SPECIFIC REQUIREMENT'S (Section- Project)

C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT REV NO 06

Employer has standardized its Specific Requirement for various equipment and works for different voltage levels. Items or clauses, which are not applicable for the scope of this package as per schedule of quantities described in BPS or as per scope defined elsewhere in Section Project, the technical specification/clauses for the items specified below should not be referred to.

S.No.	Model Section & Clause No.	Amended As (As per Specific Requirement Rev 06)
1.	**Section Switchgear-INST Rev 11** **Clause No. 9.2 Para 3 & 4**	CTs must have adequate provision for taking oil samples from the bottom of the CT without exposure to atmosphere. Manufacturer shall recommend the frequency at which oil samples should be taken and norms for various gases in oil after being in operation for different durations. Manufacturer should also indicate the total quantity of oil which can be withdrawn from CT for gas analysis before refilling or further treatment of CT becomes necessary. Manufacturer/Contractor shall supply 2 nos. of oil sampling device for every 20 nos. of oil filled CT supplied with a minimum of 2 nos. of oil sampling device for each substation.
2.	**Section Switchgear-INST Rev 11** **Clause No. 9.3**	**Voltage Transformers** a) Insulation Resistance test for primary (if applicable) and secondary winding b) Polarity test c) Ratio test d) Dielectric test of oil (wherever applicable) e) Tan delta and capacitance measurement of individual capacitor stacks f) Secondary winding resistance measurement g) DGA of oil (for IVT/PT) Dissolved Gas Analysis (DGA) shall be carried out twice within the first year of service, first within the first month of commissioning/charging and second between six months to one year from the date of commissioning/charging. IVTs/PTs must have adequate provision for taking oil samples from the bottom of the IVT/PT without exposure to atmosphere. Manufacturer shall recommend the frequency at which oil samples should be taken and norms for various gases in oil after being in operation for different durations. Manufacturer should also indicate the total quantity of oil which can be withdrawn from IVT/PT for gas analysis before refilling or further treatment of IVT becomes necessary. Manufacturer/Contractor shall supply 2 nos. of oil sampling device for every 20 nos. of oil filled IVT/PT supplied with a minimum of 2 nos. of oil sampling device for each substation.
3.	**Section Switchgear-INST Rev 11** **Clause No. 10.0**	**Defect Liability** The actions required to be taken by contractor in case of defects observed in CT/CVT**/IVT/PT** of ratings 145kV & above during the warranty period (defect liability period) shall be as per enclosed **Annexure-V (Revised)** of this specification. Further, the replaced/repaired/refurbished equipment (or part of equipment) shall have Two (2) years warranty without prejudice to contractual warranty period (defect liability period).
4.	**Section Switchgear-INST Rev 11** **Clause No. 6.2 (a)(iii)**	Seismic withstand test as per Annexure-B of Section-GTR or IEC62271-2 (with Seismic acceleration requirement as per Annexure-I of this specification/Section-Project) for 400kV and above voltage rating.

<table>
<tr><td>5.</td><td>Section Switchgear-INST Rev 11

Clause No. 6.2 (b)(iii) & (c)(iii)</td><td>Seismic withstand test (as per Annexure-B of Section-GTR) or IEC-62271-2 (with Seismic acceleration requirement as per Annexure-II of this specification/Section-Project) for 400kV and above voltage class.</td></tr>
<tr><td>6.</td><td>Section Switchgear – CB Rev 11

Clause no. 2.6 Para 2</td><td>The CSD shall be provided in Circuit breaker of switchable line reactor bay and in Main & Tie bay circuit breakers of Transformers (required for 765/400kV transformers only), line with non-switchable line reactors and Bus reactors. The CSD shall be supplied as per bid price schedules.</td></tr>
<tr><td>7.</td><td>Section Switchgear – CB Rev 11

New Clause no. 2.6.1(n)</td><td>For Circuit breaker with CSD controlling a Transformer following is applicable

"The limit for inrush current for switching of Transformer by CSD shall be 1.0 p.u. of rated current of transformer after fine tuning of CSD settings during pre-commissioning checks. For site acceptance of CSD, during online CSD test after fine tuning inrush current should be less than 1.0 P.U. of rated current in five consecutive operations".</td></tr>
<tr><td>8.</td><td>Section Switchgear – CB Rev 11

Clause No. 11.4</td><td>Separate cables shall be used for AC, DC-I, DC-II and selected DC. Each control cable shall include minimum 10% spare cores (subject to minimum 1 no. of spare core).</td></tr>
<tr><td>9.</td><td>Section Switchgear – CB Rev 11

Clause No. 11.5</td><td>Requirement of Plug-In type connector for Inter-pole cabling is deleted</td></tr>
<tr><td>10.</td><td>Section Switchgear – CB Rev 11

Clause No. 11.6</td><td>Vertical run of cables to the operating mechanism box shall be properly supported by providing the perforated closed type galvanized cable tray (Cable tray also to be supplied along with the Circuit Breaker) to be fixed as an integral part of the structures. The load of the cable shall not be transferred to the mechanism box/terminal arrangement in any circumstances. Hanging or loose run of cable is not permitted. The drawing of cable tray including fixing arrangement shall be incorporated in the GA drawing of CB also.</td></tr>
<tr><td>11.</td><td>Section Switchgear – CB Rev 11

Clause No. 16.0 S.No. 20 (i)</td><td>
<table>
<tr><th>Parameter</th><th>765kV system</th><th>400kV system</th><th>220kV system</th><th>132 kV system</th><th>66kV System</th></tr>
<tr><td>Pre-insertion resistor requirement</td><td>As per BPS</td><td>As per BPS</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>Rating (ohms)</td><td>Approx. 450 with tolerance as applicable</td><td>Approx. 400 with tolerance as applicable</td><td>NA</td><td>NA</td><td>NA</td></tr>
</table>
</td></tr>
<tr><td>12.</td><td>Section Switchgear-ISOLATOR Rev 11B

Clause No. 9.2 (iii)</td><td>Seismic withstand test on isolator (400kV & above voltage class) mounted on Support structure as per Annexure-B of Section-GTR. The test shall be performed in the following position:

Isolator open E/S Closed
Isolator open E/S Open
Isolator Closed E/S Open</td></tr>
<tr><td>13.</td><td>Section Switchgear-Surge Arrester Rev 12

New Clause No. 4.5</td><td>The Surge Arresters shall be provided with a common Junction box suitably for a set of three (3) Surge Arresters of each bay for extending the contact information of surge counter to SAS</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>14.</td><td>Section GIS Rev 5A

New Para under Clause no.1</td><td>GIS of all voltage levels envisaged under a single package, shall be supplied from one GIS manufacturer who shall be responsible for design, manufacturing, erection, testing and commissioning of complete GIS switchyard under the Contract and any other responsibilities stipulated in the contract with respect to GIS portion.</td></tr>
<tr><td>15.</td><td>Section GIS Rev 5A

Clause no. 6.8.2</td><td>The CSD shall be provided in 765kV/400kV Circuit breakers for controlling transformers (required for 765/400kV transformers only) and reactors (ie for breakers of switchable line reactor and in Main& Tie circuit breakers of Transformers, Transmission lines with non-switchable line reactors and Bus reactors). The requirement of CSD shall be explicitly specified in price schedule</td></tr>
<tr><td>16.</td><td>Section GIS Rev 5A

New Clause no. 10.1.3(n)</td><td>For 400kV & above voltage class GIS bay module, CT cores shall be duly distributed on both side of circuit breaker. For 220 kV and below voltage level GIS bay module, CT on one side of the circuit breaker is also acceptable.</td></tr>
<tr><td>17.</td><td>Section GIS Rev 5A

New Para added under Clause no.20</td><td>During detailed engineering, the type test reports of GIS equipment of the parent company/subsidiary company/group company shall also be acceptable provided that the design of offered GIS is same as that of type tested GIS equipment.</td></tr>
<tr><td>18.</td><td>Section GIS Rev 5A

New Clause no. 15.2.14</td><td>All 765kV & 400kV Circuit Breaker control schematics shall be finalized in such a way, that it may operate with or without CSD by using a suitable selector switch irrespective of whether circuit breakers to be supplied are envisaged along with CSD or not as per bid price schedules.</td></tr>
<tr><td>19.</td><td>Section GIS Rev 5A

New Clause no. 5.41(10)</td><td>The price of Bus-duct inside the GIS hall shall be integral part of the respective bay module and it will not be paid separately. However, the payment of bus-duct for outside the GIS hall along with support structure shall be paid as per running meters in line with provision of Bid Price schedule.</td></tr>
<tr><td>20.</td><td>Section GIS Rev 5A

Annexure-1 S.No. 20 (i)</td><td>
<table>
<tr><th>Parameter</th><th>765kV system</th><th>400kV system</th><th>220kV system</th><th>132 kV system</th></tr>
<tr><td>Pre-insertion resistor requirement</td><td>As per BPS</td><td>As per BPS</td><td>NA</td><td>NA</td></tr>
<tr><td>Rating (ohms)</td><td>Approx. 450 with tolerance as applicable</td><td>Approx. 400 with tolerance as applicable</td><td>NA</td><td>NA</td></tr>
</table>
</td></tr>
<tr><td>21.</td><td>Section Air Conditioner Rev 04

Clause No. 2.3.2.3</td><td>Cooling capacity of 3TR AC units shall not be less than 36000btu/hr. and shall have energy efficiency rating of 5 star as on the date of NOA.</td></tr>
<tr><td>22.</td><td>Section Air Conditioner Rev 04

Clause No. 2.3.3.4</td><td>Cooling capacity of 2TR AC units shall not be less than 22000btu/hr. and shall have energy efficiency rating of 5 star as on the date of NOA</td></tr>
<tr><td>23.</td><td>Section Air Conditioner Rev 04

New Annexure-S3</td><td>Annexure S3 – Air Conditioning & Ventilation System for GIS Building</td></tr>
<tr><td>24.</td><td>Section CRP Rev 09

New Clause No. 21.8</td><td>Back-up Impedance protection function shall be provided for 765kV & 400kV sides of 765/400/33kV ICT and for 400kV side of 400kV class ICT. This protection function and Differential Protection function shall not be combined in the same IED.</td></tr>
</table>

25.	**Section CRP Rev 09** **New para added under Clause no.18.8**	Line Differential relays used as both Main –I & Main-II protection of a line, shall be of either different make & model or shall be on different hardware platform.
26.	**Section CRP Rev 09** **New para added under Clause no.18.9(s)**	Directional Earth Fault Relay/Function provided shall have Carrier Aided scheme feature which shall be suitable for single phase auto reclosure schemes
27.	**Section CRP Rev 09** **New Para added under Clause No. 20.4**	Wherever, scope for NGR by passing is envisaged, necessary equipment, wiring etc. required for control & monitoring of 145kV Circuit Breaker for NGR by-passing arrangement shall be under contractor's scope of work. The same may be located in respective line/reactor protection panel.
28.	**Section CRP Rev 09** **New Para added under Clause No.5.1**	Requirement of Shrouding shall not be applicable to TB's where live parts are concealed.
29.	**Section CRP Rev 09** **Clause No. 32.9**	The equipment offered shall have six (6) output ports. Various combinations of output ports shall be selected by the customer, during detailed engineering, from the following : • Potential free contact (Minimum pulse duration of 50 milli seconds.) • IRIG-B • RS232C • SNTP Port **(at least 4 ports)** • IEEE 1588 PTP (Applicable only for Process bus automation station)
30.	**Section CRP Rev 09** **Clause No. 21.1 (e)**	be suitable for individual input from associated CTs with rated CT secondary current of 1 Amp.
31.	**Section SAS Rev 09** **Typical Architectural Drawing of SAS (Without Process Bus)**	TYPICAL ARCHITECTURAL DRAWING OF SUBSTATION AUTOMATION SYSTEM (Without Process Bus) stands replaced by Annexure-S5
32.	**Section SAS Rev 4** **Para 2 under Clause No. 3.3.1**	The Substation Automation System shall have communication ports on each gateway (two gateways per station) as follows: (a) Three ports for Remote Control Centres on Secure IEC60870-5-104 protocol. **(b) Two port on IEC 60870-5-104 for Regional System Coordination Centre (RSCC)**
33.	**Section SAS Rev 4** **New Para Added Under Clause No.4.1.5**	The bidder shall also provide 2 Nos. managed Ethernet switches with at least 16 copper RJ45 ports on each switch to form managed "Redundant System LAN" for connecting different NTAMC sub-systems devices (SCADA Gateways, VMS, VOIP etc.) as per revised system architecture (attached as Annexure S5). The specification of the switches is enclosed at Annexure-S6.
34.	**Section SAS Rev 4** **Para 2 Under Clause No.4.1.6**	The substation firewall shall have the following features: - IP firewall features such as Address/port inspection and filtering - Shall be stateful firewall - Shall support upto 8 Ethernet switches 10/100 Mbps - Shall support IPv4 and IPv6

		- Shall have IP sec/VPN with 3DES/AES encryption - Shall have NAT - Shall have syslog capability - Shall be NERC compliant - Shall have hot- standby operation with similar router **- Shall support SNTP & SNMPv3 protocols**
35.	**Section SAS Rev 4** **Para 3 Under Clause No.4.1.6**	The substation routers shall have the following features: - Routing protocols such as OSPF and support for IPv4 and IPv6 **- 8 Ethernet interfaces of 10/100 Mbps** - 2 E1 interfaces - Hot standby operation with a similar router - Support IEEE 802.3u, 802.1p, 802.1Q, 802.1d, 802.1w, - Traffic prioritization for routed IP flows/ports
36.	**Section SAS Rev 4** **Bullet no.4 under Clause No. 4.2.1**	Each BCU shall be equipped with Local HMI (display) facilities, enabling control of each particular bay from BCU whenever required. The Local HMI facilities shall be accomplished by means of Graphical LCD display embedded into the front panel of the BCU. Display will show the SLD (with device identification number) showing status of bay switching equipment (such as circuit breaker, isolators, earth switches) and enabling issuance of switching controls. Other display type will be multiple displays of analog values readings / reports, displays for controls other than switching, Alarm panel displays, Diagnostic/ online configuration displays etc. **Bay control unit shall have inbuilt metering CVT supervision function. It shall have feature to give alarm in case of CVT/PT metering core fuse fail.**
37.	**Section SAS Rev 4** **Clause No. 16.0 (v)**	**LIST OF EQUIPMENTS** v) **Two nos. Disturbance Recorder/Engineering Work Station where atleast one workstation shall have Linux based operating system.**
38.	**Section PLCC Rev 05** **New Clause no. 10.4.13**	All protection couplers (Analog protection coupler, digital protection coupler) shall be equipped with direct reading type counter facility for all the codes (Tx & Rx).
39.	**Section PLCC Rev 05** **New Clause no.10.5**	Digital protection coupler (DPC) shall be used as one of the two tele-protection channel on the lines between the stations having Optical Fiber link alongwith SDH Equipment. Specification of digital protection coupler is enclosed as Annexure-S2. The DPC can be housed either in offered Control & Protection Panel / PLCC Panel or in separate panel. Generally SDH Equipment are placed in communication room of Control room where as DPC is placed in panel room. The connection between SDH equipment and each DPC shall be through Optical fiber. Necessary converter(s) for converting E1 signal to optical fiber at both ends (at Panel Room as well as at Control room) along with FODP shall be in the scope of the contractor. Further sharing of additional spare ports of converter for DPC placed in other Panel Room or in same Panel Room is also permitted. Necessary optical fiber for interconnection of DPC is to be provided by the contractor. Further any copper wiring for ensuring the protection signaling/data/speech shall be in the scope of the contractor.
40.	**Section PLCC Rev 05** **New Clause No. 6.12.4**	For 765 kV Wave Trap, cantilever strength of BPIs used for Wave Trap shall be 10 kN.
41.	**Section: Power & Control Cable Rev 06** **New Para added under Clause 1.1.4**	The cable sizes specified at clause no. 1.1.4 of Section-Power & Control Cables Rev-6 are minimum required. In case, more nos. of runs or larger sizes of cables are required between two points based on design calculations, same shall deemed to be included in the scope of bidder.

42.	**Section: Power & Control Cable Rev 06** **Clause No. 4.2**	Standard lengths for each size of power and control cables shall be 500/1000 meters. However, to avoid cable wastage and cable jointing at site, non-standard lengths of each size of Power & Control cable may also be acceptable subject to maximum length of 1000meters (+ 5% tolerance)
43.	**Section Fire Protection Rev 06** **Appendix-I**	Appendix-I (Rev 4) **s**tand replaced by following Appendix-I (Rev 5)
44.	**Section: Fire Protection Rev 06** **Clause No.9.01.00(c) & Appendix-V**	Deleted
45.	**Section Fire Protection Rev 06** **New para added at Clause no.2.03.00**	Fire detection and alarm system shall also be provided in the GIS Hall using beam type smoke detectors to be installed at suitable mounting height, and in the Relay Panel room with ionization/optical type smoke detectors to be installed on the ceiling.
46.	**Section Fire Protection Rev 06** **New Clause no.2.01.02**	Adequate no. of Hydrant posts and Fire extinguishers (CO2 and DCP type) shall also be provided for GIS Building.
47.	**Section Fire Protection Rev 06** **Clause No. 2.04.02 & 10.00.00**	Mechanical foam type fire extinguishers wherever specified as 50 litre capacity, conforming to IS:13386, shall be read as 60 litre capacity conforming to IS 16018 Further in case of non-availability of any type of fire extinguisher (i.e. water, CO2, DPC, foam type) of a particular size as specified in BPS or technical specification, next available higher size conforming to IS shall be supplied.
48.	**Section DG Set Rev 05 New para added under Clause no. 7.1(a)**	Alternatively, AMF Panel for DG Set may be installed outside the acoustic enclosure near the DG Set. In such cases, AMF panel with or without additional enclosure shall meet IP-55 degree of protection.
49.	**Section: Lighting System Rev 07** **Clause no. 6.2.1(ii)**	All Outdoor Lighting Panels shall be Stainless sheet steel of Grade 304 and shall be dust, weather and vermin proof. Panels shall be of thickness not less than 1.5 mm smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary. **Alternatively, outdoor lighting panels of Aluminum shall also be acceptable as per provisions stipulated in Section GTR.**
50.	**Section: Lighting System Rev 07** **Clause no. 6.6(i) (b)**	The outdoor junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of Cable glands of required size. The junction boxes shall be provided with 4 way knockouts suitable for street lighting/switchyard lighting terminals suitable for 2 numbers 4C x 16 Sq.mm Al. cable or as per requirement. All Outdoor Junction boxes shall be of Stainless Steel of thickness 1.5mm of grade 304. Outdoor Junction Boxes shall be suitable for mounting on columns, structures etc for Outdoor Lighting. The outdoor Junction shall have IP 55 protection. **Alternatively, outdoor junction boxes of Aluminum shall also be acceptable as per provisions stipulated in Section GTR.**
51.	**Section: LT Switchgear Rev 05 Clause no. 1.21.2**	Contractor shall submit type test reports for the Lighting transformers as per IS:2026 for which test conducted once are acceptable (i.e. The requirement of test conducted within last ten years shall not be applicable)

<table>
<tr><td>52.</td><td>Section LT Switchgear Rev 05

Clause no. 1.6.1</td><td>MCCB shall in general conform to IS: 13947 Part-2. All MCCB offered shall have Ics = 100% Icu rating.</td></tr>
<tr><td>53.</td><td>Section: Battery and Battery Charger Rev 06

Clause no. 1.2.12</td><td>The battery shall be capable of giving 1200 or more charge/discharge cycles at 80% Depth of discharge (DOD) at an average temperature of 27^{o} Celsius.

DOD (Depth of Discharge) is defined as the ratio of the quantity of electricity (in Ampere-hour) removed from a cell or battery on discharge to its rated capacity.</td></tr>
<tr><td>54.</td><td>Section: Structure Rev 06

New Clause No. 3.2.4 Added</td><td>POWERGRID will issue the fabrication drawings of the standard structures to the successful bidder. The contractor shall do the proto assembly of the structures as per the issued fabricated drawings. Employer may opt to witness such proto assembly. The bidder shall follow the fabrication drawing for preparing the proto assembly and do the minor adjustments if necessary, without affecting the strength of the structure. In case of equipment support structure the attachment of stool and fixing of MOM box etc. shall be taken care by the contractor as per the requirement of the equipment. The contractor however shall not submit the proto corrected drawings and BOM for approval of the employer. The arrangement shall however not absolve the contractor from the responsibility of supply and erection of safe sound and durable structure.</td></tr>
<tr><td>55.</td><td>Section: Structure Rev 06

New Clause no. 3.4</td><td>Nuts, Bolts and washers for all non standard structures shall be payable as per BPS.</td></tr>
<tr><td>56.</td><td>Section Civil Works Rev 11A

New Clause No. 21.0</td><td>The dewatering pump shall be Portable, Self Priming, Non clog, horizontal type monobloc pump. The Pump shall be driven by electric motor suitable for outdoor application with IP-55 degree of protection. Following are the major technical parameters for the pumps to be supplied as per BPS:

(A) Pump Rating : 2 HP
Flow Rate : 200-400 LPM
Minimum Total Head : 12 Mtrs
Voltage Range : 415 ± 10% Volts (Three Phase)

(B) Pump Rating : 5 HP
Flow Rate : 1000-1400 LPM
Minimum Total Head : 10 Mtrs
Voltage Range : 415 ± 10% Volts (Three Phase)</td></tr>
<tr><td>57.</td><td>Section Switchyard Erection Rev 10

Clause No. 9.4(j) & (k)</td><td>
<table>
<tr><th>S.No</th><th>Item</th><th>Size</th><th>Material</th></tr>
<tr><td>j)</td><td>Isolator MOM Box</td><td>50X6 mm GS flat & Flexible copper braid</td><td>Galvanised steel and copper braid</td></tr>
<tr><td>k)</td><td>Insulator Guy Arrangement</td><td>75x12mm G.S. flat</td><td>Galvanised Steel</td></tr>
</table>
</td></tr>
<tr><td>58.</td><td>Section: Switchyard Erection Rev 10

New Clause no. 20.1</td><td><u>Neutral formation for Transformer(s), DELTA formation and making connection arrangement to connect spare unit in place of any unit of the bank without physical shifting and Earthing Arrangement :</u>

For Spare Unit connection to form 3-ph bank of 765kV Class Transformers with isolator based switching arrangement without physical shifting of spare unit along with necessary Neutral Formation, Earthing Arrangement & Tertiary (DELTA)</td></tr>
</table>

		formation for 3-ph bank formation with 1-ph units shall be under present scope as per the details mentioned below: **i. <u>Neutral Formation including Neutral auxiliary bus and Earthing Arrangement</u>** The contractor shall connect the neutrals of three (3) 1-phase transformers by overhead connection using 3" IPS Al tube. The neutral formation shall be such that neutral winding of single-phase spare transformer can be disconnected or connected to the three phase banks. The connection from the neutral bushing to neutral bus shall be through 3" IPS Al tube and wherever flexible jumper needs to be provided, same shall be through twin conductor. All material like Bus post insulator, Aluminium tube, conductor, clamps & connectors, earthing materials, support structure, hardware etc. required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor. **ii. <u>Tertiary Delta Formation including Tertiary auxiliary bus(Insulation level 52 kV) .</u>** The contractor shall connect 33kV tertiary of single-phase auto-transformers in DELTA configuration by overhead connection to operate in 3-Ph Bank. The Delta shall be formed by 3" IPS Al tube, which shall be insulated with heat shrinkage insulating sleeve of at least 52kV class and shall be supported by structure mounted bus post insulators at suitable intervals. Jumpers (twin conductors) wherever provided shall also be insulated using suitable insulation tape or sleeve at least 52kV class at site. The minimum phase to phase horizontal spacing for delta formation shall be 1.5meter. All associated materials like bus post insulators, Aluminium tube, conductor, clamps & connectors, support structures, hardware, earthing materials etc. required for tertiary delta formation shall be provided by the contractor. **iii. <u>HV & IV Auxiliary Buses (Applicable for AIS Substation)</u>** Formation of HV & IV auxiliary buses for connection of transformer 3-Phase bank with 1-Phase Spare transformer unit is under the present scope of the bidder. All associated materials like Bus post insulators, Aluminium tube, conductors, clamps & connectors, insulator strings, hardware, earthing materials, support structures, required for the above-mentioned arrangement shall be provided by the contractor.
59.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.2**	**<u>Neutral formation for Reactor banks, connection to neutral grounding reactor through 132kV Surge arrester, connection to ground through neutral CTs and connection arrangement to connect spare reactor unit in place of any other units of the bank without physical shifting and Earthing Arrangement :</u>** For Spare Unit connection to 3-ph bank of 765kV Class Reactors with isolator based switching arrangement without physical shifting of spare unit along with necessary Neutral Formation, Earthing Arrangement for 3-ph bank formation with 1-ph units shall be under present scope as per the details mentioned below: **i. <u>Neutral Formation including Neutral auxiliary bus and Earthing Arrangement</u>** The contractor shall connect the neutrals of three (3) 1-phase reactors by overhead connection using 3" IPS Al tube. The neutral formation shall be such that neutral winding of single-phase spare reactor can be disconnected or connected to the three phase banks. Neutral Connections of spare unit shall be extended upto the other unit(s) by forming Neutral auxiliary bus. The connection from the neutral bushing to neutral bus shall be through 3" IPS Al tube and wherever flexible jumper needs to be provided, same shall be through twin conductor. All material like Bus post insulator, Aluminum tube, conductor, clamps & connectors, earthing materials, support structure, hardware etc. required for neutral formation and connection with neutral

		CT and earthing of neutral shall be provided by contractor. Required Insulation level is 145 kV from individual reactor neutral to point of neutral formation. However after neutral formation, the insulation level is 36kV. Connection of each Line reactor bank formed under present scope to Neutral grounding reactor through 132kV Surge Arrester including NGR by passing arrangement is also under present scope. **ii.<u>HV Auxiliary Bus (Applicable for AIS Substation)</u>** Formation of HV auxiliary bus for connection of reactor 3-Phase bank with 1-Phase Spare reactor unit is under the present scope of the bidder. All associated materials like Bus post insulators, Aluminium tube, conductors, clamps & connectors, insulator strings, hardware, earthing materials, support structures, required for the above-mentioned arrangement shall be provided by the contractor.
60.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.3**	Supply & Laying of Power, Control Cables & Special Cables (if any) (including all cabling works for spare unit of transformer/reactor) along with accessories for power supply, alarm, trip, control & indication, status and monitoring signals & contacts made available at MB/CMB of Transformers/Reactors upto Control & Relay Panels and BCUs located in the Switchyard Panel Room/Control Room and successful integration of same with Station Control, Protection & SAS System is in the scope of the contractor.
61.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.4**	3½Cx300 Sq. mm XLPE power cable for oil filtration units of reactors & transformers shall be provided. The cable shall be terminated at 250A receptacle near Reactor & Transformer in the switchyard. XLPE Power cables shall be looped in & out for 250A Power receptacles.
62.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.5**	Neutral of spare transformer/reactor is to be connected to station grounding system through a jumper/copper flat. This shall be applicable for single phase transformer/reactor wherever spare unit have been provided.
63.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.6**	Tertiary connections made for tertiary loading of LT Transformer shall be insulated using suitable insulation tape or sleeve of at least 52kV class at site
64.	**Section: Switchyard Erection Rev 10** **New Clause no. 20.7**	The earthing risers from terminal of Neutral Current Transformer (NCT) of bank of 1-Phase Transformer/Reactor (as applicable) shall be brought down for connection with pipe electrodes by providing suitable insulators mounted on NCT support structure (minimum 2 nos. per support). Necessary provisions on NCT support structure for mounting of insulator shall be provided. These insulators shall deemed to be included in corresponding Erection Hardware item for Transformer/Reactor bay (as applicable) of BPS
65.	**Section Switchyard Erection Rev 10** **New Clause No. 2.5**	Transmission line side insulator string along with hardware for line termination shall be in the scope of substation contractor.

66.	**Section Switchyard Erection Rev 10** **New Clause No. 21**	Connection arrangement of 765kV equipment's shall be done as per the conceptual drawing (Drawing No. C/ENGG/SS/CONCEPTUAL 765KV BAY CONNECTIONS, Rev-01) enclosed as Annexure-S1of this Section.
67.	**Section Switchyard Erection Rev 10** **New Clause No. 22**	For connection to HV bushing of LT Transformer, insulated copper rod/strip of at least 75 sq.mm cross sectional area shall be used.
68.	**Section Switchyard Erection Rev 10** **New Clause No. 23**	**23.0 VISUAL MONITORING SYSTEM** (if specified in BPS) Visual Monitoring System for watch and ward of substation premises shall be provided for area under present scope as per Annexure-S7
69.	**Section: GTR Rev 15** **Clause No. 24.16(ii)(b)**	Contractor shall furnish performance guarantee for an amount of 3% of the ex-works cost of the equipment (s)* and this performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor.
70.	**Section: GTR Rev 15** **New Clause Clause No. 24.21**	**<u>Technical Requirement for 220/132/66 kV* level GIS/Hybrid GIS/MTS Equipment:</u>** (i) The manufacturer whose 220/132/66 kV* level GIS/Hybrid GIS/MTS bays are offered must have designed, manufactured, type tested** (as per IEC or equivalent standard), supplied and supervised erection & commissioning of at least two (2) nos. Gas Insulated Switchgear (GIS) circuit breaker bays@ of 220/110/66kV* or above voltage class in one (1) Substation or Switchyard during the last seven (7) years and these bays must be in satisfactory operation# for at least two (2) years as on the date of NOA. (ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that a) Atleast one no. 220/110/66kV* or above voltage level GIS Circuit Breaker bay@ must have been manufactured in the above Indian works based on the technological support of the Collaborator(s) and either supplied or type tested the above GIS bay (as per IEC or equivalent standard) as on the date of NOA. b) The collaborator(s) meets the requirements stipulated in (i) above. A valid collaboration agreement for technology transfer/license to design, manufacture, test and supply 220/110/66*kV or above voltage level GIS equipment in India shall be submitted. **c)** The Collaborator(s) shall furnish performance guarantee for an amount of 3% of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder. **Note:** 1. (*) voltage class of respective equipment as applicable

<table>
<tr><td></td><td></td><td>2. (@) For the purpose of technical requirement, one no. of circuit breaker bay shall be considered as a bay used for controlling a line or a transformer or a reactor or a bus section or a bus coupler and comprising of at least one circuit breaker, one disconnector and three nos. of single phase CTs / Bushing CTs. GIS means SF6 Gas insulated Switchgear.

3. Experience with combination of GIS CB bay/Hybrid GIS CB Bay/MTS CB Bay is also acceptable if supply of only Hybrid/MTS equipment is envisaged. Hybrid GIS means outdoor SF6 Gas insulated switchgear connected to outdoor Air insulated bus-bar System (AIS bus-bars System), MTS means outdoor SF6 Gas insulated Mixed Technology Switchgear connected to outdoor AIS bus bar system.

4. (**) Type test reports of the collaborator/ parent company/ subsidiary company/ group company shall also be acceptable</td></tr>
<tr><td>71.</td><td>Section: Lighting System Rev 07

New Para under Clause No. 2.1</td><td>Wherever, Indoor Illumination of building is specified as LS/Lot/SET item in BPS, illumination shall be provided using fixture types as specified in Annexure-I of Section: Lighting System. However, contractor shall submit lighting design calculation for deciding the number of fixtures in each building/room. Following Average lux (at working plane of height 1.2 Mtrs from floor level) levels to be maintained for design of illumination system:
<table>
<tr><th>S.No.</th><th>Building/Room Type</th><th>Average Lux Level to be maintained</th></tr>
<tr><td>1</td><td>Control Room /Station-In charge Room /Administrative Room/Conference Room / Switchyard Panel Room/ GIS Relay Panel Room</td><td>300 Lux</td></tr>
<tr><td>2</td><td>Electronic Test Lab</td><td>250 Lux</td></tr>
<tr><td>3</td><td>GIS Hall/ Battery Room/ACDC & DCDB Room</td><td>200 Lux</td></tr>
<tr><td>4</td><td>AHU Room/GIS Store Room/ Pantry /Reception/ FFPH Building</td><td>150 Lux</td></tr>
<tr><td>5</td><td>Corridor/ Toilets</td><td>100 Lux</td></tr>
<tr><td>6</td><td>Periphery of the Building</td><td>50 Lux</td></tr>
<tr><td>7</td><td>Any other room/building</td><td>200 Lux</td></tr>
</table>
The minimum lux level to average lux level ratio should not be less than 0.6 (i.e Emin/Eav> 0.6). The maintenance factor for indoor illumination design shall be considered as 0.8.</td></tr>
</table>

		All required items /equipment /fixtures/ panels/ receptacles/ switches/ switchboards/ fans etc. for Illumination of Control Room Building, GIS Building, FFPH, SPR, Security Hut etc. (as applicable) are deemed to be included under corresponding LS/Lot/SET item of BPS.
72.	**Section Fire Protection Rev 06** **New Clause No. 2.06.05**	For new substation, Fire Fighting LT Boards (AC & DC) and Annunciation panels (for FFPH & Control Room Building), shall have number of feeders, annunciation windows, zone-alarm modules (as applicable) required for entire present & specified future scope of the substation.
73.	**Section GTR Rev 15** **New Para under Clause no. 8.3.2**	Wherever references to SFQP is made in Technical Specifications, it shall be the latest edition/revision of the same uploaded up to seven (7) days prior to the actual date of bid opening.
74.	**Section GTR Rev 15** **New Clause No. 4.7**	**<u>Planning and Designing in purview of Vulnerability Atlas of India</u>** Vulnerability Atlas of India (VAI) is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT wise hazard, maps with respect to earthquakes, winds and floods for district wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation stage. This Atlas is one of its kind single point source for the various stakeholders including policy makers, administrators, municipal commissioners, urban managers, engineers, architects, planners, public etc. to ascertain proneness of any city/ location/ site to multi-hazard which includes earthquakes, winds, floods thunderstorms, cyclones and landslides. While project formulation, approvals and implementation of various urban housing, buildings and infrastructures schemes, this Atlas provides necessary information for risk analysis and hazard assessment. The Vulnerability Atlas of India has been prepared by Building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website <u>https://www.bmtpc.org/</u>. It is mandatory for the bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of: i) Seismic zone for earthquakes, ii) Wind velocity iii) Area liable to floods and Probable max. surge height iv) Thunderstorms history v) Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal Region vi) Landslides incidences with Annual rainfall normal vii) District wise Probable Max. Precipitation

<table>
<tr><td>75.</td><td>Section Switchyard Erection Rev 10

New Clause No. 9.5.8</td><td>In case of new substation/switchyard, maximum spacing of Main Earthmat shall be considered as 30 M x 30 M, 24 M x 24 M, 16 M x 16 M & 12 M x 12 M for 765kV, 400kV, 220kV & 132kV switchyard respectively.

Actual spacing for main earthmat shall be finalized during detailed engineering based on soil resistivity data and payment shall be made as per actual executed quantity at site. However, no cost compensation shall be considered in case of actual spacing of main earthmat finalized during detailed engineering is less than that mentioned above.

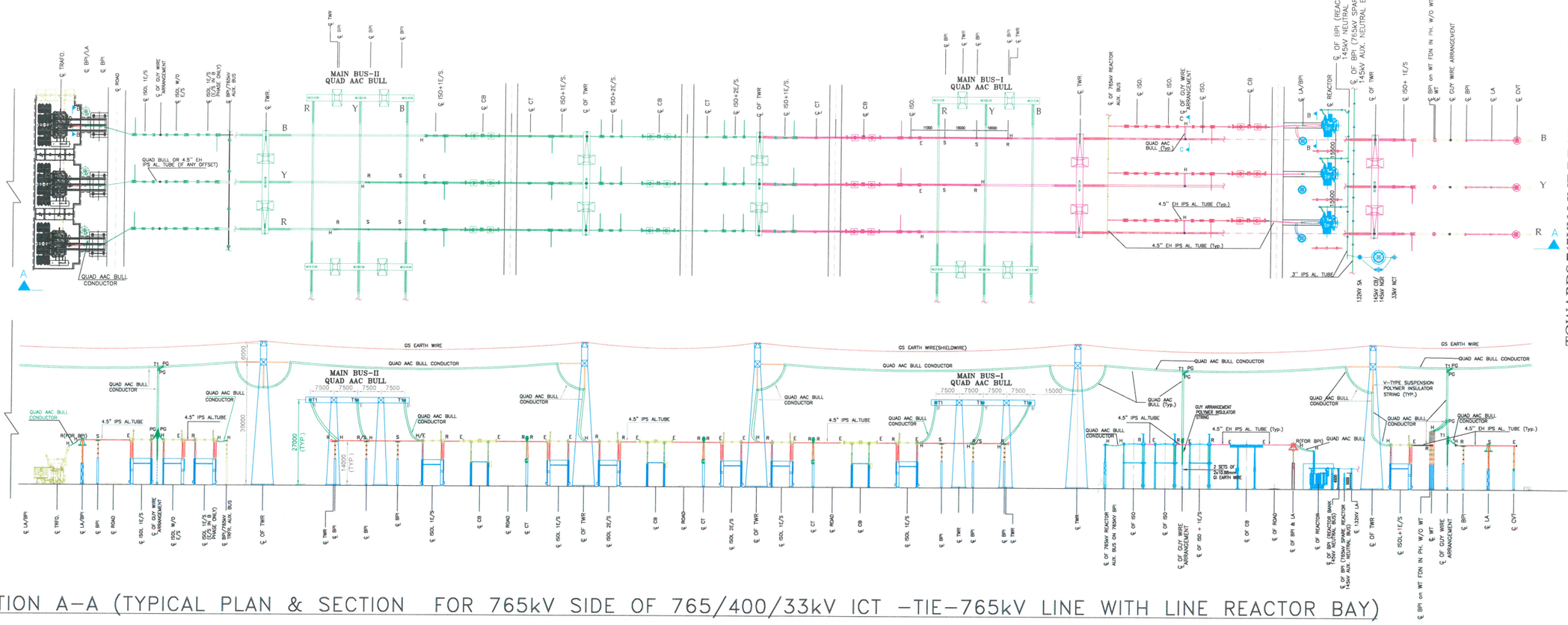
For switchyard extensions, main earthmat spacing shall be considered same as that in the existing switchyard.</td></tr>
<tr><td>76.</td><td>Section Switchyard Erection Rev 10

New Clause No. 10.2</td><td>Following type of conductor for Flexible or Rigid Bus bars/Switchyard Equipment Jumpers/Interconnections shall be provided subject to suitability of conductor as per specified/applicable current ratings:

<table>
<tr><th>Voltage Level</th><th>Conductor / Al .Tube Type</th></tr>
<tr><td>Voltage Level: 765kV</td><td>AAC Bull / 4.5'' IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 400kV</td><td>ACSR Bersimis / 4.5'' IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 220kV</td><td>ACSR Moose / 4.0'' IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 132kV</td><td>ACSR Moose / 3.0'' IPS Al. Tube</td></tr>
</table>

For substation extension works, suitable clamps & connectors for interconnection with existing buses as per drawings shall be provided by the contractor under present scope.

Conductor type with higher current rating than that specified above shall also be acceptable without any additional price implication.</td></tr>
</table>



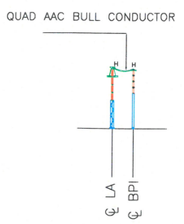
SECTION A–A (TYPICAL PLAN & SECTION FOR 765kV SIDE OF 765/400/33kV ICT –TIE–765kV LINE WITH LINE REACTOR BAY)

LEGENDS:

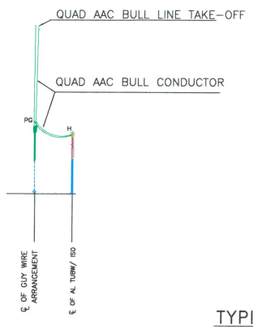
R– RIGID CONNECTION
E– EXPANSION TYPE CONNECTION
S– SLIDING TYPE CONNECTION
PG–PARALLEL GROOVE CONNECTION
T1– T1 TYPE CONNECTION (EACH T CONNECTOR SHALL BE OF TWIN TO TWIN CONDUCTOR TYPE FOR QUAD TO QUAD CONNECTION)
H– HORIZONTAL TYPE CONNECTION

NOTES:

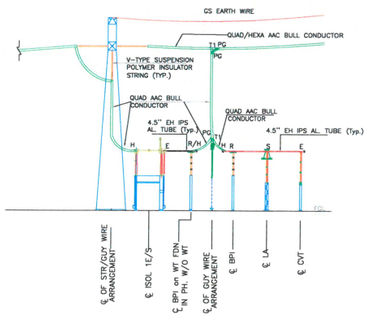
1) TWIN–TWIN CONNECTOR SHALL BE USED FOR QUAD–QUAD DROPPER CONNECTION.
2) AUXILIARY BUS ARRANGEMENT FOR 765kV TRANSFORMERS & REACTOR NEUTRALS, SPARE TRANSFORMER/REACTOR CONNECTION, TERTIARY ARRANGEMENT OF TRANSFORMERS ARE NOT SHOWN COMPLETELY.
3) CANTILEVER STRENGTH OF 765KV INSULATORS/BPI USED FOR 765KV ISOLATORS/WT SHALL BE OF 10KN AND FOR OTHER BPI IN SWITCHYARD SHALL BE OF 8KN MINIMUM.
4) HORIZONTAL TAKE–OFF OF JUMPERS AT EQUIPMENT LEVELS WITH ADEQUATE SAG SHALL BE PROVIDED



SECTION B–B



SECTION C–C



TYPICAL SECTION FOR 765KV LINE SIDE EUIPMENT CONNECTION ARRANGEMENT IN PHASE WITHOUT WT

PREPARED BY			REVIEWED BY		APPROVED BY	
GAUTAM SHARMA	D.OJHA	A.SAMBAIAH	ABHAY KUMAR	P.K. DAS	RAJIL SRIVASTAVA	R.N. SINGH
CDE (ENGG–S/S)	DGM (ENGG–S/S)	DGM (ENGG–S/S)	Sr. GM (ENGG–S/S)	Sr.GM (ENGG–S/S)	CGM (ENGG–S/S)	ED (ENGG.–S/S,T/L & Civil)

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE: CONCEPTUAL CONNECTION ARRANMENT OF 765KV TRANSFORMER BAY–TIE BAY– LINE WITH LINE REACTOR BAYS

DRAWING NO. C/ENGG/SS/CONCEPTUAL 765KV BAY CONNECTIONS

REV.1

SH.10F1

Annexure-S2

SPECIFICATION FOR DIGITIAL PROTECTION COUPLER

1.0 Digital protection coupler for protection signalling through optical fibre cable system.

1.1 The Digital protection signalling equipment is required to transfer the trip commands from one end of the line to the other end in the shortest possible time with adequate security and dependability. It shall also monitor the healthiness of the link from one end to the other and give alarms in case of any abnormality. The protection signalling equipment shall have a proven operating record in similar application over EHV systems and shall operate on 48V DC (+10%, -10%). It shall provide minimum four commands. These commands shall be suitable for Direct tripping, Intertripping and Blocking protection schemes of EHV lines.

The protection signalling equipment shall communicate to the remote end interfacing with SDH terminal equipment at its 2Mbps port. It shall provide suitable interfaces for protective relays, which operate at 220/110V DC. Power supply points shall be immune to electromagnetic interface.

1.2 Principle of operation

During normal operation, protection signalling equipment shall transmit a guard signal/code. In case Protection signalling equipment is actuated by protective relays for transmission of commands, it shall interrupt the guard signal/code and shall transmit the command code to the remote end. The receiver shall recognize the command code and absence of the guard code and will generate the command to the protective relays.

All signal processing i.e. generation of tripping signal and the evaluation of the signals being received shall be performed completely digital using Digital Signal Processing techniques.

1.3 Loop testing

An automatic loop testing routine shall check the teleprotection channel.

It shall also be possible to initiate a loop test manually at any station by pressing a button on the front of the equipment.

Internal test routine shall continuously monitor the availability of the protection signaling equipment.

Proper tripping signal shall always take the priority over the test procedure.

The high speed digital protection signalling equipment shall be designed and provided with following features.

- Shall work in conjunction with SDH terminal equipment.
- It shall communicate on G 703 (E1,2 Mbps)
- Full Duplex operation
- Auto loop facility shall be provided
- Shall meet IEC 60834-1 standard
- Shall be able to transmit upto 4 commands with trip counter simultaneously or sequentially in one 2Mbps channel

Bidder shall quote for protection signalling equipment suitable for 4 commands with separate trip counters for transmit and receive. With regard to trip counters alternate arrangement .i.e. Laptop along with software & all accessories to download events including carrier receipt and transmit shall be acceptable. Laptop for the above shall be supplied at each substation under substation package.

High security and dependability shall be ensured by the manufacturer. Probability of false tripping and failure to trip shall be minimum. Statistical curves/figures indicating above mentioned measures shall be submitted along with the bid.

The DPC can be either housed in offered Control & Protection Panel / PLCC Panel or in separate panel.

Reports of the following tests as per clause 9.2 of Chapter 2-GTR shall be submitted for approval for protection signalling equipment and relays associated with the protection signalling equipment and interface unit with protective relay units, if any.

i) <u>General equipment interface tests</u> :

a) Insulated voltage withstand tests
b) Damped oscillatory waves disturbance test
c) Fast transient bursts disturbance test
d) Electrostatic discharge disturbance test
e) Radiated electromagnetic field test
f) RF disturbance emission test

ii) <u>Specific power supply tests</u>

a) Power supply variations
b) Interruptions

c) LF disturbance emission
d) Reverse polarity

iii) Tele-protection system performance tests

a) Security
b) Dependability
c) Jitter
d) Recovery time
e) Transmission time
f) Alarm functions
g) Temperature and Humidity tests (As per IEC 68-2)

- Dry heat test (50°C for 8 hours)
- Low temperature test (-5°C for 8 hours)
- Damp heat test (40°C/95%RH for 8 hours)

All the above tests at i, ii & iii (except temperature & humidity tests) shall be as per IEC 60834-1 and the standards mentioned therein.

iv) Relays

a) Impulse voltage withstand test as per IEC 60255.

b) High frequency disturbance test as per IEC 60255.

The protection signalling equipment shall be of modular construction and preferably mounted in the Relay panels. Cabling between the protection signalling equipment & Protection relays and between protection signalling equipment & Communication equipment shall be in the scope of bidder.

The input/output interface to the protection equipment shall be achieved by means of relays and the input/output rack wiring shall be carefully segregated from other shelf/cubicle wiring.

The isolation requirements of the protection interface shall be for 2kV rms.

1.4 Major technical Particulars

The major technical particulars of protection signalling equipment shall be as follows.

i)	Power supply	48V DC +10%, -10%
ii)	Number of commands	4 (four)
iii)	Operating time	<7 ms
iv)	Back to back operate time without propagation delay	≤ 8 ms

v) Interface to Protection relays

	Input:	Contact Rating:
	Rated voltage	: 250 volts DC
	Maximum current rating:	5 amps
Output:	Contact Rating:	
	Rated voltage	: 250 volts DC
	Rated current	: 0.1 A DC
	Other parameters :	As per IEC-255-0-20

vi) Alarm contact

Rated voltage	: 250 volts DC
Rated current	: 0.1 A DC
Other parameters :	As per IEC-255-0-20

vii) Digital communication interface: G 703(E1)

AIR CONDITIONING & VENTILATION SYSTEM FOR GIS BUILDING

AIR CONDITIONING SYSTEM FOR GIS

1 GENERAL

1.1 This specification covers supply, installation, testing and commissioning and handing over to POWERGRID of Air conditioning system for the Local Control rooms & Maintenance Room in the GIS halls.

1.2 Air conditioning system shall be designed to maintain the inside DBT below 24^{o}C. Bidder shall submit necessary design calculations for employer's approval.

1.3 At least 50% spare Air-Conditioning capacity shall be provided for Local Control rooms in the GIS halls.

1.4 Controllers shall be provided in Local Control room inside GIS hall for controlling and monitoring the AC units in these rooms as detailed in clause no.2.6

1.5 Each Local Control room inside GIS hall shall be provided with temperature transducer to monitor the temperature of the Local Control rooms in the GIS halls. The Temperature transducer shall have the following specification:

Sensor	:	Air temperature sensor (indoor use)
Output	:	4 to 20mA
Temperature range	:	-5^{o}C to 60^{o}C
Resolution	:	0.1^{o}C
Accuracy	:	0.5^{o}C or better.

2 AIR CONDITIONING SYSTEM REQUIREMENTS.

2.1 Air conditioning requirement of the buildings shall be met using a combination of following types Air Conditioning units as required.

a) Cassette type split AC units of 3TR.
b) High wall type split AC units of 2TR.

2.2 Type & Capacity of air conditioners shall be so chosen such that quantity of air conditioners in the room is optimized keeping the necessary air flow.

2.3 **Scope**

The scope of the equipment to be furnished and services to be provided under the contract are outlined hereinafter and the same is to be read in

conjunction with the provision contained in other sections/ clauses. The scope of the work under the contract shall be deemed to include all such items, which although are not specifically mentioned in the bid documents and/or in Bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation.

2.3.1 Required number of Cassette type split AC units of 3TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor unit with cordless remote controller.

2.3.2 Required number of High wall type split AC units of 2TR capacity each complete with air cooled outdoor condensing unit having hermetically sealed compressor and high wall type indoor evaporator unit with cordless remote controller.

2.3.3 Copper refrigerant piping complete with insulation between the indoor and outdoor units as required.

2.3.4 First charge of refrigerant and oil shall be supplied with the unit.

2.3.5 GSS/Aluminium sheet air distribution ducting for distributing conditioned dehumidified air along with supply air diffusers and return air grilles with volume control dampers and necessary splitters etc., suitable fixtures for grilles/diffusers and supports for ducting complete with insulation.

2.3.6 Local start/stop facility for local starting/ stopping of all electrical equipment/ drives.

2.3.7 All instruments and local control panels alongwith controls and interlock arrangements and accessories as required for safe and trouble free operation of the units.

2.3.8 PVC drain piping from the indoor units upto the nearest drain point.

2.3.9 Supply and erection of Power and control cable and earthing.

2.3.10 MS Brackets for outdoor condensing units, condensers as required.

2.4 **Technical specifications.**

2.4.1 **Cassette type split AC units**.

The Cassette type AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.

AIR CONDITIONING & VENTILATION SYSTEM FOR GIS BUILDING

2.4.1.1 Outdoor unit shall comprise of hermetically/ semi hermetically sealed compressors mounted on vibration isolators, fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.

2.4.1.2 Indoor units shall be of 4-way, ceiling mounted cassette type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode etc.

2.4.1.3 Cooling capacity of 3TR AC units shall not be less than 36000btu/hr. and shall have energy efficiency rating of 5 star as on the date of NOA.

2.4.2 **High wall type split AC units**

2.4.2.1 The split AC units shall be complete with indoor evaporator unit, outdoor condensing units and cordless remote control units.

2.4.2.2 Outdoor unit shall comprise of hermetically/semi hermetically sealed compressors mounted on vibration isolators, propeller type axial flow fans and copper tube aluminium finned coils all assembled in a sheet metal casing. The casing and the total unit shall be properly treated and shall be weatherproof type. They shall be compact in size and shall have horizontal discharge of air.

2.4.2.3 The indoor units shall be high wall type. The indoor unit shall be compact and shall have elegant appearance. They shall have low noise centrifugal blowers driven by suitable motors and copper tube aluminium finned cooling coils. Removable and washable polypropylene filters shall be provided. They shall be complete with multi function cordless remote control unit with special features like programmable timer, sleep mode and soft dry mode etc.

2.4.2.4 Cooling capacity of 2TR AC units shall not be less than 22000btu/hr. and shall have energy efficiency rating of 5 star as on the date of NOA.

2.5 The Split AC units shall be of Carrier, Voltas, Blue Star, Hitachi, Daikin, LG, National, O'General, or Samsung make.

2.6 Controllers shall be provided in Local Control room inside GIS hall, one

controller for each room, to control and monitoring of AC units and shall have the following facilities;

- Standby units shall come in to operation automatically when the running main unit fails
- Main and standby units shall be changed over periodically which shall be finalised during detailed engineering.
- Following alarms shall be provided:

  a. Compressor On/OFF condition of each unit
  b. Compressor failure of each unit
  c. Power OFF to AC unit
  d. High temperature in room.

2.7 **Warranty**

All compressors shall have minimum 5 years Warranty from the date of commissioning.

Ventilation system for GIS Hall

Each GIS Hall shall have an independent ventilation system. Each Ventilation system shall consist of two 100% capacity systems, one operating and one stand-by.

To ensure that the air being supplied to the GIS hall is free from dust particles, a minimum two stage dust filtration process shall be supplied. This shall consist of at least the following:

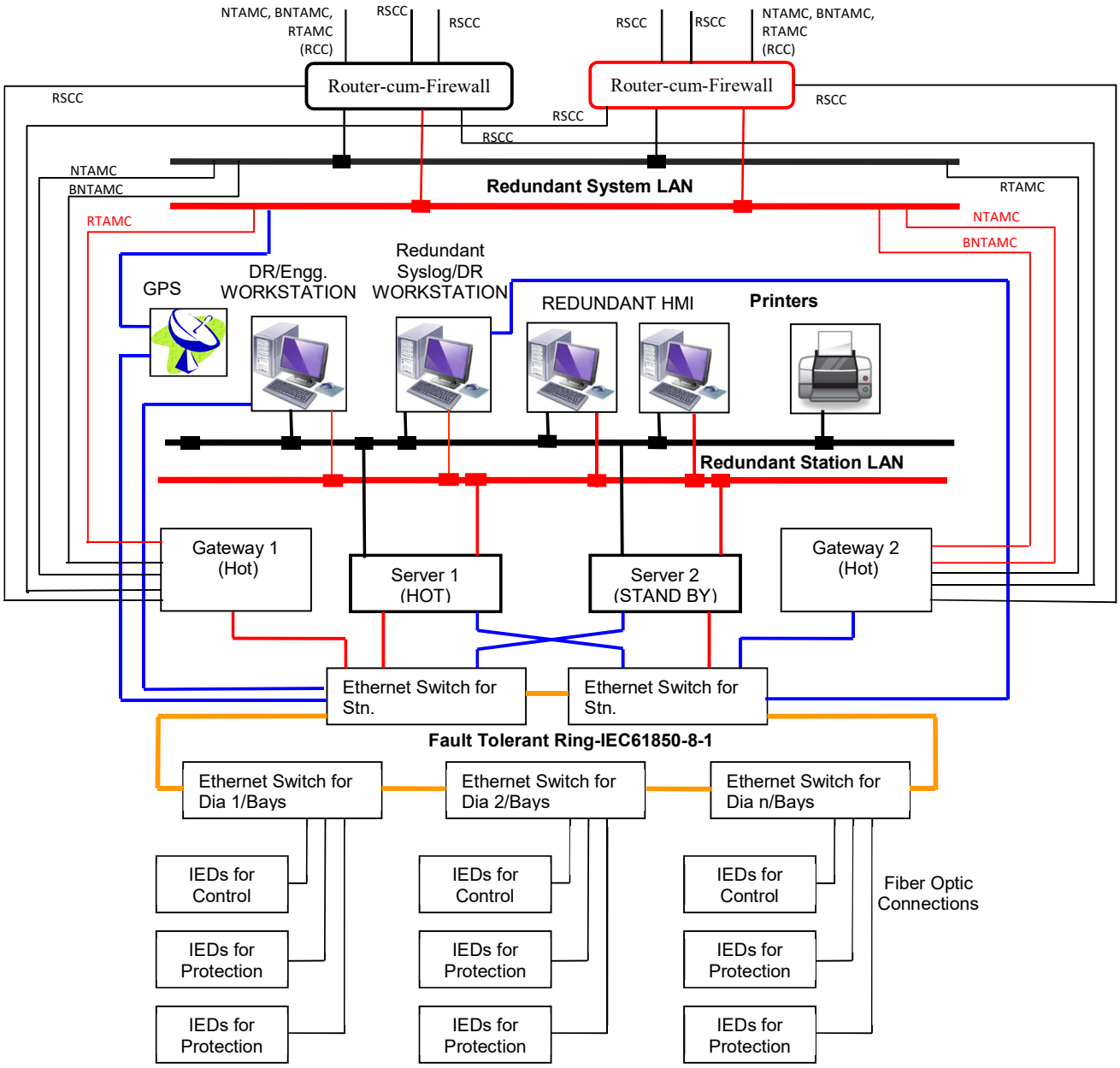
1. Pre Filters: To remove dust particles down to 10 micron in size with at least 95% efficiency.

2. Fine Filters: To remove dust particles down to 5 microns in size with at least 99% efficiency.

All the filters shall be panel type. Easy access should be available to the filters for replacement/cleaning.

The ventilation of the GIS hall shall be of a positive pressure type with minimum 2 air changes per hour. The pressure inside the GIS hall shall be maintained 5 mm of water above the atmospheric pressure. Fresh outdoor air shall be filtered before being blown into the GIS hall by the air fans to avoid dust accumulation on components present in the GIS hall. GIS hall shall be provided with motorized exhaust dampers with local control.

TYPICAL ARCHITECTURAL DRAWING OF
SUBSTATION AUTOMATION SYSTEM (Without Process Bus) for New Substation



Note:

1. The redundant managed bus (station LAN) shall be realized by high speed optical bus using industrial grade components and shall be as per IEC 61850.
2. Inside the sub-station, all connections shall be realized as per IEC 61850 protocol.
3. For gateway, it shall communicate with Remote Supervisory Control Centre (RSCC) on IEC 60870-104 protocol. The number of ports required shall be as per clause no. 1.1 and 3.3 of this specification.
4. The printer as required shall be connected to station bus directly and can be managed either from station HMI, HMI view node or disturbance recorder work stations.
5. The above layout is typical. However if any contractor offers slightly modified architecture based on their standard practice without compromising the working, the same shall be subject to approval during detailed engineering.
6. RCC means NTAMC/RTAMC. Similarly, RSCC could be SLDC for state owned substations/bays.
7. Syslog server to be Linux based. However DR/Engg. PC workstation can be other Operating System.

SPECIFICATIO FOR SWITCHES

Substation System LAN:

2 (two) nos. managed Ethernet switches with 16 copper 10/100 Mbps RJ45 ports on each switch shall be supplied to form redundant system LAN as shown in typical architecture drawing. These switches shall be different from IEC 61850 LAN and specifically used for the purpose of connecting various devices of different sub-systems (SCADA, VMS, VOIP etc.) for integration with NTAMC/RTAMC. These switches shall be suitable for substation environment and shall comply with the requirements of IEC 61850-3 standard for EMI/EMC.

These LAN switches shall have the following compliance and functional features:

(a) Compliance as per NERC-CIP-3, NERC-CIP-5. NERC-CIP-7 standard for cyber security
(b) Support SNMPv3 (Full SNMP support including Traps)
(c) Web based GUI or CLI based with HTTPS/HTTP and SSH/ Telnet support
(d) Support for IPv4 and IPv6 switching simultaneously
(e) Layer 3 Static routing functionality
(f) Syslog facility for local as well as remote server
(g) Support for remote management
(h) LED indication for port status/supply etc.
(i) Shall support VLAN IEEE 802.1Q
(j) IGMP snooping
(k) Spanning tree protocol IEEE 802.1d or RSTP IEEE 802.1w
(l) Shall support SNTP
(m) Port based Network Access Control (IEEE 802.1x)
(n) Quality of Service (IEEE 802.1p)
(o) Shall support unicast as well as multicast IP traffic
(p) SNTP time synchronization
(q) Shall support Mac Binding
(r) Fanless design

Visual monitoring system for watch and ward of Substation premises :

Visual monitoring system (VMS) for effective watch and ward of sub station premises covering the areas of entire switchyard, Control Room cum Administrative building, Fire fighting pump house, stores and main gate, shall be provided. The contractor shall design, supply, erect, test and commission the complete system including cameras, Digital video recorder system, mounting arrangement for cameras, cables, LAN Switches, UPS and any other items/accessories required to complete the system. To provide all the necessary licenses to run the system successfully shall be in the scope of contractor.

System with Color IP Cameras for VMS surveillance would be located at various locations including indoor areas and outdoor switchyard and as per the direction of Engineer-In-Charge. The VMS data partly/completely shall be recorded (minimum for 15 days) and stored on network video recorder.

The number of cameras and their locations shall be decided in such a way that any location covered in the area can be scanned. The cameras shall be located in such a way to monitor at least:

1. The operation of each and every isolator pole of the complete yard in case of AIS Sub-station.
2. The Operation of each bay(s) of GIS Hall as Applicable.
3. All the Transformer and Reactors All the Entrance doors of Control Room Building and Fire-fighting Pump House, GIS Hall and Switchyard Panel room as applicable.
4. All the gates of switchyard.
5. Main entrance Gate
6. All other Major AIS Equipment (such as CB, CT, CVT, SA etc. as applicable)

   The cameras can be mounted on structures, buildings or any other suitable mounting arrangement to be provided by the contractor.

1.1 Technical requirements of major equipment of Visual Monitoring System.

1.1.1 The Video Monitoring system shall be an integrated system with IP network centric functional and management architecture aimed at providing high-speed manual/automatic operation for best performance.

1.1.2 The system should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users.

1.1.3 The system shall use video signals from various types of indoor/outdoor CCD colour cameras installed at different locations, process them for viewing on

workstations/monitors in the control Room and simultaneously record all the cameras after compression using **H 264/**MPEG 4 or better standard. Mouse/Joystick-Keyboard controllers shall be used for Pan, Tilt, Zoom, and other functions of desired cameras.

1.1.4 The System shall provide sufficient storage of all the camera recordings for a period of 15 days or more @ 25 FPS, at 4 CIF or better quality using necessary compression techniques for all cameras. It shall be ensured that data once recorded shall not be altered by any means. The recording resolution and frame rate for each camera shall be user programmable.

1.1.5 The surveillance VMS System shall operate on 230 V, 50 Hz single-phase power supply. System shall have back up UPS power supply meeting the power supply need of all the cameras in the stations including those which are installed at gate for a period of 2 hours. The bidder shall submit the sizing calculation for the UPS considering the total load requirement of Video Monitoring System.

1.2 System requirements:

a) System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording.

b) All cameras may be connected through a suitable LAN which shall be able to perform in 765kV class sub-station environment without fail.

c) All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.

d) Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

e) Facility of Camera recording in HD (1280X720p), D1 , 4CIF , CIF, VGA, as well as in any combination i.e. any camera can be recorded in any quality.

f) System to have facility of **100%** additional camera installation beyond the originally planned capacity.

g) In order to optimize the memory, while recording, video shall be compressed using H **264/**MPEG-4 or better standard and streamed over the IP network.

h) System shall be triplex i.e. it should provide facility of Viewing, Recording & Replay simultaneously.

i) The offered system shall have facility to export the desired portion of clipping (from a specific date/time to another specific date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.

j) System shall have provision of WAN connectivity for remote monitoring.

k) The equipment should generally conform to Electro magnetic compatibility requirements for outdoor equipment in EHV switchyards. The major EMC required for Cameras and other equipment shall be as under:

1. Electrical Fast Transient (Level 4) – As per IEC 61000-4-4

2. Damped Oscillatory (1 MHz and 100 KHz) (level 3) – As per IEC 61000-4-18
3. AC Voltage Dips & Interruption/Variation (class 3) – As per IEC 61000-4-11
4. Electrostatic Discharge (Level 4) – As per IEC 61000-4-2
5. Power Frequency Magnetic Field (level 4) – As per IEC 61000-4-8
6. Ripple on DC input Power Supply Port immunity test(level 4) - As per IEC 61000-4-17

Type test reports to establish compliance with the above requirement shall be submitted during detailed engineering.

1.2.1 VIDEO SURVEILLANCE APPLICATION SOFTWARE

a) Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoder, Servers, NAS boxes/Raid backup device etc.

b) The software should have inbuilt facility to store configuration of encoders and cameras.

c) The software should Support flexible 1/2/4/8/16/32 Windows Split screen display mode and scroll mode on the PC monitor.

d) The software should be able to control all cameras i.e. PTZ control, Iris control, auto / manual focus, and color balance of camera, Selection of presets, Video tour selection etc.

e) The software should have user access authority configurable on per device or per device group basis. The system shall provide user activity log with user ID, time stamp, action performed, etc.

f) The users should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user.

g) It should have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera-wise. It should provide onscreen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.

h) The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.

i) Retrieval: The VMS application should allow retrieval of data instantaneously or any date / time interval chosen through search functionality of the application software. In case data is older than 15 days and available, the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system.

j) VMS shall provide the full functionality reporting tool which can provide

reports for user login/logoff, camera accessibility report, server health check reports etc.

1.2.2 Network video recorder

The Network Video recorder shall include at least Server (min 3.0 GHZ, 4GB RAM, 3000GB HDD(min)), RAID 5 ,with suitable configuration along with Colored TFT 22" High resolution monitor, and Internal DVD writer. Windows XP/Vista/7 Prof. or VMS compatible operating system latest version with hardware like graphic cards, licensed Anti-virus etc.

Further the digital video recorder shall conform to the following requirements:

1.	Server Spec	Intel Quad Core (or better) 3.0 Ghz (min.) , 8 MB Cache , 4 GB memory , with suitable NVIDIA graphics card,3 TB HDD , Raid 5
2.	Recording and Display Frame Rate	Real-time 25 frames per second per channel , manual select
3.	Recording Resolution	(PAL): 1280X720 , 704(H) x 586(V) It should be possible to select lower resolutions
4.	Compression Method	H.264/MPEG-4 or better and latest
5.	Video Motion Detection Capable	Standard and built-in (selectable in menu)
6.	Monitoring Options	Split screen 1, 2, 4 , 8, 16, 32 or more cameras
7.	Playback Options	Search, still image capture
8.	Alarm/Event Recording Capable	To be provided with built-in external alarm input/ output ports minimum(8 in, 2 out)
9.	Network Operation Capable	To be provided by using WAN or LAN router
10.	Remote Internet Viewing Capable	Using WAN or LAN router
11.	HDD Storage Consumption	1GB ~ per hour / channel variable based on frame speed and resolution settings, as well as compression
12.	Operation	Triplex operation (simultaneous recording, playback, network operation)
13.	Number of Video Channel	32
14.	Audio Recording Capable	32
15.	Input Voltage	230V AC or equivalent with UPS as a back up for 30 minutes.

1.2.3 VMS Camera

a) The color IP camera for substation shall have PAN, TILT and ZOOM facilities so that it can be focused to the required location from the remote station through a controller. Whereas wireless IP cameras with PTZ controls are required for installation at gates of the POWERGRID premises as per the direction of Engineer-In-Charge
b) The IP Camera at the main gate can be fixed or PTZ based and shall be used for monitoring entry and exit
c) It should have sufficient range for viewing all the poles of isolators and other equipments with high degree of clarity.
d) The VMS camera shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting.
e) It shall be possible to define at 128 selectable preset locations so that the camera gets automatically focused on selection of the location for viewing a predefined location.
f) The camera should be able to detect motion in day & night environments having light intensity of Color: 0.5 Lux; B&W:0.05 Lux
g) Housing of cameras meant for indoor use shall be of IP 42 or better rating whereas outdoor camera housing shall be of IP 66 or better rating. Housing shall be robust and not have the effect of electromagnetic induction in 765/400KV switchyard.
h) All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password
i) Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

A. Outdoor IP Fixed Megapixel Camera Specifications (For Main Gate)

1.	Image Sensor	2-megapixel Progressive ,1 / 3" CMOS/CCD sensor, Minimum illumination 0.1 Lux
2.	Min Luminous	0.5LUX(Color) 0.05Lux(Black)
3.	Camera Enclosure Type	IP66 Grade
4.	Iris/Focus	Auto/Manual
5.	Video Compression	Dual Stream H.264 and MPEG 4 user selectable
6.	Support Dual-stream	primary/secondary stream, H.264/MPEG 4 optional
7.	Video Definition	Primary stream:1600x1200,1280x960,1280x720, Secondary stream:800x600,400x288,192x144
8.	Video Parameters	Brightness, hue, contrast, saturation and image quality

9.	Video Frame Rate	PAL: 1-25frames/second NTSC:1-30frames/second
10.	Video Compression BR	32Kbit/S - 6Mbit/S
11.	Video Output	One channel composite Streaming
12.	Supported Protocols	TCP, UDP, IP, HTTP, FTP, SMTP, DHCP, DNS,ARP, ICMP, POP3, NTP, IPsec, UpnP, RTP, RTCP
13.	Operating Temperature	-5 ~ +50℃
14.	Operating Humidity	10 ~ 90%

B. Outdoor IP66 PTZ HD Camera Specifications (For Switch Yards)

1.	Image sensor	1/3 type Solid State Progressive Scan CCD,WDR(High Definition)
2.	Security	Multiple user access with password protection
3.	Effective Pixels	**(PAL): Main Stream** : **1280x720** Sub Stream：640x360、320x280 selectable
4.	Compression	Dual Stream H.264 and MPEG 4 user selectable
5.	Signal System	50 Hz
6.	S/N (signal to noise) Ratio	Better than 50 dB
7.	Electronic Shutter	1/60 ~ 1/10,000 sec. automatic or better
8.	Scanning System	Progressive/interlace
9.	Low Light Sensitivity (lux)	Color: 0.5 Lux; B&W:0.02 Lux
10.	Lens	Minimum 10x (minimum) optical in High Definition (**The system shall be able to zoom the images on the monitor without any distortion to the maximum level of optical zoom)**
11.	Lens Size	Minimum 4.1~73.8 mm
12.	Lens Aperture	F1.6(wide)~F2.8(tele), f=4.1~41.0mm, 10X Zoom, Video Auto Focus Angle of View Horizontal : 52°(wide) , 2.8°(tele)
13.	PTZ Data Transfer Baud/Bit Rates Supported	Selectable 2400 bps / 4800 bps / 9600 bps
14.	Panning Range	Complete 360 degrees (horizontal)
15.	Pan Speed	Adjustable, 0.1 degrees / second ~ 250 degrees / second
16.	Tilting Range	Minimum 180° Tilt Rotation
17.	Tilt Speed	Adjustable, 0.1 degrees / second ~ 150 degrees / second
18.	In Built Storage	Camera should have inbuilt storage TF or SD

		format for recording and storing Pictures
19.	IP Class	IP66 Standard
20.	Working temperature	-0℃ ~ +50℃
21.	Working Humidity	10 ~ 90%

1.2.4 PTZ-Keyboards

The features of PTZ shall include:

- Fully functional dynamic keyboard/joystick controllers
- Controls all pan, tilt, zoom, iris, preset functions
- Control up to 255 units from a single keyboard
- Many preset options and advanced tour programming
- Compatible with all connected cameras

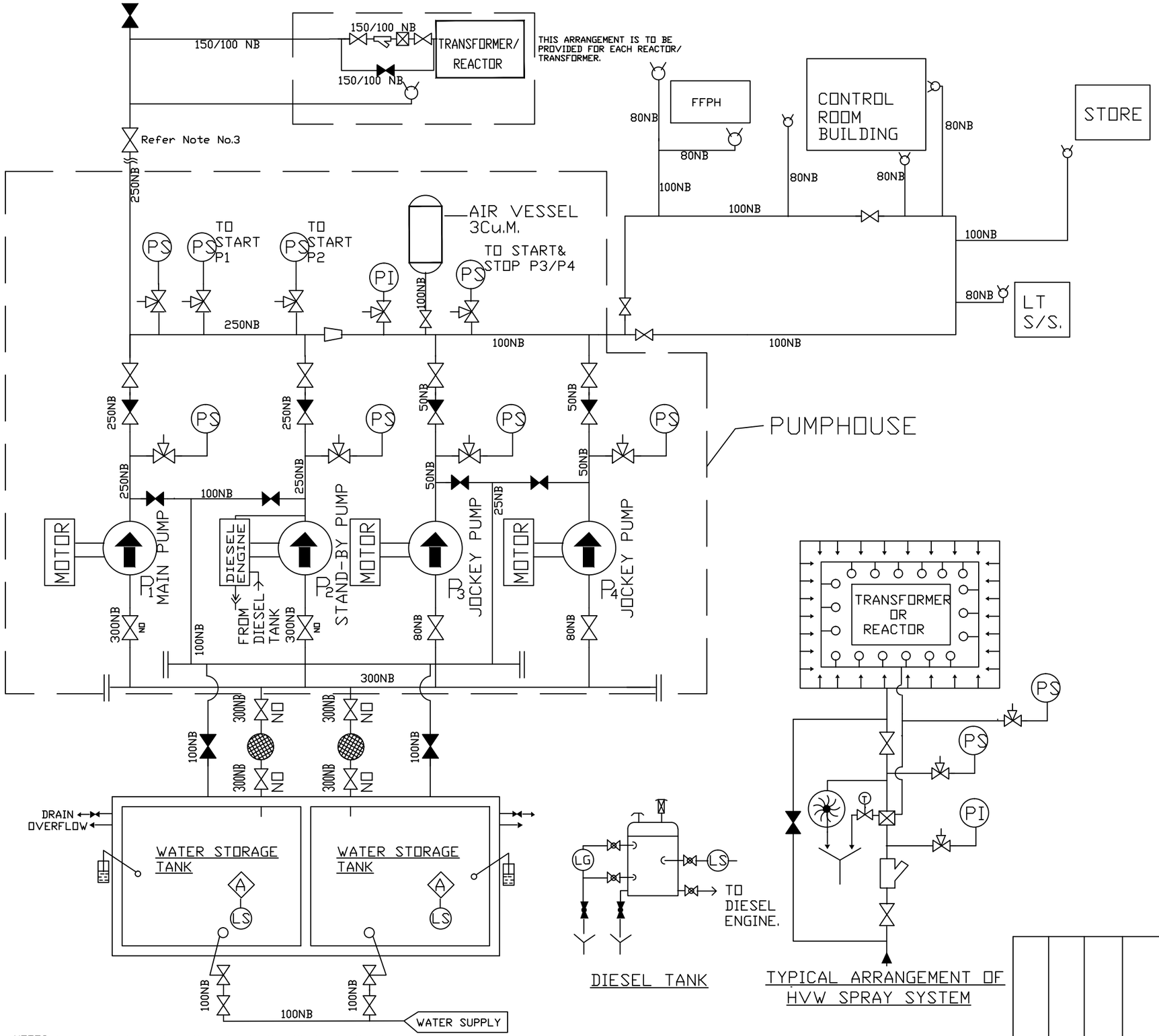
1.	Key Application	wired keyboard control operation of PTZ functions for weatherproof dome cameras
2.	Pan / Tilt / Zoom Protocol Languages Supported	Selectable
3.	PTZ Data Transfer Baud Rates Supported	selectable 1200 bps / 2400 bps / 4800 bps / 9600 bps
4.	Additional Features	dynamic joystick for smooth camera movements, preset location option for quick access to frequently monitored areas

Annexure-V (Revised): Actions required in case of defects observed during warrantee period

Equipment	Nature of problem	Corrective measures to be taken by contractor
CT**/IVT/PT** (Oil filled)	**DGA Violation** H2 > 300 ppm C2H2> 2 ppm	Refurbished or replaced
CT**/IVT/PT** (SF_6 filled)	a) SF6 gas leakage b) High Dew point of SF6 gas (> -36 deg C at atm press)	a)Repair/ replacement b)Re-processing of gas and replacement of Gas in case of no improvement
CT**/IVT/PT** (Oil filled)	**Violation of Tan delta** Tan Delta: >0.5%(during pre-commisioning) >0.7% (in operation) or change w.r.t. to previous **year** value > 0.1%	Replacement
CT, **IVT/PT** & CVT	- Oil leakage - Low Oil level -Sec winding problem leading to open/ short circuit, saturation etc	Replacement or repair as per repair procedure approved by QA.
CVT	Secondary voltage drift: Upto ± 0.5 volts Healthy a) ± 0.5 **or beyond**	a) CVT to be replaced

***Replaced/Repaired/Refurbished Equipment (or part of equipment) shall have 2 years warranty without prejudice to contractual warranty period.**

APPENDIX-I
TO TECHNICAL SPECIFICATION
FOR FIRE PROTECTION SYSTEM REV.-6



DIESEL TANK

TYPICAL ARRANGEMENT OF HVW SPRAY SYSTEM

LEGEND

- ALARM
- GATE VALVE NORMALLY OPEN
- GATE VALVE NORMALLY CLOSED
- NON-RETURN VALVE
- GLOBE VALVE NORMALLY OPEN
- GLOBE VALVE NORMALLY CLOSED
- FLOAT OPERATED GATE VALVE
- TEST VALVE
- PRESSURE GAUGE
- PRESSURE SWITCH
- LEVEL GAUGE
- LEVEL SWITCH
- BASKET STRAINER
- FLOAT OPERATED LEVEL GAUGE
- Y-TYPE STRAINER
- WATER MOTOR GONG
- REDUCER
- THREE WAY COCK/ VALVE
- VENT
- DRAIN
- OUT DOOR HYDRANT
- QUARTZOID BULB DETECTOR
- HVW SPRAY NOZZLE
- PUMP
- WATER LINE
- DELUGE VALVE

NOTES:
1. THE HYDRANT POINTS FOR TRANSFORMER/ REACTOR SHALL BE LOCATED AT LEAST 20M AWAY FROM THEM.
2. AS SAFETY MEASURE, A WARNING PLATE SHALL BE PLACED NEAR HYDRANT POINTS FOR TRANSFORMER/ REACTOR TO CLEARLY INDICATE THAT WATER SHALL BE SPRAYED ONLY AFTER ENSURING THAT THE POWER TO THE TRANSFORMER/ REACTOR WHICH IS ON FIRE IS SWITCHED OFF AND THERE ARE NO LIVE PART WITHIN 20 M. DISTANCE OF THE PERSONNEL USING THE HYDRANT.
3. FIRE HYDRANT PIPE LINE OUTSIDE THE PUMP HOUSE SHALL BE SUITABLY SECTIONALIZED AS PER LAYOUT REQUIREMENT. MINIMUM ONE(1) GATE VALVE TO BE PROVIDED FOR EVERY 200 METER OF MAIN HYDRANT PIPE FOR PURPOSE OF MAINTENANCE.

FOR TENDER PURPOSE ONLY

POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

APPD.					PROJECT: 765kV AND 400kV SUBSTATION	
					TITLE: PIPING & INSTRUMENTATION DIAGRAM FOR HYDRANT & HVW SPRAY SYSTEM.	
RECOMMENDED	DATE	DRAWN	CHKD.	APPD.	DRG.NO. C/ENGG/STD/FP/1 Sheet 1 of 1	REV. 5
	17.07.2019	HIMANSHU	S K THAKUR		NTS	