

TECHNICAL SPECIFICATION FOR SUBSTATION- ELECTRICAL WORKS

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1. GENERAL

- The Contractor shall ensure that the design, drawings, supply, construction, testing, and commissioning of all equipments, facilities, components, and systems of the Project shall be in accordance with Relevant Indian Standards (IS) and Codes issued by the Bureau of Indian Standards only.
- In case IS and Codes are not available for any specific equipments, the other equivalent internationally recognized Standards, and Codes shall be followed, with prior approval of PTCL.
- It shall be the responsibility of all the bidders to acquaint themselves with the existing Patran SS site conditions, approach road, availability of water & electricity, the area earmarked for Augmentation Work, and other associated necessities for successful commissioning & operation of the system defined in the scope of work.
- The proposed augmentation shall be GIS (Gas Insulated Switchgear) type and shall be generally in accordance with IEC: 62271-203 while conforming to the requirements of Technical Specification, CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2010, as amended from time to time including revised regulations released in 2022.
- The mentioned scope of works shall be executed in accordance with the technical specifications specified below and existing Patran equipments whose drawings or details are already attached with bid documents. The new scope tentative SLD and plan layout with the existing cable trench (outdoor and GIS halls), DSLP layout, CRB equipment layout, SAS architecture, and earthmat layout have been attached for reference purposes.
- The approval of the drawings, GTPs, type test reports, calculations, etc. shall be provided by PTCL. The list of documents/drawings that will be required for submission by the contractor shall be discussed during the detailed engineering. It shall be solely the right of PTCL to approve or disapprove the document/drawings based on the quality of the submission, details sought by PTCL in the drawings, availability of type test reports, and any other detail that is required for completion of the drawing/GTP/calculation/test report/etc.
- The list of approved vendors/OEMs/Make for this augmentation work is listed in Annexure-A of this Technical Specification.

2. EXISTING CONFIGURATION OF PATRAN 400 kV SS (TBCB)

Patran Transmission Company Limited (PTCL) was incorporated on December 19, 2012, for the development of a “Transmission System for Patran 400 kV SS” with the current configuration defined below:

- 2X500MVA, 400/220 kV Substation at Patran
2x500MVA, 400/220 kV transformer:
400 kV ICT bay – 2 no.
220 kV ICT bay – 2 no.
400 kV line bay – 4 no.
220 kV line bay – 6 no.
- LILO of both circuits of Patiala – Kaithal 400 kV D/c at Patran

The above substation was commissioned in Jun 2016 and is currently in commercial operation.

The Patran Substation is located in the Village- Banwala, Drauli Link Road, Near Peer ki, Samadhi, Patran, Patiyala-147105.

3. SUBSTATION TECHNICAL SPECIFICATION (FOR AUGMENTATION WORK)

The design and specification of substation equipment are to be governed by the following factors:

A. Insulation Coordination:

420 KV System would be designed to limit the Switching overvoltage to 2.3 p.u. and is expected to decay to 1.5 p.u. in 5 to 6 cycles. Limit to overvoltages in 245 kV system would be based on IEC. Consistent with these values and protective levels provided by lightning arrestors, the following insulation levels are proposed to be adopted for 420 KV & 245kV systems.

S. No.	Description of parameters	PATRAN 400 kV SS	
		400 kV System	220 kV System
1.	System operating voltage	400 kV	220 kV
2.	Maximum voltage of the system (rms)	420 kV	245 kV
3.	Rated frequency	50 Hz	50 Hz
4.	Rated Insulation levels		
i)	Impulse withstand voltage for (1.2/50 micro sec.) - For equipments - For Transformer Winding - For Insulator Strings - For GIS Equipment	1425 kVp 1300 kVp 1550 kVp 1425 kVp	1050 kVp 950 kVp 1050 kVp 1050 kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1050 kVp	-
iii)	One-minute power frequency dry withstand voltage (rms)	650 kV	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	-	460 kV
5.	Corona extinction voltage	320 kV	-

S. No.	Description of parameters	PATRAN 400 kV SS	
		400 kV	220 kV
6.	Minimum creepage distance for insulator string / long rod insulators / outdoor bushings	13020 mm (31 mm/kV)	7595 mm (31 mm/kV)
7.	Minimum creepage distance for switchyard equipment	10500 mm (25 mm/kV)	6125 mm (25 mm/kV)
8.	Max. fault current	63 kA	50 kA
9.	Duration of fault	1 sec	1 sec
10.	Dynamic Short Circuit or Peak Withstand Current	157.5 kA	125 kA

B. Switching Schemes

The switching schemes, as mentioned below, shall be adopted at various voltage levels of the substation/switchyard:

Substation	400 kV side	220 kV side
Patran 400 kV SS	One & half breaker (GIS)	Double Main (GIS)

C. Substation Equipment and facilities

The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All equipment shall be designed considering the transmission line capacity.

S. No.	Description of GIS bay	Patran 400 kV SS	
		400 kV	220 kV
1.	Bus Bar	4000 A	3150 A
2.	Line bay	3150 A	1600 A
3.	ICT bay	3150 A	1600 A

D. 400/220 kV, 3-Phase Transformer

500MVA 400/220/33kV 3-Phase transformer shall conform to CEA's "Standard Specifications and Technical Parameters for Transformers and Reactors (66 kV and above)" available on the CEA website.

Note: Remote tap changer control and monitoring system including the parallel operation of transformers shall be carried out using a Bay control unit or digital RTCC relay (IEC 61850 compliant) through Substation Automation System.

For parallel operation, the new transformer shall meet the parallel operating conditions for transformers including the vector group, %age impedance, and tap changer. For the new transformer, the following fittings, and accessories with suitable valves, as per CEA stated above, shall be provided for condition monitoring:

- i. Online insulating oil drying system
- ii. Online DGA
- iii. Fiber Optic Sensor (FOS) for temperature
- iv. Temperature transducer with PT100 sensor for each winding, if not considered already

E. GIS Equipment

The GIS (Gas Insulated Switchgear) shall be in accordance with IEC 62271-203: 2022, 60376: 2018. The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All the switchgear such as Circuit breaker, isolator, earth switch, etc. shall be GIS type.

The 400 kV GIS equipment shall be 1-ph type whereas the 220 kV GIS equipment shall be of either 3-ph encapsulated or 1-ph type. However, looking at the existing 220 kV GIS configuration, the 3-ph type is preferred, though not compulsory. In case the contractor supplies 220 kV GIS of 1-ph type, it shall solely be the responsibility of the contractor and its GIS OEM to ensure seamless interconnection/interfaces with the existing 3-ph encapsulated type GIS without affecting the existing system at all.

The 400 kV and 220 kV gas-insulated bus (GIB) ducts shall be provided by the contractor with the support structures for indoor and outdoor applications.

For this project, the 400kV DIA shall be considered in a complete sense with the inclusion of line bay GIS equipment. This transmission line shall come into the future and its AIS equipment and associated works are not part of this scope of work. In the present scope of work, the GIB duct for this future line in the present scope DIA shall be brought out of the GIS hall up to 1m and shall be terminated outside the GIS hall with an interface suitable for a future extension by the line developer.

The local control cubicle (LCC) for GIS equipment under the scope shall be provided as per the existing system in place. The location of LCC shall also be governed by the existing system for each voltage level.

In addition to the above, a suitable portable scissor lift shall be provided for access to the distant portion of the GIS installations.

The SLD for the proposed scope of work shall be based on the existing SS SLD.

i. Busbar (GIS)

- Busbars, 1-ph for 400 kV and 1-ph or 3-ph for 220 kV, enclosures running across the length of the switchgear to interconnect each of the bay modules in existing busbar schemes.
- Gas monitoring devices, barriers, pressure switches, UHF PD Sensors, Support structures, etc., as required.
- Extension piece (Interface) module, as required to extend existing bus to maintain minimum possible interconnection space between GIS supplied under the present scope and the GIS being extended.
- End Piece (Interface) modules with the isolating test link for Future extension of the Bus bar module on one side. The end piece module shall be designed in such a way so that future GIS modules may be tested without extending voltage to the existing bus by removing the test link. The end piece (interface) module for both buses shall be in one alignment.

ii. Circuit Breakers (GIS)

Circuit breakers shall in general comply with IEC 62271-100: 2021, 62271-203: 2022 and shall be of SF6 Type. The 400 kV and 220 kV CB shall be equipped with the spring charged operating mechanism. The rated break time shall not exceed 40 ms for 420 KV and 60 ms for 245 kV circuit breakers. Circuit breakers shall be provided with single phase and three phase auto reclosing. The line circuit breakers of 400 kV voltage class shall be provided with Controlled Switching Devices for controlling switching overvoltage. The short line fault capacity shall be the same as the rated capacity and this is proposed to be achieved without the use of opening resistors. Controlled Switching Devices shall also be used for minimizing switching transients and inrush currents in transformers and reactors of 400 kV and above voltage class. For details other than those specified above, existing system specifications shall be followed during the detailed engineering.

iii. Isolator/Disconnectors and Earthing Switches (GIS)

The isolators shall comply with IEC 62271-102 in general. Isolators rated for 400 kV and 220 kV shall be of extended mechanical endurance class-M2 and suitable for bus transfer current switching duty.

All Isolators and earth switches (maintenance ES having electrical endurance class E0 and fast acting ES having class E1-M1) shall be motor operated. Earth switches shall be provided at various locations to facilitate maintenance. Earthing switches located at the beginning of the line feeder bay modules shall be of high speed, make-proof type, and will be used to discharge the respective charging currents, trapped charge in addition to their safety grounding function. Main blades and earth blades shall be interlocked, and interlock shall be fail-safe type.

400 kV and 220 kV earth switch for the line isolators shall be suitable for induced current switching duty as defined for Class- B.

FES (fast-acting ES) shall be provided with an individual / three pole operating mechanism suitable for operation from DC.

For details other than those specified above, existing system specifications shall be followed during the detailed engineering.

iv. Current Transformers (GIS)

The ring core current transformers shall comply with IEC 61869 in general. All ratios shall be obtained by secondary taps only. Generally, Current Transformers (CT) for 400 kV shall have six cores (four for protection and two for metering). The 220 kV current transformers shall have five cores (four for protection and one for metering). The cores shall be divided into both sides of the CB as necessary for each voltage level and meeting the existing configuration. The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. The accuracy class for the protection core shall be PS for 400 kV and TPS for 220 kV whereas for the metering core, it shall be 0.2S. The rated burden of cores shall be closer to the maximum burden requirement of the metering & protection system (not more than 20 VA for metering core) for better sensitivity and accuracy. The instrument security factor shall be less than 5 for CTs up to 400 kV voltage class.

For more details, existing CT details must be referred to by the contractor during the detailed engineering.

Any GIS item that is not covered in the above GIS specification but required for the completion and commission of the scope of work shall be the responsibility of the contractor to include in their design and supply as per the applicable and governing IEC standards.

All circuit breakers, disconnect switches, and other components of GIS having identical ratings shall have identical and interchangeable parts and operating mechanisms as far as possible.

The enclosure shall be of continuous design and shall meet the requirement as specified in IEEE 80 2013 (special considerations for GIS).

The temperature rise of all current carrying parts and enclosures shall be limited to the values stipulated in IEC-62271-1, under-rated current, and the climatic conditions as specified.

An adequate number of UHF sensors shall be provided in the offered GIS for the detection of Partial discharge (of 5 pC and above) as per IEC 60270.

The number and location of these sensors shall be based on laboratory test on the typical design of GIS as per recommendations of CIGRE Document No. 654 (Application Guide for Sensitivity Verification for UHF Partial Discharge Detection System for GIS). The offered numbers and location of UHF sensors shall be submitted based on above said criteria along with attenuation calculation for approval of the PTCL. In case during site testing, additional UHF sensors are required, the same shall also be supplied & installed to complete the technical requirement.

F. Surge Arresters (AIS)

336kV Station High (SH type) class gapless type Surge arresters & 216kV Station Medium (SM type) class gapless type Surge arresters conforming to IEC 60099-4, in general, shall be provided for 420kV & 245kV systems respectively. Other characteristics of the Surge arrester shall be chosen in accordance with system requirements. Surge arresters shall be provided near line entrances, transformers & reactors to achieve proper insulation coordination. Surge Arresters shall be provided with porcelain/ polymer housing fitted with pressure relief devices. A leakage current monitor with a surge counter shall be provided with each surge arrester.

The min. continuous cantilever strength of 336kV and 216kV Surge Arrestors shall be 350kgf.

G. SF6 to Air Bushing

The SF6 to Air bushings shall comply with IEC 60137, 62271-203 & 61643 in general. The bushings shall be polymeric type and the continuous bending/cantilever load shall be min. 350kgf for all ratings of all types of the bushing.

400 kV and 220 kV SF6 to Air bushings along with terminal connectors, support structures, foundation bolts, fasteners etc. as required shall be part of the scope.

H. Protection Relaying & Control System

The protective relaying system is proposed for the current scope of work to minimize the damage to the equipment in the event of faults and abnormal conditions. All main protective relays shall be the numerical type with IEC 61850 communication interface and should have Interoperability during the integration of numerical relays to communicate over the IEC 61850 protocol with RTU/SAS/IEDs of different OEMs. All numerical relays shall have a built-in disturbance recording feature.

The protection circuits and relays of the transformer shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection groups failing, to obtain redundancy, and to take protection systems out for maintenance while the equipment remains in service.

i. Transmission Line Protection

In the current scope of work, the 400 kV line protection requirement shall be limited to the breaker relay panel with all the bay protections except the transmission line specific protection relays (be it distance or differential). The transmission line protection (Main-I and Main-II) shall be in the scope of the developer of that line in the future.

Further, all 400 kV and 220 kV lines shall be provided with single and three-phase auto-reclosing facility to allow reclosing of circuit breakers in case of transient faults. These lines shall also be provided with distance to fault locators to identify the location of faults on transmission lines.

For 400 kV transmission lines, a directional IDMT earth fault relay should be provided as a standalone unit.

ii. Auto Transformer Protection

These shall have the following protections:

- a. Numerical Differential protection

- b. Numerical Restricted earth fault protection
- c. Numerical Back-up Over-current and earth fault protection on HV & IV side
- d. Numerical Over fluxing protection on HV & IV side
- e. Numerical Overload alarm
- f. Numerical Backup Impedance protection (HV Side)
Further, Numerical Back-up Over-current and earth fault protection on the HV & IV side of the autotransformer shall not be combined with other protective functions (except backup Impedance protection) in the main relays and shall be independent relays. Besides these, power transformers shall also be provided with Buchholz relay, protection against high oil and winding temperature and pressure relief device, etc.

iii. Busbar Protection

For existing substations, the existing bus bar protection shall be augmented as per requirement.

iv. Local Breaker Backup Protection

This shall be provided for each 400 kV and 220 kV circuit breakers and will be connected to de-energize the affected stuck breaker from both sides.

Notes:

- 1. LBB & REF relays shall be provided separately from the transformer differential relay.
- 2. LBB relay may also be provided as a built-in protection function of distributed bus bar protection scheme; however, in such case, a separate LBB relay shall be provided for tie bays (in case of One and a Half breaker scheme).
- 3. Over-fluxing & overload protection can be provided as a built-in feature of the differential relay.

I. Substation Automation System

The Bay control unit is to be provided bay-wise for voltage levels 220 kV and above. All bay control units as well as protection units are normally connected through an Optical fiber high-speed network. The control and monitoring of circuit breakers, dis-connector, re-setting of relays, etc. can be done from the Human Machine Interface (HMI) from the control room.

The functions of control, annunciation, disturbance recording, event logging, and measurement of electrical parameters shall be integrated in the Substation Automation System.

In existing substations with a Substation automation system (SAS), augmentation of existing SAS with required ethernet switch, cables, patch cords, etc., as applicable, shall be done for bays under the present scope. The augmentation scope shall be considered based on the architecture prevailing at the existing substation. If the extension of the license is required for the new bays, the same shall be considered by the bidders in their scope.

J. AC & DC power supplies

The availability of modules/feeders in LTDB required for the present scope of work has to be ascertained by the bidders during their site visit. Based on the site visit, existing facilities shall be augmented as further required. In case of utilizing the existing vacant LT modules, MCCB shall be provided.

The capacity of the existing 220V battery is sufficient to cater to the LT load required for the proposed scope of work.

LT cabling (including AC and DC) in a complete sense shall be ensured by the contractor for the successful commissioning of the proposed scope of work.

K. Fire Fighting System

Fire-fighting systems for substation including transformer shall conform to CEA (Measures Relating to Safety & Electric Supply) Regulations.

Further, adequate water hydrants and portable fire extinguishers shall be provided in the substations including the mechanical foam type.

The main header of the firefighting system is suitable for extension to bays covered under the present scope; the necessary piping interface in this regard shall be provided.

At existing substations, the fire-fighting systems available shall be extended to meet the additional requirements.

L. Oil evacuating, filtering, testing & filling apparatus

To monitor the quality of oil for the satisfactory performance of transformers and for periodical maintenance necessary oil evacuating, filtering, testing, and filling apparatus would be provided at the substation. Oil storage tanks of adequate capacities for the storage of transformer oil would be provided. Please refer to Annexure-C (SOW) to understand the accessories and instruments required.

M. Illumination System

The complete illumination system including switchyard lighting, street lighting, indoor lighting, JBs, poles, panels, etc. shall be provided.

The lighting of the GIS halls, outdoor switchyard, street lighting, relay panel rooms, and any other building, if any, shall be done by LED based low power consumption luminaries. Indoor illumination shall be as per the requirement of false ceiling and non-false ceilings of buildings.

Firewall mounted Flood Light has been envisaged for Transformer.

AC Emergency Lighting in the relay panel room and switchyard area has to be provided.

Stainless steel Panels/Junction Boxes of thickness 1.5 mm for Outdoor application must be considered.

The bottom of the Outdoor Lighting Panels mounting height shall be 1000mm from FGL.

For the Outdoor Switchyard area, LED fixtures shall be installed at gantry structures (For 400 kV & below voltage level) & available lightning masts (if any).

For other outdoor areas and street lighting, the lighting poles & nearby buildings (if any) shall be used for the installation of LED fixtures.

Approximately 25 % of lighting fixtures (distributed over all above areas) shall be connected to an AC emergency lighting system.

A suitable heat sink with proper thermal management shall be provided in the luminaries. All LED Luminaries shall be PTCL approved make. The marking on luminaries & safety requirements of luminaries shall be as per IS standards.

The Contractor shall supply, store and install the following types of galvanized steel tubular lighting poles required for street lighting:

Type L1 Street Lighting Pole of 6 meters - for SL-L1 type fixture

Type D1 Post top lantern pole of 4 meters - for Sl-D1 type fixture

The distance of the center of the pole from the street edge should be approximately 1000 to 1200 mm or as per site conditions.

Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through a 3M long, 20 mm Dia. earth electrode.

Lighting Panels, Receptacles, Junction Boxes, etc. shall conform to the following degree of protection:

- Installed outdoor: IP- 55
- Installed indoor in air-conditioned area: IP-31
- Installed in the covered area: IP-52

- Installed indoor in a non-air-conditioned area where the possibility of entry of water is limited: IP-41.

The contractor shall be required to submit LM-79 & LM-80 reports for LED Luminaries.

N. GIS Hall and Adjoining Relay Panel Room

Existing HVAC shall be augmented for the proposed scope of work in both GIS Halls. The air conditioning shall be provided in the relay panel room as per the existing system in place.

The EOT crane girder extension is also in the scope of the contractor for both GIS halls.

Space in the existing indoor and outdoor cable trenches and Hume pipes under the roads needs to be ascertained by the bidders for all the cables required for the present scope of work. Also, wherever required, the existing cable trenches shall be extended in a complete sense till the present area of installation/erection as per the existing indoor and outdoor cable trench layout attached in the documents. If required, new Hume pipes for road crossing of cables shall be laid. Bidders must visit the site to understand the space available in the existing GIS halls and adjacent relay panel rooms for the bay under the present scope.

O. Control Concept

All the EHV circuit breakers in substation/switching stations shall be controlled and synchronized from the switchyard control room/remote control center. Each breaker would have two sets of trip circuits which would be connected to separate DC supplies for greater reliability. All the isolators shall have control from remote/local whereas the earth switches shall have local control only.

P. Visual Monitoring System (VMS) for watch and ward of substation premises

At existing substations, the visual monitoring system is available and shall be augmented as per existing or better specifications.

Visual monitoring system for effective watch and ward of substation premises shall cover the transformer, entrances/exits of GIS halls and relay panel rooms, and inside the GIS hall (if required) and accordingly, the location of cameras shall be decided. The camera shall be high-definition color CCD camera with a night vision feature. The VMS data partly/completely shall be recorded (minimum for 15 days) at least @25fps (or better) and stored on the existing network video recorder. The system shall use video signals from various cameras installed at different locations, process them for viewing on workstations/monitors in the

control room and simultaneously record all the cameras. Mouse/keyboard controllers shall be used for pan, tilt, zoom and other functions of the desired camera.

All camera recordings shall have a Camera ID & location/area of recording as well as date/time stamp. The equipment should generally conform to Electromagnetic compatibility requirement for outdoor equipment in EHV substation.

Q. General Facilities

- a) Gantry/Towers are envisaged for bays under the present scope only.
- b) Bay extension works at the existing substation shall be executed by the Contractor in accordance with the requirement/provisions mentioned in this specification. However, interface points shall be considered keeping in view the existing design/arrangement at the substation.
- c) Contractor must arrange for construction power and water on its own.
- d) All outdoor steel structures including anchor/foundation bolts shall be fully galvanized.
- e) The weight of the zinc coating shall be at least 610 gm/sq.m.
- f) Fencing shall be provided to contain the proposed scope of work.
- g) The lightning protection of the switchyard shall be provided using the shield wires/spikes on the towers and lightning mast (LM) in line with IEEE 998 and the buildings lightning protection shall be provided as per IEC 62305.
- h) All the dismantling works, if required, shall be in the scope of the bidders. The bidders must ascertain themselves with the existing site conditions and the area earmarked for the scope of work.

R. Roads

The new roads and the extension of existing ones shall be as per the civil drawings attached and the decision of different widths applicable shall be based on the actual requirement keeping the minimum width of the roads as per the attached existing electrical plan layout.

The existing roads shall be dismantled, if required for the construction of the proposed scope of work and new roads around the new scope of work shall be laid as per the existing road details. For the transformer movement, rail cum road shall be provided by the contractor.

S. Earthing of GIS, Switchyard, and Associated works

The earthing system of the existing Patran 400 kV SS shall be followed by the contractor for the extension of the main mat and the size of the risers.

The earthing of GIS equipment, GIB, and all other AIS equipment shall also be aligned with the practice existing in the substation.

T. Post Insulators

The cantilever strength of all types of bus post-insulators shall be min. 8kN. The corona ring shall be provided for all 400 kV post insulators.

U. Applicable Tests, Mandatory Spares & Monitoring Instruments

i. Type Tests Validity

The validity of the equipment's type test reports shall be governed by the latest CEA's "Guidelines for the Type Tests for Major Equipment in Power Sector" from the date of LOA of the project to the successful bidder.

ii. Performance Tests

The performance guarantees or ratings/parameters specified in the IEEE/IEC/IS standards or CEA specifications applicable to all the equipments to be supplied under the ambit of the scope of work shall be ensured by the contractor.

iii. Mandatory Spares

The mandatory spares w.r.t extension scope of work shall be provided as per Annexure-B (SOW) and shall not be used by the contractor in consumables during the erection.

iv. Condition Monitoring Instruments

Additionally, the list of equipment condition monitoring instruments has been provided in Annexure-C (SOW) which is also part of the supply in this augmentation scope of work.

**ANNEXURE-A:
List of Approved Make/OEM
&
Their Inspection
Category**

4. LIST OF APPROVED MAKE/OEM & THEIR INSPECTION CATEGORIES

A. List of Approved Makes for Augmentation at Patran 400 kV SS

S. No.	Equipment	Material Category	PTCL Approved Makes/OEMs	Remarks
1	Al. Tube	C	1. Sudal 2. Banco Aluminium 3. Jindal	
2	BPI	B	1. Modern 2. ABIL 3. IEC	
3	GIS	A	1. Siemens 2. GE 3. Hitachi	
4	Conductor	A	1. Apar 2. Gupta Power 3. JSK 4. Sterlite	
5	Clamps & Connectors	C	1. Legion 2. Exalt 3. Vensun Techo 4. Klemmen	
6	Control & Relay Panel including SAS	A	1. GE 2. Siemens 3. Hitachi 4. Schneider	
7	Earthing Materials	C	1. Swastika 2. VSP 3. SES 4. Balaji Metacast 5. Pragati	
8	Fire Protection System	B	1. 3D 2. AON 3. Flowgain	
9	Shield / Earth Wire	C	1. Nirmal Wire 2. Cabcon 3. UIC 4. Bedmutha	

S. No.	Equipment	Material Category	PTCL Approved Makes/OEMs	Remarks
10	Insulator Hardware Fittings	C	1. Rashtra Udhyog Ltd. 2. Legion 3. ITL	Make of the Insulator and Insulator Hardware should be selected in such a way that combination of two makes are type tested together as a single unit.
11	HVAC System	B	1. Laxmi cool zone 2. AON 3. Flowgain	1. Component Manufacturer of Following items :- i) High wall split AC ii)VRF Outdoor Unit iii) Compressor iv) Condenser Fan v) Cassette type Indoor Unit shall be from any of the below makes. a) VOLTAS b) HITACHI c) BLUE STAR
12	Illumination System	B	1. Forus Electrical 2. Aavaids 3. Instapower	Following Makes shall be considered for Luminaires: - PHILIPS/BAJAJ/ WIPRO.
13	Long Rod Insulators	B	1. Deccan 2. Olectra 3. Modern 4. ABIL	Make of the Insulator and Insulator Hardware should be selected in such a way that combination of two makes is type tested together as a single unit.
14	LT Cable	B	1. KEC 2. Nitya 3. KEI	

S. No.	Equipment	Material Category	PTCL Approved Makes/OEMs	Remarks
			4. Apar 5. Havells 6. Polycab 7. Gemscab	
15	Surge / Line Arrester	A	1. Oblum 2. CGL 3. Lamco	
16	VMS (Visual Monitoring System)	C	1. Sam Infortech 2. Delcom 3. Toshniwal	
17	Power/Auto Transformer	A1	1. Toshiba 2. Siemens 3. Hitachi 4. GE	Component Manufacturers List of Power Transformers up to 420 KV Class shall be submitted to PTCL for approval.
18	PEB Structure		1. E-Pack Polymers 2. Everest 3. Phenix 4. Zamil 5. Kirby 6. BNAL 7. Moonwalk	

Note: Contractor shall seek vendor approval from PTCL for the items of supply that are not listed above. Such items shall be of reputed Make/OEM with prior experience of supply in similar or higher rating substations with valid performance certificates from end user, earlier customer's PO and valid type test reports as per CEA guidelines.

B. Inspection Plan based on Material/Equipment Category

- Material Inspection shall be carried out as per Material Category defined below. The material category of each supply item/equipment shall be assigned by PTCL during the project stage. PTCL reserves the right to change the inspection category of any material during the course of the project.

Cat A: MQP (Material Quality Plan) is envisaged with its approval by PTCL. Inspection by PTCL/ PTCL's third-party inspection authorized agency. If the Inspection and test results are found satisfactory, formal clearance is to be issued. Material can be dispatched from the factory based on the clearance issued.

If PTCL provides a waiver, supplier/ supplier quality services shall conduct the inspection and submit the reports for review.

Cat A1: MQP is envisaged with its approval by PTCL. In stage Inspection and final inspection by PTCL / PTCL's appointed third-party Inspection authorized agency. If the inspection and test results are found satisfactory, formal clearance is to be issued. Material can be dispatched from the factory based on the clearance issued.

If PTCL provides a waiver, supplier/ supplier quality services shall conduct the inspection and submit the reports for review.

Cat B: MQP is envisaged with its approval by PTCL. Inspection by supplier/ supplier's third-party inspection authorized agency. Advance inspection call anticipated prior to inspection. The inspection report will be submitted to PTCL for clearance.

Cat C: MQP is not envisaged. No physical inspection is envisaged. Dispatch clearance shall be provided based on material test reports / certificates/ factory acceptance test (FAT). Inspection call to be submitted along with test certificates. Based on the certificates from supplier, PTCL will provide clearance after reviewing reports.