TECHNICAL SPECIFICATION

FOR

AUXILIARY SERVICE TRANSFORMERS

(OIL FILLED)

2x4000 KVA, 33/0.433 kV

BHARAT HEAVY ELECTRICALS LIMITED
FABRICATION UNIT
Third Floor, Room No.305, Corporate office,
New Delhi- 110049

भी एच ई एल BHEL	**TITLE :** Technical Specification For 4000KVA, 33/0.433 kV Transformer(Oil Filled)

CONTENTS

Section-A

SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, inspection & testing at manufacturer's works, proper packing, delivery to site and supervision of (installation & commissioning) and testing at BHEL 's works of **Two (02) Numbers** 4000 KVA, 33/0.433 kV Power Transformers (Oil filled) suitable for out door installation.

2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respect to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation.

3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the tender specification.

4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.

5.0 Bidders shall confirm total compliance to the specification without any deviation from the technical/ quality assurance requirements stipulated.

Section-B

SPECIFIC TECHNICAL REQUIREMENTS

1.00 INTENT OF SPECIFICATION

1.01 This specification covers the design, manufacture, inspection & testing, packing at manufacturer's works, delivery to site and supervision of (installation & commissioning) and testing at BHEL's works of mineral oil filled LT Transformers complete with all fittings & accessories for satisfactory operation at site.

1.02 The intent of specification is not to specify all details of design & construction of equipment. The equipment shall, however, conform in all aspects to high standard of design, engineering and workmanship and be capable of performing in continuous operation upto & after bidder's guarantee period in manner acceptable to purchaser who will interpret the drawings & specification and shall have power to reject any work or material which in his judgment is not in full accordance with this specification.

2.00 CODES AND STANDARDS

2.01 The equipment shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the equipment is to be installed including Indian Electricity Act, Indian Electricity Rules and Bureau of Indian Standards.

2.02 The design, material, construction, manufacture, inspection, testing and performance of LT Service Transformers shall conform to the currently applicable standards and codes of practices as per Annexure-VIII. General design, electrical & constructional features and various fittings & accessories shall be as per CBIP manual on Transformers Publication No. 275 (1999 edition or latest).

2.03 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.00 SCOPE OF ENQUIRY

3.01 Bidder shall quote for mineral oil filled LT Service Transformers including 10% spare oil in accordance with various sections of this specification. The transformer shall be provided with all fittings & accessories (including foundation hardware) & shall be complete in

all aspects, for satisfactory operation, in accordance with this specification & technical particulars. Design ambient temperature shall be 50 deg. C.

3.02. Bidder shall quote for following equipment & services:

3.02.01. Transformers- (Rating & quantity of transformers shall be as per Data sheet-A).

3.02.02. Special Tools & Tackles required for installation & commissioning and proper maintenance of equipment- One Lot (Bidder to furnish list along with offer)

3.02.03. Commissioning spares for each transformer- One Lot (Bidder to furnish list along with offer)

3.02.04. O & M spares as specified in Annexure-I

3.02.05 Supervision of Installation & commissioning at site.

3.02.06 Testing of Transformer at site

Note: Extra 10% of total oil quantity for each transformer shall be supplied along with the transformers in sealed non returnable drums.

4.00 SERVICES & EQUIPMENT TO BE EXCLUDED

4.01 Installation of transformer at site.

4.02 Civil work such as transformer foundation, cable trenches etc.

4.03 External power connection for HV & LV side of transformer by means of bus duct.

4.04 HV termination kits.

4.05 Connection to Station Earth.

4.06 Cable lugs and cable glands for external connections to purchaser's equipment.

5.00 TERMINAL POINTS

I. HV bushings with terminal connector-Out door Aluminium conductor.

II. LV bushings with terminal connector (3 Phase + 1 Neutral)

III. LV neutral earth busbar brought near the base of transformer.

IV. Transformer earthing pads.

V. Terminals of marshalling box for external connection to equipment supplied by the purchaser.

6.00 TECHNICAL REQUIREMENTS:

6.01 Technical particulars of transformers are specified in Data Sheet–A.

6.02 Equipment shall give continuous service under specified site conditions.

6.03 All windings shall be fully insulated. Material of the windings shall be electrolytic grade copper, free from scales and burrs. Winding shall be uniformly insulated.

6.04 The core shall be constructed from high grade, non-ageing, cold rolled, grain oriented silicon steel laminations.

6.05 Internal design of transformer shall ensure that air is not trapped in any location.

6.06 Under base of tank shall be fixed type.

6.07 Nuts, bolts and pins used inside the transformer shall be provided with lock washers& locknuts.

6.08 Specific technical requirements are as follows:

6.08.01 **Tank:** Fabricated from tested quality steel and designed to withstand continuous internal pressure of 35 k N per sq. m. over normal pressure as well as short circuit forces. The main tank body including tap-changer compartment, radiators and coolers shall be capable of withstanding full vacuum. All steel surfaces in contact with insulating oil shall be painted with two coats of heat resistant oil in soluble insulating varnish. Tank shields, if provided, shall not resonate at natural frequency of equipment.

6.08.02 **Tank mounting:** Transformer tank shall be mounted on bi-directional rollers. Suitable locking arrangement shall be provided to prevent accidental movement of transformer. Tank shall also be provided with lifting lugs and minimum four jacking pads. Rollers shall be provided with holding clamp plates (04 nos), required hardware and foundation bolts etc. for each transformer.

6.08.03 **Tank openings:** At least two adequately sized inspection openings, one at each end of the tank for easy access to bushings and earth connections.

6.08.04 **Oil preservation:** Conservator tank of adequate capacity for expansion of oil from minimum ambient to 100 deg. C shall be provided. The transformers shall be provided with conventional conservator with dry air filling of the space above oil and connected to silica gel breather.

6.08.05 **Radiators:** Tank mounted with shut off valves.

6.08.06 **Insulating Oil:** As per IS: 335.No external inhibitors are permitted.

6.08.07 Transformer shall be suitable for cable/ busduct termination as indicated in data sheet-A.

6.08.09 **Bushings/ Insulators:**

a) The bushings shall conform to the requirements of IS: 2099 and IS: 3347 and shall be of porcelain.
b) For 33 KV windings, 36kV bushing shall be provided and for 433 V windings, 1.1 KV bushing shall be provided

c) The porcelain shall not engage directly with hard metal and, wherever necessary, gaskets shall be interposed between the porcelain and the fitting.

d) Clamps and fittings of steel or malleable cast iron shall be galvanised.

e) Where bushing current transformer is provided, the bushing shall be mounted so that it can be removed and replaced without disturbing the current transformers. CT s shall be cast resin type & suitable for operation at ambient temperature existing at its location on the transformer.

f) Creep age distance shall be minimum 25 mm/kV per unit of system phase to phase voltage.

f) Minimum rated current for bushings shall be as under:
1.) HV Bushing for 33KV, 4.0 MVA = Vendor to Conform
2.) Bus duct termination on LV = Vendor to Conform

6.08.10 **Cable Box:**

a) A dust tight air insulated type cable box with D.O.P. of IP: 55 shall be provided for terminating the cables directly of size and type specified in Data sheet-A.

b) Dimensions of cable box shall be subject to purchaser's approval.

c) Inspection cover for fixed portion of cable box shall be provided. Handles for lifting cable box shall be provided.

d) Creepage distance and clearances in air shall be as per CBIP manual.

e) Provision shall be made for earthing the body of each cable box. Separate earthing pads shall be provided for this purpose, suitable for bolted connection to galvanised mild steel flat of size to be specified during contract engineering stage.

f) Gland plate for single core cable termination shall be of Aluminum.

g) Cable box(es) shall be provided with suitable air-insulated disconnecting chamber so that if required, transformer can be removed from its position without disconnecting the cables in the cable box(es). Independent supporting arrangement shall be provided for cable box(es) for this purpose. Supporting arrangement shall be supplied along with required hardware & foundation bolts etc.

6.08.11 **Bus duct Termination:**

LV terminals are specified to be connected by means of a bus duct for this purpose a flanged throat or equivalent connection shall be provided to suit purchaser's busduct. The winding termination shall be on outdoor type of bushing. Necessary flexibles shall be provided by purchaser to connect the bushing terminals to the busbar of the busduct. Details of busduct shall be furnished during detail engineering stage.

6.08.12 **Neutral Terminals:**

Two (2) nos. neutral terminals shall be provided on LV side. One neutral terminal shall be part of phase connection arrangement busduct throat/ LV cable-box (as applicable). Other neutral terminal shall be in a separate box and brought to tank bottom by means of earthing bar of 50x6mm of copper, supported on porcelain insulators mounted on transformer tank. The neutral earthing bar brought to the tank bottom for connection to station earth shall be provided with holes and suitable connecting hardware. This earthing bar shall have fork type arrangement at the end.

6.09 Neutral CT

Bidder to provide neutral bushing CT as per details given in data sheet - A for restricted earth fault protection or standby earth fault protection. In case neutral CT is tank mounted, CT box shall be weather proof having D.O.P. IP: 55. CTs shall be cast resin type. CT mounted inside the tank shall not be acceptable.

6.10 Voltage control

On Load Tap Changer –On load Tap Changer to achieve voltage regulation upto 5% should be provided. The OLTC should be motorized with suitable controls. Options of providing the OLTC on HV or LV side with details of the location & operating arrangement should be given along with the offer.

6.11 Marshalling box:

a) Tank mounted vermin and dust proof marshalling box shall be provided.

b) The marshalling box shall be fabricated using sheet steel of at least 2.5mm thickness. The marshalling box shall have domed or sloping roof.

c) Marshalling box shall be complete with all internal wiring and identification ferrules, cables, conduits required for wiring between marshalling box and instruments on transformer. Wiring shall be by 650 V grade, copper cable of size 2.5 mm^2.

d) The terminal blocks shall be complete with insulating barriers and clip-on type terminals suitable for 2.5mm^2 stranded copper wires. At least 20% spare terminals shall be provided.

e) The marshalling box shall be provided with thermostatically controlled space heaters and shall have IP: 55 degree of protection.

f) CT terminals shall be with shorting and disconnecting facility.

6.12 Flux density:

Flux density in any part of the core & yoke on any tap position with ±10% voltage variation from voltage corresponding to the tap shall not exceed 1.9 Wb/m^2.
Transformer shall also withstand following conditions due to combined voltage and frequency variations:

a. Continuous operation for 110% flux density
b. At least 1 minute operation for 125% flux density
c. At least 5 sec. operation for 140% flux density

6.13 Noise & Vibration:

The design and manufacture of transformer, fittings and accessories shall be such as to reduce noise & vibration. Noise level shall not be more than as specified in NEMA Standard Publication TR-1, when measured with transformer energized at normal voltage and frequency.

6.14 All transformers and their accessories shall be capable of withstanding without damage any external short circuit at the terminals for duration of two seconds.
Calculation shall be furnished by the bidder during contract engineering stage to substantiate the adequacy of support system to withstand short circuit forces.

6.15 Maximum Transformer losses including tolerances shall be as per annexure – III.

6.16 LOADING CAPABILITY:

Transformer shall be suitable for continuous operation at rated kVA on any tap with voltage variation of + 10 % corresponding to voltage of the tap. Short duration overloading shall be in accordance with IEC 354/IS: 6600.

7.00 Fittings & accessories:

7.01 Transformer shall be provided with, but not restricted to following minimum fittings and accessories for satisfactory operation:

a) Conventional type conservator with drain plug and oil filling hole.
b) Magnetic oil level gauge with low-level alarm contact.
c) Prismatic & toughened glass oil level gauge.
d) Silica gel breather with oil seal.
e) Double float type Buchholz relay with alarm and trip contacts with suitable gas collecting device with one shut-off valve on conservator side.
f) Diaphragm type explosion vent for transformers.
g) Pocket on tank cover for thermometer.
h) Protected type mercury in glass thermometer.
i) Dial type (150 mm) Oil temperature indicator (OTI) with two sets of electrical potential- free contact rated for 2A, 220V DC, for alarm and trip purpose. The OTI shall be provided with anti-vibration mounting. OTI shall have maximum reading pointer along with resetting device.
j) Dial type (150 mm) Winding temperature indicator (WTI) with two sets of electrical potential- free contact rated for 2A, 220V DC, for alarm and trip purpose. The WTI shall be provided with anti-vibration mounting. WTI shall have maximum reading position along with resetting devices.
k) Drain Valves.
l) Sampling devices.
m) Filter valves.
n) Earthing terminals – 2 Nos.
o) Rating & Diagram plates.
p) Valve schedule plate.
q) Two sets of lifting lugs (one for transformer with oil and other for tank cover).
r) Jacking pads.
s) Skids and pulling eyes on both sides.
t) Air release devices.
u) Inspection covers.
v) Oil filling hole and cap.
w) Tank mounted marshalling box.
x) Detachable, flat, bidirectional rollers with 90 deg. swivel mechanism.
y) Clamping arrangement for rollers.
z) Ground support for cable box.
aa) Neutral CT secondary box.
bb) Haulage facilities.
cc) Two nos. spring operated pressure relief devices with extension pipe to bring oil to plinth level along with electrically insulated contact for alarm and tripping for transformer rating 4 MVA and above.

7.02 Breather may be fitted at a height not exceeding 1.5 M.

7.03 Rating and diagram plate will be fitted at a height of about 1.75M above the ground level.

7.04 The WTI and OTI shall have accuracy class of $\pm$ 2 deg. C or better.

7.05 Rating/ Name/ Valve schedule plates shall be of white non-hygroscopic material with engraved black lettering. Such plates shall be bi- lingual with Hindi inscription first, followed by English. Alternatively, two separate plates with Hindi & English inscription shall be provided.

8.00 PAINTING:

Paint shade shall be informed to successful bidder during detail engineering. Successful bidder shall furnish painting specification/ procedure to be used for BHEL approval during detailed engineering. Adequate quantity of touch up paint shall also be supplied. There shall be no commercial or delivery implication to BHEL on account of paint shade, paint specification/ procedure.

9.00 COMMISSIONING, O&M SPARES AND SPECIAL TOOLS & TACKLES:

9.01 Commissioning spares are those, which may be required during commissioning of the equipment. Bidder to furnish list of commissioning spares along with technical offer.

9.02 O & M spares are those which are required for satisfactory & trouble free operation of equipment. List of O&M spares is enclosed as per Annexure-I.

9.03 The bidder shall supply with the equipment, one unused complete set of all special tools & tackles required for the installation, assembly, disassembly and proper maintenance of the equipment. A list of such tools & tackles (price deemed to be included in the total bid price) shall be submitted by the bidder along with the offer.

10.00 QUALITY ASSURANCE, TESTING & INSPECTION

10.01 BHEL's Standard QP (QP NO. PED-302-00-Q-001/01) is enclosed as per Annexure-V for reference. However, at contract stage, the successful bidder shall submit the QP for BHEL approval. There shall be no commercial implication to BHEL on account of QP approval.

10.02 All materials, components and accessories of the transformers shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan.

10.03 Tests shall be performed in presence of BHEL's representative. The bidder shall give at least fifteen (15) days advance notice of date when the tests are to be carried out.

10.04 All routine and acceptance tests as per relevant standards and specification shall be carried out by the vendor/ sub-vendor on all transformers. Charges for all these routine and acceptance tests for all the equipments & components shall be deemed to be included in the bid price.

10.05 Additionally, the bidder shall include in his equipment price the cost of carrying out the following special tests as routine tests on all the transformers:

a) Oil Leakage test for 24 hours
b) Jacking test on transformer's load bearing members.
c) Repeat no load loss tests after electrical tests.

10.06 Bidder shall furnish Type Test certificates already carried out on similar transformers from a reputed institute (other than bidder) along with Part-I bid. This Test certificates shall not be older than 3 years. In absence of this certificate the offer is liable to be rejected.

10.07 Bidder shall furnish List of sub-vendors/ makes of items along with part-I bid for BHEL approval.

11.00 DRAWINGS, DATA & DOCUMENTS TO BE SUBMITTED:

11.01 Following shall be submitted along with the offer:

a) The enclosed Data Sheet-B filled up completely
b) Clause – wise deviation, if any
c) Out line General Arrangement Drawings
d) Foundation plan Drawings
e) List of sub-vendors/ makes of items
f) Type Test certificates

11.02 Following documents shall be submitted after placement of order for BHEL approval:

a) The Data Sheet – C duly filled up.(Data Sheet – C shall be given to successful bidder)
b) Vendor drawing submission schedule.

c) Design calculation for short circuit withstands capability (refer cl. 6.14).
d) Overall General Arrangement Drawing clearly showing all fittings, accessories, termination details, foundation details with roller locking arrangement.
e) General Arrangement of Marshalling Box.
f) Rating & Diagram Plate Drawing.
g) Valve Schedule Plate Drawing.
h) Cable Box Arrangement Drawing.
i) Bushing/ Insulator Drawings.
j) Bus duct Trunking Drawings.
k) Quality Plan.
l) Type test procedure
m) Wiring Diagrams.
n) Painting procedure of vendor for approval of customer.
o) Recommended Field Quality Plan
q) Routine test reports
r) O & M Manuals

The documents listed at sl. no. a), b) & c) shall be submitted by successful bidder within 2 weeks from L.O.I. while documents sl. no. d) through o) shall be submitted by successful bidder within 4 weeks from L.O.I.

No. of documents/ drawings required shall be as per "Documents/ Drawings Distribution Schedule" enclosed as per Annexure-IV.

12.00 O & M MANUALS

12.01 O & M manuals for the installation, operation and maintenance of transformers shall be furnished at least three months before dispatch of equipment.

12.02 Draft manual should first be submitted for BHEL's approval. The manual should contain minimum following details:

a) General description of equipment.
b) Approved Technical Data Sheet
c) Salient constructional features.
d) Technical leaflets of fittings/ important parts.
e) All drawings.
f) Type and routine test certificates.
g) Instructions to be followed on receipt of equipment at site & for storage.
h) Instructions for foundation arrangement.
i) Erection procedures and checks.
j) Pre-commissioning checks.

k) Commissioning procedures.
l) Withdrawal arrangement/ material handling instructions.
m) Operation instructions.
n) Maintenance instructions.
o) Trouble-shooting.
p) Safety instructions.

13.0 All drawings/ documents indicated at clause no. 11 & 12 above shall be computer generated. Drgs. / documents shall be required in soft form (PDF format) also. All drawings shall be prepared in AUTOCAD latest version. Drawings & documents shall be submitted in CD also. The number of copies of various drawings/ documents shall be as per Annexure -IV.

ANNEXURE-I

LIST OF O & M SPARES

S. NO.	*DESCRIPTION*	*QTY*
1	HV bushing with metal parts & gaskets	1 no.
2	LV bushing with metal parts & gaskets	1 no.
3	WTI with alarm & trip contacts	1 no.
4	OTI with alarm & trip contacts	1 no.
5	Magnetic oil level gauge	1 no.
6	Diaphragm of explosion vent	1 no.
7	Buchholz relay	1 no.
8	Silica gel charge	Three charge
9	Floats with contacts for Buchholz relay	1 set
10	Set of gaskets	2 sets
11	Set of valves (1 no. of each size & Type)	1 set
12	Set of windings for one limb in a suitable oil container (container shall be completely filled with transformer oil)	1 no. of each rating & type of transformer.
13	Contact for tap changer	1 set
14	Pressure relief device for 4MVA transformer	1 no.
15	Hydraulic/screw Jacks	4 no.
16	Any other item considered essential by the bidder	

Note:

1) Wherever set is indicated above, it means the total parts/ accessories required to replace the particular item for one Transformer.

2) O & M spares shall be supplied along with transformers and packed separately with proper inscription.

ANNEXURE-II

TYPE TESTS FOR LT TRANSFORMERS

a) Tank Pressure test

b) Tank Vacuum test

c) Capacitance & tan delta of windings

d) Noise level

e) Measurement of harmonic current in no load current

f) PRD operation test

g) Short circuit test

h) Degree of protection (IP55) test on marshalling box.

i) Degree of protection (IP55) test on cable box.

j) Zero sequence impedance.

k) Temp rise test.

l) Dielectric type test (including chopped wave impulse test)

m) DGA test on oil before and after temperature test.

ANNEXURE III

TRANSFORMER LOSSES

1. In case a measured loss of transformer during testing exceeds the declared values, BHEL may accept the transformer with penalty. The rate of penalty shall be Rs. 1.95 lacs per kW or part thereof. The penalty shall be calculated for each transformer as given below:

   PENALTY = Penalty Rate x [measured No-Load losses - maximum No-Load losses) + (measured Load losses – maximum Load losses)]

ANNEXURE- IV

DOCUMENTS/ DRAWINGS DISTRIBUTION SCHEDULE

S. NO.	DESCRIPTION	No. hard prints/copies	No. of CD-ROMs	REMARKS
1	Master List of Drgs./ Docs.	3Copies		
2	Docs. /drgs. submission schedule for approval	3 Copies		
3	Approved Docs. /Drgs. submission schedule for distribution	4 Copies	2	
4	Docs. /drgs. for approval (First submission)	3 copies	2	
5	Drgs. / docs. for approval (Second & subsequent submission till approval)	3 copies	2	
6	Final approval drgs. / docs. for Distribution	4 Copies	2	
7	Operation & Maintenance manual for approval	3 Copies	2	
8	Approved Operation & Maintenance Manual for distribution	4 Copies	2	
9	Type Test Certificates/ Reports	4 Copies		

ANNEXURE-V

STANDARD QUALITY PLAN

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION TITLE			
	SHEET 1 OF 6		SYSTEM			ITEM :OIL FILLED TRANSFORMER			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	MATERIALS											
1.1	M.S. PLATES, MS ANGLES, CHANNELS	1.PHYSICAL PROPERTIES	MA	PHYSICAL TEST	SAMPLE	BHEL TECH. SPEC/DRG/DATA SHEETS RELEVANT IS SPEC	BHEL TECH. SPEC/DRG/DATA SHEETS RELEVANT IS SPEC	TEST CERT. INSP. REPORT	3/2	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	-DO-	3/2	-	2	
		3.SURFACE CONDITIONS	MA	VISUAL	100%	-DO-	-DO-	-DO-	3/2	-	2	
		4.MIL MARK	MA	VISUAL	100%	-DO-	-DO-	-DO-	3/2	-	2	
1.2	HARDWARE (HIGH TENSILE FASTENERS)	1.SURFACE CONDITION	MA	VISUAL	100%	-DO-	-DO-	TEST. CERT.	3	-	2	
		2.MARKING	CR	VISUAL	100%	-DO-	-DO-	-DO-	3	-	2	
1.3	CRGO SHEETS (STAMPINGS)	1.SURFACE COND.	MA	VISUAL	SAMPLE	-DO-	-DO-	-DO-	3/2	-	-	VARNISHING OF SHEETS IF REQUIRED TO BE PROVIDED AFTER ANNEALING
		2.THICKNESS	MA	MEASUREMENT	-DO-	-DO-	-DO-	-DO-	3/2	-	-	
		3.ACCEPTANCE TEST	MA	MECH. & ELECT.	SAMPLE	-DO-	-DO-	-DO-	3/2	-	2,1	
1.4	CONDUCTORS	1.SURFACE FINISH	MA	VISUAL	100%	FREE FROM SHARP EDGES, BURS SCRATCH & CUTS		INSP. REPORT	3/2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	MANUF'S STD	MANUF'S STD	-DO-	3/2	-	-	
		3.PHYSICAL PROPERTIES	MA	PHY. TEST	SAMPLE	RELEVANT STD	RELEVANT STD	-DO-	3/2	-	2	
		4.ELECT. PROPERTIES	CR	ELECT. TEST	-DO-	-DO-	-DO-	-DO-	3/2	-	2	
	BHEL		**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION : TITLE			
	SHEET 2 OF 6		SYSTEM			ITEM :OIL FILLED TRANSFORMER			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.5	INSULATING OIL	1.ELECT.PROPT (BDV, TAN-DELTA)	CR	ELECT.TEST	SAMPLE	RELEVANT IS SPEC.	RELEVANT IS SPEC.	INSP. REPORT	3/2	-	2,1	
1.6	INSULATION MATERIAL-PAPER, PRESS-BOARDS, MACANITE ETC.	1.ELECT.PROPT	CR	ELECT. TEST	-DO-	-DO-	-DO-	-DO-	3/2	-	2	
1.7	GASKETS	1.HARDNESS COMPATIBILITY WITH OIL AT HIGH TEMPERATURE	MA	MECH. TESTS	SAMPLE	MANUF.STD	MANUF.STD.	LAB REPORT	2	-	-	
1.8	TERMINAL BOX	1.SURFACE CONDITION	MA	VISUAL	100%	MANUF.STD	MANUF.STD.	-DO-	3,2	-	-	
		2.DIMENSION	MA	MEASUREMENT	SAMPLE	-DO-	-DO-	-DO-	3,2	-	-	
		3.IR-HV-IR	CR	ELECT	100%	-DO-	-DO-	-DO-	3/2	-	2	TERMINAL BLOCKS TO BE PROCURED FROM REPUTED
1.9	SUB-DELIVERY ITEMS SUCH AS CONNECTORS CONTACTORS, TERMINAL, BLOCKS, CABLES, SWITCHES INSTRUMENT , TRANSFORMER LUGS, GLANDS, VALVES RELAYS, BUSHINGS, DIAPHRAGMS, BREATHERS ETC.	1.ROUTINE TEST	MA	VISUAL & PHY	100%	BHEL DRG./ -DO-	BHEL DRG./ -DO-	TEST CERT.	2	-	-	SOURCE. ROUTINE TEST CERTIFICATE INSTRUMENT RELAYS BUSHINGS SHALL BE VERIFIED BY BHEL

	PARTICULARS	**BIDDER/VENDOR**	
BHEL	**NAME**		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION : TITLE			
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1	2	3	4	5	6	7	8	9	10			11
		2.OPERATION/ FUNCTIONAL TESTS	MA	ELECT. & FUNC. CHECK	100%	-DO-	-DO-	-DO-	2	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		4.SURFACE CONDITION	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
		5.RATING, MARKING	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
1.10	PAINT & VARNISH	SHELF LIFE	MA	VISUAL	100%	-DO-	-DO-	INSP. REPORT	2	-	-	
2.0	FABRICATION/PAINTING											
2.1	FABRICATED TANKS/ RADIATORS/ CONSERVATOR	1.DIMENSIONS	MA	MEASUREMENT	100%	----------APPROVED DRAWINGS---------		INSP. REPORT	3,2	-	-	
		2.WELD QUALITY	MA	VISUAL & PT HOLIGAN DETECTORS	100%	----------RELEVANT CODE----------		-DO-	3,2	-	-	
		3.VACUUM TIGHTNESS	CR	VAC. TEST	100%	BHEL TECH SPEC, CBIP STD	BHEL TECH SPEC, CBIP STD	-DO-	3,2	-	-	
		4.LEAK TIGHTNESS	CR	PRESSURE TEST	100%	-DO-	-DO-	-DO-	3,2	-	-	
			PARTICULARS		**BIDDER/VENDOR**							
	BHEL		**NAME**									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION : TITLE			
	SHEET 4 OF 6		SYSTEM			ITEM :OIL FILLED TRANSFORMER			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
2.2	SURFACE PREPARATION & PAINTING	1.SURFACE CONDITION	MA	VISUAL	100%	--FREE FROM GREECE, SCALE, RUST AND SHALL HAVE UNIFORM ROUGH SURFACE----------		INSP. REPORT	3,2	-	-	
		2.THICKNESS	MA	MEASUREMENT	SAMPLE	------BHEL SPEC/DATA SHEETS-------		-DO-	3,2	-	-	
		3.ADHESION	MA	ADHESION TEST	-DO-	-DO-	-DO-	-DO-	3,2	-	-	
3.0	IN PROCESS											
3.1	CORE ASSEMBLY	1.DIMENSION	MA	MEASUREMENT	100%	PLANT STD.	AS PER DRG.	QC RECORD	2	-	-	
		2.TORQUE TIGHTNESS	MA	-DO-	100%	-DO-	PLANT STD.		2	-	-	
		3.CORE INSULATION	MA	ELECT.	100%	-DO-	-DO-	-DO-	2	-	-	
		4.CORE LOSS	CR	ELEC. WITH DUMMY COIL	100%	RELEVANT STD	RELEVANT STD	-DO-	2	-	1	
3.2	COIL ASSEMBLY	1.DIMENSION	MA	MEASUREMENT	100%	PLANT STD	PLANT STD	-DO-	2	-	-	
		2.TURN OF TURN INSULT.	MA	-DO-	100%	-DO-	-DO-	-DO-	-	2	-	
		3.MEASUREMENT OF RESISTANCE	MA	ELECT.TEST	100%	-DO-	-DO-	-DO-	2	-	1	
			PARTICULARS		**BIDDER/VENDOR**							
	BHEL		**NAME**									
			SIGNATURE									
			DATE									BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION : TITLE			
	SHEET 5 OF 6		SYSTEM			ITEM :OIL FILLED TRANSFORMER			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.3	CORE-COILASSEMBLY (FINAL DRYING & OIL FILLING	1.PHY. CONDITION OF COILS	CR	VISUAL	100%	PLANT STD	PLANT STD	-DO-	2	-	1	
		2.DIMENSION	CR	MEASUREMENT	100%	APPD. DRG.	APPD. DRG.	-DO-	2	-	1	
		3.BRAZING CONNECTION TO TAPCHANGER	CR	VISUAL, MALLET MV DROP TEST	100%	PLANT STD	PLANT STD	-DO-	2	-	1	
		4.CLEARANCES	CR	MEASUREMENT	100%	APPD. DRG.	APPD. DRG.	-DO-	2	-	1	
		5.DRYNESS (TAN DELTA & I.R.	CR	ELECT. TEST	100%	BHEL SPEC/ PLANT STD APPD DATA SHEET	BHEL SPEC/ PLANT STD APPD DATA SHEET	-DO-	2	-	1	
		6.TURNS RATIO	CR	ELECT.TEST	100%	-DO-	-DO-	-DO-	2	-	1	
4.0	MARSHALLING KIOSK/BOX	1.DIMENSION	MA	MEASUREMENT	100%	MANUF. STD	MANUF. STD	INSP. REPORT	3,2	-	-	
		2.DEGREE OF PROTECTION	CR	TESTING	1/TYPE	MANUF'S DRG/DATA SHEET		-DO-	3,2	-	1	
		3.PROPER FITNESS & WIRING	MA	VISUAL	100%	BHEL/MANUF DRG	BHEL/MANUF DRG	-DO-	3,2	-	-	
5.0	OLTC/TAP SWITCH	1.SURFACE FINISH	MA	VISUAL	100%	BHEL SPEC. MANUF DRG.	BHEL SPEC. MANUF DRG.	-DO-	2	-	2	

	PARTICULARS	**BIDDER/VENDOR**	
BHEL	**NAME**		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-302-00-Q-001/01			SPECIFICATION : TITLE			
	SHEET 6 OF 6		SYSTEM CABLE			ITEM :OIL FILLED TRANSFORMER			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		2.ROUTINE TEST	CR	ELECT.	100%	-DO-	-DO-	TEST CERT	3,2	-	2,1	
		3.(FOR OLTC)	CR	ELECT.	SAMPLE	-DO-	-DO-					
6.0	FINAL ASSEMBLY	1.ROUTINE TEST	CR	ELECT	100%	AS PER BHEL SPEC. IS 2026 APPROVED DRG. DATA SHEET		TEST REPORT	2	1	-	
		2.TYPE TEST	CR	ELECT	1 FOR EACH TYPE	-DO-	-DO-	-DO-	2	1	-	
		3.LAYOUT AND ORIENTATION	MA	VISUAL	100%	-DO-	-DO-	INSP. REPORT	2	1	-	
		4.DIMENSION	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	2	1	-	
		5.GEN. APPEARANCE FINISH AND WORK MANSHIP	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	1	-	
		6.CORRECTNESS & COMPLETENESS OF ALL FITTINGS & ACCESSORIES	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	1	-	
		7.FUNCTION OF ACCESSORIES	CR	FUNCTIONAL CHECKS	100%	-DO-	-DO-	-DO-	2	1	-	
		8.PAINT SHADE THICKNESS & ADHESION	MA	VISUAL, MEAS	100%	-DO-	-DO-	-DO-	2	1	-	
7.0	PACKING	1.SOUNDINGS OF PACKINGS	MA	VISUAL	100%	BHEL SPEC	BHEL SPEC	-DO-	2	-	1	
		NOTE:										
		LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER (1) BHEL/BHEL's CUSTOMER: 2-VENDOR : 3 SUB VENDOR										

	PARTICULARS	**BIDDER/VENDOR**	
BHEL	**NAME**		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

ANNEXURE - VI

SPECIAL TOOLS AND TACKLES REQUIRED FOR INSTALLATION, COMMISSIONING AND MAINTENANCE OF EQUIPMENT

S.NO.	DESCRIPTION	QUANTITY

Note:

Bidder shall furnish the list of special tools & tackles and quantity along with the offer. Price shall be included in the total bid price.

ANNEXURE –VII

COMMISSIONING SPARES FOR EACH TRANSFORMER

S.NO.	DESCRIPTION	QUANTITY	REMARKS

Note:

Bidder shall furnish the list of commissioning spares and quantity for each type of transformer along with the offer. Price shall be included in the transformer price.

ANNEXURE - VIII
APPLICABLE STANDARDS & CODES FOR TRANSFORMERS

Specification for power transformers	IS: 2026 [ ]	IEC: 76 [ ]	BS: 171 [ ]
	IS:6600 [ ]	IEC:354 [ ]	IS: 11171 [ ]
Fittings & accessories for power transformer	IS: 3639 [ ]	IEC: [ ]	BS: [ ]
Specification for new insulation oil	IS: 335 [ ]	IEC: 296 [ ]	BS: 148 [ ]
Bushing for alternative voltage above 1000 volts	IS: 2099 [ ]	IEC: 137 [ ]	BS: 223 [ ]
Dimension for porcelain transformer bushings	IS: 3347 [ ]		
Current transformers	IS: 2705 [ ]	IEC: 185 [ ]	BS: 3938 [ ]
Gas operated relays	IS: 3637 [ ]		
Classification of insulating material for electrical machinery & apparatus in relation to their thermal stability in service	IS:1271 [ ]	IEC: 216 [ ]	
Classification of degrees of protection provided by enclosures of electrical equipment	IS: 12063 [ ]	IEC: 529 [ ]	IS: 13947 [ ]
Method of high voltage testing	IS: 2071 [ ]		IEC: 60 [ ]
Colours for ready mixed paints & enamels	IS: 5 [ ]		
Specifications for power & distribution transformers	CBIP Publication No275(1999 edition) [ ]		
Guide for loading of oil immersed transformers	IS: 6600 [ ]	IEC: 354 [ ]	BS: [ ]
Noise level	NEMA, STANDARD-TR1		

(DATA SHEET-A) for 33/0.433 kV

S. No.	Description	Unit	Particulars
1.0	Quantity	2	4000 kVA
2.0	Service (Unit/Station)		Unit/Station
3.0	Installation		Out Door
4.0	Type of insulating oil		Mineral
5.0	No. of phase	No(s)	03
6.0	Frequency	Hz	50
7.0	Type of cooling		ONAN
8.0	Rated output under site conditions	kVA	As indicated
9.0	Rated Voltage a) HV Winding b) LV Winding	 kV kV	 33.0 0.433
10.0	No Load transformation ratio		33/0.433
11.0	Vector group		Dyn11 Primary (HV) should be delta connected& secondary (LV) should be Star connected. The load consists of welding generators, welding Transformers, induction motors& lighting load.
12.0	Impedance voltage at rated current and frequency		Impedance voltage at rated current and frequency should be given along with the offer meeting the requirement of system fault level& voltage regulation.

13.0	Total range of tapping and tapping steps		Tappings of the OLTC should be suitable for +5% to -5% with 4 or 5 steps.
14.0	Type of tap changing equipment		OLTC
15.0	Temperature rise		
	a) Top oil by thermometer	deg. C	50 deg. C above ambient of 50 deg.C
	b) Winding by resistance	deg. C	55 deg. C above ambient of 50 deg.C
16.0	System Highest Voltage		
	a) HV Winding	kV	36
	b) LV Winding	V	433
17.0	Phase Connection		
	a) HV Winding		Delta
	b) LV Winding		Star
18.0	Insulation Levels		
18.1	One minute power frequency withstand voltage		
	a) HV Winding	kV	70
	b) LV Winding	kV	03
18.2	Impulse withstand voltage		
	a) HV Winding	kV	170
	b) LV Winding	kV	-
19.0	Terminal details		
	a) HV Line		Cable box(XLPE cables)
	b) HV Neutral		N.A.
	c) LV Line		Should be suitable for cable. Flange throat for TPN non-Segregated AI Busduct
	d) LV Neutral		One neutral as part of LV busduct throat and second neutral with copper earthing bar for system earthing brought near the base of the transformer.

20.0	System Fault Level		
	a) HV Winding	kA	40 kA RMS.
	b) LV Winding	kA	50 kA RMS
21.0	Method of System Earthing		
	a) HV System		Low resistance earthed to limit earth fault current to 300-1000A
	b) LV System		Solidly grounded
	c) Through fault withstand time	Sec.	2
22.0	Details of Cooling Equipment		Detachable tank mounted radiators
23.0	Provision/ accommodation of CTs		
	LV Neutral		CT are to be provided for protection. The details of current transformers for protection system to be given along with the offer.
24.0	Colour Shade:		
	a) Interior (For M. Box)		As required
	b) Exterior		As required
25.0	Space/ Layout Limitation if Any		
26.0	Cable details		
	a) HV side		
	i) Type		XLPE
	ii) Voltage Grade		33KV Unearthed
	iii) Conductor material & size		Details to be submitted along with the offer.
	iv) No. of cores & runs		Three core, one run
	b.)LV side(suitable provision is to be made for cable connection)		
	i.)Type		XLPE Cable
	ii.) Voltage Grade		1.1KV
	iii.) Conductor material and size		Details to be submitted alongwith the offer
	iv.) No. of cores and runs		Three and a half core, one run

27.0 Penalty for Losses

a) Rates for bid evaluation	N.A.
b) 'A' (for no load loss)	Losses not to exceed max. losses as per annex-III to sec-B of the specification
'B' (for load losses)	- Do-
c) Rates for penalty	
i) 'A' (for no load loss)	Rs. 1.95 lacs per kW
ii) 'B' (for load loss)	Rs. 1.95 Lacs per kW

DATA SHEET-B

(TO BE SUBMITTED ALONG WITH OFFER)

FOR 33kV/0.433V, 4000 KVA

S.No.	Description	Remarks
1	Rating	
2	No Load transformation ratio	
3	Maximum No- load losses at rated frequency and 100% rated voltage	
4	Maximum load losses at normal ratio, rated current and 75 deg. C	
5	Overall Dimensions	
6	Total weight	
7	Total oil Quantity	

SCHEDULE OF DEVIATIONS

Sl. No	Specification Clause Ref.	Technical Deviation	Reason for Deviation

We the undersigned hereby certify that the above mentioned are the only Technical deviations.

Particulars of bidder/Authorized representative:

NAME	Designation	Signature	Date	COMPANY SEAL

ANNEXURE – IX

QUALIFYING CONDITIONS

Only those vendors who have designed, manufactured, supplied and commissioned at least two number 4000 KVA, 33KV/0.433KV, 3-phase, Oil type Transformers (out door installation) with in last ten years should quote. The Transformers should be working satisfactorily for more than one year after commissioning. However, if such Transformer(s) have been supplied to BHEL, then the same should be presently working satisfactorily for more than six months after its commissioning and acceptance in BHEL. Following information should be submitted by the vendor about the companies where above Transformers have been supplied. This is required from all the vendors for qualification of their offer.

1. Name of the customer / company where the Transformer is installed.
2. Complete postal address of the customer.
3. Year of commissioning.
4. KVA Rating of the Transformer.
5. Name and designation of the contact person of the customer
6. Phone, FAX no. and email address of the contact person of the customer.
7. Performance certificate from the customers regarding satisfactory performance of Transformer supplied to them (Original Certificate or Through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required by vendor.