

5.8 INSPECTION, TESTING AND ACCEPTANCE

5.8.1.1.1 During fabrication, the switchboard shall be subject to inspection by Owner, or by TPI agency authorized by the Owner, to assess the progress of work, as well as to ascertain that only quality raw material is used. The manufacturer shall furnish all necessary information concerning the supply to Owner/Owner's inspectors.

5.8.1.1.2 All routine tests shall be carried out as per IS: 12729 at the manufacturer's works under his care and expense. The following tests shall be carried out:

- i) A general visual check shall be carried out. This shall cover measurement of overall dimensions, location, number and type of devices, location and connection of terminals, etc.
- ii) All routine tests specified in relevant Indian / British Standards shall be carried out on all circuit breakers.
- iii) Test for protective relay operation by primary or secondary injection method.
- iv) Operation of all meters.
- v) Secondary wiring continuity test.
- vi) Insulation test with 1000 Volts megger, before and after High voltage test.
- vii) HV test on primary & secondary circuits and components on which such test is permissible.
- viii) Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.
- ix) Measurement of power required for closing / trip coil of the breaker.
- x) Zreaker close time and trip time analysis.
- xi) Pick-up and dropout voltages for shunt trip and closing coils.
- xii) CT Polarity test.
- xiii) For equipment bought from other sub-suppliers, certified test reports of the tests carried out at the manufacturer's works shall be submitted. Normally, all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.

5.8.1.1.3 The Type test report for as per IS/IEC shall be submitted for verification by owner/owner's inspector during inspection.

5.9 SCHEMES

The control scheme for incomer, bus-coupler, feeders, auto changeover shall be as per engineering design guidelines and RTF recommendations and project specific requirements. The indicative scheme diagrams are attached as Annex-16 for reference only. The detailed scheme for all the feeders shall be submitted for approval of owner during detailed engineering prior to start of the manufacturing.

5.10 PACKING AND DESPATCH

The switchboard shall be divided into several shipping sections for protection and ease of handling during transportation. All outgoing feeders shall be packed as separate shipping sections. The equipment shall be properly packed for selected mode of transportation i.e. ship/rail or trailer. The panels shall be wrapped in polyethylene sheets before being placed in wooden crates/cases to prevent damage to the finish. Crates/cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Weight', 'Owner's particulars\ 'PO nos.' etc., shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing should also be suitable for outdoor storage areas with heavy rains/high ambient temperature unless otherwise agreed.

5.11 DOCUMENTATION & DRAWING

The Manufacturer shall provide technical manual(s) and drawings in accordance with the purchase order requirements, which shall include at least the following documents (preferably on a CD-ROM):

- Single line diagram of the unit – To be submitted along with the bid.
- General arrangement drawings – To be submitted along with the bid.
- Main and control circuit schematic diagrams;
- Equipment lists;
- Recommended spare parts lists;
- Test reports and performance curves, including oscillograms;
- Operating manuals which incorporate installation, commissioning, operating and maintenance instructions & fault-finding procedures

CD-ROMs shall incorporate all viewer software necessary to access the information provided.

Each drawing supplied by the manufacturer shall incorporate the following information:

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- Manufacturer's name and address
- Drawing title (including location)
- Name of the project
- Manufacturer's order or contract number
- Purchaser's order number
- Manufacturer's drawing number and revision number
- Date of original issue and dates of any revisions with details

The following drawings with associated time schedule to be provided:

- a. To be provided by the manufacturer with his quotation:
 - i) Outline drawing of the complete switchgear with its certified maximum dimensions and weight
 - ii) Typical schematic or circuit diagram for the control and protection circuits.
- b. To be submitted by the manufacturer for approval at least 4 weeks before manufacture is started:
 - i) Certified outline drawings showing dimensions and weight of each transportable unit, cable termination position, fixing details, withdrawal space and door swings where applicable and floor impact loadings for circuit breakers.
 - ii) Circuit wiring diagrams showing all connections and details (including cable sizes) with wiring identification numbers to enable all testing, calibration and fault tracing to be carried out.
 - iii) Interconnection diagrams or schedules.

A separate circuit diagram shall be prepared for each different type of functional unit with space on each drawing for external circuitry to be shown.

5.12 DATA SHEET

TECHNICAL PARAMETERS

a. System Parameters

1	Normal System voltage	33 kV
2	Highest System voltage	36 kV
3	Rated Frequency	50 Hz
4	Number of phases/ poles	Three
5	System Neutral earthing *	Solidly grounded
6	One minute power frequency withstand voltage	
	- For type tests	48
	- For routine tests	48
7	1.2/ 50 microsecond impulse withstand voltage	170 kV (peak)
8	Maximum system fault level including initial motor contribution	31.5 kA (rms)/1 Sec
9	Short time rating for bus bars, ckt. Breakers, current transformers and switchgear assembly	31.5 kA (rms) for One (1) sec
10	Dynamic withstand rating	80 kA (peak)
11	Control supply voltage *	
	- Trip and closing coils	220 V DC
	- Spring charging motor	220 V DC
	- Space heaters	240 V AC single phase with neutral solidly earthed
12	Maximum ambient air temperature	50°C

b. BUS BARS

1	Continuous current rating at 50°C ambient	1500 Amps(min)
2	Temper rise allowed above ambient	40°C for plain joints 55°C for silver plated joints

c. Switchgear cubicle constructional requirements

1	Colour finish exterior & interior	As mentioned elsewhere
2	Cable entry	Power cables And Control cables -

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		Bottom
3	busduct entry	Top
4	Owner's earthing conductor	GI strip

d. Circuit breakers

1	The circuit breakers current rating shall be selected from the load current as per project requirement which is at an ambient of 50°C	1500 amps minimum
2	Short circuit breaker current	31.5 KA RMS for 1 sec
	a. A.C. component	As per IS: 13118 or IEC-62271
3	Short ckt. making current	80 kA (peak)
4	Operating duty	B-3 Min-MB-3 Min-MB
5	Total break time	Not more than 4 cycles
6	Total make time	Not more than 5 cycles
7	Operating mechanism	Motor wound spring charged stored energy type as per IEC-62271

e. Relays

	One minute frequency	2.0 kV (rms)
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f. Meters

1	Accuracy class	1.0
2	One minute power frequency	2.0 kV (rms)

g. Current transformer

1	Class of insulation	Class b or better
2	Rated output of each core	Adequate for the relays and devices connected, but not less than fifteen (15) VA

3	Accuracy class - Protection core	Class PS for differential and core balance CTs; 5P20 for other protection CT's
	- Measurement core	1.0
4	Minimum primary earth fault current to be detected by core balance current transformer	3 Amperes

h. Voltage transformers

1	Rated voltage factor	1.2 continuous for all VTs and 1.8 for 8 hrs for underground system.
2	Class of insulation	Class b or better
3	Other parameters	

i. H.V. Fuses

1	Voltage class	33 KV
2	Rupturing capacity	Adequate for 80 kA (peak)
3	Rated current	As per applicable

j. Transducers

1	Current transducers		
	a. Input	0-1 A (CT secondary)	0-1 A (CT secondary)
	b. Rated frequency	50 HZ	50 HZ
	c. Output	4-20 mA (2 nos. decoupled)	4-20 mA (2 nos. decoupled)
	d. Over current	Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds	
	e. Accuracy	0.5%	
2	Voltage transducer		
	a. Input	110 V (VT secondary) 50 HZ (for AC)/ 110V dc (for DC)	
	b. Output	4-20 mA (2 nos. decoupled)	
	c. Accuracy	0.5%	
3	VAR transducers		
	a. Input	3 phase, 3-wire 1 A (CT secondary) 110 V (VT secondary)	
	b. Rated frequency	50 HZ	
	c. Output	4-20 mA (2 nos. decoupled)	
	d. Accuracy	0.5%	
4	Watt Transducers		
	a. Input	3 phase, 3-wire 1 A (CT secondary) 110 V (VT secondary)	
	b. Rated frequency	50 HZ	
	c. Output	4-20 mA (2 nos. decoupled)	
	d. Accuracy	0.5%	
5	Frequency Transducers		
	a. Input	110 V (VT secondary)	
	b. Rated frequency	50 Hz	
	c. Output	45 to 55 Hz	
	d. Accuracy	4-20 mA 2 nos. decoupled)	
	e. Accuracy	0.5%	
	* shall be finalized during detailed engineering		

5.13 DATA SHEET HV SWITCHBOARD (11 KV Switchboard)

	Project				Location	
	Client				Unit	
A	Site conditions					
1	Maximum ambient temperature	50°C	3	System breaking capacity	31.5 kA for 1 second	
2	Minimum ambient temperature	-2.5°C	3.1	% D.C. component	As per IEC	
3	Design ambient temperature	50°C	4	System making capacity	80 kA (peak)	
4	Relative humidity	90%	5	Type of circuit breaker	VCB	
5	Altitude above MSL	<1000m	6	Duty cycle of C.B.	0-3min-CO-3 min-CO	
6	Environment	Humid, corrosive, with sulphur	7	Suitability for Cap. Switching	Yes	
B	Operating conditions		8	Surge suppressor for Motor Feeder	Yes	
1	Voltage	33kV ± 6%	9	IDMTL Relay type	Only Numerical type	
2	Frequency	50 Hz ± 3%	10	Provision of earthing		
3	Number of phases	TP		Switch/ truck	Required	
4	System fault level	31.5 kA/ 1 Sec	D	Miscellaneous		
5	System Earthing	Solidly grounded	1	Interface with ECS	Required	
6	Auxiliary Supply		2	Incoming Power Entry	Cable entry for both incoming and outgoing	
a.	AC	240 V + 6%, 1-phase, 50 Hz	3	Cable Entry	Bottom	
b.	DC(For Control & prot'n)	220V + 10%,-15%	4	Separate bolted removable gland plate for cable entry	Required (Gland plate drilled at site)	
C	Electrical Data					
1	Busbar current rating inside panel at design temp.	1500 Amps	5	Cable glands and lugs for cable termination	Required	
2	1 sec. short circuit withstand or 3 sec	1 Sec	6	Painting/ paint shade	As mentioned elsewhere	
	Capacity	kA at kV				

Note:

1. All protection relays shall be numerical type.
2. Electrical components/ devices used in the switchboard shall be selected out of the enclosed list of approved makes listed in the vendor list for electrical components attached as Chapter-13 in Section-3.. For makes of items not covered in the list, prior written approval of Owner is mandatory.

MANUFACTURER'S DATA

A	Switchboards				
1	Make		9	Recommended clearances	
2	Type designation			Front	mm
3	Degree of protection			Rear	mm
4	Max. overall weight of C.B. panel	Kg		Above	mm
5	Overall dimensions of C.B. panel		10	Shock loading on foundation	
a.	Width	mm	11	Max. size/ no of cables that can be	
b.	Depth	mm		Terminated inside the panel	
c.	Height	mm	a.	Without rear extension panel	
6	Overall dimensions of dummy/ Adaptor panel of each type		b.	With rear extension panel	
a.	Width		c.	Size of rear extension panel	
b.	Depth		12	Clearance in air	
c.	Height		a.	Phase to phase (min.)	mm
			b.	Phase to earth (min.)	mm
7	Overall weight and dimensions of largest shipping section		13	Busbar current rating at design ambient temperature	A
a.	Weight	Kg	14	Busbar (separately for each swbd)	
b.	Width	mm	a.	Horizontal main busbar size	
c.	Depth	mm		(No. of flats X size of each flat)	
d.	Height	mm	b.	Horizontal main busbar size as tested at CPRI for full short ckt. withstand as per specification requirement (no. of flats X size of each flat)	
8	Overall dimensions of each swbd including all dummy/ adaptor/ rear Extension panels		c.	Vertical dropper size (no. of flats X size of each flat)	
a.	Width				
b.	Depth				
c.	Height				
15	Horizontal main busbar/ vertical busbar material	Al/ Cu	b.	Removable FRP shrouds for all busbar joints and tap-off connections provided	Yes
16	Insulating material (Busbar supports)		c.	Arc propagation barrier in busbar compartment provided	Yes
17	Earth busbar size	mm ²	d.	Breaker service, test and drawnout position provided	Yes
18	Earth busbar material	Copper	e.	Distinct overall lockable door for breaker compartment provided	Yes/ No
19	1 min. power frequency withstand voltage (rms)	kV	f.	Automatic safety shutter provided	Yes/ No
19.1	Over voltage factor for PTs		g.	Independent pressure release Flaps provided for all HV compartments	Yes/ No
20	Impuse withstand voltage (peak)	kV	h.	Wire mesh for all louvered openings provided	Yes/ No
20.1	Wave shape of impulse voilage		i.	Infrared windows for thermography	Yes
21	1sec. short ckt. Withstand capacity	kA			
22	Peak dynamic withstand capacity	kA			
23	Safety Features				
a.	Heat shrinkable sleeves, rated to withstand the system line to line voltage for one min., provided on busbar	Yes			
B	Circuit Breaker				
1	Type	VCB	16	Power required for closing	W/WA
2	Make		17	Power required for spring Charging motor	W/WA
3	Type designation		18	Breaker is trip free	Yes/ No
4	Circuit breaker mounting in panel	Truck/	19	Closing mechanism	

5	No. of poles/ phase	cassette	20	Provision of manual spring charging provided	Yes/ No
6	Current rating (in free air)	A at ⁰ C	21	Mechanical trip PB provided	Yes/ No
7	Current rating inside the panel at Specified design temperature	A	22	Mech. On/ Off indicator provided	Yes/ No
8	Short time rating (1 sec.)	kA	23	Operation counter provided	Yes/ No
9	Symmetrical breaking capacity	kA	24	Time taken for spring charging	Sec.
9.1	% D.C. Component		25	No. of aux. contacts and their Current ratings	No + NC, A
10	Peak making current	kA	26		
11	1 min. dry withstand voltage power frequency)	kA	a.		
			b.		
12	Duty Cycle		c.		
13	Total closing time	m sec			
14	Total closing time	m sec.			
15	Power required for opening	W/ VA			

DATA SHEET SWITCHBOARD

27	Suppressor				
a.	Type designation				
b.	Make				
28	Derating reqd. for Cap. Switching	%			
29	Earthing system	Integral earthing/ separate earthing carriage			
30	Copies of following test certificates enclosed	Yes/ No			
30.1	For each type of offered circuit breaker panel with breaker				
a.	Short circuit tests (peak and 1 sec. withstand)				
b.	Heat run test				
c.	Internal arc test				
d.	Impulse and power freq. withstand				
30.2	For each type of offered circuit breaker (in panel)				
a.	Short circuit test duties				

* Switchboard offered shall be of proven design and shall have been successfully type tested. Type test certificates for an exactly identical design of offered switchboard shall be furnished by bidders during inspection. These test reports shall not be more than 5 years old, as on the final bid opening date. In case these type tests have not been conducted during the last 5 years, bidder shall conduct these type tests on the offered design of switchboard before dispatch without any cost and delivery impact.

5.14 PROTECTION RELAYING

TO BE COMPLETED BY		PURCHASER		MANUFACTURER TYPE/ SPEC'N	
1	IDMTL over current	Yes			
2	Inst. over current	Yes			
3	Under voltage	Yes			
4	Bucholz trip, OTI, WTI, PRV	Yes			
5	Restricted earth fault	Yes			
6	Unrestricted earth fault	Yes			
7	Bus differential protection	Yes			
8	Cable differential protection	Yes			
9	IDMT Earth Fault	Yes			
10	Inst. Earth Fault	Yes			
11	Transformer Differential	Yes			
12	Standard Motor Protections	NA			
12	Frequency and dF/dT	NA			
13	Current transformers				
	• For items	In line with tender documents.			
	• For items				

5.15 Vendor Data Requirement

Sr No	Description with bids	With Bids	Post order		Final documents with equipments	
			For review	For records	soft copy	Pri nts
1	Schedule of Vendor Documents			x		
2	Data sheets (Duly filled - in)	x			x	x
3	Dimensional / Assembly Drawings					
	a.GA drawings (Elevation and Plan) of switchboard including clearance requirements	x	x		x	x
	b. Installation Plan including foundation, cutout and mounting details		x	x		
	d. Cubicle Arrangement Drawing			x		x
	g. Component Drawing			x		x
	h. Name plate Drawing			x		x
	I. Arrangement of cable termination		x			x
4	Electrical Wiring Drawings					

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	a. Single Line diagram	x	x		x	x
	b. Control Scematic		x	x	x	x
	c. Wiring Diagram and Terminal Details		x	x	x	x
	d. Interpanel Wiring Diagram		x	x	x	x
5	Panel Schedule & Bill Of Material	x	x	x		x
6	Calculations		x			x
6.1	Bus-bar sizing Calculation		x			x
6.2	Calculation of CT/PT burden ,Vk,Im,RCT etc for class PS CTs		x			x
7	Relay Characteristics Curve			x		x
8	Relay Characteristics Curve			x		x
9	Auxiliary Power Requirement data(AC&DC)			x		x
10	QA plan of Vendor		x			x
11	Inspection Plan and testing procedure (For review by inspection)		x			x
12	Test Records			x		x
13	Type Test Certificate (For Panel ,Breaker & Bus ducts)		x	x		x
14	List of Commissioning spares	x	x			
15	List Of special Tools & Tackles	x	x			x
16	Data Book/ Manual					
	a. Intallation manual			x		x
	b. Operating/Maintenance manual			x		x
	c. Catalogues/ Brochures	x				x
18	Filled-in datasheet (technical)	x				x
19	Equipment storage porcedure at site			x		x

CONTROL AND PROTECTION PHILOSOPHY

CONTROL SWITCHES

1.1 Control switch shall be rotary type provided with escutcheon plates clearly marked to show operating position and suitable for flush mounting with only the switch front plate and operating handle projecting out. The connections shall be from the rear. The contact assembly at the back of the switch shall be enclosed in dust tight removable covers. The access to the contacts shall be from the back by the removal of the cover. Contact assembly shall be smooth enough for operations.

1.2 Breaker control switch of "3 position spring return to neutral" type shall be provided. The control springs shall be strong and robust enough to prevent inadvertent operation due to light touch. The spring return type switch shall have spring return from close and trip position to 'After Close' and 'After Trip' positions respectively. The handle or base for breaker control switch shall have **RED COLOUR**

1.3 The number of contacts in the control switches shall be decided by the tenderer in view of various requirements of this specification. Two pairs of contacts one normally open and one normally closed shall be kept spare.

1.4. Safety against inadvertent operation due to light touch in the control switches shall be ensured.

1.5 Contacts of the switch shall be spring assisted and contact faces shall be silver plated. Spring shall not be used as current carrying parts. The contacts of all switches shall preferably open and close with snap action to minimize arcing. The contact rating of the switches shall be as follows:

	Description Contact rating	240V	110VDC
A	Make and carry continuously	25A	25A
B	Make and carry for 0.5 sec	30A	30A
C	1) Resistive load 2) Inductive load with L/R = 40msec	7A 7A	7A 5A

2.0 Panel Internal Wiring

2.1 All wiring shall be carried out with 1100V grade single core multi strand flexible copper conductor wires with PVC insulation and shall be Flame Retardant Low Smoke (FRLS) *type*, vermin and rodent proof. The current carrying capacity of wire shall be adequate for the duty assigned to it considering short circuit condition and shall have sufficient flexibility to facilitate proper termination at any location. Color coded wires (red, yellow, blue, black) shall be used for CT, VT secondary connections.

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The copper conductor used for internal wiring be as follows:

- a) All circuits except instrument transformer circuit of 1.5 Sq mm per lead
- b) CT circuit - one 2.5 Sq mm per lead.
- c) VT circuits one 1.5 Sq mm per lead.
- d) Energy metering - 2.5 Sq mm per lead for both PT & CT circuits.

2.2 Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common circuits shall be provided near the top of the panels running throughout the entire length of the panels.

2.3. The wire numbers shown in the wiring diagram shall be in accordance with IS375/BS152/BS156. All wires directly connected to trip circuit breaker or devices shall be distinguished by addition of a red colored or lettered ferrule. Number 6 and 9 shall not be used.

2.4. Panel wiring shall be securely supported, neatly installed by lacing and tying, readily accessible and connected to equipment terminals and terminal blocks. Flame retardant, plastic wiring channels/troughs with strap on plastic covers shall be used for this purpose. Sufficient space in channel for modification of wiring shall be kept.

2.5. Accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as closing or tripping of a breaker or positive and negative wires, these wires shall not be terminated on adjacent terminal blocks.

2.6. The unused space on the front or rear of the panels shall be kept clear of wiring to facilitate addition of devices without rewiring associated portion of the panels.

2.7. Wire termination shall be made with solder less crimping type of tinned copper lugs which firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks.

2.8. The bidder shall be responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment. Terminations on T.B. shall be grouped function wise on one region of T.B.(may not be full T.B) to take outlet connections in one cable for the function.

3.0 Earthing

3.1. Each panel shall be provided with earth bus tinned copper. The minimum earth bus bar size shall be minimum 30 x 6 mm² copper, up to short-circuit withstand capacity of 31.5 kA, and 50 x 6 mm² copper, for a short-circuit withstand capacity above 31.5 kA.. It shall be provided with M4 holes and Nuts & Bolts at a distance of 100mm. Since several panels are to be mounted adjoining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply.

Provision shall be made to extend the earth bus bars to future adjoining panels. Provision shall be on the earth bus of the end panels for connecting owner's earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply, of the manufacturer.

3.2. All metallic cases of relays, instruments and other mounted equipment shall be connected to earth bus by copper wires of size not less than 2.5 sq. mm. The colour of the earthing wire shall be green.

3.3. 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 earth connections between equipment to provide alternative paths, to earth bus shall be provided.

3.4. VT and CT secondary neutral or common lead shall be earthed at one place only. Such earthing shall be made through links, so that earthing may be removed from one group without disturbing continuity of earthing systems for other group.

3.5. A separate earthing point shall be provided in the panel for cable screens of static equipment, insulation between two earths prior to connections of the two earths to the Purchaser's earthing grid, shall withstand a test voltage of 500V for 1 minute (or higher insulation resistance of not less than 1 meg-ohms at 500V) connection between the screen terminals and the screen earth – point shall be jumper wires. Connection of this earth point to the station earth shall be carried out by Purchaser.

4 Terminal blocks

4.1. Terminal blocks shall be 800V grade, 45 amps rated, one piece molded, complete with insulated barriers, stud type, melamine housing brass terminals, washers, brass nuts and brass lock nuts and identification strips.

Markings on the terminals strips shall correspond to wire number on the wiring diagrams. Not more than 2 wires shall be connected to any terminals.

4.2. Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary wiring should be such that it can connect additional circuit in series.

4.3. At least 20% spare terminals shall be provided in each panel and these spare. Terminals shall be uniformly distributed on all terminal blocks, near each group of connections for function wise circuits.

4.4. All spare contacts and terminals of the panel mounted equipment and devices shall be wired up to terminal blocks with ferrule numbers starting with U.

4.5. Cable gland plate fitted on the bottom of panel shall be connected to earthing of panel/station through a flexible braided copper conductor rigidly.

4.6. There shall be minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate. Also the clearance between two rows of terminal blocks edge shall be minimum of 150mm.

4.7. Molding materials shall be self extinguishing or resistant to flame propagation, substantially non hygroscopic and shall not carbonized when tested for tracking. The insulation between any terminal and frame work between adjacent terminals shall withstand test of 2kV rms. For one minute. The molding shall be mechanically robust to withstand handling while making terminations.

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4.8. Easily removable Protective transparent plastic covers for placing over the live parts of the terminal blocks shall be provided invariably.

5.0 Mounting

5.1. All equipment on front of panel shall be mounted flush.

5.2. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment. Equipment mounted inside the panel shall be so located that terminals of adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible.

5.3. Cut-outs and wiring for bought out items. If any, shall be according to corresponding equipment manufacturer's drawings, cut-out, if any provided for future mounting of equipment shall be properly blanked off at a height not less than 750mm from the bottom of the panel. The centre line of relays, meters and recorders shall be at a height not less than 450mm from the bottom of the panel.

5.4. The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise, the top edges of all meters, relays and recorders etc. shall be matched.

6. Auxiliary equipment

6.1 Auxiliary relays and contactors

Auxiliary relays (Alstom make VAA,VAJC , VAJH series only or advanced version) and contactors shall generally be used for interlocking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum estimated current. In any case, their rating must not be less than 5 A for 240V AC at a power factor between 0.3 and 1.0 and 2 A for 110 V DC (inductive load)

6.2 Tripping relays (Separate Relay)

All tripping relays shall be of lockout type with hand reset contacts (Alstom make VAJH series only or advanced version), and shall be suitable to operate on the specified DC voltage. These relays shall have self coil cutoff contacts, and shall be provided with hand reset operation indicators (flags). Tripping relays will be acceptable in non drawout cases. The number of contacts shall be as shown on the approved schematic drawings.

7.0. RELAYS :

All the relays used for protection purpose shall be numerical relays only with latest state of art technology as per latest applicable standards of IS/IEC.

7.1. The general requirements for the protective relays are described here under however all relays shall in general comply with the technical specifications mentioned in Annex-11 to Annex-15.

7.2. All relays shall conform to the type test requirements of IS: 3231/IEC- 60255/IEC-61000 or other applicable standards. Relays shall be suitable for flush mounting on the front with connections from the rear.

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7.3. All protective relays shall be with proper on line testing facilities without isolation from TB where inputs viz CT/ PT and DC are wired.

7.4. All AC operated relays shall be suitable for operation at 50 Hz. AC voltage operated relays shall be suitable for 110V VT secondary and current operated relays for 1or 5 amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.

7.5 REQUIREMENT OF AUXILIARY RELAYS FOR MULTIPLICATION

7.5.1. Latched type electrically reset auxiliary relay having sufficient nos. of contacts for completing the scheme and spare for use in future shall be used for contact multiplication with Flag / LED Indication.

7.5.2. These contacts will be used for status indications, switchgear interlocks, DR & SER etc.

7.5.3. These contacts multiplication relays shall be completely wired up to the terminal blocks of the control panel.

7.5.4 The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relays coils and contacts, including spare contacts.

7.5.5 All protective relays, auxiliary relays and timers except the lockout relays and interlocking relays specified shall be provided with self-reset type contacts. All protective relay and timers shall be provided with externally hand reset positive action operation indicators with inscription.

Similarly, separate operating indicator (auxiliary relays) shall also be provided in the trip circuits of protections located outside the board such as buchholz relays, oil and winding temperature protection, sudden pressure devices, fire protection etc.

7.5.6. No control relay which shall trip the power circuit breaker when the relay is de-energized shall be employed in the circuits.

7.5.7. Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance.

7.5.8. All protective relays and alarm relays shall be provided with one extra isolated pair of contacts wired to terminals exclusively for future use.

7.5.9. The setting ranges of the relays offered, if different from the ones specified shall also be acceptable if they meet the functional requirements.

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7.5.10. Any alternative/ additional protections or relays considered necessary for providing complete effective and reliable protection shall also be offered separately. The acceptance of this alternative/ additional equipment shall lie with the Owner.

7.5.11. Wherever numerical relays are used, the scope shall include the following:

a) The relay shall be capable of supporting IEC 61850 protocol (with fibre optical port or Copper Ports).

b) Necessary software and hardware to up/down load the data to/from the relay from/to personal computer installed in the substation. Including, the supply of One no. of laptop is also covered under this clause.

c) Laptops shall be of brand new latest version of windows operating system of following specifications:

i. Controller – Intel Core-I7 2.8 GHz or higher

ii. Make - HP/DELL/IBM/Advantech

iii. RAM - 4 GB

iv. Harddisk-1 TB SATA or higher

v. Gigabit Ethernet Network Ports - 2 nos.

vi. USB Ports - 4 Nos.

vii. Serial Communication Ports: 2 Nos

viii. Keyboard & Optical Mouse with Pad

d) Necessary licensed copy of software and hardware to up/ down load the data to/from the relay from/to the personal computer installed in the substation shall be provided. All required hardware for communication with Laptop is to be supplied.

e) The software shall be suitable for operations like switching, retrieval of information or changing of setting groups, retrieve oscillographic fault data from the relay memory and to store fault record data as oscillographic records in standard format. The software shall be suitable to provide oscillographic data into several different graphical representations that can be used to analyze the fault or event captured by the relay. It shall also be possible to calculate additional values from the captured signals and display analog curve with time base phasor diagram locus diagrams, harmonic graphs etc. Automatic upload of DR files should be possible.

f) The relay shall be supplied with all the original customized licensed software, IO Cards, required cable for local or remote communication mentioned in the catalogue including all optional items.

7.5.12. All not used terminal shall also be provided with screws washers, lugs etc. as for used terminal.

7.5.13 The protection scheme as detailed below are minimum protections. While detail

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design, coordination, selection of protection shall be as per tender requirement and duly approved by Owner, as per applicable standards.

7.5.14. The offered relays must be type tested in line with the relevant IS/IEC standards. The relevant documents must be submitted along with the technical bid for evaluation.

8.0 GENERAL PROTECTION REQUIREMENTS:

The general protection requirements for different type of feeders is enlisted below for reference purpose. Detailed protection scheme shall be submitted during detailed engineering for approval of Owner.

Sl. No.	Type of Feeder	
1	LIB Feeder	a) Transformer differential (CT & other accessories only) b) Transformer REF protection (CT & other accessories only) c) Over current- IDMT d) Over current- HS e) Earth Fault- IDMT f) Earth Fault – HS g) Cable differential relay and CT & other accessories

9.0 INSTRUMENT TRANSFORMER

9.1 Current Transformers

A) General:

- i) The current transformers and accessories shall conform to IEC: 60044-1 and other relevant standards except to the extent explicitly modified in the specification.
- ii) The particulars of the various cores may change within reasonable limits as per the requirements of protection relay supplier. The Manufacturer is required to have these values confirmed from the purchaser before proceeding with design of the cores. The other characteristics of CTs shall be furnished along with the specification.
- iii) Rating and Diagram Plates

Rating and diagram plates shall be as specified in the IEC specification incorporating the year of manufacture. The rated extended current rating voltage and rated thermal current shall also be marked on the name plate.

- iv) The diagram plates shall show the terminal markings and the relative physical arrangement of the current transformer cores with respect to the primary terminals (P1 & P2).

B) Constructional Details:

- i) The current transformers incorporated into the switchgear will be used for protective relaying

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and metering and shall be of metal- enclosed type. All the current transformers shall have effective electromagnetic shields to protect against high frequency transients.

- ii) Each current transformer shall be equipped with a marshalling box with terminals for the secondary circuits, which are connected to the local control cubicle. The star/ delta configuration and the inter connection to the line protection panels will be done at the CT terminal block located in the local control cubicle.
- iii) Current transformers guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
- iv) The instrument security factor at all ratios shall be less than five (5) for metering core.
- v) The wiring diagram, for the interconnections of the three single phase CTs shall be provided inside the marshalling box.
- xi) Electromagnetic shields to be provided against high frequency transients typically 1-30MHz.
- xii) The Current Transformer must be suitable for continuous operation when installed on the condition
- xiii) Electromagnetic shields & Partial Discharge level shall be as per IEC-60044-1 standards
- xv) Each current transformer shall be provided such that the enclosure current does not affect the accuracy or the ratio of the device or the conductor current being measured. Provision shall be made to prevent arcing across the enclosure insulation.
- xvi) The secondary current of all CTs shall be either 1A or 5A. Differential CTs shall have secondary current of 1A only.
- xvii) The CT Burden of all CTs shall be as per site requirement and detailed engineering, but minimum burden shall be 15 VA.
- xviii) The type of protection CTs shall be 5P20 or better including PS class for differential protection and REF protection.

9.2 VOLTAGE TRANSFORMERS

A) General

The voltage transformers shall conform to IEC- 60044-2 and other relevant standards except to the extent explicitly modified in the specification.

B) Ratios and Characteristics

The rating, ratio, accuracy class, connection etc. for the voltage transformers shall be furnished in specification.

C) Rating and diagram plates

Rating and diagram plate shall be provided complying with the requirements of the IEC specification incorporating the year of manufacture and including turns ratio, voltage ratio,

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burden, connection diagram etc.

D) Secondary Terminals, Earthing and Fuses

The beginning and end of each secondary winding shall be wired to suitable terminals accommodated in a terminal box.

All terminals shall be stamped or otherwise marked to correspond with the marking on the diagram plate. Provision shall be made for earthing of the secondary windings inside the terminal box..

E) The transformer shall be able to sustain full line to line voltage without saturation of transformer. The accuracy class will be at maximum tap.

F) Constructional Details of Voltage Transformers :

ii) Voltage transformers secondaries shall be protected by MCB for all the windings. The secondary terminals of the VT's shall be terminated to the terminal blocks in the secondary boxes.

iv) The voltage transformer should be thermally and dielectrically safe when the secondary terminals are loaded with the guaranteed thermal burdens.

v) The diagram for the interconnection of the VTs shall be provided inside the marshalling box

vii) Adequate measures shall be provided to prevent any unacceptable impact on the secondary control & the protection circuit, which might result from fast transients (VFD) or Ferro-Resonance.

vi) Electromagnetic sheilds & partial discharge level shall be as per IEC-60044-1 standards

vii) The secondary of all VTs shall be 110V only.

viii) The minimum burden of all VTs shall be 50 VA.

ix) The type of all protection VTs shall be 3P and metering VTs shall be class 1.0

10.0 TESTS:

Current and voltage transformers shall conform to type tests and shall be subjected to routine test in accordance with IEC.

33kV AIS Switchboard (LIB)- Technical Corrigendum 1

81	Plot no. IOCL/PR/000 19/OVERALL PLOT PLAN		through Chain link from all four sides as per applicable IS standards and CEA rules with due earthing of the same at multiple points as per IS/CEA requirement. Due footing for fence support shall be developed as per standard design requirements. Proper structural type entry gate shall be developed at two entrance point as shown in GELO.	
82	Clause 18.19 of General Guidelines for civil work, Section".	Chain link fencing	The design shall be as per drawings attached with the tender. The details of chain link fencing is attached as Section-3 Chapter-19.	
83	Section-3 Chapter-11 Clause 4.8.3	The Switchboards shall be metal enclosed cubicle type, suitable for indoor installation, floor - mounting and free - standing. The design for the total enclosure shall be dust-tight, damp-proof, vermin proof and totally enclosed offering degree of protection not less than IP4X.		
84	Section-3 Chapter-11 Clause 4.8.7	The switchgear cubicles shall be rigid and robust in design & construction. Sheet steel used for fabrication shall be cold rolled. Cubicles shall be made from rigid welded structural frames made of structural steel sections or of pressed / formed sheet steel of not less than 3 mm thickness. The frames shall be enclosed by sheet steel of at least 2 mm thickness, smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.	The switchgear cubicles shall be rigid and robust in design & construction. Panel Sheet used for fabrication shall be cold rolled steel or suitable metallurgy material. Cubicles shall be made from rigid welded structural frames made of structural steel or suitable material sections or of pressed / formed sheet of not less than 2 mm thickness. The design shall have to be type tested for full short circuit rating, internal arc resistance and ingress protection..	

155	Section-3 Chapter-9, bullet point-21 under Clause 1.1.6.4	Priority based load control based on the guiding parameters as per the system requirements. The priority selection shall be a user control parameter and shall be available for all generators or PR and PNCP. The user will decide the priorities of the running generators based on the criteria defined by user. The LMS system will carry out automatic load control and voltage control based on the priorities, capacity limits, operating parameter limits and grid operating limits.	Priority based load control based on the guiding parameters as per the system requirements.
156	Section-3 Chapter-9 Part B LMS Clause 3.3 / Page-33	In order to reach the desired short reaction time It must be noted, that the entire Ethernet network must be designed and parameterized in that way to achieve a very fast reaction time typically below 100 ms excluding the field devices operation time. Same needs to be demonstrated during SAT.	In order to reach the desired short reaction time It must be noted, that the entire Ethernet network must be designed and parameterized in that way to achieve a very fast reaction time typically below 1 sec excluding the field devices operation time. Same needs to be demonstrated during SAT.
157	Section-3 Chapter-9 PART-B LMS Clause 3.20	All data transfer shall be on fast data transfer protocol to achieve data resolution of as low as 1ms	All data transfer for the offered hardwired signals shall be on fast data transfer protocol to achieve data resolution of as low as 1ms. For other acquired signals from existing system, the same shall be limited to maximum of as per existing source stamping resolution
158	Section-3 Chapter-11 Clause 4.4	The equipment offered by the Bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment/	The equipment offered by the Bidder shall be complete in all respects including technical specification and project requirements. Any Addition in the scope of work beyond tender specification shall be dealt with the change order system in line with the tender documents.

		accessories shall be supplied without any extra cost. Also all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory.	
159	Section-3 Chapter-11 Clause 4.7	The Internal Arc withstand shall be in the category IAC AFLR as per IEC62271-200 for 32.5 KA for 0.3 Sec. The bidder to offer the design of the panel in line with the Internal Arc compliance requirements only.	The Internal Arc withstand shall be in the category IAC AFLR as per IEC62271-200 for 31.5 KA for 0.3 Sec or better. The bidder to offer the design of the panel in line with the Internal Arc compliance requirements only.
160	Section-3 Chapter-11 Clause 4.8.3	The Switchboards shall be metal enclosed cubicle type, suitable for indoor installation, floor - mounting and free - standing. The design shall be totally enclosed, dust-tight, damp-proof and vermin proof offering degree of protection not less than IP4X.	The Switchboards shall be metal enclosed cubicle type, suitable for indoor installation, floor - mounting and free - standing. The design for the total enclosure shall be dust-tight, damp-proof, vermin proof and totally enclosed offering degree of protection not less than IP4X.
161	Section-3 Chapter-11 Clause 4.8.7	The switchgear cubicles shall be rigid and robust in design & construction. Sheet steel used for fabrication shall be cold rolled. Cubicles shall be made from rigid welded structural frames made of structural steel sections or of pressed / formed sheet steel of not less than 3 mm thickness. The frames shall be enclosed by sheet steel of at least 2 mm thickness, smoothly finished, leveled and free from	The switchgear cubicles shall be rigid and robust in design & construction. Panel Sheet used for fabrication shall be cold rolled steel or suitable metallurgy material. Cubicles shall be made from rigid welded structural frames made of structural steel or suitable material sections or of pressed / formed sheet of not less than 2 mm thickness. The design shall have to be type tested for full short circuit rating, internal arc resistance and ingress protection..

		flaws. Stiffeners shall be provided wherever necessary.	
162	Section-3 Chapter-11 Clause 4.10.9	The hot spot temperature for bus bars including joints at design ambient temperature shall not exceed 85°C for normal operating conditions.	The hot spot temperature for bus bars including joints at design ambient temperature shall not exceed the limits defined in IEC-62271 for normal operating conditions.
163	Section-3 Chapter-11 Clause 5.12.a.6	One minute power frequency withstand voltage - For type tests: 48 K Vrms - For routine tests: 48 K Vrms	One minute power frequency withstand voltage - For type tests: 70 K Vrms - For routine tests: 70 K Vrms
164	Section-3 Chapter-11 Clause 5.12.a.10;	Dynamic withstand rating : 80 KA	Dynamic withstand rating : 78.75 KA or better
165	Section-3 Chapter-11 Clause 5.12.d.3;	Short ckt. Making current: 80 kA (peak)	Short ckt. Making current: 78.75 kA (peak) or better
166	Section-3 Chapter-11 Clause 5.13.A.4	System making capacity: 80 kA (peak)	System making capacity: 78.75 kA (peak) or better
167	Section-3 Chapter-11 Clause 5.12.g.2	Rated output of each core: Adequate for the relays and devices connected, but not less than fifteen (15) VA	Rated output of each core: Adequate for the relays and devices connected, but not less than fifteen (15) VA. Minimum VA requirement shall be mandatory.

33kV AIS Switchboard (LIB)- Technical Corrigendum 2

40	Clause 10.1.1.9 on Page 98 of 1047 of Section-C	Complete 220 kV & 33 kV C & R Panels with remote monitoring HMI system. All required relay panels, ECS/ SCADA panels shall be installed in same 220 KV GIS switchgear building while remote HMI to be installed in existing control room of both PR and PNCP.	Complete 220 kV & 33 kV C & R Panels with remote monitoring HMI system. All required relay panels, ECS/ SCADA panels shall be installed in same 220 KV GIS switchgear building while remote HMI to be installed in existing control room of both PR and PNCP.
41	Clause 5.2 of Section-3 Chapter-12 on Page no.: 892 of 1047 of Section-C	All motor feeders rated 75 KW and above shall be ACB fed.	The relay panel shall be of relay OEM or equivalent manufacturer with due approval of E-I-C.
42	Clause 7.11 of Section-3 Chapter-12 on Page no.: 892 of 1047 of Section-C	The maximum height of the operating handle and switches shall not exceed 1900 mm and the minimum height not below 300 mm.	In line with tender clause 1.2 on Page 887 of 1047 of Section-C. The motor of capacity more than 55 KW shall be breaker fed motor.
43	Clause 4.2 of Section-3 Chapter-18	Collection of all existing system data as required for fault limiting system design shall be in the scope of LSTK contractor.	The maximum height of the operating handle and switches shall not exceed 1900 mm and the minimum height not below 300 mm or as per type tested design of approved OEMs as specified in Section-3 Chapter-17.
		Collection of all existing system data as required for fault limiting system design shall be in the scope of LSTK contractor.	Basic information related with the existing system is attached as Annexure-S-3/C-18/1.

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Technical Specification: 33kV AIS Local Isolation Breaker Panel with its Accessories

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SECTION 3:

PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS (FOR ALL EQUIPMENT UNDER PROJECT)

1. General

1. This section stipulates the general technical requirements under the contract and will form integral part of the technical specification.
2. The provisions under this specification are intended to supplement requirement for the materials, equipment and services covered under this specification and is not exclusive. However, in case of conflict between requirements specified in this section and requirements specified in other sections the requirements specified under respective sections shall hold good.

2. Project Details

Panipat Refinery is a PSU Refinery and is having capacity of 15 MMTPA, catering the customers of northern India and is strategically important as per national interest. The refinery is located at Panipat, Haryana and was commissioned in the year 1998.

Presently 132KV supply to Panipat Refinery is provided from 2 sections of grid (one from PTPS and one from Munak) and point of supply is at Panipat Refinery 132KV switchyard. Panipat Refinery complex is consisting of Refinery (will be marked as PR here onwards) and Naphtha cracker complex (will be marked as PNCP here onwards). As a strategic initiative, Panipat Refinery is planning for Bulk power import from HVPNL (Haryana Vidyut Prasaran Nigam Limited) at 220 KV level of 70 MW.

In view of this, Indian Oil Corporation Ltd. (IOCL) - Panipat Refinery is in the process of developing infrastructure to import 70 MW power from grid at 220 KV. Infrastructure development for grid power import at 220KV jobs consists of Inside Battery Limit (ISBL) jobs, Outside Battery Limit (OSBL) jobs.

Sl. No.	Description	Particulars
1	Customer	Indian Oil Corporation Ltd.
2	Consultant	TATA Consulting Ltd.
3	Project	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery
4	Project location	Panipat (City): 16 Km (approx.) Chandigarh Highway: 11 Km (approx.) Noida (Advant)/ Delhi: 150 Km/ 80 Km (approx.)
5	Transport facilities	Well connected by road, rail & air with other parts of the country.

3. Meteorological Data

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions,

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Sl. No.	Technical Parameters	Unit	Particulars
1	Location	Panipat, Haryana, India	
1.1	Maximum ambient temperature	°C	50
1.2	Minimum ambient temperature	°C	-5
1.3	Average ambient temperature	°C	35
1.4	Design ambient temperature	°C	45
2	Average no. of thunder storm days	Days	45
3.1	Maximum Relative humidity	%	95
3.2	Maximum Relative humidity	%	26
4	Average Annual Rain Fall	Mm	900
5	Maximum Wind Pressure	Kg/ sqm	195
6	Maximum Altitude above Mean Sea Level	M	1000
7	Isoceraunic Level	Days/ Year	45
8	Seismic Level (Horizontal Acceleration)	Zone	4
9	Average no. of rainy day per Year	Days/ Year	120

NOTE: Moderately hot and humid tropical climate conducive to rust and fungus growth. The climate conditions are also prone to wide variations in ambient condition. Smoke is also present in the atmosphere. Heavy lightening also occurs during June to October. Switchyard is inside the refinery premise which is also prone to other corrosive gases like sulphur, H₂S, Chlorine etc.

4. Instruction to Bidders

1. The bidders shall submit the technical requirements, data and information as per the technical specifications provided in the bid documents.
2. The bidders shall furnish catalogues, engineering data, technical information, design document, drawings etc fully in conformity with the technical specification.
3. It is recognised that the contractor may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the owner. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously; All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

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4. Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the technical specifications unless include in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard shall be deemed to be included in the scope of the specification. All similar standard components/parts of similar standard equipment provided, shall be interchangeable with one another.
5. Unless brought out clearly in the respective schedule of deviations, it will be considered that, the bid proposal scrupulously confirms compliance to the specification. The bidder must bring out all the deviations in the bid proposal.
6. In case there is a discrepancy between the data offered equipment and catalogue furnished, and unless the deviations are brought out clearly in the Technical Deviation Schedule, the equipment will be deemed to conform compliance to the specification scrupulously.

5. Standards

1. The works covered by the specification shall be designed, engineered, manufactured, built tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.
2. The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified of this section as well as under respective Sections/Chapters of the specification.
3. In addition to meeting the specific requirement called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards and shall form an internal part of the specification.
4. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intend to complement each other.
5. The Contractor shall also note that list of standards presented in this specification is not complete. Wherever necessary the list of standards shall of the specification shall take precedence.
6. When the specific requirements stipulated in the specification exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
7. Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
8. In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in deviation sheets along with English language version of standard or relevant shall be subject to Owner's approval.

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9. Indicative List of Standards and Specifications General Standards Indian Electricity Rules shall be as per **Annexure- A**.

6. Services to be Performed by the Equipment being furnished

1. The 220/33 kV system is being designed to limit the switching surge over voltage and the power frequency over voltage within limits of IEC. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, re-strike etc. under such over voltage conditions and in system where line lengths would extend up to 200 km.
2. All equipment shall also perform satisfactorily under various Electro-mechanical and meteorological conditions of the site of installation.
3. All the Equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, short circuit etc for the equipment.
4. The bidder shall design the various forces for terminal connectors of the equipment are required to withstand.
5. The equipment shall also comply to the following:
 - All outdoor EHV equipment shall be suitable for hot line washing.
 - To facilitate erection of equipment, all items to be assembled as site shall be "match marked". All piping, if any between equipment control cabinet operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.

7. Engineering Data

1. The furnishing of engineering data by the Contractor shall be in accordance with the schedule for each set of equipment as specified in the technical specifications.
2. The review of these data by the owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the owner may not indicate a thorough review of all dimensions, quantities and accuracy of the information submitted. This review and/or approval by the owner shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviation from the requirements, specified under these specifications and documents.
3. All engineering data submitted by the Contractor after final process including review and approval by the owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.

4. LIST OF DOCUMENTS

- 4.1 The bidder must furnish a detailed list of drawings/documents along with the bid proposal which he intends to submit to the owner after awarded of the contract.

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4.2 The supplier shall necessarily submit all the drawings/ documents unless anything is waived. The supplier shall submit required sets of drawings/design documents/test reports as may be required for the approval of the owner.

4.3 All engineering data submitted by the Contractor after final process including review and approval by the Owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.

5. DRAWINGS

5.1 All drawing submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnection between various portions of equipment and any other information specifically requested in the specifications.

5.2 Each drawing submitted by the Contractor shall be clearly marked with the name of the Owner, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

5.3 Further work by the Contractor shall be in strict accordance with these drawing and no deviation shall be permitted without the written approval of the Owner if so required.

5.4 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Owner. Approval of Contractor's drawing or work by the Owner shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

5.5 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Owner would be discussed and finalised at the time of award. The supplier shall also submit six (6) copies of all drawings/design documents/test report for approval of the Owner. The following tentative schedule shall be followed in general for approval. However final schedule shall be prepared with approval of Engineer in-charge post award of approval.

1	Submission, comments, by resubmission and approval recommended agency	Within 4 weeks of receipt
2	Approval/ comments/ by Owner on initial submission	Within 4 weeks of receipt.
3	Resubmission	Within 3 (three) weeks (whenever from

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		date of comments required) including both ways postal time.
4	Approval or comments	Within 3 weeks of receipt of commented drawing/ documents.
5	Furnishing of distribution copies	1 weeks from the date of last approval.

NOTE: The contractor may please note that all resubmission must incorporate all comments given in the submission by the Owner failing which the submission of documents is likely to be returned.

5.6 The drawing which are required to be referred frequently during execution should be submitted on cloth lined paper.

5.7 OTHER REQUIREMENTS OF DOCUMENTATION

5.7.1 One set of soft copy of all drawings, manual, catalogues to be submitted along with 6 sets of hardcopies during submission of as built documents.

5.7.2 6 copies of instruction/operation manuals for complete project shall also be furnished. The instruction Manuals shall contain full details of drawing of all equipment being supplied under this contract, their exploded diagrams with complete instruction for storage, handing, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

5.7.3 If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manual in the form of one (1) reproducible original and twelve (12) copies shall be submitted by the Contractor to the Owner.

The Contractor shall furnish to the Owners, twelve (12) sets of spare part catalogue.

5.8 TITLE BLOCK

Title block for project shall be as follows,

Customer:	Indian Oil Corporation Ltd.
Consultant:	TATA Consulting Ltd.
LSTK Contractor:	Bharat Heavy Electricals Ltd.
Project:	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

8. Colour Scheme and Codes

1. The contractor shall propose parts a colour scheme for those equipment/ Items for which the colour scheme has not been specified in the specification, for the approval of Owner. The decision of Owner shall be final. The scheme shall include,

- Finishing colour of Indoor equipment.
- Finishing colour of Outdoor equipment.
- Finishing colour of all cubicals.

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- Finishing colour of various auxiliary system equipment including piping.
 - Finishing colour of various building items.
2. All steel structures, plates etc shall be hot dip galvanised or painted with noncorrosive paint on a suitable primer as per the provisions of the respective Section. It may be noted that normally all Owner's electrical equipment in Owner's switchyard are painted with shade 631 of IS-5 and Owner will prefer to follow the same for this project also. All the indoor cubicles shall be of same colour scheme and for other miscellaneous items colour scheme will be approved by the Owner.

9. Material/ Workmanship

1. GENERAL REQUIREMENTS

- 1.1 Where the specification does not contain characteristics with reference to workmanship, equipment, materials and component of the covered Equipment, it is understood that the same must be new, of highest, grade of the best quality of their kind, conforming to the best engineering practice and suitable for the purpose for which they are intended.
- 1.2 The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of art in accordance with purpose for which they are intended and to ensure satisfactory performance throughout the service life.
- 1.3 In case where the equipment, material or components are indicated in the specification as "similar" to any special standard, the Owner shall decide upon the question of similarly. When required by the specification or required by the Owner the supplier shall submit, for approval, all the information concerning the material or components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Supplier.
- 1.4 The design of the work shall be such that installation, future expansions, replacement and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised; constructed and documented so that the component part shall be accurately positioned and retained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Owner.
- 1.5 Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same material and workmanship as the corresponding parts of the equipment supplied under specification. Where feasible, common component units shall be Employed in different pieces of the equipment in order to