INSTITUTE FOR PLASMA RESEARCH

Technical Specifications
SECTION 'C'

Design/engineering, manufacture, inspection, testing at vendor's site, delivery, handling at site, erection, pre-commissioning and commissioning tests of resin cast dry type Cast Resin Transformer 2500kVA, 11kV/433V, 50 Hz with required spares and accessories.

I - PROJECT INFORMATION & AUXILIARY FACILITIES

1.	Purchaser	Institute for Plasma Research Village Bhat, Gandhinagar Dt. PIN-382 428 Gujarat, INDIA Phone: +91-79-23962000 Fax: +91-79-23969017 Web: www.ipr.res.in
2.	Site elevation (average)	55 meters above MSL
3.	Ambient temperature	Max. (annual): 47 °C Min. (annual): 4°C Average (annual): 35 °C
4.	Relative humidity	Max.: 90 % Min.: 17 %
5.	Rainfall	823 mm average (annual) June-August
6.	Wind data	Max. wind speed: 130 kmph Prevailing direction: SW to W Design wind pressure: 100 kgm^{-2}
7.	Seismic data	0.04 g as per IS:1893-1973
8.	Accessibility By road: By rail : By sea : By air :	Upto site (on Hansol-Gandhinagar H-way) Ahmedabad Rly. Stn. (12 km.) Bombay Harbor (525 km.) Ahmedabad Airport (6 km.)
9.	Auxiliary power supply (each of the voltages can be made available at one point of connection to the sources)	a) AC 415 ± 10 % V, 3 phase, 50 ± 5 % Hz, 4 wire system b) DC 220 ± 20 % V, 2 wire, floating c) DC 48 ± 20 % V, 2 wire, floating
10.	Expected completion period	Supply & commissioning within 6 months from date of placement of order

II - TECHNICAL PARTICULARS

SCOPE:

This specification covers the design/engineering, manufacture, inspection and testing at vendor's works and delivery, handling at site, erection, pre-commissioning and commissioning tests of one no. of resin cast dry type Cast Resin Transformer 2500 kVA, 11 kV/433V, 50 Hz with required spared and accessories, as per the technical specification.

The scope also includes the civil work for the transformers at site, details for the layout is available in the Annex A of this document.

CODES - STANDARDS:

a) The design, manufacture and performance of equipment shall comply with all currently applicable statutes, regulations and safety codes.
b) Except where modified by this specification, wherever applicable all material and equipment shall conform to the requirements of latest Indian Electricity Rule (IER) and below given standards including all amendments.

S.No.	Description	Standard
1.	Dry type transformer	IS 11171 and IS 2026
2.	Current transformer (PS class)	IS 2705
3.	Degrees of Ingress Protection for control gear	IS 12063
4.	Bushing for Alternating voltage above 1000 V	IS 2099
5.	Thermal Evaluation and Classification of Electrical Insulation	IS 1271
6.	Fittings and Accessories	IS 3639
7.	Measurement of transformer and reactor sound levels	IEC 60076-10 or NEMA TR - 1

GENERAL CONSTRUCTIONAL FEATURES:

The dry type cast resin transformers shall be AN (Air Natural) cooled and shall be provided for indoor applications.

The mechanical and electrical design of the transformers shall be based on the following conditions and requirements:

a) The design shall be based on site and service conditions as specified.

b) The maximum permissible temperature rise of the transformer windings is to be selected by the transformer manufacturer in accordance with the thermal classes of the insulation as specified in Data Sheet.

c) The transformers shall be capable of operating continuously at full load at any tap position within their temperature rise limit.

d) The transformers shall be capable of withstanding external short circuits for at least 2 second.

e) Neutral points shall be brought out and grounded.

f) Noise level shall be limited to 68 dB as per NEMA standard TR1.

g) Doors shall be suitable to be opened from outside.

h) There should be minimum three hinges per door from top to bottom.

i) All the materials used shall be of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions without distortion or deterioration or the setting-up of undue stresses in any part and also without affecting the strength and suitability of the various parts for the work which they have to perform.

j) Similar parts, particularly removable ones, shall be interchangeable.

k) Nuts, Bolts and pins used inside the transformer and tap changer shall be provided with lock washers or lock nuts.

l) Labels shall be provided for all identifiable accessories like relays, valves, CT, thermometer pockets, switches etc.

m) All internal connections and fastenings shall be capable of operating under overloads and over excitations allowed as per specified standards, without injury.

n) The transformers must be of suitable size so as to be installed in a room of dimensions 6 m x 6 m x 4 m. Care shall be taken to provide appropriate clearances on all sides as per the latest standards and practices.

ELECTRICAL AND PERFORMANCE REQUIREMENTS:

a) The transformer shall operate without injurious heating at the rated kVA at any voltage within ± 10% of the rated voltage of that particular tap. The frequency variation is within ± 5 %.

b) The transformer shall be capable of overloading as per IS. The mechanical structure and clamping should be designed for the overload duty also, and detailed analysis to prove that the transformer design meets the requirement shall be submitted before manufacture of the transformers. The manufacturer should guarantee that no deterioration to insulation system or life results on account of such an overloading pattern.

c) The neutral terminal of windings with star connection shall be designed for the highest over-current that can flow through this winding.

d) The bidder shall ensure that the design and manufacturing of the transformer shall be such as to reduce noise and vibration level. The sound level of the transformer with its enclosure in position shall not exceed 66 dBA measure in accordance with NEMA TR-1 or IEC 60076-10 standard.

e) The apparent charge limit shall be 10 pc during partial discharge test as per IS 11171.

f) The transformer HV winding shall be suitable for vacuum circuit breakers switching.

g) All other performance requirement as per the relevant standards and codes shall be met with condition specified above.

h) The transformer shall be designed to be suitable for parallel operation.

CORE:

a) Transformer design shall be core type. The core shall be constructed from high grade cold rolled non ageing grain oriented (CRGO) silicon steel laminations. The core shall be painted and insulated with suitable resin to protect it against corrosion. The lamination shall be free from burrs and sharp projections.

b) The yoke laminations shall be interleaved and carefully assembled to avoid air-gaps in the magnetic circuit. The core shall be earthed as per the relevant standards.

c) The insulation structure in between core to bolts and core to clamp plates shall withstand a minimum voltage of 2500 V, for one minute.

d) All steel sections used for supporting the core shall be free from burrs.

e) The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure.

f) The finally assembled core with all the clamping structures should be free from deformation and shall not vibrate during operation.

g) The core clamping structure shall be designed to minimize eddy current losses and bolts passing through core laminations shall not be used for any purpose. Epoxy coated fibre-glass tapes shall be used for clamping core laminations.

INTERNAL EARTHING:

a) Internal earthling of all metal parts of transformer with the exception of the individual core laminations, core bolts associated individual clamping plates shall be earthed.

b) Flexible earthling braid shall be provided between all metal parts, joined with gaskets.

c) 2 Nos. separate Earthing pad/terminal shall be provided on the cable box for armour earthing from inside and other Earthing grid connection from outside.

d) Earthing strip from Earthing Bushing up to earthing terminal shall be provided.

e) Doors shall be earthed by suitable PVC insulated multi-stranded copper wire of suitable size

WINDINGS:

a) Copper conductor to be used for LV and HV windings. The conductors shall be transposed at sufficient intervals in order to minimize eddy current losses and equalize the distribution of currents and temperature along the windings. LV winding can be made of Foil winding also allowed.

b) The windings shall be provided with Class-F epoxy resin cast insulation. The insulation shall have high tensile and dielectric strength. Enough measures shall be taken during casting to avoid the void formation, cracking and crazing etc. of the cast coils.

c) Both HV and LV windings of each phase shall be separately cast on rigid tubular coil co-axially arranged under vacuum in to molds. The epoxy resin insulation system shall be fiber glass strengthened. LV winding should be prepeg insulation materials and should be cured under require temperature.

d) The resin used for winding insulation shall be non-hygroscopic to prevent the penetration of moisture into windings. It should be possible to energize the transformer without pre-drying even after a long period of service interruption. The resin used shall be non-inflammable, self-extinguishing, void free and suitable for tropical climate with 100% relative humidity. In the case of windings provided with taps, the inter-turn insulation of tapped windings shall be reinforced to obtain uniform stress distribution. No filler materials are allowed to use in Resin Mixture.

e) The transformer shall be able to withstand short circuits as well as switching and lightning/atmospheric impulse voltages as specified in the IS 11171 standard. The leads and connections shall be mechanically strong and adequately brazed to withstand short circuit forces and transportation shocks.

CORE AND COIL ASSEMBLY:

The cast coils are inserted on to the core limbs. The resin cast spacer blocks, end blocks and separators shall be used as required. The coils should be placed on the anti- vibration insulation materials.

TAPPING:

Off circuit tap changing link shall be provided with total tapping range of +10% to -10% in steps of 2.5%. The tapings shall be on high voltage side. The transformer shall be capable of delivering its rated output at any tap position without damage.

TERMINAL BOX ARRANGEMENT:

a) The HV side termination facility of the transformers shall be designed for connecting 11 kV XLPE insulated armoured cable terminated in crimping type lugs and heat shrinkable sleeves or pre-molded cast resin push on type terminations. Suitable undrilled gland plate shall be provided for terminating HV cables. HV terminals shall be extended up to the cable terminals and the bus bars shall be located at a convenient height. The cable entry shall be from the bottom. Preferably the bus-bars shall be supported by the supporting insulators from the top fram of the enclosure. The winding delta formation on HV side shall he in supplier's scope.

b) The LV side terminals and the LV termination box of transformers shall be suitable for cable connection of approx. 3 runs of 1000 sqmm, single core per phase and 2 runs for neutral (Total cables are 11 runs of 1000 sqmm, single core) . The earthing stud shall be provided on LV termination box for clamping earthing conductor. The winding star formation on LV side shall be in supplier's scope.

c) The LV neutral terminal of the star connected winding shall be brought out at two separate insulated terminals. One neutral terminal shall be provided by side of the phase terminals for connecting neutral to neutral bus-bar in the LV termination box. Second neutral terminal shall be provided to facilitate the earth conductor down to the ground level. The terminal shall be suitable for connecting two numbers of earth conductors (75mm x 10mm GI) for neutral earth connection with two separate earthing pads.

SUPPORT INSULATORS:

a) Support insulators shall be designed and tested to comply with the applicable standards.

b) HV terminals rated for minimum current 400 A shall have non-ferrous and non-magnetic flanges and hardware.

c) Air clearance and creepage distances shall be maintained as per the relevant standard.

d) Preferably the material for support insulators shall be Porcelain or epoxy resin cast.

CURRENT TRANSFORMER (CT):

a) The REF (Restricted Earth Fault) CT shall be epoxy resin casted under vacuum and having ratio of 3200/1A, class PS, 10 VA. The CT shall have minimum V_{knee} 400V, maximum 30 mA I_{mag} at $V_{knee}/2$ and R_{ct} less than 7 Ohm. This CT shall be provided in the common portion of the LV neutral (Before branching to LV neutral to earth connection). Class of insulation system of the CT shall be class F.

b) CT secondary leads shall be brought to the marshalling box.

c) CT details shall be indicated on name plate of the transformer.

TEMPERATURE SENSOR AND WINDING TEMPERATURE INDICATORS (WTI):

a) Temperature sensors: Two (2) numbers, reputed make simplex type (Platinum) PT 100 shall be provided in each phase at suitable place for measuring hot spot temperature.

b) A multi-channel digital winding temperature indicator shall be provided to display the temperature of the windings.

c) The indicating instrument shall be provided with four adjustable electrically independent ungrounded contacts brought out to separate terminals for winding temperature alarm and trip. One indicating instrument shall be provided for each phase. Contacts shall be suitable for 220V DC rated minimum 0.5A. Instrument shall be suitable for 220V D.C auxiliary power supply if required.

MARSHALLING BOX:

a) The weather proof marshalling box shall be mounted on the transformer housing. All doors, covers and plates shall be provided with neoprene gaskets. Bottom of the marshalling box shall be at least 600 mm above floor level and provided with removable bolted and undrilled gland plate etc. The required number of knock-out punches shall be provided for outgoing control cables.

b) All contacts for alarm, trip and indication circuits shall be electrically potential free, wired for auxiliary supply as specified and brought out to separate terminals at terminal blocks in the marshalling box. If required, separate MCBs shall be provided for protection isolation and distribution of AC and DC control supplies in the marshalling box. Wiring shall be with PTFE insulating (Insulation for wire & cable shall be in consistence with the ambient temperature in the housing). The wiring conductor shall be stranded copper and of sizes not less than 4 sq. mm for CT circuit and 2.5 sq. mm for other control circuits. CT terminals shall be provided with standard shorting facility. The wires shall be drawn through neatly clamped conduits. Engraved identification ferrules, marked as per the approved wiring diagrams shall be provided on each wire. Ferrules shall be of yellow colour with black lettering. Preferable the terminals shall be stud type and provided with crimping type cable sockets.

ENCLOSURE FOR TRANSFORMER:

a) The core and coil assembly shall have CRCA sheet steel MS enclosure. The purpose of having the enclosure is to provide safety from live parts, protect and make the equipment suitable for outdoor conditions, prevent ingress of foreign matters, vermin and rodents etc. the minimum number of louvers shall be provided on the sides of enclosure and the louvers should be covered with SS or galvanized sheet fine (openings not more than 2.5mm) mesh. The enclosure should have structural steel framework with lockable hinged door on HV and LV termination sides of the transformer. The gasketted doors shall facilitate the inspection of the transformer.

b) The enclosure frame shall be fabricated using suitable CRCA pressed and shaped sheet steel of thickness not less than 2.0 mm.

c) All panel edges and door edges shall be reinforced against distortion/deformation by rolling, bending and addition of welded reinforcement members.

d) The complete structure shall be rigid, self-supporting and shall be suitable for connecting ventilation hood on the top. To remove heat from the transformer, its metallic enclosure shall have sufficient heat dissipation capability in outdoor conditions, throughout the year without any additional cooling arrangement. GI or SS wire mesh shall be provided in the gap in between enclosure and ventilation hood

to prevent entry of birds etc. Powder/enamel paint coated 3mm thick perforated MS mesh shall be provided for enclosing the bottom side.

e) The enclosure shall not have degree of ingress protection less than IP 23.

f) Door switch with 2 NO + 2 NC auxiliary contacts of required rating shall be provided. It will be used for providing interlock in the HV breaker circuit.

g) Painting: After thorough metal treatment enclosure surface shall be given two coats of enamel/powder paint. Double coat of corrosion resistant primer shall be applied before painting. The inside of the enclosure shall have semi-glossy paint finish. All metal parts not accessible for painting shall be made of corrosion resistant material. All paints shall be carefully selected to withstand heat and tropical weather conditions. The color of painting shall be Light Grey Shade 633 of IS-5.

FITTINGS AND ACCESSORIES:

Following fittings and accessories shall be provided:

a) HV/LV terminals suitable for the purchaser's external conductors.
b) Rating, terminal marking and danger plates.
c) Three earth terminals per transformer, each suitable for earth conductor's of size 2 nos. 75 x 10 mm GI strip for earthing of the body of the transformers and its enclosure.
d) Lifting lugs for
   - Complete transformer (with enclosure)
   - Core-coil assembly
e) The under base shall be provided with channels etc.
f) Four bi-directional rollers in base frame for movement of complete transformer assembly. The stopper arrangement to lock the transformer in the required position shall also be provided.
g) Enclosure with provision for dismantling.
h) Marshalling box
i) Neutral earth terminal with lugs.
j) Six number PT 100 RTDs with WTI display
k) Off circuit tap links.

III - TESTING/INSPECTION

Purchaser and their authorized representatives will carry out stage-wise inspection. Bidder shall submit detailed QAP for approval after the placement of order. Following routine tests are included in the scope.

1.Routine Tests:

a) Measurement of voltage ratio at all tap positions
b) Check of vector group by voltmeter method
c) Measurement of winding resistance at all tap positions
d) Measurement of impedance voltage (principal tap), short circuit impedance and load loss at rated current.
e) Measurement of no-load losses current.
f) Measurement of load losses at principal tap and maximum current tap as specified in the IEC standards
g) Measurement of insulation resistance at 2500 V, DC
h) Induced over voltage withstand test with measurement of partial discharges
i) Separate source AC voltage withstand test
j) Applied over-voltage test at 2000 V AC, 60 sec. on wiring and supervisory.
k) Magnetic Balance Test.
l) Measurement of capacitance & Tan Delta for HV & LV bushings.
m) Polarity test

All routine test as per standard IS-11171 shall be conducted, on completed transformer assembly. The acceptable values shall be in accordance with the relevant standard.

2.Type Tests

The test reports for the type tests as per IS 11171 shall be submitted along with the offer. The transformers should have been type tested for the 11 kV class, 2.5 MVA within last 5 years. Such tests should have been carried out as per IS 11171, at IEC/CPRI/ERDA/NABL/Govt. approved labs only.

3.Tolerances:

Allowable tolerance for other parameters except losses shall be as per the IS 2026 Part-I. In respect of total losses maximum +10% shall only be permissible. The losses in the guaranteed Technical particulars (GTP) submitted by the supplier shall be the reference for percentage loss and bid evaluation.

IV- DOCUMENTATION

The bidder shall submit the documents at different stages as given below.

1. With Bid (Technical/Part-1)

a) Detailed catalogue/datasheet and literature indicating technical specifications.
b) The Type test reports as per IS 11171 for cast resin dry type transformer minimum 25000kVA rating.
c) Duly Filled GTP as per the format given in this specification

2. After placement of purchase Order:

The following documents shall be submitted for IPR approval within 3 weeks of placement of order, before taking up fabrication.

a) Exhaustive Quality Assurance Plan (QAP) of the manufacturer
b) Detailed transformer drawings along with LV and HV termination box dimensions.
c) Earth terminals, marshalling panel details and bill of material etc.
d) Graph of core loss in watt/kg versus flux density (wb/sq.m) for the transformer core material.

3. On Completion:

Five (5) sets of final approved drawings shall be submitted along with the delivery of the transformer.

a) Drawings for bushings, marshalling box, cable terminating boxes, bus duct terminations, foundation arrangement shall also be included.
b) Operation/Instruction manuals for the transformers and various accessories (valves, OTI, WTI, relays, etc.), GA Drawings, drawings of accessories and circuit diagram shall be supplied by BIDDER before the completion of supply.
c) Reproducible for all drawings shall be supplied.

V- DELIVERY PERIOD:

After order placement, a detailed activity bar chart shall be submitted by bidder for manufacturing, testing at works, transportation and delivery at IPR.
As mentioned above, QAP, Drawings etc. shall be submitted to IPR for approval within 3 week of receipt of Purchase Order. Fabrication/manufacturing shall be started only after final approval of the submitted documents by IPR.
Expected supply of the transformer shall be 3 months from the date of approval of drawings.
Installation and Commissioning shall be completed within 2 months from the date of site clearance from IPR.

VI - GUARANTEE PERIOD:

The Transformers shall be guaranteed for a period of 2 (Two) years from the date of acceptance at IPR.

V - Technical Specifications for Transformers

Technical Particulars		
1	Application	For distribution to Assorted loads
2	Quantity	1
3	No. of windings	Two winding
4	Rating (continuous)	2500 kVA
5	Frequency	50 Hz +/- 3%
6	No. of Phases	3 (three)
7	Rated Voltage (i) HV (ii) LV	 11000 V with +/- 10 % tolerances 433 Volts
8	Winding connections (i) HV (ii) LV	 Delta Star
9	Vector Group	Dyn11
10	Direction of Power Flow	HV to LV
11	Primary Connection	Delta
12	Secondary Connection	Yn11 (Star)
13	Service	Indoor
14	Other service conditions	As per IS 11171/2026
15	Class of insutaltion	minimum class - F
16	Allowable Max. temp. rise of windings	90 ^{o}C
17	Tapping	+10% to - 10% in step of 2.5%
18	%Impedance voltage at principal tap	6.25%
19	Type of cooling	AN
20	Terminal arrangement (i) HV (ii) LV	 HV Termination will be cable box LV Termination will be cable box.
21	Sound level in transformer	66 dBA (measured as per standards IEC 60076-10 or NEMA TR-1

Technical Particulars		
22	System voltage (i) HV side (a) Nominal system voltage (b) Highest system voltage (ii) LV side (a) Nominal system voltage (b) Highest system voltage	 11kV 12kV 433V 500V
23	System earthing	Solidly grounded
24	System fault level	25 kA for 1s at 11 kV
25	Insulation withstand voltages a) Impulse b) Power frequency HV c) Power frequency LV	 75 KV (peak) 28KV(rms) 3 KV (rms)
26	Tappings a) Tapping on winding b) Tap changer type c) Tapping range d) Tapping Step	 HV Off-circuit - 10 % to + 10 % 2.5% each
27	Short time rating:	as per IS
28	Clearances	Various electrical clearances like phase to earth and phase to phase clearances on the transformer, inside cable terminating boxes, disconnecting chambers, etc. shall be in accordance with applicable standards and Indian Electricity Rules.

REFERENCE STANDARDS

S. No.	Description	Standard No.
1	Dry Type Transformer	IS: 11171
2	Power transformers	IS: 2026
3	Fittings and accessories	IS: 3639
4	Climate proofing	IS: 3202
5	Loading of Dry type transformers	IEC 60076-12
6	12 kV Bushings	IS: 2099, IEC: 137
7	Electrical insulation classified by thermal stability	IS: 1271
8	LV Bushings	IS: 7421
9	Dimensions of porcelain transformer bushings	IS: 3347

PREFERRED MAKE OF COMPONENTS

S. No.	Description	Make
1.	Winding temperature indicator (WTI)	Accurate Controls / Perfect Controls / Precimeasure
2.	Current transformers	Prayog / Pragati
3.	12 kV & 500 V bushings	BHEL / WS Ins. / Modern Ins. / Jayshree Ins.

VI - UNLOADING, ERECTION AND COMMISSIONING

SCOPE:

a) The scope includes the erection and commissioning of the distribution transformers at IPR, Gandhinagar site.
b) Minor Civil works (if any) for the transformers are in the scope of the bidder.

The bidder is fully responsible for the timely Unloading of the transformer and accessories at proper locations at the site, verification of equipment for damages and short supplies, taking corrective measures for all damages and short supplies. IPR will not bear any expenses for the delay in unloading the Transformer.

c) Erection of transformers and its accessories. Wiring of instruments up to marshaling panel.
d) Grounding of neutral, tank, Bus duct, etc. including supply of all hardware and connectors.
e) Meggering of transformer for HV-LV, HV-E & LV-E.
f) Tap changer operation.
g) Checking of all the protection systems.
h) Carrying out all the pre-commissioning and commissioning tests on transformer.
i) Transformer load test with customer loads (if made available on commissioning date).

STATUTORY APPROVAL:

IPR will provide the required statutory approval from the CEA.

TOOLS AND COMMISSIONING SPARES:

All the erections tools and commissioning spares are to be provided by BIDDER. These includes crane of suitable capacity, trailer, megger (5 kV) and any other instruments or tools required during the erection and commissioning.

List of Spares

Sr. No.	Description	Quantity
1	Winding temperature indicator (WTI)	1 No.
3	LV insulators	1 set
4	HV insulators	1 set
5	Rating, terminal and danger plates	1 set
6	Earthing terminal with lugs	1 No.
7	Complete set of gaskets	1 set
8	REF CT	1 No.
9	Support insulators	1 set

COMMENCEMENT OF WORK:

Erection and commissioning work of the transformer shall be started after site clearance is given by the IPR Engineer-in-charge.

ACCEPTANCE TESTS:

During commissioning BIDDER has to perform all the required tests mentioned below. After all the required tests are performed the transformer is to be switched ON on no-load. BIDDER has to observe the transformer for two days after loading by the customers load. The site load test is also under BIDDER's scope.

Site Tests:

Following tests should be carried out at site:

1. Insulation resistance measurement.
2. Measurement of winding resistance.
3. Checking vector group, polarity, ratio and phase relationship.
4. Magnetic balance test.
5. Checks on off-circuit tap changer.

ANNEX-1
GUARANTEED TECHNICAL SPECIFICATION SHEET

The bidder shall submit the filled GTP along with the technical bid

Sr. No.	Description	Detail/parameter
1	Name of manufacturer	
2	Model & Type	
3	Service (Indoor/Outdoor)	
4	Rating KVA	
5	Cooling	
6	Standard followed	
7	Rated no load voltage	
	a) HV	
	b) LV	
8	Frequency	
9	Rated current	
	a) HV	
	b) LV	
10	Number of phases	
11	Vector Group reference	
12	Terminal arrangement,HV/LV	
13	Taps on HV winding	
	a) Off ckt	
	b) Tapping range	
	c) No. of steps	
14	Performance	
	a) No load loss,Kw	
	b) Load loss,Kw	
	c) Impedance,% MIN	
15	% Efficiency at 75degC/Unity P.F.	
	a) At 100% load	
16	% Efficiency at 75degC/0.8 P.F.	
	a) At 100% load	
17	% Regulation at full load	
	a) Unity P.F.	
	b) At 0.8 P.F.	
18	Short Circuit Withstand Capacity	
19	Approximate L*B*H,mm	
20	Approximate weights, kg	
	a) Total weight,kg	
	b) Core Coil weight, Kg	
21	Enclosure protection class	
22	Insulation class	
23	Insulation Level kVp/kV rms	
	HV	
	LV	
24	Transformer acoustic level (measured as per standards IEC 60076-10 or NEMA TR-1)	

Sr. No.	Description	Detail/parameter
25	Guarantee period (Two years)	
26	Accessories	