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	CONSULTANT		TATA Consulting Engineers Limited (TCE)						
	PROJECT		LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery						
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Bharat Heavy Electricals Limited

Project: LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

Technical Specification: 220kV Isolator with accessories

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SECTION 1:

SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

The scope of work under this requisition shall include but not be limited to design, engineering, manufacturing, inspection including third party inspection and testing at manufacturer's works before supply, proper packing and delivery to project site, supervision of installation, testing and commissioning of equipment complete with all fittings, accessories and associated auxiliary equipment, mandatory spares of the equipment complete in all respects for efficient & trouble-free working mentioned under this specification.

It is not the intent to specify completely herein all the details of design and construction of the equipment. However, the equipment shall conform in all respects to the high Standards of design and workmanship and be capable of performing in continuous commercial operation in a manner acceptable to BHEL/ Customer. The equipment offered shall be complete with all components necessary for its effective and trouble free operation along with associated equipment, interlocks, protection schemes etc., Such components shall be deemed to be within the scope of supply, irrespective of whether those are specially brought out in this specification and/or commercially ordered or not. All similar parts particularly movable ones shall be interchangeable.

This section covers the specific technical requirements of the equipment. This constitutes minimum technical parameters for the above item as specified by the BHEL/ Customer. The offered equipment shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) and Section-2 (Equipment Specification Under Scope of Supplies) of this specification.

The specification comprises of following sections:

- | | | |
|-----------|---|--|
| Section-1 | : | Scope, Project Specific Technical Requirements & Bill of Quantities |
| Section-2 | : | Equipment Specification under scope of Supplies |
| Section-3 | : | Project Details & General Technical Requirements (For All Equipment under the Project) |
| Section-4 | : | Annexures |
| | | Annexure A- Compliance Certificate |
| | | Annexure B- Schedule of Technical Deviations |
| | | Annexure C- Guaranteed Technical Particulars |
| | | Annexure D- Technical Checklist |

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations

In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,

- o Indian Electricity Act
- o CEA regulations
- o The Factory Act

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- o The Petroleum Rules
 - o OISD standards
 - o Requirements of other statutory bodies as applicable, e.g. CEA, CCE, LPCB.
2. Section-1
 3. Section-2
 4. Section-3
 5. Codes & Standards

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL/ Customer will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL/ Customer of their interpretation. In case bidder fails to convey the same prior to award, BHEL/ Customer decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The equipment with its Accessories is required for the following project:

Name of the Customer	:	Indian Oil Corporation Limited (IOCL)
Name of Consultant	:	Tata Consulting Engineers Limited
Name of Main Contractor	:	Bharat Heavy Electricals Limited
Name of the Project	:	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

2. Codes & Standards

1. The rating as well as performance and testing of the equipment (220kV Isolator with accessories) shall comply with the latest editions and amendments of the following standards as applicable, unless otherwise specified elsewhere in this specification,

IS:9921	Alternating current isolators (dis-connectors) and earthing switches.
IEC:129	Alternating current isolators (dis-connectors) and earthing switches.
IS:2544	Insulators.
IS:2147	Degree of protection provided by enclosure.
IS:4691	Degree of protection provided by enclosure.
IS:325	Three phase induction motors.
IS:4722	Rotating electrical machines.
IS:262	Recommended practice for hot dip galvanizing of iron & steel.
IS:4759	Hot dip galvanization coating on structural steel.
IS:2633	Method of testing weight, thickness and uniformity

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IS:1573 Electroplated coating of zinc on iron and steel.

IS:6735 Spring washers.

IS:2016 Plain washers.

2. For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ISS specification.
3. The equipment meeting with the requirements of other authoritative standards, which ensure equal or better quality than the standards mentioned above shall also be acceptable. Where the equipment offered by the bidder confirms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer.
4. In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.
5. The equipment shall also conform to the provisions of Indian Electricity Rules, 1956 and other statutory regulations currently in force in the country.
6. In case Indian standards are not available for any equipment, standards issued by IEC/ BS/ VDE/ IEEE/ NEMA or equivalent agency shall be applicable.

3. Specific Technical Requirements

1. The equipment shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.
2. 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, ice & snow, (wherever applicable) short circuit etc. for the equipment.
3. The equipment shall also comply with the following,
 - a. To facilitate erection of equipment, all items to be assembled at site shall be “match marked”.
 - b. All piping, if any between equipment control cabinet/ operating mechanisms to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.
4. In addition to this, the other specific technical requirements for the equipment shall be as follows,

Sl. No.	Technical Parameters	Unit	Particulars
1	Equipment		220kV Isolator with accessories
2	Type		Off-load type, horizontal center/ single break type, electrically operated mechanically ganged
3	Installation		Outdoor
A	Meteorological data		
1.1	Maximum ambient temperature	°C	50
1.2	Minimum ambient temperature	°C	-5
1.3	Average ambient temperature	°C	35

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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
B	System Parameters		
1	Nominal/ rated system voltage	kVrms	220
2	Highest system voltage	kVrms	245
3	Neutral grounding/ earthing		Solidly Earthed
C	Technical parameters		
1	Rated Frequency (Hz)	Hz	50
2	System Neutral Earthing		Solidly Earthed
3	Phases (Poles)	No.	3
4	Temperature Rise		As per relevant IS/IEC
5	Safe Duration of overload		
	- 150% of rated current	Minute	5
	- 120% of rated current	Minute	30
6	Type of disconnect (AB)		SB (Single break)
7	Rated normal current at 50°C ambient temperature	Arms	2000
8	Rated short time withstand current of MS & EB for 1sec duration	KArms	50
9	Rated dynamic withstand current	kA	125
10	Rated short circuit making current of EB	kAp	125
11	Basic insulation level		
	I. Lightning impulse withstand voltage (1.2/50 micro-sec) (±ve polarity)		
	- To earth	kVp	± 1050
	- Across isolating distance one terminal subjected to lightning impulse (kVp) and opposite terminal subjected to power frequency (kV rms) voltage (as per IS)	kVp	± 1200
	II. Rated 1-minute power frequency withstand voltage		

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	- Across isolating distance	kVrms	530
	- To earth and between poles	kVrms	460
	III. Switching impulse withstand voltage (250/2500micro sec.) dry and wet		
	- between line terminals and ground	kVp	--
	- between terminals with isolator open	kVp	--
12	Minimum creepage distance of support and rotating insulator	mm	6125
13	Phase to Phase spacing for installation	mm	4500/ As per layout drawing
14	Minimum clearance		
	- Phase to earth	mm	2400
	- Phase to Phase (Across the same pole)	mm	2700
	Bidders offering lesser clearance must substantiate the same with adequate information on impulse withstand capability of the equipment, However the height of Post Insulator should not be less than 2300mm in case of 220kV		
15	Height details		
	- Height of center line of terminal pad above ground level/ Centre-line of bus bar for equipment connection from the base of support structure (plinth level)	mm	6000
	- Plinth height from ground level	mm	As per layout drawing
16	Rating of auxiliary contacts		
	- Thermal rating of auxiliary contracts	A	10A at 220Vdc
	- Breaking capacity of auxiliary contacts	A	2Adc with circuit time constant of not less than 20ms
17	Seismic acceleration		0.3 g horizontal
18	Operating time	ms	12 sec or less
19	Rated mechanical terminal load		As per table III of IEC-62271-102 or as per the value calculated in Section-3, whichever is higher
20	Rated magnetizing/ capacitive current make/ break	Arms	0.7
21	RIV at 1 MHz & 1.1 X rated phase to earth voltage	μV	1000
22	Corona extinction voltage with isolator in all	kVrms	156 (min.)

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	positions		
23	Operating mechanism		
	- Isolator		Manual and motor operated
	- Earth Switch		Manual operated
24	Temperature rise over design Ambient temperature		As per Table-3 of IEC-62271-1
25	Minimum number of auxiliary contacts on each		
	- Isolator		In addition to requirements of specification, 12NO +12NC+4 MBB contacts wired to Terminal Blocks (Reversible) for future use
	- Earth switch		In addition to requirements of specification, 12NO +12NC+4 MBB contacts wired to Terminal Blocks (Reversible) for future use
26	Number of terminals in Control Cabinet		All contacts and control circuits are to be wired up to control cabinet including potential free auxiliary contacts of Isolator/ Earthing Switch.
			Additional 24 nos. evenly distributed spare TBs in Master to be provided for inter pole cabling of auxiliary contacts (employer's use).
			Sufficient TBs shall be provided in control cabinet for looping of AC supply from master to follower of Isolator and Earthing Switch.
27	TB size and type		TBs shall be stud type
			Power Cable-Each TBs Should be Suitable for terminating two wires of 10sqmm size on each side
			Control cable- Each TBs

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			Should be Suitable for terminating two wires of 2.5sqmm size on each side
28	Local/ Remote switch indication of Isolator for remote status		Yes
29	Electrical interlock with circuit breaker		Required
D	Technical parameters for proposed Isolator		
1	Type of Isolator		Silicon rubber polymer/ composite type
2	Total minimum creepage distance	mm	6125
3	Strength of insulator		
	- Cantilever strength of insulator	kN/kg	6/ 600
	- Torsion strength	nm	3000
	- Bending strength	N	4000
	- Tensile strength	N	70000
	- Compressive strength	N	140000
4	Height of insulator	mm	2300
5	No. of Isolator per stack	No.	2
6	Pitch Circle Diameter (PCD)		
	- Top		127mm
	- Bottom		275mm
7	Holes on top	No.	4XM16
8	Holes on bottom	No.	8X18dia

5. The equipment offered under this specification shall be suitable for the following auxiliary power supplies.
 - a. 415 V, 3 phase, 4 wire, 50 Hz, neutral grounded AC supply.
 - b. AC control and protective devices, 240 V, single phase, 2 wire, 50 HZ, lighting fixtures, space heaters neutral grounded AC supply.
 - c. DC alarm, control and protective devices 220 V, DC 2-wire
6. The above supply voltages may vary as below and all devices shall be suitable for continuous operation over entire range of voltages.
 - a. AC supply - voltage + 10% & -15% frequency $\pm$ 5%
 - b. DC supply - 15% to + 10%
7. The post insulators, terminal connectors and structure shall be supplied by BHEL, however, equipment mounting hardware on structure shall be supplied by Bidder.
8. Cables and gland for inter-pole cabling shall be supplied by BHEL.

4. General Technical Requirements

The general technical requirements for the equipment shall be as follows,

1. The isolators shall be a set of three individual poles with one vertical break earthing blade per pole suitable for fixing on either side of the poles or without any earthing blade.
2. Complete isolators with all the necessary items for successful operation shall be supplied

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including but not limited to the following,

- a. Isolators assembled with isolator blades (main and earth), complete base frame, linkages, operating mechanism complete etc.
- b. The three poles of the 245 kV Isolators covered by this specification will be gang operated with one central cabinet for the required electrical devices mounted therein.
3. Terminal Blocks (for AC Power Cable) shall be suitable for cable size upto 16sqmm Aluminum.
4. Bidder shall provide adequate power distribution circuit & terminal block in Isolator/ earth switch marshalling box.
5. Cable gland plate in Isolator/ earth switch marshalling box shall be suitable for cable entry of all power (4 nox 4CX16Sqmm, as applicable) / control cables.
6. Flexible Cu braided earthing for Isolator/ earth switch marshalling box (2 number/ box), size equivalent to 75X12 mm GS flat. Bidder to provide minimum cross section of 270Sq mm flexible copper braid on each side of marshaling box. Hole to hole distance for flexible copper braid shall be minimum 200mm. Hardwares for installation of flexible Cu braid for fixing on marshalling box shall be under bidder's scope.
7. Earth switch shall have grounded connection with minimum 2 number's 155sqmm Cu flexible braid.

5. General Requirements

The general requirements for the equipment shall be as follows,

1. Schedule
 - a. Bidder shall submit detailed bar chart indicating all the milestones from engineering till manufacturing/ testing, dispatch to site.
 - b. Bidder to submit list of consumables with shelf life of less than one year. It shall be supplied before erection after clearance from BHEL/ Customer/ Consultant.
2. Any special tools and tackle, which are specifically required for the equipment and are proprietary in nature shall be included in offer. List of such special tools and tackle should be clearly listed along with the technical offer. Any special tool which is not listed in the list but required during the erection/ testing/ commissioning of equipment shall also be deemed in bidder's scope.
3. The bidder must fill up all the details required for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

6. Bill of Quantities

Quantities for supply and services for the equipment shall be as per Annexure- 220kV Isolator with accessories. However, any item not appearing herein but required for completeness of the work is deemed to be included in bidder's scope.

The quantities in BOQ may vary up to $\pm 30\%$ in line with quantity variation clause. However, individual quantities may be deleted or vary up to any extent.

7. Drawings / Documents required for Engineering Manufacturing Clearance

The drawings/ documents, as follows shall be used for providing engineering manufacturing clearance of the equipment and furthermore, it shall be used for delay analysis, if any from bidder.

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The schedule for submission and resubmission shall be in line with details provided in section-3.

1	220kV Isolators- Drawings & Guaranteed Technical Particulars
2	220kV Isolators- Type Test Reports
3	220kV Isolators- Quality Assurance Plan & Inspection Test Schedule

Date of Submission of first lot of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents.

The successful bidder shall have to extend all possible supports like timely submission/ re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer approval.

8. Type Testing

Bidder shall ensure that the equipment being procured shall be of proven design and should have valid type test certificates as per specified in IS/ IEC standards (amended up to date) at any ISO/IEC/NABL accredited laboratories.

Type test certificates shall not be more than seven (7) years old as on original scheduled date of technical bid opening. In those cases, where type test certificates are more than seven (7) years old from original scheduled date of technical bid opening, bidder shall carry out the type tests at any ISO/ IEC accredited laboratories prior to dispatch of equipment with no commercial implication to BHEL/Customer.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.

9. Quality Plan

The successful bidder shall submit Quality Assurance Plan with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ Customer. In case bidder has reference Quality Assurance Plan agreed with BHEL/ Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of the equipment. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all tests for the equipment (198kV Surge Arrester with its Accessories) shall be deemed to be included in bidder's scope.

10. Inspection & Testing

1. The equipment shall be subject to inspection by BHEL/ Customer or authorized representative at bidder/manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer.
2. The inspector shall have free access to the manufacturer's/ supplier's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.
3. Bidder shall give at least 2 weeks' advance notice to BHEL/ Customer, regarding the date of testing to enable him or his representative to witness the tests. All the tests must be done as per the approved QAP.
1. Bidder shall ensure that the hazardous area equipment provided shall have the necessary test certificates and valid CCOE approval certificates.
2. Bidder shall also furnish factory acceptance test (FAT) for BHEL/ customer approval in line with specific requirements mentioned in Section-2.
3. **Testing as per HVPNL guidelines/ specification, at designated third party laboratories/ any ISO/IEC/NABL accredited laboratories, shall be carried out without any commercial implications to Customer/ BHEL.**
4. **Arranging and coordinating HVPNL for witnessing routine/ acceptance/ type tests at their works or at designated third party laboratories/ any ISO/IEC/NABL accredited laboratories is in the scope of bidder.**

11. Makes of Equipment/ Components

1. The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
2. Bidder while ordering shall ensure the availability of spare parts and maintenance support services for the equipment at least for 10 years from the date of supply.
3. Bidder shall give a notice of at least one year to the BHEL/ Customer before phasing out the products/spares to enable the owner for placement of order for spares and services.
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/ accessories shall be supplied without any extra cost. In addition to this, all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory.
5. Specific reference in this specification and documents to any material by trade name, make or catalogue number shall be construed as establishing quality and performance requirements.

12. Packing and Dispatch

1. The equipment shall be properly packed for selected mode of transportation i.e. sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. 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

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other details as per purchase order.

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2. 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 and hence, Packing shall be suitable for long storage (minimum 1 year).

13. Definitions Used

The following expressions hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following meanings hereunder respectively assigned to them, namely:

1. Battery Limit: The demarcated area within which the Unit is to be located.
2. Bid/Bidding Documents: The totality of the documents comprising the Bidding Document for the notice inviting tender.
3. Contract: The totality of agreement between Customer/ Purchaser/ Owner/IOCL and the Contractor/ LSTK Contractor/ BHEL as derived from the contract documents.
4. Contractor/ LSTK contractor: The bidder selected by the Customer/ Purchaser/ Owner/IOCL for the performance of the work and supply of materials. In this case, it is BHEL.
5. Customer/ Purchaser/ Owner: Indian Oil Corporation Limited.
6. Consultant: Any person(s)/ Firm nominated/ assigned by the Contractor/ LSTK Contractor/ BHEL for providing the engineering consultant services. In this case, it is TCE.
7. Bidder/ vendor: The bidder selected for this intended work shall be known as vendor.

14. Abbreviations Used

The following terminology/ acronym hereunder and elsewhere in the technical specification used and their grammatical variations shall unless repugnant to the subject or context thereof, have the following full form hereunder respectively assigned to them, namely,

SB:	Single Break
MS:	Main Switch
EB:	Earth Blade
PCD:	Pitch Circle Diameter
AC:	Alternating Current
DC:	Direct Current
HV:	High Voltage
EHV:	Extra High Voltage
kV:	Kilovolt
Hz:	Hertz
FAT:	Factory Acceptance Testing
OEM:	Original Equipment Manufacturer
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
PE:	Poly Ethylene
ANSI:	American National Standards Institute

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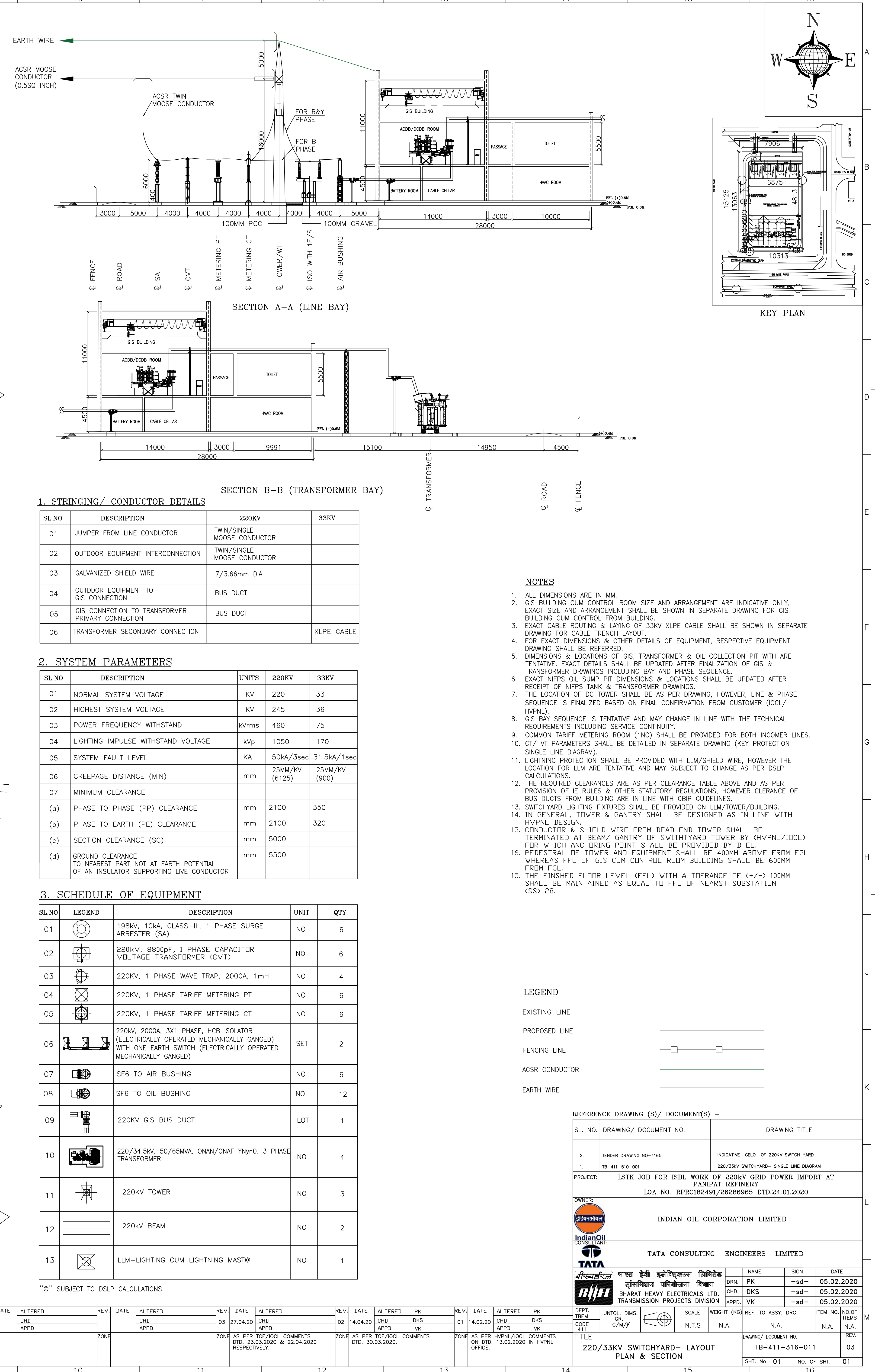
ASTM:	American Society for Testing and Materials
IEC:	International Electro Technical Commission
IEEE:	Institute of Electrical & Electronics Engineers
IS:	Indian Standards
NEMA:	National Electrical Manufactures Association
NABL:	National Accreditation Board for Testing and Calibration
CEA:	Central Electricity Authority
DIN:	Deutsches Institiut fur Normung
CCE:	Continuous and Comprehensive Evaluation
LPCB:	Loss Prevention Certification Board
CCOE:	Chief Controller of Explosives
OEM:	Original Equipment Manufacturer
BHEL:	Bharat Heavy Electricals Limited
OISD:	Oil Industry Safety Directorate
IOCL:	Indian Oil Corporation Limited
HVPNL:	Haryana Vidyut Prasaran Nigam Limited
TPI:	Third Party Agency
ISBL:	Inside Battery Limit
OSBL:	Outside Battery Limit
LSTK:	Lump sum Turnkey
PRPC:	Petroleum Refining and Petrochemical
PNC:	Panipat Naphtha Cracker Complex
PR:	Panipat Refinery Complex
GIS:	Gas Insulated Sub-station
QAP:	Quality Assurance Plan
BOQ:	Bill of Quantities
ASTM:	American Society for Testing and Materials
BIS:	Bureau of Indian Standards
BS:	British Standard
DGMS:	Director General of Mines and Safety
PEM:	Project Engineering Management

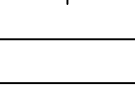
15. List of Documents/ Drawings

Following drawing/ documents are attached for information purpose,

1. TB-411-316-011: 220/33kV Switchyard- Layout Plan & Section

Annexure- 220kV Isolator with accessories								
Rev No. 00								
Sl. No.	Item Description	Long Description	PEERS SL. NO.	PEERS DESCRIPTION	PEERS MATERICAL CODE	Unit	Qty.	Remarks
A.1 Supply Item- Main Items								
1	220kV (Voltage class 245KV), 2000A, 3X1 Phase HCB Isolator (Electrically operated mechanically ganged) with provision of remote and local motor control and local manual operation with one earth switch (Manual operated mechanically ganged), complete with operating mechanism boxes, position indicating arrangement and accessories etc. excluding support insulators, structure and terminal connectors.	220kV Isolator with one Earth Switch with accessories complete in all respects with all accessories comprising of following but not limited to, a. 220kV (Voltage class 245KV), 2000A, 3X1 Phase HCB Isolator (Electrically operated mechanically ganged)with one Earh Switch (Manual operated mechanically ganged), complete with operating mechanism boxes, position indicating arrangement and accessories etc. b. All accessories such as Base, Operating rod, Contacts, Blades, Terminal Pad, Operating Mechanism, Earthing materials and Fixing Hardware etc. execpt Terminal Connectors for Isolator suitable for Twin/ Single ACSR Moose Conductor e. Fixing Hardware shall include hardware for Isolator to Mounting Structure (Support Structure & Insulator in BHEL scope) also. f. Other standard fittings and accessories, which are not specifically mentioned but are usually provided with Isolator of type and rating being offered for efficient and trouble free operation. g. Each Isolator shall have terminals of robust construction for connection to earthing lead and these shall be suitably arranged so as to enable the incoming and outgoing connections to be made with minimum bends. h. Any other item/(s) required to complete the supply in all respects but not limited to above shall be in bidder's scope.	1	SUPPLY- ISOLATOR : 220KV, 2000A, 50KA FOR 1S, THREE PHASE, HORIZONTAL CENTRE BREAK (HCB) TYPE ISOLATOR, ELECTRICALLY OPERATED, MECHANICALLY GANGED WITH PROVISION OF REMOTE AND LOCAL MOTOR CONTROL AND LOCAL MANUAL OPERATION. WITH ONE EARTH SWITCH, MANUALLY OPERATED, MECHANICALLY GANGED. SET IS COMPLETE WITH OPERATING MECHANISM BOXES, POSITION INDICATING ARRANGEMENT AND ACCESSORIES ETC. EXCLUDING SUPPORT INSULATORS, STRUCTURE AND TERMINAL CONNECTORS	TB9222552696	Set	2	Technical specification shall In line with Section-2/ Annexure-S-3/C-4/8.
A.2 Supply Item- Mandatory Spare Items								
1	Male and female contact	(1 set= 1 no. of each type)	2	SPARES- ISOLATOR : 220KV, MALE AND FEMALE CONTACT	TB8222008116	Set	1	Technical specification shall In line with Section-2/ Annexure-S-3/C-4/8 and Section-1, Chapter-2 and Clause 16.3.
2	Limit switch	(1 set= 1 no. of each type, rating and make)	3	SPARES- ISOLATOR : 220KV, LIMIT SWITCH	TB8222008123	Set	1	
3	Motor with gear assembly & bevel gear assembly complete		4	SPARES- ISOLATOR : 220KV, MOTOR WITH GEAR ASSEMBLY & BEVEL GEAR ASSEMBLY	TB8222008131	Set	1	
4	Auxiliary switch contacts assembly		5	SPARES- ISOLATOR : 220KV, AUXILIARY SWITCH CONTACTS ASSEMBLY	TB8222008144	Set	1	
5	Earthing rod & blade contact side		6	SPARES- ISOLATOR : 220KV, EARTHING ROD & BLADE CONTACT SIDE	TB8222008153	Set	1	
6	Hinge pins and terminal pad		7	SPARES- ISOLATOR : 220KV, HINGE PINS AND TERMINAL PAD	TB8222008164	Set	1	
B Services Items- Main Items								
1	Supervision for Installation, Testing & Commioissioning of 220kV (Voltage class 245KV), 2000A, 3X1 Phase HCB Isolator (Electrically operated mechanically ganged) with provision of remote and local motor control and local manual operation with one earth switch (Manual operated mechanically ganged), complete with operating mechanism boxes, position indicating arrangement and accessories etc. excluding support insulators, structure and terminal connectors.	Supervision for installation, testing & commioissioning of 220kV Isolator with one Earth Switch with its accessories shall be complete in all respects. Any other supervisory service(s) required to complete the work in all respects shall be in bidder's scope.	8	SERVICES- ISOLATOR : 220KV, SUPERVISION OF ERECTION TESTING AND COMMISSIONING INCLUDING ALIGNMENT CHECK OF THREE PHASE, HORIZONTAL CENTRE BREAK (HCB) TYPE ISOLATOR	TB3222006971	Set	2	Technical specification shall In line with Section-2/ Annexure-S-3/C-4/8.
Note:								
The quantities in BOQ may vary up to ±30% in line with quantity variation. However, individual quantities may be deleted or vary up to any extent.								



SL.NO	LEGEND	DESCRIPTION	UNIT	QTY
01		198kV, 10kA, CLASS-III, 1 PHASE SURGE ARRESTER (SA)	NO	6
02		220kV, 8800pF, 1 PHASE CAPACITOR VOLTAGE TRANSFORMER (CVT)	NO	6
03		220KV, 1 PHASE WAVE TRAP, 2000A, 1mH	NO	4
04		220KV, 1 PHASE TARIFF METERING PT	NO	6
05		220KV, 1 PHASE TARIFF METERING CT	NO	6
06		220KV, 2000A, 3X1 PHASE, HCB ISOLATOR (ELECTRICALLY OPERATED MECHANICALLY GANGED) WITH ONE EARTH SWITCH (ELECTRICALLY OPERATED MECHANICALLY GANGED)	SET	2
07		SF6 TO AIR BUSHING	NO	6
08		SF6 TO OIL BUSHING	NO	12
09		220KV GIS BUS DUCT	LOT	1
10		220/34.5kV, 50/65MVA, ONAN/ONAF Ynyn0, 3 PHASE TRANSFORMER	NO	4
11		220KV TOWER	NO	3
12		220KV BEAM	NO	2
13		LLM—LIGHTING CUM LIGHTNING MAST®	NO	1

NOTES

ALL DIMENSIONS ARE IN MM.

G/S BUILDING CUM CONTROL ROOM SIZE AND ARRANGEMENT ARE INDICATIVE ONLY. EXACT SIZE AND ARRANGEMENT SHALL BE SHOWN IN SEPARATE DRAWING FOR G/S BUILDING CUM CONTROL ROOM BUILDING.

EXACT LOCATION OF CONTROL ROOM BUILDING SHALL BE SHOWN IN SEPARATE DRAWING. EXACT LOCATION OF 33KV XLPE CABLE SHALL BE SHOWN IN SEPARATE DRAWING. EXACT DIMENSIONS OF TRENCH LAYING SHALL BE SHOWN IN SEPARATE DRAWING.

EXACT DIMENSIONS OF ALL ITEMS OF EQUIPMENT, RESPECTIVE EQUIPMENT DRAWING SHALL BE REFERRED.

LOCATIONS OF G/S TRANSFORMER & OIL COLLECTION PIT WITH ARE TENTATIVE. EXACT DETAILS SHALL BE UPDATED AFTER FINALIZATION OF GIS & TRANSFORMER DRAWINGS INCLUDING BAY AND PHASE SEQUENCE.

EXACT NIPPS OF JANK IN TRANSFORMER DRAWINGS. LOCATIONS SHALL BE UPDATED AFTER DESIGN OF JANK IN TRANSFORMER DRAWINGS.

THE LOCATION OF DC TOWER SHALL BE AS PER DRAWING, HOWEVER, LINE & PHASE SEQUENCE IS FINALIZED BASED ON FINAL CONFIRMATION FROM CUSTOMER (OCL).

G/S BAY SEQUENCE IS TENTATIVE AND MAY CHANGE IN LINE WITH THE TECHNICAL REQUIREMENTS INCLUDING SERVICE CONTINUITY.

CONNECTIONS OF NEW AND EXISTING CABLES SHALL BE PROVIDED FOR BOTH INCOMING LINES (C/T) VI PARAMETERS SHALL BE DETAILED IN SEPARATE DRAWING (KEY PROTECTION SINGLE LINE DIAGRAM).

LIGHTNING PROTECTION SHALL BE PROVIDED WITH LHM/SHIELD WIRE, OVER THE CABLES FOR LHM ARE TENTATIVE AND MAY SUBJECT TO CHANGE AS PER DSR CALCULATIONS.

THE REQUIRED CLEARANCES ARE AS PER CLEARANCE TABLE ABOVE AND AS PER REQUIREMENTS OF IE BUREAU & OTHER (H/O) SHALL BE PROVIDED FOR BOTH INCOMING BUS DUCTS FROM BUILDING ARE IN LINE WITH CRIP BUILDINGS.

SWITCHBOARD LIGHTING FIXTURES SHALL BE PROVIDED ON LHM/TOWER/BUILDING.

GENERAL TOWER & GANTRY SHALL BE DESIGNED AS IN LINE WITH H/VHDL DESIGN.

CONDUCTOR & SHIELD WIRE FROM DEAD END TOWER SHALL BE TERMINATED AT THE DEAD END TOWER. THE DEAD END TOWER SHALL BE TERMINATED AT THE ANCHORING POINT SHALL BE PROVIDED BY BHEL.

PEDESTAL OF TOWER AND EQUIPMENT SHALL BE 400MM ABOVE FROM FGL.

GENERAL TOWER & GANTRY CUM CONTROL ROOM BUILDING SHALL BE 600MM FROM FGL.

THE FINISHED FLOOR LEVEL (FFL) WITH A TOLERANCE OF (+/-) 100MM SHALL BE MAINTAINED AS EQUAL TO FFL OF NEAREST SURROUNDING CESS-28.

REFERENCE DRAWING (S) / DOCUMENT(S) -					
SL. NO.	DRAWING / DOCUMENT NO.	DRAWING TITLE			
2.	TENDER DRAWING NO-416A	INDICATIVE COLD OF 220KV SWITCH YARD			
	TR-41-518V-SW-00	220/231KV SWITCHYARD- SINGLE LINE DIAGRAM			
PROJECT:	LSTK BQ FOR ISBL WORK OF 220KV GRID POWER IMPROVEMENT AT PANIPAT REFINERY LOA NO. RPRC182491/26268965 DTD.24.01.2020				
OWNER:					
	INDIAN OIL CORPORATION LIMITED				
	TATA CONSULTING ENGINEERS LIMITED				
					
DEPT.	UNIT/CNTR.	SCALE	WEIGHT (KG)	NO. OF DESIG. DRG.	NO. OF ITEMS
DRG. CODE	C/N/A/F	 N.T.S.	N.A.	N.A.	N.A.
TITLE	DRAWING / DOCUMENT NO.				REV.
220/33KV SWITCHYARD – LAYOUT PLAN & SECTION	TR-41-316-011				03
SHT. NO			01	NO. OF SHT.	
				01	

Bharat Heavy Electricals Limited

Project: LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery

Technical Specification: 220kV Isolator with accessories

Doc No. TB-411-316-006 Rev 00

SECTION 2:

EQUIPMENT SPECIFICATION UNDER SCOPE OF SUPPLIES

1. Technical Specification for 220kV Isolator cum Earth Switch
2. Technical Specification for 220kV Isolator cum Earth Switch/ HVPNL- For reference purpose

Technical Specification for 220kV Isolator cum Earth Switch

Technical Specification

For

245/145/72.5/36 kV ISOLATORS &
LINE - CUM - EARTH SWITCHES



1.0 SCOPE:

This specification provides for design, engineering, manufacture, stage testing, inspection and testing before dispatch, packing, forwarding, delivery at site, installation, testing and commissioning of 245 kV class Isolators and line-cum-earth switch complete with all fittings, accessories and associated auxiliary equipment mandatory spares which are required for efficient and trouble free operation as specified hereunder.

It is not the intent to specify completely herein all details of the design and construction of equipments. However, 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 up to the Bidder's guarantee acceptable to the IOCL PR. The equipment offered shall be complete with all components necessary for its effective and trouble free operation along with associated equipment, interlocks, protection schemes etc., Such components shall be deemed to be within the scope of supply, irrespective of whether those are specially brought out in this specification and/or commercially ordered or not. All similar parts particularly movable ones shall be interchangeable.

2.0 STANDARDS:

Unless otherwise specified elsewhere in this specification, the rating as well as performance and test of the isolators shall conform to the latest revisions and amendments of the following standards available at the time of placement of order.

Sl. No	Standard No.	Title
1.	IS:9921	Alternating current isolators (dis-connectors) and earthing switches.
2.	IEC:129	-do-
3.	IS:2544	Insulators.
4.	IS:2147	Degree of protection provided by enclosure.
5.	IS:4691	-do-
6.	IS:325	Three phase induction motors.
7.	IS:4722	Rotating electrical machines.
8.	IS:262	Recommended practice for hot dip galvanising of iron & steel.
9.	IS:4759	Hot dip galvanisation coating on structural steel.
10.	IS:2633	Method of testing weight, thickness and uniformity
11.	IS:1573	Electroplated coating of zinc on iron and steel.
12.	IS:6735	Spring washers.
13.	IS:2016	Plain washers.
14.	-	Indian Electricity Rules, 1956

Equipment meeting with the requirements of other authoritative National or International Standards, which ensure equal or better performance than the standards mentioned above, shall also be considered.

3.0 SERVICE CONDITIONS:

The service condition shall be Annex-S-2/C-1/8.

Note: Moderately hot and tropical climate conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Smoke is also present in the atmosphere. Heavy lightening also occurs during June to October.

3.1 AUXILIARY POWER SUPPLY:

The equipment offered under this specification shall be suitable for the following auxiliary power supplies.

- a) 415 V, 3 phase, 4 wire, 50 Hz, neutral grounded AC supply.
- b) AC control and protective devices, 240 V, single phase, 2 wire, 50 HZ, lighting fixtures, space heaters neutral grounded AC supply.
- c) DC alarm, control and protective devices 220 V, DC 2-wire

Each of the foregoing supplies shall be made available by the IOCL PR at the terminal point for each equipment for operation of accessories and auxiliary equipment. Bidder's scope shall include supply of interconnecting cables, terminal boxes, etc., The above supply voltages may vary as below and all devices shall be suitable for continuous operation over entire range of voltages.

- i) AC supply - voltage + 10% & -15% frequency $\pm 5\%$
- ii) DC supply - 15% to + 10%

4.0 PRINCIPAL PARAMETERS:

The equipment covered in this specification shall meet the technical requirements listed below:

Sl.No	Technical Parameter	36kV	72.5kV	145 kV	245 kV		
1.	Rated Frequency (Hz)		----- 50 -----				
2.	System Neutral Earthing		----- Solidly Earthed -----				
3.	No. of Phases (Poles)		----- 3 -----				
4.	Temperature Rise		----- As per relevant IS/IEC ---				
5.	Safe Duration of overload						
a)	150% of rated current		----- 5 minutes -----				
b)	120% of rated current		----- 30 minutes -----				
6.	Rated voltage /Highest system voltage (kV rms)	33/36	33/36	33/36	66/72.5	132/145	220/245
7.	Type of disconnect (AB)						
8.	Rated normal current (Amp rms)	DB 2000	DB 1250	DB 630	DB 1250/1600	DB 1000	SB 2000
9.	Rated short time withstand current (kA rms) of MS & EB for 1 sec duration	26.3	26.3	26.3	31.5	31.5	50
10.	Rated dynamic withstand current (kA)	65.75	65.75	65.75	78.75	78.75	125
11.	Rated short circuit making current of EB (kA peak)	65.75	65.75	65.75	78.75	78.75	125
12.	Basic insulation level: I. 1.2/50 micro-sec lightning impulse withstand voltage (+ ve or - ve polarity)						

b) Across isolating distance One terminal subjected to lightning impulse (kVp) and opposite terminal subjected to power frequency (kV rms) voltage (as per IS)

195

375

750

1200

II. Rated 1 minute power frequency withstand voltage (kV rms)

a) Across isolating distance	100	160	315	530
b) To earth and between poles	70	140	275	460
13. Min. creepage distance of support and rotating insulator (mm)	900	1813	3625	6125
14. Phase to Phase spacing for installation (mm)	1220	1830	3000	4000
15. Minimum clearances:				
a) Phase to earth	320	630	1300	2400
b) Phase to Phase	350	1300	1600	2700

(Across the same pole)

(Bidders offering lesser clearance must substantiate the same with adequate information on impulse withstand capability of the equipment, However the height of Post Insulator should not be less than 2300mm in case of 245kV, 1500mm in case of 145kV, 770mm in case of 72.5kV and 508 mm in case of 36kV Isolator).

16. Height of center line of terminal pad above ground level (mm)	2800	3000	4000	5000
17. Rating of auxiliary contacts	10 A at 220V DC with breaking capacity of 2 A DC with time constant not less than 20 ms.			
18. Seismic acceleration	 0.3 g horizontal.....			
19. Operating time	----- 12 sec or less -----			
20. Rated mechanical terminal load	As per relevant standards			
21. Rated magnetizing/ capacitive current make/break (Amps/rms)	0.7	0.7	0.7	0.7
22. RIV at 1 MHz & 1.1 X rated phase to earth voltage (micro volts)	—	—	—	1000

5.0 GENERAL TECHNICAL REQUIREMENTS:

5.1 The specification provided below are for reference purpose. The complete design, engineering and supply of the equipments shall be in line with HVPNL guidelines, applicable standards and as per tender requirements and shall be responsibility of LSTK contractors including all liasoning requirements with HVPNL authorities

5.2 The 245 kV single break isolators shall be a set of three individual poles with one vertical break earthing blade per pole suitable for fixing on either side of the poles or without any earthing blade.

5.3 Complete isolators with all the necessary items for successful operation shall be supplied including but not limited to the following:

5.3.1 Isolators assembled with isolator blades (main and earth), complete base frame, linkages, operating mechanism complete etc.

5.3.2 The three poles of the 245 kV Isolators covered by this specification will be gang operated with one central cabinet for the required electrical devices mounted therein.

5.4 Material of Earthing blades and contacts shall be same as those of main blades and contacts. Cross sectional area of Earthing blades and contacts shall not be less than 50% of cross sectional area of main blades and contacts. The Earthing blades shall have the same short time current rating (thermal and dynamic) as that of main blades. The current density in the current carrying parts of the Isolator shall in no case exceeds the following values:

For Copper: 2A/sq.mm
For Aluminium : 1A/sq.mm

5.5 Support insulators for all types of isolators shall be of solid core type

5.5.1 The insulator shall be preferably silicon polymer rubber/composite type. In case of non-availability of such design porcelain insulators made of homogeneous and vitreous porcelain of high mechanical and di-electric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical

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Annexure-7 Glazing of the porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water. The porcelain shall be free from lamination and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture.

The porcelain and metal parts shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create undue internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings. The insulator shall be suitable for waterwashing by rain or artificial means in service condition. Profile of the insulator shall also conform to IEC-815. Insulator shall have a minimum cantilever strength of 6 KN.

5.5.2 Cap to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanised. The cap shall have four numbers of tapped holes spaced on a pitch circle diameter of 127 mm for 245 kV, 145 kV & 72.5kV Isolators & Line-cum-Earth Switches and 76 mm for 36 kV Isolators & Line- cum-Earth Switches. The holes shall be suitable for bolts with threads having anticorrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona.

5.5.3 The casting shall be free from blow holes, cracks and such other defects.

5.5.4 All the ferrous metal parts shall be hot dip galvanised smoothly as per IS: 3638 (as amended up to date), IS: 2633 or any other equivalent authoritative standard. The material shall be galvanised only after shop operations have been completed upon it. The metal parts before galvanising should be thoroughly cleaned of any paint, grease, rust, scales or alkali or any foreign deposit which are likely to come in the way of galvanising process. The coating on the metal parts shall withstand minimum four one minute dips in copper sulphate solution as per IEC-168.

5.5.5 The insulator unit shall be assembled in a suitable jig to ensure correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fittings shall be parallel and at right angles to the axis of the insulator and the corresponding holes in the top and the bottom metal fittings shall be in a vertical plane containing the axis of the insulator.

5.5.6 It shall be the sole responsibility of the Contractor to carry out thorough inspection and quality checks on the insulators at the insulator Contractor's works, before offering the insulators for IOCL PR's inspection.

5.6 OPERATING MECHANISM:

5.6.1 a) Each 245 kV, 145 kV, 72.5kV & 36 kV isolators shall be remote controlled from the control room. Provision shall be made for local motor control also. Operating mechanism shall also be equipped with local manual operating device intended for emergency operation when motor operating mechanism becomes inoperative. Additional electromagnetic type interlock shall be provided so as to prevent the operation of isolator manually or electrically when the corresponding circuit breaker is ON.

b) Manual operating mechanism through crank and reduction gear shall be provided for the earth switch which too will be gang operated. The operation of earth switch which too will be gang operated. The operation of earth switch shall also be electrically inter-locked by providing a 63.5V rated contractor and 220 kV DC rated electro magnet. The contractor will be fed from single phase (132kV/sqrt3/110 kV/sqrt3) CVT/ PT provided at the entry of a transmission line in the sub-station. The normally closed contact of said contactor will form part of series chain with other contacts of line isolator/ earth switch to prevent closing of earth switch when the contactor is in picked up position (which means that when the concerned transmission line is live).

5.6.2 The operating mechanism shall provide quick, simple and effective operation. The motor operated type operating mechanism shall be suitable for remote operation of all three poles simultaneously as well as local manual operation through crank and reduction gear. The design of manual operation shall be such that one man shall be able to operate the isolator without undue effort with about 20 (twenty) revolutions of the crank.

The operating mechanism shall be suitable to hold the dis-connector in CLOSE OR OPEN position and prevent operation by gravity, wind, short circuit forces, seismic forces, vibration, shock, accidental touching etc.

5.6.3 Limit switches for control shall be fitted on the isolator shaft within the cabinet to sense the open and close positions of the isolators and earth switches.

5.6.4 It shall not be possible, after final adjustment has been made, for any part of the mechanism to be displaced at any point in the travel sufficient enough to cause improper functioning of the isolator when the isolator is opened or closed at any speed. All holes in cranks, linkage etc., having moving pins, shall be drilled to fit accurately so as to maintain the minimum amount of slack and lost-motion in the entire mechanism.

5.6.5 A "local/remote" selector switch and a set of open/close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons. The remote push buttons shall be arranged by the IOCL PR.

5.6.6 Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.

5.6.7 Each motor operated mechanism shall be subjected to blocked rotor test.

5.7 CONTROL CABINET:

The control cabinet of the operating mechanism shall be made out of 12 SWG(2.64 mm thick) sheet steel duly hot dip galvanised or 10 mm thick aluminium plate or casting. Hinged door shall be provided with pad locking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gaskets shall be provided to ensure degree of protection of at least IP:55 as per IS:2147. The cabinet shall be suitable for mounting on support structure with adjustment for vertical alignment. Details of these arrangements shall be furnished along with the tender.

5.8 MOTOR:

The motor shall be suitable for three phase, 415 V, A.C. with variations as specified in this specification. It shall be totally enclosed type if mounted outside the control cabinet. The motor shall withstand without damage stalled torque for at least three times the duration of tripping device. The motor shall, in all other respects, conform to the requirement of IS-325.

5.9 GEAR:

The disconnector may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gears shall be made out of aluminium bronze or any other better material and lubricated for life with graphite or better quality non draining and non hardening type grease. Wherever necessary automatic relieving mechanism shall be provided. Complete details of components, material, grade, self lubricating arrangement, grade of lubricants, details of jig, fixtures and devices used for quality check, shall be furnished by the Bidder during detailed engineering stage.

5.10 GLAND PLATE AND GLANDS:

A removable gland plate with double compression type brass cable glands shall be provided with each operating mechanism for terminating all cables. Exact quantity of glands to be provided, shall be intimated to the Contractor.

5.11 CONTROL CIRCUITS:

Control device shall store OPEN and CLOSE command even if the corresponding switch is momentarily pressed until the command is fully executed and the components get de-energised after execution. Failure of auxiliary power supply or loose contact shall not cause faulty operation.

5.12 SUPPORTING STRUCTURE:

The Isolators and isolator – cum – earth switches shall be mounted rigidly in an upright position on their own supporting structure and not on the line or bus bar structure. The

Supporting structures will be arranged by the IOCL PR. The isolator and isolator – cum – earth switch will be suitable for mounting on IOCL PR's standard supporting structure HTD/ST-170, HTD/ST-90R3, HTD/ST-87F & HTD/ST-110 for 245 kV, 145kV, 72.5kV & 36 kV respectively. One print of detailed structure drawing is enclosed with the specification which may be perused & its suitability for the offered equipment be confirmed by the bidders. Any additional member of structure required for mounting the MOM box of isolators as well as line-cum-earth switch will be in scope of bidder's supply.

5.13 LIMIT SWITCH:

Limit switches shall be of reputed make. Auxiliary switch shall not be used as limit switch. Details of make, rating and type of limit switch shall be furnished during detailed engineering stage.

5.14 OVERLOAD AND SINGLE PHASING PREVENTER:

Suitable relay/device shall be provided to prevent overloading of the motor. Single phase preventer shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished during detailed engineering stage.

5.15 CONTACTOR:

The contractor shall be suitable for making and breaking stalled motor current. The contractor coil shall be suitable for 220 V D.C. Two numbers of contractors shall be provided for each motor for OPEN and CLOSE operation respectively. Make, type, rating and details of the contractor shall be furnished during detailed engineering stage.

5.16 AUXILIARY SWITCH:

5.16.1 Each operating mechanism box shall be equipped with ten numbers of NC and ten numbers of NO auxiliary switches exclusively for IOCL PR's use. In addition, two pairs of make – before – break NO/NC contacts shall be provided in the operating mechanism box. 3 pairs of NC and 3 pairs of NO contacts shall be provided in the auxiliary switch box for earth mechanism.

5.16.2 The auxiliary switches and auxiliary circuits shall be capable of carrying the current of atleast 10 Amps continuously.

5.16.3 Auxiliary switches shall be capable of breaking atleast 2A in a 220 V D.C. circuit with a time constant of not less than 20 milli seconds.

5.16.4 Quick Make and Break (QMB) type auxiliary switch shall have snap action built-in within the switch.

5.16.5 The auxiliary switches shall be actuated by a cam or similar arrangement directly mounted on the isolator and shall be without any intermediate levels, linkages etc., to ensure fool proof operation.

5.17 SPACE HEATERS:

Space heater, thermostatically controlled, suitable for single phase 240 V AC supply shall be provided for motor operated operating mechanism to prevent condensation. A switch and fuse/link shall be provided in the operating mechanism.

5.18 TERMINAL BLOCK AND WIRING:

Each operating mechanism shall be provided with 1100 V grade stud type terminal block having washers, nuts & check nuts. All auxiliary switches, interlocks and other terminals shall be wired up to terminal block. The terminal block shall have at least 20% extra terminals. All wiring shall be carried out with 1100 V grade insulated 2.5 mm² copper wires.

5.19 DUTY REQUIREMENTS:

5.19.1 Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

5.19.2 The earth switches, wherever provided, shall be constructionally interlocked so that the earth switch can be operated only when the isolator is open and not vice-versa. The constructional interlocks shall be built-in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.

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5.19.3 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent the electrical and manual operation unless the associated another interlocking conditions are met. All these interlocks shall be of fail safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range stipulated in this volume.

5.19.4 The isolator shall be capable of making/breaking normal currents when no voltage occurs across the terminals of each pole of isolator on account of make/break operation.

5.19.5 The isolator shall be capable of making/ breaking magnetising current of 0.7 A at 0.15 power factor and capacitive current of 0.7 A at 0.15 power factor.

5.19.6 Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamic forces on the attached conductor without impairing reliability or current carrying capacity.

5.20 INTERIOR ILLUMINATION:

A switch, HRC fuse and holder suitable for a 240 V lamp shall be provided in one of the motor operated mechanism box of isolator and manually operated mechanism box or earth switch.

5.21 POWER SOCKET:

A single phase 240 V 15A power socket and switch shall be provided in the motor operated operation mechanisms of the Isolators poles.

5.22 CONTROL AND AUXILIARY SUPPLY:

A three phase switch with HRC fuses for phases and link for neutral shall be provided for power supply and a 2 way switch with HRC fuses shall be provided for control supply in the motor operated mechanisms of the Isolators.

5.23 ACCESSORIES:

The accessories to be provided on the isolator shall include but not limited to the following:

5.23.1 POSITION INDICATOR:

A position indicator to show whether the isolator is in ON or OFF position.

5.23.2 COUNTER BALANCE SPRINGS:

Counter balance springs, cushions etc., shall be provided to prevent impact at the end of travel both on opening and closing of the isolator. The springs shall be made of durable and non-rusting type alloy.

5.24 NAME PLATES:

Isolator and Earthing switches and their operating devices shall be provided with a name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information duly engraved or punched on it.

5.24.1 Isolator Base:

Name of utility (i.e. IOCL PR):
 Name of Manufacturer:
 P.O. No.:
 Type Designation:
 Manufacturer's serial number:
 Rated voltage:
 Rated normal current:
 Rated short time current (rms):
 and duration:
 Rated short time peak current (kAp):
 Weight:

5.24.2 Earthing Switch:

Name of utility (i.e. IOCL PR):
 Name of Manufacturer:
 P.O. No.:
 Type Designation:
 Manufacturer's serial number:
 Rated voltage:
 Rated short time current (rms):
 and duration:
 Rated short time peak current (kAp):
 Weight:

5.24.3 Operating Device:

Name of utility (i.e. IOCL PR):
 Name of Manufacturer:
 P.O. No.:
 Type Designation:
 Reduction gear ratio:
 AC Motor:
 I.) Rated auxiliary voltage:
 II.) Starting current:
 III.) Designation of AC motor as per IS:4722:
 IV.) Starting torque at 80% of supply voltage:
 V.) Over travel in degrees after cutting off supply :

Total operating time in seconds
 I.) CLOSE operation - electrical:
 II.) OPEN Operation - electrical:
 -do-- manual:

Space Heater:
 I.) Rated voltage and power Auxiliary contacts
 II.) Rated current (Amps):
 III.) Time constant (ms):
 IV.) No. of contacts used (NC & NO):
 No. of free contacts (NC & NO):
 Terminal blocks and wiring
 I.) Rated current:
 II.) Voltage grade and type:

5.25 PADLOCKING DEVICE:

All Isolator and Earthing switches shall be provided with padlocking device to permit locking of the isolator and Earthing switch in both fully open and fully closed positions. Power driven isolator and Earthing switch shall be arranged to be interlocked electrically also.

5.26 SIGNALLING:

5.26.1 Signalling of the close position shall not take place unless the movable contact has set in a position in which the rated normal current, the peak withstand current and the short time withstand current can be carried safely.

5.26.2 Signalling of the open position shall not take place unless the movable contact has reached the position such that the clearance between the moveable and fixed contacts is at least 80% of the isolating distance.

5.27 EARTHING:

5.27.1 Flexible copper connections shall be provided between rotating earth blades and the frame which shall have a cross-section of atleast 50 mm² and shall be tinned or suitably treated against corrosion.

5.27.2 The frame of each disconnecter and Earthing switch shall be provided with two reliable Earthing terminals for connection to the IOCL PR's Earthing conductor/flat and also

clamping screws suitable for carrying specified short time current. Flexible connections shall be provided for connecting operating handle to the Earthing flat. The diameter of clamping screw shall be atleast 12 mm. The connecting point shall be marked with earth symbol.

5.28

DESIGN AND CONSTRUCTION:

5.28.1

Full particulars of design, manufacture, jig template and quality control devices developed for manufacture of the equipment offered in respect of but not limited to the following, shall be furnished with drawings and descriptions alongwith the tender.

- i.) Contacts, material, current density etc.,
 - ii.) Design of contact pressure.
 - iii.) Contact support and fixing arrangement on isolators.
 - iv.) Turn and twist mechanism, clamps, locks etc.,
 - v.) Bearings, housing of bearings, bushes etc.,
 - vi.) Balancing of heights,
 - vii.) Coupling pipes, joints, connection adjustments.
 - viii.) Base plates.
 - ix.) Down pipe guides and joints.
 - x.) Brass bushes and bearings at various joints.
 - xi.) Operating mechanism, type of gear motor, limit switch, aux. switch, timers, size and thickness of box, degree of protection, gland plate, gland etc.,
 - xii.) Nuts, bolts and fasteners.
 - xiii.) Interlocking devices.
- Offers without the above information or with incomplete information shall not be considered.

5.28.2

FASTENERS:

Nuts, bolts and washers of 5/8" and higher size shall be hot dip galvanised. The bolts used on tapped holes of insulator cap shall be galvanised by centrifuge process to avoid excess deposition of zinc on threads. Nuts, bolts and washers of less than 5/8" size shall be of stainless steel when used on live parts and nickel plated brass in other parts.

5.28.3

CONTACTS:

Contacts shall be made out of hard drawn electrolytic grade copper. Arcing contacts wherever provided shall close first and open last. The contacts surface shall be silver plated. Fabrication of contact shall be made with suitable jig to avoid deviations during production. Details of size and shape of contacts, springs, back plate, fixing arrangements, design of contact pressure, life of contacts, limit of temperature rise etc., shall be furnished along with the tender. The moving contacts of tubular section shall be so dimensioned as to carry the rated current.

5.28.4

MOUNTING OF CONTACTS:

The contacts shall rest on a brass block and with initial tension. Suitable device shall be provided to prevent dashing. Fabrication, welding etc., shall be done in suitable jig to avoid deviations during production.

5.28.5

TERMINAL PAD:

The terminal pad shall be suitable for connection to aluminium terminal connector through bimetallic plate wherever necessary. It shall be made out of electrolytic copper heavily silver plated. Dimensions of the terminal pad shall be furnished with the tender.

5.28.6

MOVING BLADE:

Moving blade shall be made out of hard drawn Electrolytic grade copper for 145/72.5/36 kV Isolators and hard drawn Electrolytic grade copper/aluminium for 245kV Isolators. Contact surface of moving blade shall be heavily silver plated. The surface shall be wiped during closing and opening operations to remove any film, oxide coating etc., Wiping action shall not cause scouring or abrasion of surfaces.

5.28.7

The rotating insulator shall be mounted on housing with bearing housing. The housing shall be made of gravity die-cast aluminium with smooth surfaces suitably machined for seating the bearings. Two numbers of bearings with adequate shaft diameter and

distance between the bearings shall be provided to avoid wobbling during operations. The bearings shall be of atleast 50 mm shaft diameter. The bearings shall be of reputed make e.g. SKF, HMT, NBC, TATA, and lubricated for life. All other friction locations shall be provided with bearings, bushes, joints, springs etc., shall be so designed that no lubrication shall be required during service. Complete details of bearings, bushes, housing, greasing etc., shall be furnished with the tender. The Earthing switch shaft shall also be provided with necessary bearings.

- 5.28.8** Tandem pipes shall be of adequately dimensioned for the given duty and shall be class B. Base plate of insulators for connection of tandem pipe shall be made out of one piece 10 mm thick MS plate. Bolt and shackle device shall be used to connect tandem pipe to the base plate.
- 5.28.9** The operating pipe too shall be of class B and adequately dimensioned for the given duty. The pipe shall be terminated into a suitable swivel or universal type joint between the insulator bottom bearing and the operating mechanism to take care of marginal angular misalignment at site.
- 5.28.10** Each phase of isolator shall be provided with a rigid base fabricated from steel sections. The base shall be suitable for mounting on support structures. Fabrication, welding etc., shall be done by suitable jig, power press and templates to avoid deviations during production. Details of dimensions sections, jig templates and device used for production of the base shall be furnished with the tender.

5.29**TERMINAL CONNECTORS:****5.29.1**

All Isolators shall be provided with universal type terminal connectors suitable for Single ACSR Zebra Conductor/Twin ACSR Zebra Conductor (AAC Tarantula for 220kV S/Stns). The unit rate for types of terminal connector shall be quoted in the relevant schedule.

5.29.2

The terminal connectors shall meet the following requirements:

- i.) Terminal connectors shall be manufactured and tested as per IS: 5561.
- ii.) All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
- iii.) No part of a clamp shall be less than 10 mm thick.
- iv.) All ferrous parts shall be hot dip galvanised conforming to IS: 2629.
- v.) For bimetallic connectors, copper alloy liner of minimum thickness of 2 mm shall be cast integral with aluminium body.
- vi.) Flexible connectors shall be made from tinned copper / aluminium sheets.
- vii.) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- viii.) Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS: 5561.
- viii.) Wherever necessary bimetallic strip of standard quality shall be used to avoid galvanic corrosion.

5.29.3**ASSEMBLY:**

The disconnecter shall be fully assembled at the works of the Contractor and operations shall be carried out on it to ascertain that all parts fit correctly and function satisfactorily.

5.30**PAINTING, GALVANISING AND CLIMATE PROOFING:****5.30.1**

All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by recognised phosphating (e.g. Seven tank phosphating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable staving and air drying before final painting. Colour of the final paints shall be of shade no. 631 of IS: 5 i.e. epoxy light grey. The finally painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface.

5.30.2

All components shall be given adequate treatment of climate proofing as per IS: 3202 so as to withstand corrosive and severe service conditions.

5.30.3

All metal parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc., shall be hot dip galvanised and shall be capable to prevent corrosion in view of the severe climatic conditions.

5.30.4

Complete details of painting, galvanising and climate proofing of the equipment shall be furnished in the tender.

6.0**TESTS:****6.1****TYPE TESTS:**

The equipment offered should be type tested. Test reports should not more than seven years old reckoned from date of bid opening in respect of all the tests carried out in accredited laboratories (based on ISO/IEC) by a reputed accredited body or witnessed by HVPN or another electric power utility and be submitted by the successful bidder to IOCL PR for approval as schedule given in Bar Chart.

- i.) Insulation level test
- ii.) Temperature rise test
- iii.) Rated peak withstand current and rated short time withstand current test.
- iv.) Short circuit making capacity test of earthing switch.
- v.) Operation and mechanical endurance test.

6.2**ROUTINE TESTS:**

As per quality assurance program (QAP).

6.3**ACCEPTANCE TESTS:**

The following acceptance tests as stipulated in the relevant IS: 9921 (PART-IV) 1985 shall be carried out by the Supplier in presence of IOCL PR representative, unless dispensed with in writing by the IOCL PR.

- i.) Power Frequency withstand voltage dry test of main circuit.
- ii.) Voltage test on control auxiliary circuits.
- iii.) Measurement of resistance of main circuit.
- iv.) Mechanical operating test.

7.0**INSPECTION:**

- i.) The TPI agency authorized by IOCL PR shall have access at all times to the works and all other places of manufacture, where the dis-connectors, earth switches and associated equipment are being manufactured and the Contractor shall provide all facilities without extra cost for unrestricted inspection of the works, raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.
 - ii.) The Contractor shall keep the IOCL PR informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection
 - iii.) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
- 

8.0 DRAWINGS, DATA & MANUALS:
Annexure-7P

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Sr No	Description with bids	With Bids	Post order		Final documents with equipments	
			For review	For records	soft copy	Prints
1	Schedule of Vendor Documents			x		
2	Dimensional / Assembly Drawings		x			
	a. General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector	x	x		x	x
	b. Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides.	x	x	x	x	x
	c. Earth Mat Design		x	x		
	d. Schematic drawing along with detailed write-up.		x		x	x
3	Electrical Wiring Drawings					
	a. Wiring Diagram and Terminal Details		x	x	x	x
	b. Inter-panel Wiring Diagram		x	x	x	x
4	Bill Of Material		x	x		x
5	Calculations		x			x
6	QA plan of Vendor		x			x
7	Inspection Plan and testing procedure (For review by inspection)		x			x
8	Test Records			x		x
9	Type Test Certificate (For Panel ,Breaker & Bus ducts)	x		x		x
10	List of Commissioning spares	x				
11	List of Maintenance Spares	x				x
12	List Of special Tools & Tackles	x				x
13	Data Book/ Manual					
	a. Installation manual			x		x
	b. Operating/Maintenance manual					
	c. Catalogues/ Brochures			x		x
14	Equipment storage procedure at site including environmental guide for handling SF6 gas & decommissioning.		x		x	x

- Drawings, Data and Manuals shall be submitted in triplicate to IOCL for approval during engineering and in quantities and procedures as specified in General Conditions on Contract and/or elsewhere in this specification for approval and subsequent distribution after the issue of Letter of Intent.
- The bidder shall note that the approval of drawings & documents by the Owner does not relieve him of his contractual obligation.
- The bidder may note that the drawings, data and manuals listed herein are minimum required only. The bidder shall ensure that all other necessary write-up, curves, etc require to fully describe the equipment are to be submitted with the bid.
- All drawings shall be prepared by using AutoCAD and documents shall be generated using Electronic version. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and documents shall be submitted in CD in AutoCAD 2010 and MS office format as applicable for Owner's future reference. Also AutoCAD version of Main GA drawings is to be submitted for Owner's layout finalization.



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LIST OF SPECIAL TESTS TO BE CARRIED OUT

Sl. No.	Name of the Test	Standard to which it Confirms
1.	Tests on insulators	IS:2544/IEC:168
2.	Tests on terminal connectors	IS:5561
3.	Tests on galvanised components	IS:2633



GUARANTEED TECHNICAL PARTICULARS OF ISOLATORS & L&E SWITCHES

- | Sr. No | Description |
|--------|--|
| 1. | Type/Installation |
| 2. | Manufacturer's Name & Country of Manufacture |
| 3. | Standards according to which the Isolators are Manufactured |
| 4. | Maximum design voltage at which the Isolator can operate (kV) |
| 5. | Frequency (Hz) |
| 6. | Rated Voltage (kV) |
| 7. | Maximum current that can be safely interrupted by the Isolator |
| | i. Inductive (A X % of PF) |
| | ii. Capacitive (A X % of PF) |
| 8. | Continuous current rating
Nominal (Amps.)
Under the conditions (Amps.) |
| 9. | Rate short time current (kvp) |
| | i. For 3 seconds (kA rms) |
| | ii. For 1 seconds (KA rms) |
| | iii. Rate peak short time current (kvp) |
| 10. | Max. Temp. rise of current carrying parts when carrying rated current continuously (deg.C) |
| 11. | Insulation levels |
| | i. Impulse withstand voltage (kV Peak) |
| | Phase to earth |
| | Isolating distance |
| | ii. Power frequency withstand voltage (kV rms) |
| 12. | Phase to earth |
| 13. | Isolating distance |
| | Minimum creepage distance of support & rotating insulators |
| | Minimum clearance in air |
| | i. Between Poles (mm) |
| | ii. Between live parts and earth (mm) |
| | iii. Between live parts when switch is open |
| 14. | a) On the same pole (mm) |
| | b) Between adjacent poles (mm) |
| | Current density at the minimum cross-section of |
| | i) Moving blade (Amps/Sq.mm) |
| | ii) Terminal Pad |
| 15. | iii) Contacts |
| | iv) Terminal connector |
| | Design and construction |
| | i. No. of Insulators as per pole |
| | ii. No. of Breakers per pole |
| | iii. Type of closing/operating mechanism (Horizontal/Vertical break straight etc.) |
| | iv. Contacts |
| | a) Material and Grade |
| | b) Cross sectional area in Sq.mm |
| | v. Moving Blades |

Sr.
No

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Description

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- a) Material and Grade
- b) Cross sectional area
- vi. Contract support
- a) Material and size of Channel/Block
- b) Material and size of plate
- vii. Turn and Twist mechanism
- a) Material and size of clamps
- b) Material and size of springs
- c) Whether springs are encased
- viii. Bearings
- a) Material and size of housing
- b) No. of bearings, location and size
- ix. Type of interlock
- x. Down pipe size and class
- xi. Type of universal/swivel joint
- a) Between bearing and down pipe
- b) Between down pipe and operating mechanism
- xii. Insulators make
- a) Type
- b) No. of units per insulator
- c) Rating of insulators (kV)
- d) Height of each insulator stack (mm)
- e) Bolt circle diameter (mm)
- f) Power frequency dry flashover voltage (kV) rms
- g) Power frequency wet flashover voltage (kV) rms
- h) Impulse flashover voltage (positive wave) (kV)peak
- i) Impulse withstand voltage (kV)
- j) Power frequency puncture voltage (kV) rms
- k) Creepage distance
- Total (mm)
- Protected (mm)
- l) Visual discharge voltage level (kV) rms
- m) Compressive strength
- n) Tensile strength
- o) Cantilever strength upright
- xiii. Terminal connectors
- a) Clamp body
- Alloy compositions
- Area at min. cros-section
- b) Temperature ruse when carrying rated current at 50°C ambient (deg.C)
- c) Type of washers used
- d) Bolts and nuts size Alloy composition
- e) Weight of each type of clamps (kg.)

HARYANA VIDYUT PRASARAN NIGAM LTD.

SPECIFICATION NO. HGD-S-98/DGM-43/R-3

TECHNICAL SPECIFICATION

FOR

**245/145/72.5/36 KV ISOLATOR AND LINE-CUM-
EARTHSWITCH**

**CHIEF ENGINEER/MM ,
HVPNL, SHAKTI BHAWAN,
SECTOR-6, PANCHKULA**

AUGUST-2018

FOR 245/145/72.5/36 kV ISOLATORS & LINE - CUM - EARTH SWITCHES

1.0 SCOPE:

This specification provides for design, engineering, manufacture, stage testing, inspection and testing before dispatch, packing, forwarding and delivery at site of 245 kV, 145 kV 72.5 kV and 36 kV class Isolators and line-cum-earth switch complete with all fittings, accessories and associated auxiliary equipment mandatory spares which are required for efficient and trouble free operation as specified hereunder.

It is not the intent to specify completely herein all details of the design and construction of equipments. However, 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 up to the Bidder's guarantee acceptable to the HVPNL. The equipment offered shall be complete with all components necessary for its effective and trouble free operation along with associated equipment, interlocks, protection schemes etc., Such components shall be deemed to be within the scope of supply, irrespective of whether those are specially brought out in this specification and/or commercially ordered or not. All similar parts particularly movable ones shall be interchangeable.

2.0 STANDARDS:

Unless otherwise specified elsewhere in this specification, the rating as well as performance and testing of the isolators shall conform to the latest revisions and amendments of the following standards available at the time of placement of order.

Sl. No	Standard No.	Title
1.	IS:9921	Alternating current isolators (dis-connectors) and earthing switches.
2.	IEC:129	-do-
3.	IS:2544	Insulators.
4.	IS:2147	Degree of protection provided by enclosure.
5.	IS:4691	-do-
6.	IS:325	Three phase induction motors.
7.	IS:4722	Rotating electrical machines.
8.	IS:262	Recommended practice for hot dip galvanising of iron & steel.
9.	IS:4759	Hot dip galvanisation coating on structural steel.
10.	IS:2633	Method of testing weight, thickness and uniformity
11.	IS:1573	Electroplated coating of zinc on iron and steel.
12.	IS:6735	Spring washers.
13.	IS:2016	Plain washers.
14.	–	Indian Electricity Rules, 1956

Equipment meeting with the requirements of other authoritative National or International Standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the bidder conforms to other standards salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in English shall be furnished along with the offer.

3.0 SERVICE CONDITIONS:

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

i.	Location	IN THE STATE OF HARYANA
ii.	Max. ambient air temp (°C)	50
iii.	Min. ambient air temp (°C)	-2.5
iv.	Max. Relative humidity %	100

v.	Min. Relative humidity %	26
vi.	Average annual rainfall (mm)	900
vii.	Max. wind pressure (kg./Sq.m)	195
viii.	Max. altitude above mean sea level (meters)	less than 1000
ix.	Isocerannic level (days/years)	45
x.	Seismic level (horizontal acceleration)	0.3g
xi.	Average no. of dust storm days/annum	35

Note: Moderately hot and tropical climate conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Smoke is also present in the atmosphere. Heavy lightening also occurs during June to October.

3.1 AUXILIARY POWER SUPPLY:

The equipment offered under this specification shall be suitable for the following auxiliary power supplies.

- a) Power Devices (like drive motors) 415 V, 3 phase, 4 wire, 50 Hz, neutral grounded AC supply.
- b) AC control and protective devices, lighting fixtures, space heaters. 240 V, single phase, 2 wire, 50 HZ, neutral grounded AC supply.
- c) DC alarm, control and protective devices 220 V, DC 2-wire

Each of the foregoing supplies shall be made available by the HVPNL at the terminal point for each equipment for operation of accessories and auxiliary equipment. Bidder's scope shall include supply of interconnecting cables, terminal boxes, etc., The above supply voltages may vary as below and all devices shall be suitable for continuous operation over entire range of voltages.

- i) AC supply - voltage + 10% & -15% frequency $\pm$ 5%
- ii) DC supply - 15% to + 10%

4.0 PRINCIPAL PARAMETERS:

The equipment covered in this specification shall meet the technical requirements listed below:

Sl.No	Technical Parameter		36kV	72.5kV	145 kV	245 kV	
1.	Rated Frequency (Hz)		----- 50 -----				
2.	System Neutral Earthing		----- Solidly Earthed -----				
3.	No. of Phases (Poles)		----- 3 -----				
4.	Temperature Rise		----- As per relevant IS/IEC ---				
5.	Safe Duration of overload						
a)	150% of rated current		----- 5 minutes -----				
b)	120% of rated current		----- 30 minutes -----				
6.	Rated voltage /Highest system voltage (kV rms)	33/36	33/36	33/36	66/72.5	132/145	220/245
7.	Type of disconnect (AB)	DB	DB	DB	DB	DB	SB
8.	Rated normal current (Amp rms)	2000	1250	630	1250/1600	1000	1250
9.	Rated short time withstand current (kA rms) of MS & EB for 1 sec duration	25/31.5*	25/31.5*	25/31.5*	31.5	31.5	40
10.	Rated dynamic withstand current (kA)	62. 5/** 78.75	62. 5/** 78.75	62.5/** 78.75	78.75	78.75	100
11.	Rated short circuit making current of EB (kA peak)	62.5/** 78.75	62. 5/** 78.75	62.5/** 78.75	78.75	78.75	100

12.	Basic insulation level:				
I.	1.2/50 micro-sec lightning impulse withstand voltage (+ ve or - ve polarity)				
a)	To earth (kVp)	170	325	650	1050
b)	Across isolating distance One terminal subjected to lightning impulse (kVp) and opposite terminal subjected to power frequency (kV rms) voltage (as per IS)	195	375	750	1200
II.	Rated 1 minute power frequency withstand voltage (kV rms)				
a)	Across isolating distance	100	160	315	530
b)	To earth and between poles	70	140	275	460
13.	Min. creepage distance of support and rotating insulator (mm)	900	1813	3625	6125
14.	Phase to Phase spacing for installation (mm)	1220	1830	3000	4000
15.	Minimum clearances:				
a)	Phase to earth	320	630	1300	2400
b)	Phase to Phase (Across the same pole)	350	1300	1600	2700
	(Bidders offering lesser clearance must substantiate the same with adequate information on impulse withstand capability of the equipment, However the height of Post Insulator should not be less than 2300mm in case of 245kV, 1500mm in case of 145kV, 770mm in case of 72.5kV and 508 mm in case of 36kV Isolator)				
16.	Height of center line of terminal pad above ground level (mm)	2800	3000	4000	5000
17.	Rating of auxiliary contacts	10 A at 220V DC with breaking capacity of 2 A DC with time constant not less than 20 ms.			
18.	Seismic acceleration	 0.3 g horizontal.....			
19.	Operating time	----- 12 sec or less -----			
20.	Rated mechanical terminal load	As per relevant standards			
21.	Rated magnetizing/ capacitive current make/break (Amps/rms)	0.7	0.7	0.7	0.7
22.	RIV at 1 MHz & 1.1 X rated phase to earth voltage (micro volts)	–	–	–	1000

* i. 25kA –for 66kV,132kV & existing 220kV S/Stns.

ii. 31.5KA –for new 220kV S/Stns.

** i. 62.5kA –for 66kV,132kV & existing 220kV S/Stns.

ii. 78.75KA –for new 220kV S/Stns.

5.0 GENERAL TECHNICAL REQUIREMENTS:

5.1 The 245 kV single break isolators shall be a set of three individual poles with one vertical break earthing blade per pole suitable for fixing on either side of the poles or without any earthing blade.

5.2 The 145 kV, 72.5kV and 36 kV Isolators with & with out earth blade shall be triple pole, single throw, double break, three post per phase, central pole rotating type. The blade shall open and close in a horizontal plane.

- 5.3** Complete isolators with all the necessary items for successful operation shall be supplied including but not limited to the following:
- 5.3.1** Isolators assembled with isolator blades (main and earth), complete base frame, linkages, operating mechanism complete etc.
- 5.3.2** The three poles of the 245/145/72.5/36 kV Isolators covered by this specification will be gang operated with one central cabinet for the required electrical devices mounted therein.
- 5.4** Material of Earthing blades and contacts shall be same as those of main blades and contacts. Cross sectional area of Earthing blades and contacts shall not be less than 50% of cross sectional area of main blades and contacts. The Earthing blades shall have the same short time current rating (thermal and dynamic) as that of main blades.
The current density in the current carrying parts of the Isolator shall in no case exceeds the following values:
For Copper : 2A/sq.mm
For Aluminium : 1A/sq.mm
- 5.5** Support insulators for all types of isolators shall be of solid core type except for 33 kV Isolators where in post insulators shall be used.
- 5.5.1** The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and di-electric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit forces etc., Glazing of the porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water. The porcelain shall be free from lamination and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture. The porcelain and metal parts shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create undue internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings. The insulator shall be suitable for water washing by rain or artificial means in service condition. Profile of the insulator shall also conform to IEC-815. Insulator shall have a minimum cantilever strength of 6 KN.
- 5.5.2** Cap to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanised. The cap shall have four numbers of tapped holes spaced on a pitch circle diameter of 127 mm for 245 kV, 145 kV & 72.5kV Isolators & Line-cum-Earth Switches and 76 mm for 36 kV Isolators & Line-cum-Earth Switches. The holes shall be suitable for bolts with threads having anti corrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona.
- 5.5.3** The casting shall be free from blow holes, cracks and such other defects.
- 5.5.4** All the ferrous metal parts shall be hot dip galvanised smoothly as per IS: 3638 (as amended up to date), IS: 2633 or any other equivalent authoritative standard. The material shall be galvanised only after shop operations have been completed upon it. The metal parts before galvanising should be thoroughly cleaned of any paint, grease, rust, scales or alkali or any foreign deposit which are likely to come in the way of galvanising process. The coating on the metal parts shall withstand minimum four one minute dips in copper sulphate solution as per IEC-168.
- 5.5.5** The insulator unit shall be assembled in a suitable jig to ensure correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fittings shall be parallel and at right angles to the axis of the insulator

and the corresponding holes in the top and the bottom metal fittings shall be in a vertical plane containing the axis of the insulator.

- 5.5.6** It shall be the sole responsibility of the Contractor to carry out thorough inspection and quality checks on the insulators at the insulator Contractor's works, before offering the insulators for HVPNL's inspection.

5.6 OPERATING MECHANISM:

- 5.6.1a)** Each 245 kV, 145 kV, 72.5kV & 36 kV isolators shall be remote controlled from the control room. Provision shall be made for local motor control also. Operating mechanism shall also be equipped with local manual operating device intended for emergency operation when operating mechanism becomes inoperative. Additional electromagnetic type interlock shall be provided so as to prevent the operation of isolator manually or electrically when the corresponding circuit breaker is ON.
- b)** Manual operating mechanism through crank and reduction gear shall be provided for the earth switch which too will be gang operated. The operation of earth switch which too will be gang operated. The operation of earth switch shall also be electrically inter-locked by providing a 63.5V rated contractor and 220 kV DC rated electro magnet. The contractor will be fed from single phase ($132\text{kV}/\sqrt{3}/110\text{ kV}/\sqrt{3}$) CVT/ PT provided at the entry of a transmission line in the sub-station. The normally closed contact of said contactor will form part of series chain with other contacts of line isolator/ earth switch to prevent closing of earth switch when the contactor is in picked up position (which means that when the concerned transmission line is live).
- 5.6.2** The operating mechanism shall provide quick, simple and effective operation. The motor operated type operating mechanism shall be suitable for remote operation of all three poles simultaneously as well as local manual operation through crank and reduction gear. The design of manual operation shall be such that one man shall be able to operate the isolator without undue effort with about 20 (twenty) revolutions of the crank. The operating mechanism shall be suitable to hold the dis-connector in CLOSE OR OPEN position and prevent operation by gravity, wind, short circuit forces, seismic forces, vibration, shock, accidental touching etc.,
- 5.6.3** Limit switches for control shall be fitted on the isolator shaft within the cabinet to sense the open and close positions of the isolators and earth switches.
- 5.6.4** It shall not be possible, after final adjustment has been made, for any part of the mechanism to be displaced at any point in the travel sufficient enough to cause improper functioning of the isolator when the isolator is opened or closed at any speed. All holes in cranks, linkage etc., having moving pins, shall be drilled to fit accurately so as to maintain the minimum amount of slack and lost-motion in the entire mechanism.
- 5.6.5** A "local/remote" selector switch and a set of open/close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons. The remote push buttons shall be arranged by the HVPNL.
- 5.6.6** Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.
- 5.6.7** Each motor operated mechanism shall be subjected to blocked rotor test.

5.7 CONTROL CABINET:

The control cabinet of the operating mechanism shall be made out of 12 SWG(2.64 mm thick) sheet steel duly hot dip galvanised or 10 mm thick aluminium plate or casting. Hinged door shall be provided with pad locking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gaskets shall be provided to ensure degree of protection of at least IP:55 as per IS:2147. The cabinet shall be suitable for mounting on support structure with adjustment for vertical alignment. Details of

these arrangements shall be furnished along with the tender.

5.8 MOTOR:

The motor shall be suitable for three phase, 415 V, A.C. with variations as specified in this specification. It shall be totally enclosed type if mounted outside the control cabinet. The motor shall withstand without damage stalled torque for at least three times the duration of tripping device. The motor shall, in all other respects, conform to the requirement of IS-325.

5.9 GEAR:

The disconnecter may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gears shall be made out of aluminium bronze or any other better material and lubricated for life with graphite or better quality non draining and non hardening type grease. Wherever necessary automatic relieving mechanism shall be provided. Complete details of components, material, grade, self lubricating arrangement, grade of lubricants, details of jig, fixtures and devices used for quality check, shall be furnished by the Bidder in his offer.

5.10 GLAND PLATE AND GLANDS:

A removable gland plate with double compression type brass cable glands shall be provided with each operating mechanism for terminating all cables. Exact quantity of glands to be provided, shall be intimated to the Contractor.

5.11 CONTROL CIRCUITS:

Control device shall store OPEN and CLOSE command even if the corresponding switch is momentarily pressed until the command is fully executed and the components get de-energised after execution. Failure of auxiliary power supply or loose contact shall not cause faulty operation.

5.12 SUPPORTING STRUCTURE :

The Isolators and isolator – cum – earth switches shall be mounted rigidly in an upright position on their own supporting structure and not on the line or bus bar structure. The supporting structures will be arranged by the HVPNL. The isolator and isolator – cum –earth switch will be suitable for mounting on HVPNL's standard supporting structure HTD/ST-170, HTD/ST-90R3, HTD/ST-87R & HTD/ST-110 for 245 kV, 145kV, 72.5kV & 36 kV respectively. One print of detailed structure drawing is enclosed with the specification which may be perused & its suitability for the offered equipment be confirmed by the bidders. Any additional member of structure required for mounting the MOM box of isolators as well as line-cum-earth switch will be in scope of bidder's supply.

5.13 LIMIT SWITCH:

Limit switches shall be of reputed make. Auxiliary switch shall not be used as limit switch. Details of make, rating and type of limit switch shall be furnished in the offer.

5.14 OVERLOAD AND SINGLE PHASING PREVENTER:

Suitable relay/device shall be provided to prevent overloading of the motor. Single phase preventer shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished in the offer.

5.15 CONTACTOR:

The contractor shall be suitable for making and breaking stalled motor current. The contractor coil shall be suitable for 220 V D.C. Two numbers of contractors shall be provided for each motor for OPEN and CLOSE operation respectively. Make, type, rating and details of the contractor shall be furnished in the offer.

5.16 AUXILIARY SWITCH:

5.16.1 Each operating mechanism box shall be equipped with ten numbers of NC and ten numbers of NO auxiliary switches exclusively for HVPNL's use. In addition,

two pairs of make – before – break NO/NC contacts shall be provided in the operating mechanism box. 3 pairs of NC and 3 pairs of NO contacts shall be provided in the auxiliary switch box for earth mechanism.

5.16.2 The auxiliary switches and auxiliary circuits shall be capable of carrying the current of atleast 10 Amps continuously.

5.16.3 Auxiliary switches shall be capable of breaking atleast 2A in a 220 V D.C. circuit with a time constant of not less than 20 milli seconds.

5.16.4 Quick Make and Break (QMB) type auxiliary switch shall have snap action built-in within the switch.

5.16.5 The auxiliary switches shall be actuated by a cam or similar arrangement directly mounted on the isolator and shall be without any intermediate levels, linkages etc., to ensure fool proof operation.

5.17 SPACE HEATERS:

Space heater, thermostatically controlled, suitable for single phase 240 V AC supply shall be provided for motor operated operating mechanism to prevent condensation. A switch and fuse/link shall be provided in the operating mechanism.

5.18 TERMINAL BLOCK AND WIRING:

Each operating mechanism shall be provided with 1100 V grade stud type terminal block having washers, nuts & check nuts. All auxiliary switches, interlocks and other terminals shall be wired up to terminal block. The terminal block shall have at least 20% extra terminals. All wiring shall be carried out with 1100 V grade insulated 2.5 mm² copper wires.

5.19 DUTY REQUIREMENTS:

5.19.1 Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

5.19.2 The earth switches, wherever provided, shall be constructionally interlocked so that the earth switch can be operated only when the isolator is open and not vice-versa. The constructional interlocks shall be built-in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.

5.19.3 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of fail safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range stipulated in this volume.

5.19.4 The isolator shall be capable of making/breaking normal currents when no voltage occurs across the terminals of each pole of isolator on account of make/break operation.

5.19.5 The isolator shall be capable of making/ breaking magnetising current of 0.7 A at 0.15 power factor and capacitive current of 0.7 A at 0.15 power factor.

5.19.6 Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamic forces on the attached conductor without impairing reliability or current carrying capacity.

5.20 INTERIOR ILLUMINATION:

A switch, HRC fuse and holder suitable for a 240 V lamp shall be provided in one of the motor operated mechanism box of isolator and manually operated mechanism box of earth switch.

5.21 POWER SOCKET:

A single phase 240 V 15A power socket and switch shall be provided in the motor operated operating mechanisms of the Isolators poles.

5.22 CONTROL AND AUXILIARY SUPPLY:

A three phase switch with HRC fuses for phases and link for neutral shall be provided for power supply and a 2 way switch with HRC fuses shall be provided for control supply in the motor operated mechanisms of the Isolators.

5.23 ACCESSORIES:

The accessories to be provided on the isolator shall include but not limited to the following:

5.23.1 POSITION INDICATOR:

A position indicator to show whether the isolator is in ON or OFF position.

5.23.2 COUNTER BALANCE SPRINGS:

Counter balance springs, cushions etc., shall be provided to prevent impact at the end of travel both on opening and closing of the isolator. The springs shall be made of durable and non-rusting type alloy.

5.24 NAME PLATES:

Isolator and Earthing switches and their operating devices shall be provided with a name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information duly engraved or punched on it.

5.24.1 Isolator Base:

Name of utility (i.e. HVPNL)	:
Name of Manufacturer	:
P.O. No.	:
Type Designation	:
Manufacturer's serial number	:
Rated voltage	:
Rated normal current	:
Rated short time current (rms)	:
and duration	:
Rated short time peak current (kAp)	:
Weight	:

5.24.2 Earthing Switch:

Name of utility (i.e. HVPNL)	:
Name of Manufacturer	:
P.O. No.	:
Type Designation	:
Manufacturer's serial number	:
Rated voltage	:
Rated short time current (rms)	:
and duration	:
Rated short time peak current (kAp)	:
Weight	:

5.24.3 Operating Device:

Name of utility (i.e. HVPNL)	:
Name of Manufacturer	:
P.O. No.	:
Type Designation	:
Reduction gear ratio	:
AC Motor	:
I.) Rated auxiliary voltage	:
II.) Starting current	:

III.)	Designation of AC motor as per IS:4722	:
IV.)	Starting torque at 80% of supply voltage	:
V.)	Over travel in degrees after cutting off supply	:
	Total operating time in seconds	:
I.)	CLOSE operation - electrical	:
II)	OPEN Operation - electrical	:
	-do- - manual	:
	Space Heater	:
	Rated voltage and power Auxiliary contacts	:
I.)	Rated current (Amps)	:
II.)	Time constant (ms)	:
III.)	No. of contacts used (NC & NO)	:
IV.)	No. of free contacts (NC & NO)	:
	Terminal blocks and wiring	:
I)	Rated current	:
II)	Voltage grade and type	:
5.25	PADLOCKING DEVICE:	
	All Isolator and Earthing switches shall be provided with padlocking device to permit locking of the isolator and Earthing switch in both fully open and fully closed positions. Power driven isolator and Earthing switch shall be arranged to be interlocked electrically also.	
5.26	SIGNALLING:	
5.26.1	Signalling of the close position shall not take place unless the movable contact has set in a position in which the rated normal current, the peak withstand current and the short time withstand current can be carried safely.	
5.26.2	Signalling of the open position shall not take place unless the movable contact has reached the position such that the clearance between the moveable and fixed contacts is at least 80% of the isolating distance.	
5.27	EARTHING:	
5.27.1	Flexible copper connections shall be provided between rotating earth blades and the frame which shall have a cross-section of atleast 50 mm ² and shall be tinned or suitably treated against corrosion.	
5.27.2	The frame of each disconnecter and Earthing switch shall be provided with two reliable Earthing terminals for connection to the HVPNL's Earthing conductor/flat and also clamping screws suitable for carrying specified short time current. Flexible ground connections shall be provided for connecting operating handle to the Earthing flat. The diameter of clamping screw shall be atleast 12 mm. The connecting point shall be marked with earth symbol.	
5.28	DESIGN AND CONSTRUCTION:	
5.28.1	Full particulars of design, manufacture, jig template and quality control devices developed for manufacture of the equipment offered in respect of but not limited to the following, shall be furnished with drawings and descriptions alongwith the tender.	
i.)	Contacts, material, current density etc.,	
ii.)	Design of contact pressure.	
iii.)	Contact support and fixing arrangement on isolators.	
iv.)	Turn and twist mechanism, clamps, locks etc.,	
v.)	Bearings, housing of bearings, bushes etc.,	
vi.)	Balancing of heights,	
vii.)	Coupling pipes, joints, connection adjustments.	
viii.)	Base plates.	
ix.)	Down pipe guides and joints.	
x.)	Brass bushes and bearings at various joints.	
xi.)	Operating mechanism, type of gear motor, limit switch, aux. switch, timers, size and thickness of box, degree of protection, gland plate, gland etc.,	

- xii.) Nuts, bolts and fasteners.
- xiii) Interlocking devices.

Offers without the above information or with incomplete information shall not be considered.

5.28.2 FASTENERS:

Nuts, bolts and washers of 5/8" and higher size shall be hot dip galvanised. The bolts used on tapped holes of insulator cap shall be galvanised by centrifuge process to avoid excess deposition of zinc on threads. Nuts, bolts and washers of less than 5/8" size shall be of stainless steel when used on live parts and nickel plated brass in other parts.

5.28.3 CONTACTS:

Contacts shall be made out of hard drawn electrolytic grade copper. Arcing contacts wherever provided shall close first and open last. The contacts surface shall be silver plated. Fabrication of contact shall be made with suitable jig to avoid deviations during production. Details of size and shape of contacts, springs, back plate, fixing arrangements, design of contact pressure, life of contacts, limit of temperature rise etc., shall be furnished along with the tender. The moving contacts of tubular section shall be so dimensioned as to carry the rated current.

5.28.4 MOUNTING OF CONTACTS:

The contacts shall rest on a brass block and with initial tension. Suitable device shall be provided to prevent dashing. Fabrication, welding etc., shall be done in suitable jig to avoid deviations during production.

5.28.5 TERMINAL PAD:

The terminal pad shall be suitable for connection to aluminium terminal connector through bimetallic plate wherever necessary. It shall be made out of electrolytic copper heavily silver plated. Dimensions of the terminal pad shall be furnished with the tender.

5.28.6 MOVING BLADE:

Moving blade shall be made out of hard drawn Electrolytic grade copper for 145/72.5/36 kV Isolators and hard drawn Electrolytic grade copper/aluminium for 245kV Isolators. Contact surface of moving blade shall be heavily silver plated. The surface shall be wiped during closing and opening operations to remove any film, oxide coating etc., Wiping action shall not cause scouring or abrasion of surfaces.

5.28.7 The rotating insulator shall be mounted on housing with bearing housing. The housing shall be made of gravity di-cast aluminium with smooth surfaces suitably machined for seating the bearings. Two numbers of bearings with adequate shaft diameter and distance between the bearings shall be provided to avoid wobbling during operations. The bearings shall be of atleast 50 mm shaft diameter. The bearings shall be of reputed make e.g. SKF, HMT, NBC, TATA, and lubricated for life. All other friction locations shall be provided with bearings, bushes, joints, springs etc., shall be so designed that no lubrication shall be required during service. Complete details of bearings, bushes, housing, greasing etc., shall be furnished with the tender. The Earthing switch shaft shall also be provided with necessary bearings.

5.28.8 Tandem pipes shall be of adequately dimensioned for the given duty and shall be class B. Base plate of insulators for connection of tandem pipe shall be made out of one piece 10 mm thick MS plate. Bolt and shackle device shall be used to connect tandem pipe to the base plate.

- 5.28.9** The operating pipe too shall be of class B and adequately dimensioned for the given duty. The pipe shall be terminated into a suitable swivel or universal type joint between the insulator bottom bearing and the operating mechanism to take care of marginal angular misalignment at site.
- 5.28.10** Each phase of isolator shall be provided with a rigid base fabricated from steel sections. The base shall be suitable for mounting on support structures. Fabrication, welding etc., shall be done by suitable jig, power press and templates to avoid deviations during production. Details of dimensions sections, jig templates and device used for production of the base shall be furnished with the tender.
- 5.29** **TERMINAL CONNECTORS:**
- 5.29.1** All Isolators shall be provided with universal type terminal connectors suitable for Single ACSR Zebra Conductor/Twin ACSR Zebra Conductor (AAC Tarantula for 220kV S/Stns). The unit rate for types of terminal connector shall be quoted in the relevant schedule.
- 5.29.2** The terminal connectors shall meet the following requirements:
- i.) Terminal connectors shall be manufactured and tested as per IS: 5561.
 - ii.) All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
 - iii.) No part of a clamp shall be less than 10 mm thick.
 - iv.) All ferrous parts shall be hot dip galvanised conforming to IS: 2629.
 - v.) For bimetallic connectors, copper alloy liner of minimum thickness of 2 mm shall be cast integral with aluminium body.
 - vi.) Flexible connectors shall be made from tinned copper / aluminium sheets.
 - vii.) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
 - viii.) Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS: 5561.
- 5.29.3** Wherever necessary bimetallic strip of standard quality shall be used to avoid galvanic corrosion.
- 5.30** **ASSEMBLY:**
- The disconnecter shall be fully assembled at the works of the Contractor and operations shall be carried out on it to ascertain that all parts fit correctly and function satisfactorily.
- 5.31** **PAINTING, GALVANISING AND CLIMATE PROOFING:**
- All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by recognised phosphating (e.g. Seven tank phosphating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable staving and air drying before final painting. Colour of the final paints shall be of shade no. 631 of IS: 5 i.e. epoxy light grey. The finally painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface.
- 5.31.1** Paint inside the metallic housing shall be of anti-condensation type and the paint on outside surfaces shall be suitable for outdoor installation.
- 5.31.2** All components shall be given adequate treatment of climate proofing as per IS: 3202 so as to withstand corrosive and severe service conditions.
- 5.31.3** All metal parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc., shall be hot dip galvanised and shall be capable to prevent corrosion in view of the severe climatic conditions.
- 5.31.4** Complete details of painting, galvanising and climate proofing of the equipment shall be furnished in the tender.

- 6.0 TESTS:**
- 6.1 TYPE TESTS:**
- The equipment offered should be type tested. Test reports should not more than seven years old reckoned from date of bid opening in respect of all the tests carried out in accredited laboratories (based on ISO/IEC) by a reputed accredited body or witnessed by HVPN or another electric power utility and be submitted by the successful bidder to HVPNL for approval as schedule given in Bar Chart.
- i.) Insulation level test
 - ii.) Temperature rise test
 - iii.) Rated peak withstand current and rated short time withstand current test.
 - iv.) Short circuit making capacity test of earthing switch.
 - v.) Operation and mechanical endurance test.
- 6.2 ROUTINE TESTS:**
- As per quality assurance program (QAP).
- 6.3 ACCEPTANCE TESTS:**
- The following acceptance tests as stipulated in the relevant IS: 9921 (PART-IV) 1985 shall be carried out by the Supplier in presence of HVPNL representative, unless dispensed with in writing by the HVPNL.
- i.) Power Frequency withstand voltage dry test of main circuit.
 - ii.) Voltage test on control auxiliary circuits.
 - iii.) Measurement of resistance of main circuit.
 - iv.) Mechanical operating test.
- 7.0 INSPECTION:**
- i.) The HVPNL shall have access at all times to the works and all other places of manufacture, where the dis-connectors, earth switches and associated equipment are being manufactured and the Contractor shall provide all facilities with out extra cost for unrestricted inspection of the works, raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.
 - ii.) The Contractor shall keep the HVPNL informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection
 - iii.) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
 - iv.) The acceptance of any quantity of the equipment shall in no way relieve the Contractor of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.
- 8.0 DOCUMENTATION:**
- All drawings shall conform to International Standards Organisation (ISO) 'A' series of drawing sheet/Indian Standards Specification.

8.1 LIST OF DRAWINGS AND DOCUMENTS:

The Bidder shall furnish four sets of following drawings alongwith his offer:

- a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.
- b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides.
- c) Name plate.
- d) Schematic drawing along with detailed write-up.
- e) Wiring diagram.

NOTE: All above drawings should be a minimum space (14x10cm) for stamping the approval of drawings by HVPNL.

8.2 The bidder shall submit four sets of final versions of complete and correct equipment drawings for Purchaser's approval along with bid in a sealed envelope. The Purchaser shall communicate his comments/approval on the drawings to the Supplier within 21 days from the date of issue of LOI. The submission of complete and correct readable drawings for approval is the responsibility of the bidder/supplier. The Supplier shall, if so required by the purchaser, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. Then, the purchaser shall approve the revised drawings within 2 weeks from the date of its receipt.

8.3 The successful Bidder shall also supply one set of all the approved drawings and instruction manual containing handling, installation, testing and commissioning, operation and maintenance of the equipment at the time of despatch of material to consignee with each equipment for our field staff. In addition, 5 sets of such bound manuals and final approved drawings shall be supplied for reference and record in our design office.

One set of all the approved drawings and manual of instructions will be supplied along with each equipment without which the supply will not be considered as complete supply.

8.4 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Supplier's risk.

8.5 Approval of drawings/work by Purchaser shall not relieve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices.

8.6 Instruction Manuals:

Twenty copies of the erection, operation and maintenance manuals in English be supplied for each type of dis-connector one month prior to despatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the dis-connector including but not limited to the following particulars:

- a) Marked erection prints identifying the component parts of the dis-connector as shipped with assembly drawings.
- b) Detailed dimensions and description of all auxiliaries.
- c) Detailed views of the insulator stacks, metallic, operating mechanism, structure, interlocks, spare parts etc.,

9.0 Packing and Forwarding:

- 9.1** The equipment shall be packed in crates suitable for vertical/horizontal transport, as the case may be and suitable to withstand bundling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied by Supplier without any extra cost.
- 9.2** Each consignment shall be accompanied by a detailed packing, list containing the following information:-
- a) Name of the consignee.
 - b) Details of consignment.
 - c) Destination.
 - d) Total weight of consignment.
 - e) Handling and unpacking instructions.
 - f) Bill of material indicating contents of each package.
- 9.3** The supplier shall ensure that the packing list and bill of material are approved by the purchaser before despatch.

ANNEXURE-I**(Isolators)****LIST OF SPECIAL TESTS TO BE CARRIED OUT**

Sl. No.	Name of the Test	Standard to which it Conforms
1.	Tests on insulators	IS:2544 IEC:168
2.	Tests on terminal connectors	IS:5561
3.	Tests on galvanised components	IS:2633

ANNEXURE-A

GUARANTEED TECHNICAL PARTICULARS OF ISOLATORS & L&E SWITCHES

Sr. No	Description	
1.	Type/Installation	
2.	Manufacturer's Name & Country of Manufacture	
3.	Standards according to which the Isolators are Manufactured	
4.	Maximum design voltage at which the Isolator can operate (kV)	
5.	Frequency (Hz)	
6.	Rated Voltage (kV)	
7.	Maximum current that can be safely interrupted by the Isolator	
	i. Inductive (A X % of PF)	
	ii. Capacitive (A X % of PF)	
8.	Continuous current rating	
	Nominal (Amps.)	
	Under the conditions (Amps.)	
9.	Rate short time current (kvp)	
	i. For 3 seconds (kA rms)	
	ii. For 1 seconds (KA rms)	
	iii. Rate peak short time current (kvp)	
10.	Max. Temp. rise of current carrying parts when carrying rated current continuously (deg.C)	
11.	Insulation levels	
	i. Impulse withstand voltage (kV Peak)	
	Phase to earth	
	Isolating distance	
	ii. Power frequency withstand voltage (kV rms)	
	Phase to earth	
	Isolating distance	
12.	Minimum creepage distance of support & rotating insulators	
13.	Minimum clearance in air	
	i. Between Poles (mm)	
	ii. Between live parts and earth (mm)	
	iii. Between live parts when switch is open	
	a) On the same pole (mm)	
	b) Between adjacent poles (mm)	
14.	Current density at the minimum cross-section of	
	i) Moving blade (Amps/Sq.mm)	
	ii) Terminal Pad	
	iii) Contacts	
	iv) Terminal connector	
15.	Design and construction	
	i. No. of Insulators as per pole	
	ii. No. of Breakers per pole	
	iii. Type of closing/operating mechanism (Horizontal/Vertical break straight etc.)	
	iv. Contacts	
	a) Material and Grade	
	b) Cross sectional area in Sq.mm	
	v. Moving Blades	

Sr. No	Description	
	a) Material and Grade	
	b) Cross sectional area	
	vi. Contract support	
	a) Material and size of Channel/Block	
	b) Material and size of plate	
	vii. Turn and Twist mechanism	
	a) Material and size of clamps	
	b) Material and size of springs	
	c) Whether springs are encased	
	viii. Bearings	
	a) Material and size of housing	
	b) No. of bearings, location and size	
	ix. Type of interlock	
	x. Down pipe size and class	
	xi. Type of universal/swivel joint	
	a) Between bearing and down pipe	
	b) Between down pipe and operating mechanism	
	xii. Insulators make	
	a) Type	
	b) No. of units per insulator	
	c) Rating of insulators (kV)	
	d) Height of each insulator stack (mm)	
	e) Bolt circle diameter (mm)	
	f) Power frequency dry flashover voltage (kV) rms	
	g) Power frequency wet flashover voltage (kV) rms	
	h) Impulse flashover voltage (positive wave) (kV)peak	
	i) Impulse withstand voltage (kV)	
	j) Power frequency puncture voltage (kV) rms	
	k) Creepage distance	
	Total (mm)	
	Protected (mm)	
	l) Visual discharge voltage level (kV) rms	
	m) Compressive strength	
	n) Tensile strength	
	o) Cantilever strength upright	
	xiii. Terminal connectors	
	a) Clamp body	
	Alloy compositions	
	Area at min. cross-section	
	b) Temperature rise when carrying rated current at 50°C ambient (deg.C)	
	c) Type of washers used	
	d) Bolts and nuts size Alloy composition	
	e) Weight of each type of clamps (kg.)	

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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

- 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

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minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

- 1.6 All material and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). The erection procedure must be approved by the OEM and erection completion shall be certified by OEM for satisfactory completion. The commissioning of all major equipment as recommended by Engineer in-charge.
- 1.7 Only first-class work in accordance with the best modern practice will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouping, levelling, aligning, coupling of or bolting down to previously installed equipment bases/ foundation, performing the alignment check and final adjusting prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instruction and the specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and/or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated location and tested for healthiness.
- 1.8 The Supplier shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purpose shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Supplier shall apply all operational lubricants to the equipment installed by him.
- 1.9 All oil, grease and other consumable used in the Works/Equipment shall be purchased in India unless the Supplier has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Owner in establishing equivalent India make and Indian supplier. The same shall be applicable to other consumable too.
- 1.10 A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Owner. Each base plate shall support the units and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, if so required.
2. PROVISION FOR EXPOSURE TO HOT HUMID CLIMATE
Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipment located in non- air conditioned areas shall also be same type.

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2.1 SPACE HEATERS

2.1.1 The heater shall be suitable for continuous operation at 240 V as supply voltage. On-off switch and fuse shall be provided.

2.1.2 One or more adequately rated permanently or thermostatically connected heater shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connection shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation. This shall be demonstrated by tests.

2.1.3 The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternately, they shall consist of a resistance wire mounted into a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heater shall be restricted wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

2.2 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied to parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

2.3 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass or galvanized steel to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

2.4 DEGREE OF PROTECTION

The enclosures of the control cabinets, junction boxes and marshalling boxes to be installed shall provide degree of protection as detailed here under:

- a) Installed outdoor: IP 55
- b) Installed indoor in air conditioned area: IP31

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c) Installed in covered area: IP 52

d) Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP 41

The degree of protection shall be in accordance with IS: 13947(Part-I) or IEC-947 (Part-I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

The above requirement is indicative only. Requirements as provided in respective technical specification shall prevail.

10. Rating Plates, Name Plates and Labels

1. Each main and auxiliary item of substation is to be permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading condition under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Owner. The rating plates of each equipment shall be according to IEC requirement.
2. All such nameplates instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively, two separate plates one with Hindi and the other English Instruction may be provided.

11. First Fill of Consumable, Oil and Lubricant

All the first fill consumable such as SF6, AC refrigerant, oil, lubricant, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful operation, shall be supplied by the Contractor unless specification excluded under the exclusions in these specifications and documents.

12. Design Improvements

1. The bidder may note that the equipment offered by him in the bid only shall be acceptable, however, the Purchaser or the Supplier may propose changes in the specification of the equipment or quality thereof and if the parties agreed upon any such changes, the specification shall be modified accordingly.
2. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of the completion before the contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

13. Quality Assurance Programme

1. To ensure that the equipment and services under the scope of this contract whether manufactured or performed within the contractor's Work or at his Subcontractor's premises or at the Owner's site or at any other place of work are in accordance with the

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specification, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary.

Such programme shall be outlined by the contractor and shall be finally accepted by the Owner after discussions before award of contract. A quality assurance programme of the contractor shall be generally covered the following,

- a) His Organization structure for the management and implementation of the proposed quality assurance programme.
- b) Qualification data for bidder's key personnel.
- c) Documentation control System.
- d) The procedure for purchases of material, parts components and selection of subcontractor's services including vendor analysis, source, inspection, incoming raw material inspection, verification of material purchases etc.
- e) System for shop manufacturing and, site erection control including process controls and fabrication and assembly control.
- f) Control and non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and field activities.
- h) Control of calibration and testing of measuring instruments and field activities.
- i) System for indication and appraisal of inspection status.
- j) System for quality audits.
- k) System for authorising release of manufactured product to the Purchaser.
- l) System for maintenance of records.
- m) System for handling storage and delivery. and
- n) A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services ordered.

The Owner or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his vendor's quality management and control activities.

2. QUALITY ASSURANCE DOCUMENTS

The contractor shall be required to submit the following quality Assurance Documents within three weeks after despatch of the equipment.

All Non-destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and report including radiography interpretation reports.

Welder identification list, listing welder's and welding operator qualification procedure and welding identification symbols.

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Welder and Welding operator qualification certificate.

Raw material test reports on components as specified by the specification and for agreed to in the quality plan.

Stress relief time temperature chart/oil impregnation tile temperature chart.

Factory test results for testing required as per applicable codes/ mutually agreed quality plan/standards referred in the technical specification.

The quality plan with verification of various customer inspection points(CAP) as mutually agreed and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

14. Inspection, Testing and Inspection Certificate

1. The Owner his duly authorised representative and/or outside inspection agency acting on behalf of the Owner shall have at all reasonable times free access to the Contractor's premises or Works and shall have the power at all reasonable times to inspect and examine the material and the Workmanship of the Works during its manufacture or erection and if part of the works during its manufacturing or erection and if the part of works being manufactured or assembled at other premises or works, the contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the work were manufactured or assembled on the Contractor own premises or works, Inspection may be made at any stage of manufacture, despatch or at site at the option of the Owner and equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
2. All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with relevant standards.
3. The Contractor shall give the Owner/Inspector thirty (30) days written notice of any material being ready for testing along with work test certificate. Such tests shall be to the Contractor's account. The Owner unless witnessing of the tests is virtually waived, will attend such tests with thirty (30) days of the date of which the equipment is notified as being ready for tests/inspection, the contractor must ensure TPI for all inspections in line with tender documents.
4. The Owner or Inspector shall, within fifteen (15) days from the date of inspection as defined here in give notice in writing to the contractor, of any objection to any drawings and all any equipment and workmanship which in his opinion is not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either made the modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.
5. When the, factory tests have been completed at the Contractor's or Subcontractor's Works

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the Owner/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of dispatch clearances in approved by the Owner.

6. In all cases where the Contract provides for tests whether at the premises or at the works of the contractor or of any Sub-Contractor. The Contractor except where otherwise specified shall provide free of charge such items as labour, material electrically, field water, stores, apparatus and instruments as may be reasonably demanded by the Owner/Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the contract and shall give facilities to the Owner/inspector or to his authorised representative to accomplish testing.
7. The inspection by Owner and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the contractors.
8. The Owner will have the right of having at his own expenses any other test(s) of Reasonable nature carried out at Contractor premises or at site of in any other place in addition of aforesaid type and routine tests, to satisfy that the materials comply with the specification.
9. The Owner reserves the right for getting any field tests conducted on the completely assembled equipment at site.

15. Tests

1. CHARGING

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed are given in section-7 and shall be included in the Contractor's quality assurance programme.

2. COMMISSIONING TESTS

- 2.1 The available instrumentation and control equipment will be used during such tests shall calibrated. However un-measurable parameters shall be taken into account in a reasonable manner by the Owner for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Owner will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified condition.
- 2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- 2.3 The specified tests to be conducted on equipment have been brought out in the respective chapters of the technical specification.

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2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However, necessary fee shall be paid by Owner.

16. Packing and Shipping

All the equipment shall be suitably protected, coated, covered or boxes and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Owner takes no responsibility of the wagons.

17. Protection

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pilings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

18. Painting and Finishing of Metal Surfaces

1. GENERAL

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

2. HOT DIP GALVANIZING

2.1 The minimum weight of the zinc coating shall be 610g/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM.

2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel; The finished surfaces shall be clean and smooth and shall be free from defects like colour patches, are spots, unevenness of coating, plate which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium

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dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.

2.5 Sharp edges with radii less than 2.5mm shall be able to withstand four immersions of the standard price test. All other coating shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating
- Uniformity of zinc
- Adhesion test
- Mass of Zinc

2.6 Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

3. PAINTING

3.1 All sheet steel work shall be digressed, pickled, phosphated in accordance with the IS-6005 "code of practice for phosphating iron and sheet". All surfaces which will not be easily accessible after shop assembly shall beforehand to be treated and protected for the life of the equipment. The surface which are to be finished painted after installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swart shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and over drying. The phosphate coating shall be sealed with application of two coats may be "flash dried" while the second coat shall be stoved.

3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

3.4 The exterior colour of the paint shall be as per shade No.:631 of IS-5 and inside shall be glossy white. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment.

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3.5 In case the bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc. the procedure shall be submitted along with the bids for Owner's review & approval.

19. Handling, Storing and Installation

1. In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the contractor shall unload, store, erect, install, wire test and place into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.
2. Contractor may engage manufacturer's engineer to supervise the unloading, transportation to site, storing and erection. The contractor shall engage the manufacturer's Engineer's for testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s)/ as per Manufacturer's approved process and shall extend full cooperation to them.
3. In case of any doubt or misunderstanding as to the correct interpretation of manufacture's drawing or instruction, necessary clarifications shall be obtained from the Owner/ Manufacturer. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawing/instructions correctly.
4. Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between section including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected during testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
5. Supplier shall be responsible for examining all the shipment and notify the Owner immediately of any damage, shortage, discrepancy etc. for the purpose of Owner's information only. The supplier shall submit to the Owner every week a report detailing all the receipts for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Supplier.
6. The Contractor shall be fully responsible for the equipment material unit the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment material while in storage as well as after erection unit taken over by Owner, as well as protection of the same against theft,

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element of nature, corrosion, damages etc.

7. Where material/equipment is unloaded by Owner before the Contractor arrives at site or even when he is at site. Owner by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.
8. The Supplier shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.
9. The words 'erection' and 'installation' used in the specification are synonymous.
10. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
11. The minimum phase to earth, phase to phase and section clearance for the various 132 kV, 66 kV and 33 kV sections of the switchyard are given below,

Voltage Grade	220kV	132kV	33kV
Phase to earth (mm)	2100	1300	320
Phase to Phase (mm)	2100	1600	350
Section clearance (mm)	5000	4000	2800

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life.

20. Protective Guard

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

21. Design Co-ordination

1. The Contractor shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinate performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done so that it facilitates easy field assembly and maintenance.
2. The Contractor has to coordinate designs and termination with the agencies (If any) who are LSTK vendors/ contractor for the Owner if applicable. The names of agencies shall be intimated to the successful bidders.

22. Design Co-Ordination Meeting

The Contractor will be called upon to attend design co-ordination meeting with the Engineer, other Contractor's and the LSTK vendors of Owner (If any) during the period of Contract. The Contractor shall attend such meeting at his own cost as and when required and fully cooperate with such person and agencies involved during those discussions.

23. Tools and Tackles

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment.

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However, these tools and tackles shall be separately, packed and brought on to Site.

24. Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base unless otherwise agreed to by the Owner. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

25. Support Structure

1. The support structures should be hot dip galvanised with minimum 610 gram/m² net of Zinc.
2. In case of any deviation in this regard the bid is liable to be rejected.
3. Support structure shall meet the following mandatory requirements.
4. The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 meters or as per applicable standard.
5. The design calculations taking into account the environmental conditions of the substations shall be furnished for sizing of the structures.

26. Clamps and Connectors including Terminal Connectors

1. All power clamps and connectors shall conform to IS:5561 & NEMA CC1 and shall be made of materials listed below,

a)	For connecting ACSR Conductors	Aluminium alloy casting conforming to designation A6 of IS:617 and shall be tested for all test as per IS:617
b)	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminium alloy casting, conforming to designation A6 of IS 617 with 2mm thick bimetallic liner and shall tested as per IS:617
c)	For connecting GI shield wire	Galvanised mild steel
d)	Bolts, nuts & plain washer galvanised Spring washers for items 'a' to 'c'	Electro galvanisation for sizes Plain, washers below M12, for others hot dip galvanised. Electro-galvanised mild steel suitable for at least service condition-3 as per IS:1573

2. Each equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor termination of equipment shall be suitable for Moose ACSR Conductor. The requirement regarding external RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position.
3. Where copper to aluminium connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept

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to a minimum and restricted to parts which are not current carrying or subjected to stress. The design details of the joint shall be furnished to the Owner by the supplier.

4. Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of work.
5. No current carrying part of any of any clamp shall be less than 12 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminium body for Bi-metallic clamps.
6. Lateral load deflection test shall be carried out as an acceptance test. The test procedure and accepted norms shall be mutually discussed and agreed to.
7. All casting shall be free blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
8. Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.
9. All current carrying parts shall be designed and manufactured to have minimum contact resistance.
10. Clamps and connectors shall be designed to be corona controlled. RIV level for 220 kV system shall not be more than 1000/ micro volts respectively at the specified test voltage as per IS/NEMA.
11. TESTS
Clamps and connectors shall conform to type tests and shall be subjected to routine tests as per IS:5561.

27. Control Cabinets, Junction Boxes, Terminal Boxes & Marshalling Boxes for Outdoor Equipment

1. All type of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS5039/IS-8623, IEC-439, as applicable, and the clauses given below.
2. Control cabinet, junction boxes, marshalling boxes & terminal boxes shall be made of sheet steel or aluminium and shall be dust, water and vermin proof. Sheet used shall be least 2.0 mm cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminium enclosed box the thickness of aluminium shall be such that it provides adequate rigidity and long life as comparable with sheet of specified thickness.
3. The enclosures of the control cabinets, junction boxes, terminal boxes & marshalling boxes shall provide a degree of protection of not less than IP 55 as per IS: 2147. The bidder shall offer type tested (IP:55) Marshalling kiosk and type test report for degree of protection test each type of box shall be furnished for arrival. After protection degree test of marshalling kiosk, 2.0 kVrms for 1 (one) minute, insulation resistance and functional test

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should have been conducted. In case these tests have not been carried out during IP55 test, then the contractor shall carry out the IP-55 test along with these tests, at his cost.

4. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.
5. All door, removable covers and plates shall be gasketed all around with suitably profiled EPDM gaskets. The gasket shall be tested in the presence of Owners representative. The quality of gasket shall be such that it does not get damaged/ cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced of necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass or GI wires.
6. All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connection. Boxes and cabinet shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.
7. A 240V, single phase, 50Hz, 15amp AC plug and socket shall be provided the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.
8. For illumination of control cabinet, a 7 Watt LED shall be provided.
9. All control switches shall be of rotary switch type and Toggle/piano switches shall not be provided.
10. EARTHING

Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of star of self-etching washer. Earthing of hinged door shall be done by using a separate earth wire.

11. TESTS

The marshalling kiosks shall be subject to routine tests as per 18:5039. The following routine tests shall also be conducted:

- Check for wiring
- Visual and dimension check

Marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/ferruling by pasting the same on the inside of the door.

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28. Auxiliary Switches

The auxiliary switch shall confirm to the following type tests:

- a) Electrical endurance test -A minimum of 2000 operation for 2A DC with a time constant examination of mV drop/visual defects/temperature rise test.
- b) Mechanical endurance test. A minimum of operations as specified in the relevant IS with a subsequent checking of contact pressure test visual examination. Heat run test on contacts.

29. Terminal Blocks and Wiring

1. Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.
2. Terminal blocks shall be 1100 v grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.
3. Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.
4. The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.
5. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.
6. The terminal blocks shall be of extensible design.
7. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
8. The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.
9. Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a)	All circuits except CT circuits	Minimum of 2.5 sq.mm copper flexible
b)	All CT circuits copper flexible.	Minimum of 4 sq.mm.

10. The arrangements shall be in such a manner so that it is possible to safely connect or

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disconnect terminals on live circuits and replace fuse links when the cabinet is live.

11. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.
12. There shall be a minimum clearance of 250 mm between the First bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.
The Supplier shall furnish all wire, conduits and terminals for the necessary interphase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets. The wiring required in these items shall be run in metallic ducts or shielded cables in order to avoid surge overvoltage either transferred through the equipment or due to transients induced from the EHV circuits.
13. All input and output terminals of each control cubicle shall be tested for surge withstand capability and transverse modes. The supplier shall also provide all necessary to achieve an impulse withstand level at the cable interfaces of equipment.

30. Lamps and Sockets

1. LAMPS

All indication lamps shall also be LED based. Socket base shall be as per IS-1258, except in the case of signal lamps.

2. SOCKETS

All sockets (convenience outlets) shall be suitable to accept both 5 A & 15 A pin round Standard Indian plugs. They shall be switched sockets with shutters.

3. HAND LAMP

A 240 Volts, single phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

4. INTERIOR LIGHTING

Each panel shall be provided with a LED lighting fixture of Standard Indian type rates for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel during maintenance. The Fitting shall be controlled by the respective panel door switch.

5. SWITCHES AND FUSES

5.1 Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch fuse units. Selection of the main and Sub-circuit fuse rating shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by fuses.

5.2 All fuses be of HRC cartridge type conforming to IS:9228 mounted on plug-in type fuse bases.

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5.3 Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuses carrier base shall have imprints of the fuse rating and voltage.

31. Bushings, Hollow Column Insulators, Support Insulators

1. The bidder shall offer composite silicon rubber polymer insulator for all insulation purpose as per project requirement, conforming to IEC-61109. In case if non-compliance of composite insulators with respect to State/National electricity authorities' guidelines/requirements, the anti-fog type porcelain insulators may be used wherever mandatory. The required deviations with respect to above requirements shall be clearly mentioned in the deviation sheet along with the supporting documents. In absence of such deviations statements, the compliance of this point is mandatory and binding on the vendor.
2. Bushing shall be manufactured and tested in accordance with IS:2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/18 5621. The support insulators shall be manufactured and tested as per IS 2544/IEC 168 and IEC 273. The Insulators shall also conform to IEC 815 as applicable.
3. Following requirements to be fulfilled if anti-fog porcelain insulators are provided as instructed in point 29.1 of this chapter.
 - 3.1 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.
 - 3.2 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.
 - 3.3 Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical and rigidity for the conditions under which they will be used.
 - 3.4 When operating at rated voltage there shall be no electric discharge between the conductors and busing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.
 - 3.5 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and support other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed

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porcelain.

3.6 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

4. TESTS

Bushing hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS:2099 & IS: 2544.

4.1 Technical parameters of bushing/ Hollow column insulators/ support insulators,

Sl. No.	Voltage Class	220kV System	132kV System	66kV System	33kV System
a)	Rated Voltage (kV)	245	145	72.5	36
b)	Impulse withstand voltage (dry and wet) (kVp)	1050	650	325	170
c)	Power frequency with stand voltage (dry and wet (kVrms))	460	275	140	75
d)	Total creepage distance (mm)	25mm/kV			
e)	Pollution	Class – III heavy (as per IEC 71) and as specified in section 2 for all class of equipment.			
f)	Insulator shall also meet requirement of and IEC-815 as applicable having alternate long and short sheds.				

32. Motors

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and conform to type tests and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

1. ENCLOSURES

- Motor to be installed shall have enclosure equivalent to IP 55 as per IS:4691.
- Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
- Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
- Motor weighing more than 25 kg shall be provided with eyebolts, lugs or other means to facilitate lifting.

33. Rating Plates, Name Plates and Labels

Each main and auxiliary item of equipment is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment, type or serial number together

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with details of loading conditions under which the item of equipment in question has been designed to operate and such diagram plates as may be required by the Owner. The rating plate shall conform to IEC requirement.

All such name plates, instruction plates rating plates etc. shall be in bilingual with Hindi inscription first followed by English. Alternatively, two separate plates one with Hindi & the other with English inscription may be provided.

34. Radio Interference Voltage (RIV) Test

1. GENERAL

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for measurement of radio interference voltage (RIV).

2. TEST LEVELS

The test voltage levels for measurement of external RIV are listed under the relevant clauses of the specification.

3. TEST METHOD FOR RIV

3.1 RIV tests shall levels for according to measuring as per International Special-Committee on radio Interference (CISPR) Publication 16-1 (1993) Part-1. The measuring circuit shall preferably be tuned to frequency with 10 % of 0.5 MHz but other frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No.107-1964, except otherwise noted herein.

3.3 In measurement, RIV, temporary additional external shielding may be provided. In measurements of RIV only standard fitting of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing voltages 85%, 100%, 115% and 130% of the specified RIV test voltage for all equipment unless otherwise specified.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

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Annexure-A:

List of Standards and Specifications/ General Standards/ Indian Electricity Rules

- IS-5: Colours for Ready Mixed Paints and Enamels IS-335 Insulating Oil for Transformers and switchgear
- IS-375: Marketing and Arrangement for Bus-bars, Main Connection & Auxiliary Winding
- IS-617: Aluminium and Aluminium alloy & Ingots and Castings for General Engineering Purposes
- IS-1448: Methods of Test for Petroleum and its Products.
- IS-2071: Measuring Devices
- IS-2147: Degree of Protection Provided by Enclosures of for Low voltage switch gear and control Gear
- IS-2165: Phase-to-Phase Insulation Co-ordination, Principles and Rules
- IS-2362: Determination of Water by the Karl fisher Method
- IS-3043: Codes of practice for earthing
- IS-3202: Code of Practice for climate proofing of electrical equipment
- IS-3637: Gas Operated Relays
- IS-6103: Methods of Test for specific resistance (Resistivity) of Electrical Insulating Liquids
- IS-6104: Method of Test for Interfacial Tension of Oil against Water by the Ring Method.
- IS-6262: Method for Determination of Electric strength of insulating liquids.
- IS-6792: Method for Radio Interference Tests on High Voltage Insulators
- IEC-214: On-Load Tap-Changers
- IEC-289: Reactors
- IEC-354: Loading Guide for Oil Immersed power transformers.
- IEC-551: Determination of Transformer and reactor Sound levels
- ANSI-C57, 12, 80: General requirements for Distribution, Power and Regulating Transformers.
- ANSI-C57, 12, 90: Test Code for Distribution, Power and Regulation Transformers.
- ANSI-C57, 16: Terminology & Test Code for current limiting Reactors.
- ANSI-C57, 21: Requirements Terminology and Test Code for Shunt Reactors Rates over 500 KVA.
- ANSI-C57, 92: Guide for loading Oil-Immersed Power Transformer up to and including 100 MVA with 55oC or 65oC Winding Rise
- ANSI-CG, IEEE-4: Standard Techniques for high Voltage Testing
- NEMA-TR-1: Transformers, Regulators and Reactors
- IS-4379: Identification of the Contents of Industrial Gas Cylinders

1. Disconnecting Switches

- IEC-129: Alternating Current Dis-connectors (Isolators) and Earthing switches
- IS-9921: Isolators
- IEC-265: High voltage switches
- ANSI-C37.32: Schedule of preferred Ratings, manufacturing specification and application guide of high voltage air switches, bus supports and switch accessories.

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ANSI-C37.34: Test code for high voltage air switches
NEMA-SG6: Power switching equipment.

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SECTION 4:

Annexure-A: Compliance Certificate of Technical Specification

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.
3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date:

Bidder's Stamp & Signature

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SECTION 4:

Annexure-B: Deviation/ Change Request of Technical Specification

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Bidder's Stamp & Signature

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SECTION 4: Annexure-C: Technical Checklist

Sl. No.	Particulars	Confirmation by Bidder	
1	Technical Qualifying Requirement		
1.1	The bidder to furnish relevant documents for meeting the qualifying requirement. Performance certificates shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/ No
1.2	The technical bid shall be submitted by the Manufacturer of the equipment in case of Indian Manufacturer; however, agent may submit the technical offer in case of foreign manufacturer.	Confirmed	Yes/ No
1.3	All the documents shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/ No
2	Un-priced BOQ		
2.1	Confirm that all items have been quoted separately. (If any item has not been quoted, the same shall be specifically brought out with technical reasons thereof, else offer shall be liable for rejection).	Confirmed	Yes/ No
2.2	Any other supply required for the execution for the complete work of equipment is deemed to be included in the offer, whether specifically mentioned in the specification or not. Bidder to submit list of items along with their respective quantities required for completeness of equipment.	Confirmed (List is attached)	Yes/ No
2.3	Bidder to submit list of consumables with shelf life of less than one year. It shall be supplied before erection after clearance from BHEL/ Customer/ Consultant.	Confirmed (List is attached)	Yes/ No
2.4	Any special tools and tackle, which are specifically required for the equipment and are proprietary in nature shall be included in offer. List of such special tools and tackle should be clearly listed along with the technical offer. Any special tool which is not listed in the list but required during the erection/ testing/ commissioning of Surge Arrestor shall also be deemed in bidder's scope.	Confirmed (List attached)	Yes/ No
3	Technical		
3.1	The isolators shall be a set of three individual poles with one	Confirmed	Yes/ No

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	vertical break earthing blade per pole suitable for fixing on either side of the poles or without any earthing blade.		
4	Technical Deviations		
4.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered.	Confirmed	Yes/ No
5	Bar-chart		
5.1	Bidder shall submit detailed bar chart indicating all the milestones from engineering till manufacturing/ testing, dispatch to site.	Confirmed	Yes/ No
6	Type Test Requirements		
6.1	Bidder shall ensure that the equipment being procured shall be of proven design and should have valid type test certificates as per specified in IS/ IEC standards (amended up to date) at any ISO/IEC/NABL accredited laboratories.	Confirmed	Yes/ No
6.2	Type test certificates shall not be more than seven (7) years old as on original scheduled date of technical bid opening. In those cases, where type test certificates are more than seven (7) years old from original scheduled date of technical bid opening, bidder shall carry out the type tests at any ISO/ IEC accredited laboratories prior to dispatch of equipment with no commercial implication to BHEL/Customer.	Confirmed	Yes/ No
6.3	In case any of Type tests have not been conducted on the offered design or there has been a change in the design after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.	Confirmed	Yes/ No
7	Quality Plan		
7.1	The successful bidder shall submit Quality Assurance Plan etc. with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ Customer.	Confirmed	Yes/ No
7.2	In case bidder has reference Quality Assurance Plan agreed with BHEL/ Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.	Confirmed	Yes/ No
8	Inspection & Testing		
8.1	The equipment shall be subject to inspection by BHEL/	Confirmed	Yes/ No

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	Customer or authorized representative at bidder/manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer.		
8.2	The inspector shall have free access to the manufacturer's/ supplier's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality.	Confirmed	Yes/ No
9	Makes of Equipment/ Components		
9.1	The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.	Confirmed	Yes/ No
9.2	Bidder while ordering shall ensure the availability of spare parts and maintenance support services for the equipment at least for 10 years from the date of supply.	Confirmed	Yes/ No
9.3	Bidder shall give a notice of at least one year to the BHEL/ Customer before phasing out the products/spares to enable the owner for placement of order for spares and services.	Confirmed	Yes/ No

Date:

Bidder's Stamp & Signature