BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-411-316-007	REV 00	PREPARED	CHECKED	APPROVED
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	DKS	VK	AG
TITLE 198kV Surge Arrester with accessories (For 220kV Voltage Class) *(Suitable for highly corrosive environment of process/ petrochemical industry)*		SIGN	*-sd-*	*-sd-*	*-sd-*
		DATE	20.04.2020	20.04.2020	20.04.2020
		GROUP	TBEM		
		WO NO.	I19TB00003 REV00		
CUSTOMER	Indian Oil Corporation Limited (IOCL)				
CONSULTANT	TATA Consulting Engineers Limited (TCE)				
PROJECT	LSTK job for ISBL work of 220KV Grid Power Import at IOCL, Panipat Refinery				
LOA. NO. WO. No.	RPRC182491/26286965 dtd. 24.01.2020 26286965 dtd. 24.01.20120				

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Remarks: It is to be noted that data and details of Guaranteed Technical Particulars (GTP) shall not be reviewed during Technical Evaluation/ Review, hence compliance of Guaranteed Technical Particulars (GTP) in line with Technical Specification shall be deemed to under complete compliance of bidder.

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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 of the equipment (198kV Surge Arrester with its Accessories) 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 Surge Arrestors. However, Surge Arrestors shall conform in all respects to the high Standard of design and workmanship and be capable of performing in continuous commercial operation in a manner acceptable to Purchaser. The Arrestors offered shall be complete with all parts, necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether they are specifically brought out in the technical specification or not.

This section covers the specific technical requirements of the equipment (198kV Surge Arrester with its Accessories). This constitutes minimum technical parameters for the above item as specified by the BHEL/ Customer. The offered equipment (198kV Surge Arrester with its Accessories) 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
- 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 (198kV Surge Arrester with its Accessories) 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 equipment (198kV Surge Arrester with its Accessories) shall comply with the latest editions and amendments of the following standards as applicable, unless otherwise specified,

IS 5:	Colors for ready mixed paints and enamels
IEC: 99-4	Specification Part-4 for Surge Arrestors without gap for AC system.
IS: 3070 (Part-III)	Specification for Lightning Arrestors for alternating current system
IS: 2629	Recommended practice for hot dip galvanising of iron and steel.
IS: 2633	Method for testing uniformity of coating on zinc coated articles.
IS:5621	Specification for large hollow porcelain for use in electrical installation.
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control.

1. For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ISS specification.
2. For the parameters of the Arrestor which are not specified in IEC specification for Surge Arrestors, the provisions of IS: 3070 (Part-I) shall be applicable.

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

The equipment (198kV Surge Arrester with its Accessories) shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

The specific technical requirements for the equipment (198kV Surge Arrester with its Accessories) shall be as follows,

Sl. No.	Technical Parameters	Unit	Particulars
1	Equipment		198kV Surge Arrester with its Accessories
2	Type		Metal oxide gapless type
3	Installation		Outdoor
4	Housing		Porcelain / Polymer
A	**Meteorological data**		
1.1	Maximum ambient temperature	^{0}C	50
1.2	Minimum ambient temperature	^{0}C	-5
1.3	Average ambient temperature	^{0}C	35
1.4	Design ambient temperature	^{0}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 system voltage	kVrms	220
2	Highest system voltage	kVrms	245
3	1.2/50 microsecond impulse voltage withstand level		
	- Transformers and Reactors	kVp	900
	- Other equipment and lines	kVp	1050
4	Minimum prospective symmetrical fault current for 1 second at Arrestor location	kArms	40
5	Anticipated levels of temporary overvoltage and its duration		
	- Voltage	pu	1.5/1.2
	- Duration	Second	1/10
6	Frequency	Hz	50±3%
7	Neutral grounding/ earthing		Effectively earth
8	Number of Phases		Three
C	Technical parameters		
1	Rated Arrestor Voltage	kV	198
2	Maximum continuous operating voltage (MCOV) at 50^0C	kVrms	168
3	Installation		Outdoor
4	Class		Station
5	Type of construction for 10 kA rated Arrestor		Single Column, Single Phase
6	Nominal discharge current corresponding to 8/20microsec wave shape	kArms	10KA
7	Minimum discharge capability		5kJ/kV referred to rated arrester voltage corresponding to minimum discharge characteristics
8	Type of mounting		Pedestal
9	Connection (Between phase to earth P/E) /(Between phase to phase P/P)		P/E
10	Long duration discharge class		3
11	Maximum switching surge protective level/ residual voltage at 1000A	kVp	455
12	Maximum residual voltage for nominal discharge current 10 KA with 8/20 micro second wave	kVp	550
13	Maximum residual voltage steep fronted current impulse at 10kA	kVp	600

14	Minimum prospective symmetrical fault current for pressure relief test	kArms	40
15	Terminal Connector		
	- Suitable for conductor		Single/ Twin ACSR Moose Conductor
	- Take off		Universal (Horizontal/ Vertical)
16	Voltage (corona extinction)		Rated voltage of the Arrestor
17	Maximum radio interference voltage when energized at MCOV	mV	500
18	Whether insulating base and discharge counter with milli-ammeter are required		Yes
19	Minimum creepage distance of Arrestor housing	mm	6125

1. The equipment (198kV Surge Arrester with its Accessories) 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 +5%
   ii) DC Supply-15% to +10%
2. All 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.

4. General Technical Requirements

The general technical requirements for the equipment (198kV Surge Arrester with its Accessories) shall be as follows,

1. The Surge Arrestors shall confirm to the technical requirements of this specification and shall be designed in line with IEC-60099.
2. The energy handling capability of each rating of Arrestor offered, supported by calculations, shall be furnished during detailed engineering stage.
3. The Surge Arrestors shall be fitted with pressure relief devices and arc diverting ports an shall be tested as per the requirements of IEC specification for minimum prospective symmetrical fault current as specified above.
4. The grading ring on each complete Arrestor for proper stress distribution shall be provided if required for attaining all the relevant technical parameters. The suitable mounting insulators shall also be provided with adequate rating and capacity.
5. All accessories such as Insulating Base, Surge Monitor, Corona Ring/ Grading Ring (if required), Insulated copper rod/ strip, Terminal Pad and Fixing Hardware etc.), Terminal Connectors for Surge Arrester (Single Phase) suitable for Single/ Twin ACSR Moose Conductor
6. Terminal Connector shall be suitable for Universal Take Off i.e. suitable for horizontal as well as vertical entry. The conductor shall be as Single/ Twin ACSR Moose Conductor.
7. Insulated copper rod/ strip between Lightning Arrestor and Surge monitor shall be supplied in

single length for all Surge Arresters. (i.e. 4m for 216kV and cross-sectional area of 75sqmm)

8. Fixing Hardware shall include hardware for interunit connector for Surge Arrester, Surge Arrester to Mounting Structure (Structure in BHEL scope), Surge Monitor to Structure and Earthing Hardware etc.
9. Other standard fittings and accessories, which are not specifically mentioned but are usually provided with Surge Arrester of type and rating being offered for efficient and trouble-free operation.
10. Surge Monitor 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.
11. The Surge Arrestors shall be suitable for hot line washing.

5. General Requirements

The general requirements for the equipment (198kV Surge Arrester with its Accessories) 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 Surge Arrestor 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.
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 (198kV Surge Arrester with its Accessories) shall be as per Annexure- 198kV Surge Arrester with its 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 ±30% in line with quantity variation. 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 (198kV Surge Arrester with its Accessories) and furthermore, it shall be used for delay analysis, if any from bidder. The schedule for submission and resubmission shall be in line with details provided in section-3.

1	198kV Surge Arresters- Drawings & Guaranteed Technical Particulars
2	198kV Surge Arresters- Type Test Reports

3	198kV Surge Arresters- Quality Assurance Plan & Inspection Test Schedule

8. Type Testing

Bidder shall ensure that the equipment (198kV Surge Arrester with its Accessories), 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 in line with reference QAP attached in Section-2 for the equipment (198kV Surge Arrester with its Accessories), 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. 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 (198kV Surge Arrester with its Accessories). 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 (198kV Surge Arrester with its Accessories) 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 (198kV Surge Arrester with its Accessories) 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 (198kV Surge Arrester with its Accessories) 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 other details as per purchase order.
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,

MO:	Metal Oxide
ID:	Inner Diameter
OD:	Outer Diameter
MCOV:	Maximum continuous operating voltage
AC:	Alternating Current
DC:	Direct Current
HV:	High Voltage
EHV:	Extra High Voltage
kV:	Kilovolt
Hz:	Hertz
SAT:	Site Acceptance Testing
OEM:	Original Equipment Manufacturer
kV:	Kilovolt
Hz:	Hertz
IP:	Ingress Protection
PE:	Poly Ethylene
ANSI:	American National Standards Institute
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,

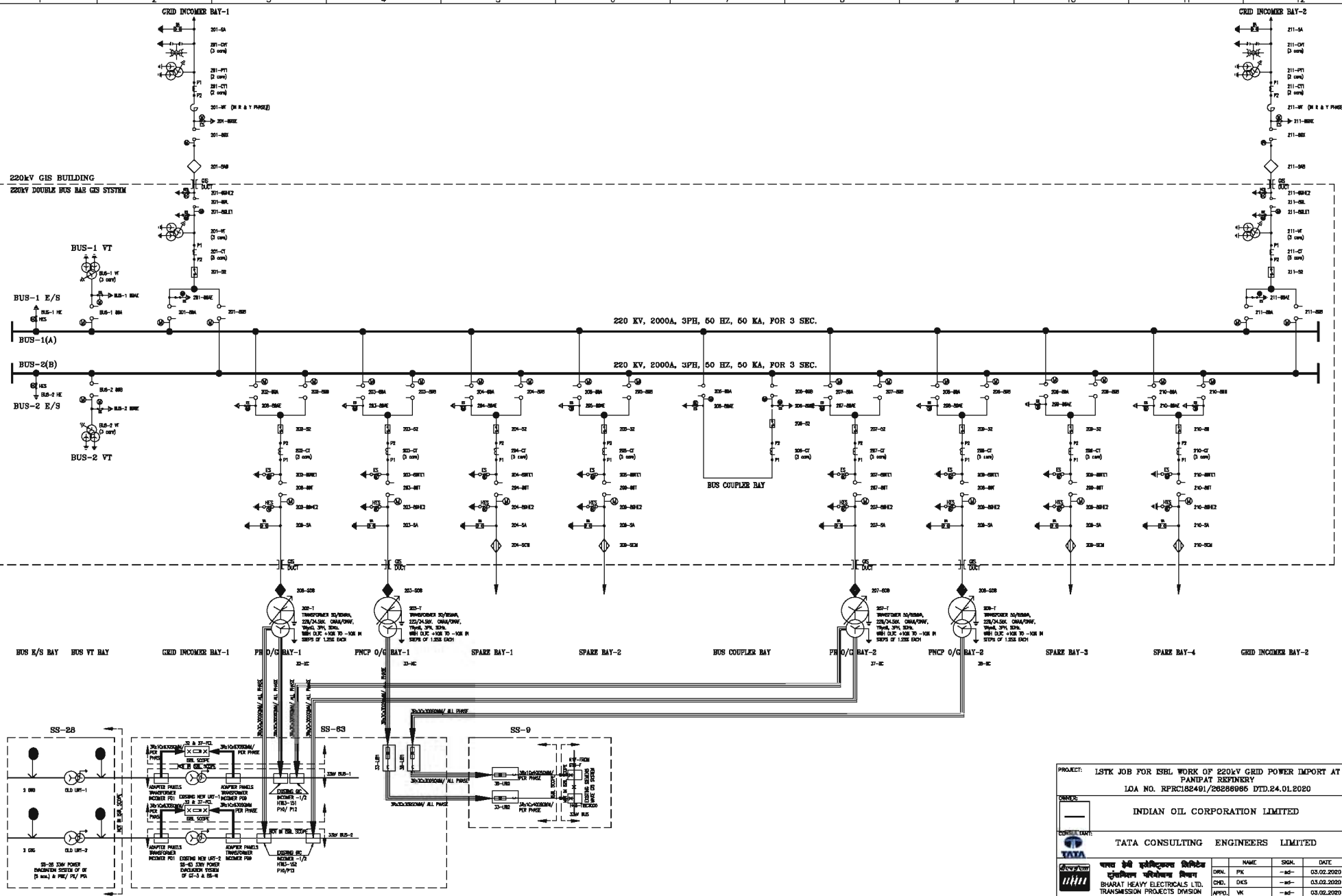
1. TB-411-510-001: 220/33kV Switchyard- Single Line Diagram

Sl. No.	Item Description	Long Description	Unit	Qty.	Remarks
A.1	**Supply Item- Main Items**				
1	198kV, 10kA, 1 Phase, Class-III, 25mm/kV Metal oxide (ZnO) gapless Surge Arrester (SA) complete with all accessories (Corona ring, if applicable, Surge Counter/ Monitor, Insulating Base, Lugs, Fixing & Earthing Hardware etc.) except Terminal Connector and Insulated Connecting Cable.	Metal oxide gapless Surge Arrester (SA) complete in all respects with all accessories comprising of following but not limited to, a. 198kV, 10kA, 1 Phase, Class-III, metal oxide gapless Surge Arrester (SA) complete in all respects. b. All accessories such as Insulating Base, Surge Monitor, Corona Ring/ Grading Ring (if required), Insulated copper rod/ strip, Terminal Pad and Fixing Hardware etc.), Terminal Connectors for Surge Arrester (Single Phase) suitable for Twin/ Single ACSR Moose Conductor c. Terminal Connector shall be suitable for Universal Take Off i.e. suitable for horizontal as well as vertical entry. The conductor shall be Twin/ Single ACSR Moose Conductor. d. Insulated copper rod/ strip between Lightning Arrestor and Surge monitor shall be supplied in single length for all Surge Arresters including Main and Spare items (i.e. 4m for 220kV and cross sectional area of 75sqmm). e. Fixing Hardware shall include hardware for interunit connector for Surge Arrester, Surge Arrester to Mounting Structure (Structure in BHEL scope), Surge Monitor to Structure and Earthing Hardware etc. f. Other standard fittings and accessories, which are not specifically mentioned but are usually provided with Surge Arrester of type and rating being offered for efficient and trouble free operation. g. Each Surge Monitor 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.	No	6	Technical specification shall In line with Section-2/Section-3, Chapter-4 and Annexure-S-3/C-4/7. Criteria/ guidelines for selection of class-III surge arrester shall be submitted.
2	198kV Terminal Connector suitable for single/ Twin ACSR Moose Conductor		No	6	Technical specification shall In line with Section-2/Section-3, Chapter-4 and Annexure-S-3/C-4/7. Criteria/ guidelines for selection of class-III surge arrester shall be submitted.
3	Insulated Cu Cable connecting Surge Arrestre to Surge Monitor.		No	6	Technical specification shall In line with Section-2/Section-3, Chapter-4 and Annexure-S-3/C-4/7. Criteria/ guidelines for selection of class-III surge arrester shall be submitted.
A.2	**Supply Item- Mandatory Spare Items**				
1	198kV, 10kA, 1 Phase, Class-III, Metal oxide gapless Surge Arrester (SA) complete with surge monitor inclusive of discharge counter and ammeter, and insulating base as per specification complete with all accessories	Metal oxide gapless Surge Arrester (SA) complete in all respects with all accessories comprising of following but not limited to, a. 198kV, 10kA, 1 Phase, Class-III, metal oxide gapless Surge Arrester (SA) complete in all respects. b. All accessories such as Insulating Base, Surge Monitor, Corona Ring/ Grading Ring (if required), Insulated copper rod/ strip, Terminal Pad and Fixing Hardware etc.), Terminal Connectors for Surge Arrester (Single Phase) suitable for Twin/ Single ACSR Moose Conductor c. Terminal Connector shall be suitable for Universal Take Off i.e. suitable for horizontal as well as vertical entry. The conductor shall be Twin/ Single ACSR Moose Conductor. d. Insulated copper rod/ strip between Lightning Arrestor and Surge monitor shall be supplied in single length for all Surge Arresters including Main and Spare items (i.e. 4m for 220kV and cross sectional area of 75sqmm). e. Fixing Hardware shall include hardware for interunit connector for Surge Arrester, Surge Arrester to Mounting Structure (Structure in BHEL scope), Surge Monitor to Structure and Earthing Hardware etc. f. Other standard fittings and accessories, which are not specifically mentioned but are usually provided with Surge Arrester of type and rating being offered for efficient and trouble free operation. g. Each Surge Monitor 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.	No	2	Technical specification in line with Section-1, Chapter-2 and Clause 16.2.
2	198kV Terminal Connector suitable for single/ Twin ACSR Moose Conductor		No	1	Technical specification in line with Section-1, Chapter-2 and Clause 16.2.
3	Insulated Cu Cable connecting Surge Arrestre to Surge Monitor.		No	2	Technical specification in line with Section-1, Chapter-2 and Clause 16.2.
	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.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO



PROJECT:	LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY LOA NO. RPRC152491/26256965 DTD.24.01.2020		
OWNER:	INDIAN OIL CORPORATION LIMITED		
CONSULTANT:	TATA CONSULTING ENGINEERS LIMITED		
भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION		NAME	SIGN.	DATE
	DRN.	PK	–ad–	03.02.2020
	CHD.	DKS	–ad–	03.02.2020
	APPD.	VK	–ad–	03.02.2020

REV.	DATE	ALTERED	CHECKED	APPROVED	ZONE
02	13.02.20	PK	DKS	VK	AS PER CUSTOMER COMMENTS DTD. 30.03.2020 DURING MEETING AT IOCL, PANIPAT OFFICE
01	14.02.20	PK	DKS	VK	AS PER HVPNL/IOCL COMMENTS ON DTD. 13.02.2020 IN HVPNL OFFICE.

DEPT. CODE	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TBEM 411	-G/A1/F-	-N.A.-	-N.A.-	-N.A.-	-N.A.-	-N.A.-

TITTLE: 220/33KV SWITCHYARD-SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO.: TB-411-510-001 | REV.: 02

SHT. No 01 | NO. OF SHT. 03

SIZE–A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

A. 220kV OUTDOOR EQUIPMENT

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	198kV, 10kA, CLASS-III, 1 PHASE SURGE ARRESTER (SA)		SA	201, 211.	NO	06
2.	220kV, 8800pF, 1 PHASE CAPACITOR VOLTAGE TRANSFORMER (CVT), (220/ √3kV)/ (110/ √3V)/(110/ √3V)/(110/ √3V)		CVT	201, 211.	NO	08
3.	220kV, 1 PHASE WAVE TRAP, 2000A, 0.5mH #		WT	201, 211.	NO	04
4.	220kV, 1 PHASE TARIFF METERING PT		PT1	201, 211.	NO	06
5.	220kV, 1 PHASE TARIFF METERING CT		CT1	201, 211.	NO	06
6	220kV, 2000A, 1K3 PHASE, HCB ISOLATOR (ELECTRICALLY OPERATED MECHANICALLY GANGED) WITH ONE EARTH SWITCH (ELECTRICALLY OPERATED MECHANICALLY GANGED)		89X	201, 211	SET	02

'#' CUSTOMER TO CONFIRM.

B. 220kV INDOOR GIS

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	220kV, 2000A, 1K3 PHASE CIRCUIT BREAKER		52	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	11
2.	220kV, 2000A, 1K3 PHASE DISCONNECTING SWITCH WITHOUT EARTH SWITCH		89B	201, 202, 203, 204, 205, 207, 208, 209, 210, 211	SET	10
3.	220kV, 2000A, 1K3 PHASE DISCONNECTING SWITCH WITH SINGLE EARTH SWITCH		89A, 89AE 89B, 89BE 89L, 89LE1 89T, 89TE1	BUS-1, BUS-2 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	24
4.	220kV, 2000A, 1K3 PHASE HIGH SPEED/ FAST EARTHING SWITCH		89HE2	BUS-1, BUS-2 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	SET	12
5.	198kV, 10kA, CLASS-III, 1 PHASE SURGE ARRESTER		SA	202, 203, 204, 205, 207, 208, 209, 210	NO	24
6.	220kV, 1 PHASE CURRENT TRANSFORMER		CT	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211.	NO	33
7.	220kV, 1 PHASE VOLTAGE TRANSFORMER		VT	BUS-1, BUS-2, 201, 211	NO	12
8.	220kV, 1 PHASE SF6 TO AIR BUSHING		SAB	201, 211.	NO	06
9.	220kV, 1 PHASE SF6 TO OIL BUSHING		SOB	202, 203, 207, 208.	NO	12
10.	220kV, 1 PHASE SF6 TO CABLE MODULE		SCM	204, 205, 209, 210.	NO	12
11.	220kV, 1 PHASE GIS BUS DUCT		--	201, 202, 203, 204, 205, 206, 207, 208, 209 210 211.	LOT	01

C. 33kV OUTDOOR EQUIPMENT INCLUDING 220/33KV POWER TRANSFORMER

SL.NO.	DESCRIPTION	SYMBOL	LEGEND	BAY NO/LOCATION	UNIT	QTY
1.	220/34.5kV, 50/63MVA, ONAN/ONAF 7%mΩ, 3 PHASE TRANSFORMER WITH OLTC +10% TO -10% IN STEPS OF 1.25% EACH		TR	202/32, 203/33, 207/37, 208/38.	NO	04
2.	33kV AIS LIB PANEL		LIB1, LIB2	33, 38	SET	04
3.	33kV FAULT CURRENT LIMITER PANEL		FCL	33KV BUS-1, 33KV BUS-2	SET	02
4.	33kV(E), 3CX300SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	32, 33, 37, 38.	LOT	01
5.	33kV(E), 1CX400SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	33, 38.	LOT	01
6.	33kV(E), 1CX630SQMM, CU, XLPE, ARMORED CABLE INCLUDING END TERMINATION AND STRAIGHT THROUGH JOINTS		--	33KV BUS-1, 33KV BUS-2	LOT	01

SYSTEM PARAMETERS –

SL. NO.	DATA	220kV SYSTEM	33kV SYSTEM
01	NOMINAL VOLTAGE (kV)	220kV±10%	33kV±6%
02	FREQUENCY (Hz)	50±5%	50±3%
03	SYSTEM EARTHING	SOLIDLY EARTHED	SOLIDLY EARTHED
04	SHORT-TIME CURRENT RATING (kA/Sec)	50kA/3sec	31.5kA/1sec
05	RATED PEAK WITHSTAND CURRENT (kAp)	125	80
06	BASIC INSULATION LEVEL (kVP)	1050	170
07	RATED CURRENT AT 50°C (A)	2000	2500
08	RATED POWER FREQUENCY WITHSTAND VOLTAGE DRY/WET (kVrms)	460	70
09	LIGHTNING IMPULSE WITHSTAND VOLTAGE (kVp)	1050	170
10	CREEPAGE DISTANCE (mm/kV)	25	25
11	MINIMUM AMBIENT TEMPERATURE (°C)	-5°C	-5°C
12	MAXIMUM AMBIENT TEMPERATURE (°C)	+50.0°C	+50.0°C
13	EQUIPMENT DESIGN TEMPERATURE (°C)	+45.0°C	+45.0°C
14	AUXILIARY SUPPLY VOLTAGE (Vac)	415V,3 PHASE/ 240V,1 PHASE	415V,3 PHASE/ 240V,1 PHASE
15	PROETCTION & CONTROL SUPPLY (Vdc) 1. [illegible] SUPPLY 2. CLOSE COIL SUPPLY 3. SPRING CHARGING MOTOR SUPPLY	220 ±5% 220 -70% +110% 220 -80% +110% 220 -80% +110%	220 ±5% 220 -70% +110% 220 -80% +110% 220 -80% +110%

CT/ VT PARAMETERS –

220kV GIS CT DETAILS

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Minimum Rct (Ohms)	Accuracy Class	Purpose
1	[illegible]	-	[illegible]-600	30-60-120	[illegible]	PS	Protection
2	[illegible]	-	2000-1000-500	30-60-120	[illegible]	PS	Protection
3	[illegible]	20	-	-	-	0.2s, ISF ≤ 5	Metering
4	[illegible]	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection
5	[illegible]	-	2000-1000-500	30-60-120	10-5-2.5	PS	Protection

220kV OUTDOOR CT DETAILS

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Minimum Rct (Ohms)	Accuracy Class	Purpose
1	[illegible]	20	-	-	-	0.2s, ISF ≤ 5	Tariff Metering
2	[illegible]	20	-	-	-	0.2s, ISF ≤ 5	Tariff Metering

220kV GIS VT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	[illegible]	3P	50	Protection
2	[illegible]	3P	50	Protection
3	[illegible]	0.2	50	Metering

220kV, 4400pF (+10%, -5%) OUTDOOR CVT DETAILS **

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	[illegible]	3P	50	Protection
2	[illegible]	3P	50	Protection
3	[illegible]	0.2	50	Metering

** IOCL to confirm the capacitance value of CVT

220kV OUTDOOR EMVT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	[illegible]	0.2	50	Tariff Metering
2	[illegible]	0.2	50	Tariff Metering

NOTES:–

1. BAY SEQUENCE FOR GIS TENTATIVE AND MAY CHANGE IN LINE WITH THE REQUIREMENTS OF SERVICE CONTINUITY AND STANDARD DESIGN OF OEM.
2. COMMON TARIFF METERING ROOM (1NO) SHALL BE PROVIDED FOR BOTH INCOMER BAYS
3. LOCATION OF GIS CT IN BAY MAY CHANGE AS PER OEM RECOMMENDATIONS.
4. FOR INDIVIDUAL EQUIPMENT OF GIS & AIS SHALL BE IN LINE WITH TECHNICAL SPECIFICATION. DEVIATION IF ANY SHALL BE TAKEN UP SEPARATELY.
5. TRANSFORMER DETAILS SHALL BE UPDATED AS PER MANUFACTURE'S DRAWINGS.
6. CT/ VT PARAMETERS SHALL BE DEFINED IN SEPARATE DRAWING (DRG. NO TB-3-411-810-001 220/33kV SWITCHYARD - KEY METERING & PROTECTION SINGLE LINE DIAGRAM), HOWEVER TENTATIVE DETAILS ARE PROVIDED.
7. SCHEDULE OF EQUIPMENT COVERS ONLY HV/ CHV EQUIPMENT FOR POWER FLOW THE DETAILS OF OTHER AUXUARY EQUIPMENT SHALL BE COVERED ON OTHER DRAWING/ DOCUMENTS, TO BE COVERED SEPARATELY.
8. THE DETAILS OF PANELS/ EQUIPMENT UNDER CUSTOMER SCOPE MAY CHANGE AS LATER STAGE.
9. # CONFIRMATION FROM CUSTOMER/ HVPNL IS REQUIRED.

REFERENCE DRAWING (S)/ DOCUMENT(S) –

SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
3.	ANNEXURE-7P	220kV GIS- SLD
2.	ANNEXURE-S-2/C-1/5	INTERCONNECTION SLD FOR PR
1.	ANNEXURE-S-2/C-1/6	INTERCONNECTION SLD FOR PNCP POWER EVACUATION FACILITY

PROJECT: LSTK JOB FOR EIL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286885 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

भारत भेल लिमिटेड
ट्रांसमिशन प्रोजेक्ट्स डिवीजन
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRN.	PK	-sd-	03.02.2020
CHD.	DKS	-sd-	03.02.2020
APPD.	VK	-sd-	03.02.2020

DEPT. ITEM CODE	UNTOL. DIMS. OR. ±A/.F.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
411		-N.A.-	-N.A.-	-N.A.-	-N.A.-	-N.A.-

TITLE: 220kV/400kV SWITCHYARD-SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO.: TB-411-810-001 | REV.: 02

SHT. No 02 | NO. OF SHT. 03

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
03	13.02.20	PK / DKS / VK	AS PER CUSTOMER COMMENTS DTD. 30.01.2020 DURING MEETING AT IOCL, PANIPAT OFFICE
01	14.02.20	PK / DKS / VK	AS PER HVPNL/IOCL COMMENTS ON DTD. 13.02.2020 IN HVPNL OFFICE.

COMPUTER FILE NAME | REF. DWG. NO. | SIGN. AND DATE | INVENTORY NO

SIZE – A1

D. 33kV XLPE CABLE AND ACCESSORIES

Sl. No.	33/19kV Cu Cable, minimum sizing for the complete project shall be considered as stated below,	Termination Details		Cable Details		Cable Length Details						Termination Details (For 3C cables, 1set= 3Phase Terminations, and 1C cables, 1no=1 phase termination)							Link Box Details		Clamp Details		Remarks
		From	To	No. of Core (s)	Cable Size (In sqmm)	No. of Runs/ (Phase/ All Phase)	No. of Runs/ Feeder	No. of Feeder	Total No. of Runs	Route Length (In mtrs)	Total Cable Length (In meters)	No. of 220/34.5kV Power Transformer End Termination(s)	No. of 33kV LIB End Termination(s)	No. of 33kV GIC Incomer End Termination(s) (Customer Scope)	No. of 33kV Adapter Panel End Termination(s) (Customer Scope)	No. of 33kV FCL Panel End Termination(s)	No. of 33kV GIS Panel End Termination(s) (Customer Scope)	No. of 33kV Straight Through Joints @500mtrs	Link Box (3-phase) (Source End)	Link Box (3-phase) (Load End)	Trefoil Clamp	Single Clamp	
1	Cabling from 220/34.5kV Power Transformer of 220/33kV Switchyard to PR Generatin Bus (GIC Incomer-1/2 & 3/4) at SS-63	220/34.5kV Power Transformer of 220/33kV Switchyard	PR Generatin Bus at SS-63	3C	300sqmm	1 Run/ All phase	3	4	12	250	3000	12	0	12	0	0	0	6	4	4	0	250	Bonded at one end in single core and at both ends for three core cables.
2	Cabling from 33kV Adapter Panels of Existing URT (URT-1&2) at SS-63 to 33kV FCL (202&207-FCL) for incoming & outgoing at SS-63	33kV Adapter Panels at SS-63 of Existing URT (URT-1&2)	33kV FCL (202&207-FCL) for incoming & outgoing at SS-63	1C	630sqmm	3 Run/ Phase	9	4	36	40	1440	0	0	0	36	36	0	3	4	0	13	0	
3	Cabling from 220/34.5kV Power Transformer of 220/33kV Switchyard to PR Side 33kV LIB at SS-63	220/34.5kV Power Transformer of 220/33kV Switchyard	PR Side 33kV LIB at SS-63	3C	300sqmm	1 Run/ All phase	3	2	6	250	1500	6	6	0	0	0	0	3	2	2	0	250	
4	Cabling from PR Side 33kV LIB at SS-63 to PNCP side 33kV LIB at SS-9	PR Side 33kV LIB at SS-63	PNCP side 33kV LIB at SS-9	3C	300sqmm	1 Run/ All phase	3	2	6	4500	27000	0	12	0	0	0	0	54	2	2	0	4500	
5	Cabling from PNCP side 33kV LIB at SS-9 to PNCP side GIS Generation Bus at SS-9	PNCP side 33kV LIB at SS-9	PNCP side GIS Generation Bus at SS-9	1C	400sqmm	3	9	2	18	80	1440	0	18	0	0	0	18	3	2	0	27	0	
									3Cx300sqmm		31500	18	18	12	0	0	0	63	8	8	0	5000	
									1Cx400sqmm		1440	0	18	0	0	0	18	3	2	0	27	0	
									1Cx630sqmm		1440	0	0	0	36	36	0	3	4	0	13	0	
									Total:		34380	18	36	12	36	36	18	69	14	8	40	5000	

REFERENCE DRAWING (S)/ DOCUMENT(S) –

SL. NO.	DRAWING/ DOCUMENT NO.	DRAWING TITLE
3.	ANNEXURE-7P	220kV GIS- SLD
2.	ANNEXURE-S-2/C-1/5	INTERCONNECTION SLD FOR PR
1.	ANNEXURE-S-2/C-1/6	INTERCONNECTION SLD FOR PNCP POWER EVACUATION FACILITY

PROJECT: LSTK JOB FOR ISBL WORK OF 220kV GRID POWER IMPORT AT PANIPAT REFINERY
LOA NO. RPRC182491/26286965 DTD.24.01.2020

OWNER: INDIAN OIL CORPORATION LIMITED

CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
संचरण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRN.	PK	–sd–	03.02.2020
CHD.	DKS	–sd–	03.02.2020
APPD.	VK	–sd–	03.02.2020

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
02	13.02.20	ALTERED PK / CHECKED DKS / APPROVED VK	AS PER CUSTOMER COMMENTS DTD. 30.03.2020 DURING MEETING AT IOCL, PANIPAT OFFICE
01	14.02.20	ALTERED PK / CHECKED DKS / APPROVED VK	AS PER HVPNL/IOCL COMMENTS ON DTD. 13.02.2020 IN HVPNL OFFICE.

DEPT: TBEM | CODE: 411 | UNTOL. DIMS. GR. -C/M/F- | SCALE: –N.A.– | WEIGHT (KG): –N.A.– | REF. TO ASSY. DRG.: –N.A.– | ITEM NO.: –N.A.– | NO.OF ITEMS: –N.A.–

TITLE: 220/33KV SWITCHYARD-SINGLE LINE DIAGRAM

DRAWING/ DOCUMENT NO.: TB-411-610-001 | REV.: 02

SHT. No 03 | NO. OF SHT. 03

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

SIZE–A1

Comments Resolution Sheet for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 00

Sl. No.	Comment (s)/ Observation(s)	Resolution(s)
A	CONSULTANT	
1	No comments	
B	CONSULTANT	
1	Surge arrestor shall also be provided in the incomer/line bays also in line with the observation point: (f) of mail ref. no.: PR/P&U/DGM(MN-EL)/26286965/2020/3 ; Dt.28.1.20.	It is to be noted that the requirements of surge arrester, if required in line with sytem studies, shall taken care.
2	The no. of FCL is shown as 1 Set instead of the requirement of 2 Set in document no.: TB-1-411-510-001 9 Sheet 02 of 02. Please correct and submit.	Noted and complied.
3	The no. of runs of cable shown in the SLD is still incomplete. Please correct as detailed below, a. Cabling from existing URT to New Fault limiting devices both incoming and outgoing side- 3 Runs per phase per URT X 1 Core X 630 sqmm i.e. total of 18 runs per URT and 36 runs for two URT system b. From SS-9 LIB to SS-9 Generation Board (PNCP): 3 Runs per phase per feeder X 1 Core X400 sqmm i.e. total 9 Runs per feeder and 18 runs for 2 feeders	Noted and complied.

NOTE:

CONTRACTOR IS OBLIGED TO FURNISH THIS SHEET (DULY FILLED UP WITHRESOLUTION TO ALL CUSTOMER/ CONSULTANT COMMENTS ALONGWITH REVISED DRAWINGS

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
A.	CONSULTANT (dtd. 26.03.2020)		
1	General	For tariff metering "Use of only single ratio metering CT will be allowed. Multi core CT are not to be used in any case" as per Appendix-I B, HVPNL guide lines for installation of metering equipment, sr no-ix.	Noted and shall be complied in line Protection Single Line Diagram (TB-411-510-002).
2	General	Client logo missing in title block	Noted and complied.
3	Notes	Following protections to be considered in protection scheme, same to be added in Notes a. Transformer switching Relay b. Trip circuit supervision for both trip coils (195 and 295). c. Master Trip Relay (186 and 286) d. DC supervision relays(80A and 80B). e. Over Fluxing protection f. Non-directional O/C & E/F (50/51; 50N; 51N). g. Oil Surge Relay (OSR) h. SEF relay selection shall have both IDMT and DT based settings	This requirement is not pertaining to this drawing and shall be complied in Protection Single Line Diagram (TB-411-510-002).
4	Sheet-1, Line bay	Lightning Arrester/ LA shall be mentioned instead of SA. Use same symbol in all drawings (TB-3-411-510-002)	Please note as per HVPNL guidelines, it shall be SA only. Please refer latest specification of HVPNL (www.hvpnl.org).
5	Sheet-1, Line bay	For Wave trap '#' symbol is shown. Kindly clarify. Any notes for same to be provided?	Noted and complied.

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
6	Sheet-1, Line bay	ES 201-89XE shall be shown in open position	Please note that this is only symbolic representation, not functional representation.
7	Sheet-1, Line bay	Disconnector 201-89X Motor symbol text direction to be rotated. Kindly check for equipments.	Noted and revised.
8	Sheet-1, Line bay	Equipment symbol & numbering used for SLD & Protection SLD shall be similar.	As per customer/ HVPNL guidelines, line trap shall be outdoor suspension type.
9	Sheet-1, Line bay	Kindly check 201-89HE2 shall be 89LE2 as indicated in drawing.	Pleas note that HE2 is used for decdiacted and separate equipment/ high Speed Earth Switch and hence this symbol is used.
10	Sheet-1, Line bay	201-PT2 shall be mentioned instead of 201-VT as indicated in drawing.	Please note that VT is commonly used symbol/ nomenclature and same has been used.
11	Sheet-1, Line bay	As per drawing no. TB-3-411-510-002, earth switch is provided as 89BE. Please provide in 89A for all bays	Noted.
12	Sheet-1, Line bay	Change all GIS Symbols. Indicated symbols are for not of GIS.	Please note that GIS specifc symbols shall be used in OEM drawings/ documents.

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
13	Sheet-1, Line bay	Kindly check the sequence of equipment w.r.t Protection SLD. In protection SLD, PT2 is place after bus duct, then High speed ES & Isolator with ES.	The sequence of equipment is in line with customer/ HVPNL guidelines.
14	Sheet-1, Line bay	Placing Metering CT & PT between CVT & Wave Trap for communication need to be confirmed with PLCC Vendor whether it will function correctly or not	The sequence of equipment is in line with customer/ HVPNL guidelines.
15	Sheet-1, TR bay	Kindly rename Disconnector with 2 ES as 89TE1, 89T, 89TE2	Noted and complied. Pleas note that HE2 is used for decdiacted and separate equipment/ high Speed Earth Switch and hence this symbol is used.
16	Sheet-1, TR bay	OLTC shall be on HV side of Transformer.	Noted and revised.
17	Sheet-1, TR bay	OLTC Range & Impedance value to be mentioned	Noted and revised.
18	Sheet-1, TR bay	Spelling of Transformer to be corrected	Noted and Revised.
19	Sheet-1, TR bay	Submit separate SLD for 33kV side with Panel Number, Protection details & equipment parameters	Noted and Revised.
20	Sheet-1, TR bay	Transformer 33kV side cable shall be 3Rx1Cx630sqmm / ph shall be mentioned. Also mentioned cable is copper or Aluminium.	Noted and Revised in table of schedule of equipment.

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
21	Sheet-1	1. Adapter is indicated as not in Scope, modify as applicable. 2. Check the requirement of Adapter Panel. If feasibility of connecting is not possibile in existing Switchgear, Adapter Panel shall be proposed. 3. Also providing adapter panel may require cable rerouting, same shall be reflected in 33kV SLD.	Noted and Revised.
22	Sheet-1	CTs and protection (CRP) for spare bays to be provided as per future use, to be confirmed by IOCL	This requirement is not pertaining to this drawing and shall be complied in Protection Single Line Diagram (TB-411-510-002).
23	Sheet-2	GAS SLD to be submitted.	This OEM drawing shall be submitted separately.
24	Sheet-2	Lightning Arrester/ LA shall be mentioned instead of SA. Use same symbol in all drawings (TB-3-411-510-002)	Please note as per HVPNL guidelines, it shall be SA only. Please refer latest specification of HVPNL (www.hvpnl.org).
25	Sheet-2	Wave trap rating shall be 1mH	To be confirmed by Customer/HVPNL.
26	Sheet-2	Bay no shall be revised to 201 for sr no-4,5 & 6 in 220kV OUTDOOR EQUIPMENT	Noted and revised.
27	Sheet-2	All equipments symbol for AIS & GIS shall be different.	OEM drawing for GIS shal be submitted separately having the different symbols for GIS.
28	Sheet-2	Why 89A is shown both rows in 220kV INDOOR EQUIPMENT	Noted and revised.

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
29	Sheet-2	Line VT qty is missing. Qty shall be 12 Nos.	Noted and revised.
30	Sheet-2	GAS insulated bus duct-1 Lot qty shall be added	Noted and revised.
31	Sheet-2	In 33kV OUTDOOR EQUIPMENT TABLE, 220kV Bay numbers. Not applicable for 33kV. Separate SLD for 33kV shall be submitted with Bay/ Feeder numbers. Location shall be indicated with Building/ Substation Numbers	Noted and revised.
32	Sheet-2	33kV termination Not part for 33kV Equipments. Show in separate Table as indicated in drawing	Noted and revised.
33	Sheet-2	In System Parameters frequency variation shall be $\pm$ 3%	This is in line with customer technical specification.
34	Sheet-2	In System Parameters short circuit rating of 33kV system is 31.5kA/1sec as per Section-1, Chapter-11, Cl. No. 5.12	Noted and revised.
35	Sheet-2	In System Parameters rated peak withstand current of 33kv system shall be 80kA	Noted and revised.
36	Sheet-2	In System Parameters BIL of 33kv system shall be 170kVp	Noted and revised.

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
37	Sheet-2	In System Parameters equipment design temperature shall be 50 deg C	This is in line with customer technical specification of Engineering Design Basis.
38	Sheet-2	Protection & control supply shall be +10% & -20%. 1. Trip Coil Operating Range: 220VDC -70% +110% 2. Close Coil Operating Range: 220VDC -80% +110% 3. Spring Charging Motor: 220VDC -80% +110%	This is in line with customer technical specification of Engineering Design Basis. Noted and revised.
39	Sheet-2	Transformer Bushing CT details to be provided	These details shall be updated in line with OEM drawings.
40	Sheet-2	For tariff metering "Use of only single ratio metering CT will be allowed. Multi core CT are not to be used in any case" as per Appendix-I B, HVPNL guide lines for installation of metering equipment, sr no-ix.	This requirement is not pertaining to this drawing and shall be complied in Protection Single Line Diagram (TB-411-510-002).
41	Sheet-2	CT sizing calculation to be submitted.	This requirement shall be submitted in separate design document.
42	Sheet-2	Kindly make CT/VT parameters legible.	Noted and revised.
43	Sheet-2	Kindly mentioned Reference drawing details.	Noted and complied.
44	Sheet-2	Orientation/Section of the CT cores shall be in line as per IOCL comments dtd. 27.02.2020. Same to be followed in Protection SLD.	Noted.
B	CUSTOMER (dtd. 30.03.2020)		

COMMENTS RESOLUTION SHEET for

DRAWING / DOCUMENT TITLE: 220/33kV Switchyard- Single Line Diagram
DOCUMENT NUMBER: TB-411-510-001
REVISION NO: 01

Sl. No.	Drawing Reference Details	Comment (s)/ Observation(s)	Resolution(s)
1		Equipment specification wise detailed drawings to be submitted.	Noted. Individual drawing/ document from OEM shall be submitted for all the equipment.
2		Surge Arrestor in the Incomers of the GIS to be provided in line with if required in the system study.	Noted.
3		The Cable module in the GIS spare outgoing bays suitable cable terminations to be provided fully ready for cable termination with availability of female contact contacts.	Noted.

NOTE:

CONTRACTOR IS OBLIGED TO FURNISH THIS SHEET (DULY FILLED UP WITHRESOLUTION TO ALL CUSTOMER/ CONSULTANT COMMENTS ALONGWITH REVISED DRAWINGS

SECTION 2:
EQUIPMENT SPECIFICATION UNDER SCOPE OF SUPPLIES

1. Technical Specification for 198kV Surge Arrester
2. Technical Specification for 198kV Surge Arrester/ HVPNL- For reference purpose

Both type of construction porcelain/ polymer is acceptable for SA.

Technical Specification for 198kV Surge Arrester

Annex-S-3/C-4/7

SWTCHYARD LIGHTNING ARRESTOR

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.

1.0 SCOPE:

1.1 This specification provides for the design, engineering, manufacture, assembly, stage testing, inspection and testing before dispatch, packing, forwarding, delivery at site, installation, testing and commissioning of Metal Oxide (gapless) 220 KV Surge Arrestors complete with discharge counter, insulating base and other accessories for all rating arresters.

1.2 It is not the intent to specify completely herein all the details of design and construction of Surge Arrestors. However, Surge Arrestors shall conform in all respects to the high Standard of design and workmanship and be capable of performing in continuous commercial operation upto LSTK contractor's guarantee in a manner acceptable to Purchaser. The Arrestors offered shall be complete with all parts, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether they are specifically brought out in the commercial order or not.

2.0 STANDARDS:

2.1 The Surge Arrestors shall conform to the latest editions and amendments available at the time of supply, of the standards listed hereunder.

Sl. No.	Standard Ref. No.	Title
1.	IEC:99-4	Specification Part-4 for Surge Arrestors without gap for AC system.
2.	IS:3070 (Part-III)	Specification for Lightning Arrestors for alternating current system
3.	IS: 2629	Recommended practice for hot dip galvanising of iron and steel.
4.	IS: 2633	Method for testing uniformity of coating on zinc coated articles.
5.	IS:5621	Specification for large hollow porcelain for use in electrical installation.
6.	IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control.
7.	Indian Electricity Rules, 1956.	

Note:

i) For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ISS specification.

ii) For the parameters of the Arrestor which are not specified in IEC specification for Surge Arrestors, the provisions of IS: 3070 (Part-I) shall be applicable.

2.2 Surge Arrestors 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 LSTK contractor confirms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer.

2.3 Each of the foregoing supplies shall be made available by the Purchaser at the terminal point for each equipment for operation of accessories and auxiliary equipment. LSTK contractor'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 ±5%

ii) DC Supply-15% to +10%

4.0 SYSTEM PARAMETERS:

The Surge Arrestors offered under this specification shall conform to the parameters given below:

Sl.	Particulars	System Voltage (KV rms)				
1.	Nominal system voltage (kV rms)	220	132	66	33	11
2.	Highest system voltage (kV rms)	245	145	72.5	36	12
3.	1.2/50 microsecond impulse voltage withstand level					
	a. Transformers and Reactors (kVp)	900	550	325	170	75
	b. Other equipment and lines (kVp)	1050	650	325	170	75
4.	Minimum prospective symmetrical fault current for 1 second at Arrestor location (kA rms)	50	31.5	31.5	40/3 sec	18.4
5.	Anticipated levels of temporary overvoltage and its duration					
	a) Voltage (p.u.)	1.5/1.2	1.5/1.2	1.5/1.2	1.5/1.2	1.5/1.2
	b) Duration (Seconds)	1/10	1/10	1/10	1/10	1/10
6.	System frequency (Hz)	---------- 50 ± 2.5 C/S ----------				
7.	Neutral Grounding	E.E*	E.E*	E.E*	E.E*	E.E*
8.	Number of Phases	---------- Three ----------				

*E/E = Effectively earth

5.0 GENERAL TECHNICAL REQUIREMENTS:

5.1 The Surge Arrestors shall confirm to the technical requirements of this specification and shall be designed in line with IEC-60099

5.2 The energy handling capability of each rating of Arrestor offered, supported by calculations, shall be furnished during detailed engineering stage.

5.3 The Surge Arrestors shall be fitted with pressure relief devices and arc diverting ports and shall be tested as per the requirements of IEC specification for minimum prospective symmetrical fault current as specified in Clause 4.0 (4) above.

5.4 The grading ring on each complete Arrestor for proper stress distribution shall be provided if required for attaining all the relevant technical parameters. The suitable mounting insulators shall also be provided with adequate rating and capacity.

5.5 PROTECTIVE LEVELS:

The basic insulation levels and switching impulse withstand levels of the lines and equipment to be protected, have been specified in clause 4.0, "Principal Parameters". The protective characteristics of the Arrestors offered shall be clearly specified in the schedule of guaranteed technical particulars.

5.6 GENERAL REQUIREMENTS:

5.6.1 The materials and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment are deemed to be included in the scope of supply unless specifically excluded.

5.6.2 Unless otherwise brought out separately by the LSTK contractor in the schedule of deviations the Surge Arrestors offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations. The discrepancies between the specification and the catalogues or literature submitted as part of the shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

5.6.3 Any deviation which has not been specifically brought out in the schedule of deviations of the Bid Proposal Sheets, shall not be given effect to. The deviations brought out in the schedule shall be supported by authentic documents, standards and other references.

5.6.4 Each individual unit of Surge Arrestor shall be hermetically sealed and fully protected against ingress of moisture. The hermetic seal shall be effective for the entire life time of the Arrestor and under the service conditions as specified. The LSTK contractor shall furnish sectional view of the Arrestor, showing details of sealing employed.

5.6.5 The LSTK contractor shall furnish during the detailed engineering and approval stage, a sectional view of pressure relief device employed in the Surge Arrestors offered.

5.6.6 The Surge Arrestors shall be suitable for hot line washing.

5.7 CONSTRUCTION:

5.7.1 All the units of Arrestors of same rating shall be inter-changeable without adversely affecting the performance.

5.7.2 The Surge Arrestors shall be suitable for pedestal type mounting.

5.7.3 All the necessary flanges, bolts, nuts, clamps etc., required for assembly of complete Arrestor with accessories and mounting on support structure to be supplied by the Purchaser, shall be included in LSTK contractor's scope of supply.

5.7.4 The drilling details for mounting the Arrestor on Purchaser's support shall be provided by the LSTK contractor.

5.7.5 The minimum permissible separation between the Surge Arrestor and any earthed object shall be indicated by the LSTK contractor during detailed engineering and approval stage.

5.8 PORCELAIN HOUSING:

5.8.1 All porcelain housings shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths.

5.8.2 The porcelain shall be well vitrified and nonporous.

5.8.3 The Creepage distance of the Arrestor housing shall be as per IEC-60099 only.

5.8.4 The porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc., shall be indicated by the LSTK contractor during detailed engineering and approval stage in the form of a detailed drawing.

5.8.5 The Arrestor housing shall confirm to the requirements of IEC/ISS specification.

5.9 GALVANISATION, NICKEL PLATING ETC.:

5.9.1 All ferrous parts exposed to atmosphere shall be hot dip galvanised as per IS:2629 as amended from time to time., Tinned copper/brass lugs shall be used for internal wiring of discharge counter. Screws used for electrical connections shall be either made of brass or nickel plated.

5.9.2 Ground terminal pads and name plate brackets shall be hot dip galvanised.

5.9.3 The material shall be galvanised only after completing all shop operations.

5.10 ACCESSORIES AND FITTINGS:

5.10.1 Discharge counters shall be provided for the Arrestors and measuring the leakage current and shall not require any DC or AC Aux. supply. It shall be suitable for outdoor use. The installation of discharge counter shall not adversely affect the Arrestor performance.

5.10.2 The discharge counter shall register operation whenever lightning or any other type of surge strikes the Surge Arrestor.

5.10.3 All necessary accessories and Earthing connection leads between the bottom of the Arrestor and the discharge counter shall be in the LSTK contractor's scope of supply. The connecting lead between discharge counter and Surge Arrestor shall be of copper flexible tape of size 25x4 mm and minimum of 1.5 meter length. The discharge counter shall be so designed that the readings of discharges recorded by the counter and the readings of milli-ammeter shall be clearly visible through an inspection window to a person standing on ground. The minimum height of Purchaser's support shall be 2.5

Mts. Terminal connector conforming to IS:5561 shall be supplied along with the arrester.

5.11 Each Surge Counter 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.

5.11.1 Suitable grounding terminal shall be provided for earthing of surge arrestors up to water level. Proper functioning of the Surge counter with Surge Arrestor shall be ensured by the LSTK contractor.

5.12 NAME PLATE:

The arrestor shall be provided with non-corrosive legible name plate indelibly marked with the following information:

1. IOCL Panipat.
2. Order No.
3. LSTK contractor's name or trade mark and identification no. of the Arrestor being supplied.
4. Rated voltage.
5. Maximum continuous operating voltage.
6. Type.
7. Rated Frequency.
8. Nominal discharge current.
9. Long duration discharge class.
10. Pressure relief current in kA rms.
11. Year of manufacture.

6.0 TESTS:

6.1 TYPE TESTS:

Following type test reports, as specified in IEC standard (amended up to date) shall be submitted for the offered type, rating of equipments invariably at the time of inspection for verification by TPI with/without owner's representatives. The type test reports shall not be older than Seven years and shall be valid up to expiry of validity of offer. The type test must have been carried out at any ISO/IEC/NABL accredited laboratories.

i.) Insulation withstand test.
ii.) Residual voltage test.
iii.) Long duration current impulse withstand test.
iv.) Operating duty test.
v.) Pressure relief test.
vi.) Test of arrestor dis-connector.
vii.) Artificial pollution test on porcelain housed arrestors.
viii.) Temperature cycle test on porcelain housed arrestors.
ix.) Porosity test on porcelain house arrestors.
x.) Galvanising test on exposed ferrous metal parts.

6.2 ROUTINE TESTS:

As per quality assurance program (QAP).

Additionally the following routine test shall be performed in the presence of authorized Third Party Agency (TPI):

i.) Tests for satisfactory operation of surge counter while discharging surges.
ii.) Test for correctness of leakage current meter before and after the passage of surges.
iii.) Visual examination tests.

6.3 ACCEPTANCE TESTS:
The following acceptance tests as stipulated in the relevant IS:3070 (PART-III) 1993 shall be carried out by the LSTK contractor on one item for each type in presence of authorized Third Party Agency (TPI):

i.) Measurement of power frequency reference voltage.
ii.) Lightening impulse residual voltage test.
iii.) Partial discharge test.

7.0 INSPECTION

The inspection may be carried out by the TPI agency only.

The successful LSTK contractor shall grant free access to the IOCL PANIPAT's representative/TPI at all times to the works and all other places of manufacture, where equipment are being manufactured and the Contractor shall provide all facilities without extra charges, for unrestricted inspection of the Contractor's works, raw materials, manufacture of the equipment., all the accessories and for conducting necessary test as detailed herein.

8.0 DOCUMENTATION: The document schedule for this section shall follow the following vendor data requirement schedule.

Sr. No	Description with bids	With Bids	Post order		Final documents with equipments	
			For review	For records	soft copy	Prints
1	General outline drawings of the complete Arrestors		x	x	x	x
	a.GA drawings (Elevation and Plan)		x	x	x	x
	b.Drawing showing clearance from grounded and other live objects and between adjacent poles of Surge Arrestors		x	x	x	x
	c. Cross Sectional View		x	x	x	x
	d.Drawings showing details of pressure relief devices		x		x	x
	e.Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter		x			x
	f. Outline drawing of insulating base		x	x		x
	g. Details of grading rings, if used		x	x		x

	h. Mounting details of Surge Arrestors		**x**	**x**		**x**
	i. Details of line terminal and ground terminals.		**x**	**x**	**x**	**x**
	j. The detailed dimensional drawing of porcelain housing (if applicable) such as ID, OD, thickness and insulator details such height, profile of petticoats, angle of inclination and gap between successive petticoats, total Creepage distance.		**x**	**x**	**x**	**x**
2	Volt-time characteristics of Surge Arrestors		**x**		**x**	**x**
3	Sizing Calculations (MCOV) and residual voltage at NDC		**x**	**x**		**x**
4	Inspection Plan and testing procedure (For review by inspection) & QAP		**x**			**x**
5	Type Test Certificate		**x**	**x**		**x**
6	List of Commissioning spares		**x**		**x**	**x**
7	a. Installation and Maintenance manual			**x**		**x**
	b. Operating/Maintenance manual			**x**		**x**
	c. Catalogues/ Brochures			**x**		**x**
8	Equipment storage procedure at site					**x**

GAURANTEED TECHNICAL PARAMETERS: MO GAPLESS SURGE ARRESTORS

Sr. No.	Particulars	System Voltage wise requirement of parameters				
		220kV	132kV	66kV	33kV	11kV
1.	Rated Arrestor Voltage	198	120	60	30	9
2.	M.C.O.V. (kV rms)	168	104	49	25	7
3.	Installation	---------- Outdoor ----------				
4.	Class	as recommended by IEC				
5.	Type of construction	----------Single Column, Single Phase----------				
6.	Nominal discharge current corres-ponding to 8/20 microsec wave shape (kA rms)	10KA	10 KA	10KA	10KA	10 kA
7.	Min. discharge capability.	5 KJ/kV (Referred to rated arrester voltage corresponding to Min. discharge characteristics)				
8.	Type of mounting	---------- Pedestal ----------				
9.	Connection (Between phase to earth P/E) (Between phase to phase P/P)	P/E	P/E	P/E	P/E	P/E
10.	Long duration class	3	3	3	2	1 discharge
11.	Max. Switching Surge Protective level voltage at 1000 Amp.	455	280	140	70	21 kV(P)
12.	Max. residual voltage NDC:10 KA with 8/20 micro	550	340	170	85	25 kV(P)
13.	Max.residual voltage steep fronted current impulse of 10 KA	600	372	186	93	28 kV(P)
14.	Minimum pros- symmetr fault current for press relief test (kA rms)	40	31.5	31.5	26.3	18.4
15.	Terminal Connector conductor size	----------As per OSBL---------- suitable for ACSR				

16.	Maximum radio interference voltage (Microvolt) when energized at MCOV	----------	----------	500	----------	----------
17.	Whether insulating base and discharge counter with milli-ammeter are required.	Yes	Yes	Yes	Yes	Yes
18.	Minimum creepage distance of Arrester housing (mm)	6125	3625	1813	900	300

HARYANA VIDYUT PRASARAN NIGAM LTD.

Technical Specification for 198kV Surge Arrester/ HVPNL- For reference purpose

SPECIFICATION NO. HGD-S-759/DGM-511/R-2

TECHNICAL SPECIFICATION

FOR

198/120/60/30/9 KV SURGE ARRESTORS

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

AUGUST-2018

TECHNICAL SPECIFICATION FOR SURGE ARRESTORS (LIGHTNING ARRESTORS)

1.0 SCOPE:

1.1 This specification provides for the design, engineering, manufacture, assembly, stage testing, inspection and testing before despatch, packing, forwarding and delivery at site of Metal Oxide (gapless) 198 kV, 120 kV, 60 kV, 30 kV & 9 kV Surge Arrestors complete with discharge counter, insulating base and other accessories for all rating arresters except 9 kV & 30 kV surge arrester as specified hereunder.

1.2 It is not the intent to specify completely herein all the details of design and construction of Surge Arrestors. However, Surge Arrestors shall conform in all respects to the high Standard of design and workmanship and be capable of performing in continuous commercial operation upto Bidder's guarantee in a manner acceptable to Purchaser. The Arrestors offered shall be complete with all parts, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether they are specifically brought out in the commercial order or not.

2.0 STANDARDS:

2.1 The Surge Arrestors shall conform to the latest editions and amendments available at the time of supply, of the standards listed hereunder.

Sl. No.	Standard Ref. No.	Title
1.	IEC:99-4	Specification Part-4 for Surge Arrestors without gap for AC system.
2.	IS:3070 (Part-III)	Specification for Lightning Arrestors for alternating current system
3.	IS: 2629	Recommended practice for hot dip galvanising of iron and steel.
4.	IS: 2633	Method for testing uniformity of coating on zinc coated articles.
5.	IS:5621	Specification for large hollow porcelain for use in electrical installation.
6.	IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control.
7.	Indian Electricity Rules, 1956.	

Note:

i) For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ISS specification.

ii) For the parameters of the Arrestor which are not specified in IEC specification for Surge Arrestors, the provisions of IS: 3070 (Part-I) shall be applicable.

2.2 Surge Arrestors 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 conforms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer. Four (4) copies of the reference standards in English language shall be furnished along with the offer.

3.0 CLIMATIC CONDITIONS:

The equipment is required to operate satisfactorily under the following site condition:

i) Temperature
   a) Maximum — 50^0C
   b) Minimum — -2.5^0C

ii) Relative Humidity
   a) Maximum — 100%
   b) Minimum — 26%

iii)	Isocerounic level	45
iv)	Approx. no. of rainy days/year	120 days nearly
v)	Average rain fall/year	900 mm
vi)	Altitude above mean sea level	Below 1000 meters
vii)	Max. wind pressure	195 Kg./m^2
viii)	Average number of dust storm days per annum	35

The reference ambient temperature may be taken as 50^0 C.

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

Each of the foregoing supplies shall be made available by the Purchaser 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 ± 5%

ii) DC Supply-15% to +10%

4.0 SYSTEM PARAMETERS:

The Surge Arrestors offered under this specification shall conform to the parameters given below:

Sl. No.	Particulars	System Voltage (KV rms) 220	132	66	33	11
1.	Nominal system voltage (kV rms)	220	132	66	33	11
2.	Highest system voltage (kV rms)	245	145	72.5	36	12
3.	1.2/50 microsecond impulse voltage withstand level					
	a. Transformers and Reactors (kVp)	900	550	325	170	75
	b. Other equipment and lines (kVp)	1050	650	325	170	75
4.	Minimum prospective symmetrical fault current for 1 second at Arrestor location (kA rms)	40	31.5	31.5	25/31.5**	18.4
5.	Anticipated levels of temporary overvoltage and its duration					
	a) Voltage (p.u.)	1.5/1.2	1.5/1.2	1.5/1.2	1.5/1.2	1.5/1.2
	b) Duration (Seconds)	1/10	1/10	1/10	1/10	1/10

6.	System frequency(Hz)	---------- 50 ± 2.5 C/S ----------				
7.	Neutral Grounding	E.E*	E.E*	E.E*	E.E*	E.E*
8.	Number of Phases	---------- Three ----------				

*E/E = Effectively earth

** i. 25kA –for 66kV,132kV & existing 220kV S/Stns.
ii. 31.5KA –for new 220kV S/Stns.

5.0 GENERAL TECHNICAL REQUIREMENTS:

5.1 The Surge Arrestors shall conform to the technical requirements as per Annexure-II

5.2 The energy handling capability of each rating of Arrestor offered, supported by calculations, shall be furnished in the offer.

5.3 The Surge Arrestors shall be fitted with pressure relief devices and arc diverting ports and shall be tested as per the requirements of IEC specification for minimum prospective symmetrical fault current as specified in Clause 4.0 (4).

5.4 The grading ring on each complete Arrestor for proper stress distribution shall be provided if required for attaining all the relevant technical parameters.

5.5 PROTECTIVE LEVELS:

The basic insulation levels and switching impulse withstand levels of the lines and equipment to be protected, have been specified in clause 4.0, "Principal Parameters". The protective characteristics of the Arrestors offered shall be clearly specified in the schedule of guaranteed technical particulars.

5.6 GENERAL REQUIREMENTS:

5.6.1 The materials and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment are deemed to be included in the scope of supply unless specifically excluded.

5.6.2 Unless otherwise brought out separately by the Bidder in the schedule of deviations the Surge Arrestors offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations. The discrepancies between the specification and the catalogues or literature submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

5.6.3 Any deviation which has not been specifically brought out in the schedule of deviations of the Bid Proposal Sheets, shall not be given effect to. The deviations brought out in the schedule shall be supported by authentic documents, standards and other references.

5.6.4 Each individual unit of Surge Arrestor shall be hermetically sealed and fully protected against ingress of moisture. The hermetic seal shall be effective for the entire life time of the Arrestor and under the service conditions as specified. The Bidder shall furnish sectional view of the Arrestor, showing details of sealing employed.

5.6.5 The Bidder shall furnish in the offer, a sectional view of pressure relief device employed in the Surge Arrestors offered.

5.6.6 The Surge Arrestors shall be suitable for hot line washing.

5.7 CONSTRUCTION:

5.7.1 All the units of Arrestors of same rating shall be inter changeable without adversely affecting the performance.

5.7.2 The Surge Arrestors shall be suitable for pedestal type mounting.

5.7.3 All the necessary flanges, bolts, nuts, clamps etc., required for assembly of complete Arrestor with accessories and mounting on support structure to be supplied by the Purchaser, shall be included in Bidder's scope of supply.

5.7.4 The drilling details for mounting the Arrestor on Purchaser's support shall be supplied by the Supplier.

5.7.5 The minimum permissible separation between the Surge Arrestor and any earthed object shall be indicated by the Bidder in his offer.

5.8 PORCELAIN HOUSING:

5.8.1 All porcelain housings shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths.

5.8.2 The porcelain shall be well vitrified and nonporous.

5.8.3 The Creepage distance of the Arrestor housing shall be as per Annexure-I.

5.8.4 The porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc., shall be indicated by the Bidder in his offer in the form of a detailed drawing.

5.8.5 The Arrestor housing shall conform to the requirements of IEC/ISS specification.

5.9 GALVANISATION, NICKEL PLATING ETC.:

5.9.1 All ferrous parts exposed to atmosphere shall be hot dip galvanised as per IS:2629 as amended from time to time., Tinned copper/brass lugs shall be used for internal wiring of discharge counter. Screws used for electrical connections shall be either made of brass or nickel plated.

5.9.2 Ground terminal pads and name plate brackets shall be hot dip galvanised.

5.9.3 The material shall be galvanised only after completing all shop operations.

5.10 ACCESSORIES AND FITTINGS:

5.10.1 Discharge counters shall be provided for the Arrestors except for 9 kV and 30 kV Arresters The discharge counter shall be provided with milli-ammeter for measuring the leakage current and shall not require any DC or AC Aux. supply. It shall be suitable for outdoor use. The installation of discharge counter shall not adversely affect the Arrestor performance.

5.10.2 The discharge counter shall register operation whenever lightning or any other type of surge strikes the Surge Arrestor.

5.10.3 All necessary accessories and Earthing connection leads between the bottom of the Arrestor and the discharge counter shall be in the Bidder's scope of supply. The connecting lead between discharge counter and Surge Arrestor shall be of copper flexible tape of size 25x4 mm and minimum of 1.5 meter length. The discharge counter shall be so designed that the readings of discharges recorded by the counter and the readings of milli-ammeter shall be clearly visible through an inspection window to a person standing on ground. The minimum height of Purchaser's support shall be 2.5 Mts. Terminal connector conforming to IS:5561 shall be supplied along with the arrester.

5.11 Each Surge Counter 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.

5.11.1 Suitable grounding terminal shall be provided for earthing of surge arrestors up to water level. Proper functioning of the Surge counter with Surge Arrestor shall be ensured by the Supplier.

5.12 NAME PLATE:

The arrestor shall be provided with non-corrosive legible name plate indelibly marked with the following information:

1. Haryana Vidyut Prasaran Nigam Ltd.
2. Order No.
3. Manufacturer's name or trade mark and identification no. of the Arrestor being supplied.
4. Rated voltage.
5. Maximum continuous operating voltage.
6. Type.
7. Rated Frequency.
8. Nominal discharge current.
9. Long duration discharge class.
10. Pressure relief current in kA rms.
11. Year of manufacture.

6.0 TESTS:

6.1 TYPE TESTS:

The equipment should be offered type test. Test reports should not more then 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 withstand test.
ii.) Residual voltage test.
iii.) Long duration current impulse withstand test.
iv.) Operating duty test.
v.) Pressure relief test.
vi.) Test of arrestor dis-connector.
vii.) Artificial pollution test on porcelain housed arrestors.
viii.) Temperature cycle test on porcelain housed arrestors.
ix.) Porosity test on porcelain house arrestors.
x.) Galvanising test on exposed ferrous metal parts.

6.2 ROUTINE TESTS:

As per quality assurance program (QAP).

6.3 ACCEPTANCE TESTS:

The following acceptance tests as stipulated in the relevant IS:3070 (PART-III) 1993 shall be carried out by the Supplier in presence of HVPNL representative, unless dispensed with in writing by the HVPNL.

i.) Measurement of power frequency reference voltage.
ii.) Lightening impulse residual voltage test.
iii.) Partial discharge test.

6.4 SURGE MONITOR

The following routine test shall be performed in the presence of HVPNL's representative:

i.) Tests for satisfactory operation of surge counter while discharging surges.
ii.) Test for correctness of leakage current meter before and after the passage of surges.
iii.) Visual examination tests.

7.0 INSPECTION

7.1 The inspection may be carried out by the HVPNL at any stage of manufacture. The successful Bidder shall grant free access to the HVPNL's representative at all times to the works and all other places of manufacture, where equipment are being manufactured and the Contractor shall provide all facilities without extra charges, for unrestricted inspection of the Contractor's works, raw materials, manufacture of the equipment., all the accessories and for conducting necessary test as detailed herein.

7.2 The Contractor shall keep the HVPNL informed in advance, about the manufacturing program so that arrangement can be made for inspection.

7.3 No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

7.4 The HVPNL reserves the right to insist for witnessing the acceptance/routine testing of the bought out items.

7.5 The Contractor shall submit their internal inspection report containing manufacturer's test certificates before offering the material for inspection.

7.6 The acceptance of any quantity of 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:

8.1 The successful bidder shall submit four sets of following drawings for HVPNL approval.

List of drawings:-

i.) General outline drawings of the complete Arrestors with technical parameters.
ii.) Drawing showing clearance from grounded and other live objects and between adjacent poles of Surge Arrestors, required at various heights of Surge Arrestors.

iii.) Drawings showing details of pressure relief devices.
iv.) Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter.
v.) Outline drawing of insulating base.
vi.) Details of grading rings, if used.
vii.) Mounting details of Surge Arrestors.
viii.) Details of line terminal and ground terminals.
ix.) Volt-time characteristics of Surge Arrestors.
x.) Details of galvanising being provided on different ferrous parts.
xi.) The detailed dimensional drawing of porcelain housing such as ID, OD, thickness and insulator details such height, profile of petticoats, angle of inclination and gap between successive petticoats, total Creepage distance etc.,

NOTE: All above drawings should bear 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 i) Four copies of acceptance test reports shall be furnished to the Purchaser. One copy will be returned, duly certified by the Purchaser and only thereafter shall the materials be despatched.
ii) All records of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Purchaser.
iii) All test reports of tests conducted during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when requested for by the Purchaser.

NOTE: In case the equipment offered by the Supplier does not meet with the requirement of technical specification the offer of the Firm shall not be considered.

ANNEXURE - I
(Surge Arrestors)
SHEET 1 OF 3

TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTORS

Sl. No.	Particulars	System voltagewise requirement of parameters				
		220 kV	132 kV	66 kV	33 kV	11KV
1.	Rated Arrestor Voltage	198	120	60	30	9
2.	M.C.O.V. (kV rms)	168	104	49	25	7
3.	Installation	---------- Outdoor ----------				
4.	Class	--------- ---------- Station Class ----------				
5.	Type of construction for 10 kA rated Arrestor.	---------- ---------- Single Column, Single Phase---				
6.	Nominal discharge current corresponding to 8/20 microsec wave shape (kA rms)	10KA	10 KA	10KA	10KA	10 kA
7.	Min. discharge capability.	5 KJ/kV (Referred to rated arrester voltage corresponding to Min. discharge characteristics)				
8.	Type of mounting	---------- Pedestal ----------				
9.	Connection (Between phase to earth P/E) (Between phase to phase P/P)	P/E	P/E	P/E	P/E	P/E
10.	Long duration discharge class	3	3	3	2	1
11.	Max. Switching Surge kV(P) Protective level voltage at 1000 Amp.	455	280	140	70	21
12.	Max. residual voltage kV(P) for nominal discharge current 10 KA with 8/20 micro second wave	550	340	170	85	25
13.	Max.residual voltage kV(P) steep fronted current impulse of 10 KA.	600	372	186	93	28
14.	Minimum prospective symmetrical fault current for pressure relief test (kA rms)	40	31.5	31.5	25/31.5**	18.4

** i. 25kA –for 66kV,132kV & existing 220kV S/Stns.
ii. 31.5KA –for new 220kV S/Stns.

TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTORS

Sl. No.	Particulars	System voltagewise requirement of parameters				
		220 kV	132 kV	66 kV	33 kV	11KV
15.	a) Terminal Connector suitable for ACSR conductor size	----------Single Zebra----------				
	b) Take off	Vertical	Vertical	Vertical	vertical	vertical
16.	Voltage (kV rms) (corona extinction)	Rated voltage of the Arrestor				
17.	Maximum radio interference voltage (Microvolt) when energised at MCOV	---------- 500 ----------				
18.	Whether insulating base and discharge counter with milli-ammeter are required.	Yes	Yes	Yes	Yes	Yes
19.	Minimum creepage distance of Arrestor housing (mm)	6125	3625	1813	900	300

ANNEXURE 'A'

TECHNICAL AND GUARANTEED PARTICULARS FOR LIGHTNING ARRESTORS.

1.	Name of the manufacturer	
2.	Country of origin	
3.	Standard specification on which performance is based.	
4.	Manufacturer's type designation	
5.	Rated voltage (rms)	KV
6.	Continuous operating voltage	KV
7.	Reference voltage	KV
8.	Watt-loss at continuous operating voltage	Watt/ KV
9.	Watt-loss at rate voltage	Watt/ KV
10.	Leakage current at C.O.V.	MA
11.	Leakage current at rated voltage	MA
12.	Nominal discharge current (8/20 micro second wave)	KA
13.	Reference current	A
14.	Max. residual voltage for 8/20 micro second discharge current a) at 0.5 times nominal discharge current b) at nominal discharge current c) at twice the nominal discharge current	 KV(Peak) KV(Peak) KV(Peak)
15.	Max. switching surge protective with front level voltage at 500 Amp.	KVP
16.	Steep/current impulse residual voltage test with 1 micro second front time current wave of 10 KA Peak	KVP
17.	High current impulse withstand (4/10 micro second wave)	KAP
18.	Long duration current impulse rating: a) Peak current b) Virtual duration of peak c) Line discharge class of arrestor	 A Micro second.
19.	Power frequency voltage withstand of arrestor insulation(rms) a) dry b) wet	 KV KV
20.	Total creepage distance	mm
21.	Lightning impulse withstand voltage of arrester	KVP
22.	Type of non-linear resistor disc. Size (dia, height)	Dia mm height mm KV
23.	No. of non-linear discs. Per section of arrester	No.
24.	No. of sections in one arrester	No.
25.	Material of retainer use inside lightning arrester bakelite, ceramic, rubber or other material.	
26.	Is pressure relief device provided, if so, its class?	
27.	Overall dimensions: a) Height b) Diameter	 mm mm
28.	Net weight	Kg.
29.	Cantilever strength	Kg.m
30.	Are the live and earth ends of arrester suitable for jumper/flats as specified?	
31.	Any other technical data	
32.	Temporary power frequency over voltage withstand capability for arresters: For 0.1 second For 1.0 second For 10.00 seconds For 100.00 seconds	

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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,

Sl. No.	Technical Parameters	Unit	Particulars
1	Location	Panipat, Haryana, India	
1.1	Maximum ambient temperature	^{0}C	50
1.2	Minimum ambient temperature	^{0}C	-5
1.3	Average ambient temperature	^{0}C	35
1.4	Design ambient temperature	^{0}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 conductive 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.

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 inter changeable 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.

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 from 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.

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 from 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

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

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

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

5.7 OTHER REQUIREMENTS OF DOCUMENTATION

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

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

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

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

5.8 TITLE BLOCK

Title block for project shall be as follows,

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

8. Colour Scheme and Codes

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

- 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 ardent 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

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.

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 gale. 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 if 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

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 if 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

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.

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

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 contractor 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.

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 liked is 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 notices 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

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.

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,

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.

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

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 then 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

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.

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

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 though 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.

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 2544/1EC 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 vilified 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 as metal or glazed

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
   a) Motor to be installed shall have enclosure equivalent to IP 55 as per IS:4691.
   b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
   c) 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.
   d) 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

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 ratio 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.

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 earning
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. Circuit Breakers

IEC-56: High Voltage Alternating Current Circuit Breakers
IS 13118/ IEC-427: Synthetic Testing of high voltage alternating current circuit breakers

2. Current Transformers, Voltage Transformers and Coupling Capacitor Voltage Transformers

IS-2705: Current Transformers
IS-3156: Voltage Transformers
IS-7311: Coupling capacitor and capacitor divider
IEC-185: Current transformers
EC-186A: Voltage Transformers
IEC-186B: Coupling capacitors and capacitor dividers
IEC-44: Instrument Transformers measurement of Partial discharges
IEC-481: Requirements for instrument transformers
ANSI-C93.1: Requirements for power line carrier coupling capacitor

3. Bushing Insulators

IS-2099: Bushing for alternating Voltages above 1000V
IEC-137: Insulated Bushings for Alternating voltages above 1000 V
IEC-61109: Composite Silicon Rubber polymer insulators.
IEC-60437: Radio Interference Test on High voltage Insulators
IEC-60507: Artificial pollution test on high voltage insulators to be used on AC systems
IEC-60815: Guide for the selection of insulators in respect of polluted conditions.
IEC-61952: Insulators for overhead lines, composite line, post insulators for alternative current within nominal voltage greater than 1000 volts upto 245 KV- Definitions, test methods and acceptance criteria.
IEC-61466/1: Composite strings, insulator units for overhead lines for nominal voltage greater than 1 KV-part-1 Standard strength classes and end fittings.
IEC-61466/2: Composite strings, insulator units for overhead lines for nominal voltage greater than 1 KV-part-2 Dimensional and electrical characteristics.

4. Surge Arresters

IS-3070: Lightning arrestors for alternating current systems: Metal (part-3) oxide lightning arrestors without gaps.
IEC 99-4: Metal oxide urge arresters without gaps

5. Cubicles and Panels & Other related Equipment

IS:722: AC Electricity Meters (P1 to P9)
IS 1248 Direct acting indicating analogue electrical measuring instruments their accessories.
IS722, IS-1248: (PO-3) Electrical relays for power system protection.
IS-3231, 3231, IEC-68.2.2: Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-529: Degree of Protection provided by enclosures
IEC-158: Low Voltage control gear, contractors
IEC-439: Low voltage switchgear and control gear assemblies
ANSI-C37.20: Switchgear assemblies, including metal enclosed bus.
ANSI-C37.50: Test Procedures for low voltage alternating current power circuit breakers
ANSI-C39: Electric Measuring instrument.

ANSI-C83:	Components for electric equipment
IS:8623:	Specification for sugar NEMA-AB-Moulded Case circuit and systems

6. Lt Switchgear

IS:8623:	Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC/ 1200V DC
IS:4237:	General requirements for switchgear and control gear for voltage not exceeding 1000 V.
IS2147:	Degree of protection provided by enclosures for low voltage switchgear and control gear.
IS:3202:	Code of practice for climate proofing of electrical equipment.
IS:3072:	Code of practice for installation and maintenance of switchgear
IS:8544:	AC motor starters of voltage not exceeding 1000 Volts
IS:4064:	Air-break switches, air break dis-connectors air break dis-connectors and fuse combination unit for voltages not exceeding 1000V AC or 1200V DC.
IS:3231:	Electrical relays for power system protection.
IS:1248:	Electricity indicating instruments
IS:722:	AC Electricity meters.
IS:375:	Marking and arrangements of bus bars.
IS:9224:	HRC Cartridge fuses (Part II)
IS:6875:	Switches and push-buttons
IS:6005:	Code of practice of phosphating iron and steel
IS:5082:	Wrought Aluminium and Aluminium alloys for electrical purposes.

7. 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.
ANSI-C37.34:	Test code for high voltage air switches
NEMA-SG6:	Power switching equipment.

8. Protection and Control Equipment

IEC-51:	Recommendations for Direct acting indicating analogue electrical measuring instruments and their accessories.
IEC-255:	Electrical relays
IEC-297:	Dimensions of mechanical structures of the 482.6mm (19 inches) series.
IEC-359:	Expression of the performance of electrical & electronic measuring equipment. IEC-387 Symbols for Alternating-Current Electricity meters
IEC-447:	Man machine interface/ MM-Alternating principles
IEC-521:	Class 0.5, 1 and 2 alternating current wall hour meters
IEC-547:	Modular plug-in unit and standard 19-inch rack mounting unit based on NIM standard (for electronic nuclear instruments)
ANSI-81:	Screw threads.

ANSI-B18: Bolts and Nuts
ANSI-C37.1: Relays, Station controls etc.
ANSI-C37.2: Manual and automatic station control, supervisory and associated telemetering equipment.
ANSI-C37.2: Relays and relay system associated with electric power apparatus.
ANSI-C39.1: Requirements for electrical analogue indicating instruments.

9. Motors

IS-325: Three phase induction motors
IS-4691: Degree of protection provided by enclosure for rotating electrical machinery
IEC-34: Rotating electrical machines
IEC-68 (P1 to P5): Environmental testing
IEC-326 (P1 to P2): Printed boards.

10. Material and Workmanship Standards

IS-1363: Hexagon head bolts, screws and nuts of product grade C.
IS-1364: Hexagon head bolts, screws and nuts of products grades A and B
IS-3138: Hexagonal Bolts and nuts (M42 to M150)
IS-898: Fasteners: Bolts, screws and studs

11. Clamps and Connectors

IS:2121: Fitting for aluminium and steel cored aluminium conductors for overhead power lines.
IS:731: Porcelain insulators for overhead power line with a nominal voltage than 1000 V
IS:2486: Insulator fitting for overhead power lines with a nominal voltage greater than 1000 V
IEC-120: Dimensions of Ball and socket couplings of string insulator units.
IEC-137: Insulated turning for alternating voltages above 1000 V.
IEC-168: Tests on indoor and outdoor post insulators of glass for system with nominal voltages greater than 1000 V.
IEC-233: Tests on Hollow insulators for use in electrical equipment.
IEC-273: Characteristics of indoor and outdoor post insulators for systems with nominal voltage greater than 1000 V.
IEC-305: Insulators for overhead lines with nominal volt above 1000 V-ceramic or glass mull units for AC system characteristics of string insulator units of the cap and pin type.
IEC-372: Locking devices for ball and socket couplings of string insulator units dimensions and tests
IEC-383: Insulators for overhead lines with a nominal voltage above 1000 V.
IEC-433: Characteristics of string insulator units of the long rod type.
IEC-471: Dimensions of Clevis and tongue coupling of string insulator units
ANSI-C29: Wet Process porcelain insulators
ANSI-C29.1: Test Methods for electrical power insulators
ANSI-C29.2: For insulators, wet-process porcelain and toughened glass suspension type. ANSI-C29.8 For wet-process porcelain insulators apparatus, post-type.
ANSI-G.8: Iron and steel hardware
ASTM A-153: Zinc Coating (Hot-Dip) on iron and steel hardware

12. Strain and Rigid Bus-Conductor

IS-2678: Dimensions & tolerances for wrought aluminium and aluminium alloys.
IS-5082: Wrought aluminium and aluminium alloy bars, Roads, tubes and sections for electrical purposes.
ASTM-B 230-82: Aluminium 1350 H19 Wire for electrical purposes
ASTM-B 221-81: Concentric – lay – stranded, aluminium 1350 conductors
ASTM-B 221: Aluminium – Alloy extruded bard, road, wire shape.
ASTM-B 236-83: Aluminium bars for electrical purpose (Bus-bars)
ASTM-B 317-83: Aluminium – Alloy extruded bar, rod, pipe and structural shapes for electrical purposes (Bus Conductors)

13. Battery Chargers

IS:3895: Mono-Crystalline Semiconductor Rectifier Cells and stacks
IS:4540: Mono-crystalline semiconductor rectifier assemblies and equipment
IS:6619: Safety code for semiconductor rectifier equipment.
IS:2026: Power Transformer
IS:2959: AC Contractors for voltage not exceeding 1000 Volts
IS:1248: Indicating Instruments
IS:2208: HRC Fuses
IS:4064: Air break switches, air break Disconnector & fuse combination units for voltage not exceeding 1000V Ac or 1200V DC.
IS:2147: Degree of protection provided by enclosures for low voltage switchgear and control gear.
IS: 600:5: Code of practice for phosphating of Iron and steel.
IS:3231: Electrical relays for power system protection
IS:3842: Electrical relay for AC systems.
IS:5: Colours for ready mix paints.

14. Battery

IS:1651: Stationary Cells and Batteries, Lead-Acid Type (with Tubular Positive Plates).
IS:1652: Stationary Cells and Batteries, Lead-Acid Type (with Plant Positive Plates).
IS:1146: Rubber and plastic containers for Lead-Acid Batteries
IS:6071: Synthetic separators for Lead-Acid batteries.
IS:266: Specification for Sulphuric Acid.
IS:1069: Specification of water for storage batteries
IS:3116: Specification for sealing compound for lead-acid batteries
IS:1248: Indicating Instruments

15. Wire and Cables

IS-694: PVC insulated cables for working voltages upto and including 1100Volts.
IS-1255: Code of practice for installation and maintenance of power cables upto and including 33 kV rating.
IS-1554: PVC insulated (heavy duty) electric cables (part 1) for working voltage upto and including 1100 V Part (2) for working voltage from 3.3 upto including 11 kV.

IS-1753:	Aluminium conductors for insulated cables
IS-2982:	Copper conductors in insulated cables and cords.
IS-3961:	Recommended current rating for cables.
IS-3975:	Mild steel wires, formed wires and tapes for armouring of cables
IS-5831:	PVC insulated and sheath of electric cables
IS-6380:	Elastomeric insulating and sheath of electric cables.
IS-7098:	Cross linked polyethylene insulated PVC sheathed cables for working voltage up to and including 1100 volts. Part (2) Cross-linked polyethylene insulated PVC sheathed cables for working voltage from 3.3 kV up to and including 33 kV.
IS-8130:	Conductors for insulated electrical cables and flexible cords.
IS-10418:	Specification for drums for electrical cables. IEC-96 Radio Frequency cables
IEC-183:	Guide to the selection of High Voltage Cables.
IEC-189:	Low frequency cables and wires with PVC insulation and PVC Sheath
IEC-227:	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750 V.
IEC228L	Conductors of insulated cables.
IEC-230:	Impulse tests on cables and their accessories.
IEC-287:	Calculation of the continuous current rating of cables (100% load factor).
IEC-304:	Standard colours for insulation for low frequency cables and wires.
IEC-331:	Fire resisting characteristics of Electric cables.
IEC-332:	Tests on electric cables under fire conditions
IEC-502:	Extruded solid dielectric insulated power cable for rates voltages from 1 kV up to 30 kV.
IEC-754:	Tests on gases evolved during combustion of electric cables.
NEMA-WC1:	Asbestos and asbestos-varnished cloth and asbestos thermoplastic insulated wire and cable
NEMA-WC2:	Steel armour and associated covering for impregnated paper insulated cables
NEMA-WC3:	Rubber insulated wire and cable for transmission and distribution of electrical energy.
NEMA-WC5:	Thermoplastic insulated wire and cable for the transmission and distribution of electric energy.
NEMA-WC7:	Cross linked thermo setting polyethylene insulated wire and cable for the transmission and distribution of electrical energy.
NEMA-WC8:	Ethylene-propylene-rubber insulated wire and cable for the transmission and distribution of electrical energy.
NEMA-W67:	Cross linked thermo setting polyethylene
IS-659:	Safety code for air conditioning
IS-1391:	Room air conditioners.
IS-6272:	Industrial cooling fans.

16. Galvanizing

IS-209:	Zinc Ingot.
IS-2629:	Recommended practice for Hot-Dip galvanizing on iron and steel.
IS-2629:	Methods for testing uniformity of coating of zinc coating articles.

ASTM-a-123: Specification for zinc (Hot galvanizing) coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.
ASTM-A-153: Specification for Zinc coating (Hot Dip) on iron and steel hardware
ASTM-A-239: Test method for locating the thinnest. Spot in a Zinc (galvanised) coating on iron and steel articles by the preece test (Copper sulfated dip).

17. Fire Protection

IS-554: Dimensions for pipe threads where pressure tight joints are required on the threads.
IS638: Sheet rubber jointing and rubber insertion jointing.
IS-778: Copper alloy gate, globe and check values for water works purposes.
IS-780: Sluice valves for water-works purposes (50 to 300 mm size)
IS-1536: Centrifugally cast (spun) iron pressure pipes for water gas and sewage.
IS-1538(1993): Cast iron fitting for pressure pipes for water gas and sewage.
IS-1703(1989): Copper aloy bar values (horizontal plunger type) for water supply fittings.
IS2379(1990): Colour code for identification of pipe lines.
IS-2643 (P1 to P3: 1990): Dimensions for pipe threads for fastening purposes.
IS-2685(1992): Code of practice for selection, installation and maintenance of sluice valves.
IS-2906(1990): Specification for sluice valves for water works purposes (350 to 1200 mm size)
IS-3589(1991): Seamers or eclectically welded steel pipes for water, gas and sewage (168.3 to 2032 mm outside diameter).
IS-4038(1990): Foot valves for water works purposes
IS-4927(1991): Unlined flax canvas hose for firefighting.
IS-5321-(P1 and P2 1991): Swing check type reflux (non-return) valves
IS-13095 (1991): Butterfly valves for general purposes

18. Steel Structures

IS-228: Method of chemical analysis of pig iron, cast iron and plain carbon and low alloy steels.
IS-802: Code of practice for use of structural steel in overhead transmission line towers.
IS-806: Code of practice for use of steel tubes in general building construction.
IS-808: Dimensions for hot rolled steel beam column channel and angle sections.
IS-814: Covered electrodes for manual arc welding of carbon manganese steel
IS-816: Code of practice for use of metal arc welding for general construction in mild steel.
IS817: Code of practice for training and testing of metal arc welders. Part 1: Manual metal arc welding
IS-875: Code of practice for design loads (other than earthquake) for buildings and structures.
IS-1161: Steel tube for structural purposes.
IS-1182: Recommended practice for radiographic examination of fusion welded but joints in steel plates.
IS-1363: Hexagonal head bolts, screws and nuts of products grade C.
IS-1364: Hexagon head bolts, screw & nuts of products grade A and B.
IS-1367: Technical supply condition for threaded steel fasteners
IS-1599: Method for bend test.
IS-1608: Method for tensile testing of steel products.

IS-1893: Criteria for earthquake resistant design of structures
IS-1978: Line pipe
IS-2062: Steel for general structural purposes
IS-2595: Code of practice for Radiographic testing
IS-3063: Single built rectangular section spring washers for bolts, nuts and screws.
IS-3664: Code of practice for ultra-sonic pulse echo testing by contact and immersion methods.
IS-7205: Safety code for erection of structural steel work.
IS-9595: Recommendations for metal arc welding of iron and carbon manganese steels.
ANSIB18.2.1: Inch series square and Hexagonal bolts and screws.
ANSI-B18.2.2: Square and hexagonal nuts
ANSI-G8.14: Round head bolts

19. Other Civil Works Standards

IS-269 33: Grade ordinary portland cement
IS-2721: Galvanized steel chain link fence fabric.
IS-278: Galvanized steel barbed wire for fencing
IS-383: Coarse and fine aggregates from natural sources for concrete.
IS-432: Mild steel and medium tensile steel bars and hard-dawn steel wire for concrete reinforcement
IS-456: Code of practice for plain and reinforced concrete.
IS-516: Method of test for strength of concrete
IS-800: Code of practice for general construction in steel
IS-806: Steel tubes for structural purposes
IS-1172: Basic requirements for water supply, drainage and sanitation
IS-1199: Method of sampling and analysis of concrete
IS-1566: Hard-dawn steel wire fabricated concrete reinforcement
IS-1742: Building drainage
IS-1785: Plain hard-drawn steel wire for pre stressed concrete
IS-1786: High strength deformed and wires for concrete reinforcement
IS-1811: Method of sampling Foundry sands.
IS-1893: Criteria for earthquake resistant design of structures. IS-2062 Steel for general structural purposes
IS-2065: Code of practice for water supply in buildings
IS-2090: High tension steel bars used in pre-stressed concrete
IS-2140: Standard galvanised steel wire for fencing
IS-2470: Code of practice for installation of septic tanks
IS-2514: Concrete vibrating tables
IS-2645: Integral cement waterproofing compounds
IS-3025: Method of sampling and test physical chemical for water waste water.
IS-4091: Code of practice for design and construction of foundations for transmission line tower and poles
IS-4111: Code of practice for ancillary structure in sewerage system

IS-4990:	Plywood for concrete shuttering work
IS-5600:	Sewage and drainage pumps

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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

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)

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

SECTION 4:
Annexure-C: Guaranteed Technical Particulars

Sl. No.	Description	Unit	Particulars to be filled by Bidder
A.	198kV Surge Arrester		
1.	Name of the manufacturer		
2.	Location		
3.	Applicable Standard		
4.	Type designation		
5.	Rated voltage	kVrms	
6.	Continuous operating voltage	kV	
7.	Reference voltage	kV	
8.	Watt-loss at continuous operating voltage	Watt/ KV	
9.	Watt-loss at rate voltage	Watt/ KV	
10.	Leakage current at COV	mA	
11.	Leakage current at rated voltage	mA	
12.	Nominal discharge current (8/20 micro second wave)	kA	
13.	Reference current	A	
14.	Max. residual voltage for 8/20 micro second discharge current		
	a) at 0.5 times nominal discharge current	kVp	
	b) at nominal discharge current	kVp	
	c) at twice the nominal discharge current	kVp	
15.	Maximum switching surge protective with front level voltage at 500A	kVp	
16.	Steep/current impulse residual voltage test with 1 micro second front time current wave of 10kA Peak	kVp	
17.	High current impulse-withstand (4/10 micro second wave)	KAp	
18.	Long duration current impulse rating		
	a) Peak current	A	
	b) Virtual duration of peak	Micro-second	
	c) Line discharge class of arrestor		
19.	Power frequency voltage withstand of arrestor insulation		
	a) dry	kVrms	

	b) wet	kVrms	
20.	Total creepage distance	mm	
21.	Lightning impulse withstand voltage of arrester	kVp	
22.	Type of non-linear resistor disc. Size (dia., height)	Dia. mm height mm KV	
23.	Non-linear discs per section of arrester	No.	
24.	Sections in one arrester	No.	
25.	Material of retainer use inside lightning arrester bakelite, ceramic, rubber or other material		
26.	Is pressure relief device provided, if so, its class?		
27.	Overall dimensions:	mm	
	a) Height	mm	
	b) Diameter		
30.	Net weight	kg	
31.	Cantilever strength	kg-m	
32.	Are the live and earth ends of arrester suitable for jumper/ flats as specified?		
33.	Temporary power frequency over voltage withstand capability for arresters,		
	a) For 0.1 second		
	b) For 10.00 seconds		
	c) For 100.00 seconds		
34.	Any other technical data		
B.	**Terminal Connector**		
1.	Manufacturer's Name		
2.	Applicable Standards		
3.	Type		
4.	Material of connector		
	a) Clamp body		
	b) Bolts & Nuts		
	c) Spring washers		
5.	Rated current		
6.	Terminal load		
	a) Rated terminal load	kg	
	b) Factor of safety		
7.	Minimum thickness of any part	mm	
8.	Weight of clamp complete with	kg	

	hardware		
C.	Support Insulator/ Housing		
1.	Manufacturer's Name		
2.	Type		
3.	Applicable Standards		
4.	Dimensions		
	a) Height		
	b) Diameter (Top)		
	c) Diameter (Bottom)		
5.	Total Creepage distance	mm	
6.	Rated voltage	kV	
7.	Power frequency withstand voltage for 1 min dry and wet	kVrms	
8.	1.2/50 micro sec. Impulse withstand voltage	kVp	
9.	250/2500 micro sec. Switching impulse withstand voltage dry and wet	kVp	
10.	Corona Extinction voltage	kV	
11.	Weight	kg	
12.	Maximum allowable span	mm	
13.	Cantilever Strength	Kg-mm	

Date: Bidder's Stamp & Signature

SECTION 4:
Annexure-D: 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 (198kV Surge Arrester with accessories) 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 (198kV Surge Arrester with accessories) 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 Surge Arrestor 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 Surge Arrestors shall confirm to the all the specific and general technical requirements of this specification and shall be designed in line with IEC-60099.	Confirmed	Yes/ No
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 (198kV Surge Arrester with its Accessories), 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 in line with reference QAP attached in Section-2 for the equipment (198kV Surge Arrester with its Accessories), 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	Confirmed	Yes/ No

	project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.		
8	Inspection & Testing		
8.1	The equipment (198kV Surge Arrester with its Accessories) 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.	Confirmed	Yes/ No
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 (33kV AIS Local Isolation Breaker Panel with its Accessories) 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