<table>
<tr><td></td><td>07

New Clause

Clause No.22.1 (xxix)</td><td>Level Gauge and Buchholz Relay. Connection of plug and socket with cable is not acceptable at site</td></tr>
<tr><td>83.</td><td>Section: 765kV Shunt Reactor Rev-07

Annexure-A S.No. 1.19</td><td>
<table>
<tr><td>1.19</td><td>Maximum Permissible Losses of Reactor</td><td>Unit</td><td>80MVAR, 765/√3kV 1-Ph Shunt Reactor</td><td>110MVAR, 765/√3kV 1-Ph Shunt Reactor</td></tr>
<tr><td>i)</td><td>Max. Load loss at rated voltage, frequency and at 75^{0}C</td><td>kW</td><td>98</td><td>120</td></tr>
<tr><td>ii)</td><td>Max. I^{2}R loss at rated current and at 75^{0}C</td><td>kW</td><td>52</td><td>60</td></tr>
</table>
</td></tr>
<tr><td>84.</td><td>Section: 765kV Shunt Reactor Rev-07

Annexure – C Test Procedures</td><td>Annexure-C: Test Procedures stands replaced by STANDARD TEST PROCEDURE FOR TRANSFORMER & REACTOR (DOC. No.: POWERGRID/STD/TEST PROCEDURE/TR-RT/REV 01) attached as Annexure to this Section.</td></tr>
<tr><td>85.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause no. 11.13</td><td>Deleted</td></tr>
<tr><td>86.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause no. 11.14</td><td>Tan δ value of RIP / RIS / RIF condenser bushing shall be 0.005 (max.) in the temperature range of 20°C to 90°C. The measured Tan δ value at site of in-service bushing should not exceed by 0.001 w.r.t. factory results (measured at approx. similar temperature conditions) during warrantee period.

The measured Tan δ value at site of in-service bushing should not exceed by 0.001 w.r.t. factory results during warrantee period.</td></tr>
<tr><td>87.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause No.7.1.5 (d)</td><td>04 nos. of Gate valves (minimum size 50NB) for UHF sensors for PD Measurements (applicable for 420kV Reactor only) at various locations. Location of valves shall be finalized during design review.</td></tr>
<tr><td>88.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

New Para added under Clause No.7.4</td><td>For 400kV Reactors, cooler bank shall be tank mounted.

Further, reactor Manufacturers to ensure that roller mounting pad at the bottom of the tank shall be removed for better contact of reactor bottom plate to plinth. Roller to be mounted directly with tank bottom.

Specific area shall not be provided for jacking pad in the foundation as jacking shall be done by laying temporary metal plates size 400 mm x 400 mm x 32 mm (min) thick. One set of metal plates for jacking of reactor shall be provided.</td></tr>
<tr><td>89.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

New para added under Clause No.9</td><td>Manufacturer may also offer Gas to Liquid (GTL) based insulating oil. The technical parameters of this oil is attached at Annexure-S8</td></tr>
</table>

<table>
<tr><td>90.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause No.7.14</td><td>Deleted</td></tr>
<tr><td>91.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

New Clause No.7.1.5 (f)</td><td>Suitable provision (valves, etc.) shall be provided for installation of Nitrogen Injection Fire Protection System in transformer.</td></tr>
<tr><td>92.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause No. 22.1 (xxiii) & 22.1. (xxix)</td><td>(xxiii) Deleted

(xxix) Nitrogen Injection Type Fire Prevention & Extinguishing System (if specified in BPS) as per Annexure – S9</td></tr>
<tr><td>93.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

New Clause No.22.1. (xxxi)</td><td>Plug & socket type arrangement with factory fitted cable of adequate length shall be supplied by OEM for Pressure Relief Device, Sudden Pressure Relay, Magnetic Oil Level Gauge and Buchholz Relay. Connection of plug and socket with cable is not acceptable at site</td></tr>
<tr><td>94.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Clause No.14.8 (c)</td><td>When the flow from conservator to main tank is more than the normal operating conditions, the valve shall shut off by itself and will have to be reset manually. It shall be provided with valve open/close position indicator along with alarm contact indication in control room during closing operation of valve. This valve shall be provided with locking arrangement for normal position and oil filling / filtration position. Glass window for visual inspection similar to Buchholz glass inspection window shall be provided for physical checking of status of valve. It shall have IP 67 class degree of protection. A suitable platform or ladder (if required) shall be provided to approach the valve for manual reset.</td></tr>
<tr><td>95.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Annexure – C Test Procedures</td><td>Annexure-C: Test Procedures stands replaced by STANDARD TEST PROCEDURE FOR TRANSFORMER & REACTOR (DOC. No.: POWERGRID/STD/TEST PROCEDURE/TR-RT/REV 01) attached as Annexure to this section.</td></tr>
<tr><td>96.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

Annexure-A S.No.1.22</td><td><u>1.0 Technical Particulars / Parameters of 420kV Shunt Reactor</u>

<table>
<tr><td>1.22</td><td>Maximum Permissible Losses of Reactor</td><td>Unit</td><td>Max. Load loss at rated voltage, frequency and at 75^{0}C</td><td>Max. I^{2}R loss at rated current and at 75^{0}C</td></tr>
<tr><td>i)</td><td>125MVAR, 420kV 3-Ph Reactor</td><td>kW</td><td>160</td><td>90</td></tr>
<tr><td>ii)</td><td>80MVAR, 420kV 3-Ph Reactor</td><td>kW</td><td>115</td><td>65</td></tr>
<tr><td>iii)</td><td>63MVAR, 420kV 3-Ph Reactor</td><td>kW</td><td>100</td><td>57</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>iv)</td><td>50MVAR, 420kV 3-Ph Reactor</td><td>kW</td><td>85</td><td>45</td></tr>
</table>
</td></tr>
<tr><td>97.</td><td>Section : Upto 400kV Shunt Reactor Rev 10

New Clause Annexure-A S.No.2.22</td><td>
1.0 <u>Technical Particulars / Parameters of 245kV Shunt Reactor</u>
<table>
<tr><td>2.22</td><td>Maximum Permissible Losses of Reactor</td><td>Unit</td><td>Max. Load loss at rated voltage, frequency and at 75^{0}C</td><td>Max. I^{2}R loss at rated current and at 75^{0}C</td></tr>
<tr><td>i)</td><td>25MVAR,245kV 3-Ph Reactor</td><td>kW</td><td>50</td><td>28</td></tr>
</table>
</td></tr>
<tr><td>98.</td><td>Section: GTR Rev 15

Clause No. 24.16(ii)(b)</td><td>Contractor shall furnish performance guarantee for an amount of 3% of the ex-works cost of the equipments(s)* and this performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor.</td></tr>
<tr><td>99.</td><td>Section: GTR Rev 15

New Clause Clause No. 24.21</td><td>
<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.

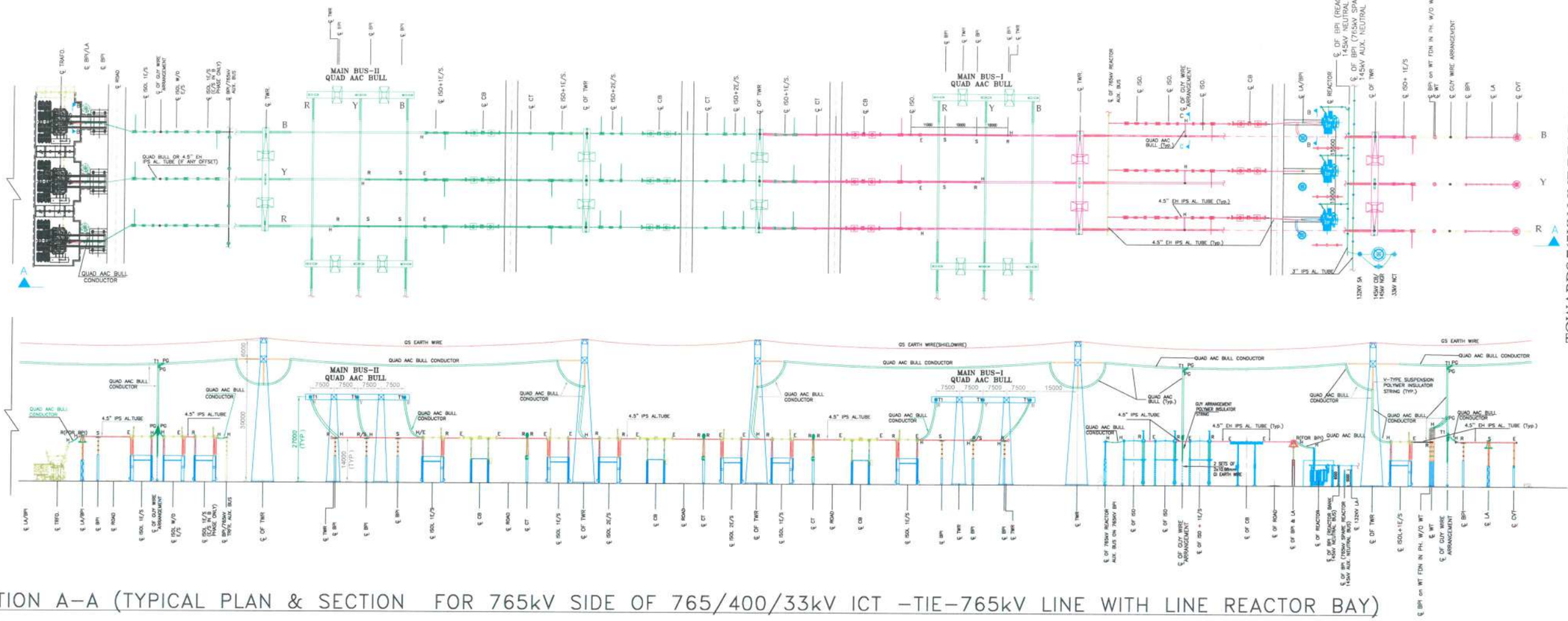
(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

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.
</td></tr>
</table>

		Note: 1. (*) voltage class of respective equipment as applicable 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
100.	**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.
101.	**Section Switchgear-INST Rev 11** **Clause No. 6.2 (b)(iii) & (c)(iii)**	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.
102.	**Section Switchgear-ISOLATOR Rev 11B** **Clause No. 9.2 (iii)**	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



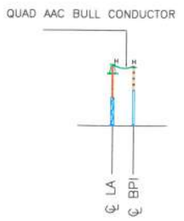
SECTION A–A (TYPICAL PLAN & SECTION FOR 765kV SIDE OF 765/400/33kV ICT –TIE–765kV LINE WITH LINE REACTOR BAY)

LEGENDS:

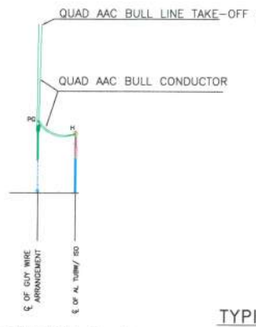
R– RIGID CONNECTION
E– EXPANSION TYPE CONNECTION
S– SLIDING TYPE CONNECTION
PG–PARALLEL GROOVE CONNECTION
T1– T1 TYPE CONNECTION (EACH T CONNECTOR SHALL BE OF TWIN TO TWIN CONDUCTOR TYPE FOR QUAD TO QUAD CONNECTION)
H– HORIZONTAL TYPE CONNECTION

NOTES:

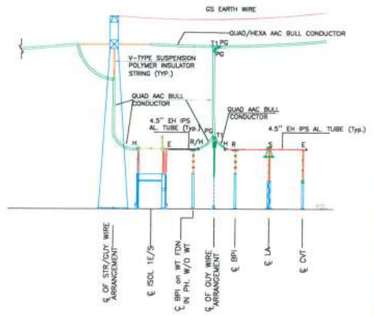
1) TWIN–TWIN CONNECTOR SHALL BE USED FOR QUAD–QUAD DROPPER CONNECTION.
2) AUXILIARY BUS ARRANGEMENT FOR 765kV TRANSFORMERS & REACTOR NEUTRALS, SPARE TRANSFORMER/REACTOR CONNECTION, TERTIARY ARRANGEMENT OF TRANSFORMERS ARE NOT SHOWN COMPLETELY.
3) CANTILEVER STRENGTH OF 765KV INSULATORS/BPI USED FOR 765KV 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.1OF1

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.