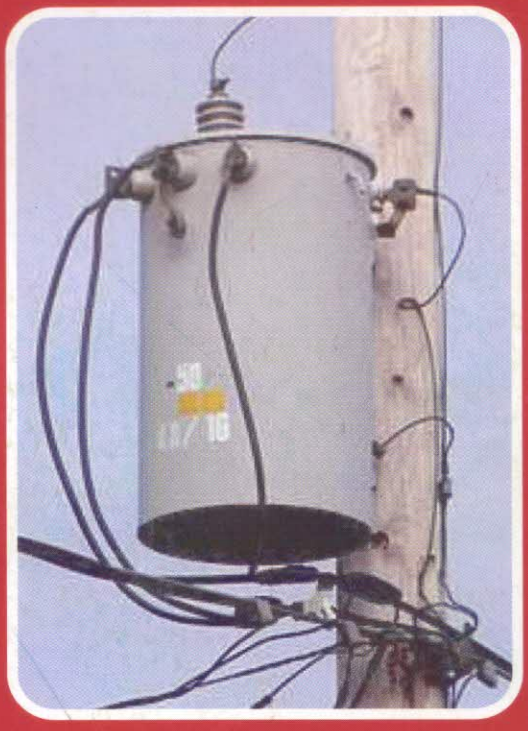
MANUAL ON

TECHNICAL SPECIFICATIONS

OF

DISTRIBUTION TRANSFORMERS



Power Division

Ministry of Power, Energy & Mineral Resources

August, 2015

Government of the People's Republic of Bangladesh

MANUAL ON TECHNICAL SPECIFICATIONS OF DISTRIBUTION TRANSFORMERS

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Secretary
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Preface

I have the pleasure to learn that Power Division is going to publish a Manual on Technical Specifications of Distribution Transformer (1-phase and 3-phase). So far I know this is the first kind of initiative in power sector. The necessary information of distribution transformer specification has been accomplished in this manual. I believe that all the distribution entities, manufacturers, suppliers and investors will be greatly benefitted with this manual. It will ensure quality, standard of the product and transparency of the procurement process.

It may be mentioned that one third investment is required for distribution transformer during construction of distribution system. It is one of the major equipment for distribution system. It plays pivotal role to ensure uninterrupted power supply to the customers. Therefore procurement of quality transformer is inevitable for quality power supply. In this regard this manual will be helpful for all concerned.

I appreciate the team for preparing this standard specification. It will help the entities of power sector to ensure quality and uninterrupted power supply in the country.

It's a live document. It will be updated continuously as per requirement of the distribution system in commensurate with the development of technology.

Monowar Islam, ndc

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়
বিদ্যুৎ বিভাগ
প্রশাসন-১ অধিশাখা
www.powerdivision.gov.bd

নং ২৭.০০.০০০০.০৪১.৩১.০২৫.১৫-১৭৬৯ তারিখ: ২০ আগস্ট, ২০১৫ খ্রিঃ

পরিপত্র

বিষয়ঃ বিদ্যুৎ বিভাগের আওতাধীন সংস্থা/কোম্পানিসমূহের ট্রান্সফর্মারের Specification Standardization।

বিদ্যুৎ বিভাগের আওতাধীন সংস্থা/কোম্পানির ১ ফেজ ও ৩ ফেজ বিতরণ ট্রান্সফর্মার-এর Specification Standardization–এর জন্য বিদ্যুৎ বিভাগ কর্তৃক গঠিত কমিটির প্রস্তাব অনুসারে এ বিভাগের আওতাধীন সংস্থা/কোম্পানির জন্য বিতরণ ট্রান্সফর্মার-এর Specification Standardization সরকার অনুমোদন করেছে (কপি সংযুক্ত)। এ বিষয়ে নিম্নলিখিত নিয়মাবলী অনুসরণ করতে হবে:

(ক) ট্রান্সফর্মার ক্রয়কালে এ স্পেসিফিকেশন টেন্ডার ডকুমেন্টের সংশ্লিষ্ট অংশে সন্নিবেশ করতে হবে;

(খ) ট্রান্সফর্মারের ওয়ারেন্টি পিরিয়ড স্ব স্ব সংস্থা/কোম্পানি প্রয়োজন অনুযায়ী স্পেসিফিকেশনে উল্লেখ করবে;

(গ) এ স্পেসিফিকেশন অনুসরণ করা ব্যতীত বিতরণ ট্রান্সফর্মার ক্রয় করা যাবে না;

(ঘ) কোন সংস্থা/কোম্পানির নিকট এ স্পেসিফিকেশন ভবিষ্যতে সংশোধন/হালনাগাদ করার প্রয়োজনীয়তা অনুভূত হলে বিদ্যুৎ বিভাগে প্রস্তাব প্রেরণ করতে হবে;

(ঙ) বিদ্যুৎ বিভাগ এ স্পেসিফিকেশন সংশোধন/হালনাগাদ করতে পারবে; এবং

(চ) ১ সেপ্টেম্বর, ২০১৫ তারিখের পূর্বে টেন্ডার আহ্বান করা হলে পূর্বের নিয়মে ট্রান্সফর্মার ক্রয় করা যাবে।

২। আগামী ১ সেপ্টেম্বর, ২০১৫ তারিখ থেকে Transformer-এর এ Standard Specification কার্যকর হবে।

৩। যথাযথ কর্তৃপক্ষের অনুমোদনক্রমে এ পরিপত্র জারী করা হল।

সংযুক্তি: বর্ণনামতে।

(মোঃমাহবুব-উল-আলম, এনডিসি)
অতিরিক্ত সচিব (প্রশাসন)

বিতরণ: (জ্যেষ্ঠতার ক্রমানুসারে নয়)

১। চেয়ারম্যান, বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড।
২। চেয়ারম্যান, বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড।
৩। বৈদ্যুতিক উপদেষ্টা ও প্রধান বিদ্যুৎ পরিদর্শক।
৪। ব্যবস্থাপনা পরিচালক, পিজিসিবি লি:/ডিপিডিসি লি:/ডেসকো লি:/ওজোপাডিকো লি:/ইজিসিবি লি:/নওপাজেকো লি:/ আরপিসিএল/এপিএসসিএল/সিপিজিসিবি লি:/নওজোপাডিকো লি:/বিপিডিবি আরপিসিএল-পাওয়ারজেন লি:।

অনুলিপি: (জ্যেষ্ঠতার ক্রমানুসারে নয়)

১। অতিরিক্ত সচিব, বিদ্যুৎ বিভাগ।
২। অতিরিক্ত সচিব (প্রশাসন/উন্নয়ন/সমন্বয়/বাজেট), বিদ্যুৎ বিভাগ।
৩। যুগ্ম-সচিব(সকল), বিদ্যুৎবিভাগ।
৪। মহাপরিচালক, পাওয়ার সেল।
৫। প্রধানমন্ত্রীর জ্বালানি বিষয়ক উপদেষ্টার একান্ত সচিব, বিদ্যুৎ বিভাগ।
৬। প্রতিমন্ত্রীর একান্ত সচিব, বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়।
৭। বাংলাদেশ এনার্জি রেগুলেটরি কমিশনের চেয়ারম্যানের একান্ত সচিব।
৮। সচিবের একান্ত সচিব, বিদ্যুৎ বিভাগ।

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CHAPTER-1

TECHNICAL SPECIFICATIONS OF SINGLE -PHASE DISTRIBUTION TRANSFORMERS

(5, 10, 15, 25, 37.5, 50, 75, 100 & 167 KVA)

PART-I
Technical Specifications of
Overhead –Type Single Phase Distribution Transformers

1.1 SCOPE

This standard covers the electrical, mechanical and performance requirements for single phase, mineral-oil-filled, overhead type distribution transformers for use on 11,000/6350 GRD "Y" volt (INSERT THE NAME OF THE ORGANIZATION) overhead distribution system.

1.2 GENERAL

Distribution transformers furnished to (INSERT THE NAME OF THE ORGANIZATION) specifications shall conform in all respects to the requirement of this standard. These transformers will be used in a tropical climate with high annual rainfall. The text, tables, figures and references to other standards supplement each other and are considered of this standard.

1.3 RATINGS

1.3.1 Nominal voltage ratings

a. H.V. winding - 6350 volts
b. L.V. winding - 240 volts

1.3.2 Basic insulation levels.

a. H.V. winding - 95 KV
b. L.V. winding - 30 KV or as per latest ANSI requirement.

1.3.3 Frequency - 50 Hertz

1.3.4 Percent impedance shall be

a. 2.5% for 5 KVA to 37.5KVA.
b. 3% for 50 KVA to 167 KVA.

Note: Percentage impedance may vary up to +10%.

1.3.5 Ambient air temperature is 40°C. Average winding temperature rises above ambient shall not exceed 65°C when measured by the resistance method. The hottest spot temperature rise of the winding shall not exceed 80°C over ambient. Temperature rise of the insulating liquid shall not exceed 65°C whenmeasured near the top of the tank. Temperature limits shall not be exceeded when the transformer is operating at rated KVA output and rated secondary voltage for 24 (twenty four) hours.

1.3.6 Transformers with ratings of 200 KVA or less shall have additive polarity; transformers with ratings over 200 KVA shall have subtractive polarity.

1.3.7 KVA ratings shall be as shown in Table 1.

1.4 DESIGN:

1.4.1 Transformers shall be designed in accordance with the revision (revision from 2010 to the latest revision) of the following ANSI standards: ANSI C57.12.00, ANSI C57.12.20

1.4.2 Transformers shall be class OA, (Self-cooled) wound core and have two windings of high conductivity copper. **Transformer Core shall be of Cold Rolled Grain Oriented Silicon Strip Steel (CRGO)/Amorphous.**

1.4.3 H.V. Bushings:

a. Outdoor type porcelain. The bushing should be easily replaceable & fitted with Corrosion resistant bolts, nuts & gaskets.

b. Connectors shall be bolted ring type, suitable for copper or aluminium. Connectors shall accommodate the range of conductor sizes indicated in Table-1.

c. Connectors shall be bird-proof with a rubber like insulating cover.

d. Transformers rated 200 KVA or less shall have one (1) H.V. bushing mounted on the cover of the tank. All transformers rated over 200 KVA shall have two (2) H.V. bushings mounted on the cover of the tank.

1.4.4 L.V. Bushings:

a. Outdoor type, porcelain. The bushing should be easily replaceable & fitted with corrosion resistance bolts, nuts & gaskets.

b. Connectors shall be in accordance with Table 1. Where bolted ring type connectors are used they shall be suitable for use with copper or aluminium and shall accommodate the range of conductor sizes as indicated in Table 1.

c. There shall be two (2) L.V. bushings mounted on the side of the tank.

1.4.5 Tank

a. Transformer tank shall be sealed type design complete with cover and gaskets.

b. Tank shall be supplied with a tank grounding bolted ring-type connector suitable foruse with copper or aluminium. The connector shall have a range of #6 to #3 AWG.

c. There shall be a low voltage grounding provision with a removable copper strap.

d. Tank shall have permanent lugs for lifting the complete unit.

e. There shall be facilities for lifting the core and coil assembly.

f. Tank shall be equipped with a self-sealing pressure release device designed tooperate at a minimum gage pressure of 0.564 Kg/cm2 (8 lb / inch2)

g. Tank shall be painted with two coats of light grey paint, ANSI colour #70 over a suitable primer coat.

h. The letters "REB" shall be painted in 7.62 centimetre (3") letters in front of the tank.

i. Nameplate shall be made of stainless steel and shall have engraved letters filled with black enamel. Nameplate information must include, but is not limited to, the following:

Contract number and IFB number
Serial Number
Class
Number of phases
Frequency
Voltage Rating
KVA ratings
Ambient temperature
Temperature rise, degree C
Polarity
Percent impedance
Approximate total mass in pounds & kilograms
Connection diagram
Name of manufacturer
Date of manufacture
Installation and operating instructions reference
The word "Transformer"
Type of insulating liquid (generic name preferred)
Conductor material (of each winding)

j. Tank shall have supporting lugs in accordance with the designations in Table-1.

k. Rating in KVA shall be painted in 7.62 centimetre (3") letters in front of the tank.

l. Transformer serial number shall be painted (2") letters in black 180^0 opposite to transformer hanger bracket centre line & 1" clear bottom of tank.

m. The bottom of the Tank should be one (l) inch above the Transformer bottom.

1.4.6 Insulating Oil

Insulating oil shall be new, unused mineral (non-PCB) oil and meet the requirements of ANSI/ASTM D3487-79. A suitable marking inside of the tank shall indicate oil level at 25^0C. The active part (Core &Coil) of the Transformer shall be submersed within oil and sufficient air space shall be provided.

Transformer Oil	
Application	Insulating mineral oil for Transformer
Grade of oil	Class-1
PHYSICAL PROPERTIES	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0C	0.895g/cm^3 (maximum)
Flash point (Closed cup)	140^0C (minimum)
Kinematics Viscosity at-15^0C	800 cst. (Maximum)
Kinematics Viscosity at-20^0C	40 cst. (Maximum)
Pour point	-30^0C (maximum)
ELECTRICAL PROPERTIES	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	On new untreated oil, the break down voltage shall be at least ≥30KV.
Loss tangent/ Dielectric dissipation factor at temp 90° C, stress 500V/ mm to 1000 v/ mm and frequency 40 Hz to 62 Hz.	0.005 (maximum)
CHEMICAL PROPERTIES	

Neutralization value	0.03mg KOH/g (maximum)
Neutralization value after oxidation	0.40mg KOH/g (maximum)
Total sludge after oxidation	0.10% weight (maximum)
PCB Content	Free from PCB

1.4.7 Lock washers

All electrical connections, bushing mounting bolts and cover attachment bolts require lock Washers. Lock Washers shall be fabricated from materials that comply with the requirements of ANSI B18.21.1.

1.4.8 Bolts.

The bushing mounting bolts and cover attachment bolts must be fabricated from steel that complies with the requirement of ANSI standard C 135.1. The bolts, Lock washers and Nuts if used shall be hot-dip galvanised in accordance with ASTM A 153.4.9

1.4.9 Gaskets.

Gaskets of nitrile rubber shall be used to ensure perfect oil tightness and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. All gaskets shall be closed design (without open ends) and shall be one piece only. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. Care shall be taken to secure uniformly distributed mechanical strength over the gaskets and retains throughout the total length. No gaskets shall be used in which the material of the gasket is mounted on a textile backing. Gaskets of neoprene or any kind of impregnated/ bonded core or cork only which can easily damage by over pressing is not acceptable. Use of hemp as gasket material is also not acceptable.

1.5 TESTS

All tests shall be carried out as per ANSI Standard C57.12.90 (revision from 2010 to the latest revision) in a reputed independent testing laboratory.

1.5.1 Routine tests:

The following routine tests shall be conducted at the factory on all transformers.

a. Resistance measurement of all windings.
b. Ratio test
c. Polarity and phase relation test
d. No-load losses at rated voltage and rated frequency
e. Excitation current at rated voltage and rated frequency.
f. Impedance voltage and load loss measurement
g. Induced high voltage test.
h. Power frequency withstand test.
i. Dielectric tests of oil
j. Loss tangent / Dielectric dissipation factor test of oil
k. * Lightning impulse test
l. ** Temperature Rise Test

*Note 1: KVA rating wise one sample from the daily production lot .
** Note 2: KVA rating wise two samples from a lot/batch will be tested for Temperature rise.
.

1.5.2 Type Tests:

a. Lightning Impulse test
b. Temperature Rise test
c. Short Circuit withstand test

Note: These all type tests shall be done on same Transformer (having same serial no.)

1.5.3 The losses of the transformers at 85°C will be limited (loss tolerances are notapplicable) as stated below:

Ratings(in KVA)/Loss (in Watt)	5 KVA	10 KVA	15 KVA	25 KVA	37.5 KVA	50 KVA	75 KVA	100 KVA	167 KVA
No-load Loss (in Watt)	19	25	35	46	65	75	115	140	240
Full-load Loss (in Watt)	120	190	250	380	480	600	860	1120	1900

1.6 SPARE PARTS:

1.6.1 The Bidder shall include separately with his Tender a list of recommended spare parts with per unit price quotedfor each item. The list shall include, but not be limited to, the spares listed below:

a. One complete set of all gaskets.
b. One complete H.V. bushing.
c. One complete L.V. bushing.

1.7 EVALUATION OF BIDS FOR DISTRIBUTION TRANSFORMERS:

Distribution transformers will be evaluated on the basis of formula given below:

$O = C_P + 65,432 \times e \times P_O + 26,173 \times e \times P_{FL}$

Where: O = Evaluated price in BDT
C_P = Quoted price in BDT
e = Average electricity selling price, Tk/KWh
P_O = Iron loss in KW
P_{FL}= Copper loss in KW at full load at 85°C

Guaranteed loss values must be supported by test reports from reputed independent testing laboratory. In case of difference between the loss value declared inthe offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

1.8 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of offered 1-Phase distribution transformer.

b) Detail dimensional drawings of offered 1-Phase distribution transformer.

c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per ANSI standard.

d) Manufacturer's valid ISO 9001 Certificate.

1.9 DOCUMENTATION

The following documents are to be submitted by the Tenderer along with the Tender for the similar KVA rating of same voltage class of offered 1-Phase Distribution Transformer**;otherwise the bid will be rejected**:

A. COMMERCIAL

Tenderer shall be eligible as per ITT Clause No. 5 and they should submit Bid validity, Bid Bond, Bid Bond validity, Price Schedule, Delivery Schedule, Authorisation of the signatory, Tender Submission Sheet, Tenderer Information Sheet & Documentary evidence for establishing the Tenderer's Qualifications, etc. and all other documents including information related to rejection clause as per Tender Document.

B. TECHNICAL

1) Guaranteed Technical Particulars (GTP) shall be properly filled up and signed by both Manufacturer & Tenderer;

2) Letter of authorization from the Manufacturers, in case, the Tenderer is not the manufacturer, in the prescribed Form;

3) 2 nos. of Manufacturer's Supply Record for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the date of bid opening in the following format (The supply record covering 25% of the tendered quantity in a single Contract will be considered only);

Sl. No.	Name, Address, Phone No., e-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of Material with Quantity	Date of Completion of Supply

4) At Least 2(two) nos. of Satisfactory Performance Certificate from Electricity utility as End User for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the year of Tender Notice. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication.

5) Type test along with Routine test report as per clause no. 1.5for similar KVA rating of same voltage class of offered type Distribution Transformer from a reputed independent testing laboratory as per ANSI standard C57.12.90 (revision from 2010 to the latest revision). All Type Test shall be done on the same transformer (having same serial number) from a reputed independent testing laboratory .The no-load offered loss of a transformer shall not exceed the independent laboratory test value by more than 10 % and the total losses of a transformer shall not exceed the independent laboratory test value by more than 6%. It is noted that no-load and full-load losses offered by the supplier shall not exceed the specified losses (mentioned in the clause 1.5.3 in the specification.)

6) Local manufacturers, who have supplied the same offered item to [INSERT THE NAME OF THE ORGANIZATION] within the last 5 (five) years from the date of bid opening, need not to submit any Manufacturer's Supply Record, with

the tender proposal. In that case, they have to submit one Satisfactory Performance Certificate (within last three years) from [INSERT THE NAME OF THE OFFICE AND ORGANIZATION], for the same offered item covering 25% of the tendered quantity in a single Contract.

7) The following provision will be applicable for purchasing less or equal to 1000 nos. transformers from new manufacturers.

At least 50 (fifty) nos. of Satisfactory Performance Certificate from end users (public/private) for similar or higher KVA rating of same voltage class of offered type Distribution Transformers within last 3 (three) years from the date of bid opening. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication. Factory shall be inspected by the TEC/Committee constituted by the authority as per following guide lines:

1. Location of the Factory & layout plan.
2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
3. Factory Project Profile
4. Production Capacity (Yearly)
5. Production Line description.
6. List of Key Personnel (with Bio-data)
7. Provide sample of the Tendered product manufactured in the Factory for evaluation of TEC during factory Inspection.
8. Testing Facilities as per ANSI
9. Warranty period 24 months from R&I issuing date.
10. Trade License, TIN & VAT certificate.
11. Source of raw materials.
12. A sample of the offered type Distribution Transformer shall be tested by TEC/Committee at manufacturer’s testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.9 B 3 & 4) shall be applicable for Bid Submission and Evaluation.

1.10 TEST REPORTS

Tenderer's shall include in their offer all routine tests and type tests as per ANSI standard C57.12.90 (revision from 2010 to the latest revision) from an reputed Independent Testing Laboratoryfor 1-phase Distribution Transformer as per clause no.1.5 . All type tests shall be done on same transformer (having same serial no.) from reputed independent testing laboratory.

1.11 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of relevant ITT clauses. The capitalized cost of the Transformer losses will **be considered** for evaluation purposes.

b) Bidder's declared/ guaranteed no load loss and load loss value shall be within the specified value(mentioned in the clause 1.5.3 in the specification), otherwise the bid will be rejected.

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value; otherwise the bid will be rejected.

1.12 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS/PRE-DELIVERY INSPECTION

Transformer will be tested during factory test witness/Pre-delivery inspection and testing and will be accepted if the measured transformer losses are within the offered/declared value or within the following tolerance with deduction of money from the contract price as below :

i) Each component loss (No load loss or Full load loss) shall not exceed up to 10% of the offered/declared component loss, provided that the total losses cannot be exceeded 6% of the offered/declared total losses.

ii) Percentage Impedance may vary up to + 10 % of the specified value.

iii) The purchaser can carryout the testing of any transformers during pre-delivery inspection. But, the testing of transformers during pre-delivery inspection will not be less than 1% or minimum 4nos.whichever is higher of total quantity ready for delivery on random sampling basis (sample selected by the inspection team) in manufacturer's factory premises. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

iv) If the results of any transformer exceeds the offered/declared losses (each component loss exceeds more than 10% or total loss exceeds more than 6% of the offered/declared losses) and percentage impedance exceeds +10% of the offered/declaredpercentage impedance then the whole lot will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness/pre-delivery inspection by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET(both tests will be applicable for local manufacturer only) exceed the offered/declared loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 1.12(i), then an amount will be deducted from the Contract price for the loss(s) exceeding the offered/declared loss(s) (No load loss or Full load loss or Both) according to the following formula :

Amount to be deducted from the Contract price

= {(Measured Loss - offered/declaredLoss) ÷ 1000} x20x365x24xLLFxex%MTxTotal nos. of transformer under the lot/batch.

Where, Measured Loss(in watt) = Measured Average No-load Loss[*1] + Measured Average Full Load Loss[*2].
Offered/declared Loss (in watt) = Offered/declaredNo Load Loss + Offered/declared Full load Loss
Transformer Economic Life = 20 Years
LF (Load Factor) = 60%
LLF (Loss Load Factor) = $0.15xLF+0.85x(LF)^2$
e = Average electricity selling price Tk/KWh

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness/pre-delivery inspection by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/

KUET/ DUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the offered/declaredloss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during pre-delivery inspection is 8, 6 nos. are found within the offered/declaredlosses and 2 nos. are found exceeding the offered/declared losses then the %MT will be (2/8)x100=25%

*[1]Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered/declaredNo-load loss ÷ Nos. of tested transformer(s) which exceeds the offered/declared No-load loss]

*[2]Measured Average Full Load Loss =[Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered/declaredFull-load loss ÷ Nos. of tested transformer(s) which exceeds the offered/declaredFull-load loss]

vi) All Weights&Dimensions will have a tolerance of ±5% from test report weights& Dimensions.

1.13 A. FACTORY TEST WITNESS/ PREDELIVERY INSPECTION AND TESTING

The purchaser shall have the right to inspect, examine and test the materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises. The Purchaser or its representative maximum 2 (two) times may inspect the goods during the manufacturing process and shall also request for the purchase/ import/ shipping documents of copper, oil and transformer core material and shall check in accordance with Guaranteed Technical Particulars (GTP).

An inspection team will be formed by (INSERT THE NAME OF THE ORGANIZATION) immediate after signing of the contract to control the quality and monitoring the manufacturing process of the transformer. The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team. This team will witness the Factory test at the manufacturer's plant. The Manufacturer shall have facilities to carryout all tests at its premises.

Tests shall be performed in accordance with the relevantANSIand as per contract shall be complied with offered technical particulars and guarantees of the contract. All expenses for such tests shall be borne by the bidder.

Supplier shall inform Purchaser by fax/e-mail at least four (4) weeks prior to scheduled testing of transformers for (THE ORGANIZATION) so that Purchaser may send representatives to witness testing if he so desires. Supplier shall promptly provide Purchaser one (1) original copy and three (3) certified copies of all test data and reports on the units being manufactured for (THE ORGANIZATION).Transformers shall not be shipped until Purchaser has examined and acknowledged receipt of all test data and accepted then for shipment.

(INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will witness the following test of not less than 1% or minimum 5 nos.(KVA rating wise)whichever is higher of total quantity ready for delivery on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises

a. Resistance measurement of all windings
b. Ratio test
c. Polarity and phase relation test
d. No-load losses at rated voltage and rated frequency
e. Excitation current at rated voltage and rated frequency

f. Impedance voltage and load loss measurement
g. Induced high voltage test
h. power frequency withstand test
i. Dielectric tests of oil
j Loss tangent / Dielectric dissipation factor test of oil
k.Lightning impulse test (1 No./KVA wise)
l.Temperature rise test (1% or 4No./KVA rating wise)

Besides (INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will perform some physical test/inspection of at least 1 (one) Transformer (KVA rating wise)of each batch on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS EN ISO 1461:1999 of all bolts & nuts connected with transformer tank, conservator, radiator etc.;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Dimension of core dia, height and measurement of weight of active parts as per demand of (INSERT THE NAME OF THE ORGANIZATION)'s inspection team;
6. Dimension of coil, inner dia & outer dia (HT & LT) etc.
7. Checking of Creepage distance of HT/LT bushings.

The dimension and weight must be as per the approved Technical Specifications/ Technical Guaranteed Data and Drawings.

The manufacturer shall have all testing facilities at the manufacturer's premises to carry out the tests in accordance with the relevant ANSI Standards. If, any test(s) pending due to lack of testing facilities at the manufacturer's premises, then the Inspection team shall select transformer(s) as sample and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s). All cost of testing of transformers including carrying, loading, un-loading etc. will be borne by the Bidder.

The Tenderer/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

The Tenderer/Manufacturer shall submit the valid Calibration Certificate from competent authority of the testing/ measuring equipments, meters etc. used for Factory test with the tender. The Supplier/Manufacturer shall also submit the following documents along with the request letter for Pre-delivery inspection:

I. Updated valid Calibration Certificates of the testing/ measuring equipments, meters etc. used for Factory test.

II. The factory test report (Routine test report) of each transformer to be supplied under the contract.

Failing to submit the above documents, the inspection team will not perform the Pre-delivery Inspection and all the liabilities along with delay (if any) will be borne by the Supplier/Manufacturer.

It is noted that at the time of Factory Test witness (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will check the calibration seal/ certificate of the testing/ measuring equipment, meters etc. by the competent authority. If the calibration seal/ certificate of the testing/ measuring equipment, meters etc. are not found and the calibration not done within the due date then (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will not witness the test. In that case the Bidder/ Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. from the competent authority within a reasonable period without any delay ofdelivery period.

B. RANDOM SAMPLE TEST AT INDEPENDENT LABORATORY:

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the tests as per Clauses No. 1.12&1.13(A) of the Tender Document. Besides that the Inspection Team will select 1 (one) Transformer (KVA rating wise) from each batch/sub package/IFB(if the total contract quantity is permitted to inspect in several batches) on random sampling basis. The selected Transformer will be sent toBUET/ RUET/ CUET/ KUET/ DUET(applicable for local manufacturer only) for performing relevant tests as per ANSI Standard. The Tests will be performed as per clause 1.13A at BUET/ RUET/ CUET/ KUET/ DUET as per ANSI standard and contract. All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

C. ACCEPTANCE OF TRANSFORMER:

If the test results of the tested sample(s) transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET fail to confirm the specification, the full consignment will be rejected.A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET.

D. POST-DELIVERY INSPECTION & TESTING

The Inspection team of (INSERT THE NAME OF THE ORGANIZATION) shall performed post-delivery inspection in presence of Bidder’s representative after the delivery of the transformers at the designated store of (INSERT THE NAME OF THE ORGANIZATION). The Bidder shall arrange the program of such inspection. Any defect or damage have been found at post-delivery inspection, the defective or damaged Transformers/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

The purchaser’s right to inspect, test (where necessary) and reject the transformer(s) after delivery at the designated store of (INSERT THE NAME OF THE ORGANIZATION) shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary, the inspection team may select 1% of the transformer (minimum 1 No. KVA rating wise) from the quantity inspected (if the total contract quantity is permitted to inspect in several batches) on random sampling basis and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s) as per Clause 1.13(A). All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

If the tests of transformer(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per Clause 1.13A from the same testing facility. If the test of any one of the selected sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his own cost.

1.14 PACKAGING:

14.1 Lumber used in the fabrication of shipping/delivery crates shall be new, sound, well seasoned and free of knots and decay.

14.2 Crates shall be provided with a skid base. Transformers shall be strapped, bolted, braced or secured to the crate base during shipment and handling.

14.3 Particular attention shall be given to protection of the porcelain bushings during shipment.

14.4 Crates shall be sufficiently strong to prevent damage from stacking and handling.

1.15 OTHER STANDARDS:

(i) The physical and performance requirements of distribution transformers based on other international recognised standards are acceptable only if the requirements of such standards are equivalent to or exceed the requirements quoted in this document.

(ii) Drawing, design and dimensions will be applicable as per entities' requirement.

TABLE-1
TRANSFORMER

BREB Item No.	KVA Rating	H.V. Bushing	L.V. Bushing	Support	Polarity
		Conductor Range	Conductor Range	Lug Type	
G-21	5	6 solid – 3 ACSR	6 solid-1/0 ACSR	A	Additive
G-4	10	6 solid – 3 ACSR	6 solid-1/0 ACSR	A	Additive
G-5	15	6 solid – 3 ACSR	6 solid-1/0 ACSR	A	Additive
G-16	25	6 solid – 3 ACSR	6 solid-4/0 ACSR	A	Additive
G-17	37.5	6 solid – 3 ACSR	6 solid-4/0 ACSR	A	Additive
G-6	50	6 solid – 3 ACSR	6 solid-4/0 ACSR	A	Additive
G-7	75	6 solid – 3 ACSR	2 solid-4/0 ACSR	B	Additive
G-8	100	6 solid – 3 ACSR	2 solid-4/0 ACSR	B	Additive
G-9	167	6 solid – 3 ACSR	Spade H	B	Additive

TABLE-2

DIMENSION OF THE TRANSFORMER TANK

REB ITEM NO.	KVA RATING	MINIMUM DIAMETER OF TANK	MINIMUM HEIGHT OF TANK
G-21	5	12"(305mm)	22"(559mm)
G-4	10	13.5"(338mm)	24"(610mm)
G-5	15	15"(381mm)	26"(660mm)
G-16	25	16"(406mm)	29"(737mm)
G-17	37.5	18"(457mm)	32"(813mm)
G-6	50	20"(508mm)	36"(914mm)
G-7	75	22"(559mm)	38"(965mm)
G-8	100	24"(610mm)	40"(1016mm)
G-9	167	26"(660mm)	44"(1118mm)

1.16 BIBLIOGRAPHY OF REFERENCE STANDARDS, (revision from 2010 to the latest revision)

1. ANSI C57.12.00 : General requirements for overhead-Type Distribution and PowerTransformers.
2. ANSI C57.12.20 : Requirements for Overhead-Type DistributionTransformers6700 Volts and Below 500 KVA and Smaller.
3. ANSI C57.12.90 : Test Code for Liquid Immersed, Distribution, Power andRegulating Transformers.
4. ANSI B18.21.1 : Lock Washers.
5. ANSI C 135.1 : American National Standard for Galvanized Steel Bolts and Nut for Over Head Line Constructions.
6. ANSI C 135 : Standard Specification for Zinc Coating (Hot-Dip) or iron and steelHardware.

PART-II

2.1 Manufacturer's Guaranteed Technical Data Schedule for 1-Phase Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Package No:
Sub-Package No:
Item: Distribution Transformer

Sl. No.	Technical Particulars	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data Specification
1	Manufacturer's Name& Address		
2	Design standard	ANSI C57.12.00 , C57.12.20 & C57.12.90 (Revisions from 2010 to the latest revision)	
3	Type	Single-phase wound core	
4	KVA Rating	To be mentioned	
5	Winding material	High conductivity Cu	
6	Core material	Cold Rolled Grain Oriented Silicon Strip Steel(CRGO)/Amorphos	
7	Nominal voltage	HT = 6350V	
		LT = 240V	
8	BIL	HT winding = 95 KV	
		LT winding = 30 KV or as per latest ANSI requirement	
9	(a) % impedance at rated KVA (For 5 KVA to 37.5 KVA)	2.5% (with + 10% Tolerance)	
	(b) % impedance at rated KVA (For 50 KVA to 167 KVA)	3% (with + 10% Tolerance)	
10	Polarity	Additive	
11	Cooling method	Class- OA (Self-cooled)	
12	Temperature rise:		
	a) Winding	Shall not exceed 65^0C (Resistance method)	
	b) Insulating liquid	Shall not exceed 65^0C	
13	Bushings		
	a) Type & material	Out door type, Porcelain	
	b) Connectors	Bolted ring type	
	c) Quantity	HT = 1, LT = 2	
	d) Mounting position	HT-on the tank cover	
		LT- on the tank side	
14	Tank		
	a) Design	Sealed type complete with cover & gasket	

Sl. No.	Technical Particulars	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data Specification
	b) Grd. Provision	With bolted ring type connector	
	c) LV grd. Provision	With removable Cu strap	
	d) Lifting facilities	Facilities for lifting the core & coil	
	e) Support lug	Shall have support lugs	
	f) Pressure release device	Self sealing pressure release device	
	g) Min.size (dxh) (mm)	As per table - 2 of specification	
	h) Painting	Light Gray, ANSI Color # 70	
15	Insulating Oil	New, unused, mineral oil as per ANSI/ ASTM D3487-79	
16	Guaranteed Load loss in Watt at rated voltage of 85^0C :		
	a) 1/2 load	To be mentioned	
	b) 3/4 load	To be mentioned	
	c) Full load	05 KVA≤120 W; 10 KVA≤190W; 15 KVA≤250 W; 25 KVA≤380 W; 37.5 KVA≤480 W; 50 KVA≤600 W; 75 KVA≤860 W; 100 KVA≤1120 W; 167KVA≤1900W	
17	Guaranteed No load loss in Watt	05 KVA≤19 W; 10 KVA≤25 W; 15 KVA≤35 W; 25 KVA≤46 W; 37.5 KVA ≤ 65 W; 50KVA≤75 W; 75 KVA≤115 W; 100 KVA≤140 W; 167 KVA≤240 W	
18	Core Loss , watt/kg (supported by loss curve)	To be mentioned	
19	HT & LT Weight of Copper with percent of purity .	To be mentioned	
20	HT & LT Conductor Sizes (Dia in mm & Area in sq.mm)	To be mentioned	
21	Current Densities (in Amps / sq.mm)	To be mentioned	
22	Number of Turns at HT & LT Side	To be mentioned	
23	Excitation current in Amp	To be mentioned	
24	Regulation at unity & 0.8 P.F	To be mentioned	
25	Full load current in amp	To be mentioned	
26	% Resistance at rated KVA	To be mentioned	
27	Efficiency at unity P.F.	To be mentioned	
	a) 1/2 load		
	b) 3/4 load		
	c) Full load		

Sl. No.	Technical Particulars	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data Specification
28	Weight in Kg.	To be mentioned	
	a) with oil		
	b) without oil		
29	Drawing showing general arrangement and out line dimension.	To be submitted with the offer.	
30	Test Reports		
	a) Routine test	Test reports must be submitted for the offered transformer. As per ANSI Standard ANSI C57.12.00 , C57.12.20 & C57.12.90 (Revisions from 2010 to the latest revision)	
	b) Temperature rise test		
	c) Impulse test		
	d) Short circuit test		
31	Loss value from test report	To be filled up from test report	
	a) No load loss in KW		
	b) Full load loss in KW at 85^0C		
32	Test Lab.	Should be reputed Independent Testing Laboratory	
33	Packing & Shipping Box	Packing shall be as per specification and Shipping box shall be per design no. 2 of Exhibit E-2 of bid document.	

Note:- 1) The bidders are required to submit all Test Reports as per clause no.1.5 In the event of non-submission of anyTest Report, **the bid shall be rejected**.

2) The no load loss of transformer shall not exceed the test report by more than 10% and the total lossesof transformer shall not exceed test report by more than 6%.

3) All weights & Dimensions will have tolerance of ±5% from the test report weights &dimensions.

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

CHAPTER-2

TECHNICAL SPECIFICATIONS OF 11/0.415KV, THREE PHASE, 250KVA DISTRIBUTION TRANSFORMER

PART-I
Technical Specifications/ Requirements of 11/0.415KV, 250KVA 3-Phase Distribution Transformer

1.1 GENERAL

This section of the document includes the design, manufacture, testing & inspection of 11/0.415KV, 250KVA, 3-Phase, Dyn11 distribution transformer as specified.

1.2 CLIMATE DATA

The distribution transformers to be supplied against this contract shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid. Maximum Humidity and Temperature sometimes occur simultaneously.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%
Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Average isokeraunic level	:	80 days/ year
Maximum altitude above the sea level	:	300 metres
Atmospherical, Mechanical and Chemical impurities	:	Moderately polluted

Transformers as specified will be installed in a hot humid environment and presence of the insects and presence of the insects and vermin locations. The information is given as a guide for Tenders and no responsibility for its accuracy will be accepted, nor any claim based on the above be entertained.

1.3 SYSTEM PARTICULARS

S/N	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
2.	Maximum System Voltage, kV	245	145	36	12
3.	System Frequency, Hz	50	50	50	50
4.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
5.	Type of System Grounding	Solid	Solid	Solid	Solid
6.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	12550	6000	1500	381
7.	Basic Insulation Level, kV	750	650	170	75
LOW VOLTAGE 415/ 240V CHARACTERISTICS					
8	Normal System Voltage, V (Voltage Class)	415/ 240			
9	Type of System Grounding	Solid			
10	Basic Insulation Level of LT	2500			

	Winding of Transformer, V	

1.4 STANDARDS

The equipment specified in this Section shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076	Power Transformers.
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils.
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	60722	Guide to lightning and switching impulse testing of power transformers.
IEC	60529-3	Protective coating of iron and steel structures against corrosion.
ASTM A90/ BS EN ISO 1461:1999		Galvanization
IEC 60296 & BS 148		Transformer Oil

1.5 SPECIFICATIONS

1.	Installation	Outdoor, Tropical, High Rainfall & Humidity
2.	Type	Stack Core or Wound Core
3.	Coolant	Mineral oil
4.	Method of Cooling	ONAN
5.	Phases	3 (Three)
6.	Frequency	50 Hz.
7.	Winding	Two windings of high conductivity copper
8.	KVA Rating	250 KVA
9.	Rated Voltage at no-load	11/0.415 kV
10.	Vector Group	Dyn11
11.	Percentage Impedance at 75^0C, %	4 %
12.	No Load Loss	520 Watts
13.	Load loss at 75^0 C	3180 Watts
14.	Maximum Temperature Rise at full load Over 40^0C ambient temperature with tap changer in principal position.	a 65^0C for Winding measured by Resistance Method.
		b 60^0C for Top Oil measured by thermometer Method.

1.5.1 MAJOR COMPONENTS

H.T WINDING :

Nominal rated voltage	11 kV
Maximum system voltage	12 kV
Basic insulation level (minimum)	75 kV
Tap Changer	+1x2.5%, 0, -3x2.5% of rated kV & all fully rated capacity. Tap Changer shall be off load type, manually operated from an external five-position mechanism.
Inter phase connection	Delta
Bushings	Porcelain, outdoors type with arcing horns of standard gap, mounted on top of tank. Quantity - 3 Nos.

Power frequency withstand voltage for one minute	28 kV

L.T. WINDING :

Nominal rated voltage	415 volts
Highest system voltage	457 volts
Inter phase connection	Y (Wye) with neutral brought out.
Bushings	Porcelain, outdoor type, mounted on the top or side (Longest side) of tank. Quantity – 4 nos.
Power frequency withstand voltage for one minute	2.5 kV

TRANSFORMER OIL :	
Application	Insulating mineral oil for Transformer. It will be free from PCB (Poly Chlorinated Biphenyl)
Grade of oil	Class-1
a) Physical Properties	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0 C	0.895 g/cm^3 (Max^m.)
Flash point (Closed cup)	140^0 C (Min^m.)
Kinematics Viscosity at -15^0 C	800 cSt. (Max^m.)
Kinematics Viscosity at 20^0 C	40 cSt. (Max^m.)
Pour point	-30^0 C (Max^m.)
b) Electrical Properties	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oils are introduced into the apparatus or equipment. The break down voltage of this oil shall be more than 50 kV.
Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 V/mm and frequency 40 Hz to 62 Hz.	0.005 (Max^m.)
c) Chemical Properties	
Neutralization value	0.03 mg KOH/g (Max^m.)
Neutralization value after oxidation	0.40 mg KOH/g (Max^m.)
Total sludge after oxidation	0.10% weight (Max^m.)
PCB Content	Free from PCB (Poly Chlorinated Biphenyl)
d) Standards	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148 : 1972, IEC-60296 or latest revision there on.

1.6 FEATURES AND ACCESSORIES

a) All bolts and nuts connected with transformer tank, conservator, radiator etc. shall be of non-ferrous metal. If it is ferrous metal, it shall be hot dip galvanized as per standard ASTM A90/ BS EN ISO 1461:1999.

b) Lugs for lifting & towing complete unit.

c) Facilities for lifting core & coil assembly.

d) Base designed for platform mounting on poles.

e) First filling of new oil shall comply to the latest revision of IEC-60296 standard or other equivalent standards.

f) Each H.T. bushing shall have bolted type bimetallic connector suitable for accommodating ACSR conductor having Dia. range from 9mm to 14.5mm.

g) Each L.T. bushing shall have bolted type bimetallic connector for accommodating copper/AAC of area range 2x95mm^2 to 2x120mm^2 depending upon the KVA rating of the transformer.

h) The L.T. bushing shall be installed on the top or side of tank lengthwise of the transformer body.

i) Dial thermometer for oil temperature mounted on L.T. side of the tank.

j) Earthing terminals at the bottom corners of Tank.

k) Name plate with transformer rating & winding diagram made of stainless steel shall have engraved letters filled with black enamel and shall be continuously welded in the transformer body.

l) The tank & radiator or flanged radiator shall be painted with two coats of gray finishing paint on suitable prime coats.

m) Transformer capacity with Sl.No. and (INSERT THE NAME OF THE ORGANIZATION) Contract No. should be marked with emboss/ engrave on the transformer tank adjacent to name plate easily visible from ground as per tender clause-1.14.6.

FOR CONSERVATOR :

a) Transformer tank completes with covers, necessary openings & gaskets.

b) Complete oil preservation system consisting of an oil conservator with shut-off valve oil level gauge. The system shall have valve for filter press inlet & oil drain. The oil sampling valve & dehydrating breather shall be provided.

1.7 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of offered 11/0.415KV, 250KVA, 3-Phase, Dyn11 distribution transformer.

b) Detail dimensional drawings of offered 11/0.415KV, 250KVA, 3-Phase, Dyn11 distribution transformer.

c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

d) Manufacturer's valid ISO 9001 Certificate.

1.8 DOCUMENTATION

The following documents are to be submitted by the Tenderer along with the Tender for the similar KVA rating of same voltage class of offered 11/0.415KV Distribution Transformer**;otherwise the bid will be rejected**:

A. COMMERCIAL

Tenderer shall be eligible as per ITT Clause No. 5 and they should submit Bid validity, Bid Bond, Bid Bond validity, Price Schedule, Delivery Schedule, Authorisation of the signatory, Tender Submission Sheet, Tenderer Information Sheet & Documentary evidence for establishing the Tenderer's Qualifications, etc. and all other documents including information related to rejection clause as per Tender Document.

B. TECHNICAL

1) Guaranteed Technical Particulars (GTP) shall be properly filled up and signed by both Manufacturer & Tenderer;

2) Letter of authorization from the Manufacturers, in case, the Bidder is not the manufacturer, in the prescribed Form;

3) 2 nos. of Manufacturer's Supply Record for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the date of bid opening in the following format (The supply record covering 25% of the tendered quantity in a single Contract will be considered only);

Sl. No.	Name, Address, Phone No., e-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of Material with Quantity	Date of Completion of Supply

4) At Least 2(two) nos. of Satisfactory Performance Certificate from Electricity utility as End User for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the year of Tender Notice. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication.

5) Type test & Special test along with Routine test report as per clause no. 1.9 for similar KVA rating of same voltage class of offered type Distribution Transformer from an independent testing laboratory as per IEC 60076. All Type Test & Special test shall be done on the same transformer (having same serial number) from an independent testing laboratory.

6) Local manufacturers, who have supplied the same offered item to [INSERT THE NAME OF THE ORGANIZATION] within the last 5 (five) years from the date of bid opening, need not to submit any Manufacturer's Supply Record with the tender proposal. In that case, they have to submit one Satisfactory Performance Certificate (within last three years) from [INSERT THE NAME OF THE OFFICE AND ORGANIZATION] for the same offered item covering 25% of the tendered quantity in a single Contract.

7) The following provision will be applicable for purchasing less or equal to 50 nos. transformers from new manufacturers.

   At least 30 (thirty) nos. of Satisfactory Performance Certificate from end users (public/private) for similar or higher KVA rating of same voltage class of offered type Distribution Transformers within last 3 (three) years from the date of bid opening. The Satisfactory Performance certificate shall be from End User's stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication. Factory shall be inspected by TEC as per following guide lines:

   1. Location of the Factory & layout plan.
   2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
   3. Factory Project Profile
   4. Production Capacity (Yearly)
   5. Production Line description.
   6. List of Key Personnel (with Bio-data)
   7. Provide sample of the Tendered product manufactured in the Factory for evaluation of TEC during factory Inspection.
   8. Testing Facilities as per IEC 60076.
   9. Warranty period 24 months from R&I issuing date.
   10. Trade License, TIN & VAT certificate.
   11. Source of raw materials.

12. A sample of the offeredtype Distribution Transformer shall be tested by TEC at manufacturer's testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.8 B 3 & 4) shall be applicable for Bid Submission and Evaluation.

1.9 TEST REPORTS

Tenderer's shall include in their offer the following routine tests, type tests and Short circuit withstands tests as prescribed in IEC-60076 for 11/0.415KV, 250KVA, 3-Phase, Dyn11 Distribution Transformer.

ROUTINE TESTS

1) Measurement of turn ratio test.
2) Vector group test.
3) Measurement of winding resistance.
4) Measurement of insulation resistance.
5) Measurement of no-load loss & no-load current.
6) Measurement of impedance voltage & load loss.
7) Dielectric withstands Tests.
8) Transformer oil tests.

TYPE TESTS

1) Impulse Voltage withstands test.
2) Temperature rise test.

SPECIAL TESTS

1) Short circuit withstand test and detail calculation along with thermal & mechanical on the basis of design data.

1.10 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of relevant ITT clauses. The capitalized cost of the Transformer losses will **be considered** for evaluation purposes.

Distribution transformers will be evaluated on the basis of following formula:

$$O = C_P + 65{,}432 \times e \times P_O + 26{,}173 \times e \times P_{FL}$$

Where: O = Evaluated Price in BDT

C_P = Quoted Price in BDT

P_O = Iron loss in KW

P_{FL} = Copper loss in KW at full load at 75□C

Guaranteed loss values must be supported by test reports from independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

b) Bidder's declared/ guaranteed no load loss and load loss value shall be within the specified value, otherwise the bid will be rejected.

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value; otherwise the bid will be rejected.

1.11 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with

deduction of money from the contract price as below :

i) Each component loss (No load loss or Full load loss) shall not exceed up to 15% of the offered component loss, provided that the total losses cannot be exceeded 10% of the offered total losses.

ii) Percentage Impedance may vary up to ± 10 % of the specified value.

iii) The purchaser can carryout the testing of any transformers during pre-delivery inspection. The testing of transformers during pre-delivery inspection will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 5 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

iv) If the results of any transformer exceeds the offered losses (each component loss exceeds more than 15% or total loss exceeds more than 10% of the offered losses) and percentage impedance exceeds ±10% of the specified percentage impedance then the whole lot will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET (both tests will be applicable for local manufacturer only) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 1.11(i), then an amount will be deducted from the Contract price for the loss(s) exceeding the offered loss(s) (No load loss or Full load loss or Both) according to the following formula :
Amount to be deducted from the Contract price

= {(Measured Loss - Offered Loss) ÷ 1000} x 20x365x24 x LLFx e x %MTx Total nos. of Transformer under the batch

Where,

Measured Loss (in watt) = Measured Average No-load Loss[*1] + Measured Average Full Load Loss[*2].

Offered Loss (in watt) = Offered No Load Loss + Offered Full load loss

Transformer Economic Life = 20 Years
LF (Load Factor) = 60%
LLF (Loss Load Factor) = $0.15xLF+0.85x(LF)^2$
e = Average Energy Selling Price Tk/KWh

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

[*1]Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

[*2]Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss]

1.12 APPROVAL OF DRAWINGS

Calculation for the Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.

1.13 A. FACTORY INSPECTION AND TEST WITNESS

The purchaser shall have the right to inspect, examine and test the materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises. The Purchaser or its representative maximum 2 (two) times may inspect the goods during the manufacturing process and shall also request for the purchase/ import/ shipping documents of copper, oil and transformer core material and shall check in accordance with Guaranteed Technical Particulars (GTP).

An inspection team will be formed by (INSERT THE NAME OF THE ORGANIZATION) immediate after signing of the contract to control the quality and monitoring the manufacturing process of the transformer. The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team. This team will witness the Factory test at the manufacturer's plant. The Manufacturer shall have facilities to carryout all tests at its premises.

Tests shall be performed in accordance with the relevant IEC & other relevant standards and as per contract shall be complied with offered technical particulars and guarantees of the contract. All expenses for such tests shall be borne by the bidder.

(INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will witness the following test of not less than 10% (KVA rating wise) of total quantity ready for delivery on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test (not less than 5%)

Besides (INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will perform some physical test of at least 1 (one) Transformer (KVA rating wise) of each batch on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS EN ISO 1461:1999 of all bolts & nuts connected with transformer tank, conservator, radiator etc.;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Dimension of core dia, height and measurement of weight of active parts as per demand of (INSERT THE NAME OF THE ORGANIZATION)'s inspection team;
6. Dimension of coil, inner dia & outer dia (HT & LT) etc.
7. Checking of Creepage distance of HT/LT bushings.

The dimension and weight must be as per the approved Technical Specifications/ Technical Guaranteed Data and Drawings.

The manufacturer shall have all testing facilities at the manufacturer's premises to carry out the tests in accordance with the relevant IEC Standards. If, any test(s) pending due to lack of testing facilities at the manufacturer's premises, then the Inspection team shall select transformer(s) as sample and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s). All cost of testing of transformers including carrying, loading, un-loading etc. will be borne by the Bidder.

The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

The Bidder /Manufacturer shall submit the valid Calibration Certificate from competent authority of the testing/ measuring equipments, meters etc. used for Factory test with the tender. The Bidder /Manufacturer shall also submit the following documents along with the request letter for Pre-delivery inspection:

I. Updated valid Calibration Certificates of the testing/ measuring equipments, meters etc. used for Factory test.

II. The factory test report (Routine test report) of each transformer to be supplied under the contract.

Failing to submit the above documents, the inspection team will not perform the Pre-delivery Inspection and all the liabilities along with delay (if any) will be borne by the Bidder/Manufacturer.

It is noted that at the time of Factory Test witness (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will check the calibration seal/ certificate of the testing/ measuring equipment, meters etc. by the competent authority. If the calibration seal/ certificate of the testing/ measuring equipment, meters etc. are not found and the calibration not done within the due date then (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will not witness the test. In that case the Bidder/ Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. from the competent authority within a reasonable period without any delay in delivery period.

B. RANDOM SAMPLE TEST DURING FACTORY INSPECTION AND WITNESS:

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the tests as per Clauses No. 1.11 & 1.13(A) of the Tender Document. Besides that the Inspection Team will select 1 (one) Transformer (KVA rating wise) from each batch (if the total contract quantity is permitted to inspect in several batches) on random sampling basis. The selected Transformer will be sent to BUET/ RUET/ CUET/ KUET/ DUET (applicable for local manufacturer only) for performing relevant tests as per IEC Standard. The Tests will be performed as per clause 1.13A at BUET/ RUET/ CUET/ KUET/ DUET as per IEC standard and contract. All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

C. ACCEPTANCE OF TRANSFORMER:

If the test results of the tested sample(s) transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET fail to confirm the specification, the full consignment will be rejected. A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET.

D. POST-DELIVERY INSPECTION & TESTING

The Inspection team of (INSERT THE NAME OF THE ORGANIZATION) shall performed post-delivery inspection in presence of bidder's representative after the delivery of the transformers at the designated store of (INSERT THE NAME OF THE ORGANIZATION). The Bidder shall arrange the program of such inspection. Any defect or damage have been found at post-delivery inspection, the defective or damaged Transformers/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

The purchaser's right to inspect, test (where necessary) and reject the transformer(s) after delivery at the designated store of (INSERT THE NAME OF THE ORGANIZATION) shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary the inspection team may select 1% of the transformer (minimum 1 no. KVA rating wise) from the quantity inspected (if the total contract quantity is permitted to inspect in several batches) on random sampling basis and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s) as per Clause 1.13(A). All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

If the tests of transformer(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per Clause 1.13(A) from the same laboratory. If the test of any one of the selected sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his own cost.

1.14 TRANSFORMER CONSTRUCTION

1.14.1 GENERAL

The transformers shall be double-wound, oil immersed naturally air cooled and conventional type with tank breathers.

The core shall be high-grade cold rolled electrical sheet steel/Amorphos. The primary and secondary windings shall be constructed form high conductivity copper. All turns of windings shall be adequately supported to prevent movement. In cases where turns are spaced out, suitable inter-turn packing shall be provided.

No material, which can be deleteriously affected by the action of oil under the operating conditions of the transformers, shall be used in the transformers or leads or bushings. Construction features shall permit local repairs to be easily carried out in the event of equipment failure.

1.14.2 TRANSFORMER TANK

The transformer tank shall be fabricated from steel and be of robust construction; all welds shall be made by the electrical arc welding process and the slag carefully removed after each run.

With the exception of radiator elements, all external joints shall be welded properly. Cooling radiators shall be of robust and simple construction. Complicated shapes shall not be acceptable, and horizontal stiffeners on tanks should be avoided. The bearing surface of the tank to which bushings are clamped shall be substantially flat.

All matching faces or joints to be made oil tight shall be finished with a smooth surface to ensure that the gasketing material will make a satisfactory joint material will make a satisfactory joint.

Flanges and covers of tanks shall be of sufficient thickness to prevent any depression occurring, which would retain water around the bolts.

Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be located such that there will be a minimum of 50 mm between the lifting chain and the nearest part of the bushings.

All transformers shall be suitable for outdoor mounting on pole platforms and shall have four mounting lugs with 19 mm dia holes suitable for bolting the transformer to the platform. The two lifting lugs shall be located 150 mm on each side of the centre line of the longest sides of the transformers.

The oil conservator shall be fitted with oil draining and oil filling gate valves, and a breather. The breather shall consist of a looped pipe fitted to the top of the transformer.

The LT Bushings shall be mounted on one of the longest side of the transformer tank. An oil level sight glass shall be fitted and marked with minimum & maximum oil level mark at ambient temperature.

All the transformer shall have the hole (dia 3mm) on the top cover and tank in 2 (two) corners for sealing purpose.

1.14.3 TRANSFORMER CORE AND COILS

Transformers core and coils must be new, unused, and clean.
Supporting frames of the core and coils of transformers shall be designed to accommodate variations in tank height.
The core and coil assembly shall have the core and coils rigidly connected to the tank and suitably closed lugs shall be provided for removing the core and coil assembly from the tank.

Transformer Sl. no. should be marked with emboss on the Supporting frames of the core and coils of each transformers minimum in 2(two) places.

1.14.4 TRANSFORMER SEALING

A satisfactory lid-sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level (COL) mark shall be provided inside each transformer marked COL.

1.14.5 FINISHES

a) Painting

Painting ferrous metal work is to be provided with an effective vapour sealing paint finish, applied generally in accordance with BS 5493 and /or other recognised international standard.

Paint shall be applied to produce a uniform film. Edges corners, crevices, welds, bolts, and rivets shall receive special attention to maintain the required thickness.

Before painting or filling with oil or compound, all un-galvanised parts shall be completely clean and free from rust, scale and grease and all external rough metal surfaces on the casting shall be filled.

The paint system shall be in accordance with best practice for hot and humid locations in a highly aggressive environment. A description of the paint system to be used and the proposed method of application shall be fully described in the Tender.

All external surfaces shall receive a minimum of three coats of paint. The primary coat shall contain an approved rust inhibitor and shall be applied as soon as possible after the completion of the surface preparation. The second coat shall be of oil and weather resisting nature and have a shade of colour easily distinguishable from the primary. The final coat shall be of oil and weather resisting and non-fading glossy paint of a colour agreed by the Engineer.

b) Non-ferrous parts and Bright Steel parts

All exposed metal liable iron corrosion during transport is to be appropriately protected by casting with an approved anti-rusting composition. Other non-ferrous parts shall be adequately protected against corrosion during shipment or in service.

c) Galvanizing

Galvanizing where applicable shall be applied by the hot dipped process generally in accordance with ASTM A90/ BS EN ISO 1461:1999 or equivalent standard of metal surface unless specified otherwise.

The zinc coating shall be smooth clean and of uniform thickness and free from defects. The preparation of galvanizing itself shall not adversely affect the mechanical properties of the coated material.

All drilling, punching, cutting, shaping and welding of parts shall be completed and all burrs shall be removed before the galvanizing process is applied.

Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

1.14.6 RATING PLATE

A brass or stainless steel rating plate shall be fitted to each transformer. The information shall deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars. The plate shall be mounted in an accessible position and preferably adjacent to the tapping switch if this is located on the side of the tank.

The rating plate shall be fitted below the LV terminals. Rating and diagram plates shall be attached by a 5 mm brass screw in each corner to 20 mm mild steel brackets continuously welded horizontally approximately 20 mm from the tank side. The following information is to be provided on the rating and diagram plate in the English language – clearly and indelibly marked.

* Transformer type
* Manufacture's name and country of origin
* Manufacturer's serial number
* Year of Manufacture
* Number of phases
* Rated power
* Rated frequency
* Rated voltages
* Rated currents
* Connection symbol
* Impedance voltage at rated current
* Type of cooling
* Total mass
* Mass of insulating oil
* Insulation levels
* Details regarding tapings

Each Transformer should be marked with emboss or welded on the body easily visible from the ground, with letters of size mentioned against each word(s)/ sentence(s) below:

(INSERT THE NAME OF THE ORGANIZATION) (40 mm)
Contract No & Date: (20 mm)
Country of Origin:
Sl. No. :--------- of ----------KVA ---------- (20 mm)

Note :

a) Sl. No. .....of .....KVA ..... is meant for particular No. of the Transformer out of the contracted quantity under this contract.

b) The above marking on the body of the transformer shall be done in addition to the normal nameplate of the transformer. The nameplate shall be continuous welded on the body of the Transformer before Pre-delivery inspection.

1.14.7 TERMINAL MARKING

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall preferably be 25 mm in height. The terminal marking shall be embossed on the body of the Transformer with respective color code.

1.14.8 TERMINAL LEADS

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

1.14.9 BUSHINGS

All bushings shall be porcelain clad, and shall be of the highest quality. They shall be sealed in a manner to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing stems, nuts and washers shall be made of brass.

1.14.10 EARTHING CONNECTIONS

Earthing connections shall be provided with connection facilities for 2x50 mm2 copper stranded conductor. The bolts shall be located on the lower side of the transformer and be of M12 size; each shall be clearly indicated with an engraved ‘earth symbol’. Two earthing connections are required on each transformer.

1.14.11 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. All gaskets shall be closed design (without open ends) and shall be one piece only.

1.14.12 OIL

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

1.14.13 TAPINGS

Five voltage tapings shall be provided on the primary side of each transformer and shall give: + 2.5%, 0,- 2.5%, – 5% and –7.5% steps of the primary nominal voltage.

The tapings shall be selected by an ‘off load’ tapping switch with an external hand wheel with provision for looking onto a selected tapping. The switch shall have a positive action designed to eliminate the possibility of stopping in an intermediate position. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service.

The voltage operating positions, together with tap change positions shall be clearly and indelibly marked.

PART-II

2.1 Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 250KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

SL. NO.	DESCRIPTION	(INSERT THE NAME OF THE ORGANIZATION)'S REQUIREMENT	MANUFACTURER'S GUARANTEED DATA
1	Manufacturer's Name & Address	To be mentioned	
2	Manufacturer's Type/ Model No.	To be mentioned	
3	KVA Rating	250	
4	Number of Phases	3	
5	Rated frequency, Hz	50	
6	Rated primary voltage, KV	11	
7	Rated no load sec. voltage, V	415	
8	Vector group	Dyn11	
9	**Highest system voltage of :**		
	a) Primary winding, KV	12	
	b) Secondary winding, V	457	
10	Basic insulation level, KV	75	
11	Power frequency withstand voltage, KV		
	a) HT Side	28	
	b) LT Side	2.5	
12	Type of cooling	ONAN	
13	**Max. Temp. Rise over 40^0C of ambient supported by Calculation (to be submitted) of Load Loss, Temperature Rise and Heat Dissipation by Radiator on the basis of Design Data:**		
	a) Windings deg. C	65	
	b) Top oil deg. C	60	
14	Type of primary tapping off load, %	+1x2.5%, 0, -3x 2.5%	
15	Percentage Impedance at 75^o C, % (supported by type test report)	4%	
16	No-load loss, Watts (supported by type test report)	520	
17	Load losses at rated full load at 75^0C, Watts (supported by type test report)	3180	
18	Magnetising current at normal voltage, Amps	To be mentioned	
19	**Efficiency at 75^0C and 100% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
20	**Efficiency at 75^0C and 75% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
21	**Efficiency at 75^0C and 50% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
22	**Efficiency at 75^0C and 25% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
23	**Regulation at full load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 250KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data
	Transformer Oil :		
24	a) Type of oil	Mineral Insulating Oil	
	b) Manufacturer's Name & Address	To be mentioned	
25	Total weight of oil, Kg	To be mentioned	
26	Breakdown Voltage at 2.5mm gap between electrodes	> 50 kV	
	Transformer Core (Stack Core or Wound Core):		
27	Manufacturer's Name & Address	To be mentioned	
28	Total weight of core, Kg	To be mentioned	
29	Material of core & grading (CRGO/Amorphos)	To be mentioned	
30	Core Loss/ Kg, supported by Characteristic Curve& Core Manufacturer's Brochure	To be mentioned	
31	Thickness of core, mm	To be mentioned	
32	Core Dia, mm	To be mentioned	
33	Max. magnetic flux density, Tesla	To be mentioned	
	Transformer Windings :		
34	Copper Conductor's Manufacturer Name & Address	To be mentioned	
35	Material of windings	copper	
36	Winding resistance of :		
	a) H.T. winding, Ohm. (per phase at 75^{o} C)	To be mentioned	
	b) L.T. winding, milli-Ohm. (per phase at 75^{o} C)	To be mentioned	
37	Current density of :		
	a) H.T. winding, Amps/sq. mm	To be mentioned	
	b) L.T. winding, Amps/sq. mm	To be mentioned	
38	Outer, Inner & Mean dia of copper winding:		
	a) H.T. winding, mm	To be mentioned	
	b) L.T. winding, mm	To be mentioned	
39	Size of Copper Conductor :		
	a) H.T. winding SWG, dia. in mm & area in mm^2	To be mentioned	
	b) L.T. winding SWG, area in mm^2	To be mentioned	
40	Number of Turns :		
	a) HT winding, nos.	To be mentioned	
	b) LT winding, nos.	To be mentioned	
41	Copper weight of windings :		
	a) HT winding, Kg	To be mentioned	
	b) LT winding, Kg	To be mentioned	
42	Total weight of copper windings, Kg	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

MANUFACTURER'S GUARANTEED TECHNICAL DATA SCHEDULEFOR 11/ 0.415 KV, 3-PHASE, 250KVA DISTRIBUTION TRANSFORMER

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

43	**Dimension of Transformer :**		
	a) Width, mm (supported by type test report)	To be mentioned	
	b) Length, mm (supported by type test report)	To be mentioned	
	c) Height, mm (supported by type test report)	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm	5, 5 & 4	
	e) Total weight of transformer tank, Kg	To be mentioned	
44	a) Total weight of active part (core, coil and other accessories), Kg	To be mentioned	
	b) Total weight of complete Transformer including fittings & oil, Kg (supported by type test report)	To be mentioned	
45	Type of breathings	To be mentioned	
46	Name of relevant IEC or other Equivalent Standards for Design, manufacture, testing and performance.	To be mentioned	
47	**Drawing :**		
	a) General Arrangement & Outline Dimensions	To be submitted	
	b) Internal Construction Details/ Sectional drawing of active parts including Insulation arrangement	To be submitted	
	c) HT & LT Bushings with dimension & current ratings	To be submitted	
	d) Cross-section &Dimensional drawing of Core & Windings	To be submitted	
	e) Radiator with detail dimensional drawing	To be submitted	
	f) Tap changer with dimension & current ratings.	To be submitted	
48	**Routine Test Report :**		
	a) Measurement of turn ratio test.	To be submitted	
	b) Vector group test.	To be submitted	
	c) Measurement of winding resistance.	To be submitted	
	d) Measurement of insulation resistance.	To be submitted	
	e) Measurement of no load loss & no-load current.	To be submitted	
	f) Measurement of impedance voltage & load loss.	To be submitted	
	g) Dielectric withstands Tests.	To be submitted	
	h) Transformer oil test (including Tan delta).	To be submitted	
49	**Type Tests report along with details test result and drawings for 11/0.415KV, 250KVA, 3-Phase, Dyn11 Distribution Transformer from an independent testing Laboratoryas per IEC 60076 Standards.**		
	a) Impulse Voltage Withstands test.	To be submitted	
	b) Temperature Rise test.	To be submitted	
50	Short-circuit Tests Report for the offered 11/0.415KV, 250KVA, 3-Phase, Dyn11 Distribution Transformer as per relevant IEC with detail test results & drawings from reputed independent testing Laboratory/ Institution and detail calculation on the basis of design data by the manufacturer.	To be submitted	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

2.2 Schedule of Manufacturers Name and places of Manufacture & Testing

Item No.	Description	Manufacture's Name	Place of Manufacture	Place of Testing & Inspection
01	11/0.415KV, 3-phase, 250KVA Distribution Transformer			

Seal and Signature of the Bidder

2.3 Schedule of Proposed Standards to which Transformers shall be provided

The Bidder shall indicate the Standard to which the materials offered by him conforms to.

Should these standards differ from the specified Standard in any respect the Bidder shall detail the differences between the proposed and specified Standard.

Item No.	Description	Standard
1.	11/0.415KV, 3-phase, 250 KVA Distribution Transformer	

Seal and Signature of the Bidder

CHAPTER-3

TECHNICAL SPECIFICATIONS OF 11/0.415KV, THREE PHASE, 200KVA DISTRIBUTION TRANSFORMER

PART-I

TECHNICAL SPECIFICATIONS/ REQUIREMENTS OF 11/0.415KV, 200KVA 3-PHASE DISTRIBUTION TRANSFORMER

1.1 GENERAL

This section of the document includes the design, manufacture, testing & inspection of 11/0.415KV, 200KVA, 3-Phase, Dyn11 distribution transformer as specified.

1.2 CLIMATE DATA

The distribution transformers to be supplied against this contract shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid. Maximum Humidity and Temperature sometimes occur simultaneously.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%
Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Average isokeraunic level	:	80 days/ year
Maximum altitude above the sea level	:	300 metres
Atmospherical, Mechanical and Chemical impurities	:	Moderately polluted

Transformers as specified will be installed in a hot humid environment and presence of the insects and presence of the insects and vermin locations. The information is given as a guide for Tenders and no responsibility for its accuracy will be accepted, nor any claim based on the above be entertained.

1.3 SYSTEM PARTICULARS

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
2.	Maximum System Voltage, kV	245	145	36	12
3.	System Frequency, Hz	50	50	50	50
4.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
5.	Type of System Grounding	Solid	Solid	Solid	Solid
6.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	12550	6000	1500	381
7.	Basic Insulation Level, kV	750	650	170	75
LOW VOLTAGE 415/ 240V CHARACTERISTICS					
8.	Normal System Voltage, V (Voltage Class)	415/ 240			
9.	Type of System Grounding	Solid			
10.	Basic Insulation Level of LT Winding of Transformer, V	2500			

1.4 STANDARDS

The equipment specified in this Section shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076	Power Transformers.
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils.
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	60722	Guide to lightning and switching impulse testing of power transformers.
IEC	60529-3	Protective coating of iron and steel structures against corrosion.
ASTM A90/ BS EN ISO 1461:1999		Galvanization
IEC 60296 & BS 148		Transformer Oil

1.5 SPECIFICATIONS

1.	Installation	Outdoor, Tropical, High Rainfall & Humidity
2.	Type	Stack Core or Wound Core
3.	Coolant	Mineral oil
4.	Method of Cooling	ONAN
5.	Phases	3 (Three)
6.	Frequency	50 Hz.
7.	Winding	Two windings of high conductivity copper
8.	KVA Rating	200 KVA
9.	Rated Voltage at no-load	11/0.415 kV
10.	Vector Group	Dyn11
11.	Percentage Impedance at 75^0C, %	4 %
12.	No Load Loss	435 Watts
13.	Load loss at 75^0 C	2820 Watts
14.	Maximum Temperature Rise at full load Over 40^0C ambient temperature with tap changer in principal position.	a) 65^0C for Winding measured by Resistance Method.
		b) 60^0C for Top Oil measured by thermometer Method.

1.5.1 MAJOR COMPONENTS

H.T WINDING :

Nominal rated voltage	11 kV
Maximum system voltage	12 kV
Basic insulation level (minimum)	75 kV
Tap Changer	+1x2.5%, 0, -3x2.5% of rated kV & all fully rated capacity. Tap Changer shall be off load type, manually operated from an external five-position mechanism.
Inter phase connection	Delta
Bushings	Porcelain, outdoors type with arcing horns of standard gap, mounted on top of tank. Quantity - 3 Nos.
Power frequency withstand voltage for one minute	28 kV

L.T. WINDING :

Nominal rated voltage	415 volts
Highest system voltage	457 volts
Inter phase connection	Y (Wye) with neutral brought out.
Bushings	Porcelain, outdoor type, mounted on the top or side (Longest side) of tank. Quantity – 4 nos.
Power frequency withstand voltage for one minute	2.5 kV

TRANSFORMER OIL :	
Application	Insulating mineral oil for Transformer. It will be free from PCB (Poly Chlorinated Biphenyl)
Grade of oil	Class-1
a) Physical Properties	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0 C	0.895 g/cm^3 (Max^m.)
Flash point (Closed cup)	140^0 C (Min^m.)
Kinematics Viscosity at -15^0 C	800 cSt. (Max^m.)
Kinematics Viscosity at 20^0 C	40 cSt. (Max^m.)
Pour point	-30^0 C (Max^m.)
b) Electrical Properties	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oils are introduced into the apparatus or equipment. The break down voltage of this oil shall be more than 50 kV.
Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 V/mm and frequency 40 Hz to 62 Hz.	0.005 (Max^m.)
c) Chemical Properties	
Neutralization value	0.03 mg KOH/g (Max^m.)
Neutralization value after oxidation	0.40 mg KOH/g (Max^m.)
Total sludge after oxidation	0.10% weight (Max^m.)
PCB Content	Free from PCB (Poly Chlorinated Biphenyl)
d) Standards	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148 : 1972, IEC-60296 or latest revision there on.

1.6 FEATURES AND ACCESSORIES

a) All bolts and nuts connected with transformer tank, conservator, radiator etc. shall be of non-ferrous metal. If it is ferrous metal, it shall be hot dip galvanized as per standard ASTM A90/ BS EN ISO 1461:1999.

b) Lugs for lifting & towing complete unit.

c) Facilities for lifting core & coil assembly.

d) Base designed for platform mounting on poles.

e) First filling of new oil shall comply to the latest revision of IEC-60296 standard or other equivalent standards.

f) Each H.T. bushing shall have bolted type bimetallic connector suitable for accommodating ACSR conductor having Dia. range from 9mm to 14.5mm.

g) Each L.T. bushing shall have bolted type bimetallic connector for accommodating copper/AAC of area range 2x95mm^2 to 2x120mm^2 depending upon the KVA rating of the transformer.

h) The L.T. bushing shall be installed on the top or side of tank lengthwise of the transformer body.

i) Dial thermometer for oil temperature mounted on L.T. side of the tank.

j) Earthing terminals at the bottom corners of Tank.

k) Name plate with transformer rating & winding diagram made of stainless steel shall have engraved letters filled with black enamel and shall be continuously welded in the transformer body.

l) The tank & radiator or flanged radiator shall be painted with two coats of gray finishing paint on suitable prime coats.

m) Transformer capacity with Sl.No. and (INSERT THE NAME OF THE ORGANIZATION) Contract No. should be marked with emboss/ engrave on the transformer tank adjacent to name plate easily visible from ground as per tender clause-1.14.6.

FOR CONSERVATOR :

a) Transformer tank completes with covers, necessary openings & gaskets.

b) Complete oil preservation system consisting of an oil conservator with shut-off valve oil level gauge. The system shall have valve for filter press inlet & oil drain. The oil sampling valve & dehydrating breather shall be provided.

1.7 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

e) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of offered 11/0.415KV, 200KVA, 3-Phase, Dyn11 distribution transformer.

f) Detail dimensional drawings of offered 11/0.415KV, 200KVA, 3-Phase, Dyn11 distribution transformer.

g) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

h) Manufacturer's valid ISO 9001 Certificate.

1.8 DOCUMENTATION

The following documents are to be submitted by the Tenderer along with the Tender for the similar KVA rating of same voltage class of offered 11/0.415KV Distribution Transformer**;otherwise the bid will be rejected**:

A. COMMERCIAL

Tenderer shall be eligible as per ITT Clause No. 5 and they should submit Bid validity, Bid Bond, Bid Bond validity, Price Schedule, Delivery Schedule, Authorisation of the signatory, Tender Submission Sheet, Tenderer Information Sheet & Documentary evidence for establishing the Tenderer's Qualifications, etc. and all other documents including information related to rejection clause as per Tender Document.

B. TECHNICAL

1) Guaranteed Technical Particulars (GTP) shall be properly filled up and signed by both Manufacturer & Tenderer;

2) Letter of authorization from the Manufacturers, in case, the Bidder is not the manufacturer, in the prescribed Form;

3) 2 nos. of Manufacturer's Supply Record for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the date of bid opening in the following format (The supply record covering 25% of the tendered quantity in a single Contract will be considered only);

Sl. No.	Name, Address, Phone No., e-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of Material with Quantity	Date of Completion of Supply

4) At Least 2(two) nos. of Satisfactory Performance Certificate from Electricity utility as End User for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the year of Tender Notice. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication.

5) Type test & Special test along with Routine test report as per clause no. 1.9 for similar KVA rating of same voltage class of offered type Distribution Transformer from an independent testing laboratory as per IEC 60076. All Type Test & Special test shall be done on the same transformer (having same serial number) from an independent testing laboratory.

6) Local manufacturers, who have supplied the same offered item to [INSERT THE NAME OF THE ORGANIZATION] within the last 5 (five) years from the date of bid opening, need not to submit any Manufacturer's Supply Record with the tender proposal. In that case, they have to submit one Satisfactory Performance Certificate (within last three years) from [INSERT THE NAME OF THE OFFICE AND ORGANIZATION]for the same offered item covering 25% of the tendered quantity in a single Contract.

7) The following provision will be applicable for purchasing less or equal to 50 nos. transformers from new manufacturers.

   At least 30 (thirty) nos. of Satisfactory Performance Certificate from end users (public/private) for similar or higher KVA rating of same voltage class of offered type Distribution Transformers within last 3 (three) years from the date of bid opening. The Satisfactory Performance certificate shall be from End User's stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication. Factory shall be inspected by TEC as per following guide lines:

   1. Location of the Factory & layout plan.
   2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
   3. Factory Project Profile
   4. Production Capacity (Yearly)
   5. Production Line description.
   6. List of Key Personnel (with Bio-data)
   7. Provide sample of the Tendered product manufactured in the Factory for evaluation of TEC during factory Inspection.
   8. Testing Facilities as per IEC 60076.
   9. Warranty period 24 months from R&I issuing date.
   10. Trade License, TIN & VAT certificate.
   11. Source of raw materials.
   12. A sample of the offeredtype Distribution Transformer shall be tested by TEC at manufacturer’s testing laboratory.

   All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.8 B 3 & 4) shall be applicable for Bid Submission and Evaluation.

1.9 TEST REPORTS

Tenderer's shall include in their offer the following routine tests, type tests and Short circuit withstands tests as prescribed in IEC-60076 for 11/0.415KV, 200KVA, 3-Phase, Dyn11 Distribution Transformer.

ROUTINE TESTS

1) Measurement of turn ratio test.
2) Vector group test.
3) Measurement of winding resistance.
4) Measurement of insulation resistance.
5) Measurement of no-load loss & no-load current.
6) Measurement of impedance voltage & load loss.
7) Dielectric withstands Tests.
8) Transformer oil tests.

TYPE TESTS

1) Impulse Voltage withstands test.
2) Temperature rise test.

SPECIAL TESTS

1) Short circuit withstand test and detail calculation along with thermal & mechanical on the basis of design data.

1.10 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of relevant ITT clauses. The capitalized cost of the Transformer losses will **be considered** for evaluation purposes.

Distribution transformers will be evaluated on the basis of following formula:

$O = C_P + 65{,}432 \times e \times P_O + 26{,}173 \times e \times P_{FL}$

Where: O = Evaluated Price in BDT

C_P = Quoted Price in BDT

P_O = Iron loss in KW

P_{FL} = Copper loss in KW at full load at 75□C

Guaranteed loss values must be supported by test reports from independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

b) Bidder's declared/ guaranteed no load loss and load loss value shall be within the specified value, otherwise the bid will be rejected.

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value; otherwise the bid will be rejected.

1.11 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with deduction of money from the contract price as below :

i) Each component loss (No load loss or Full load loss) shall not exceed up to 15% of the offered component loss, provided that the total losses cannot be exceeded 10% of the offered total losses.

ii) Percentage Impedance may vary up to ± 10 % of the specified value.

iii) The purchaser can carryout the testing of any transformers during pre-delivery inspection. The testing of transformers during pre-delivery inspection will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 5 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

iv) If the results of any transformer exceeds the offered losses (each component loss exceeds more than 15% or total loss exceeds more than 10% of the offered losses) and percentage impedance exceeds ±10% of the specified percentage impedance then the whole lot will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET (both tests will be applicable for local manufacturer only) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 1.11(i), then an amount will be deducted from the Contract price for the loss(s) exceeding the offered loss(s) (No load loss or Full load loss or Both) according to the following formula :

Amount to be deducted from the Contract price

= {(Measured Loss - Offered Loss) ÷ 1000} x 20x365x24 x LLFx e x %MTx Total nos. of Transformer under the batch

Where,

Measured Loss (in watt) = Measured Average No-load Loss[*1] + Measured Average Full Load Loss[*2].

Offered Loss (in watt) = Offered No Load Loss + Offered Full load loss

Transformer Economic Life = 20 Years
LF (Load Factor) = 60%
LLF (Loss Load Factor) = $0.15xLF+0.85x(LF)^2$
e = Average Energy Selling Price Tk/KWh

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

[*1]Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

[*2]Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss]

1.12 APPROVAL OF DRAWINGS

Calculation for the Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.

1.13 A. FACTORY INSPECTION AND TEST WITNESS

The purchaser shall have the right to inspect, examine and test the materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises. The Purchaser or its representative maximum 2 (two) times may inspect the goods during the manufacturing process and shall also request for the purchase/

import/ shipping documents of copper, oil and transformer core material and shall check in accordance with Guaranteed Technical Particulars (GTP).

An inspection team will be formed by (INSERT THE NAME OF THE ORGANIZATION) immediate after signing of the contract to control the quality and monitoring the manufacturing process of the transformer. The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team. This team will witness the Factory test at the manufacturer's plant. The Manufacturer shall have facilities to carryout all tests at its premises.

Tests shall be performed in accordance with the relevant IEC & other relevant standards and as per contract shall be complied with offered technical particulars and guarantees of the contract. All expenses for such tests shall be borne by the bidder.

(INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will witness the following test of not less than 10% (KVA rating wise) of total quantity ready for delivery on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test (not less than 5%)

Besides (INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will perform some physical test of at least 1 (one) Transformer (KVA rating wise) of each batch on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS EN ISO 1461:1999 of all bolts & nuts connected with transformer tank, conservator, radiator etc.;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Dimension of core dia, height and measurement of weight of active parts as per demand of (INSERT THE NAME OF THE ORGANIZATION)'s inspection team;
6. Dimension of coil, inner dia & outer dia (HT & LT) etc.
7. Checking of Creepage distance of HT/LT bushings.

The dimension and weight must be as per the approved Technical Specifications/ Technical Guaranteed Data and Drawings.

The manufacturer shall have all testing facilities at the manufacturer's premises to carry out the tests in accordance with the relevant IEC Standards. If, any test(s) pending due to lack of testing facilities at the manufacturer's premises, then the Inspection team shall select transformer(s) as sample and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s). All cost of testing of transformers including carrying, loading, un-loading etc. will be borne by the Bidder.

The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

The Bidder /Manufacturer shall submit the valid Calibration Certificate from competent authority of the testing/ measuring equipments, meters etc. used for Factory test with the tender. The Bidder /Manufacturer shall also submit the following documents along with the request letter for Pre-delivery inspection:

I. Updated valid Calibration Certificates of the testing/ measuring equipments, meters etc. used for Factory test.

II. The factory test report (Routine test report) of each transformer to be supplied under the contract.

Failing to submit the above documents, the inspection team will not perform the Pre-delivery Inspection and all the liabilities along with delay (if any) will be borne by the Bidder/Manufacturer.

It is noted that at the time of Factory Test witness (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will check the calibration seal/ certificate of the testing/ measuring equipment, meters etc. by the competent authority. If the calibration seal/ certificate of the testing/ measuring equipment, meters etc. are not found and the calibration not done within the due date then (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will not witness the test. In that case the Bidder/ Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. from the competent authority within a reasonable period without any delay in delivery period.

B. RANDOM SAMPLE TEST DURING FACTORY INSPECTION AND WITNESS:

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the tests as per Clauses No. 1.11 & 1.13(A) of the Tender Document. Besides that the Inspection Team will select 1 (one) Transformer (KVA rating wise) from each batch (if the total contract quantity is permitted to inspect in several batches) on random sampling basis. The selected Transformer will be sent to BUET/ RUET/ CUET/ KUET/ DUET (applicable for local manufacturer only) for performing relevant tests as per IEC Standard. The Tests will be performed as per clause 1.13A at BUET/ RUET/ CUET/ KUET/ DUET as per IEC standard and contract. All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

C. ACCEPTANCE OF TRANSFORMER:

If the test results of the tested sample(s) transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET fail to confirm the specification, the full consignment will be rejected. A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET.

D. POST-DELIVERY INSPECTION & TESTING

The Inspection team of (INSERT THE NAME OF THE ORGANIZATION) shall performed post-delivery inspection in presence of bidder's representative after the delivery of the transformers at the designated store of (INSERT THE NAME OF THE ORGANIZATION). The Bidder shall arrange the program of such inspection. Any defect or damage have been found at post-delivery inspection, the defective or damaged Transformers/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

The purchaser’s right to inspect, test (where necessary) and reject the transformer(s) after delivery at the designated store of (INSERT THE NAME OF THE ORGANIZATION) shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary the inspection team may select 1% of the transformer (minimum 1 no. KVA rating wise) from the quantity inspected (if the total contract quantity is permitted to inspect in several batches) on random sampling basis and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s) as per Clause 1.13(A). All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

If the tests of transformer(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per Clause 1.13(A) from the same laboratory. If the test of any one of the selected sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his own cost.

1.14 TRANSFORMER CONSTRUCTION

1.14.1 GENERAL

The transformers shall be double-wound, oil immersed naturally air cooled and conventional type with tank breathers.

The core shall be high-grade cold rolled electrical sheet steel/Amorphos. The primary and secondary windings shall be constructed form high conductivity copper. All turns of windings shall be adequately supported to prevent movement. In cases where turns are spaced out, suitable inter-turn packing shall be provided.

No material, which can be deleteriously affected by the action of oil under the operating conditions of the transformers, shall be used in the transformers or leads or bushings. Construction features shall permit local repairs to be easily carried out in the event of equipment failure.

1.14.2 TRANSFORMER TANK

The transformer tank shall be fabricated from steel and be of robust construction; all welds shall be made by the electrical arc welding process and the slag carefully removed after each run.

With the exception of radiator elements, all external joints shall be welded properly. Cooling radiators shall be of robust and simple construction. Complicated shapes shall not be acceptable, and horizontal stiffeners on tanks should be avoided. The bearing surface of the tank to which bushings are clamped shall be substantially flat.

All matching faces or joints to be made oil tight shall be finished with a smooth surface to ensure that the gasketing material will make a satisfactory joint material will make a satisfactory joint.

Flanges and covers of tanks shall be of sufficient thickness to prevent any depression occurring, which would retain water around the bolts.

Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be located such that there will be a minimum of 50 mm between the lifting chain and the nearest part of the bushings.

All transformers shall be suitable for outdoor mounting on pole platforms and shall have four mounting lugs with 19 mm dia holes suitable for bolting the transformer to the platform. The two lifting lugs shall be located 150 mm on each side of the centre line of the longest sides of the transformers.

The oil conservator shall be fitted with oil draining and oil filling gate valves, and a breather. The breather shall consist of a looped pipe fitted to the top of the transformer.

The LT Bushings shall be mounted on one of the longest side of the transformer tank. An oil level sight glass shall be fitted and marked with minimum & maximum oil level mark at ambient temperature.

All the transformer shall have the hole (dia 3mm) on the top cover and tank in 2 (two) corners for sealing purpose.

1.14.3 Transformer Core and Coils

Transformers core and coils must be new, unused, and clean.

Supporting frames of the core and coils of transformers shall be designed to accommodate variations in tank height.

The core and coil assembly shall have the core and coils rigidly connected to the tank and suitably closed lugs shall be provided for removing the core and coil assembly from the tank.

Transformer Sl. no. should be marked with emboss on the Supporting frames of the core and coils of each transformers minimum in 2(two) places.

1.14.4 Transformer Sealing

A satisfactory lid-sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level (COL) mark shall be provided inside each transformer marked COL.

1.14.5 Finishes

a) Painting

Painting ferrous metal work is to be provided with an effective vapour sealing paint finish, applied generally in accordance with BS 5493 and /or other recognised international standard.

Paint shall be applied to produce a uniform film. Edges corners, crevices, welds, bolts, and rivets shall receive special attention to maintain the required thickness.

Before painting or filling with oil or compound, all un-galvanised parts shall be completely clean and free from rust, scale and grease and all external rough metal surfaces on the casting shall be filled.

The paint system shall be in accordance with best practice for hot and humid locations in a highly aggressive environment. A description of the paint system to be used and the proposed method of application shall be fully described in the Tender.

All external surfaces shall receive a minimum of three coats of paint. The primary coat shall contain an approved rust inhibitor and shall be applied as soon as possible after the completion of the surface preparation. The second coat shall be of oil and weather resisting nature and have a shade of colour easily distinguishable from the primary. The final coat shall be of oil and weather resisting and non-fading glossy paint of a colour agreed by the Engineer.

b) Non-ferrous parts and Bright Steel parts

All exposed metal liable iron corrosion during transport is to be appropriately protected by casting with an approved anti-rusting composition. Other non-ferrous parts shall be adequately protected against corrosion during shipment or in service.

c) Galvanizing

Galvanizing where applicable shall be applied by the hot dipped process generally in accordance with ASTM A90/ BS EN ISO 1461:1999 or equivalent standard of metal surface unless specified otherwise.

The zinc coating shall be smooth clean and of uniform thickness and free from defects. The preparation of galvanizing itself shall not adversely affect the mechanical properties of the coated material.

All drilling, punching, cutting, shaping and welding of parts shall be completed and all burrs shall be removed before the galvanizing process is applied.

Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

1.14.6 RATING PLATE

A brass or stainless steel rating plate shall be fitted to each transformer. The information shall deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars. The plate shall be mounted in an accessible position and preferably adjacent to the tapping switch if this is located on the side of the tank.

The rating plate shall be fitted below the LV terminals. Rating and diagram plates shall be attached by a 5 mm brass screw in each corner to 20 mm mild steel brackets continuously welded horizontally approximately 20 mm from the tank side. The following information is to be provided on the rating and diagram plate in the English language – clearly and indelibly marked.

* Transformer type
* Manufacture's name and country of origin
* Manufacturer's serial number
* Year of Manufacture
* Number of phases
* Rated power
* Rated frequency
* Rated voltages
* Rated currents
* Connection symbol
* Impedance voltage at rated current
* Type of cooling
* Total mass
* Mass of insulating oil
* Insulation levels
* Details regarding tapings

Each Transformer should be marked with emboss or welded on the body easily visible from the ground, with letters of size mentioned against each word(s)/ sentence(s) below:

(INSERT THE NAME OF THE ORGANIZATION) (40 mm)

Contract No & Date: (20 mm)

Country of Origin:

Sl. No. :--------- of ----------KVA ---------- (20 mm)

Note :

a) Sl. No. .....of .....KVA ..... is meant for particular No. of the Transformer out of the contracted quantity under this contract.

b) The above marking on the body of the transformer shall be done in addition to the normal nameplate of the transformer. The nameplate shall be continuous welded on the body of the Transformer before Pre-delivery inspection.

1.14.7 TERMINAL MARKING

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall preferably be 25 mm in height. The terminal marking shall be embossed on the body of the Transformer with respective color code.

1.14.8 TERMINAL LEADS

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

1.14.9 BUSHINGS

All bushings shall be porcelain clad, and shall be of the highest quality. They shall be sealed in a manner to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing stems, nuts and washers shall be made of brass.

1.14.10 EARTHING CONNECTIONS

Earthing connections shall be provided with connection facilities for 2x50 mm2 copper stranded conductor. The bolts shall be located on the lower side of the transformer and be of M12 size; each shall be clearly indicated with an engraved ‘earth symbol’. Two earthing connections are required on each transformer.

1.14.11 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. All gaskets shall be closed design (without open ends) and shall be one piece only.

1.14.12 OIL

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

1.14.13 TAPINGS

Five voltage tapings shall be provided on the primary side of each transformer and shall give: + 2.5%, 0,- 2.5%, – 5% and –7.5% steps of the primary nominal voltage.

The tapings shall be selected by an ‘off load’ tapping switch with an external hand wheel with provision for looking onto a selected tapping. The switch shall have a positive action designed to eliminate the possibility of stopping in an intermediate position. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service.

The voltage operating positions, together with tap change positions shall be clearly and indelibly marked.

PART-II

2.1 Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 200KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

SL. NO.	DESCRIPTION	(INSERT THE NAME OF THE ORGANIZATION)'S REQUIREMENT	MANUFACTURER'S GUARANTEED DATA
1	Manufacturer's Name & Address	To be mentioned	
2	Manufacturer's Type/ Model No.	To be mentioned	
3	KVA Rating	200	
4	Number of Phases	3	
5	Rated frequency, Hz	50	
6	Rated primary voltage, KV	11	
7	Rated no load sec. voltage, V	415	
8	Vector group	Dyn11	
9	**Highest system voltage of :**		
	a) Primary winding, KV	12	
	b) Secondary winding, V	457	
10	Basic insulation level, KV	75	
11	Power frequency withstand voltage, KV		
	a) HT Side	28	
	b) LT Side	2.5	
12	Type of cooling	ONAN	
13	**Max. Temp. Rise over 40^0C of ambient supported by Calculation (to be submitted) of Load Loss, Temperature Rise and Heat Dissipation by Radiator on the basis of Design Data:**		
	a) Windings deg. C	65	
	b) Top oil deg. C	60	
14	Type of primary tapping off load, %	+1x2.5%, 0, -3x 2.5%	
15	Percentage Impedance at 75^o C, % (supported by type test report)	4%	
16	No-load loss, Watts (supported by type test report)	435	
17	Load losses at rated full load at 75^0C, Watts (supported by type test report)	2820	
18	Magnetising current at normal voltage, Amps	To be mentioned	
19	**Efficiency at 75^0C and 100% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
20	**Efficiency at 75^0C and 75% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
21	**Efficiency at 75^0C and 50% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
22	**Efficiency at 75^0C and 25% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
23	**Regulation at full load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 200KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data
	Transformer Oil :		
24	a) Type of oil	Mineral Insulating Oil	
	b) Manufacturer's Name & Address	To be mentioned	
25	Total weight of oil, Kg	To be mentioned	
26	Breakdown Voltage at 2.5mm gap between electrodes	> 50 kV	
	Transformer Core (Stack Core or Wound Core):		
27	Manufacturer's Name & Address	To be mentioned	
28	Total weight of core, Kg	To be mentioned	
29	Material of core & grading (CRGO/Amorphos)	To be mentioned	
30	Core Loss/ Kg, supported by Characteristic Curve& Core Manufacturer's Brochure	To be mentioned	
31	Thickness of core, mm	To be mentioned	
32	Core Dia, mm	To be mentioned	
33	Max. magnetic flux density, Tesla	To be mentioned	
	Transformer Windings :		
34	Copper Conductor's Manufacturer Name & Address	To be mentioned	
35	Material of windings	Copper	
36	Winding resistance of :		
	a) H.T. winding, Ohm. (per phase at 75^{o} C)	To be mentioned	
	b) L.T. winding, milli-Ohm. (per phase at 75^{o} C)	To be mentioned	
37	Current density of :		
	a) H.T. winding, Amps/sq. mm	To be mentioned	
	b) L.T. winding, Amps/sq. mm	To be mentioned	
38	Outer, Inner & Mean dia of copper winding:		
	a) H.T. winding, mm	To be mentioned	
	b) L.T. winding, mm	To be mentioned	
39	Size of Copper Conductor :		
	a) H.T. winding SWG, dia. in mm & area in mm^2	To be mentioned	
	b) L.T. winding SWG, area in mm^2	To be mentioned	
40	Number of Turns :		
	a) HT winding, nos.	To be mentioned	
	b) LT winding, nos.	To be mentioned	
41	Copper weight of windings :		
	a) HT winding, Kg	To be mentioned	
	b) LT winding, Kg	To be mentioned	
42	Total weight of copper windings, Kg	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 200KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

43	**Dimension of Transformer :**		
	a) Width, mm (supported by type test report)	To be mentioned	
	b) Length, mm (supported by type test report)	To be mentioned	
	c) Height, mm (supported by type test report)	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm	5, 4 & 3	
	e) Total weight of transformer tank, Kg	To be mentioned	
44	a) Total weight of active part (core, coil and other accessories), Kg	To be mentioned	
	b) Total weight of complete Transformer including fittings & oil, Kg (supported by type test report)	To be mentioned	
45	Type of breathings	To be mentioned	
46	Name of relevant IEC or other Equivalent Standards for Design, manufacture, testing and performance.	To be mentioned	
47	**Drawing :**		
	a) General Arrangement & Outline Dimensions	To be submitted	
	b) Internal Construction Details/ Sectional drawing of active parts including Insulation arrangement	To be submitted	
	c) HT & LT Bushings with dimension & current ratings	To be submitted	
	d) Cross-section &Dimensional drawing of Core & Windings	To be submitted	
	e) Radiator with detail dimensional drawing	To be submitted	
	f) Tap changer with dimension & current ratings.	To be submitted	
48	**Routine Test Report :**		
	a) Measurement of turn ratio test.	To be submitted	
	b) Vector group test.	To be submitted	
	c) Measurement of winding resistance.	To be submitted	
	d) Measurement of insulation resistance.	To be submitted	
	e) Measurement of no load loss & no-load current.	To be submitted	
	f) Measurement of impedance voltage & load loss.	To be submitted	
	g) Dielectric withstands Tests.	To be submitted	
	h) Transformer oil test (including Tan delta).	To be submitted	
49	**Type Tests report along with details test result and drawings for 11/0.415KV, 200KVA, 3-Phase, Dyn11 Distribution Transformer from an independent testing Laboratoryas per IEC 60076 Standards.**		
	a) Impulse Voltage Withstands test.	To be submitted	
	b) Temperature Rise test.	To be submitted	
50	Short-circuit Tests Report for the offered 11/0.415KV, 200KVA, 3-Phase, Dyn11 Distribution Transformer as per relevant IEC with detail test results & drawings from reputed independent testing Laboratory/ Institution and detail calculation on the basis of design data by the manufacturer.	To be submitted	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

2.2 Schedule of Manufacturers Name and places of Manufacture & Testing

Item No.	Description	Manufacture's Name	Place of Manufacture	Place of Testing & Inspection
01	11/0.415KV, 3-phase, 200KVA Distribution Transformer			

Seal and Signature of the Bidder

2.3 Schedule of Proposed Standards to which Transformers shall be provided

The Bidder shall indicate the Standard to which the materials offered by him conforms to.

Should these standards differ from the specified Standard in any respect the Bidder shall detail the differences between the proposed and specified Standard.

Item No.	Description	Standard
1.	11/0.415KV, 3-phase, 200 KVA Distribution Transformer	

Seal and Signature of the Bidder

CHAPTER-4

TECHNICAL SPECIFICATIONS OF 11/0.415KV, THREE PHASE, 100KVA DISTRIBUTION TRANSFORMER

PART-I

TECHNICAL SPECIFICATIONS/ REQUIREMENTS OF 11/0.415KV, 100KVA 3-PHASE DISTRIBUTION TRANSFORMER

1.1 GENERAL

This section of the document includes the design, manufacture, testing & inspection of 11/0.415KV, 100KVA, 3-Phase, Dyn11 distribution transformer as specified.

1.2 CLIMATE DATA

The distribution transformers to be supplied against this contract shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid. Maximum Humidity and Temperature sometimes occur simultaneously.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%
Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Average isokeraunic level	:	80 days/ year
Maximum altitude above the sea level	:	300 metres
Atmospherical, Mechanical and Chemical impurities	:	Moderately polluted

Transformers as specified will be installed in a hot humid environment and presence of the insects and presence of the insects and vermin locations. The information is given as a guide for Tenders and no responsibility for its accuracy will be accepted, nor any claim based on the above be entertained.

1.3 SYSTEM PARTICULARS

S/N	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
2.	Maximum System Voltage, kV	245	145	36	12
3.	System Frequency, Hz	50	50	50	50
4.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
5.	Type of System Grounding	Solid	Solid	Solid	Solid
6.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	12550	6000	1500	381
7.	Basic Insulation Level, kV	750	650	170	75
LOW VOLTAGE 415/ 240V CHARACTERISTICS					
8	Normal System Voltage, V (Voltage Class)	415/ 240			
9	Type of System Grounding	Solid			
10	Basic Insulation Level of LT Winding of Transformer, V	2500			

1.4 STANDARDS

The equipment specified in this Section shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076	Power Transformers.
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils.
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	60722	Guide to lightning and switching impulse testing of power transformers.
IEC	60529-3	Protective coating of iron and steel structures against corrosion.
ASTM A90/ BS EN ISO 1461:1999		Galvanization
IEC 60296 & BS 148		Transformer Oil

1.5 SPECIFICATIONS

1.	Installation	Outdoor, Tropical, High Rainfall & Humidity
2.	Type	Stack Core or Wound Core
3.	Coolant	Mineral oil
4.	Method of Cooling	ONAN
5.	Phases	3 (Three)
6.	Frequency	50 Hz.
7.	Winding	Two windings of high conductivity copper
8.	KVA Rating	100 KVA
9.	Rated Voltage at no-load	11/0.415 kV
10.	Vector Group	Dyn11
11.	Percentage Impedance at 75^0C, %	4 %
12.	No Load Loss	245 Watts
13.	Load loss at 75^0 C	1635 Watts
14.	Maximum Temperature Rise at full load Over 40^0C ambient temperature with tap changer in principal position.	a) 65^0C for Winding measured by Resistance Method.
		b) 60^0C for Top Oil measured by thermometer Method.

1.5.1 MAJOR COMPONENTS

H.T WINDING :

Nominal rated voltage	11 kV
Maximum system voltage	12 kV
Basic insulation level (minimum)	75 kV
Tap Changer	+1x2.5%, 0, -3x2.5% of rated kV & all fully rated capacity. Tap Changer shall be off load type, manually operated from an external five-position mechanism.
Inter phase connection	Delta
Bushings	Porcelain, outdoors type with arcing horns of standard gap, mounted on top of tank. Quantity - 3 Nos.
Power frequency withstand voltage for one minute	28 kV

L.T. WINDING :

Nominal rated voltage	415 volts
Highest system voltage	457 volts
Inter phase connection	Y (Wye) with neutral brought out.
Bushings	Porcelain, outdoor type, mounted on the top or side (Longest side) of tank. Quantity – 4 nos.
Power frequency withstand voltage for one minute	2.5 kV

TRANSFORMER OIL :	
Application	Insulating mineral oil for Transformer. It will be free from PCB (Poly Chlorinated Biphenyl)
Grade of oil	Class-1
a) Physical Properties	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0 C	0.895 g/cm^3 (Max^m.)
Flash point (Closed cup)	140^0 C (Min^m.)
Kinematics Viscosity at -15^0 C	800 cSt. (Max^m.)
Kinematics Viscosity at 20^0 C	40 cSt. (Max^m.)
Pour point	-30^0 C (Max^m.)
b) Electrical Properties	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oils are introduced into the apparatus or equipment. The break down voltage of this oil shall be more than 50 kV.
Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 V/mm and frequency 40 Hz to 62 Hz.	0.005 (Max^m.)
c) Chemical Properties	
Neutralization value	0.03 mg KOH/g (Max^m.)
Neutralization value after oxidation	0.40 mg KOH/g (Max^m.)
Total sludge after oxidation	0.10% weight (Max^m.)
PCB Content	Free from PCB (Poly Chlorinated Biphenyl)
d) Standards	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148 : 1972, IEC-60296 or latest revision there on.

1.6 FEATURES AND ACCESSORIES

a) All bolts and nuts connected with transformer tank, conservator, radiator etc. shall be of non-ferrous metal. If it is ferrous metal, it shall be hot dip galvanized as per standard ASTM A90/ BS EN ISO 1461:1999.

b) Lugs for lifting & towing complete unit.

c) Facilities for lifting core & coil assembly.

d) Base designed for platform mounting on poles.

e) First filling of new oil shall comply to the latest revision of IEC-60296 standard or other equivalent standards.

f) Each H.T. bushing shall have bolted type bimetallic connector suitable for accommodating ACSR conductor having Dia. range from 9mm to 14.5mm.

g) Each L.T. bushing shall have bolted type bimetallic connector for accommodating copper/AAC of area range 2x95mm^2 to 2x120mm^2 depending upon the KVA rating of the transformer.

h) The L.T. bushing shall be installed on the top or side of tank lengthwise of the transformer body.

i) Dial thermometer for oil temperature mounted on L.T. side of the tank.

j) Earthing terminals at the bottom corners of Tank.

k) Name plate with transformer rating & winding diagram made of stainless steel shall have engraved letters filled with black enamel and shall be continuously welded in the transformer body.

l) The tank & radiator or flanged radiator shall be painted with two coats of gray finishing paint on suitable prime coats.

m) Transformer capacity with Sl.No. and (INSERT THE NAME OF THE ORGANIZATION) Contract No. should be marked with emboss/ engrave on the transformer tank adjacent to name plate easily visible from ground as per tender clause-1.14.6.

FOR CONSERVATOR :

a) Transformer tank completes with covers, necessary openings & gaskets.

b) Complete oil preservation system consisting of an oil conservator with shut-off valve oil level gauge. The system shall have valve for filter press inlet & oil drain. The oil sampling valve & dehydrating breather shall be provided.

1.7 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

i) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of offered 11/0.415KV, 100KVA, 3-Phase, Dyn11 distribution transformer.

j) Detail dimensional drawings of offered 11/0.415KV, 100KVA, 3-Phase, Dyn11 distribution transformer.

k) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

l) Manufacturer's valid ISO 9001 Certificate.

1.8 DOCUMENTATION

The following documents are to be submitted by the Tenderer along with the Tender for the similar KVA rating of same voltage class of offered 11/0.415KV Distribution Transformer**;otherwise the bid will be rejected**:

A. COMMERCIAL

Tenderer shall be eligible as per ITT Clause No. 5 and they should submit Bid validity, Bid Bond, Bid Bond validity, Price Schedule, Delivery Schedule, Authorisation of the signatory, Tender Submission Sheet, Tenderer Information Sheet & Documentary evidence for establishing the Tenderer's Qualifications, etc. and all other documents including information related to rejection clause as per Tender Document.

B. TECHNICAL

1) Guaranteed Technical Particulars (GTP) shall be properly filled up and signed by both Manufacturer & Tenderer;

2) Letter of authorization from the Manufacturers, in case, the Bidder is not the manufacturer, in the prescribed Form;

3) 2 nos. of Manufacturer's Supply Record for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the date of bid opening in the following format (The supply record covering 25% of the tendered quantity in a single Contract will be considered only).

Sl. No.	Name, Address, Phone No., e-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of Material with Quantity	Date of Completion of Supply

4) At Least 2(two) nos. of Satisfactory Performance Certificate from Electricity utility as End User for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the year of Tender Notice. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication.

5) Type test & Special test along with Routine test report as per clause no. 7.9 for similar KVA rating of same voltage class of offered type Distribution Transformer from an independent testing laboratory as per IEC 60076. All Type Test & Special test shall be done on the same transformer (having same serial number) from an independent testing laboratory.

6) Local manufacturers, who have supplied the same offered item to [INSERT THE NAME OF THE ORGANIZATION] within the last 5 (five) years from the date of bid opening, need not to submit any Manufacturer's Supply Record with the tender proposal. In that case, they have to submit one Satisfactory Performance Certificate (within last three years) from [INSERT THE NAME OF THE OFFICE AND ORGANIZATION] for the same offered item covering 25% of the tendered quantity in a single Contract.

7) The following provision will be applicable for purchasing less or equal to 50 nos. transformers from new manufacturers.

   At least 30 (thirty) nos. of Satisfactory Performance Certificate from end users (public/private) for similar or higher KVA rating of same voltage class of offered type Distribution Transformers within last 3 (three) years from the date of bid opening. The Satisfactory Performance certificate shall be from End User's stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication. Factory shall be inspected by TEC as per following guide lines:

   1. Location of the Factory & layout plan.
   2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
   3. Factory Project Profile
   4. Production Capacity (Yearly)
   5. Production Line description.
   6. List of Key Personnel (with Bio-data)
   7. Provide sample of the Tendered product manufactured in the Factory for evaluation of TEC during factory Inspection.
   8. Testing Facilities as per IEC 60076.
   9. Warranty period 24 months from R&I issuing date.
   10. Trade License, TIN & VAT certificate.
   11. Source of raw materials.
   12. A sample of the offeredtype Distribution Transformer shall be tested by TEC at manufacturer’s testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.8 B 3 & 4) shall be applicable for Bid Submission and Evaluation.

1.9 TEST REPORTS

Tenderer's shall include in their offer the following routine tests, type tests and Short circuit withstands tests as prescribed in IEC-60076 for 11/0.415KV, 100KVA, 3-Phase, Dyn11 Distribution Transformer.

ROUTINE TESTS

1) Measurement of turn ratio test.
2) Vector group test.
3) Measurement of winding resistance.
4) Measurement of insulation resistance.
5) Measurement of no-load loss & no-load current.
6) Measurement of impedance voltage & load loss.
7) Dielectric withstands Tests.
8) Transformer oil tests.

TYPE TESTS

1) Impulse Voltage withstands test.
2) Temperature rise test.

SPECIAL TESTS

1) Short circuit withstand test and detail calculation along with thermal & mechanical on the basis of design data.

1.10 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of relevant ITT clauses. The capitalized cost of the Transformer losses will **be considered** for evaluation purposes.

Distribution transformers will be evaluated on the basis of following formula:

$O = C_P + 65{,}432 \times e \times P_O + 26{,}173 \times e \times P_{FL}$

Where: O = Evaluated Price in BDT

C_P = Quoted Price in BDT

P_O = Iron loss in KW

P_{FL} = Copper loss in KW at full load at 75□C

Guaranteed loss values must be supported by test reports from independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

b) Bidder's declared/ guaranteed no load loss and load loss value shall be within the specified value, otherwise the bid will be rejected.

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value; otherwise the bid will be rejected.

1.11 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with deduction of money from the contract price as below :

i) Each component loss (No load loss or Full load loss) shall not exceed up to 15% of the offered component loss, provided that the total losses cannot be exceeded 10% of the offered total losses.

ii) Percentage Impedance may vary up to ± 10 % of the specified value.

iii) The purchaser can carryout the testing of any transformers during pre-delivery inspection. The testing of transformers during pre-delivery inspection will not be less than 10% at

random basis of the transformer ready for inspection but in any case it will not be less than 5 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

iv) If the results of any transformer exceeds the offered losses (each component loss exceeds more than 15% or total loss exceeds more than 10% of the offered losses) and percentage impedance exceeds ±10% of the specified percentage impedance then the whole lot will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET (both tests will be applicable for local manufacturer only) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 1.11(i), then an amount will be deducted from the Contract price for the loss(s) exceeding the offered loss(s) (No load loss or Full load loss or Both) according to the following formula :
Amount to be deducted from the Contract price

= {(Measured Loss - Offered Loss) ÷ 1000} x 20x365x24 x LLFx e x %MTx Total nos. of Transformer under the batch

Where,

Measured Loss (in watt) = Measured Average No-load Loss[*1] + Measured Average Full Load Loss[*2].

Offered Loss (in watt) = Offered No Load Loss + Offered Full load loss

Transformer Economic Life = 20 Years
LF (Load Factor) = 60%
LLF (Loss Load Factor) = $0.15xLF+0.85x(LF)^2$
e = Average Energy Selling Price Tk/KWh

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

[*1]Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

[*2]Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss]

1.12 APPROVAL OF DRAWINGS

Calculation for the Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.

1.13 A. FACTORY INSPECTION AND TEST WITNESS

The purchaser shall have the right to inspect, examine and test the materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises. The Purchaser or its representative maximum 2 (two) times may inspect the goods during the manufacturing process and shall also request for the purchase/ import/ shipping documents of copper, oil and transformer core material and shall check in accordance with Guaranteed Technical Particulars (GTP).

An inspection team will be formed by (INSERT THE NAME OF THE ORGANIZATION) immediate after signing of the contract to control the quality and monitoring the manufacturing process of the transformer. The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team. This team will witness the Factory test at the manufacturer's plant. The Manufacturer shall have facilities to carryout all tests at its premises.

Tests shall be performed in accordance with the relevant IEC & other relevant standards and as per contract shall be complied with offered technical particulars and guarantees of the contract. All expenses for such tests shall be borne by the bidder.

(INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will witness the following test of not less than 10% (KVA rating wise) of total quantity ready for delivery on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test (not less than 5%)

Besides (INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will perform some physical test of at least 1 (one) Transformer (KVA rating wise) of each batch on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS EN ISO 1461:1999 of all bolts & nuts connected with transformer tank, conservator, radiator etc.;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Dimension of core dia, height and measurement of weight of active parts as per demand of (INSERT THE NAME OF THE ORGANIZATION)'s inspection team;
6. Dimension of coil, inner dia & outer dia (HT & LT) etc.
7. Checking of Creepage distance of HT/LT bushings.

The dimension and weight must be as per the approved Technical Specifications/ Technical Guaranteed Data and Drawings.

The manufacturer shall have all testing facilities at the manufacturer's premises to carry out the tests in accordance with the relevant IEC Standards. If, any test(s) pending due to lack of testing facilities at the manufacturer's premises, then the Inspection team shall select transformer(s) as sample and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s). All cost of testing of transformers including carrying, loading, un-loading etc. will be borne by the Bidder.

The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

The Bidder /Manufacturer shall submit the valid Calibration Certificate from competent authority of the testing/ measuring equipments, meters etc. used for Factory test with the tender. The Bidder /Manufacturer shall also submit the following documents along with the request letter for Pre-delivery inspection:

III. Updated valid Calibration Certificates of the testing/ measuring equipments, meters etc. used for Factory test.

IV. The factory test report (Routine test report) of each transformer to be supplied under the contract.

Failing to submit the above documents, the inspection team will not perform the Pre-delivery Inspection and all the liabilities along with delay (if any) will be borne by the Bidder/Manufacturer.

It is noted that at the time of Factory Test witness (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will check the calibration seal/ certificate of the testing/ measuring equipment, meters etc. by the competent authority. If the calibration seal/ certificate of the testing/ measuring equipment, meters etc. are not found and the calibration not done within the due date then (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will not witness the test. In that case the Bidder/ Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. from the competent authority within a reasonable period without any delay in delivery period.

B. RANDOM SAMPLE TEST DURING FACTORY INSPECTION AND WITNESS:

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the tests as per Clauses No. 1.11 & 1.13(A) of the Tender Document. Besides that the Inspection Team will select 1 (one) Transformer (KVA rating wise) from each batch (if the total contract quantity is permitted to inspect in several batches) on random sampling basis. The selected Transformer will be sent to BUET/ RUET/ CUET/ KUET/ DUET (applicable for local manufacturer only) for performing relevant tests as per IEC Standard. The Tests will be performed as per clause 1.13A at BUET/ RUET/ CUET/ KUET/ DUET as per IEC standard and contract. All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

C. ACCEPTANCE OF TRANSFORMER:

If the test results of the tested sample(s) transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET fail to confirm the specification, the full consignment will be rejected. A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET.

D. POST-DELIVERY INSPECTION & TESTING

The Inspection team of (INSERT THE NAME OF THE ORGANIZATION) shall performed post-delivery inspection in presence of bidder's representative after the delivery of the transformers at the designated store of (INSERT THE NAME OF THE ORGANIZATION). The Bidder shall arrange the program of such inspection. Any defect or damage have been found at post-delivery inspection, the defective or damaged Transformers/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

The purchaser’s right to inspect, test (where necessary) and reject the transformer(s) after delivery at the designated store of (INSERT THE NAME OF THE ORGANIZATION) shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary the inspection team may select 1% of the transformer (minimum 1 no. KVA rating wise) from the quantity inspected (if the total contract quantity is permitted to inspect in

several batches) on random sampling basis and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s) as per Clause 1.13(A). All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

If the tests of transformer(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per Clause 1.13(A) from the same laboratory. If the test of any one of the selected sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his own cost.

1.14 TRANSFORMER CONSTRUCTION

1.14.1 GENERAL

The transformers shall be double-wound, oil immersed naturally air cooled and conventional type with tank breathers.

The core shall be high-grade cold rolled electrical sheet steel/Amorphos. The primary and secondary windings shall be constructed form high conductivity copper. All turns of windings shall be adequately supported to prevent movement. In cases where turns are spaced out, suitable inter-turn packing shall be provided.

No material, which can be deleteriously affected by the action of oil under the operating conditions of the transformers, shall be used in the transformers or leads or bushings. Construction features shall permit local repairs to be easily carried out in the event of equipment failure.

1.14.2 TRANSFORMER TANK

The transformer tank shall be fabricated from steel and be of robust construction; all welds shall be made by the electrical arc welding process and the slag carefully removed after each run.

With the exception of radiator elements, all external joints shall be welded properly. Cooling radiators shall be of robust and simple construction. Complicated shapes shall not be acceptable, and horizontal stiffeners on tanks should be avoided. The bearing surface of the tank to which bushings are clamped shall be substantially flat.

All matching faces or joints to be made oil tight shall be finished with a smooth surface to ensure that the gasketing material will make a satisfactory joint material will make a satisfactory joint.

Flanges and covers of tanks shall be of sufficient thickness to prevent any depression occurring, which would retain water around the bolts.

Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be located such that there will be a minimum of 50 mm between the lifting chain and the nearest part of the bushings.

All transformers shall be suitable for outdoor mounting on pole platforms and shall have four mounting lugs with 19 mm dia holes suitable for bolting the transformer to the platform. The two lifting lugs shall be located 150 mm on each side of the centre line of the longest sides of the transformers.

The oil conservator shall be fitted with oil draining and oil filling gate valves, and a breather. The breather shall consist of a looped pipe fitted to the top of the transformer.

The LT Bushings shall be mounted on one of the longest side of the transformer tank. An oil level sight glass shall be fitted and marked with minimum & maximum oil level mark at ambient temperature.

All the transformer shall have the hole (dia 3mm) on the top cover and tank in 2 (two) corners for sealing purpose.

1.14.3 TRANSFORMER CORE AND COILS

Transformers core and coils must be new, unused, and clean.

Supporting frames of the core and coils of transformers shall be designed to accommodate variations in tank height.

The core and coil assembly shall have the core and coils rigidly connected to the tank and suitably closed lugs shall be provided for removing the core and coil assembly from the tank.

Transformer Sl. no. should be marked with emboss on the Supporting frames of the core and coils of each transformers minimum in 2(two) places.

1.14.4 TRANSFORMER SEALING

A satisfactory lid-sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level (COL) mark shall be provided inside each transformer marked COL.

1.14.5 FINISHES

a) Painting

Painting ferrous metal work is to be provided with an effective vapour sealing paint finish, applied generally in accordance with BS 5493 and /or other recognised international standard.

Paint shall be applied to produce a uniform film. Edges corners, crevices, welds, bolts, and rivets shall receive special attention to maintain the required thickness.

Before painting or filling with oil or compound, all un-galvanised parts shall be completely clean and free from rust, scale and grease and all external rough metal surfaces on the casting shall be filled.

The paint system shall be in accordance with best practice for hot and humid locations in a highly aggressive environment. A description of the paint system to be used and the proposed method of application shall be fully described in the Tender.

All external surfaces shall receive a minimum of three coats of paint. The primary coat shall contain an approved rust inhibitor and shall be applied as soon as possible after the completion of the surface preparation. The second coat shall be of oil and weather resisting nature and have a shade of colour easily distinguishable from the primary. The final coat shall be of oil and weather resisting and non-fading glossy paint of a colour agreed by the Engineer.

b) Non-ferrous parts and Bright Steel parts

All exposed metal liable iron corrosion during transport is to be appropriately protected by casting with an approved anti-rusting composition. Other non-ferrous parts shall be adequately protected against corrosion during shipment or in service.

c) Galvanizing

Galvanizing where applicable shall be applied by the hot dipped process generally in accordance with ASTM A90/ BS EN ISO 1461:1999 or equivalent standard of metal surface unless specified otherwise.

The zinc coating shall be smooth clean and of uniform thickness and free from defects. The preparation of galvanizing itself shall not adversely affect the mechanical properties of the coated material.

All drilling, punching, cutting, shaping and welding of parts shall be completed and all burrs shall be removed before the galvanizing process is applied.

Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

1.14.6 RATING PLATE

A brass or stainless steel rating plate shall be fitted to each transformer. The information shall deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars. The plate shall be mounted in an accessible position and preferably adjacent to the tapping switch if this is located on the side of the tank.

The rating plate shall be fitted below the LV terminals. Rating and diagram plates shall be attached by a 5 mm brass screw in each corner to 20 mm mild steel brackets continuously welded horizontally approximately 20 mm from the tank side. The following information is to be provided on the rating and diagram plate in the English language – clearly and indelibly marked.

* Transformer type
* Manufacture's name and country of origin
* Manufacturer's serial number
* Year of Manufacture
* Number of phases
* Rated power
* Rated frequency
* Rated voltages
* Rated currents
* Connection symbol
* Impedance voltage at rated current
* Type of cooling
* Total mass
* Mass of insulating oil
* Insulation levels
* Details regarding tapings

Each Transformer should be marked with emboss or welded on the body easily visible from the ground, with letters of size mentioned against each word(s)/ sentence(s) below:

(INSERT THE NAME OF THE ORGANIZATION) (40 mm)
Contract No & Date: (20 mm)
Country of Origin:
Sl. No. :--------- of ----------KVA ---------- (20 mm)

Note :

a) Sl. No. .....of .....KVA ..... is meant for particular No. of the Transformer out of the contracted quantity under this contract.

b) The above marking on the body of the transformer shall be done in addition to the normal nameplate of the transformer. The nameplate shall be continuous welded on the body of the Transformer before Pre-delivery inspection.

1.14.7 TERMINAL MARKING

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall preferably be 25 mm in height. The terminal marking shall be embossed on the body of the Transformer with respective color code.

1.14.8 TERMINAL LEADS

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

1.14.9 BUSHINGS

All bushings shall be porcelain clad, and shall be of the highest quality. They shall be sealed in a manner to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing stems, nuts and washers shall be made of brass.

1.14.10 EARTHING CONNECTIONS

Earthing connections shall be provided with connection facilities for 2x50 mm2 copper stranded conductor. The bolts shall be located on the lower side of the transformer and be of M12 size; each shall be clearly indicated with an engraved ‘earth symbol’. Two earthing connections are required on each transformer.

1.14.11 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. All gaskets shall be closed design (without open ends) and shall be one piece only.

1.14.12 OIL

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

1.14.13 TAPINGS

Five voltage tapings shall be provided on the primary side of each transformer and shall give: + 2.5%, 0,- 2.5%, – 5% and –7.5% steps of the primary nominal voltage.

The tapings shall be selected by an ‘off load’ tapping switch with an external hand wheel with provision for looking onto a selected tapping. The switch shall have a positive action designed to eliminate the possibility of stopping in an intermediate position. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service.

The voltage operating positions, together with tap change positions shall be clearly and indelibly marked.

PART-II

2.1 Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 100KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

SL. NO.	DESCRIPTION	(INSERT THE NAME OF THE ORGANIZATION)'S REQUIREMENT	MANUFACTURER'S GUARANTEED DATA
1	Manufacturer's Name & Address	To be mentioned	
2	Manufacturer's Type/ Model No.	To be mentioned	
3	KVA Rating	100	
4	Number of Phases	3	
5	Rated frequency, Hz	50	
6	Rated primary voltage, KV	11	
7	Rated no load sec. voltage, V	415	
8	Vector group	Dyn11	
9	**Highest system voltage of :**		
	a) Primary winding, KV	12	
	b) Secondary winding, V	457	
10	Basic insulation level, KV	75	
11	Power frequency withstand voltage, KV		
	a) HT Side	28	
	b) LT Side	2.5	
12	Type of cooling	ONAN	
13	**Max. Temp. Rise over 40^0C of ambient supported by Calculation (to be submitted) of Load Loss, Temperature Rise and Heat Dissipation by Radiator on the basis of Design Data:**		
	a) Windings deg. C	65	
	b) Top oil deg. C	60	
14	Type of primary tapping off load, %	+1x2.5%, 0, -3x 2.5%	
15	Percentage Impedance at 75^o C, % (supported by type test report)	4%	
16	No-load loss, Watts (supported by type test report)	245	
17	Load losses at rated full load at 75^0C, Watts (supported by type test report)	1635	
18	Magnetising current at normal voltage, Amps	To be mentioned	
19	**Efficiency at 75^0C and 100% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
20	**Efficiency at 75^0C and 75% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
21	**Efficiency at 75^0C and 50% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
22	**Efficiency at 75^0C and 25% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
23	**Regulation at full load :**		
	a) at 1.0 power factor, %	To be mentioned	

	b) at 0.8 power factor, %	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 100KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data
	Transformer Oil :		
24	a) Type of oil	Mineral Insulating Oil	
	b) Manufacturer's Name & Address	To be mentioned	
25	Total weight of oil, Kg	To be mentioned	
26	Breakdown Voltage at 2.5mm gap between electrodes	> 50 kV	
	Transformer Core (Stack Core or Wound Core):		
27	Manufacturer's Name & Address	To be mentioned	
28	Total weight of core, Kg	To be mentioned	
29	Material of core & grading (CRGO/Amorphos)	To be mentioned	
30	Core Loss/ Kg, supported by Characteristic Curve& Core Manufacturer's Brochure	To be mentioned	
31	Thickness of core, mm	To be mentioned	
32	Core Dia, mm	To be mentioned	
33	Max. magnetic flux density, Tesla	To be mentioned	
	Transformer Windings :		
34	Copper Conductor's Manufacturer Name & Address	To be mentioned	
35	Material of windings	copper	
36	Winding resistance of :		
	a) H.T. winding, Ohm. (per phase at 75^{o} C)	To be mentioned	
	b) L.T. winding, milli-Ohm. (per phase at 75^{o} C)	To be mentioned	
37	Current density of :		
	a) H.T. winding, Amps/sq. mm	To be mentioned	
	b) L.T. winding, Amps/sq. mm	To be mentioned	
38	Outer, Inner & Mean dia of copper winding:		
	a) H.T. winding, mm	To be mentioned	
	b) L.T. winding, mm	To be mentioned	
39	Size of Copper Conductor :		
	a) H.T. winding SWG, dia. in mm & area in mm^2	To be mentioned	
	b) L.T. winding SWG, area in mm^2	To be mentioned	
40	Number of Turns :		
	a) HT winding, nos.	To be mentioned	
	b) LT winding, nos.	To be mentioned	
41	Copper weight of windings :		
	a) HT winding, Kg	To be mentioned	
	b) LT winding, Kg	To be mentioned	
42	Total weight of copper windings, Kg	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 100KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

43	**Dimension of Transformer :**		
	a) Width, mm (supported by type test report)	To be mentioned	
	b) Length, mm (supported by type test report)	To be mentioned	
	c) Height, mm (supported by type test report)	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm	4, 3 & 3	
	e) Total weight of transformer tank, Kg	To be mentioned	
44	a) Total weight of active part (core, coil and other accessories), Kg	To be mentioned	
	b) Total weight of complete Transformer including fittings & oil, Kg (supported by type test report)	To be mentioned	
45	Type of breathings	To be mentioned	
46	Name of relevant IEC or other Equivalent Standards for Design, manufacture, testing and performance.	To be mentioned	
47	**Drawing :**		
	a) General Arrangement & Outline Dimensions	To be submitted	
	b) Internal Construction Details/ Sectional drawing of active parts including Insulation arrangement	To be submitted	
	c) HT & LT Bushings with dimension & current ratings	To be submitted	
	d) Cross-section &Dimensional drawing of Core & Windings	To be submitted	
	e) Radiator with detail dimensional drawing	To be submitted	
	f) Tap changer with dimension & current ratings.	To be submitted	
48	**Routine Test Report :**		
	a) Measurement of turn ratio test.	To be submitted	
	b) Vector group test.	To be submitted	
	c) Measurement of winding resistance.	To be submitted	
	d) Measurement of insulation resistance.	To be submitted	
	e) Measurement of no load loss & no-load current.	To be submitted	
	f) Measurement of impedance voltage & load loss.	To be submitted	
	g) Dielectric withstands Tests.	To be submitted	
	h) Transformer oil test (including Tan delta).	To be submitted	
49	**Type Tests report along with details test result and drawings for 11/0.415KV, 100KVA, 3-Phase, Dyn11 Distribution Transformer from an independent testing Laboratoryas per IEC 60076 Standards.**		
	a) Impulse Voltage Withstands test.	To be submitted	
	b) Temperature Rise test.	To be submitted	
50	Short-circuit Tests Report for the offered 11/0.415KV, 100KVA, 3-Phase, Dyn11 Distribution Transformer as per relevant IEC with detail test results & drawings from reputed independent testing Laboratory/ Institution and detail calculation on the basis of design data by the manufacturer.	To be submitted	

Manufacturer's Seal & Signature **Bidder Seal & Signature**

2.2 Schedule of Manufacturers Name and places of Manufacture & Testing

Item No.	Description	Manufacture's Name	Place of Manufacture	Place of Testing & Inspection
01	11/0.415KV, 3-phase, 100KVA Distribution Transformer			

Seal and Signature of the Bidder

2.3 Schedule of Proposed Standards to which Transformers shall be provided

The Bidder shall indicate the Standard to which the materials offered by him conforms to.

Should these standards differ from the specified Standard in any respect the Bidder shall detail the differences between the proposed and specified Standard.

Item No.	Description	Standard
1.	11/0.415KV, 3-phase, 100 KVA Distribution Transformer	

Seal and Signature of the Bidder

CHAPTER-5

TECHNICAL SPECIFICATIONS OF 11/0.415KV, THREE PHASE, 50KVA DISTRIBUTION TRANSFORMER

PART-I

TECHNICAL SPECIFICATIONS/ REQUIREMENTS OF 11/0.415KV, 50KVA 3-PHASE DISTRIBUTION TRANSFORMER

1.1 GENERAL

This section of the document includes the design, manufacture, testing & inspection of 11/0.415KV, 50KVA, 3-Phase, Dyn11 distribution transformer as specified.

1.2 CLIMATE DATA

The distribution transformers to be supplied against this contract shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid. Maximum Humidity and Temperature sometimes occur simultaneously.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%
Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Average isokeraunic level	:	80 days/ year
Maximum altitude above the sea level	:	300 metres
Atmospherical, Mechanical and Chemical impurities	:	Moderately polluted

Transformers as specified will be installed in a hot humid environment and presence of the insects and presence of the insects and vermin locations. The information is given as a guide for Tenders and no responsibility for its accuracy will be accepted, nor any claim based on the above be entertained.

1.3 SYSTEM PARTICULARS

S/N.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
2.	Maximum System Voltage, kV	245	145	36	12
3.	System Frequency, Hz	50	50	50	50
4.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
5.	Type of System Grounding	Solid	Solid	Solid	Solid
6.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	12550	6000	1500	381
7.	Basic Insulation Level, kV	750	650	170	75
LOW VOLTAGE 415/ 240V CHARACTERISTICS					
8	Normal System Voltage, V (Voltage Class)	415/ 240			
9	Type of System Grounding	Solid			
10	Basic Insulation Level of LT	2500			

	Winding of Transformer, V	

1.4 STANDARDS

The equipment specified in this Section shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076	Power Transformers.
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils.
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	60722	Guide to lightning and switching impulse testing of power transformers.
IEC	60529-3	Protective coating of iron and steel structures against corrosion.
ASTM A90/ BS EN ISO 1461:1999		Galvanization
IEC 60296 & BS 148		Transformer Oil

1.5 SPECIFICATIONS

1.	Installation	Outdoor, Tropical, High Rainfall & Humidity
2.	Type	Stack Core or Wound Core
3.	Coolant	Mineral oil
4.	Method of Cooling	ONAN
5.	Phases	3 (Three)
6.	Frequency	50 Hz.
7.	Winding	Two windings of high conductivity copper
8.	KVA Rating	50 KVA
9.	Rated Voltage at no-load	11/0.415 kV
10.	Vector Group	Dyn11
11.	Percentage Impedance at 75^0C, %	4 %
12.	No Load Loss	155 Watts
13.	Load loss at 75^0 C	810 Watts
14.	Maximum Temperature Rise at full load Over 40^0C ambient temperature with tap changer in principal position.	a) 65^0C for Winding measured by Resistance Method.
		b) 60^0C for Top Oil measured by thermometer Method.

1.5.1 MAJOR COMPONENTS

H.T WINDING :

Nominal rated voltage	11 kV
Maximum system voltage	12 kV
Basic insulation level (minimum)	75 kV
Tap Changer	+1x2.5%, 0, -3x2.5% of rated kV & all fully rated capacity. Tap Changer shall be off load type, manually operated from an external five-position mechanism.
Inter phase connection	Delta
Bushings	Porcelain, outdoors type with arcing horns of standard gap, mounted on top of tank. Quantity - 3 Nos.

Power frequency withstand voltage for one minute	28 kV

L.T. WINDING :

Nominal rated voltage	415 volts
Highest system voltage	457 volts
Inter phase connection	Y (Wye) with neutral brought out.
Bushings	Porcelain, outdoor type, mounted on the top or side (Longest side) of tank. Quantity – 4 nos.
Power frequency withstand voltage for one minute	2.5 kV

TRANSFORMER OIL :	
Application	Insulating mineral oil for Transformer. It will be free from PCB (Poly Chlorinated Biphenyl)
Grade of oil	Class-1
a) Physical Properties	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0 C	0.895 g/cm^3 (Max^m.)
Flash point (Closed cup)	140^0 C (Min^m.)
Kinematics Viscosity at -15^0 C	800 cSt. (Max^m.)
Kinematics Viscosity at 20^0 C	40 cSt. (Max^m.)
Pour point	-30^0 C (Max^m.)
b) Electrical Properties	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oils are introduced into the apparatus or equipment. The break down voltage of this oil shall be more than 50 kV.
Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 V/mm and frequency 40 Hz to 62 Hz.	0.005 (Max^m.)
c) Chemical Properties	
Neutralization value	0.03 mg KOH/g (Max^m.)
Neutralization value after oxidation	0.40 mg KOH/g (Max^m.)
Total sludge after oxidation	0.10% weight (Max^m.)
PCB Content	Free from PCB (Poly Chlorinated Biphenyl)
d) Standards	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148 : 1972, IEC-60296 or latest revision there on.

1.6 FEATURES AND ACCESSORIES

a) All bolts and nuts connected with transformer tank, conservator, radiator etc. shall be of non-ferrous metal. If it is ferrous metal, it shall be hot dip galvanized as per standard ASTM A90/ BS EN ISO 1461:1999.
b) Lugs for lifting & towing complete unit.
c) Facilities for lifting core & coil assembly.
d) Base designed for platform mounting on poles.

e) First filling of new oil shall comply to the latest revision of IEC-60296 standard or other equivalent standards.
f) Each H.T. bushing shall have bolted type bimetallic connector suitable for accommodating ACSR conductor having Dia. range from 9mm to 14.5mm.
g) Each L.T. bushing shall have bolted type bimetallic connector for accommodating copper/AAC of area range 2x95mm^2 to 2x120mm^2 depending upon the KVA rating of the transformer.
h) The L.T. bushing shall be installed on the top or side of tank lengthwise of the transformer body.
i) Dial thermometer for oil temperature mounted on L.T. side of the tank.
j) Earthing terminals at the bottom corners of Tank.
k) Name plate with transformer rating & winding diagram made of stainless steel shall have engraved letters filled with black enamel and shall be continuously welded in the transformer body.
l) The tank & radiator or flanged radiator shall be painted with two coats of gray finishing paint on suitable prime coats.
m) Transformer capacity with Sl.No. and (INSERT THE NAME OF THE ORGANIZATION) Contract No. should be marked with emboss/ engrave on the transformer tank adjacent to name plate easily visible from ground as per tender clause-1.14.6.

FOR CONSERVATOR :

a) Transformer tank completes with covers, necessary openings & gaskets.
b) Complete oil preservation system consisting of an oil conservator with shut-off valve oil level gauge. The system shall have valve for filter press inlet & oil drain. The oil sampling valve & dehydrating breather shall be provided.

1.7 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

m) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of offered 11/0.415KV, 50KVA, 3-Phase, Dyn11 distribution transformer.
n) Detail dimensional drawings of offered 11/0.415KV, 50KVA, 3-Phase, Dyn11 distribution transformer.
o) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.
p) Manufacturer's valid ISO 9001 Certificate.

1.8 DOCUMENTATION

The following documents are to be submitted by the Tenderer along with the Tender for the similar KVA rating of same voltage class of offered 11/0.415KV Distribution Transformer**;otherwise the bid will be rejected**:

A. COMMERCIAL

Tenderer shall be eligible as per ITT Clause No. 5 and they should submit Bid validity, Bid Bond, Bid Bond validity, Price Schedule, Delivery Schedule, Authorisation of the signatory, Tender Submission Sheet, Tenderer Information Sheet & Documentary evidence for establishing the Tenderer's Qualifications, etc. and all other documents including information related to rejection clause as per Tender Document.

B. TECHNICAL

1) Guaranteed Technical Particulars (GTP) shall be properly filled up and signed by both Manufacturer & Tenderer;

2) Letter of authorization from the Manufacturers, in case, the Bidder is not the manufacturer, in the prescribed Form;

3) 2 nos. of Manufacturer's Supply Record for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the date of bid opening in the following format (The supply record covering 25% of the tendered quantity in a single Contract will be considered only);

Sl. No.	Name, Address, Phone No., e-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of Material with Quantity	Date of Completion of Supply

4) At Least 2(two) nos. of Satisfactory Performance Certificate from Electricity utility as End User for similar or higher KVA rating of same voltage class of offered type Distribution Transformer within the last 5 (five) years from the year of Tender Notice. The Satisfactory Performance certificate should be in End User's letterhead Pad in English stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication.

5) Type test & Special test along with Routine test report as per clause no. 1.9 for similar KVA rating of same voltage class of offered type Distribution Transformer from an independent testing laboratory as per IEC 60076. All Type Test & Special test shall be done on the same transformer (having same serial number) from an independent testing laboratory.

6) Local manufacturers, who have supplied the same offered item to [INSERT THE NAME OF THE ORGANIZATION] within the last 5 (five) years from the date of bid opening, need not to submit any Manufacturer's Supply Record with the tender proposal. In that case, they have to submit one Satisfactory Performance Certificate (within last three years) from [INSERT THE NAME OF THE OFFICE AND ORGANIZATION], for the same offered item covering 25% of the tendered quantity in a single Contract.

7) The following provision will be applicable for purchasing less or equal to 50 nos. transformers from new manufacturers.

   At least 30 (thirty) nos. of Satisfactory Performance Certificate from end users (public/private) for similar or higher KVA rating of same voltage class of offered type Distribution Transformers within last 3 (three) years from the date of bid opening. The Satisfactory Performance certificate shall be from End User's stating at least one year satisfactory operation from the date of installation of the said transformer and shall contain end-user's full mailing address/ e-mail address, website address/fax and phone no for convenience of authentication. Factory shall be inspected by TEC as per following guide lines:

   1. Location of the Factory & layout plan.
   2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
   3. Factory Project Profile
   4. Production Capacity (Yearly)
   5. Production Line description.
   6. List of Key Personnel (with Bio-data)
   7. Provide sample of the Tendered product manufactured in the Factory for evaluation of TEC during factory Inspection.
   8. Testing Facilities as per IEC 60076.
   9. Warranty period 24 months from R&I issuing date.
   10. Trade License, TIN & VAT certificate.
   11. Source of raw materials.

12. A sample of the offered type Distribution Transformer shall be tested by TEC at manufacturer's testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.8 B 3 & 4) shall be applicable for Bid Submission and Evaluation.

1.9 TEST REPORTS

Tenderer's shall include in their offer the following routine tests, type tests and Short circuit withstands tests as prescribed in IEC-60076 for 11/0.415KV, 50KVA, 3-Phase, Dyn11 Distribution Transformer.

ROUTINE TESTS

1) Measurement of turn ratio test.
2) Vector group test.
3) Measurement of winding resistance.
4) Measurement of insulation resistance.
5) Measurement of no-load loss & no-load current.
6) Measurement of impedance voltage & load loss.
7) Dielectric withstands Tests.
8) Transformer oil tests.

TYPE TESTS

1) Impulse Voltage withstands test.
2) Temperature rise test.

SPECIAL TESTS

1) Short circuit withstand test and detail calculation along with thermal & mechanical on the basis of design data.

1.10 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of relevant ITT clauses. The capitalized cost of the Transformer losses will **be considered** for evaluation purposes.

Distribution transformers will be evaluated on the basis of following formula:

$O = C_P + 65{,}432 \times e \times P_O + 26{,}173 \times e \times P_{FL}$

Where: O = Evaluated Price in BDT

C_P = Quoted Price in BDT

P_O = Iron loss in KW

P_{FL} = Copper loss in KW at full load at 75□C

Guaranteed loss values must be supported by test reports from independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

b) Bidder's declared/ guaranteed no load loss and load loss value shall be within the specified value, otherwise the bid will be rejected.

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value; otherwise the bid will be rejected.

1.11 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with deduction of money from the contract price as below :

i) Each component loss (No load loss or Full load loss) shall not exceed up to 15% of the offered component loss, provided that the total losses cannot be exceeded 10% of the offered total losses.

ii) Percentage Impedance may vary up to ± 10 % of the specified value.

iii) The purchaser can carryout the testing of any transformers during pre-delivery inspection. The testing of transformers during pre-delivery inspection will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 5 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

iv) If the results of any transformer exceeds the offered losses (each component loss exceeds more than 15% or total loss exceeds more than 10% of the offered losses) and percentage impedance exceeds ±10% of the specified percentage impedance then the whole lot will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET (both tests will be applicable for local manufacturer only) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 1.11(i), then an amount will be deducted from the Contract price for the loss(s) exceeding the offered loss(s) (No load loss or Full load loss or Both) according to the following formula :

Amount to be deducted from the Contract price
= {(Measured Loss - Offered Loss) ÷ 1000} x 20x365x24 x LLFx e x %MTx Total nos. of Transformer under the batch

Where,

Measured Loss (in watt) = Measured Average No-load Loss[*1] + Measured Average Full Load Loss[*2].

Offered Loss (in watt) = Offered No Load Loss + Offered Full load loss

Transformer Economic Life = 20 Years
LF (Load Factor) = 60%
LLF (Loss Load Factor) = $0.15xLF+0.85x(LF)^2$
e = Average Energy Selling Price Tk/KWh

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

[*1]Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

[*2]Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss]

1.12 APPROVAL OF DRAWINGS

Calculation for the Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.

1.13 A. FACTORY INSPECTION AND TEST WITNESS

The purchaser shall have the right to inspect, examine and test the materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises. The Purchaser or its representative maximum 2 (two) times may inspect the goods during the manufacturing process and shall also request for the purchase/ import/ shipping documents of copper, oil and transformer core material and shall check in accordance with Guaranteed Technical Particulars (GTP).

An inspection team will be formed by (INSERT THE NAME OF THE ORGANIZATION) immediate after signing of the contract to control the quality and monitoring the manufacturing process of the transformer. The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team. This team will witness the Factory test at the manufacturer's plant. The Manufacturer shall have facilities to carryout all tests at its premises.

Tests shall be performed in accordance with the relevant IEC & other relevant standards and as per contract shall be complied with offered technical particulars and guarantees of the contract. All expenses for such tests shall be borne by the bidder.

(INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will witness the following test of not less than 10% (KVA rating wise) of total quantity ready for delivery on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test (not less than 5%)

Besides (INSERT THE NAME OF THE ORGANIZATION)'s Inspection Team will perform some physical test of at least 1 (one) Transformer (KVA rating wise) of each batch on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS EN ISO 1461:1999 of all bolts & nuts connected with transformer tank, conservator, radiator etc.;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Dimension of core dia, height and measurement of weight of active parts as per demand of (INSERT THE NAME OF THE ORGANIZATION)'s inspection team;
6. Dimension of coil, inner dia & outer dia (HT & LT) etc.
7. Checking of Creepage distance of HT/LT bushings.

The dimension and weight must be as per the approved Technical Specifications/ Technical Guaranteed Data and Drawings.

The manufacturer shall have all testing facilities at the manufacturer's premises to carry out the tests in accordance with the relevant IEC Standards. If, any test(s) pending due to lack of testing facilities at the manufacturer's premises, then the Inspection team shall select

transformer(s) as sample and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s). All cost of testing of transformers including carrying, loading, un-loading etc. will be borne by the Bidder.

The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

The Bidder /Manufacturer shall submit the valid Calibration Certificate from competent authority of the testing/ measuring equipments, meters etc. used for Factory test with the tender. The Bidder /Manufacturer shall also submit the following documents along with the request letter for Pre-delivery inspection:

V. Updated valid Calibration Certificates of the testing/ measuring equipments, meters etc. used for Factory test.

VI. The factory test report (Routine test report) of each transformer to be supplied under the contract.

Failing to submit the above documents, the inspection team will not perform the Pre-delivery Inspection and all the liabilities along with delay (if any) will be borne by the Bidder/Manufacturer.

It is noted that at the time of Factory Test witness (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will check the calibration seal/ certificate of the testing/ measuring equipment, meters etc. by the competent authority. If the calibration seal/ certificate of the testing/ measuring equipment, meters etc. are not found and the calibration not done within the due date then (INSERT THE NAME OF THE ORGANIZATION)'s Inspection team will not witness the test. In that case the Bidder/ Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. from the competent authority within a reasonable period without any delay in delivery period.

B. RANDOM SAMPLE TEST DURING FACTORY INSPECTION AND WITNESS:

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the tests as per Clauses No. 1.11 & 1.13(A) of the Tender Document. Besides that the Inspection Team will select 1 (one) Transformer (KVA rating wise) from each batch (if the total contract quantity is permitted to inspect in several batches) on random sampling basis. The selected Transformer will be sent to BUET/ RUET/ CUET/ KUET/ DUET (applicable for local manufacturer only) for performing relevant tests as per IEC Standard. The Tests will be performed as per clause 1.13A at BUET/ RUET/ CUET/ KUET/ DUET as per IEC standard and contract. All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

C. ACCEPTANCE OF TRANSFORMER:

If the test results of the tested sample(s) transformer(s) during factory test witness by the (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET fail to confirm the specification, the full consignment will be rejected. A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by (INSERT THE NAME OF THE ORGANIZATION)'s inspection team and test performed by BUET/ RUET/ CUET/ KUET/ DUET.

D. POST-DELIVERY INSPECTION & TESTING

The Inspection team of (INSERT THE NAME OF THE ORGANIZATION) shall performed post-delivery inspection in presence of bidder's representative after the delivery of the transformers at the designated store of (INSERT THE NAME OF THE ORGANIZATION). The Bidder shall arrange the program of such inspection. Any defect or damage have been found at post-delivery inspection, the defective or damaged Transformers/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

The purchaser's right to inspect, test (where necessary) and reject the transformer(s) after delivery at the designated store of (INSERT THE NAME OF THE ORGANIZATION) shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary the inspection team may select 1% of the transformer (minimum 1 no. KVA rating wise) from the quantity inspected (if the total contract quantity is permitted to inspect in several batches) on random sampling basis and sent the selected sample transformer(s) to BUET/ RUET/ CUET/ KUET/ DUET to carryout the test(s) as per Clause 1.13(A). All cost of testing of Transformer(s) including carrying, loading, un-loading etc. will be borne by the Bidder.

If the tests of transformer(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per Clause 1.13(A) from the same laboratory. If the test of any one of the selected sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his own cost.

1.14 TRANSFORMER CONSTRUCTION

1.14.1 GENERAL

The transformers shall be double-wound, oil immersed naturally air cooled and conventional type with tank breathers.

The core shall be high-grade cold rolled electrical sheet steel/Amorphos. The primary and secondary windings shall be constructed form high conductivity copper. All turns of windings shall be adequately supported to prevent movement. In cases where turns are spaced out, suitable inter-turn packing shall be provided.

No material, which can be deleteriously affected by the action of oil under the operating conditions of the transformers, shall be used in the transformers or leads or bushings. Construction features shall permit local repairs to be easily carried out in the event of equipment failure.

1.14.2 TRANSFORMER TANK

The transformer tank shall be fabricated from steel and be of robust construction; all welds shall be made by the electrical arc welding process and the slag carefully removed after each run.

With the exception of radiator elements, all external joints shall be welded properly. Cooling radiators shall be of robust and simple construction. Complicated shapes shall not be acceptable, and horizontal stiffeners on tanks should be avoided. The bearing surface of the tank to which bushings are clamped shall be substantially flat.

All matching faces or joints to be made oil tight shall be finished with a smooth surface to ensure that the gasketing material will make a satisfactory joint material will make a satisfactory joint.

Flanges and covers of tanks shall be of sufficient thickness to prevent any depression occurring, which would retain water around the bolts.

Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be located such that there will be a minimum of 50 mm between the lifting chain and the nearest part of the bushings.

All transformers shall be suitable for outdoor mounting on pole platforms and shall have four mounting lugs with 19 mm dia holes suitable for bolting the transformer to the platform. The two lifting lugs shall be located 150 mm on each side of the centre line of the longest sides of the transformers.

The oil conservator shall be fitted with oil draining and oil filling gate valves, and a breather. The breather shall consist of a looped pipe fitted to the top of the transformer.

The LT Bushings shall be mounted on one of the longest side of the transformer tank. An oil level sight glass shall be fitted and marked with minimum & maximum oil level mark at ambient temperature.

All the transformer shall have the hole (dia 3mm) on the top cover and tank in 2 (two) corners for sealing purpose.

1.14.3 TRANSFORMER CORE AND COILS

Transformers core and coils must be new, unused, and clean.

Supporting frames of the core and coils of transformers shall be designed to accommodate variations in tank height.

The core and coil assembly shall have the core and coils rigidly connected to the tank and suitably closed lugs shall be provided for removing the core and coil assembly from the tank.

Transformer Sl. no. should be marked with emboss on the Supporting frames of the core and coils of each transformers minimum in 2(two) places.

1.14.4 TRANSFORMER SEALING

A satisfactory lid-sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level (COL) mark shall be provided inside each transformer marked COL.

1.14.5 FINISHES

a) Painting

Painting ferrous metal work is to be provided with an effective vapour sealing paint finish, applied generally in accordance with BS 5493 and /or other recognised international standard.

Paint shall be applied to produce a uniform film. Edges corners, crevices, welds, bolts, and rivets shall receive special attention to maintain the required thickness.

Before painting or filling with oil or compound, all un-galvanised parts shall be completely clean and free from rust, scale and grease and all external rough metal surfaces on the casting shall be filled.

The paint system shall be in accordance with best practice for hot and humid locations in a highly aggressive environment. A description of the paint system to be used and the proposed method of application shall be fully described in the Tender.

All external surfaces shall receive a minimum of three coats of paint. The primary coat shall contain an approved rust inhibitor and shall be applied as soon as possible after the completion of the surface preparation. The second coat shall be of oil and weather resisting nature and have a shade of colour easily distinguishable from the primary. The final coat shall be of oil and weather resisting and non-fading glossy paint of a colour agreed by the Engineer.

b) Non-ferrous parts and Bright Steel parts

All exposed metal liable iron corrosion during transport is to be appropriately protected by casting with an approved anti-rusting composition. Other non-ferrous parts shall be adequately protected against corrosion during shipment or in service.

c) Galvanizing

Galvanizing where applicable shall be applied by the hot dipped process generally in accordance with ASTM A90/ BS EN ISO 1461:1999 or equivalent standard of metal surface unless specified otherwise.

The zinc coating shall be smooth clean and of uniform thickness and free from defects. The preparation of galvanizing itself shall not adversely affect the mechanical properties of the coated material.

All drilling, punching, cutting, shaping and welding of parts shall be completed and all burrs shall be removed before the galvanizing process is applied.

Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

1.14.6 RATING PLATE

A brass or stainless steel rating plate shall be fitted to each transformer. The information shall deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars. The plate shall be mounted in an accessible position and preferably adjacent to the tapping switch if this is located on the side of the tank.

The rating plate shall be fitted below the LV terminals. Rating and diagram plates shall be attached by a 5 mm brass screw in each corner to 20 mm mild steel brackets continuously welded horizontally approximately 20 mm from the tank side. The following information is to be provided on the rating and diagram plate in the English language – clearly and indelibly marked.

* Transformer type
* Manufacture's name and country of origin
* Manufacturer's serial number
* Year of Manufacture
* Number of phases
* Rated power
* Rated frequency
* Rated voltages
* Rated currents
* Connection symbol
* Impedance voltage at rated current
* Type of cooling
* Total mass
* Mass of insulating oil
* Insulation levels
* Details regarding tapings

Each Transformer should be marked with emboss or welded on the body easily visible from the ground, with letters of size mentioned against each word(s)/ sentence(s) below:

(INSERT THE NAME OF THE ORGANIZATION) (40 mm)
Contract No & Date: (20 mm)
Country of Origin:
Sl. No. :--------- of ----------KVA ---------- (20 mm)

Note :

a) Sl. No. .....of .....KVA ..... is meant for particular No. of the Transformer out of the contracted quantity under this contract.

b) The above marking on the body of the transformer shall be done in addition to the normal nameplate of the transformer. The nameplate shall be continuous welded on the body of the Transformer before Pre-delivery inspection.

1.14.7 TERMINAL MARKING

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall preferably be 25 mm in height. The terminal marking shall be embossed on the body of the Transformer with respective color code.

1.14.8 TERMINAL LEADS

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

1.14.9 BUSHINGS

All bushings shall be porcelain clad, and shall be of the highest quality. They shall be sealed in a manner to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing stems, nuts and washers shall be made of brass.

1.14.10 EARTHING CONNECTIONS

Earthing connections shall be provided with connection facilities for 2x50 mm2 copper stranded conductor. The bolts shall be located on the lower side of the transformer and be of M12 size; each shall be clearly indicated with an engraved ‘earth symbol’. Two earthing connections are required on each transformer.

1.14.11 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. All gaskets shall be closed design (without open ends) and shall be one piece only.

1.14.12 OIL

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

1.14.13 TAPINGS

Five voltage tapings shall be provided on the primary side of each transformer and shall give: + 2.5%, 0,- 2.5%, – 5% and –7.5% steps of the primary nominal voltage.

The tapings shall be selected by an ‘off load’ tapping switch with an external hand wheel with provision for looking onto a selected tapping. The switch shall have a positive action designed to eliminate the possibility of stopping in an intermediate position. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service.

The voltage operating positions, together with tap change positions shall be clearly and indelibly marked.

PART-II

2.1 Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 50KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

SL. NO.	DESCRIPTION	(INSERT THE NAME OF THE ORGANIZATION)'S REQUIREMENT	MANUFACTURER'S GUARANTEED DATA
1	Manufacturer's Name & Address	To be mentioned	
2	Manufacturer's Type/ Model No.	To be mentioned	
3	KVA Rating	50	
4	Number of Phases	3	
5	Rated frequency, Hz	50	
6	Rated primary voltage, KV	11	
7	Rated no load sec. voltage, V	415	
8	Vector group	Dyn11	
9	**Highest system voltage of :**		
	a) Primary winding, KV	12	
	b) Secondary winding, V	457	
10	Basic insulation level, KV	75	
11	Power frequency withstand voltage, KV		
	a) HT Side	28	
	b) LT Side	2.5	
12	Type of cooling	ONAN	
13	**Max. Temp. Rise over 40^0C of ambient supported by Calculation (to be submitted) of Load Loss, Temperature Rise and Heat Dissipation by Radiator on the basis of Design Data:**		
	a) Windings deg. C	65	
	b) Top oil deg. C	60	
14	Type of primary tapping off load, %	+1x2.5%, 0, -3x 2.5%	
15	Percentage Impedance at 75^o C, % (supported by type test report)	4%	
16	No-load loss, Watts (supported by type test report)	155	
17	Load losses at rated full load at 75^0C, Watts (supported by type test report)	810	
18	Magnetising current at normal voltage, Amps	To be mentioned	
19	**Efficiency at 75^0C and 100% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
20	**Efficiency at 75^0C and 75% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
21	**Efficiency at 75^0C and 50% load :**		
	a) at 1.0 power factor, %	To be mentioned	

	b) at 0.8 power factor, %	To be mentioned	
22	**Efficiency at 75^0C and 25% load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
23	**Regulation at full load :**		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	

Manufacturer's Seal & Signature **Bidder's Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 50KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	(INSERT THE NAME OF THE ORGANIZATION)'S Requirement	Manufacturer's Guaranteed Data
	Transformer Oil :		
24	a) Type of oil	Mineral Insulating Oil	
	b) Manufacturer's Name & Address	To be mentioned	
25	Total weight of oil, Kg	To be mentioned	
26	Breakdown Voltage at 2.5mm gap between electrodes	> 50 kV	
	Transformer Core (Stack Core or Wound Core):		
27	Manufacturer's Name & Address	To be mentioned	
28	Total weight of core, Kg	To be mentioned	
29	Material of core & grading (CRGO/Amorphos)	To be mentioned	
30	Core Loss/ Kg, supported by Characteristic Curve& Core Manufacturer's Brochure	To be mentioned	
31	Thickness of core, mm	To be mentioned	
32	Core Dia, mm	To be mentioned	
33	Max. magnetic flux density, Tesla	To be mentioned	
	Transformer Windings :		
34	Copper Conductor's Manufacturer Name & Address	To be mentioned	
35	Material of windings	copper	
36	Winding resistance of :		
	a) H.T. winding, Ohm. (per phase at 75^o C)	To be mentioned	
	b) L.T. winding, milli-Ohm. (per phase at 75^o C)	To be mentioned	
37	Current density of :		
	a) H.T. winding, Amps/sq. mm	To be mentioned	
	b) L.T. winding, Amps/sq. mm	To be mentioned	
38	Outer, Inner & Mean dia of copper winding:		
	a) H.T. winding, mm	To be mentioned	
	b) L.T. winding, mm	To be mentioned	
39	Size of Copper Conductor :		
	a) H.T. winding SWG, dia. in mm & area in mm^2	To be mentioned	
	b) L.T. winding SWG, area in mm^2	To be mentioned	
40	Number of Turns :		
	a) HT winding, nos.	To be mentioned	
	b) LT winding, nos.	To be mentioned	
41	Copper weight of windings :		
	a) HT winding, Kg	To be mentioned	

	b) LT winding, Kg	To be mentioned	
42	Total weight of copper windings, Kg	To be mentioned	

Manufacturer's Seal & Signature **Bidder Seal & Signature**

Manufacturer's Guaranteed Technical Data Schedule for 11/ 0.415 KV, 3-Phase, 50KVA Distribution Transformer

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

43	**Dimension of Transformer :**		
	a) Width, mm (supported by type test report)	To be mentioned	
	b) Length, mm (supported by type test report)	To be mentioned	
	c) Height, mm (supported by type test report)	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm	4, 3 & 3	
	e) Total weight of transformer tank, Kg	To be mentioned	
44	a) Total weight of active part (core, coil and other accessories), Kg	To be mentioned	
	b) Total weight of complete Transformer including fittings & oil, Kg (supported by type test report)	To be mentioned	
45	Type of breathings	To be mentioned	
46	Name of relevant IEC or other Equivalent Standards for Design, manufacture, testing and performance.	To be mentioned	
47	**Drawing :**		
	a) General Arrangement & Outline Dimensions	To be submitted	
	b) Internal Construction Details/ Sectional drawing of active parts including Insulation arrangement	To be submitted	
	c) HT & LT Bushings with dimension & current ratings	To be submitted	
	d) Cross-section &Dimensional drawing of Core & Windings	To be submitted	
	e) Radiator with detail dimensional drawing	To be submitted	
	f) Tap changer with dimension & current ratings.	To be submitted	
48	**Routine Test Report :**		
	a) Measurement of turn ratio test.	To be submitted	
	b) Vector group test.	To be submitted	
	c) Measurement of winding resistance.	To be submitted	
	d) Measurement of insulation resistance.	To be submitted	
	e) Measurement of no load loss & no-load current.	To be submitted	
	f) Measurement of impedance voltage & load loss.	To be submitted	
	g) Dielectric withstands Tests.	To be submitted	
	h) Transformer oil test (including Tan delta).	To be submitted	
49	**Type Tests report along with details test result and drawings for 11/0.415KV, 50KVA, 3-Phase, Dyn11 Distribution Transformer from an independent testing Laboratory as per IEC 60076 Standards.**		
	a) Impulse Voltage Withstands test.	To be submitted	
	b) Temperature Rise test.	To be submitted	

50	Short-circuit Tests Report for the offered 11/0.415KV, 50KVA, 3-Phase, Dyn11 Distribution Transformer as per relevant IEC with detail test results & drawings from reputed independent testing Laboratory/ Institution and detail calculation on the basis of design data by the manufacturer.	To be submitted	

Manufacturer's Seal & Signature **Bidder Seal & Signature**

2.2 Schedule of Manufacturers Name and places of Manufacture & Testing

Item No.	Description	Manufacture's Name	Place of Manufacture	Place of Testing & Inspection
01	11/0.415KV, 3-phase, 50KVA Distribution Transformer			

Seal and Signature of the Bidder

2.3 Schedule of Proposed Standards to which Transformers shall be provided

The Bidder shall indicate the Standard to which the materials offered by him conforms to.

Should these standards differ from the specified Standard in any respect the Bidder shall detail the differences between the proposed and specified Standard.

Item No.	Description	Standard
1.	11/0.415KV, 3-phase, 50 KVA Distribution Transformer	

Seal and Signature of the Bidder

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়
বিদ্যুৎ বিভাগ
প্রশাসন-১ অধিশাখা
www.powerdivision.gov.bd

সূত্র নং- ২৭.০০.০০০০.০৪১.০০৬.২৪.১৩.১৬২০ তারিখ: ২৭-১১-২০১৪

বিষয়ঃ Transformer এর Specification Standardization এর জন্য কমিটি গঠন প্রসঙ্গে।

উপর্যুক্ত বিষয়ে বিদ্যুৎ বিভাগের আওতাধীন দপ্তর/সংস্থা/কোম্পানির Transformer এর Specification Standardization এর জন্য নিম্নরুপভাবে একটি কমিটি গঠন করা হলোঃ

ক্র:নং	কর্মকর্তাদের নাম, পদবী ও কর্মস্থল	পদ
০১।	ড. আহমেদ কায়কাউস, অতিরিক্ত সচিব, বিদ্যুৎ বিভাগ।	আহবায়ক
০২।	জনাব মোঃ মাহবুব-উল-আলম, যুগ্ম-সচিব (প্রশাসন), বিদ্যুৎ বিভাগ।	সদস্য
০৩।	জনাব মোঃ আনোয়ার হোসেন, যুগ্ম-সচিব (উন্নয়ন), বিদ্যুৎ বিভাগ।	সদস্য
০৪।	সদস্য (বিতরণ), বিউবো।	সদস্য
০৫।	মহাপরিচালক, পাওয়ার সেল।	সদস্য
০৬।	পরিচালক (প্রকৌশল), ডিপিডিসি।	সদস্য
০৭।	পরিচালক (প্রকৌশল), ডেসকো।	সদস্য
০৮।	পরিচালক (কারিগরী), ওজোপাডিকো।	সদস্য
০৯।	পরিচালক, ডিজাইন-২, বিউবো।	সদস্য
১০।	পরিচালক (MPSS), বাপবিবো।	সদস্য
১১।	পরিচালক (কমার্শিয়াল), পাওয়ার সেল।	সদস্য-সচিব

কমিটির কর্মপরিধি নিম্নরূপঃ

(ক) কমিটি কর্তৃক বিদ্যুৎ বিভাগের ২০-১১-২০১৪ তারিখের ২৭.০০.০০০০.০৪১.০১০.১৮. ১৩(অংশ).১৫৬৬ নং পরিপত্রের আলোকে বিভিন্ন বিতরণ সংস্থা/কোম্পানির বিতরণ ট্রান্সফর্মারের Specification Standardization নির্ধারণ;

(খ) বর্তমানে ব্যবহৃত ট্রান্সফর্মারের ত্রুটি-বিচ্যুতি বা সীমাবদ্ধতা নিরুপন;

(গ) এতদসংশ্লিষ্ট অন্যান্য কার্যাদি;

২। ক) কমিটি প্রয়োজনবোধে কারিগরী উপ-কমিটি গঠন করতে পারবে এবং বিশেষজ্ঞদের পরামর্শ গ্রহণ করতে পারবে।

খ) কমিটি প্রয়োজনবোধে সদস্য কো-অপ্ট করতে পারবে।

৩। যথাযথ কর্তৃপক্ষের অনুমোদনক্রমে জারীকৃত এ আদেশ অবিলম্বে কার্যকর হবে।

স্বাক্ষরিত/-২৭-১১-২০১৪
(শেখ শোয়েবুল আলম)
উপ-সচিব
ফোন: ৯৫১৩৩৬৪
e-mail:admin-1@pd.gov.bd

কার্যার্থে বিতরণঃ

০১। ড. আহমেদ কায়কাউস, অতিরিক্ত সচিব, বিদ্যুৎ বিভাগ।
০২। জনাব মোঃ মাহবুব-উল-আলম, যুগ্ম-সচিব (প্রশাসন), বিদ্যুৎ বিভাগ।
০৩। জনাব মোঃ আনোয়ার হোসেন, যুগ্ম-সচিব (উন্নয়ন), বিদ্যুৎ বিভাগ।

০৪। মহাপরিচালক, পাওয়ার সেল।
০৫। সদস্য (বিতরণ), বিউবো।
০৬ পরিচালক (কমার্শিয়াল), পাওয়ার সেল।
০৭। পরিচালক (প্রকৌশল), ডিপিডিসি।
০৮। পরিচালক (প্রকৌশল), ডেসকো।
০৯। পরিচালক (কারিগরী), ওজোপাডিকো।
১০। পরিচালক (MPSS), বাপবিবো।
১১। পরিচালক, ডিজাইন-২, বিউবো।

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়
বিদ্যুৎ বিভাগ
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নং-২৭.০০.০০০০.০৪১.০১০.১৮.১৩(অংশ).১৫৬৬ তারিখঃ ২০-১১-২০১৪খ্রি:

পরিপত্র

বিষয়: সকল সংস্থা/কোম্পানির ট্রান্সফর্মার ওভারলোড ও পুড়ে যাওয়া রোধকল্পে নীতিমালা।

ট্রান্সফর্মার ওভারলোড ও পুড়ে যাওয়া রোধকল্পে এ বিভাগের অধীনস্থ সকল সংস্থা/কোম্পানিকে নিম্নোক্ত নীতিমালা অনুসরণ করতে হবে–

ক) ওভারলোডেড ট্রান্সফর্মারের পরিমান লক্ষ্যমাত্রা অনুযায়ী কমাতে হবে এবং লাইনে স্থাপিত ট্রান্সফর্মারের হালনাগাদ লোড না জেনে উক্ত ট্রান্সফর্মার থেকে নতুন কোন সংযোগ দেয়া যাবে না;

(খ) ট্রান্সফর্মার নিয়মিত মনিটরিং নিশ্চিত করতে হবে;

(গ) বছরে ন্যূনতম তিনবার পিক সময়ে (মে, জুলাই ও অক্টোবর মাসে) ট্রান্সফর্মারের লোড পরিমাপ করতে হবে;

(ঘ) ৩ ফেজের ট্রান্সফর্মার/ট্রান্সফমার ব্যাংকের ক্ষেত্রে লোড পরিমাপের সময় ও নুতন সংযোগ প্রদানের সময় ফেজ ব্যালেন্সিং করতে হবে;

(ঙ) উপযুক্ত তার (wire) দিয়ে ট্রান্সফর্মারের যথাযথ গ্রাউন্ডিং নিশ্চিত করতে হবে;

(চ) ট্রান্সফর্মারের HT সাইডে গুনগত মান ও সঠিক সাইজের Lightning Arrester ও Drop Out Fuse Cut-out (DOFT) স্থাপন নিশ্চিত করতে হবে;

(ছ) ট্রান্সফর্মারের HT সাইডে Proper Insulated Connector ব্যবহার করতে হবে;

(জ) হর্ণগ্যাপ টাইপ ট্রান্সফর্মার এর গ্যাপ সঠিক মানের রাখতে হবে;

(ঝ) বছরে ন্যূনতম একবার প্রতিটি ট্রান্সফর্মারের তেলের Break down Voltage Test সম্পন্ন করতে হবে;

(ঞ) ট্রান্সফর্মারের LT Side এ প্রটেকশন নিশ্চিত করতে হবে;

(ট) প্রত্যেকটি বিদ্যুৎ বিতরণ সংস্থায় ট্রান্সফর্মার মেরামত ও টেস্টের জন্য ওয়ার্কশপ স্থাপন করতে হবে যাতে নিজস্ব ওয়ার্কশপে প্রয়োজনীয় রুটিন টেস্ট ও মেরামত কাজ করা সম্ভব হয়;

(ঠ) সংগ্রহকালীন সময়ে ট্রান্সফর্মারের প্রকৃত ক্ষমতা নিশ্চিত হওয়ার জন্য আলাদা আলাদা রেটিং এর ন্যূনতম ৫% স্যাম্পল সাইজ নিয়ে Temperature rise test করতে হবে;

(ড) সকল বিদ্যুৎ বিতরণী সংস্থা/কোম্পানির জন্য বিতরণ ট্রান্সফর্মারের Standardized Specification বিদ্যুৎ বিভাগ নির্ধারণ করবে;

(ঢ) পল্লী বিদ্যুতায়ন বোর্ডের ঢাকার পার্শ্ববর্তী পল্লী বিদ্যুৎ সমিতিসমূহে যেমন- ঢাকা-১,২,৩, গাজীপুর, মুন্সিগঞ্জ, নরসিংদী-১,২, নারায়ণগঞ্জ, টাঙ্গাইল পবিসসহ যে সকল পবিসে বিদ্যুতের চাহিদার পরিমান বেশি (Concentrated load এর ক্ষেত্রে) সে সকল স্থানে ৩ ফেজ ট্রান্সফর্মার স্থাপন করা যেতে পারে;

(ণ) ট্রান্সফর্মার এর পিরিয়ডিক রক্ষণাবেক্ষণ নিশ্চিত করতে হবে;

(ত) বিদ্যুৎ বিভাগের নির্দেশনার আলোকে ট্রান্সফর্মার ওভারলোড ও পুড়ে যাওয়া রোধে বিতরণ সংস্থা/ কোম্পানি মাসিক অগ্রগতি প্রতিবেদন বিদ্যুৎ বিভাগে প্রেরণ করতে হবে;

উপরোক্ত নির্দেশনা যথাযথভাবে প্রতিপালন করার জন্য অনুরোধ করা হলো।

(মোঃ মাহবুব-উল-আলম)
যুগ্ম-সচিব

নং-২৭.০০.০০০০.০৪১.০১০.১৮.১৩ (অংশ).১৫৬৬ তারিখঃ ২০-১১-২০১৪ খ্রি:

অনুলিপি অবগতি ও পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য প্রেরণ করা হলোঃ

১। বৈদ্যুতিক উপদেষ্টা ও প্রধান বিদ্যুৎ পরিদর্শক, ঢাকা।
২। চেয়ারম্যান, বিউবো/পবিবো, ঢাকা।
৩। ব্যবস্থাপনা পরিচালক, ডিপিডিসি/ডেসকো/ওজোপাডিকো/পিজিসিবি/ইজিসিবি/নওজোপাডিকো/ নওপাজেকো/এপিএসসিএল/আরপিসিএল/কোল পাওয়ার জেনারেশন কোম্পানি বাংলাদেশ লিঃ, ঢাকা/খুলনা/ বি-বাড়িয়া।
৪। ----------
৫। যুগ্ম-সচিব (প্রশাসন/উন্নয়ন/সমন্বয়), বিদ্যুৎ বিভাগ।
৬। মাননীয় উপদেষ্টার একান্ত সচিব, বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়।
৭। মাননীয় প্রতিমন্ত্রীর একান্ত সচিব, বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়।
৮। সচিব মহোদয়ের একান্ত সচিব, বিদ্যুৎ বিভাগ।
৯। অতিরিক্ত সচিব মহোদয়ের ব্যক্তিগত কর্মকর্তা, বিদ্যুৎ বিভাগ।

(শেখ শোয়েবুল আলম) ২০/১১/১৪
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