

BSES							
a	Spec	cifica	tion fo	or single	e pha	se	
	16	6/25/5	50kVA,	6.35/.2	40kV		
	oil	fillec	CSP	transfo	rmer		
	Sp	ecificat	ion no – G	N101-01-S	P-08-03		
Prepared by: Checked by : Approved by:					Rev	Date	
Name	Sign	Name	Sign	Name	Sign		
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1 <u>SCOPE</u>

- 1.1 This specification covers design, engineering, manufacture, assembly, testing at manufacture's works, packing, transportation and delivery to site, supervision of erection, testing at site & commissioning and submission of complete documentation of CSP transformers to be used in HVDS system.
- 1.2 The transformer shall be complete with all components and accessories, which are necessary or usual for their efficient performance and trouble free operation under the various operating and atmospheric conditions specified in annexure I, data sheet.
- 1.3 Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.

2 <u>CODES AND STANDARDS</u>

- 2.1 All equipment and material shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards, IEC standard and CBIP manuals enlisted in the Appendix-A, except where modified and / or supplemented by this specification.
- 2.2 Equipment and material confirming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted by the vendor with the offer
- 2.3 The electrical installation shall meet the requirement of Indian Electricity Rules as amended upto date; relevant IS code of practice and Indian electricity act. In addition other rules & regulations applicable to the work shall be followed. In case of any discrepancy the most stringent & restrictive one shall be binding.
- 2.4 The equipment offered shall in general comply with the latest issues including amendments of the standards enlisted in the Appendix-A but not restricted to it.
- 2.5 Vendor shall possess valid BIS Certification.

3 <u>DESIGN</u>

The design and workmanship shall be in accordance with the best engineering



practices to ensure satisfactory performance throughout the service life. The features and construction details of each transformer shall be in accordance with the requirements stated herein under.

3.1 APPLICATION

The transformers are intended to be used for High Voltage Distribution System for making available single phase supply to the consumers at voltage level as indicated in Annexure-I.

3.2 RATINGS

The rating of the transformer shall be as indicated in Annexure-I.

3.3 NORMAL SITE CONDITIONS

The distribution transformers to be supplied against this Specification shall be suitable for satisfactory continuous operation under the conditions as per Annexure-I data sheet of client requirement.

3.4 TRANSFORMER TANK

The transformer shall be sealed tank construction with bolted cover which seals the interior of the tank from atmosphere .The transformer tank should be round and made of good quality sheet steel of adequate thickness suitably stiffed to provide sturdy and robust construction to withstand extreme pressure conditions. The tank should be capable of withstanding pressure and vacuum as per values specified in IS: 1180 (Part - I) .The tank cover shall have plasticized surface at the top to guard against birdage faults. Alternatively, suitable insulating shrouds shall be provided on the bushing terminals. The transformer shall have a self pressure venting system. Steel surface of the tank shall be prepared by sand blast or chemical cleaning including phosphating as per IS: 3618. The space on the top of oil shall be filled with dry air or nitrogen .The nitrogen plus oil volume inside the tank shall be such that even under extreme operating conditions, the pressure generated inside the tank does not exceed 0.4 Kg/cm2 positive or negative. Heat resistance paint (Hot oil proof) shall be provided inside the tank. On external surface one coat of Thermo setting powder paint or two coats of zinc chromate followed by two coats of synthetic enamel paint of shade conforming to No.631 of IS:-5 shall be provided. The overall thickness of the paint shall be minimum 150micron.

3.5 BUSHING

All bushings shall be porcelain clad, and shall be sealed to prevent ingress of moisture and to facilitate removal. The HV bushings shall be fitted with molded heat



shrinkage insulating covers / shrouds suitable for Aerial Bunched Conductor to provide protection of the bushing palm.

The bushing stems/terminals for both HV bushing shall be made of suitable copper alloy. The bushing palm is suitable for termination of 1CX 150 sqmm Aerial bunched cable, with bolted type clamping arrangement both in horizontal and vertical directions. In case of copper/copper alloy stems, suitable bimetallic clamps with bolted type arrangement described above shall be used.

3.4 FITTINGS

- Two earthing terminals with the earthing symbol
- Rating & terminal marking plates
- Lifting lugs for complete transformers as well as for core & winding
- Bird guard.
- Pressure relief valve.
- Non return valve.
- Terminal connector.
- HV side neutral earthing strip.
- LV earthing arrangement.
- Additional fittings for CSP type of distribution transformers, if any.

The fittings and accessories listed are indicative only and any other fittings and accessories which are generally required for satisfactory operation of the transformer are to be provided without any extra cost

3.7 CORE AND WINDINGS

Transformer core shall have doubly wound, oil immersed, naturally cooled ONAN type construction. The core shall be constructed from high grade cold rolled, non-ageing, grain oriented silicone sheet steel and shall be properly annealed to relieve stresses. The core shall be 0.23mm thick. The no load current shall be 2% and 4% of RFLC at 100% and 112.5% respectively. ^{R1}

The HV and LV windings for these transformers shall be wound using high conductivity Copper of electrolytic grade.

DPC insulation shall be used for HV and LV winding wires and electrical grade plain insulation Kraft paper for interleaving, no material, which can be affected by the action of oil under the operating conditions of the transformers, shall be used in the transformers or leads of the bushings.

The type of winding provided for HV side shall be preferably disc type or spiral winding. The type of winding for LV side shall be preferably cylindrical, layer

The core and coil assembly shall be securely held in position to avoid any Page 5 of 31



movement under short-circuit conditions. All turns of windings shall be adequately supported to prevent movement, in cases where turns are spaced out, a suitable inter-turn packing shall be provided. The insulation between core & bolts and core & clamps shall be suitable for withstanding 2000 Volts minimum, for one minute.

3.8 WINDING CONNECTIONS

Both ends of the primary winding shall be brought out through an appropriate HV bushings, one end of HV winding shall be externally earthed. The secondary winding shall be connected to two LV bushing; all bushings shall conform to IS: 3347 and 2099. The bushings shall not have arcing horns.

3.9 TAPS

No taps are to be provided on these transformers.

3.10 MOUNTING ARRANGEMENT

The transformers are to be mounted on single pole MS – I channel or tubular pole or PCC pole, the transformer therefore shall be provided with suitable and robust mounting arrangement. The mounting arrangement drawing shall be furnished for approval.

3.11 RATING AND TERMINAL MARKING PLATE

The transformer shall be provided with non-detachable rating marking plate / Diagram plate(s) of non corroding, weather proof material, fitted in a visible position and showing the complete information as given in IS : 1180 (Part -I) – 2014 Rating plate shall also include Transformer Actual %Z, No-Load Loss & Full-Load Loss at 75°C and total losses(No load losses+load losses at 75°C) at 50 % of rated load and at 100 % of rated load along with details like PO No, date, name of the Owner, as the case may be. The name plate marking shall be done with fluorescent colour.

Serial No. of the transformer shall be written with fluorescent paint on the body of each transformer so that the same can be read from the ground.

3.12 LIMITS OF TEMPERATURE RISE

The temperature rise shall not exceed the limits of 40° C (measured by resistance) for transformer windings and 35° C (measured by thermometer) in top oil over an ambient temperature of 50° C, when tested in accordance with IS: 2026.



3.13 PROTECTION

3.13.1 HV Protection

The HV protection shall be provided by an internally mounted HV fuse in series with the primary winding for CSP type transformer and externally mounted HV fuse link inside the bushing for conventional type transformer. The option of using 11 KV fuse tube (preferably made of fiber glass), connected externally between the terminals of the lightning arrestor and the HV bushing can also be explored and quoted for CSP type. The arrangement shall be such that the fuse tube remains in position when the fuse element inside the fuse tube blows off. Make of fuse shall be ERMCO,USA^{R1}

3.13.2 LT Protection^{R1}

The CSP type transformer shall be fitted with a trip-free LT Molded Case Circuit Breaker of suitable capacity provided after LT bushing in the LT box. The LT box shall be provided as an integral part of the transformer designed for outdoor duty with minimum IP-55 protection.LT bushing shall be inside the distribution box and a facility for sufficient outgoing feeders through cable glands shall be provided. The LT MCCB shall be selected such that it provides protection to transformer from over-loads and short-circuits on the secondary side.

The LT box shall be equipped with LED to indicate tripping of LT MCCB. On resetting of LTCB the LED shall be automatically switched off

The breaker shall be coordinated thermally with the transformer rating to follow closely the variation of winding temperature due to fluctuating loads and ambient temperature.

The rated short circuit breaking capacity of the circuit breaker shall not be less than 35 kA(Isc=Icu=35kA). The circuit breakers shall be tested in accordance with IS: 13947 (Part - 2) but at a power factor of 0.4 (lagging) or less.

The circuit breaker shall be capable of being operated from the ground level by means of an operating rod. For this purpose a suitable hook shall be provided on the transformer tank in a suitable position for easy and safe operation of the circuit breaker from the ground level. The design of the operating mechanism of the circuit breaker shall be such that it shall have only two positions i.e. 'ON' and 'OFF', it shall not require resetting before being switched to 'ON' position.

Make of MCCB shall be ABB/SCHNEIDER/L&T Low Voltage Circuit Breaker Characteristics:



Item	Description	Requiremen	t		
1.	Utilization Category	A			
2.	Interrupting medium	Air			
3.	Design	Molded case			
4.	Type of operation	Independent	manual clo	sing	
5.	Suitability for isolation	Not suitable f	or isolation	<u> </u>	
6.	Provision for maintenance	Maintainable			
7.	Method of installation – fixed	For 16 kVA Transformer	For 25 kVA Transfor mer	For 50 KVA Transforme r ^{R2}	
8.	Number of poles	2		-	
9.	Rated uninterrupted current (enclosed)	80 A	140 A	250A	
10.	Voltage rating	240/415			
11.	Rated insulation voltage	2kV			
12.	Rated impulse withstand voltage	8kV			
13	Ultimate Breaking Capacity Icu	35 KA min.			
14.	Service Breaking capacity Ics	35 KA min.			
15.	Rated frequency	50Hz			
16.	Rated duty	Uninterrupted	l duty		
17.	Trip current characteristics:				
	Normal current setting	66 A	108 A	208	
	Trip time at rated uninterrupted current	>2.5 hrs			
	Trip time at 2.5 Setting times normal current	< 1 minute			
	Trip time at 6 times normal current setting	< 5 secs.			
	Trip time at 12times normal current setting	40 millisec.			

3.13.3 Coordination

Coordination of 11 KV fuse with LT Circuit Breaker is the most important feature of the CSP transformer and shall be properly tested and proved. The supplier shall furnish the time – current curves. The characteristics of LT MCCB and 11 KV fuse



for various current multiples shall be drawn on the same sheet to indicate coordination between the LT CB and the HT fuse.

- The LT MCCB shall operate with time delay for over load above rated capacity of transformer unit.
- The HT fuse shall be selected such that it shall act as a back up protection for LT system faults and shall provide close co-ordination with LT MCCB
- The HT fuse shall be selected such that it shall not operate for in rush current during transformer charging
- The HT fuse shall be selected such that it shall operate instantaneously for all internal faults in the transformer.

The supplier shall carry out coordination test, as indicated above, on minimum one transformer out of every 50 transformers and this shall form an Acceptance Test by the purchaser. Co-ordination of LT MCCB for external faults and HT fuse for internal faults complete with expected fault currents and I^2t value of CB /HT fuse shall be assured/ proved.

3.13.4 Lightning Arrestor:

Lightning arrestor of non linear resistance type shall be provided. Lightning arrestor shall be mounted external to the transformer and shall be suitable for outdoor type duty. The rating shall be 9kV, 5kA lightning arrestor. The line terminal of the surge arrestor shall be connected the HV bushing and the earth terminal of the surge arrestor shall be solidly connected to a separate earth externally. Make of Lightning Arrestor shall be Electrolite Power^{R1}

3.14 LOSSES AND IMPEDENCE VALUES

The supplier shall furnish the maximum total losses (no load losses+ Load losses at 75 deg.c) at 50 % of rated load and 100% of rated load (with no plus tolerance). The total losses (no load losses and load-losses at 75 deg.C) at 50% of rated load & 100% of rated load shall not exceed the values given below:

KVA	Maximum total losses (Watts)			
	50 % load	100 % load		
16	82	224		
25	110	300		
50	210	590		

[R2]



Other factors being equal, due consideration shall be given to offers of transformer with lesser Guaranteed Losses.

These losses are maximum allowable and there would not be any plus tolerance. However, the manufacture can offer losses less than above.

3.14.2 Impedance

The percentage impedance at 75[°] C shall not exceed 4% with IS tolerance.

3.15 OVERFLUXING

The transformer shall be suitable for continuous over fluxing (due to combined effect of voltage and frequency) up to 12.5%, without injurious heating or saturation at full load conditions.

The maximum flux density in any part of the core under such condition shall not exceed 1.6 Tesla. The supplier shall furnish necessary design data in support of this stipulation.

3.16 Transformer Oil

Should be in accordance with specification as per **Annex III**^{R1} of this document One sample of oil drawn from every lot of transformer offered for inspection should be tested at NABL accredited lab for tests as listed under Table-1 of IS:1866 (2000). The cost of this testing should be included within the cost of transformer. The results shall be confirming to BSES specification **Annex III**^{R1}

4. QUALITY ASSURANCE

4.1 General

The Supplier shall adopt suitable quality assurance program and procedures to ensure that all activities are being controlled as necessary. The Supplier shall indicate following in the quality assurance plan –

Hold Point "A stage in the material procurement or workmanship process beyond which work shall not proceed without the documented approval of designated individuals or organizations."

The Purchaser's written approval is required to authorize work to progress beyond the Hold Points indicated in approved quality plans.

Notification Point "A stage in material procurement or workmanship process for which advance notice of the activity is required to facilitate witness."

If the Purchaser does not attend after receiving documented notification in



accordance with the agreed procedures and with the correct period of notice then work may proceed.

4.2 Quality Plans

The Supplier shall draw up for each section of the work quality plans which shall be submitted to the Purchaser for approval at least two weeks prior to the commencement of work on the particular section. Each quality plan shall set out the activities in a logical sequence and, unless advised otherwise, shall include the following:

- An outline of the proposed work and programme sequence
- The structure of the Supplier's organisation for the contract
- The duties and responsibilities assigned to staff ensuring quality of work for the contract
- Hold and notification points
- Submission of engineering documents required by the specification
- The inspection of materials and components on receipt
- Reference to the Supplier's work procedures appropriate to each activity
- Inspection during fabrication/construction
- Final inspection and test

4.3 Sub-suppliers

The Supplier shall ensure that the quality assurance requirement of this specification is followed by sub-supplier appointed by him under the Contract. The Supplier shall assess the sub-supplier's quality assurance arrangements prior to his appointment to ensure compliance with the specification.

Auditing of the sub-supplier's quality assurance arrangements shall be carried out by the Supplier and recorded in such a manner that demonstrates to the Purchaser the extent of the audits and their effectiveness.

4.4 Guarantee

The Supplier shall guarantee the following:

- Quality and strength of materials used.
- Satisfactory operation during the guarantee period of 60 months from the date of commissioning or 66 months from the date of receipt at the purchasers stores, whichever is the early.
- Performance figures as supplied by the Bidder in the schedule of guaranteed particulars.



• The offered surface treatment shall protect the treated metal from corrosion for a period of not less than five years from the date of delivery.

5 INSPECTION AND TESTING

- 5.1 The manufacture shall carry out comprehensive inspection and testing during manufacturing of the transformer.
- 5.2 The manufacturer shall carry out all type tests and routine tests on the transformer and special test if required any, shall be carried out as per IS by mutual arrangement between purchaser and supplier. The charges, if any, for conducting each of the type tests and special tests shall be indicated separately in the tender.
- 5.3 The purchaser reserves the rights to waive off certain or all tests.
- 5.4 All external components and fittings that are likely to affect the performance of the transformer during the test shall be in its place.

TESTS

ROUTINE TESTS:

All transformers shall be subjected to the following routine tests at the manufacturer's works and in accordance with IS: 2026 and IS: 1180 (Part - I & II) and shall be deemed to be included in the supplier's scope:

- Measurement of winding resistance
- Measurement of voltage ratio and check of voltage vector relationship
- Measurement of impedance voltage/short-circuit impedance and load loss at 50 % & 100 % load.
- Measurement of no-load loss and no load current
- Measurement of insulation resistance and polarization index.
- Induced over voltage withstand test
- Separate source voltage withstand test
- Coordination test .
- Oil breakdown voltage test.
- Over voltage withstand capability Test.
- Pressure test.
- Oil leakage test.



TYPE TESTS:

In addition to the routine tests, certificates for type test, conducted on each type of the transformer of the same rating and characteristics from CPRI/ERDA shall be submitted (as per IS 2026). Type test carried out in last five year will be valid.

- Lightning impulse test
- Heat run test
- Short-circuit test
- Air Pressure test:

The supplier has to carry out heat run test for one transformer out of fifty transformers.

PRESSURE TEST FOR TRANSFORMER TANK

The tank shall be fixed with a dummy cover with all fittings including bushings in position and shall be subjected to following pressure created inside the tank of 100 KPa above the atmospheric pressure for 30 min. there should be no leakage at any point and there is no deformation of tank.

If records of a type test on a transformer, which is representative of the one being purchased, are furnished, the purchaser may accept this as evidence of the type test instead of actual test

The supplier shall furnish calculations in accordance with IS: 2026 to demonstrate the thermal ability of the transformers to withstand short circuit.

Note: Purchaser reserves the right to get all or any type test carried out on one sample per 100 unit of transformer at the cost of supplier from any recognized laboratory *I* government test house.

6 PACKING, SHIPPING, HANDLING AND STORAGE

- 6.1 Packing shall be sturdy and adequate to protect all assemblies, components and accessories from injury by corrosion, dampness, heavy rains, breakage and vibration encountered during transportation, handling and storage at the plant site. All accessories, which are likely to get damaged during transit if transported mounted on the equipment, shall be removed, adequately packed and shipped separately. All openings shall be sealed. Spare parts shall be packed separately and clearly marked. They shall be specially packed for long storage without injury.
- 6.2 The bidder shall after proper painting, pack and crate all plant equipment for sea



shipment/air freight in a manner suitable for export to a tropical humid and saline air borne climate region as per Internationally accepted export practice in such a manner so as to protect it from damage and deterioration in transit by road, rail and/or sea and during storage at site till the time of erection. The bidder shall be held responsible for all damages due to improper packing.

- 6.3 The bidder shall give complete shipping information concerning the weight, size, contents of each package including any other information the Purchaser may require. The weight and size of the package shall be such that they can be easily transported from the maker's works to the plant site by ship/air, road way and railways.
- 6.4 The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site; and furnish to the Purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be done and borne by the bidder.
- 6.5 The bidder shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment dispatched to 'site'. The bidder shall further be responsible, for making all necessary arrangements for loading, unloading and other handling right from his works; and from Indian port for equipment under the Off-shore Supply till the 'site' and also till the equipment is erected, tested and commissioned. The bidder shall be solely responsible for proper storage and safe custody of all equipment.
- 6.6 Each packing case shall be indelibly marked, on two adjacent sides and on the top, with the following:
 - Individual serial number.
 - Purchaser's name.
 - Contract number.
 - Destination.
 - A colour coded marking to indicate destination.
 - Supplier's name.
 - Name and address of Supplier's agent.
 - Description and numbers of contents.
 - Manufacturer's name.
 - Country of origin.



- Case measurements.
- Gross and net weights in kilograms.
- All necessary slinging and stacking instructions.

Each crate or container shall be marked clearly on the outside of the case to show TOP and BOTTOM positions with appropriate signs to indicate where the mass is bearing and the correct positions for slings. Six copies of each packing list shall be sent to the Purchaser prior to dispatching the equipment.



APPENDIX-A

LIST OF APPLICABLE CODES AND STANDARDS

All Material against this specification shall conform in all respect to the relevant Indian standard specifications /International Standard Specification, with latest amendments from time to time, thereof, some of which are listed below :

Indian Standard	Title
IS-2026/2011	Specification for Power Transformer
IS-1180-2014	Outdoor type oil immersed DT upto & including 2500 KVA,33 KV
IS-335/1983	Specification for oil
REC Specification 39/1993	
IS-2099-1973	Specification for High voltage Porcelain Bushings
IS-7421/1976	Specification for Low voltage Bushings
IS-3347	Specification for Outdoor Bushings
IS-12444	Specification for Cu Wire rods
IS-5484	Specification for AI Wire rods
IS-5	Specification for Colors for ready mixed paints.
IS-6600/1972	Guide for loading of oil immersed Transformers.
IS-13947-Part 2	Low voltage switchgear and control gear.
IS 10028/1985	Code of Practice for Selection, Installation and
	Maintenance of Transformers.

IEC Standard	Title
IEC 60296	Specification for unused and reclaimed mineral
	Insulating oil for transformer and switchgear.
IEC 60076	Specification for power transformer.
IEC 60076-1	General
IEC 60076-2	Specification for temperature rise requirement
IEC 60076-3	Specification for insulation levels and dielectric tests.
IEC 60076-4	Specification for tapping and connections
IEC 60076-5	Specification for ability to withstand short circuit
IEC 60076-10	Determination for transformer and reactor sound levels
IEC 60076-7	Guide to loading of oil immersed power transformer
IEC 60137	Insulated bushings for alternating voltage above 1kV

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Other International and Internationally recognized standard	Title
BS148, ASTM D-1275	Specification for oil
D-1473, D-1533-1934	
DIN 42531 to 33	Specification for Outdoor Bushings
ASTM B-49	Specification for Cu Wire rods
ASTM B-233	Specification for AI Wire rods

Material conforming to other internationally accepted standards, which ensures equal or better quality than the standards mentioned above would be acceptable, subject to prior approval of Owner. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the Standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translation shall be furnished along with the offer. In the case of conflict the order of precedence shall be 1) Indian Standards, 2) IEC Standards, 3) Other alternative standards.



APPENDIX-B

DRAWINGS SUBMITTAL REQUIREMENT OF THE SUPPLIER

Drawings, Data and Manuals shall be submitted with the bid and in quantities and procedures as specified in this specification for approval and subsequent distribution after the issue of Notice to proceed.

Submittals required with the bid

The following shall be required with each copy of the bid :

- Completed technical data schedule.
- Descriptive literature giving full technical details of equipment offered.
- Outline dimension drawing for the equipment and for each major component, general arrangement drawing showing component layout and general schematic diagrams.
- Type test certificates, where applicable, and sample routine test reports.
- Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating.
- Details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certification.
- Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted.
- List of recommended spare parts for five years of operation with prices and spare parts catalogue with price list for future requirements.

Submittals required after award of contract

Within 10 days of contract award, five bound folders with records of the technical particulars / drawings / calculations relating to the equipment shall be submitted by supplier. Each folder shall contain the following information:

- General description of the equipment and all components, including brochures.
- Technical data schedule, with approved revisions.
- Calculations to substantiate choice of electrical, structural, mechanical component size/ratings.



• Detailed dimension drawing for the equipment and for all components, general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings.

• Statement drawing attention to all exposed points in the equipment at which copper/aluminium or copper/aluminium alloy parts are in contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point.

• Detailed installation and commissioning instructions.



<u>ANNEXURE -I</u>

DATA SHEET OF CLIENT REQUIREMENT

1 Electrical System Data

Continuous rated capacity	16 KVA	25KVA	50 KVA *2
System voltage (max.)	12 KV	12kv	12 KV
System Frequency	50 Hz	50 Hz	50 Hz
Rated voltage HV/ Phase to Phase	11 KV +/ - 10%	11 KV +/ -	11 KV +/ - 10%
Trated voltage ITV I hase to I hase	111070		1110/0
Rated voltage HV Phase to Neutral	11/√3 KV +/ - 10%	10%	11/√3 KV +/ - 10%
Rated voltage LV	240V	240V	240V
Line current HV(A)	2.52	3.96	7.87
Line current LV(A)	66	108	208
Frequency	50 c/s +/- 5%	50 c/s +/- 5%	50 c/s +/- 5%
No. of phases on HV & LV side	Single	Single	Single
	As per IEC	As per IEC	As per IEC 60076-
Max allowable noise level	60076-10	60076-10	10
System fault level at 11kv terminal	500Mva	500Mva	500Mva
Method of 11kv system earthing	Effectively earthed at 11kv source	Effectively earthed at 11kv source	Effectively earthed at 11kv source

2 Transformer Requirements

Type of transformer	CSP / conventional distribution transformer		
Type of construction	Core type, oil immersed		
Type of cooling	Oil natural air natural (ONAN)		
No of phases	Single phase on primary & secondary side		
No of windings	Two (one each for primary & secondary)		
Type of service	Outdoor application		
Type of mounting	Suitable for pole mounting		

The transformer shall be capable of withstanding the thermal and dynamic effects of short circuits, as specified in IEC 76-5(Ability to withstand short circuits)Each transformer shall be capable of withstanding for **3 seconds**^{R1} a bolted metallic short circuit on the terminals of either winding with rated voltage on the other



winding.

The following insulation levels as defined in IEC 76-3 / IS 2026 Insulation levels and dielectric tests shall apply:

	HV Winding	LV Winding
Basic Impulse voltage Level (kV) (1.2/50 micro-second. wave)	75 kV	Not Applicable
Power Frequency one minute voltage withstand level, Wet and Dry (kV)	28 kV	3 kV (Three)

3 Normal site conditions

The distribution transformers to be supplied against this Specification shall be suitable for satisfactory continuous operation under the following climate conditions as per IS:2026 (Part-I) Latest Revision

Max ambient air temperature	: 50 (Deg. C)
Min ambient air temperature	: 0 (Deg. C)
 Max average daily ambient air temperature 	: 40 (Deg. C)
 Max. Altitude above mean sea level 	: 1000 (Meters)
Humidity	: 100%

4 GENERAL PARTICULARS AND GUARANTEES

4.1 COMPLIANCE WITH SPECIFICATION

The transformers shall comply in all respects with the requirements of this specification. However, any deviation from the specification shall be disclosed at the time of tendering.

4.2 COMPLIANCE WITH REGULATIONS

All the equipment shall comply in every respect with the Indian Regulations and acts in force.

The equipment and connections shall be designed and arranged to minimize the risk of fire and any damage which might be caused in the event of fire.

5 SPARE PARTS AND SPECIAL TOOLS

The bidder shall quote separately for the following mandatory spares;



- HV Bushing
- LV Bushing.

The Bidder shall provide a list of recommended spare parts together with their individual prices and shall include HV and LV bushings and bi-metallic connectors for HV and LV bushings. This list shall identify all essential spares and consumable items for any recommended maintenance for a period of five years after commissioning.

Spare parts shall be delivered suitably packed and treated for long periods in storage. Each pack shall be clearly and indelibly marked with its contents, including a designation number corresponding to the spare parts list in the operation and maintenance instructions.



ANNEXURE II VENDOR DATA (GURANTEED TECHNICAL PARTICULARS)

Note: This GTP is to be filled by the supplier in accordance with the given specification. Any deviation from the same shall be clearly highlighted and shall be supported with relevant documents.

S. No.	Description	UNIT	16KVA	25KVA	50 KVA ^{K2}
1	Name of manufacturer				
2	Туре				
3	Ratings				
(a)	Rated output	kVA			
(b)	Rated voltage-HV	Volts			
(c)	Rated voltage-HV	Volts			
(d)	No load voltage ratio				
(e)	Number of phases				
(f)	Frequency	Hzs			
4	Connections				
(a)	High voltage				
(b)	Low voltage				
5	Method of cooling				
6	Internal dimensions of tank				
(a)	Length	mm			
(b)	Breadth	mm			
(c)	Height	mm			
6	Thickness of tank sheet				
(a)	Sides	mm			
(b)	Тор	mm			
(c)	Bottom	mm			
7	Details of core				
(a)	Diameter	mm			
(b)	Cross sectional area				
	i) Gross	mm			
	ii)Net	mm			
(c)	Window height	mm			
(d)	Limb center	mm			
(e)	Maximum flux density at rated				
	voltage and frequency(to be supported by calculations)	Tesla			
(f)	Material and thickness of lamination	mm			
(g)	Weight of stamping in core and voke		1		
(0)	separately				
	i)Core	Kgs			



	ii)Yoke	Kgs		
	iii)Total	Kgs		
8	HV coil construction details			
(a)	Type of winding			
(b)	Size of conductor (Bare)	mm		
(C)	Cross sectional area of conductor	mm		
(d)	Number of coils per limb			
(e)	Outer diameter of coil	mm		
(f)	Inner diameter of coil	mm		
(g)	Insulation of conductor			
(h)	Interlayer reinforcement detail			
(i)	Current at full load	Amp		
(j)	Normal working current density	Amp/		
		mm [∠]		
(k)	End turn insulation			
(I)	Weight of bare conductor used in one	Kg		
	leg of HV			
(m)	Weight of insulated conductor used in	Kg		
	one leg of HV			
(n)	Number of turns per leg			
(0)	Length of mean turns	mm		
(p)	I'R at 75°C (To be supported by			
	calculations)			
(q)	Axial length	mm		
(r)	Resistance per phase at 75 C (Max)	Ohms		
9	LV coll constructional details			
(a)	l ype of winding			
(b)	Size of conductor(Bare)	mm		
(C)	Cross sectional area of conductor	mm		
(d)	Number of coils per limb			
(e)	Outer diameter of coil	mm		
(†)	Inner diameter of coll	mm		
(g)	Insulation of conductor			
(h)	Interlayer reinforcement detail	•		
(i)	Current at full load	Amp		
()	Normal working current density	Amp/ 2		
		mm ⁻		
(1.)	End turn inculation			
(K)	End turn insulation	l/ a		
(1)	weight of bare conductor used in one	ng		
(m)	Weight of insulated conductor used in	Ka		
(11)	one leg of I V	rvy		



(n)	Number of turns per leg			
(0)	Length of mean turns	mm		
(a)	I ² R at 75 [°] C (To be supported by			
(17)	calculations)			
(a)	Axial length	mm		
(r)	Resistance per phase at 75°C (Max)	Ohms		
10	Insulation details material and size	•		
(a)	HV coil end packing			
(b)	LV coil end packing			
(c)	Inter coil spacer of HT sections			
(d)	Bottom core strip insulation			
(e)	Yoke insulation			
(f)	Clamp insulation			
(a)	Inter phase barrier			
(b)	Core wrap			
(i)	Cylindrical insulation between HT &			
()	LT			
(i)	Type of blocks used between coils			
11	Details of clearances			
	Internal clearance between inner			
(a)	walls	mm		
	of tank and core coil assembly unit			
(b)	Radial clearance between LV and HV	mm		
	winding			
(c)	Phase to phase clearance between	mm		
())	HV limb			
(d)	Clearance from top of the yoke to the	mm		
	inside of the top cover of tank			
(e)	Radial clearance of LV coil from core	mm		
(†)	Horizontal duct between HT sectional			
(g)	End clearance of H1 coll from yoke	mm		
(h)	winimum clearance between core	mm		
(1)	anu tank bottom	11111		
10	Impulse test voltage of winding for			
12	1 2/50 micro soconde wave according			
	to relevant ISS			
(2)	HV			
(a) (b)				
12	Volts per coil of HV winding	Volte		
13	Approximate volts per laver of HV/	Volte	}	— —
	winding	VOILS		
14	winding			
15	Performance reference temperature	٥C		



16		Watte						
10	Total lagges (no load lagges lagd	vvalio						
17	losses at 75 deg.Cjat 50 % of load							
17								
	l otal losses(no load losses+load	10/-44-						
40	losses at 75 deg.C)at 100% of load	vvatts						
18	Induced over voltage test at double							
	frequency							
10(-)	No load current at 100% rated							
19(a)	vollage							
	and rated inequency as percentage of							
(1-)	full load current.							
(D)	No load current at 112.5% of rated							
	voltage as percentage of full load							
20	current Regulation at normal full load and							
20								
	UPF at 75 C Degulation at normal full load and 0.9							
21								
	Lag PF at 75 C							
22	Impedance voltage at rated voltage	VOIIS						
	and frequency at 75 C							
23	Percentage reactance at rated							
20	and frequency at 75°							
04	Derecenterie registeres et 75 °C							
24	Percentage resistance at 75 C							
25	Percentage at 75 C							
(a)	with respect to high voltage							
(b)	With respect to low voltage							
26	Unbalance current as percentage of							
	full load current					1		
27	Percentage efficiency			At		At	At	At
				0.8		0.8	UPF	0.8
			At	Lag		Lag		DE
			UPF	PF	At	PF		
()					UPF			
(a)								
(b)	¾ full load							
(c)	1/2 full load							
(d)	¼ full load							
	Permissible duration of overload							
	tollowing continuous running at							
	normal							
	rated load in ambient temperature of							
	50°C							
28							1	



(a)	10%overload				
(b)	20%overload				
(C)	30%overload				
	RMS value of symmetrical short				
29	circuit				
	current which the transformer can				
	withstand and its duration according				
	to				
	clause 9.1 of ISS-2026 or clause –				
	1001 of BSS with latest amendment.				
30	Increase in temperature of winding at				
	full load by resistance method in an				ļ I
	ambient temperature of 50 [°] C				
31	Increase in temperature of oil by				
	thermometer at full load in an				l I
	ambient temperature of 50°C				
32	Temperature of hottest spot in the				
	winding at tuil load in an amplent			ļ	l I
	temperature of 50°C		ļ	 	
33	Terminal arrangement of HV side				
34	Terminal arrangement of LV side				
35	Particulars of HV bushing				
(a)	Name of manufacturer				
(b)	Туре				
(C)	Dry withstand voltage for one minute				
(d)	Wet withstand voltage for thirty				
	minutes				
(e)	Voltage rating				
(f)	Impulse withstand voltage 1.2/50				
	micro second wave				
	i)Positive				
	ii)Negative				
	Total creepage distance in				
(g)	air	mm			
(h)	Height of bushing above transformer				l I
	tank				
36	Particulars of LV neutral bushing				
(a)	Name of manufacturer				
(b)	Туре				
(c)	Voltage rating				
(d)	Dry withstand voltage for one minute				
(e)	Wet withstand voltage for thirty				
	minutes		1		



(f)	Total creepage distance in air	mm		
		Mm		
(g)	Height of bushing above transformer			
	Tank			
37	Time constant of transformer			
38	Transformer oil			
(a)	Dielectric strength			
(b)	Resistivity			
(c)	Acidity			
(d)	Tan delta			
(e)	Name of supplier			
39	Quantity of transformer oil			
40	Weight of the following			
(a)	Tank and fittings	Kgs		
(b)	Core and windings	Kgs		
(c)	Transformer oil	Kgs		
(d)	Total weight of transformer including	Kgs		
	oil			
41	Overall dimensions of transformer			
(a)	Length	mm		
(b)	Breadth	mm		
(C)	Height	mm		
42	Name of material and size used for			
	clamping of core winding			
(a)	Core clamp			
(b)	Tie rod			
(C)	Core bolt			
(d)	Bottom plate			
43	Type testing			
(a)	Is the offered 16/25/50 kVA ,			
	conventional distribution transformer			
	type tested? (Yes, No)			
(b)	If yes, when and where was it type			
	tested?			
			1	
(c)	Is there any deviation in the			

(c)	Is there any deviation in the technical specification of offered 16/25/50kVA Is conventional type distribution transformer? If yes, give details				
(d)	Details of type test reports	Date of test	Whether test report	If yes,nos. of sheet enclosed	



		enclo	osed	
		or		
		not(y	es/N	
		0)		
	Name of test			
i)	Unbalance current test			
ii)	Impulse voltage withstand test			
iii)	Temperature rise test			
iv)	Short circuit test			
V)	Thermal ability test			
vi)	Air pressure test			
44	Whether you will use specified			
	aluminum alloy or brass copper with			
	suitable bimetallic arrangement for			
	HV/LV connector			
45	Have you submitted drawing and			
	calculation of cross sectional area of			
	core?(Yes/No)			
46	Have you submitted calculation for			
40	computation of no load & load loss			
	at 75 deg. As per design data of			
	offered transformers?(ves/No.)			
47	Any other information			
			1	

Annexure – III

Technical Particulars of transformer Oil

Transformer oil shall be new and conform to the following requirements:

1.0 Codes & standards

Latest revision of following codes & standards with all amendments -

	Standard no	Title
1.1	IS 335	New insulating oils
1.2	IS 1783	Drums for oils

2.0 Properties

The insulating material shall have following features:



Sr No	Item description	Specification requirement
2.1	Appearance of oil	Clear, transparent and free from suspended matter or sediments
2.2	Density at 29.5 [°] C Max.	0.89 g/cm ³
2.3	Kinematics viscosity Max.	16 cSt at 27ºC
		11 cSt at 40ºC
2.4	Interfacial tension at 27 ⁰ C	0.04 N/m min
2.5	Flash point Pensky-Marten (Closed), Min.	140ºC
2.6	Pour Point, Max	- 15⁰C
2.7	Neutralization value	
	i) Total acidity, Max.	0.03 mg KOH/g
	ii) Inorganic acidity/ Alkalinity	Nil
2.8	Corrosive sulfur	Non-corrosive
2.9	Electric strength breakdown voltage	Average value of six samples
	i) New unfiltered oil. Min.	30 kV (rms) min.
	ii) After filtration Min.	60 kV (rms)
2.10	Dielectric dissipation factor (tan δ).	0.002 at 90 ⁰ C, Max
		0.0005 at 27ºC, Max
2.11	Specific resistance	(resistivity)
	i) At 90ºC, Min	150 X 10 ¹² ohm-cm
	ii) At 27ºC, Min	3000 X 10 ¹² ohm-cm
2.12	Oxidation stability	
	i) Neutralization value after oxidation, Max.	0.15 mg KOH/g
	ii) Total sludge, after oxidation, Max.	0.03 % by weight
	iii) Max Tan delta	0.1 at 70 [°] C



Sr No	Item description	Specification requirement
2.13	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)
	i) Specific resistance (resistivity)	
	a) At 27ºC Min.	27 X 10 ¹² ohm-cm
	b) At 90ºC Min	2 X 10 ¹² ohm-cm
	ii) Dielectric dissipation factor (tan δ)	0.10 at 90 ⁰ C Max
	iii) Total acidity, Max	0.05 mg KOH/g
	iv) Total sludge, Max	0.05 % by weight
2.14	Presence of oxidation inhibitor	no antioxidant additives
2.15	Water content, Max	40 ppm
2.16	List of clients	To be enclosed
2.17	PCA content	3% max
2.18	PCB content	Not detectable