BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-431-510-009	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	PC	JK	VK
TITLE	LT TRANSFORMER			SIGN			
				DATE	03.03.25	03.03.25	03.03.25
				GROUP	TBEM	W.O. No	--

CUSTOMER	**POWERGRID Corporation of India Ltd (PGCIL)**
PROJECTS	**Substation Package SS43T** for (a) Establishment of 765/400/ 220kV Mandsaur S/s and (b) Extn. of 765kV Indore (PG) for termination of Mandsaur PS – Indore (PG) 765 kV D/c Line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-C" **Substation Package -SS-47T** for (a) Establishment of 765/ 400/220/132kV Kurawar Substation (New) including 1x125MVAr 420kV (3-Ph)Bus Reactor, (b) Extn. of 765kV Mandsaur Substation for termination of 765 kV D/C Mandsaur – Kurawar line, (c) Extn. of 400kV Shujalpur Substation for termination of 400kV D/C Shujalpur – Kurawar Line and (d) Extn. of 400kV Ashtha S/s for LILO of one circuit of 400kV D/C Indore-Itarsi line at Ashtha & also Bays for termination of New 400 kV D/C Kurawar-Ashtha line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-H1" **Substation Package -SS-46T** for (a) Establishment of 765/400/220 kV Barmer-I S/s including 400 kV, 2x125MVAr reactor, (b) Extension of 765 kV Sirohi for termination of Barmer I PS-Sirohi PS 765 kV D/c line (c) Extension of 400 kV Fatehgarh-III for termination of Fatehgarh-III(Sec-2) PS-Barmer I PS 400 kV D/c line

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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, engineering, manufacturing, assembly, stage testing, inspection, testing before supply, documentation, packing and loading at works and transportation to site of outdoor (**plinth mounted**) type oil filled Station transformers complete with its accessories, foundation bolts, fittings etc. as mentioned in this section and in various other sections of this specification to site.

This section covers the scope and quantities of outdoor type oil filled transformers. The Specific Technical Requirements for the above item as specified by the customer (POWERGRID) are given in Section-2. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

The specification comprises of following sections:

Section-1: Scope, Specific Technical Requirements & Bill of Quantities
Section-2: Equipment Specification
Section-3: Project Details & General Technical Requirements
Section-4: Guaranteed Technical Particulars
Section-5: Checklist

In case of any conflict between various sections, **order of precedence** shall be in the same order as listed above.

Note: The terms used in this specification namely, "Employer/Purchaser" refers to POWERGRID & "Contractor/Sub-contractor/manufacturer" refers to successful bidder.

2.0 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of Customer: POWERGRID Corporation of India Ltd (PGCIL)

Name of the Project: 1) 765/400/220kV Mandsaur S/s
2) 765/400/220/132 kV Kurawar S/s
3) 765/400/220kV Barmer S/s

Refer Section - 3 for Project Details and General Specifications.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

Technical Parameters of 800kVA LT Transformer:

S.No.	Description of parameters	Data
1.	Rated Capacity	800 kVA
2.	Rated Voltage HV/LV	33 kV/0.433 kV
3.	Maximum Loss at 50% Load	2.308 kW
4.	Maximum Loss at 100% Load	6.274 kW

During factory test, if the measured cumulative losses of transformer are more than above mentioned maximum losses, then the employer shall reject the equipment.

Minimum indicative requirement of Potential Free contacts which should be available at LT Transformer for remote indication & control from Auxiliary BCU located in S/s control room is as follows:

a.	LT transformer-1: Bucholz Alarm
b.	LT transformer-1: Bucholz Trip
c.	LT transformer-1: WTI Alarm
d.	LT transformer-1: WTI Trip
e.	LT transformer-1: OTI Alarm
f.	LT transformer-1: OTI Trip

For detailed Technical requirements refer Section-II of the Technical Specification.

4.0 TECHNICAL PRE-QUALIFYING REQUIREMENTS:

Refer – Annexure-TQR

5.0 BILL OF QUANTITES:

Refer- Annexure-BOQ

6.0 MANUFACTURING QUALITY PLAN:

Bidder should have POWERGRID approved and valid quality plan at contract stage. In case bidder don't have POWERGRID approved Quality plan, it will be bidder's responsibility to get its quality plan approved directly from POWERGRID.

7.0 TYPE TEST:

a. All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under section II.

b. The reports for all type tests as per technical specification shall be furnished by the bidder along with equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all project with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab or reputed consultant.

Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted within 05 years from the date of 01-01-2025. In case the test reports are of the test

conducted earlier than the years specified date of 01-01-2025, the Bidder shall repeat these test(s) at no extra cost to BHEL/Employer.

c. Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication and delivery implication to the BHEL/Employer. The Bidder shall intimate the Employer/BHEL the detailed program about the type tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

d. The Employer reserves the right to witness any or all the type tests. The Employer shall bear all expenses for deputation of Employer's representative(s) for witnessing the type tests except in the case of re-deputation if any, necessitated due to no fault of the Employer.

e. The list of makes of various items, for which Type test reports are not required to be submitted are specified in Annexure-J, Section-3

8.0 DEVIATIONS:

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

9.0 PACKING:

9.1 All equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and outdoor storage (for a minimum period of 6 months) at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be considered. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

9.2 The Bidder shall include and provide for security, protection and packing the equipment so as to avoid loss or damage during transport by any mode.

9.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the purchaser.

9.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.

9.5 Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.

9.6 Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.

9.7 All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.

9.8 Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.

9.9 Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

10.0 DRAWINGS and SCHEME:

Date of Submission of first lot of drawings will be counted only from the date of submission of reasonably correct drawings. Preparation of AS- BUILT drawings is also in the scope of the bidder. List of drawings required for technical clearance of manufacturing are as follows:

a. Approved GTP
b. Approved GA.
c. Approved Type Test Reports

12.0 DOCUMENTS REQUIRED WITH TECHNICAL OFFER:

a) Clause-wise confirmation/ comments
b) Bill of Materials
c) Unpriced schedule of Unit Prices
d) Filled-up Guaranteed Technical Particulars
e) Catalogue and Technical Leaflets for the offered Equipments

ANNEXURE-BOQ

PROJECT WISE BILL OF QUANTITY

SN	Description	Unit	QUANTITY		
			Mandsaur (New) S/s	Kurawar (New) S/s	Barmer-I S/s
I	800 kVA, 33/0.433 kV, ONAN, Dyn1, 3-phase LT Transformer as per specification complete with accessories in all respect	Nos.	02	02	02

NOTE:

1) Ten (10) percent extra oil shall also be supplied for topping up, in non-returnable containers suitable for outdoor storage. The cost of the same should be included in the quoted price and no price implication will be accepted at later stages.
2) Supply of **lugs** for proper termination of 2-1Cx630 sq.mm XLPE cables (per phase) and 1-1Cx630 sq. mm XLPE cables (for neutral) on LV side of LT Transformer is deemed to be included in bidder's scope, i.e. total 7 number matching lug per transformer to be supplied.
3) Size of cable box on LV side shall be adequate enough for proper termination of 7 nos. 630 sq. mm single phase XLPE cable.
4) **Gland plate** shall be of **non-magnetic** material of at least 4mm thickness in case of termination of single core power cables.
5) Transformer fitting and accessories shall be provided as per section-2 of technical specification.
6) The Neutral terminal of 433V winding shall be brought out on a bushing along with the 433V phase terminal to form a 4-wire system for the 415V, this neutral terminal shall be suitable for cable connection.
7) Additional Neutral bushing shall also be provided for connection of 75X12 mm MS flat for earthing of Transformer. Required connector for connection of 75X12 mm MS flat with neutral bushing shall be in Bidder scope.
8) No deviation shall be allowed from Annexure-A of Section-02.
9) Please refer Annexure-A of Section-02 for technical parameters of LT transformer.
10) 33kV cable or Overhead connection on HV side shall be informed during detailed engineering stage.
11) The Quantity is subject to change by +/-20%

SECTION-II : LT TRANSFORMER

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SECTION: LT TRANSFORMER

1.0 SCOPE

1.1 This specification covers design, engineering, manufacture, testing, delivery at site including all materials, accessories, spares, Transportation inclusive of insurance and delivery FOR site basis, unloading, handling, proper storage at site, erection, testing and commissioning of the equipment specified.

2.0 Fittings

The following fittings shall be provided with each transformer covered under this specification:

i) Conservator with drain plug and oil filling hole with blanking plate
ii) Plain oil Gauge
iii) Silica gel Breather
iv) Pressure Relief vent
v) Pocket on tank cover for Thermometer
vi) Valves
vii) Earthing Terminals
viii) Rating & Terminal Marking Plates
ix) Lifting Lugs
x) Rollers
xi) Air Release Plug

The fittings listed above are only indicative and any other fittings which generally are required for satisfactory operation of transformer are deemed to be included.

3.0 General Information

3.1 All temperature indicators, Buchholz relays and other auxiliary devices shall be suitable for 220 V/110V (as applicable**)** DC Control supply. All alarm and trip Contacts shall also be suitable for connection in 220V/110V DC Circuits.

3.2 Transformers offered shall conform to dynamic short circuit test and dielectric test as per IS-2026. Test report for the same shall be submitted during detail engineering for approval of EMPLOYER.

4.0 TECHNICAL REQUIREMENTS

4.1 Core

The core shall be constructed from high grade, non-aging, cold rolled grain-oriented (conventional or better) silicon steel laminations. The maximum flux density in any part of the cores and yoke at rated voltage and frequency shall be such that the flux density with +12.5% combined voltage and frequency variation from rated voltage and frequency shall not exceed 1.9 Tesla.

4.2 **Windings**

The conductor shall be of electrolytic copper, free from scales and burrs.

4.3 **Insulating Oil**

The oil supplied with transformer shall be unused and shall have the parameters conforming to IS:335 while tested at oil Contractor's premises, No inhibitors shall be used in oil.

4.4 **Terminal Arrangement**

a) Bushing terminals shall be provided with suitable terminal connectors of approved type and size for cable/overhead conductors termination of HV side and cable termination on LV side.

b) The neutral terminals of 433V winding shall be brought out on a bushing along with the 433 volt phase terminals to form a 4 wire system. Additional neutral bushing shall also be provided for earthing.

4.5 **Off Circuit Tap Changing Equipment**

The tap change switch shall be three phase, hand operated for simultaneous switching of similar taps on the three phases by operating an external hand wheel.

4.6 **Marshalling Box**

A metal enclosed (Stainless steel of minimum 1.5 mm thickness), weather, vermin & dust proof marshalling box shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have a degree of protection of IP 55 as per IS: 13947Part-1.

4.7 **Cable boxes**

Whenever cable connections are required, suitable cable boxes shall be provided and shall be air insulated. They shall be of sufficient size to accommodate Purchaser's cables and shall have suitable removable side/top cover to facilitate cable termination and inspection. Cable boxes shall be dust & vermin proof.

5.0 Inspection and Testing

The Contractor shall draw up and carry out a comprehensive inspection and testing program during manufacture and commissioning of the transformer.

5.1 Inspection

All stage inspection checks (Raw material) and In-process checks need to be carried out in line with approved MQP of POWERGRID

5.1.1 Assembled Transformer

a) Check complete transformer against approved outline drawing provision for all fittings, finish etc.

b) Jacking test on all the assembled transformers.

5.1.2 Oil

All standard tests in accordance with relevant Standards shall be carried out on oil samples taken from the transformer before and after testing of the transformer.

5.1.3 Fittings:

All sub-contracted items shall be sourced from POWERGRID approved vendors as listed in Compendium of Vendors (COV) of POWERGRID. The contractor shall also prepare a comprehensive inspection and testing programme for all bought out sub-contracted items. Such programme shall include the following components:

a) Buchholz Relay
b) Winding temperature Indicator
c) Bushings
d) Marshaling Box
e) Tap changer switch
f) Oil temperature indicator
g) Magnetic Oil gauge
h) Pressure Relief valve or explosion vent
i) Silica gel breather assembly
j) Oil conservator tank

5.2 Testing (Factory Test)

5.2.1 All standard routine tests in accordance with latest issue of IS : 2026 shall be carried out on each transformer.

5.2.2 All auxiliary equipment shall be tested as per the relevant **Indian Standard** (IS)

5.2.3 High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

5.2.4 **Tank Tests**:
Following tests (as routine test) shall be performed on tank as per 'CBIP manual on Transformers':

i) Vacuum Tests
ii) Pressure Test

5.2.5 **Type Tests**:

The transformer shall conform to all the type tests including following special test (as type test) in accordance with latest issues of IS : 2026 :

a) Measurement of zero sequence impedance
~~b)~~ ~~Short circuit test~~
c) Measurement of acoustic noise level. This shall conform to NEMA standard publication TR-1.
d) Measurement of capacitance and tan delta of transformer winding

The manufacturer shall submit type tests & special test reports as listed above, already carried out on transformers of identical design for EMPLOYER's acceptance. In such a case validity of type test reports shall be in line with clause 9.2 of Sec-GTR of technical specifications. Following parameters in general shall be ensured for establishment of identical design as per IEC 60076, Part-V.

a) Same Voltage ratio, KVA rating, vector group & impedance.
b) Same conceptual design of core and winding.
c) Same arrangement and geometrical sequence of the main windings.
d) Same type of winding conductors with proper covering
e) Same type of internal clearances, core, winding dimension
f) Same type of main windings.
g) Absorbed power at short circuit (i.e. rated power/per unit short circuit impedance) between 30% and 130% of that relating to the reference transformer.
h) Same manufacturing process.
i) Same Clamping and winding support arrangement..

5.3 In addition to the above, the following checks should be carried out at manufacturer's works before despatch for all transformers:

a) Check for interchangeability of components of similar transformers and for mounting dimensions.

b) Check for proper packing and preservation of accessories like radiators, bushings explosion vent, dehydrating breather, Buchholz relay, conservator etc.

c) Check for proper provision of bracings to arrest the movements of core and winding assembly inside the tank.

d) Test for gas tightness and derivation of leakage rate. To ensure adequate reserve gas capacity during transit and storage.

5.4 **Site Testing:**

The indicative checks and tests at site are given below:

a) Physical checks on each transformer on receipt at site for any damage or short supply.
b) Tests on oil samples
c) Oil leakage test
d) Physical checks for colour of silica in breather
e) Check for oil level in breather housing, conservator tank, etc.
f) Check for correct operation of all protections and alarms.
g) Insulation Resistance Measurement for Main Winding, control wiring etc.
h) Continuously observe the transformer operation at no load for 24 hours.

6.0 The major technical parameters of LT Transformer is defined at **Annexure - A**

ANNEXURE-A

Technical Parameters

S. N.	Description	Unit	Parameters						
1	Rated Capacity	kVA	~~250~~	~~315~~	~~630~~	~~800~~	~~315~~	~~630~~	800
2	Rated Voltage								
a)	HV	kV	~~11~~	~~11~~	~~11~~	~~11~~	~~33~~	~~33~~	33
b)	LV	kV	~~0.433~~	~~0.433~~	~~0.433~~	~~0.433~~	~~0.433~~	~~0.433~~	0.433
3	Standard		IS 1180 & IS 2026						
4	Type of Winding		Two Winding						
5	Service		Outdoor						
6	No of Phases	No.	Three						
7	Frequency	Hz	50						
8	Type of Cooling		ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN
9	Impedance at 75 Deg C (Minimum)	%	~~4.5~~	~~4.5~~	~~4.5~~	~~5~~	~~5~~	~~5~~	5
10	Tolerance on Impedance	%	~~±10~~	~~±10~~	~~±10~~	~~±10~~	~~±10~~	~~±10~~	±10
11	Duty		Continuous						
12	Overload		IS 2026						
13	Max. Temp. Rise over an ambient of 50 Deg C								
a)	Oil (Temperature rise measurement by thermometer)	^{o}C	40						
b)	Winding Temperature rise measurement by resistance method)	^{o}C	45						
14	Windings								
a)	System Apparent Short circuit level (kA)		As per IS 2026-Part 1						
b)	Winding Connection								
(i)	HV		~~Delta~~	~~Delta~~	~~Delta~~	~~Delta~~	~~Delta~~	~~Delta~~	Delta
(ii)	LV		~~Star~~	~~Star~~	~~Star~~	~~Star~~	~~Star~~	~~Star~~	Star
15	Vector Group		Dyn1						

S. N.	Description	Unit	Parameters						
16	Insulation		Uniform						
17	Insulation Level	kVrms							
a)	Power Frequency Test Level								
(i)	HV	kVrms	~~28~~	~~28~~	~~28~~	~~28~~	~~95~~	~~95~~	95
(ii)	LV	kVrms	2						
18	Basic Impulse Level								
(i)	HV	kVp	~~75~~	~~75~~	~~75~~	~~75~~	~~250~~	~~250~~	250
(ii)	LV	kVp	-	-	-	-	-	-	-
19	Highest voltage (kV) for each winding	kV	~~12~~	~~12~~	~~12~~	~~12~~	~~52~~	~~52~~	52
20	Method of earthing		Solidly earthed						
21	Tap changer								
a)	(i) Tap Change		+5% to -10% in step of 2.5% on HV side						
b)	(ii) Tap control		Off Circuit Tap Change Switch						
22	HV Bushing								
a)	Rated Voltage	kV	~~12~~	~~12~~	~~12~~	~~12~~	~~52~~	~~52~~	52
b)	Rated current	A	~~100~~	~~100~~	~~100~~	~~100~~	~~100~~	~~100~~	100
c)	Basic Impulse Level (kVp)	kVp	~~75~~	~~75~~	~~75~~	~~75~~	~~250~~	~~250~~	250
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	~~28~~	~~28~~	~~28~~	~~28~~	~~95~~	~~95~~	95
e)	Min. Total Creepage Distance	mm	~~300~~	~~300~~	~~300~~	~~300~~	~~1300~~	~~1300~~	1300
f)	Mounting		Tank / Transformer Body						
23	LV & Neutral Bushing								
a)	Rated Voltage	kV	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	1
b)	Rated current	A	~~630~~	~~630~~	~~1000~~	~~2000~~	~~630~~	~~1000~~	2000
c)	Wet & Dry Power frequency Withstand Voltage	kVrms	~~5~~	~~5~~	~~5~~	~~5~~	~~5~~	~~5~~	5
d)	Mounting		Tank / Transformer Body						
24	Terminal Details								

S. N.	Description	Unit	Parameters						
a)	HV		Suitable for 11kV Cable or Over Head Conductor				Suitable for 33kV Cable or Over Head Conductor		
b)	LV & Neutral		Cable Box						
25	Min. Clearance in Air and cable box								
a)	Ph-Ph (HV/LV)	mm	**As per IS: 1180**						
b)	Ph-Earth (HV/LV)	mm	**As per IS: 1180**						
26	Rated Short Circuit Current	kA	**25 kA for 3 second**						
27	**Maximum Permissible Loss* (No-Load+load loss at 75^{o} C)**	**Rating (KVA)**	~~250~~	~~315~~	~~630~~	~~800~~	~~315~~	~~630~~	800
i)	**50% Load***	**kW**	~~0.920~~	~~0.955~~	~~1.745~~	~~2.147~~	~~1.026~~	~~1.875~~	2.308
ii)	**100% Load***	**kW**	~~2.7~~	~~2.750~~	~~4.850~~	~~5.837~~	~~2.956~~	~~5.213~~	6.274

*** LT Transformer losses shall not exceed the value specified above (at 50 % and/or 100 % loads), failing which, the LT Transformer shall be rejected.**

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TYPE OF DOC.	**TECHNICAL SPECIFICATION**			SIGN			
TITLE	**GENERAL TECHNICAL REQUIREMENTS-SECTION 3**			NAME	PC	JK	VK
				DATE			
				GROUP	TBEM	W.O.	**431,433,434**

CUSTOMER	**Power Grid Corporation of India Limited** (POWERGRID)
Station	**Mandsaur/Indore, Kurawar/Mandsaur/Ashtha/Shujalpur-Madhya Pradesh** **Barmer/Sirohi/Fategrah-Rajasthan**
	PROJECT: Substation Package -**SS-43T** for (a) Establishment of 765/400/ 220kV Mandsaur S/s including 400kV, 2x125MVAr (3-Ph) Reactor and (b) Extn. of 765kV Indore(PG) for termination of Mandsaur PS – Indore(PG) 765 kV D/c Line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-C" **Substation Package -SS-47T for** (a) Establishment of 765/ 400/220/132kV Kurawar Substation (New) including 1x125MVAr 420kV (3-Ph)Bus Reactor, (b) Extn. of 765kV Mandsaur Substation for termination of 765 kV D/C Mandsaur – Kurawar line, (c) Extn. of 400kV Shujalpur Substation for termination of 400kV D/C Shujalpur – Kurawar Line and (d) Extn. of 400kV Ashtha S/s for LILO of one circuit of 400kV D/C Indore-Itarsi line at Ashtha & also Bays for termination of New 400 kV D/C Kurawar-Ashtha line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-H1" **Substation Package -SS-46T** for (a) Establishment of 765/400/220 kV Barmer-I S/s including 400 kV, 2x125MVAr reactor, (b) Extension of 765 kV Sirohi for termination of Barmer I PS-Sirohi PS 765 kV D/c line (c) Extension of 400 kV Fatehgarh-III for termination of Fatehgarh-III(Sec-2) PS-Barmer I PS 400 kV D/c line

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Site Information -1

S.No.	Particular	Details
a)	Owner	Power Grid Corporation of India Limited (POWERGRID)
b)	Customer	Power Grid Corporation of India Limited (POWERGRID)
c)	Project Title	**Substation Package -SS-43T for (a) Establishment of 765/400/ 220kV Mandsaur S/s including 400kV, 2x125MVAr (3-Ph) Reactor and (b) Extn. of 765kV Indore (PG) for termination of Mandsaur PS – Indore (PG) 765 kV D/c Line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-C"**
d)	Location	**Mandsaur & Indore, Madhya Pradesh**
e)	Transport Facilities	Road/Train Nearest Rail Head For **765/400/220kV Mandsaur (New) PS -** Mandsaur Nearest Rail Head For **765/400kV Indore (PG) S/S -** Indore
	SITE CONDITIONS	
f)	Max. ambient air temp.	50°C
g)	Min. ambient air temp.	0°C
h)	Max. design ambient temp.	50°C
i)	Costal area consideration	No
j)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
k)	Seismic Zone	NBC2016
l)	Wind Zone	NBC2016
m)	Snow fall	NIL
	Main Electrical Parameters:	
n)	Fault Levels:	765kV: 50kA for 1 Sec 400kV: 63kA for 1 Sec 220kV: 50kA for 1 sec
o)	Creepage Distance	25mm/kV for All Equipment i.e BPI/Bushings, CB, Isolator, CT, CVT, LA, WT, NCT etc. and for insulator string/ long rod insulators/ outdoor bushings - 31 mm/kV

Site Information -2

S.No.	Particular	Details
a)	Owner	Power Grid Corporation of India Limited (POWERGRID)
b)	Customer	Power Grid Corporation of India Limited (POWERGRID)
c)	Project Title	**Substation Package -SS-47T for (a) Establishment of 765/ 400/220/132kV Kurawar Substation (New) including 1x125MVAr 420kV (3-Ph)Bus Reactor, (b) Extn. of 765kV Mandsaur Substation for termination of 765 kV D/C Mandsaur – Kurawar line, (c) Extn. of 400kV Shujalpur Substation for termination of 400kV D/C Shujalpur – Kurawar Line and (d) Extn. of 400kV Ashtha S/s for LILO of one circuit of 400kV D/C Indore-Itarsi line at Ashtha & also Bays for termination of New 400 kV D/C Kurawar-Ashtha line associated with "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 : 5.5GW) Jaisalmer/Barmer Complex)Part-H1"**
d)	Location	**Kurawar, Mandsaur, Shujalpur & Ashtha , Madhya Pradesh**
e)	Transport Facilities	Road/Train Nearest Rail Head For **765/400/220/132kV Kurawar (New) PS -** Sehore Nearest Rail Head For **765 Mandsaur Extn. -** Mandsaur Nearest Rail Head For **400kV Shujalpur Extn. -** Shujalpur Nearest Rail Head For **400kV Ashtha Extn. -** Sehore
SITE CONDITIONS		
f)	Max. ambient air temp.	50°C
g)	Min. ambient air temp.	0°C
h)	Max. design ambient temp.	50°C
i)	Costal area consideration	No
j)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
k)	Seismic Zone	NBC2016
l)	Wind Zone	NBC2016
m)	Snow fall	NIL
	Main Electrical Parameters:	
n)	Fault Levels:	765kV: 50kA for 1 Sec 400kV: 63kA for 1 Sec 220kV: 50kA for 1 sec 132kV: 40kA for 1 sec
o)	Creepage Distance	25mm/kV for All Equipment i.e BPI/Bushings, CB, Isolator, CT, CVT, LA, WT, NCT etc. and for insulator string/ long rod insulators/ outdoor bushings - 31 mm/kV

Site Information -3

S.No.	Particular	Details
a)	Owner	Power Grid Corporation of India Limited (POWERGRID)
b)	Customer	Power Grid Corporation of India Limited (POWERGRID)
c)	Project Title	**Substation Package -SS-46T for (a) Establishment of 765/400/220 kV Barmer-I S/s including 400 kV, 2x125MVAr reactor, (b) Extension of 765 kV Sirohi for termination of Barmer I PS-Sirohi PS 765 kV D/c line (c) Extension of 400 kV Fatehgarh-III for termination of Fatehgarh-III(Sec-2) PS-Barmer I PS 400 kV D/c line**
d)	Location	**Barmer, Sirohi, Fatehgarh-Rajasthan**
e)	Transport Facilities	Road/Train Nearest Rail Head For **765/400/220kV BarmerS/s -** Barmer Nearest Rail Head For **765kV Sirohi Extn. -** Sirohi Nearest Rail Head For **400kV Fategarh Extn. -** Fategrah
SITE CONDITIONS		
f)	Max. ambient air temp.	50°C
g)	Min. ambient air temp.	0°C
h)	Max. design ambient temp.	50°C
i)	Costal area consideration	No
j)	Altitude above sea level	Less than 1000 meter above mean sea level (MSL)
k)	Seismic Zone	NBC2016
l)	Wind Zone	NBC2016
m)	Snow fall	NIL
	Main Electrical Parameters:	
n)	Fault Levels:	765kV: 50kA for 1 Sec 400kV: 63kA for 1 Sec 220kV: 50kA for 1 sec
o)	Creepage Distance	25mm/kV for All Equipment i.e BPI/Bushings, CB, Isolator, CT, CVT, LA, WT, NCT etc. and for insulator string/ long rod insulators/ outdoor bushings - 31 mm/kV

GENERAL TECHNICAL REQUIREMENTS - SECTION 3

1.0 FOREWORD

The provisions under this section are intended to supplement requirements for the materials, equipment's and services covered under other sections of tender documents and are not exclusive.

The Supplier shall note that the standards mentioned herein are not mutually exclusive or complete in themselves, but are intended to complement each other, with minimum repetition, to define the requirements of the Specification. In the event of a conflict between requirements of any two clauses of the Specification/ documents or requirements of different codes/ standards specified, the more stringent requirement as per the interpretation of the owner shall apply, unless confirmed otherwise by the owner in writing based on a written request from the Supplier.

In case of conflicting requirements between this document (General Technical Requirement Section 3) and equipment specification (Section 1 & Section 2), equipment specification shall prevail.

When specific requirements stipulated in the Specification exceed or change those required by the applicable standards, the stipulations of the Specification shall take precedence.

Unless specifically agreed to by the Purchaser prior to Award of Contract, the Work shall be in accordance with the standards indicated and the requirements of the Specification. The Supplier shall be held responsible for any deviation.

In case of conflict between the various standards, the decision of owner shall be binding & final.

The following words and expressions shall have the meanings hereby assigned to them throughout this document

"Employer/Owner" means Power Grid Corporation of India Ltd.

"Purchaser" means Bharat Heavy Electricals Limited.

"Supplier/Manufacturer/Bidder" means the person or persons, firm or company assigned to execute the works as defined by the scope of supply, described here.

"Specification" refers to this document.

The supplier should be approved by Power Grid. If not, it is the responsibility of the vendor to be assessed and approved by Power Grid, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

2.0 GENERAL REQUIREMENT

2.1 a) All equipment/materials/items, as applicable under present scope of works, shall be supplied by domestic manufacturers only with **minimum Local Content for individual items as listed annexure-K (rev.01)**

Any imported equipment/material/item/parts/component (comprising of embedded systems) to be supplied under the contract shall be tested in the certified laboratories to check for any kind of embedded malware/trojans/cyber threats and for adherence to Indian Standards as per the directions issued by Ministry of Power/Govt. of India from time to time. In case of such import from specified "prior reference" countries, the requirement of prior permission from the Govt. of India including protocol for testing in certified and designated laboratories by Ministry of Power/Govt. of India shall also be complied with by the Bidder.

The bidder/contractor shall list out the products and components producing Toxic e-waste under the contract and shall furnish to the Employer the procedure of safe disposal at the time of closing of the contract.

2.1 b) The Supplier/Manufacturer shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification during detailed engineering.

2.2 It is recognised that the Bidder may have standardised on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to Employer.

2.3 Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.

2.4 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components which are minor in nature and incidental to the requirement but not specifically stated in the specification, which are necessary for commissioning and satisfactory operation of the switchyard/ substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard

components/parts of similar standard equipment provided, shall be inter-changeable with one another.

2.5 Deleted.

2.6 Deleted.

3.0 STANDARDS

3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

3.2 The equipment offered by the Bidder shall at least conform to the requirements specified under relevant IS standard. In case of discrepancy between IS and other international standard, provisions of IS shall prevail. The Bidder shall also note that the list of standards presented in Annexure-C is not complete. Whenever necessary, the list of standards shall be considered in conjunction with specific IS. If the IS standard is not available for an equipment/material, then other applicable International standard (IEC/Equivalent), as per the specification, shall be accepted.

3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

3.4 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.5 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards specified under Annexure-C / individual sections for various equipments shall also, be accepted, however the salient points of difference shall be clearly brought out during detailed engineering along with English language version of such standard. The equipment conforming to standards other than specified under Annexure-C /individual sections for various equipments shall be subject to Employer's approval.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 Switching surge over voltage and power frequency over voltage is specified in the system parameters below. In case of the 400kV system, the initial value of the temporary overvoltages could be 2.0 p.u. for 1-2 cycles. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc under such over voltage conditions.

4.2 All equipments shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

4.4 The Bidder shall design terminal connectors of the equipment taking into account various forces as above at Sl.No.4.3 that are required to withstand.

4.5 The equipment shall also comply to the following:

a) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

b) All piping, if any between equipment control cabinet/operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 **System Parameter**

765kV, 400kV & 220kV System

SL No	Description of parameters	765kV System	400kV System	220kV System
1.	System operating voltage	765kV	400kV	220kV
2.	Maximum operating voltage of the system (rms)	800kV	420kV	245kV
3.	Rated frequency	50Hz	50Hz	50Hz
4.	No. of phase	3	3	3
5.	Rated Insulation levels			
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	2100kVp	1550kVp	1050 kVp
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1550kVp	1050kVp	-
iii)	One minute power frequency dry withstand voltage (rms)	830kV	630kV	-
iv)	One minute power frequency dry and wet withstand voltage (rms)	-	-	460kV
6.	Corona extinction voltage	508kV	320kV	-
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	2500 µV at 508kV rms	1000 µV at 266kV rms	1000 µV at 156kV rms
8.	Minimum creepage distance - for Equipment other than Insulator string	20000 mm	10500 mm	6125 mm
	Minimum creepage distance - for Insulator String	24800 mm	13020 mm	7595 mm
9.	Min. clearances			

i.	Phase to phase	7600mm (for conductor conductor configuration) 9400mm (for rod -conductor configuration)	4000mm (for conductor conductor configuration) 4200mm (for rod - conductor configuration)	2100 mm
ii.	Phase to earth	4900mm (for conductor-structure) 6400mm (for rod- structure)	3500 mm	2100 mm
iii)	Sectional clearances	10300 mm	6500 mm	5000 mm
10.	Rated short circuit current for 1 sec. duration	50kA	63 kA	50kA
11.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed

66kV, 52kV and 33kV System

SL No	**Description of parameters**	**66kV System**	**52 kV System**	**33 kV System**
1.	System operating voltage	66kV	52kV	33kV
2.	Maximum operating voltage of the system(rms)	72.5kV	52kV	36kV
3.	Rated frequency	50Hz	50Hz	50Hz
4.	No. of phase	3	3	3
5.	Rated Insulation levels			
i)	Full wave impulse withstand voltage (1.2/50 microsec.)	325 kVp	250 kVp	170 kVp
ii)	One-minute power frequency dry and wet withstand voltage (rms)	140kV	95kV	70kV
6.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	-	-	-
7.	Minimum creepage distance	1813 mm (2248mm for coastal area)	1300mm (1612 mm for coastal area)	900 mm (1116m m for coastal area)
8.	Min. Clearance			
i.	Phase to phase	750 mm	530mm	320 mm
ii.	Phase to earth	630 mm	480mm	320 mm
iii.	Sectional clearances	3100 mm	3100mm	2800 mm

9.	Rated short circuit current	25kA for 3 Sec*	25kA for 1 Sec	25 kA for 3 sec
10.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed

Notes:

1. The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable as per relevant IEC/IS.
2. The insulation and RIV levels of the equipments shall be as per values given in the Technical Specification of respective equipment.
3. Corona and radio interference voltage test and seismic withstand test procedures for equipments shall be in line with the procedure given at **Annexure-A** and **Annexure-B** respectively.
4. "*" For tertiary loading Equipment's fault level shall be 25kA for 3 Sec.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 Deleted.

5.2 Deleted.

5.3 Drawings

5.3.1 All drawings submitted by the Bidder shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Drawings submitted by the Bidder shall be clearly marked with the name of the Employer, the unit designation, the specifications title, the specification number and the name of the Project. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings alongwith type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

5.3.3 The review of these data by the Employer will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Employer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Employer shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

5.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Bidder's risk. The Bidder may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Bidder's drawing or work by the Employer shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

5.6 All engineering data submitted by the Bidder after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

5.7 Approval Procedure

The following schedule shall be followed generally for approval and for providing final documentation.

i)	Approval/comments/ by Employer on initial submission	15 days
ii)	Resubmission (whenever required)	Within 3 (three) weeks from date of comments
iii)	Approval or comments	Within 3 (three) weeks of receipt of resubmission
iv)	Furnishing of distribution copies (2 hard copies to each substation and one scanned copy (pdf format)	Within 3 (three) weeks of receipt of resubmission
v)	Furnishing of distribution copies of test reports	
	a) Type test reports (one scanned softcopy in pdf format to each substation plus one for corporate centre & one hardcopy per substation)	2 weeks from the date of final approval
	b) Routine Test Reports (one copy for each substation)	-do-

vi)	Furnishing of instruction/ operation manuals (2 copies per substation and one softcopy (pdf format) for corporate centre & per substation)	On completion of Engineering
vii)	As built drawings (two sets of hardcopy per substation & one softcopy (pdf format) for corporate centre & per substation)	On completion of entire works

NOTE :

(1) The bidder may please note that all resubmissions must incorporate all comments given in the earlier submission by the Employer or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) Deleted.

(3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer.

(5) The Bidder shall furnish to the Employer catalogues of spare parts.

(6) All As-built drawings/documents shall be submitted after incorporating the changes before final submission.

5.8 Deleted.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

6.1.2 In case where the equipment, materials or components are indicated in the specification as “similar” to any special standard, the Employer shall decide upon the question of similarity. When required by the specification or when required by the Employer the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of

subsequent rejection, it is to be understood that the cost as well as the time delay associated with the rejection shall be borne by the Bidder.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Employer.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 Deleted.

6.1.6 The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Bidder shall apply all operational lubricants to the equipment installed by him.

6.1.7 All oil, grease and other consumables used in the Works/Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare source of oil/grease /other consumables in the GTP/Drawings, where such oil or grease is available. He shall help Employer in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

6.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air-conditioned areas shall also be of same type.

6.2.1 Space Heaters

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

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.2 FUNGI STATIC VARNISH

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

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall comply with following degree of protection as detailed here under:

a) Installed out door: IP- 55
b) Installed indoor in air-conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with IS/IEC60947; IS/IEC/60529. Type test report for of relevant Degree of Protection test, shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

6.3.1 Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, Customer Name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Employer. The rating plate of each equipment shall be according to IS/ IEC requirement.

6.3.2 All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments shall be bilingual with Hindi inscription first followed by English.

Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation,

shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 Deleted.

7.2 Deleted.

7.3 The Bidder shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Bidder has to coordinate designs and terminations with the agencies (if any) who are Consultants/Bidder for the Employer. The names of agencies shall be intimated to the successful bidders.

7.5 The Bidder will be called upon to attend design co-ordination meetings with the Engineer, other Contractor's and the Consultants of the Employer (if any) during the period of Contract. The Bidder shall attend such meetings at his own cost at POWERGRID Corporate Centre, Gurgaon (Haryana) or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work as applicable, are in accordance with the specifications, the Contractor shall ensure suitable quality assurance programme to control such activities at all points necessary. A quality assurance programme of the Contractor shall be in line with ISO requirements & shall generally cover the following:

a) The organisation structure for the management and implementation of the proposed quality assurance programme.

b) System for Document and Data Control.

c) Qualification and Experience data of Bidder's key personnel.

d) The procedure for purchases of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

e) System for shop manufacturing and site erection controls including process controls, fabrication and assembly control.

f) System for Control of non-conforming products including deviation dispositioning, if any and system for corrective and preventive

actions based on the feedback received from the Customers and also internally documented system for Customer complaints.

g) Inspection and test procedure both for manufacture and field activities.

h) System for Control of calibration of testing and measuring equipment and the indication of calibration status on the instruments.

i) System for indication and appraisal of inspection status.

j) System of Internal Quality Audits, Management review and initiation of corrective and Preventive actions based on the above.

k) System for authorising release of manufactured product to the Employer.

l) System for maintenance of records.

m) System for handling, storage and delivery.

n) A quality plan detailing out the specific quality control measures and procedure adopted for controlling the quality characteristics relevant to each item of equipment furnished and /or service rendered.

o) System for various field activities i.e. unloading, receipt at site, proper storage, erection, testing and commissioning of various equipment and maintenance of records. In this regard, the Employer has already prepared Standard Field Quality Plan for transmission line/substation equipments as applicable, Civil/erection Works which is required to be followed for associated works.

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

8.2 **Quality Assurance Documents**

The Bidder shall ensure availability of the following Quality Assurance Documents:

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

ii) Welder and welding operator qualification certificates.

iii) Welder's identification list, welding operator's qualification procedure and welding identification symbols.

iv) Raw Material test reports on components as specified by the specification and in the quality plan.

v) The Manufacturing Quality Plan(MQP) indicating Customer Inspection Points (CIPs) at various stages of manufacturing and methods used to verify that the inspection and testing points in the quality plan were performed satisfactorily.

vi) Factory test results for testing required as per applicable quality plan/technical specifications/GTP/Drawings etc.

vii) Stress relief time temperature charts/oil impregnation time temperature charts, wherever applicable.

8.3 INSPECTION, TESTING & INSPECTION CERTIFICATE

8.3.1 The responsibility and the basis of inspection for various items & equipment is placed at **Annexure-G** along with the requirement of MQP (Manufacturing Quality Plan), ITP(Inspection & Test Plan), FAT(Factory Acceptance Test) which should be valid & POWERGRID approved and Level of inspection envisaged against each item.
Bidder shall ensure that order for items where MQP/ITP/FAT is required will be placed only on vendors having valid MQP/ITP/FAT and where the supplier's MQP/ITP/FAT is either not valid or has not been approved by POWERGRID, MQP shall be generally submitted as per POWERGRID format before placing order.

Items not covered under MQP/ITP/FAT shall be offered for inspection as per POWERGRID LOA/technical Specifications/POWERGRID approved data sheets/ POWERGRID approved drawings and relevant Indian/International standards.

Inspection **Levels**: For implementation of projects in a time bound manner and to avoid any delay in deputation of POWERGRID or its authorized representative, involvement of POWERGRID for inspection of various items / equipment will be based on the level below:

Level –I: Bidder to raise all inspection calls and review the report of tests carried out by the manufacturer, on his own, as per applicable standards/ POWERGRID specification, and submit to concerned POWERGRID inspection office/Inspection Engineer. CIP/MICC will be issued by POWERGRID based on review of test reports/certificates of manufacturers.

Level – II: Bidder to raise all inspection calls and carry out the inspection on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during inspection, the same would be intimated to Bidder and CIP/MICC will be issued by POWERGRID. Else, Bidder would submit their test reports/certificates to POWERGRID. CIP/MICC will be issued by POWERGRID based on review of test reports/ certificates.

Level - III: Bidder to raise inspection calls for both, stage (as applicable) & final inspection and carry out the stage inspections (if applicable) on behalf of POWERGRID on the proposed date of inspection as per applicable standards/specification. However, in case POWERGRID wishes to associate itself during stage inspection, the same would be intimated to Bidder and CIP will be issued by POWERGRID. Else, Bidder would submit the test reports / certificates of stage inspection after their own review and CIP will be issued by POWERGRID based on review of test reports / certificates. Final inspection will be carried out by POWERGRID and CIP/MICC will be issued by POWERGRID.

Level – IV: Bidder to raise inspection calls for both, stage (as applicable) & final inspections. POWERGRID will carry out the inspection for both stage & final inspection as per applicable standards/specification and CIP/MICC will be issued by POWERGRID.

8.3.2 Bidder shall ensure that to implement the above inspection levels, particularly for the quality control and inspection at sub-vendor's works, they would depute sufficient qualified & experienced manpower in their Quality Control and Inspection department. Further, to assure quality of construction, Bidder shall have a separate workforce having appropriate qualification & experience and deploy suitable tools and plant for maintaining quality requirement during construction in line with applicable Field Quality Plan (FQP).

8.3.3 The Employer, his duly authorised representative and/or outside inspection agency acting on behalf of the Employer shall have at all reasonable times access to the Bidder's premises or Works and shall have the power at all reasonable times to ensure that proper Quality Management practices / norms are adhered to, inspect and examine the materials & workmanship of the Works, to carry out Quality/Surveillance Audit during manufacture or erection and if part of the Works is being manufactured or assembled at other premises or works. The Bidder shall obtain for the Employer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works. The item/equipment, if found unsatisfactory with respect to workmanship or material is liable to be rejected. The observations for improvements during product/ process inspection by POWERGRID shall be recorded in Quality Improvement Register (available & maintained at works) for review & timely compliance of observations.

8.3.4 Bidder shall submit inspection calls over internet through POWERGRID website. The required vendor code and password to enable raising inspection call will be furnished to the main Contractor within 30 days of award of contract on submission of documents by Contractor. After raising the inspection calls, Contractor shall then proceed as per the message of that particular call which is available on the message board.

8.3.5 The Employer reserves the right to witness any or all type, acceptance and routine tests specified for which the Bidder shall give the Employer/Inspector Twenty one (21) days written notice of any material being ready for testing for each stage of testing as identified in the approved quality plan as customer inspection point (CIP) for indigenous inspections. All inspection calls for overseas material shall be given at least forty five (45) days in advance. Such tests shall be to the Bidder's account except for the expenses of the Inspection Engineer. The Employer/inspector, unless witnessing of the tests is waived by Employer, will attend such tests within Twenty one (21) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Bidder may proceed with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector three copies of tests, duly certified. Bidder shall ensure, before giving notice for type test, that all drawings and quality plans have been got approved. The equipment shall be dispatched to site

only after approval of Routine and Acceptance test results and Issuance of Dispatch Clearance in writing by the Employer. CIP/Material Inspection clearance certificate (MICC) shall be issued by the Employer after inspection of the equipment or review of test reports as applicable. Employer may waive off the presence of Employer's inspecting engineer. In that case test will be carried out as per approved QP and test certificate will be furnished by the supplier for approval. CIP/MICC will be issued only after review and approval of the test reports.

8.3.6 Bidder shall generally offer material for inspection as per supply bar chart approved by POWERGRID and not before 30 days from schedule indicated in the bar chart. In case Bidder offers material(s) for inspection prior to 30 days from the scheduled date with necessary approval of POWERGRID, POWERGRID shall inspect the material and issue CIP only. However, in such an exceptional case, MICC shall be issued only as per provision of original / revised approved supply schedule.

8.3.7 Bidder shall minimize the number of inspection calls by offering optimum quantities in each inspection call at the respective manufacturer's works.

8.3.8 Bidder shall inspect the material themselves and only after they are fully convinced about the Quality, they shall offer the material for POWERGRID inspection and shall also ensure that relevant portion of LOA/NOA, approved drawing and data sheets along with applicable Quality Plans are available at the works of Contractor or their Sub-vendor before the material is offered for inspection.

8.3.9 Bidder shall ensure that material which has been cleared for dispatch after inspection will be dispatched within 30 days in case of domestic supplies and within 60 days in case of Off-shore supplies from the date of issuance of CIP. Material which is not dispatched within stipulated time as above will be reoffered for POWERGRID inspection or specific approval of POWERGRID QA&I shall be obtained for delayed dispatch.

8.3.10 The Employer or IE shall give notice in writing to the Bidder, of any objection either to conformance to any drawings or to any equipment and workmanship which in his opinion is not in accordance with the Contract. The Bidder shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Employer/Inspection Engineer giving reasons therein, that no modifications are necessary to comply with the Contract.

8.3.11 All Test Reports and documents to be submitted in English during final inspection of equipment by POWERGRID or as and when required for submission.

8.3.12 When the factory tests have been completed at the Bidder's or Sub-Bidder's works, the Employer/Inspection Engineer(IE) shall issue a certificate to this effect within fifteen (15) days after completion of tests & submission of documents by Bidder/manufacturer but if the tests are not witnessed by the Employer/IE, the certificate shall be issued within fifteen (15) days of receipt of the Bidder's Test certificate by the Employer/IE. Bidder shall, on completion of all tests, submit test reports within Ten (10) days to POWERGRID IE. Failure of the Employer/IE to issue such a certificate shall not prevent the Contractor from proceeding with the

Works. The completion of these tests or the issue of the certificate shall not bind the Employer to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract.

8.3.13 In all cases, where the Contract provides for tests whether at the premises or works of the Bidder or of any Sub-Bidder, the Bidder, except where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Employer/Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer/Inspection Engineer or to his authorised representative to accomplish testing.

8.3.14 The inspection and acceptance by Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract, or if such equipment is found to be defective at a later stage.

8.3.15 The Employer will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

8.3.16 The Employer reserves the right for getting any additional field tests conducted on the completely assembled equipment at site to satisfy that material complies with specifications.

8.3.17 Rework/ Re-engineering, if any, on any item/equipment shall be carried out only after mutual discussions and in accordance with mutually agreed procedure. Bidder shall submit Joint Inspection Report of equipments under Re-Work/Re-Engineering alongwith procedure for the same to POWERGRID for approval, before taking up the Re-Work/Re-Engineering, failing which POWERGRID reserves the right to reject the equipment.

8.3.18 Bidder may establish a field test Laboratory to execute Civil Construction testing requirements at site with the condition that all testing equipment shall be calibrated from POWERGRID approved accredited Testing laboratories, with calibration certificates kept available at site and all testing personnel employed in the Field-Testing Laboratories to be qualified and experienced Engineers or testing to be carried out at POWERGRID approved Third Party Laboratories.

8.3.19 Bidder shall ensure that all possible steps are taken to avoid damages to the equipment during transport, storage and erection.

8.3.20 Deleted.

8.3.21 Bidder shall ensure commissioning of all CSDs along with Circuit Breakers wherever applicable.

8.3.22 **For EHV transformers/reactors**:

Insulation oil shall be as per POWERGRID Technical specifications and same grade shall be used for impregnation of the active part & testing at the works of Transformer/Reactor Manufacturer and as well as for filling the Transformer/Reactors at site. Contractor to ensure that windings for

Transformer/Reactors are made in air-conditioned environment. Core-coil assembly shall be performed in positive pressurized dust-controlled environment. Dust measurements shall be monitored regularly at Transformer / Reactor Manufacturer works. Contractor shall ensure that respective civil foundations & Fire walls for Transformer/Reactors units to be commissioned, shall be made ready at concerned sites before receipt of Transformer/Reactors units. All the requisite material for Neutral & Delta Bus formation required for charging of complete bank of 765KV class 1-ph Transformer/Reactor units shall be made available at the concerned sites before receipt of the Transformer/Reactor units at site.

8.3.23 The Employer reserves the right to increase or decrease their involvement in inspections at Bidder's Works or at his Sub-Bidder's premises or at the Employer's site or at any other place of Work based on performance of Bidder/sub-bidder.

9.0 TYPE TESTING & CLEARANCE CERTIFICATE

9.1 All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.

9.2 The reports for all type tests as per technical specification shall be furnished by the Contractor along with equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all projects with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID/representative authorized by POWERGRID/representative of Utility /representative of accredited test lab/ representative of The National Accreditation Board for Certification Bodies (NABCB) certified agency shall also be acceptable.
Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted within the years specified below from the date of NOA. In case the test reports are of the test conducted earlier than the years specified below from the date of NOA, the contractor shall repeat these test(s) at no extra cost to the Employer.

S.No	Name of Equipment	Validity of type test (in years)
1	Power Transformer	5
2	LT Transformer	5
3	Shunt Reactor	5
4	OLTC	10
5	Bushing of Power Transformers/Reactors	7
6	Fittings and accessories for Power transformers & Reactors	10
7	Circuit Breaker	10
8	Isolator	10
9	Lighting Arrester	10
10	Wave Trap	10
11	Instrument transformer	7
12	GIS & Hybrid GIS	10
13	LT Switchgear	10

14	Cable and associated accessories	10
15	Relays	7
16	Capacitors	10
17	Battery & Battery Charger	7
18	Conductor & Earth wire	10
19	Insulators (Porcelain/Glass)	10
20	Composite Insulators	5
21	PLCC	5

Note :
For all other equipment's validity of type test shall be 10 years from date of NOA.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Employer.

The Contractor shall intimate the Employer the detailed program about the type tests at least two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

9.3 The Employer intends to repeat those type tests which are indicated in the price schedule and the same shall be payable as per provision of contract. The price of conducting type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal Sheets. These Type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected. The Employer reserves the right to waive the repeating of type tests partly or fully and in case of waival, test charges for the same shall not be payable.

9.4 The Employer reserves the right to witness any or all the type tests. The Employer shall bear all expenses for deputation of Employer's representative(s) for witnessing the type tests except in the case of re-deputation if any, necessitated due to no fault of the Employer.

9.5 The list of makes of various items, for which Type test reports are not required to be submitted are specified at Annexure-J.

10.0 Deleted.

11.0 PACKAGING & PROTECTION

11.1 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Employer, the Bidder shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Employer

to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Employer/BHEL takes no responsibility of the availability of the wagons.

11.2 All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

12.2 HOT DIP GALVANISING

12.2.1 The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq.m minimum.

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

12.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate or alternate approved treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to four numbers of one minute dips in copper sulphate solution as per IS-2633.

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

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of touch-up zinc rich paint at site shall be allowed with approval of Engineer Incharge.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS6005 "Code of practice for phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

12.3.2 Hot Phosphating shall be done for phosphating process under pretreatment of sheets After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.

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

12.3.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards /panels/junction boxes is also acceptable. The exterior colour for panels shall be matching with the existing panels in case of extension of a substation. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

12.3.5 In case the contractor proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted during detailed engineering for Employer's review & approval.

12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No.	PIPE LINE	Base colour	Band colour

Fire Protection System			
1	Hydrant and Emulsifier system pipeline/NIFPS	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line –Air	FIRE RED	Sky Blue
4	Pylon support pipes	FIRE RED	
Air Conditioning Plant			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	-
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

The direction of flow shall be marked by → (arrow) in black colour.

Base Colour Direction of flow Band Colour

12.3.7 For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures, the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting. For stainless steel surfaces, no painting is envisaged.

12.3.8 Band colour is required for Emulsifier system detection line only if both water and air detection lines are present at the same substation. Further, band colour shall be applied at an interval of 2 meters approx. along the length and minimum width of band shall be 25mm.

13.0 Deleted.

14.0 TOOLS

14.1 Deleted.

14.2 SPECIAL TOOLS AND TACKLES

The bidder shall supply all special tools and tackles required for Operation and maintenance of equipment. The special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. The list of special tools and tackles, if any, shall be finalized during detail engineering and the same shall be supplied without any additional cost implication to the Employer.

14.3 Deleted.

15.0 AUXILIARY SUPPLY

15.1 The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform the parameters as indicated in the following table:

Normal Voltage	Variation in Voltage	Frequency in HZ	Phase/Wire	Neutral connection
415V	± 10%	50 ± 5%	3/4 Wire	Solidly Earthed.
240V	± 10%	50 ± 5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	Isolated 2 wire System	-
110V	95V to 120V	DC	Isolated 2 wire System	-
48V	--	DC	2 wire system (+) earthed	-

Combined variation of voltage and frequency shall be limited to ± 10%.

15.2 Pickup value of binary input modules of Intelligent Electronic Devices, Digital protection couplers, Analog protection couplers shall not be less than 50% of the specified rated station auxiliary DC supply voltage level.

16.0 SUPPORT STRUCTURE (ONLY OF CIRCUIT BREAKER)

16.1 The equipment support structures shall be suitable for equipment connections at the first level i.e 14.0-meter, 8.0-meter, 5.9 meter and 4.6 meter from plinth level for 765kV, 400kV, 220kV and 132kV substations respectively. All equipment support structures shall be supplied alongwith brackets, angles, stools etc. for attaching the operating mechanism, control cabinets & marshalling box (wherever applicable) etc.

16.2 The minimum vertical distance from the bottom of the lowest porcelain/polymer part of the bushing, porcelain/polymer enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 metres.

17.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS (For Lightning Arrester & Wave Trap only)

17.1 All power clamps and connectors shall conform to IS:5561 or other equivalent international standard and shall be made of materials listed below :

Sl. No.	Description	Materials

a)	For connecting ACSR conductors/AAC conductors/ Aluminium tube	Aluminum alloy casting, conforming to designation **4600** of IS:617 and all test shall conform to IS:617
b)	For connecting equipment terminals mad of copper with ACSR conductors/AAC conductors/ Aluminium tube	Bimetallic connectors made from aluminum alloy casting, conforming to designation **4600** of IS:617 with 2mm thick bimetallic liner/strip and all test shall conform to IS:617
c)	For connecting G.I	Galvanised mild steel shield wire
d)	Bolts, nuts & plain washers	Electro-galvanised for sizes below M12, for others hot dip galvanised.
e)	Spring washers	Electro-galvanised mild steel suitable for atleast service condition-3 as per IS:1573

17.2 Necessary clamps and connectors shall be supplied for all equipment and connections. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

17.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.

17.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

17.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner/strip of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic liner/strips shall be provided for Bi-metallic clamps.

17.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

17.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS AL tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

17.8 Current carrying parts (500A and above) of the clamp/connector shall be provided with minimum four numbers of bolts preferably for 132kV and above.

17.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

17.10 Power Clamps and connectors shall be designed to control corona as per requirement.

17.11 Tests

Clamps and connectors should be type tested on minimum three samples as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Following type test reports shall be submitted for approval. Type test once conducted shall hold good. The requirement of test conducted within last ten years, shall not be applicable.

i) Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient)

ii) Short time current test

iii) Corona (dry) and RIV (dry) test [for 132kV and above voltage level clamps]

iv) Resistance test and Pullout strength test

v) Cantilever Strength test on bus support clamps & connectors

18.0 **CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES MARSHALLING BOXES FOR OUTDOOR EQUIPMENT**

18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS/IEC 61439-0, as applicable, and the clauses given below:

18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes, Out door ACDB cum DCDB panels shall be made of stainless steel of atleast 1.5 mm thick or aluminium enclosure of atleast 1.6 mm thick and shall be dust, water and vermin proof. Stainless steel used shall be of grade SS304 (SS316 for coastal area) or better. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

Control cabinets, junction boxes, marshalling boxes & terminal boxes, out-door ACDB cum DCDB panels shall have adequate space/clearance as per guidelines/technical specifications to access/replace any component. Necessary component labelling to be also done on non-conducting sheet.

For CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES MARSHALLING BOXES

FOR OUTDOOR EQUIPMENT Junction Box, wire should be as per IS or equivalent IEC with FRLS grade.

Machine laid PU Foam gasket may be permitted for use in Control Cabinets etc.

18.3 A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.

18.4 Cabinet/boxes with width more than 700 mm shall be provided with double hinged doors with padlocking arrangements. The distance between

two hinges shall be adequate to ensure uniform sealing pressure against atmosphere.

18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM/Neoprene/PU gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

Further, the gasketing arrangement shall be such that gaskets are pasted in slots (in door fabrication/gasket itself) in order to prevent ingression of dust and moisture inside the panels so that no internal rusting occurs in panels during the operation of the equipment.

18.6 All boxes/cabinets shall be designed for the entry of cables by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

18.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

18.8 LED based illumination of minimum 9 watts shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

18.9 All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

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

18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

18.12 The following routine tests alongwith the routine tests as per IS:5039 shall also be conducted:

i) Check for wiring
ii) Visual and dimension check

18.13 The enclosure of bay marshalling kiosk, junction box, terminal box and control cabinets shall conform to IP-55 as per IS/IEC60947 including application of 1kV rms for 1 (one) minute, after IP-55 test.

19.0 Deleted.

20.0 TERMINAL BLOCKS AND WIRING

20.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.

20.2 Terminal blocks shall be 650V grade and have continuous rating to carry the maximum expected current on the terminals and non-breakable type. These shall be of moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But the terminal blocks shall be non-disconnecting stud type except for the secondary junction boxes of Current Transformer and Voltage Transformer.

20.3 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

20.4 The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.

20.5 The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.

20.6 The terminal blocks shall be of extensible design, multilayer terminal arrangement is not allowed in any junction box (Common MB, Individual MB, JB etc.). There should be sufficient space at both sides of terminals so that ferrule number of wires / TB numbers are clearly visible during wire removal or insertion.

20.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

20.8 The terminal blocks shall be fully enclosed with removable covers of transparent, nondeteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

20.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a) All circuits except CT/PT circuits	Minimum of two of 2.5 sq mm copper flexible.

b)	All CT/PT circuits	Minimum of 4 nos. of 2.5 sq mm copper flexible.

20.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

20.11 Atleast 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

20.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate for outdoor ground mounted marshalling box and the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

20.13 The Contractor shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets

21.0 LAMPS & SOCKETS

21.1 **Lamps & Sockets**

All lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

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

21.2 **Hand Lamp:**

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

21.3 **Switches and Fuses:**

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

21.3.2 All fuses shall be of HRC cartridge type conforming to relevant IS mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

22.0 **BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS**:

22.1 Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS: 5621.The support insulators shall

be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable.

The bidder may also offer composite hollow insulators, conforming to IEC-61462.

22.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

22.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

22.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

22.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

22.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non-hygroscopic material such as metal or glazed porcelain.

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

22.8 Void

22.9 Deleted.

23.0 MOTORS

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

23.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.

b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.

c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.

d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

23.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

23.3 Starting Requirements:

a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

23.4 Running Requirements:

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3-phase induction motors) after adjustment due to increased ambient temperature specified.

b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by

the relevant standard for the driven equipment when measured at the motor bearings.

c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

23.5 **TESTING AND COMMISSIONING**

An indicative list of tests is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./Instructions of the equipment Contractor or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Employer for approval.

(a) Insulation resistance.

(b) Phase sequence and proper direction of rotation.

(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected

SECTION IV

GUARANTEED AND TECHNICAL PARTICULARS
(Bidder shall furnish the technical parameters for offered LT Transformer in the below mentioned format after award of contract)

S N	Parameter	33/0.433 kV
1	Manufacture's Name & Address	
2	Service	
3	Rated Voltage (i) HV Winding (kV) (ii) LV Winding (kV)	
4	Rated frequency (Hz)	
5	Number of phases	
6	Connections (i)HV Winding (ii)LV Winding	
7	Connections symbol	
8	Type of cooling	
9	Rating available at different cooling (if any) in %	
10	Tap changing equipment (i) Manufacture (ii) Type (iii) No. Of steps	
11	Guaranteed positive sequence impedance at 75 °C with 100 % rating at (i) Principal tap (ii) Maximum tap (iii) Minimum tap	
12	Temperature rise over an ambient of 50 °C (i) Top oil (if applicable °C) (ii) Windings (by resistance measurement method) °C	
13	Guaranteed losses at rated voltage on principal tap and at rated frequency (i) No load loss or iron losses (KW) (ii) Copper loss at full load at 75 °C (KW)	
14	Cooler Data (i) Type of Cooler (ii) Number of Coolers and % of transformer cooling equipment	
15	Withstand time for three phase short circuit at terminals (second)	
16	No load current at rated voltage and rated frequency (A)	
17	Insulation level (a) Separate source power frequency voltage withstand (i) HV Winding (kV rms) (ii) LV Winding (kV rms) (b) Induced over voltage withstanding (i) HV Winding (kV rms) (ii) LV Winding (kV rms (c) Full wave lighting impulse withstanding (i) HV Winding (kVp) (ii) LV Winding (kVp) (d)Switching impulse withstand voltage (i) HV Winding (kV) (ii) LV Winding (kV)	

18	Regulation at full load at 75 °C (i) At unity power factor (%) (ii) At 0.8 power factor (%)	
19	Terminal arrangement (i) High voltage (ii) Low voltage (iii) LV Neutral	
20	Over excitation withstand time (second) (i) 120 % (ii) 150 %	
21	Bushing (a) High voltage (i) Manufacturer (ii) Type (iii) Minimum Creepage distance (mm) (b) Low voltage (i) Manufacturer (ii) Type (iii) Minimum Creepage distance (mm) (c) LV Neutral (i) Manufacturer (ii) Type (iii) Minimum Creepage distance (mm)	
22	Proposed method of transformer shipment	
23	Total quantity of oil (liters) required for first filling (wherever applicable)	
24	Is vacuum filling required? If so state absolute pressure	
25	Efficiency at 75 °C at Unit power factor (a) At full load (%) (b) At ¾ load (%) (c) At ½ load (%)	
26	Approximate dimensions (a) Tank enclosure LxBxH (mm) (b) Overall LXBXH (mm)	
27	Untaking height (m)	
28	Approximate weight (i) Core and winding (kg) (ii) Tank fittings (kg) (iii) Oil (if applicable) (kg) (iv) Total weight (kg)	
29	Dispatch details (i) Approximate mass of heaviest package (kg) (ii) Approximate dimensions of largest package- (a) Length (mm) (b) Breath (mm) (c) Height (mm)	
30	Reference Standards	
31	Type of Construction (Core Shell)	
32	Thermal time constant (Hours)	
33	Magnetising in rush current (A)	

34	No load current at rated frequency and at (i)90 %voltage (A) (ii) 100 %voltage (A) (iii)110% voltage(A)	
35	Power factor of no load current	
36	Zero sequence impedance at principal tap	
37	Capacitance between winding and to earth(micro farad)	
38	Percentage reactance at rated current and frequency and at (i)Principal tap (ii)Maximum tap (iii)Minimum tap	
39	Off/ON load tap changer details (a) Ratings (i)Rated voltage (ii)Rated current (iii)Step voltage (iv)Number of steps	
40	Radiator (i) Overall dimensions LxBxH (mm) (II) Total weight with oil (kg) (iii) Total weight without oil (kg) (iv) Type of mounting (v) Thickness of Radiator tube	
41	Weight of Transformer (i)Core (kg) (ii)Windings (a) HV (kg) (b) LV (kg)	
	(c)	
	(iii)Insulation(kg) (iv)Tank/enclosure and fittings (kg) (v) Oil) (kg) (vi)Total weight (kg)	
42	Dimensions (i)Tank/enclosure LxBxH (mm) (ii)Overall LxBxH (mm)	
43	Shipping details (i)Weight of heaviest package (kg) (ii)Total shipping weight (kg) (iii)No. of packages (iv) Dimension of largest package LxBxH (mm)	

SECTION V

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED
The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:

BIDDER: OFFER REFERENCE:

PLEASE NOTE:
a) The offer will not be evaluated if the following information and this Checklist are not enclosed with the Offer.
b) The evaluation of bidder against qualifying criteria specified in Section-01 shall be based on the documentary proof submitted by bidder along with the offer.
Bidder shall ensure the completeness of their offer in this regard.

A) Technical Parameters: -

S.No	Parameters	Data		Confirmation	Remarks
1.	Applicable Standard	IS-2026, IEC 60076 , IS-1180		Yes	
2.	Type	Outdoor type oil filled , three phase , two winding Aux Transformer		Yes	
3.	Rated Frequency	50 Hz		Yes	
4.	HV	33kV	~~11 kV~~	Yes	
5.	-				
6.	LV	0.433kV	~~0.433kV~~	Yes	
7.	Type of Cooling	ONAN		Yes	
8.	Impedance at 75 Degree C	5% +/-10%		Yes	
9.	Duty	Continuous		Yes	
10.	Overload	As per IS 2026		Yes	
11.	Winding connection	HV – Delta LV – Star		Yes	
12.	Vector Group	Dyn1		Yes	
13.	Insulation	Uniform		Yes	
14.	Tap Changer	a) Tap Change: +5% to -10% in step of 2.5% on HV side b) Tap Control : OFF Circuit Tap Change Switch		Yes	
15.	HV Termination	Suitable for overhead conductor or 33kV Cable (cable or overhead conductor shall be defined during detailed engineering)		Yes	

16.	LV Termination	Suitable for (3x2 +1) 1C, 630Sq.mm XLPE Power cable , in cable box	Yes	
17.	Neutral termination	Suitable for 1C, 630 sq.mm. cable connection	Yes	
18.	Additional neutral bushing for earthing of transformer	Provided	Yes	
19.	HV Bushing for 33/0.433kV Transformer	a) Rated Voltage = 52 kV b) Rated Current = 100A c) Basic Impulse Level = 250kVp d) Wet & Dry Power frequency withstand Voltage = 95kVrms e) Min. Total Creepage distance =1300 mm (as per 25mm/kV) for Bikaner and Kopal and 1612mm for Vataman f) Mounting= Tank / Transformer body	Yes	
20.	~~HV Bushing for 11/0.433kV Transformer~~	~~a) Rated Voltage = 12 kV~~ ~~b) Rated Current = 100A~~ ~~c) Basic Impulse Level = 75kVp~~ ~~d) Wet & Dry Power frequency withstand Voltage = 28 kVrms~~ ~~e) Min. Total Creepage distance =300 mm~~ ~~f) Mounting= Tank / Transformer body~~	YES	
21.	LV & Neutral Bushing	a) Rated Voltage = 1kV b) Rated Current = 2000A c) Wet & Dry Power frequency withstand Voltage = 5kVrms d) Mounting= Tank / Transformer body	Yes	
22.	Min Clearance (mm)	Ph-Ph(HV/LV) – 530/25 Ph-E (HV/LV) – 480/25	yes	
23.	Transformer oil	10% extra oil for top-up to be supplied	Yes	
24.	Lug	Supply of 7 numbers matching lug for 0.415kV Terminal to 630Sqmm 1C cable	Yes	

25.	Gland Plate	**Gland plate** shall be of **non-magnetic** material of at least 4mm thickness	Yes	
26.	Provision to be made for remote indication of transformer alarms in the BCU (SAS). Potential free contacts to be provided for the same and wired up to the transformer Marshalling Kiosk.	Complied	YES/NO	
27.	Maximum Losses as per clause 1.2, section 1	Bidder scope	YES/NO	
28.	Offered transformer complies all technical parameters listed in Annexure-A of Section-02		YES/NO	
29.	Type test Reports (Already approved by Power grid and not older than 5 years from **01.01.2025**) available		YES/NO	
30.	Powergrid standard approval on drawings & GTP available		YES/NO	
31.	MQP (Approved by Powergrid with validity date available)		YES/NO	
32.	Compliance to clause 1.5 (Type test) of section 1 of this specification.		YES/NO	
33.	Nil deviation certificate, Annex-A submitted		YES/NO	

Date:

Signature of the authorized representative of Bidder with Company Seal