT
02	Miniature circuit breaker (MCB).	MDS / CROMPTON GREAVES / INDO - ASIAN / IM / LUPUS / SCHNEIDER ELECTRIC / SIEMENS / L&T – HAGER /INDOKOPP/COOPER BUSMANN /STANDARD
03	Moulded case circuit breaker (MCCB).	L&T / GEPC./ CROMPTON GREAVES / BCH / ABB / SIEMENS / CONTROLS & SWITCHGEAR Co.LTD/SCHNEIDER ELECTRIC / ANDREW YULE /AREVA
04	Power contactors – AC.	L&T / SIEMENS / CONTROLS & SWITCHGEAR CONTACTORS LTD (TC) / SPRECHER & SCHUH / ANDREW YULE / BCH / GEPC / CROMPTON GREAVES / SCHNEIDER ELECTRIC
05	Power & Auxiliary Contactors – DC.	GEPC / BCH / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC) / SIEMENS / SPRECHER & SCHUH / L&T / SCHNEIDER ELECTRIC/ANDREW YULE.
06	Auxiliary Contactors – AC.	L&T / SIEMENS / ABB / BCH / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC) / CROMPTON GREAVES / GEPC/ SPRECHUR & SCHUH / SCHNEIDER ELECTRIC / ANDREW YULE.
07	Indicating lamp.	SIEMENS / VAISHNAO / GEPC / BCH / L&T - ESBEE / CANDS / TEKNIC / CONCORD / ESSEN / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC)-RASS Series
08	Push Button.	SIEMENS / BCH / TEKNIC / CANDS / L&T - ESBEE / VAISHNAO / GEPC / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC)-RASS Series / SCHNEIDER ELECTRIC/CONCORD.
09	Illuminated Push button	PARAMOUNT / BCH
10	Indicating Instruments.	AE / IMP / MECO / L&T-RISHAB / SIETEX / MASSIBUS/ALSTOM.
11	Switches (Power / Control).	KAYCEE / SIEMENS / L&T / SALZAR/ GEPC / CONTROLS & SWITCHGEAR Co. LTD / SCHNEIDER ELECTRIC / SWITRON (For Control switch only)

SL.NO	PRODUCT	APPROVED VENDORS
12	Thermal Overload Relays.	L&T / SIEMENS / CONTROLS & SWITCHGEAR CONTACTORS LTD (TC) / BCH / GEPC / SPRECHER & SCHUH / CROMPTON GREAVES / SCHNEIDER ELECTRIC/ ANDREW YULE.
13	Protective Relays(Electromechanical).	AREVA / EASUN REYROLLE / ABB / SEG & CONTROLS / SIEMENS.
14	Protective Relays(Microprocessor).	AREVA / ABB / L&T
14	Timers - Electronic.	SIEMENS / ABB / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC) / GEPC / OMRON / SPRECHER & SCHUH / SELECTRON. / BCH
15	Timers - Electro – Pneumatic.	BCH / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC)/ SPRECHER & SCHUH
16	Timers - Synchronous.	L&T - G I C.
17	Annunciators.	IIC / L&T / PROCON / ADVANI OERLIKON / OMRON / PIRI / PECON / SIEMENS/MINILEC
18	Current & Potential transformers.	AE / KAPPA / INDCOIL / PRAYOG / CONTROLS & SWITCHGEAR CONTACTORS LTD(TC) / SIEMENS / APPOLO / PRAGATI / PRECISE / JYOTI / SILKAANS/G&M(For PT only) .
19	Control supply transformers.	AE / KAPPA / INDCOIL / SOUTHERN ELECTRIC / SIEMENS / APPOLO / CONTROLS & SWITCHGEAR / PRECISE / LOGICSTAT/PRAGATI/PRAYOG
20	Terminal block - screw type (terminals & fasteners shall be brass with nickel cadmium plated).	ESSEN / ELMEX (THERMO –PLASTIC TYPE) / TOSHA / ASIA ELECTRIC (IEC MAKE) / CONNECT WELL / TECHNOPLAST / VEECON / PHOENIX/WAGO
21	Terminal Block – Cage Clamp type.	WAGO / PHOENIX / ELMEX
22	Fuse Carriers.	SIEMENS / L&T / S&S / CROMPTON GREAVES / CONTROLS & SWITCHGEAR Co. LTD / GEPC / COOPER BUSSMAN.
23	Fuse Links/Neutral Links.	SIEMENS / L&T / CROMPTON GREAVES / CONTROLS & SWITCHGEAR Co.LTD/ GEPC / CANDS / COOPER BUSSMAN.

SL.NO	PRODUCT	APPROVED VENDORS
24	Panel Wires	BIS APPROVED
25	Cable Glands – (weather proof).	COMET / POWER ENGG / SUNIL & CO / SMI / BRACCO / ARUP ENGG. WORKS / QPIE / GLANDMECH / CONTROLS & SWITCHGEAR Co. LTD / QUALITY PRECISION
26	Ferrules	MICROSIGN/MAY FAIR/OESER
27	Lugs.	DOWELL / 3D / DIVYA JYOTHI / CHETNA / JAINSONS
28	Space Heater.	SOPHIA / CANDS / CROMPTON GREAVES / PYRO SYSTEM / VELCO / CONTROLS & SWITCHGEAR Co.LTD.
29	15/5 A Power Supply Switch With Plug & Socket (Metal Clad Type With Spring Loaded Cap).	CROMPTON GREAVES/AJMERA / BCH / BEST & CROMPTON./GEWIS INDIA
30	Cubicle Illumination Lamp.	PHILIPS / BAJAJ / CROMPTON GREAVES / MYSORE LAMPS / HMT.
31	Door Switch.	ESSEN / IEC.
32	Cooling Fan.	RALLI-WOLF / KHAITAN / USHA.
33	Interposing Relay (Low Burden).	JYOTHI / OMRON / ABIL / ABB / SIEMENS / GEPC / OEN / L&T/OWN MAKES OF APPROVED PLC VENDORS.
34	Cable Glands - Flame Proof.	BALIGA / SUDHIR / CEAG / PROMPT / COMET
35	Indicating Lamp – LED.	SRISHYLA / TEKNIC / PARAMOUNT / BINAY / KWALITY / HEWLETT PACKARD
36	Motor Protection Circuit Breaker	L&T / GEPC / SIEMENS / SCHNEIDER ELELCTRIC / SPRECHER & SCHUH .
37	Cable Dressing Material.	MICROSIGN.
38	Wire Duct.	SALZAR.

SL.NO	PRODUCT	APPROVED VENDORS	
		ABB / AE / SOUTHERN TRANSDUCER/ELSTER/RISHAB.	
39	Electrical Transducer		
40	Thermostat	APT / TEMPTROL / VIKAS ELECTRIC / AI / RENUTROL / ANCO	
41`	Trivector Meter	ALSTOM / BHEL/AREVA/IMP	



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Bharat Heavy Electricals Limited

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPPALLI 620 014.

CONTROLS AND INSTRUMENTATION / PE / FB

STANDARD SPECIFICATION FOR POWER CABLE

Data Sheet Format Prepared by C&I/PE/FB	Date : 23-03-2006
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Filled in By :

Name, Signature & Seal of Vendor

APPROVAL SEAL

Data Sheet No.	Rev.	Sheet No.	P.O. No.	P.O. Date
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CABLE DATA SHEET				
For Multicore Power Cables				

Type of cable/No. of pair		2 Core x 2.5 sq.mm.		3 Core x 2.5 sq.mm.					
PO / Enquiry sl.numbers									
Name and Address of the Manufacturer									
1	Technical Specification		DS:TCI:239:STD / Rev00						
2	Applicable Standards		IS-1554, IS-3961, IS-4905, IS-5831, IS-8130, IS-9938, IS-10418, IS-10462, IS-10810, IEC-332, IEC-754, IEEE-383, ASTM-D-2843, ASTM-D-2863, SS-4241475						
3	Voltage grade	V	1100						
4	Temperature Rating Short circuit withstand Rating	°C	85 °C 160°C						
Construction of cable :									
5	As per Constructional Diagram Enclosed.								
6	Conductor :-								
a	No. Of Cores and Area of Conductor	No./ sq.mm	2 Core x 2.5 sq.mm.		3 Core x 2.5 sq.mm.				
b	No. of Strands / Strand Dia.	No. / mm	7 Nos. /0.68		7 Nos. /0.68				
c	Material		Annealed, Plain, Copper Conductor						
d	Grade / Standard		High Conductivity, Electrolytic grade Copper to IS 8130						
e	Dia. over Conductor (approx.)	mm							
7	Insulation :-		PVC						
a	Material		Type-C, as per IS-5831						
b	Type and Standard								
c	Thickness (Nominal) (As per IS:1554)	mm							
d	Method of application		Extruded						
e	Dia. over insulation (approx.)	mm							
f	Core Identification		Red, Black		Red, Yellow & Blue				
8	Dia. under Inner Sheath (app.)	mm							
9	Fillers (wherever applicable)	Flame Retardant, Non Hygroscopic, moisture resistant material, suitable for the operating temperature of the cable. Fillers shall not stick to the insulation and inner sheath							

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CABLE DATA SHEET
For Multicore Power Cables

Type of cable/No. of pair	2 Core x 2.5 sq.mm.	3 Core x 2.5 sq.mm.			
PO / Enquiry sl.numbers					
10 Distinct Inner Sheath :-					
a Material					PVC
b Type and Standard					Type-ST2, as per IS-5831
c Thickness (minimum) (As per IS:1554)	mm				
d Method of application					Extruded
e Colour					Black
f Dia. over Inner Sheath (approx.)	mm				
11 Armouring :-					
a Material					Galvanized Steel
b Standard					As per IS-3975 & IS-1554
c Direction of lay					Left Hand
d Shape and Dimension (As per IS:1554)	mm				
e Dia. over armour (approx.)	mm				
12 Outer Sheath :-					
a Material					PVC, With FRLS Properties
b Type and Standard					Type-ST2, as per IS-5831
c Thickness (minimum) (As per IS:1554)	mm				
d Method of application					Extruded
e Colour					BLACK
f Dia. over Outer Sheath	mm				
13 Cable Marking on Outer sheath @ 1 metre interval					Manufacturer's Name, Insulation material, Conductor material, Conductor size, Insulation, Number of Cores, Voltage rating, Type of cable, Year of manufacture @ 1 Metre Interval. Printing/Embossing shall be legible and indelible.
14 Sequential marking on Outer sheath					Every 1 Metre for Progressive Length by printing / Embossing . Every 5 Metre to read 'FRLS' by Embossing
15 Tolerance on Outer diameter	mm				+/- 2 mm
16 Tolerance on Outer diameter for the entire length	mm	1 mm	1 mm		
17 Ovality	mm	1 mm	1 mm		
18 Weight of cable (approx.)	kg/km				
19 Recommended Installation Radius					
20 Standard Packing Length	metre	1000 Metre	1000 Metre		

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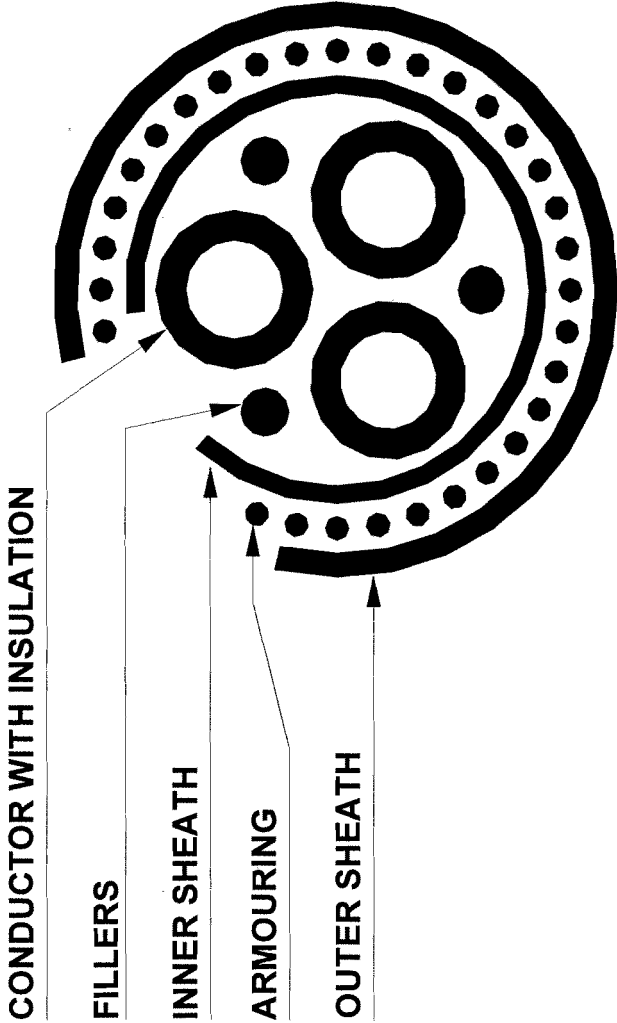
CABLE DATA SHEET					
For Multicore Power Cables					
Type of cable/No. of pair		2 Core x 2.5 sq.mm.	3 Core x 2.5 sq.mm.		
PO / Enquiry sl.numbers					
21	Tolerance on standard packing length	%	+/- 5%		
22	Non-standard Length		Last length, less than the packing length shall be supplied in single length		
23	Marking on Cable Drum		Manufacturer's Name, Conductor size, Insulation, Number of cores, Type of cable, Year of manufacture and Purchase order Number		
24	Electrical Parameters at 20° C :-				
a	DC Resistance (max.)	Ω/km	7.41Ω	7.41Ω	
b	Short circuit rating of conductor for 1 sec.	K Amp.			
c	Insulation Resistance (min.)	MΩ/km	100		
d	Test Voltage - Between Conductor- Conductor	KV/ minute			
25	FRLS Properties for Outer Sheath :-				
a	Oxygen Index @ ambient temp. As per ASTM-D-2863	%	Not Less than 29%		
b	Temperature Index @ oxygen index 21 As per ASTM-D-2863	° C	Not Less than 250 °C		
c	Smoke density rating As per ASTM-D-2843	%	Shall not be more than 60%		
d	Acid gas generation As per IEC 754-Part 1	%	Shall not be more than 20% by weight		
e	Flammability Tests As per IEEE 383, IEC 332 and SS 4241475		Shall pass IEEE-383 Class IE, IEC-332-Part 3, Category B, SS-4241475 (F3 Category)		
26	Quality Plan		AS PER APPLICABLE QUALITY PLAN REFERED IN ENQUIRY & PURCHASE ORDER		
27	Packing Details		Cables shall be supplied in Non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with waterproof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/Rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS-10418. Each drum shall carry Manufacturer's name, Purchaser's name, Address and Contract number, Item number and type, size and length of cable and net, gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction of rotation in which it should be rolled.		

NOTE :- Vendor to Fill in the appropriate values wherever it is left blank, as per IS.

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CABLE DATA SHEET
For Multicore Power Cables

TYPICAL CONSTRUCTIONAL DIAGRAM
OF A 3 CORE POWER CABLE



FOR OTHER CABLES, THE RESPECTIVE NUMBER OF
CORES SHALL BE LAID UP ALONG WITH FILLERS
(IF APPLICABLE) BEFORE APPLICATION OF INNER SHEATH

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CABLE DATA SHEET
For Multicore Power Cables

TOLERANCE ON OUTER DIAMETER FOR THE ENTIRE LENGTH

Definition :-

This is the maximum allowable difference between the highest actual cable diameter and the lowest actual cable diameter measured over a drum length.

The specification indicates 1 mm. This means that if the Highest actual cable diameter is say, 'D1' mm, and the Lowest actual cable diameter is 'D2' mm, then, 'D1 - D2' shall be maximum 1 mm and 'D1' and 'D2' shall also fall within the Upper and Lower limits as above.

Example :-

Let the Highest actual cable diameter measured be

}
}
= 16 mm (D1)

Let the Lowest actual cable diameter measured be

}
}
= 15 mm (D2)

Then, Tolerance for the entire length
}
= 16 mm - 15 mm = 1 mm
(D1) (D2)

Comment :-

As the Highest actual cable diameter and Lowest actual cable diameter falls within the Upper and Lower Limits as above, and the difference between them is 1 mm maximum, the diameter values are acceptable.

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CABLE DATA SHEET
For Multicore Power Cables

OVALITY

Definition :-

This is the maximum allowable difference between the measurements of the actual cable diameter in 'x' and 'y' directions in any particular section.

The specification indicates 1 mm. This means that if the actual cable diameters measured are say, 'D3' mm, and 'D4' mm, in 'x' and 'y' directions respectively in one particular section. Then, the difference between 'D3' and 'D4' shall be maximum 1 mm. Also 'D3' and 'D4' shall fall within the Upper and Lower limits as above.

Example :-

Let the actual cable diameter in 'x' direction in one section be } = 16 mm (D3)

Let the actual cable diameter in 'y' direction in the same section be } = 15 mm (D4)

Then, Ovality = 16 mm - 15 mm = 1 mm (D3) (D4)

Comment :-

As the actual cable diameters measured in 'x' and 'y' directions of the same section falls within the Upper and Lower limits as above, and the difference between them is 1 mm maximum, the diameter values are acceptable.



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Piping Centre Chennai-17

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TECHNICAL SPECIFICATION FOR FRLS MULTICORE CABLE (IS-1554)

APPLICABLE TO UTILITY AND INDUSTRIAL UNITS

1.0 APPLICATION STANDARDS

- 1.1 IS-694, IS-1554, IS-5831, IS-6380, IS-8130,
IEC-332, IEC-754, IEEE-383,
ASTM-D-2843, ASTM-D-2863, SS-4142475

05					
04					
03					
02					
01	25.10.02	Generally revised	E.Loganathan	R.Prabha	GR.Srinivasan
00	10.03.98	Fresh issue	-Sd- M.Devendran	-Sd- R.Prabha	-Sd- GR.Srinivasan
REV.	DATE	ALTERATION	PREPARED	CHECKED	APPROVED



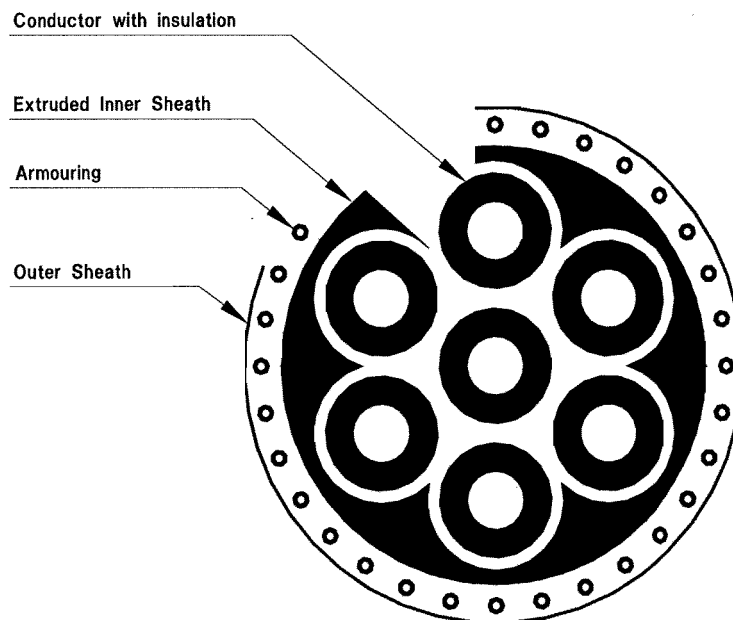
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TECHNICAL SPECIFICATION FOR FRLS MULTICORE CABLE (IS-1554)

2.0 CONSTRUCTION OF CABLE

Annealed, tinned, copper conductor, PVC insulated, cores laid up, FRLS PVC fillers may be used to make the cable circular. Extruded FRLS PVC inner sheathed, galvanised steel wire/strip armoured, extruded FRLS PVC outer sheathed cable.



3.0 CONDUCTOR

- | | | | |
|-----|-----------------------|---|---|
| 3.1 | Material | : | Annealed tinned copper to IS-8130 |
| 3.2 | Area of Cross Section | : | 1.5 mm ² / 2.5 mm ² |
| 3.3 | Number of Strands | : | 7 / 10 |
| 3.4 | Strand diameter | : | 0.52 mm minimum |

4.0 INSULATION

- | | | | |
|-----|---------------------------------|---|---|
| 4.1 | Material | : | HRPVC, Type – C to IS-5831 |
| 4.2 | Thickness | : | As per IS-1554 |
| 4.3 | Type | : | Extruded |
| 4.4 | Colour Coding & Number Printing | : | As per IS-1554, Number printing at the interval of every 100 mm |



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TECHNICAL SPECIFICATION FOR FRLS MULTICORE CABLE (IS-1554)

5.0 FILLERS

Material : HRPVC, Type ST-2 to IS-5831

6.0 INNER SHEATH

- 6.1 Material : PVC, Type ST-2 to IS-5831
- 6.2 Thickness : As per IS-1554 ; Bidder to specify
- 6.3 Type : Extruded
- 6.4 Colour : Black

7.0 ARMOURING

Material : Single layer, Galvanised Wire/Strip

Conform to : IS-1554, IS-3975

8.0 OUTER SHEATH

Material : FRLS PVC. As per VDE-207, Part-5. Resistant to Water Fungus, Termite & Rodent attack

Thickness : As per VDE-815

Type : Extruded

Colour : Blue

9.0 VOLTAGE GRADE

As per VDE Standard.

10.0 TEMPERATURE RATING

70 Deg.C (minimum)



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TECHNICAL SPECIFICATION FOR FRLS MULTICORE CABLE (IS-1554)

11.0 FRLS PROPERTIES FOR INNER AND OUTER SHEATH

Oxygen Index	:	Minimum 29 @ room temperature as per ASTM-D-2863
Temperature Index	:	Minimum 250oC at oxygen index of 21 as per ASTM-D-2863.
Smoke Density	:	Maximum 60% as per ASTM-D-2843
Acid Gas Generation	:	Maximum 20% by weight as per IEC-754.
Flammability	:	As per IEEE-383, SS 4241475 Characteristics

12.0 ELECTRICAL VALUES OF CABLE @ 20 Deg.C

12.1	Insulation Resistance	:	100 M Ohm/KM (minimum)
12.2	Conductor Resistance	:	12.8 Ohm/KM (maximum)

13.0 TESTING AND INSPECTION

As per approved Quality Plan.

14.0 CABLE MARKING ON OUTER SHEATH

Manufacturer's Name, insulation, conductor, size, number of pairs, voltage rating, type of cable at every 625 mm length.

15.0 SEQUENTIAL MARKING ON OUTER SHEATH

15.1	Every one metre for length.
15.2	Every five metres to read "FRLS".

16.0 TOLERANCE

16.1	Tolerance for outer diameter of cable	:	+ 2mm
16.2	Tolerance for outer diameter for entire Length	:	+ 0.5mm
16.3	Ovality	:	+ 0.5mm



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TECHNICAL SPECIFICATION FOR FRLS MULTICORE CABLE (IS-1554)

17.0 CABLE LENGTH

Ordered length + 5%. Non-standard length in multiples of 100 metres upto a maximum of 10% of the total quantity.

18.0 PACKING

500 metres + 5%. Shall be in non-returnable seasoned wooden drums with both ends of cable properly sealed, the end(s) protruding both side(s) shall be covered with sheet-steel. Rust preventive coating shall be applied on all ferrous parts. Drums shall be marked with cable details including Purchase Order number.

19.0 GUARANTEE

A Guarantee Certificate for 24 months of trouble-free operation/performance from the date of shipment or 12 months from the date of commissioning whichever is earlier, shall be furnished.

20.0 GENERAL

20.1 It is not the intent to specify completely herein all aspects of design and construction of equipment. Nevertheless the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the owner who will interpret the meaning of specification for the purpose of which the owner reserves the right to alter the specification even during the contract execution stage (for which commercial implications will not be entertained).

20.2 Any deviation to this specification requirement shall be clearly brought out in the quotation stage itself.


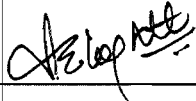



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TECHNICAL SPECIFICATION FOR POWER DISTRIBUTION PANEL

05					
04					
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01					
00	15.04.11	Fresh issue			
			B.Sumith	E.Loganathan	R.Prabha
REV.	DATE	ALTERATION	PREPARED	CHECKED	APPROVED



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TECHNICAL SPECIFICATION FOR POWER DISTRIBUTION PANEL

1.0 GENERAL

This specification covers the design, fabrication, inspection, testing and delivery to Site of AC control supply panels and the associated equipments mounted thereon. This panel serves the purpose of receiving 415 volts, AC, 3 phase, 50 Hz power supply and to distribute to different segments of EHT (Electrical Heat Tracers)

2.0 SCOPE

This standard specifies the requirement of distribution panel for use in Utility/Captive Power Plants.

3.0 DATA SHEET

3.1 In addition to the general specification, specific data sheet (if enclosed indicating special requirements) shall be followed / adhered.

3.2 Wherever the specification / data sheet requires information to be furnished by the tenderer / supplier, the same shall be furnished in the offer.

4.0 CODES AND STANDARDS

4.1 The design, material, construction, manufacture, inspection and testing of the control panel shall comply with the currently applicable Indian Standards and the safety codes in the locality where the equipment will be installed.

4.2 Nothing in the specification shall be construed to relieve the vendor of his responsibility. Annexure-A may be referred for applicable standards.

4.3 Design Calculations

Calculations supporting layout of components, busbar sizing, temperature rise, short circuit withstandability, component rating adequacy to be furnished.

5.0 SCOPE OF WORK

5.1 The scope of work covers-

5.1.1 Design, fabrication and testing of the complete panel;

5.1.2 Procurement, mounting and wiring of all equipment, specified;

5.1.3 All internal wiring from equipment to terminal blocks and all interpanel wiring between panels;



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TECHNICAL SPECIFICATION FOR POWER DISTRIBUTION PANEL

- 5.2 Supply of all cable terminations and mounting accessories like trays, troughs, clamps, lugs, etc.;
- 5.3 Supply of all necessary drawings;
- 5.4 Testing of panels as specified and furnishing of test certificates;
- 5.5 Preparation and furnishing of instruction manual and catalogues giving the make, model and type of all the equipments used;
- 5.6 Packing and delivery of the equipment in acceptable condition at the place specified to the satisfaction of the purchaser;
- 5.7 Typical wiring diagram for a single segment is enclosed to this specification. Bidder to actually determine the rating of each component for each segment and in total and shall furnish a consolidated wiring diagram covering all sections.

6.0 CONSTRUCTIONAL FEATURES

- 6.1 The panel shall be completely metal enclosed, free standing floor mounting modular type. Shall be of dust moisture and vermin proof. Shall be made of vertical sections easily extendable on both sides by addition of vertical sections. The panel enclosures shall meet the degree of protection IP 55.
- 6.2 The metal used shall be of cold rolled sheet steel of thickness not less than 3 mm for the front and rear and 2.5 mm for the other sections & sides. The panel shall be free from flaws, dents and undulations. Shall be, if needed, reinforced to provide level surfaces as mentioned below.

<u>Width</u>	<u>Desired Flatness Tolerance</u>
Upto 61 mm	0.15875 mm
61 to 82 mm	0.238125 mm
> 82 mm	0.3175 mm

The flatness tolerance is defined as the maximum allowable deflection of the surface from a flat parallel reference plane.

- 6.3 The panel shall be provided with base channels in the form of metal channels properly drilled and shall be furnished with anchor bolts and necessary hardware for mounting the panel. All the bolts and hard wares shall be cadmium plated / chrome plated / zinc passivated / nickel-plated. The panel shall be provided with kick plates, which shall be of min. 2 mm thick and of stainless steel.



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- 6.4 All removable plates, doors and glass plates shall be properly gasketed all around with neoprene gaskets. Ventilating louvers, if provided, shall be provided with fine Brass or GI meshes. All door hinges shall be of concealed type.
- 6.5 The panel shall be provided with proper anti-vibration pads between the base channel and panel so as not to transmit the vibration, if any, to the panel and panel mounted equipments.
- 6.6 The dimensions and the general arrangement of the panel shall be furnished. The cable entry to the panel shall be bottom on a 3 mm removable cable gland plate. Required number of proper cable glands shall be provided. The cable glands shall be of brass and double compression of screwed type suitable to receive PVC armoured cables.
- 6.7 The panel shall be provided with illumination lamp operated through a door switch. The panel shall be provided with necessary space heaters and accessories. The panel shall be provided with capped power sockets with switch and fuse.
- 6.8 The panel edges shall be properly smoothened or deburred so as not have any sharp or pointed surface, which may cause injury to the operating personnel. The doors provided in the panel shall have in-built locking facility.
- 6.9 All equipments / components shall be properly labelled for easy identification.
- 6.10 The switch gear section shall be divided into distinct vertical sections each comprising-
- 6.10.1 a completely metal enclosed bus bar compartment running horizontally;
- 6.10.2 individual feeder modules arranged in multi-tier formation. It is essential that modules are integral multiples of the basic unit size to provide for flexibility in changes, if any, at Site;
- 6.10.3 enclosed vertical bus bars serving all modules in the vertical section with proper safety isolation;
- 6.10.4 a vertical cable alley covering the entire height - the cable alley shall be minimum 500 mm wide for circuit breaker controlled modules;
- 6.10.5 a horizontal separate enclosure for all auxiliary power and control buses, as required, shall be located and tap off connection from these buses shall be arranged separately;
- 6.10.6 each vertical section shall have space heater located on vertical cable alley.
- 6.10.7 there is no back access available; vertical bus bar alleys have to be provided.



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7.0 PAINTING

- 7.1 The interior and exterior of the panel are to be furnished with a paint of colour approved by the purchaser.
- 7.2 The pre-treatment of all steel work, including, de-greasing, rust / scale removal, phosphating and even drying shall be carried out as per IS 6005.
- 7.3 Panels are to be coated with two coats of anti-rust paint (primer) and two coats of acid-alkali resisting epoxy based paint suitable for working in atmosphere laden with saline and corrosive air. The panel shall be dried by solving / air-drying.
- 7.4 The final finished thickness of the paint shall be 100 microns to 150 microns. A small quantity of finishing paint shall be supplied for minor touching up at Site after installation.

8.0 MOUNTING

- 8.1 All equipments on front of panel shall be flush mounted or semi-flush. In case of semi-flush mounting only flange or bezel shall be visible from the front.
- 8.2 Equipments shall be mounted such that removal, replacement and maintenance can be accomplished easily without interruption of service to adjacent equipment. The terminal markings shall be clearly visible. All live parts shall be provided with at least phase to phase and phase to earth clearance in air of 25 mm / 20 mm respectively.
- 8.3 The centre lines of switches, push buttons and indicating instruments shall not be less than 300 mm from the bottom of the panel. Control switches, push buttons and indicating instruments shall be so located for ease of operation and reading.
- 8.4 No equipments shall be mounted on the doors unless otherwise there is specific mention.
- 8.5 Current transformers shall not be directly mounted on the buses. CT on circuit breaker controlled circuits shall be mounted on the fixed portion of the compartment.

9.0 LABELS AND FERRULES

- 9.1 All the panel front mounted components are to be provided with labels or name plates of white non-hygroscopic material with engraved black lettering or transparent plastic material with black coloured lettering engraved on the back in English.
- 9.2 The labels for the components coming inside the panel such as contactor switches, fuses, lamps terminal blocks, etc. shall be mounted directly below and shall be designated as per the circuit. The lettering size shall be min. 3 mm.



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- 9.3 All wires shall be properly ferruled. Ferruling shall be over the insulation and not over the conductor. Ferrules shall not fall down from the wire when removed from the terminals. Both ends of wires shall be ferruled.

10.0 WIRING

- 10.1 All the wiring inside the panel shall be done as per relevant IS 375 of 1963.
- 10.2 All wiring shall be carried out with 650V grade for 110 V application and 1100 V grade for 220 V / 415 V application. The wires shall be of single core, standard copper conductor with PVC insulation and shall be of FRLS type with vermin and rodent proof. The minimum size of the wiring shall be as follows.
- 10.2.1 All circuits excepting CT circuits : 1.5 mm sq. per core minimum & as dictated by current rating.
- 10.2.2 CT circuits : 2.5 mm² per core
- 10.3 Panel wiring shall be securely supported, neatly dressed and readily accessible. Flame retardant plastic wire trays with straps on plastic covers shall be used wherever necessary.
- 10.4 No loose wires are allowed. All the wires shall be either terminated to the terminal block or to the equipment as required. If accidental short circuiting of wires is likely to result in closing or tripping or breaker or the system, then wires shall not be terminated on adjacent terminal blocks.
- 10.5 Only one wire per terminal shall be used on the outgoing side of these blocks. Any common connections required, shall be provided on the panel side of the block. Wires shall not be looped around the terminal screws or studs. No more than two wire shall be connected to one terminal
- 10.6 All wire terminations shall be made with solderless crimping type tinned copper lugs. The lugs must be of the compression, insulated sleeve ring tongue type so as to firmly grip the conductor and insulation. Open-ended lugs are not acceptable. Plastic identification ferrules marked to correspond with panel wiring diagram shall be fitted at both the ends of the wires.
- 10.7 Wiring of circuits for power supply to transducers and amplifiers for signal transmission shall be suitably fused to limit short circuit currents. Means for detection of blown or open circuited fuses shall be provided.



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10.8 The vertical wiring on the panels between the terminal blocks and the devices shall be enclosed in non-metallic race ways with removable covers. All exposed wiring shall be formed neatly with wires neatly grouped using plastic bands and binders and substantially supported, along with the panels. Wire stripping shall be done in such a manner that conductor will not be nicked or cut. Wire shall not be tapped or spliced between terminal blocks.

10.9 Power cable between main incoming Power transformer to PDP shall be supplied with accessories (if applicable)

11 EARTHING

11.1 A continuous copper earth bus of required size identified with green colour shall, run continuously throughout the length of the control panel. And it shall have the provision for termination to 50x6 mm GI station earth bus. Necessary terminal clamps and connectors for this, shall be supplied along with the panel.

11.2 The vendor shall specify the size of the bus along with the capacity.

11.3 All metallic covers of components, instruments and other panel mounted equipments shall be independently connected to the green earth bus by using 1100 / 650 V grade 16 SWG copper conductor. Soldering of earthing wires is not permitted.

11.4 Looping of earth connections, which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. However, looping of earthing connections between equipment to provide alternative paths to earth bus can be provided.

11.5 VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system.

12.0 TERMINAL BLOCKS

12.1 Power TBs of 1100 V rating and control TBs of 600 V rating shall be used. Separate TBs for power and control cables as per drawing, shall be provided and have to be segregated. The power TBs shall be shrouded properly.

12.2 Power TBs shall be of one piece moulded complete with insulated barriers, stud type terminals, washers, nuts, lock nuts and identification strips for the power circuit.

12.3 TBs shall be of self-extinguishing or resistant to flame propagations substantially non-hygroscopic and shall not carbonise when tested for tracking. The insulation between any



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terminal and framework or between adjacent terminals, shall stand a test of 2 kV for one minute.

- 12.4 Unless otherwise specified, the TBs for the control circuit shall be suitable for connecting minimum two 2.5 mm.sq. copper conductors.
- 12.5 TBs for CT & PT secondary leads shall have test links and isolating facilities. Also CT secondary leads shall be provided with short-circuiting and earthing facilities.
- 12.6 There shall be a minimum clearance of 250 mm between the gland plate and the terminal blocks. The minimum clearance between two rows of TBs shall be 150 mm.
- 12.7 At least 10% spare terminals shall be provided on each panel and there shall be uniformly distributed on all rows of terminal blocks.
- 12.8 Unless the terminals for external connections shall be arranged for consecutive connections of different cores of a multicore cable.
- 12.9 All TBs shall be suitable for terminating recommended cables.

13.0 CABLE TERMINATION

- 13.1 The vendor shall provide all necessary cable terminating accessories such as gland plates, cable glands, crimp type tinned copper lugs, supporting clamps, brackets, etc.

COMPONENTS

14.0 TRANSFORMER

14.1 Control Transformer

The step down transformer shall be of double wound, dry type with Class-B insulation or better. Sufficient margin in rating shall be available to take care of overload. Redundant transformer and auto selection of healthy transformer to be provided.

14.2 Power Transformer

- 14.2.1 Main incomer power transformer of dry type to relevant IS shall be provided with all protective switch gear.



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14.3 Bus bars:

- 14.3.1 The bus bars shall be insulated copper or insulated aluminium alloy of E 91E grade and shall have adequate cross section to carry the required continuous current such that the operating temperature of the bus bar does not exceed 85°C. Bus bars shall meet the standard IS:5082.
- 14.3.2 The bus bars shall have the short circuit rating of minimum 50 KA for 1 second. The bus bars shall have proper identification. Clearance between the bus bars shall be as per IS 4237 for 500V 3 phase.
- 14.3.3 The joints made in the bus bars shall be treated suitably to avoid oxidation of contact surfaces and bimetallic corrosion.
- 14.3.4 The bus bar shall be properly supported by epoxy / SMC / DMC supports.
- 14.3.5 Bus bars shall run at the top or bottom as required all along the length of the switch gear in a separate enclosure.

14.4 Switches / MCCBs / MCBs:

- 14.4.1 Switches / MCCBs (Incomer) / MCBs (Out going Feeders) shall be hand operated air break heavy duty, quick make and quick break type.
- 14.4.2 These units shall confirm to relevant IS Standards like IS:13947.
- 14.4.3 The control and instrument switches shall be of rotary type suitable for semi-flush mounting with only the switch front projecting out.
- 14.4.4 The contacts of the switches shall be spring assisted and contact faces shall be of Silver/ Silver alloy. Springs shall not be used as current carrying paths. The minimum current rating of the contacts shall be 10A.
- 14.4.5 Instrument selector switches shall be of stay-put type.
- 14.4.6 The MCCBs shall have a short circuit capacity of 50 KA for 1 second and MCBs for 9 KA for 1 second. The MCCBs / MCBs shall have a dolly for 3 position indication viz. ON / OFF and TRIP. The MCB shall be switched off on a trip and then only switched on manually.
- 14.4.7 The contacts shall be of Silver alloy to have high arc resistance and long electrical life. The MCCBs / MCBs shall have min. 3 changeover contacts for the control purposes.
- 14.4.8 The rupturing capacity of the MCBs in the outgoing feeders shall be higher than the fault level of the bus bars used in the panel.
- 14.4.9 The MCCBs / MCBs shall have both adjustable thermal and magnetic tripping system.

14.5 Contactors:

- 14.5.1 Main contacts of the power contactors shall be of silver /silver alloy or silver plated copper. The contacts shall be of bounce free, double break non-gravity type.
- 14.5.2 The contactors shall have minimum two auxiliary contacts. The contactors shall confirm to IS:13947 in case of AC.



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14.6 **Relays:**

- 14.6.1 Necessary auxiliary relays, time delay relays and voltage relays as required for control and protection shall be mounted inside the cabinet. Relays shall be equipped with positive action operation indicator. Voltage relays shall have sufficient thermal capacity for continuous energisation.
- 14.6.2 The relays shall be rated to operate satisfactorily between 80% and 110% of the rated voltage.
- 14.6.3 Unless otherwise specified, all these auxiliary relays shall be of electro-magnetic type and time delay relays shall be of either static or electro-magnetic type.
- 14.6.4 The contacts of these relays shall be rated for min.10A and adequate for breaking inductive loads at 220V DC, 5A and 110 V AC 5A.
- 14.6.5 In case of static relays, the electronic hardware shall conform to the requirements of applicable standards and suitable for environmental conditions at Site. The non-availability of air condition system shall not affect the performance of the relay.
- 14.6.6 Static relays shall be immune to self induced and externally induced noise. The printed circuit cards shall be of fibreglass with gold plated contact connectors and shall be designed for trouble free service throughout the life of the plant when subjected to normal operation, handling and maintenance.

14.7 **Push Buttons:**

- 14.7.1 The push buttons of momentary contact push to actuate type. The push button shall be rated, continuously to carry and break 10A at 240V AC and 1A inductive load at 220V DC.
- 14.7.2 The push buttons shall be provided with 2 NO + 2 NC self reset contacts, with rear terminals. The actuator shall be of oil tight and waterproof condition. The contact faces shall be of silver / silver alloy.
- 14.7.3 The push buttons shall be provided with integral inscription plates engraved with designation.

14.8 **Indicating Lamps:**

- 14.8.1 The indicating lamps shall be panel-mounted type with rear terminal connections. The lamps shall be LED type. The lamps shall have translucent lamp-covers to diffuse lights, coloured red, green and amber as specified.
- 14.8.2 LED Bulbs and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if any, required in replacing the bulbs and lenses shall also be supplied along with the panel.



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14.9 Indicating Instruments:

- 14.9.1 Unless otherwise specified, all the indicating instruments shall be 96 mm² with 90° scale. They shall be suitable for semi-flush mounting with only flanges projecting on vertical panels.
- 14.9.2 The instrument dials shall be of white with black numerals and lettering. Dials shall be parallax free and shall be provided with knife-edge pointers. The instrument shall be provided with anti-dazzle glass.
- 14.9.3 Shall have zero adjustment provision in the front side. The instrument shall have an accuracy class of 1.5 or better.
- 14.9.4 The enclosure protection shall be of IP 55. The meter shall satisfy the environmental test requirements when exposed to ambient temperatures within -10 to +55°C at all times and vibration test as said in IS 1248. The case of the meters shall be made of self extinguishing, flame retardant polycarbonate material.
- 14.9.5 The meter shall comply with IS 9249 (Part-I) safety requirement for indicating electrical instruments and their accessories.
- 14.9.6 Ammeter shall continuously withstand 120% of rated current and DC ammeter shall be provided with external shunts whenever the current exceeds 5 Amp. Motor ammeter shall have extended suppressed end scale range to indicate starting current.

14.10 Current Transformers:

- 14.10.1 The current transformers shall be of Cast resin type.
- 14.10.2 The max. VA Burden shall be 10 with accuracy Class of 1 and instrument safety factor of 5 and shall confirm to IS:2705, Part-V of 1981.
- 14.10.3 CTs shall have short time withstand rating equal to the short time withstand rating of the associated switch gear for one second.
- 14.10.4 All CTs shall be earthed through a separate earth link on the terminal block to permit easy measurement of the current transformers insulation resistance. Tests links shall be provided in the CT secondary leads to carryout current measurement tests with CTs in service.

14.11 Annunciators:

- 14.11.1 Annunciators of the visual and audible type suitable for operation with the power supplies as mentioned in the scheme shall be provided. The annunciator panel shall be of flush or semi-flush mounting type.
- 14.11.2 The system shall be of solid state, which dispenses with the moving contacts. The system shall use industrial grade CMOS circuitry so as to have reliable operation and immune to electro-magnetic noise.



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- 14.11.3 All printed plug boards, if used, shall be provided with Gold plated edge connectors so as to have positive contacts.
- 14.11.4 The unit shall be supplied with swing door display with front accessibility for the printed circuit modules.
- 14.11.5 The windows shall be provided with two lamps for reliability. The lamps shall be provided with series resistors or shall be biased with small current. The lamps shall be replaceable from the front. However, LED type lamps are preferable. The window shall be provided with easily changeable photo type film with black letters on white translucent background.
- 14.11.6 The first in alarm condition shall be displayed distinctly from subsequent alarms by different flash rates or by continued flash after accept. First in alarm conditions shall be interlocked with subsequent alarm ensuring accept and first in reset operator sequence. The system shall have dual tone system.
- 14.11.7 The system shall be suitable for operation with normally open fault contacts which close on a fault. The system shall have the facility to change the operation from "close on a fault" to "open on a fault". Each channel shall also have a potential free output contact of rating 50 VA min. for customers use. These contacts shall be brought out in terminal blocks on the rear of the panel.
- 14.11.8 Facilities for lamp testing, audio testing and flasher testing be provided.
- 14.11.9 The annunciator shall be designed for the following conditions.

<u>Operation</u>	<u>Fault Contact</u>	<u>Audible</u>	<u>Visual</u>
NORMAL	OPEN	OFF	OFF
ALARM	CLOSE	ON (BEEPS)	FLASH (BRIGHT)
ACCEPT (P.B.)	CLOSE	OFF	ON (CONTINUOUS)
BACK TO NORMAL	OPEN	OFF	FLASH (DIM)
RESET PB	OPEN	OFF	OFF
TEST PB	---	ON	ON CONTINUOUS

NOTE: Once the first fault is accepted if there is a subsequent fault even before the clearance of the first fault then the audio shall be continuous and the corresponding visual shall be a bright flash.

During a lamp test if a fault occurs, the corresponding lamp circuit shall be fed automatically disconnected from the "lamp test" circuit and go into the normal mode



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15.0 MAKES

The materials used shall be as per the approved list of vendors enclosed vide Annexure-B.

16.0 INSPECTION & TESTING : Standard Quality Plan, **QA:CI:STD:QP:30/Rev.04 to be followed**, with the following tests as minimum.

- 1) Dimension check, 2) Component rating check, 3) Functional check, 4) IR test,
- 5) HV test, 6) Temperature raise, 7) Enclosure, 8) Paint thickness & finish,
- 9) Component layout(aesthetics, ease of access and maintenance)

17.0 QUALITY ASSURANCE PROGRAMME

17.1 In order to ensure desired level of quality of the equipment offered, the manufacturer shall adopt a well established "Quality Assurance Programme (QAP)" covering detail check on incoming bought out components, all stages of manufacturing stage inspection and final testing. The QAP in general shall comprise the following

- 17.1.1 Structure of the organisation for management and implementation of proposed QAP.
- 17.1.2 Documentation control system.
- 17.1.3 Detailed procedures for purchase of material and source inspection, etc.
- 17.1.4 System of shop manufacturing.
- 17.1.5 Control of non-confirming item and system of corrective action.
- 17.1.6 Detailed inspection and testing procedure.
- 17.1.7 Control of calibration and testing of testing equipments
- 17.1.8 System for indication and appraisal of inspection status
- 17.1.9 System of quality audit.
- 17.1.10 System for handling and delivery.
- 17.1.11 System for maintenance and records.
- 17.1.12 Detailed quality plan for each item raw materials, sub-assembly and final testing in tabulated format covering 100% batch inspection, along with expected values and tolerance levels. International standards / IS shall be referred under Acceptance Norms.

18.0 PACKING as per procedure QA:CI:STD:PR:02/02

- 18.1 All equipment shall be protected for ocean shipment, inland transport and outdoor storages during transit and at the Site, strictly accordingly to the instructions given in this specification.
- 18.2 The vendor shall be responsible for any damage to the equipment during transit due to improper and inadequate packing.



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- 18.3 Only packages constructed out of sound material and of dimensions proportional to the size and weight of the contents shall be used.
- 18.4 Fragile materials shall be securely braced within the containers or otherwise amply fastened and packed to prevent shifting or rattling. Soft non-hygroscopic packing materials shall be placed between the hard packing materials and the fragile equipment. The over- hanging or simply supported articles must be cushioned, braced, fastened or blocked to prevent damage to the article itself or destruction of the container.
- 18.5 Loose materials, e.g. anchor bolts, nuts, etc. be packed separately, sealed in polythene bags with proper tagging and shall be properly secured with the main panel.
- 18.6 Components containing glass shall be carefully covered with shock absorbing protection material such as expanded polystyrene (thermocol).
- 18.7 All openings in the equipment shall be tightly covered, plugged or capped to prevent foreign material from entering.
- 18.8 Wherever necessary, proper arrangements for attaching slings for lifting shall be provided.
- 18.9 All the inside walls of the packages shall be lined with waterproof paper to protect the equipment from damage due to dust and moisture. The protective wrapping shall last for a minimum period of three months.
- 18.10 Silicagel or approved equivalent moisture absorbing material in small bags shall be placed and tied on the equipment wherever necessary.
- 18.11 Dolegnate provision of stebs and pallets shall be made to tap the packages above the collecting drainage. Crates should have drain holes in the bottom to prevent collection of water within the packing.
- 18.12 Each crate or package shall contain a packing list in a waterproof envelope. All items of materials shall be clearly marked for easy identification against the packing list. All packages shall be clearly, legibly and durably marked with uniform block letters on at least three sides with-
- 18.12.1 Destination address as communicated;
- 18.12.2 Dimensions / weight of the equipment;
- 18.12.3 Name of the equipment.



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ANNEXURE-A
CODES AND STANDARDS

The design, manufacture and performance of the equipment shall comply with the following currently applicable standards, regulations and safety codes. Nothing in this specification shall be construed to relieve vendor of this responsibility.

- | | | |
|----|----------|---|
| 01 | IS:1248 | Electrical indicating instruments. |
| 02 | IS:2147 | Degree of protection provided by enclosure for low voltage switch gear and control gear. |
| 03 | IS:9224 | HRC cartridges, fuse-links upto 650V. |
| 04 | IS:13947 | Low voltage switch gear and control gear Part-I to V. |
| 05 | IS:2705 | Current Transformers. |
| 06 | IS:3156 | Voltage Transformers. |
| 07 | IS:6005 | Code of Practice for phosphating iron and steel. |
| 08 | IS:5082 | Aluminium alloys for electrical bus bars. |
| 09 | IS:6875 | Specification for control switches. |
| 10 | IS:8623 | Specification for factory built switch gear assemblies. |
| 11 | IS:12021 | Control transformer for switch gear and control gear for voltage not exceeding 1000 V AC. |



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ANNEXURE-B

The component makes shall be as per **QA:CI:STD:QP:34/03**

ANNEXURE-C
DOCUMENTS

The Tenderers shall furnish all information, drawings and catalogues as listed below.

Sl. No.	Documents	No. of Copies with Offer	Submission schedule after the award of contract	
			No. of Copies	Week after PO Date
01	Wiring diagram and G.A. drawing	4	12	2
02	Wiring Schedule	-	12	2
03	Internal Arrangement Diagram	-	12	2
04	Bill of Material & Total Weight	4	12	2
05	Name Plate Details Inscription Details	-	12	4
06	Write-up	4	12	4
07	Descriptive Catalogues for various components	4	12	4
08	Test Certificates	-	12	Immediately after inspection
09	O & M Manual including Erection Instructions	-	5 + 1 CD	8 Weeks before despatch



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PART-1 DATA SHEET (FOR BHEL/ PC's PORTION)

Project : G V K POWER – 2 x 270 MW
Customer No. : 1204 & 1205

- 1 Type of panel : Free standing, floor mounted, compartment modular, Non –Drawn out, Front Access
- 2 Bus bar and cable : Vertical and Horizontal runs with clearly Identifiable sections.
- 3 Cable Entry : Bottom
- 4 Protection : IP 55
- 5 Colour : EXT: 631/IS:5 with semi glossy finish
INT: Brilliant white (two coat with fire resistant coat) with glossy finish.
- 6 No. of panels required : 1 NO. (Each 100 kW)
- 7 **PDP Details**
(Located in F.O Pump House)
 - 7.1 Service : This will Drive EHT in
 - a) Pump House to Boiler-1 & Boiler-2
 - b) Boiler-1 & Boiler-2 Outlet to Pump House
 - c) Pump House
 - 7.2 Space required for panel : Bidder to specify
 - 7.3 No of Feeders required for Driving Pump House EHT : 5 (1.2 kW, 1.7 kW, 2.2 kW, 3.0 kW & 2.2 kW)



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- 8 No. of Circuit : Shall be minimum by using Power splice
- 9 No. of Spare Feeders required in each panel : **3** (each of 2.5 kW rating)
- 10 Main incomer Power Transformer : **Dry type transformer**
(Bidder to specify incomer feeder rating to each panel)
- 11 Main incomer cable size : Bidder to specify for each panel.



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TECHNICAL SPECIFICATION FOR POWER DISTRIBUTION PANEL

PART-2 BHEL/ TRY's REQUIREMENT

BILL OF QUANTITY

- | | | | |
|---|---|---|-------------------------------------|
| 1 | PDP (with 24 feeders in line with specification)
a) PC:TSP:PDP:GVK POWER
b) CI-EHT-1204-0001/00 | } | 2 No (45 kW) |
| 2 | Space restriction for Panel | | |
| | | : | (Bidder to Specify Panel Dimension) |