Bid Number/बोली क्रमांक (बिड संख्या):
GEM/2023/B/4135135
Dated/दिनांक : 26-10-2023

Bid Document/ बिड दस्तावेज़

Bid Details/बिड विवरण	
Bid End Date/Time/बिड बंद होने की तारीख/समय	06-11-2023 13:00:00
Bid Opening Date/Time/बिड खुलने की तारीख/समय	06-11-2023 13:30:00
Bid Offer Validity (From End Date)/बिड पेशकश वैधता (बंद होने की तारीख से)	90 (Days)
Ministry/State Name/मंत्रालय/राज्य का नाम	Ministry Of Heavy Industries And Public Enterprises
Department Name/विभाग का नाम	Department Of Heavy Industry
Organisation Name/संगठन का नाम	Bharat Heavy Electricals Limited (bhel)
Office Name/कार्यालय का नाम	10090001-edn Bangalore
Total Quantity/कुल मात्रा	22
Item Category/मद केटेगरी	CT BAR RING, 2CORE, 2000/1A, 5P10 & 0.2 (BHEL Material code: SA0481710069) (Q3) , TRFMR 4KVA 3PH YND11 415/320V (BHEL Material code: SA0481710116) (Q3) , TRFMR 4KVA 3PH DYN5 415/320V (BHEL Material Code: SA0481710132) (Q3) , TRFMR 2KVA, 3PH, 220/85V, YNYNO (BHEL Material Code: SA0481929010) (Q3) , TRFMR 3KVA, 3PH, 220/100V, YNYNO (BHEL Material Code: SA0481929029) (Q3) , TRFMR PWR 5KVA 3PH YNYN0 220/415V (BHEL Material Code: SA0482905034) (Q3) , TRFMR PWR 4KVA, 3PH YNYN0, 415V / 165V (BHEL Material Code: SA0482969130A) (Q3)
MSE Exemption for Years of Experience and Turnover/ अनुभव के वर्षों से एमएसई छूट	No
Startup Exemption for Years of Experience and Turnover/ अनुभव के वर्षों से स्टार्टअप छूट	No
Document required from seller/विक्रेता से मांगे गए दस्तावेज़	Additional Doc 1 (Requested in ATC) *In case any bidder is seeking exemption from Experience / Turnover Criteria, the supporting documents to prove his eligibility for exemption must be uploaded for evaluation by the buyer
Bid to RA enabled/बिड से रिवर्स नीलामी सक्रिय किया	No
ITC available to buyer/क्रेता के लिए उपलब्ध आईटीसी	Yes
Type of Bid/बिड का प्रकार	Two Packet Bid

Bid Details/बिड विवरण	
Primary product category	CT BAR RING, 2CORE, 2000/1A, 5P10 & 0.2 (BHEL Material code: SA0481710069)
Time allowed for Technical Clarifications during technical evaluation/तकनीकी मूल्यांकन के दौरान तकनीकी स्पष्टीकरण हेतु अनुमत समय	2 Days
Inspection Required (By Empanelled Inspection Authority / Agencies pre-registered with GeM)	No
Payment Timelines	Payments shall be made to the Seller within **90** days of issue of consignee receipt-cum-acceptance certificate (CRAC) and on-line submission of bills (This is in supersession of 10 days time as provided in clause 12 of GeM GTC)
Evaluation Method/मूल्यांकन पद्धति	Item wise evaluation/

EMD Detail/ईएमडी विवरण

Required/आवश्यकता	No

ePBG Detail/ईपीबीजी विवरण

Required/आवश्यकता	No

Splitting/विभाजन

Bid splitting not applied/बोली विभाजन लागू नहीं किया गया.

MII Purchase Preference/एमआईआई खरीद वरीयता

MII Purchase Preference/एमआईआई खरीद वरीयता	No

MSE Purchase Preference/एमएसई खरीद वरीयता

MSE Purchase Preference/एमएसई खरीद वरीयता	Yes

1. Purchase preference to Micro and Small Enterprises (MSEs): Purchase preference will be given to MSEs as defined in Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of Micro, Small and Medium Enterprises and its subsequent Orders/Notifications issued by concerned Ministry. If the bidder wants to avail the Purchase preference, the bidder must be the manufacturer of the offered product in case of bid for supply of goods. Traders are excluded from the purview of Public Procurement Policy for Micro and Small Enterprises. In respect of bid for Services, the bidder must be the Service provider of the offered Service. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered product or service. If L-1 is not an MSE and MSE Seller (s) has/have quoted price within L-1+ 15%

(Selected by Buyer)of margin of purchase preference /price band defined in relevant policy, such Seller shall be given opportunity to match L-1 price and contract will be awarded for 25%(selected by Buyer) percentage of total QUANTITY.The buyers are advised to refer the OM No.F.1/4/2021-PPD dated 18.05.2023 OM_No.1_4_2021_PPD_dated_18.05.2023 for compliance of Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017.
2. Estimated Bid Value indicated above is being declared solely for the purpose of guidance on EMD amount and for determining the Eligibility Criteria related to Turn Over, Past Performance and Project / Past Experience etc. This has no relevance or bearing on the price to be quoted by the bidders and is also not going to have any impact on bid participation. Also this is not going to be used as a criteria in determining reasonableness of quoted prices which would be determined by the buyer based on its own assessment of reasonableness and based on competitive prices received in Bid / RA process.

Evaluation Method (Item Wise Evaluation Method)

Contract will be awarded schedulewise and the determination of L1 will be done separately for each schedule. The details of item-consignee combination covered under each schedule are as under:

Evaluation Schedules	**Item/Category**	**Quantity**
Schedule 1	Ct Bar Ring, 2core, 2000/1a, 5p10 & 0.2 (bhel Material Code: Sa0481710069)	12
Schedule 2	Trfmr 4kva 3ph Ynd11 415/320v (bhel Material Code: Sa0481710116)	1
Schedule 3	Trfmr 4kva 3ph Dyn5 415/320v (bhel Material Code: Sa0481710132)	1
Schedule 4	Trfmr 2kva, 3ph, 220/85v, Ynyno (bhel Material Code: Sa0481929010)	1
Schedule 5	Trfmr 3kva, 3ph, 220/100v, Ynyno (bhel Material Code: Sa0481929029)	1
Schedule 6	Trfmr Pwr 5kva 3ph Ynyn0 220/415v (bhel Material Code: Sa0482905034)	5
Schedule 7	Trfmr Pwr 4kva, 3ph Ynyn0, 415v / 165v (bhel Material Code: Sa0482969130a)	1

CT BAR RING, 2CORE, 2000/1A, 5P10 & 0.2 (BHEL Material Code: SA0481710069) (12 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	**ITC on GST Cess/जीएसटी उपकर कर क्रेडिट**
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	12	30

TRFMR 4KVA 3PH YND11 415/320V (BHEL Material Code: SA0481710116) (1 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	1	30

TRFMR 4KVA 3PH DYN5 415/320V (BHEL Material Code: SA0481710132) (1 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	1	30

TRFMR 2KVA, 3PH, 220/85V, YNYNO (BHEL Material Code: SA0481929010) (1 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	1	30

TRFMR 3KVA, 3PH, 220/100V, YNYNO (BHEL Material Code: SA0481929029) (1 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	1	30

TRFMR PWR 5KVA 3PH YNYN0 220/415V (BHEL Material Code: SA0482905034) (5 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

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ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	5	30

TRFMR PWR 4KVA, 3PH YNYN0, 415V / 165V (BHEL Material Code: SA0482969130A) (1 pieces)

Technical Specifications/तकनीकी विशिष्टियाँ

Buyer Specification Document/क्रेता विशिष्टि दस्तावेज़	Download

Input Tax Credit(ITC)/इनपुट कर क्रेडिट(आईटीसी) and/ तथा Reverse Charge(RCM)/रिवर्स प्रभार (आरसीएम) Details

ITC on GST/जीएसटी पर इनपुट कर क्रेडिट	ITC on GST Cess/जीएसटी उपकर कर क्रेडिट
100%	NA

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी and/ तथा Quantity/मात्रा

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Quantity/मात्रा	Delivery Days/डिलीवरी के दिन
1	Dinesh Kumar Bhagat	560026,MANAGER STORES,- GI Bharat Heavy Electricals Limited Electronics Division, Mysore Road, Bangalore - 560026 Karnataka India	1	30

Buyer Added Bid Specific Terms and Conditions/क्रेता द्वारा जोड़ी गई बिड की विशेष शर्तें

1. **Scope of Supply**

   Scope of supply (Bid price to include all cost components) : Only supply of Goods

2. **Generic**

   OPTION CLAUSE: The Purchaser reserves the right to increase or decrease the quantity to be ordered up to 25 percent of bid quantity at the time of placement of contract. The purchaser also reserves the right to increase the ordered quantity by up to 25% of the contracted quantity during the currency of the contract at the contracted rates. Bidders are bound to accept the orders accordingly.

3. **Generic**

   Data Sheet of the product(s) offered in the bid, are to be uploaded along with the bid documents. Buyers can match and verify the Data Sheet with the product specifications offered. In case of any unexplained mismatch of technical parameters, the bid is liable for rejection.

4. **Generic**

   Bidders are advised to check applicable GST on their own before quoting. Buyer will not take any responsibility in this regards. GST reimbursement will be as per actuals or as per applicable rates (whichever is lower), subject to the maximum of quoted GST %.

5. **Generic**

   Supplier shall ensure that the Invoice is raised in the name of Consignee with GSTIN of Consignee only.

6. **Generic**

   While generating invoice in GeM portal, the seller must upload scanned copy of GST invoice and the screenshot of GST portal confirming payment of GST.

7. **Buyer Added Bid Specific ATC**

   Buyer Added text based ATC clauses

   A. PRE-QUALIFICATION REQUIREMENT (PQR)

   Bidder should submit documentary evidence for PQC, for evaluating the eligibility of Bidder as per **Buyer s pecification document** in this bid.

   B. Payment Timelines:

Type of Bidder	Payment Terms (Number of days)
Micro & Small Enterprises (MSEs)	45 days from CRAC date
Medium Enterprises	60 days from CRAC date
Non MSME	90 days from CRAC date

C. Risk Purchase - In case of failure of supplier, BHEL at its discretion may make purchase of the material s/ services not supplied/ rendered in time at the RISK & COST of the supplier. Under such situation, the sup plier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase. In case of invocation of risk purchase, BHEL shall get Balance work/ supply done at supplier risk and cost, which shall be recovered from supplier out of dues of this contract, any other contract with BHEL and balance amount, if any shall be required to be deposited by supplier.

D. Contact Details:

Engineering Dept.	Tender Dept.
Mr. Rajkumar Rangu/ Manager	Mr. Dinesh Kumar Bhagat/ Manager
e-mail: rajkumarrangu@bhel.in	e-mail: dkbhagat@bhel.in
Tel: 080 26998107	Tel: 080 26998108

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Disclaimer/अस्वीकरण

The additional terms and conditions have been incorporated by the Buyer after approval of the Competent Authority in Buyer Organization, whereby Buyer organization is solely responsible for the impact of these clauses on the bidding process, its outcome, and consequences thereof including any eccentricity / restriction arising in the bidding process due to these ATCs and due to modification of technical specifications and / or terms and conditions governing the bid. Any clause(s) incorporated by the Buyer regarding following shall be treated as null and void and would not be considered as part of bid:-

1. Definition of Class I and Class II suppliers in the bid not in line with the extant Order / Office Memorandum issued by DPIIT in this regard.
2. Seeking EMD submission from bidder(s), including via Additional Terms & Conditions, in contravention to exemption provided to such sellers under GeM GTC.
3. Publishing Custom / BOQ bids for items for which regular GeM categories are available without any Category item bunched with it.
4. Creating BoQ bid for single item.
5. Mentioning specific Brand or Make or Model or Manufacturer or Dealer name.
6. Mandating submission of documents in physical form as a pre-requisite to qualify bidders.
7. Floating / creation of work contracts as Custom Bids in Services.
8. Seeking sample with bid or approval of samples during bid evaluation process.
9. Mandating foreign / international certifications even in case of existence of Indian Standards without specifying equivalent Indian Certification / standards.
10. Seeking experience from specific organization / department / institute only or from foreign / export experience.
11. Creating bid for items from irrelevant categories.
12. Incorporating any clause against the MSME policy and Preference to Make in India Policy.
13. Reference of conditions published on any external site or reference to external documents/clauses.
14. Asking for any Tender fee / Bid Participation fee / Auction fee in case of Bids / Forward Auction, as the case may be.

Further, if any seller has any objection/grievance against these additional clauses or otherwise on any aspect of this bid, they can raise their representation against the same by using the Representation window provided in the bid details field in Seller dashboard after logging in as a seller within 4 days of bid publication on GeM. Buyer is duty bound to reply to all such representations and would not be allowed to open bids if he fails to reply to such representations.

This Bid is also governed by the General Terms and Conditions/ यह बिड सामान्य शर्तों के अंतर्गत भी शासित है

In terms of GeM GTC clause 26 regarding Restrictions on procurement from a bidder of a country which shares a land border with India, any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority. While participating in bid, Bidder has to undertake compliance of this and any false declaration and non-compliance of this would be a ground for immediate termination of the contract and further legal action in accordance with the laws./जेम की सामान्य शर्तों के खंड 26 के संदर्भ में भारत के साथ भूमि सीमा साझा करने वाले देश के बिडर से खरीद पर प्रतिबंध के संबंध में भारत के साथ भूमि सीमा साझा करने वाले देश का कोई भी बिडर इस निविदा में बिड देने के लिए तभी पात्र होगा जब वह बिड देने वाला सक्षम प्राधिकारी के पास पंजीकृत हो।बिड में भाग लेते समय बिडर को इसका अनुपालन करना होगा और कोई भी गलत घोषणा किए जाने व इसका अनुपालन न करने पर अनुबंध को तत्काल समाप्त करने और कानून के अनुसार आगे की कानूनी कार्रवाई का आधार होगा।

---Thank You/धन्यवाद---

BHEL	PREQUALIFICATION CRITERIA FOR CURRENT TRANSFORMER	PQC: 408-015 PAGE 01 OF 01

SL. NO.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of LT resin cast ring type current transformers for 2 years or more. This CT plays a vital role and used in conjunction with over current relay for protection of excitation circuit from over current.	Self-certification by OEM
2.	The bidder shall submit valid test certificates (i.e. Type test and Routine test) complying with relevant standard mentioned in the technical specification **PS/408/2082** Clause no. **10** on the date of submission of offer against the tender.	Test certificates for similar item may be submitted.
3.	The bidder shall submit the documents indicated for Current Transformer or should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate of current transformer used for protection application b) Reference list of customers c) Purchase order copies along with invoice and corresponding delivery challans.
4.	On receipt at purchaser's works, if it is observed that the item requires rework / rectification, supplier shall arrange for the same at EDN works, Bangalore within 6 working days.	Conformance for complying.

Rev.00		**Approved:** R.Rukmani
		Prepared: Arun Kumar / Issued: GCE / Date: 29.03.2021

BHEL Material Code: SA0481710069

Material Description: CT BAR RING,2CORE, 2000/1A ,5P10 & 0.2

CURRENT TRANSFORMER RESIN CAST DUAL CORE,

BAR PRY RING TYPE RATIO: 2000/1A,1A

CORE 1 :- 15VA & ACCY.CLASS:5P10

CORE 2 :- 15VA & ACCY.CLASS:0.2

INSULATION CLASS:B

HIGHEST SYSTEM VOLTAGE 1.1KV TEST VOLTAGE:4 KV 50HZ FOR 1 MIN

SUITABLE FOR 2 RUNS OF 10 X 100 SQMM BUSBARS ON PRIMARY

REF.STD :IS2705

REFERENCE DOCUMENT: PS-408-2082

PURCHASE SPECIFICATION
FOR
LT RESIN CAST RING TYPE CURRENT TRANSFORMER

1.0 APPLICATION:

This purchase specification is for LT Resin cast, Ring type, Current Transformer used in the Excitation system for sensing over current in the Excitation circuit. This current transformer plays a vital role and used in conjunction with over current relay for protection of excitation circuit from over current.

The supplier shall confirm in writing, the complete clause wise compliance with the specification. Suppliers shall be fully responsible for the supplied current transformer for its completeness, safe and satisfactory operation.

2.0 SERVICE CONDITIONS OF CURRENT TRANSFORMER:

1. Installation : Indoor & inside the cubicle
2. Max. ambient temperature outside the enclosure : 50°C
3. Cooling : Air natural
4. Humidity : 100% tropical non condensing
5. Ventilation : Restricted as it is mounted inside the cubicle.

3.0 SPECIFCATION

Sl. No.	Description	Compliance
	Technical data	
1.	LT Resin cast, Ring type, Current Transformer	
2.	No. of Cores: As per RFQ/P.O.	
3.	Current Ratio: As per RFQ/P.O.	
4.	Burden: As per RFQ/P.O.	
5.	Accuracy Class: 5P10 (Unless otherwise specified)	
6.	Insulation Class : B (Unless otherwise specified)	
7.	Frequency: 50 Hz	
8.	Current density shall be suitable for 1.2 x rated current	
9.	Highest system voltage: 1100V (Unless otherwise specified)	
10.	Test Voltage: 4KV, 50 Hz, 1 MIN. (Unless otherwise specified)	
11.	Inner Diameter: As per RFQ/P.O.	
12.	Reference Standard: IS 2705	

4.0 TERMINAL MARKINGS

Terminals shall be marked clearly for identifying primary and secondary windings. For Primary winding P1 and P2 and for Secondary winding S1 and S2.

5.0 SECONDARY TERMINALS

Secondary terminals of current transformer shall be brought out for easy external connection to be suitable for upto 4Sq.mm cable wiring and to be provided with cover for covering the live terminals. CT secondary terminals shall be nickel plated brass stud type.

6.0 RATING PLATE

CT shall carry at least following markings and shall be marked legibly with following

a. CT ratio
b. Rated Frequency
c. Burden
d. Accuracy Class
e. Highest System Voltage
f. Insulation Class
g. Insulation Test Voltage
h. Reference standard: IS2705
i. Sl. No. & Year of manufacture
j. Manufacturer name

7.0 MAJOR MATERIALS:

Following are the major materials recommended to be used for construction of CT

a. Core: CRGO (Cold-Rolled Grain-Oriented steel)
b. Winding: Copper of 99.99% pure electrolytic grade.
c. Insulation: Shall be suitable for class of insulation indicated in RFQ/PO
d. Type : Epoxy Resin cast
e. Secondary terminal : 5mm pillar inside the casting, screwable from outside for 10mm length.

8.0 DIMENSIONAL DETAILS

Overall dimensional drawing clearly indicating overall dimensions, inner diameter as per RFQ/P.O., Outer diameter, base plate 5mm thick with mounting details shall be submitted along with the offer.

9.0 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER.

Supplier shall provide the following information along with the offer. *Bids without detailed and point wise compliance statement / documents required, will not be considered for further processing.*

a. Compliance to this specification and material description in the **R**equest **F**or **Q**uotation / **P**urchase **O**rder. List of deviations, if any, clause number-wise with reasons thereof, wherever applicable shall be clearly brought out.
b. **Type test and routine reports as mentioned in the clause no. 10 to be submitted**.
c. Overall Dimensional drawing as per clause no. 8.0
d. Materials used for process as per clause no. 7.0

10.0 TESTS

Following tests are to be performed on the current transformer as per IS 2705.

1. Type tests
   a. Temperature rise test (Not required for ring type CTs)
   b. Short time current test
2. Routine tests
   a. Verification of terminal marking and polarity test
   b. Dimensional check
   c. Power frequency dry withstand test
   d. Inter turn insulation test
   e. Ratio & Phase angle error test
   f. Composite error test

11.0 AFTER PLACEMENT OF PURCHASE ORDER

a. Final dimensional drawing for BHEL-EDN approval before manufacturing.
b. 'Quality assurance plan' for BHEL-EDN approval before manufacturing.
c. Test certificates for major materials used

12.0 PACKING

The item shall be properly packed to ensure that there are no damages / dislocation of parts during transit.

13.0 ACCEPTANCE CRITERIA

a. Dispatch clearance by purchaser after verification of a) routine test reports b) Material reports submitted.
b. On receipt of item at BHEL-EDN final acceptance will be by quality services of purchaser, verifying the conformance of item to this purchase specification and Inspection of item as per specification / drawings / documents at purchaser's works.

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0481710116

Material Description: TRFMR 4KVA 3PH YND11 415/320V

TRANSFORMER POWER DRY 4KVA, 3 PHASE, 50 HZ HV=415V, LV=320V,

VECTOR GROUP=YND11, LV TAP:+/-5%, +/-10%, IMPEDANCE=4%

INSULATION CLASS:B, INSULATION LEVEL: 4.0KV, 50HZ, 1 MIN.

8 MM THICK TRANSPARENT POLYCARBONATE SHEET OVER TERMINAL BOARD REQUIRED.

NICKEL PLATED BRASS STUD TERMINALS. EARTHED SHIELD BETWEEN HV & LV WINDINGS REQUIRED.

NO-LOAD CURRENT SHALL BE LESS THAN 15% OF RATED CURRENT

REF.STD: IS2026, IS11171, ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
600V	19.0	19.0
3300V	50.8	50.8
6600V	63.5	88.9
11KV	76.2	127.0

12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

13. ADDITIONAL INFORMATION

The following are the materials recommended to be used for constructions of transformers

A. Core: CRGO grade 41/51 or any equivalent grade.
B. Winding: Pure copper of appropriate grade and with suitable insulation.
C. Insulation, Varnish etc: Shall be to appropriate class of insulation.

14. DIMENSIONAL DETAILS

All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

15.1 Following are the tests for power transformers

A. Type tests :
1. Temperature rise test
2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
TT-08	4.00	400	425	250	250X200	10	350	180
TT-09	5.00	450	425	250	250X200	10	350	200
TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

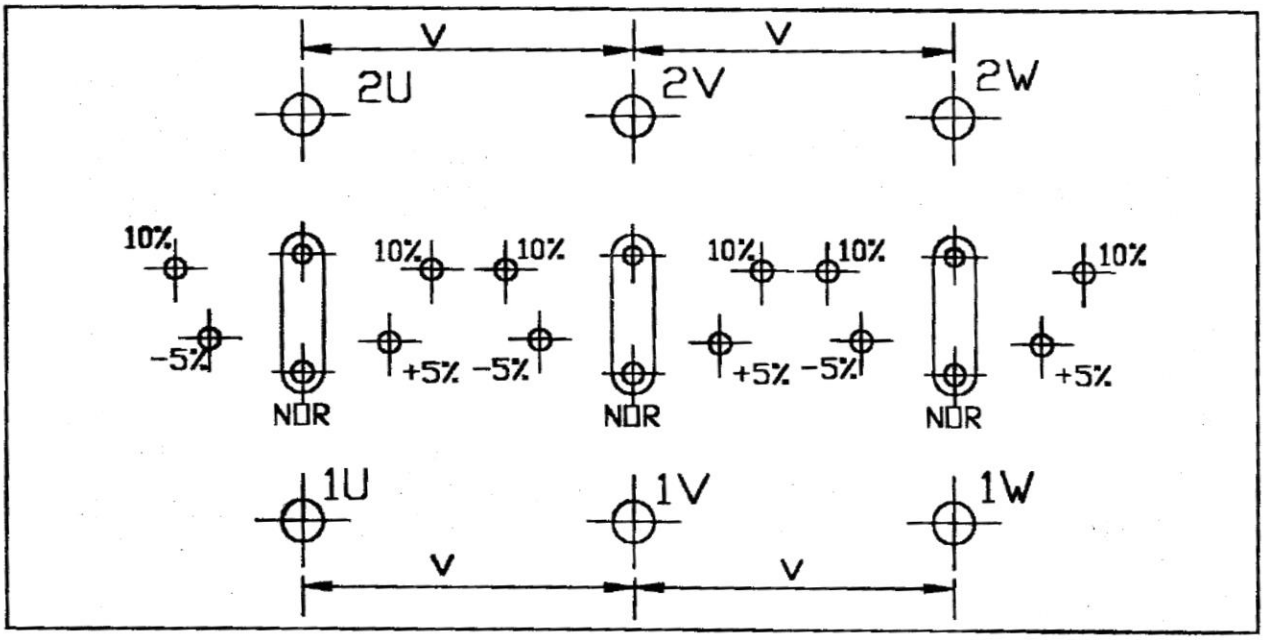
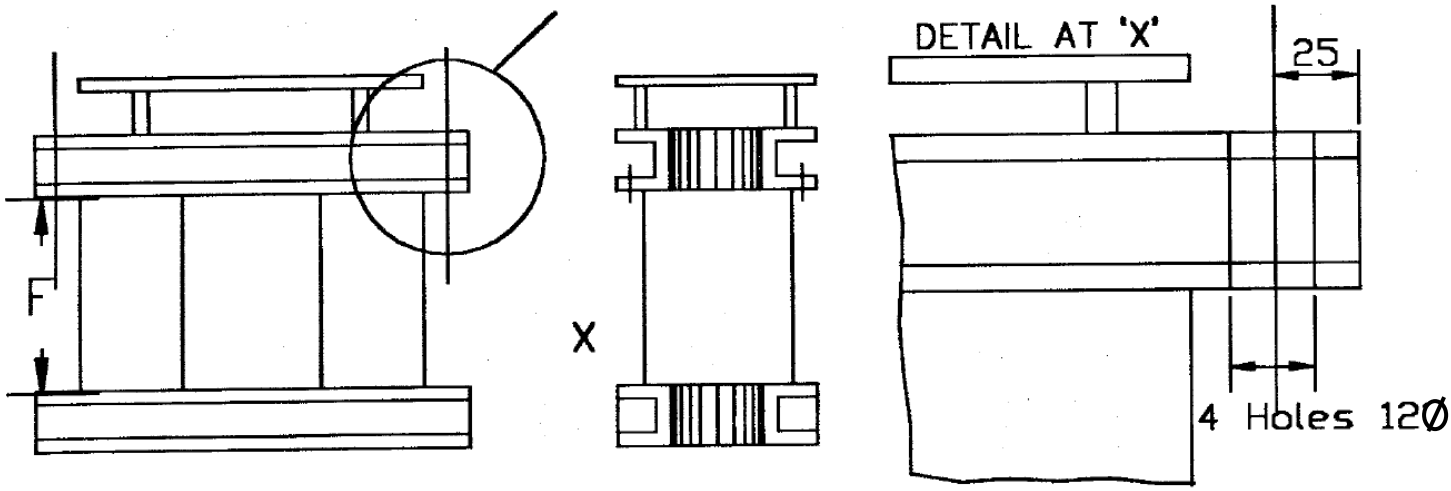


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

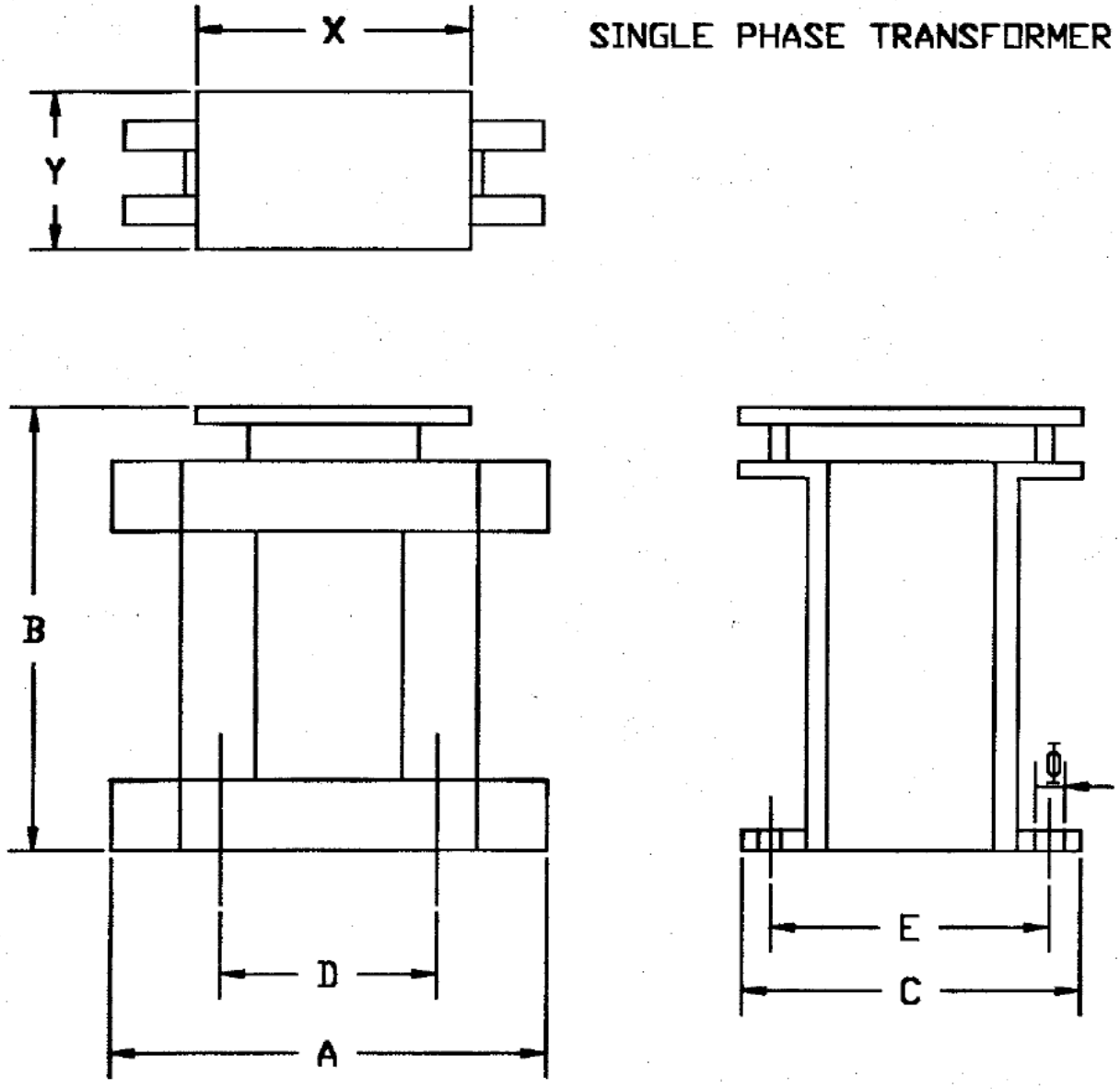


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

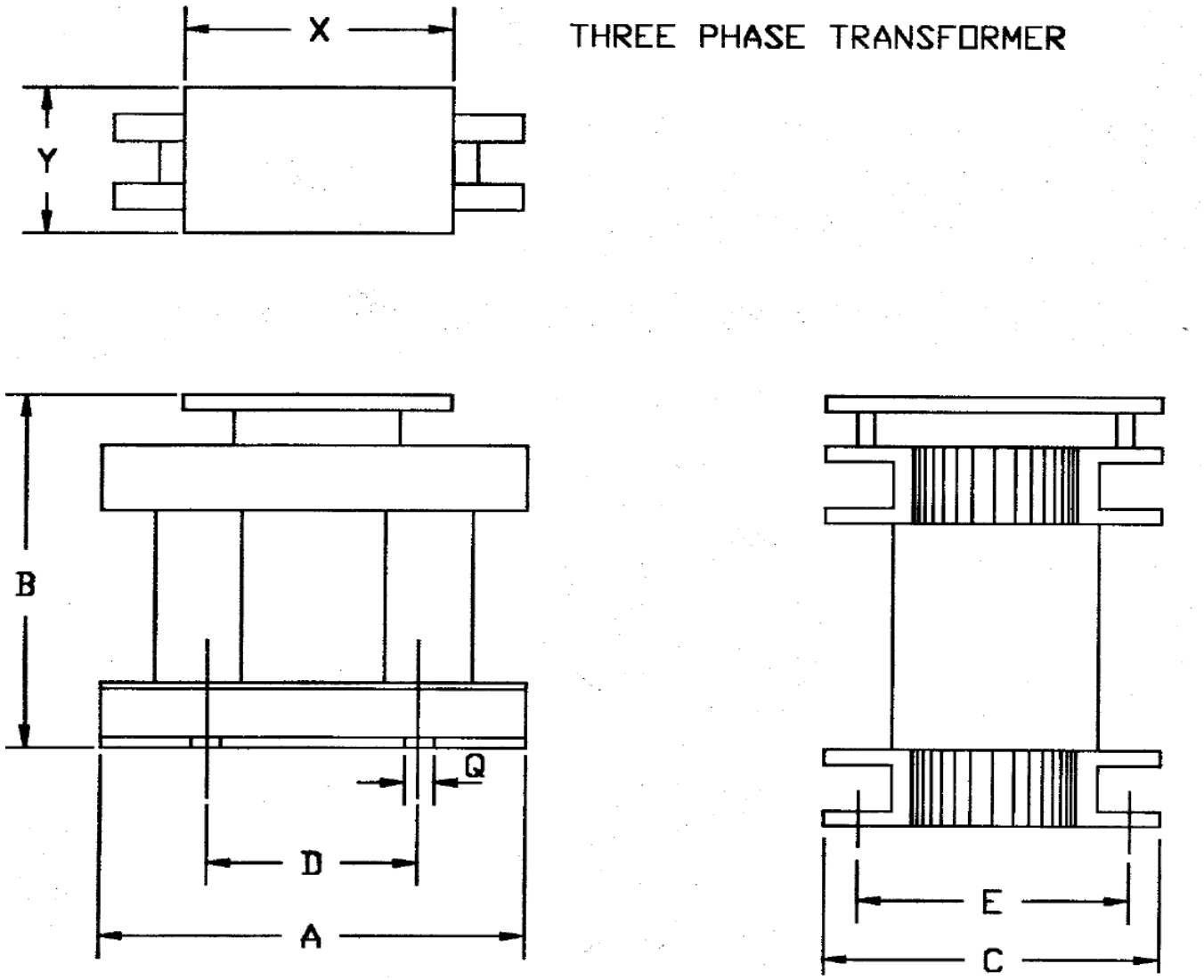


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0481710132

Material Description: TRFMR 4KVA 3PH DYN5 415/320V

TRANSFORMER POWER DRY 4KVA, 3 PHASE, 50 HZ HV=415V, LV=320V,

VECTOR GROUP=DYN5, HV TAP:+/-5%, +/-10%, IMPEDANCE=4%

INSULATION CLASS:B, INSULATION LEVEL: 4.0KV, 50HZ, 1 MIN.

8 MM THICK TRANSPARENT POLY CARBONATE SHEET OVER TERMINAL BOARD REQUIRED.

NICKEL PLATED BRASS STUD TERMINALS. EARTHED SHIELD BETWEEN HV & LV WINDINGS REQUIRED.

NO-LOAD CURRENT SHALL BE LESS THAN 15% OF RATED CURRENT

REF.STD: IS2026, IS11171, ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
600V	19.0	19.0
3300V	50.8	50.8
6600V	63.5	88.9
11KV	76.2	127.0

12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

13. ADDITIONAL INFORMATION

The following are the materials recommended to be used for constructions of transformers

A. Core: CRGO grade 41/51 or any equivalent grade.
B. Winding: Pure copper of appropriate grade and with suitable insulation.
C. Insulation, Varnish etc: Shall be to appropriate class of insulation.

14. DIMENSIONAL DETAILS

All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

15.1 Following are the tests for power transformers

A. Type tests :
1. Temperature rise test
2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
TT-08	4.00	400	425	250	250X200	10	350	180
TT-09	5.00	450	425	250	250X200	10	350	200
TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

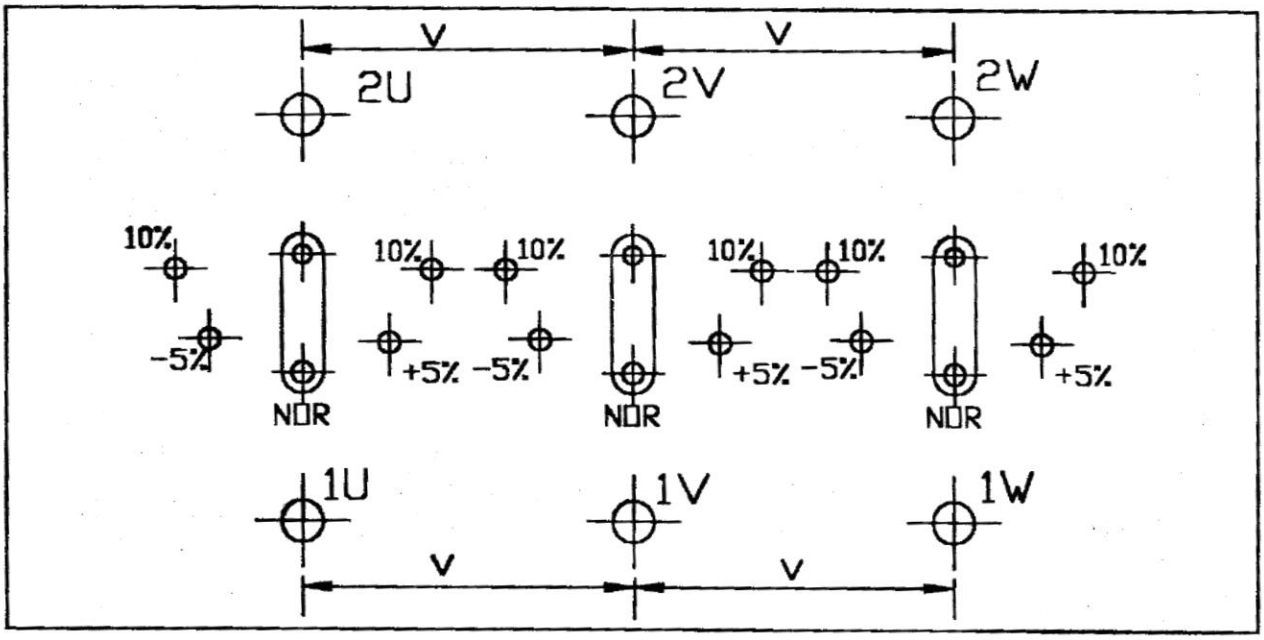
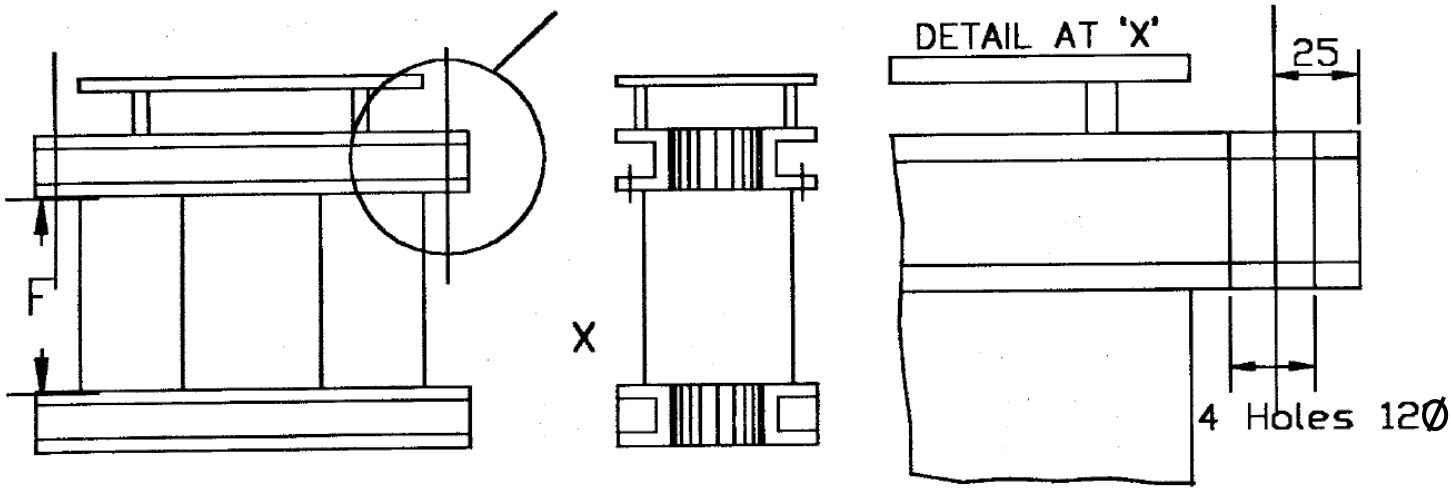


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

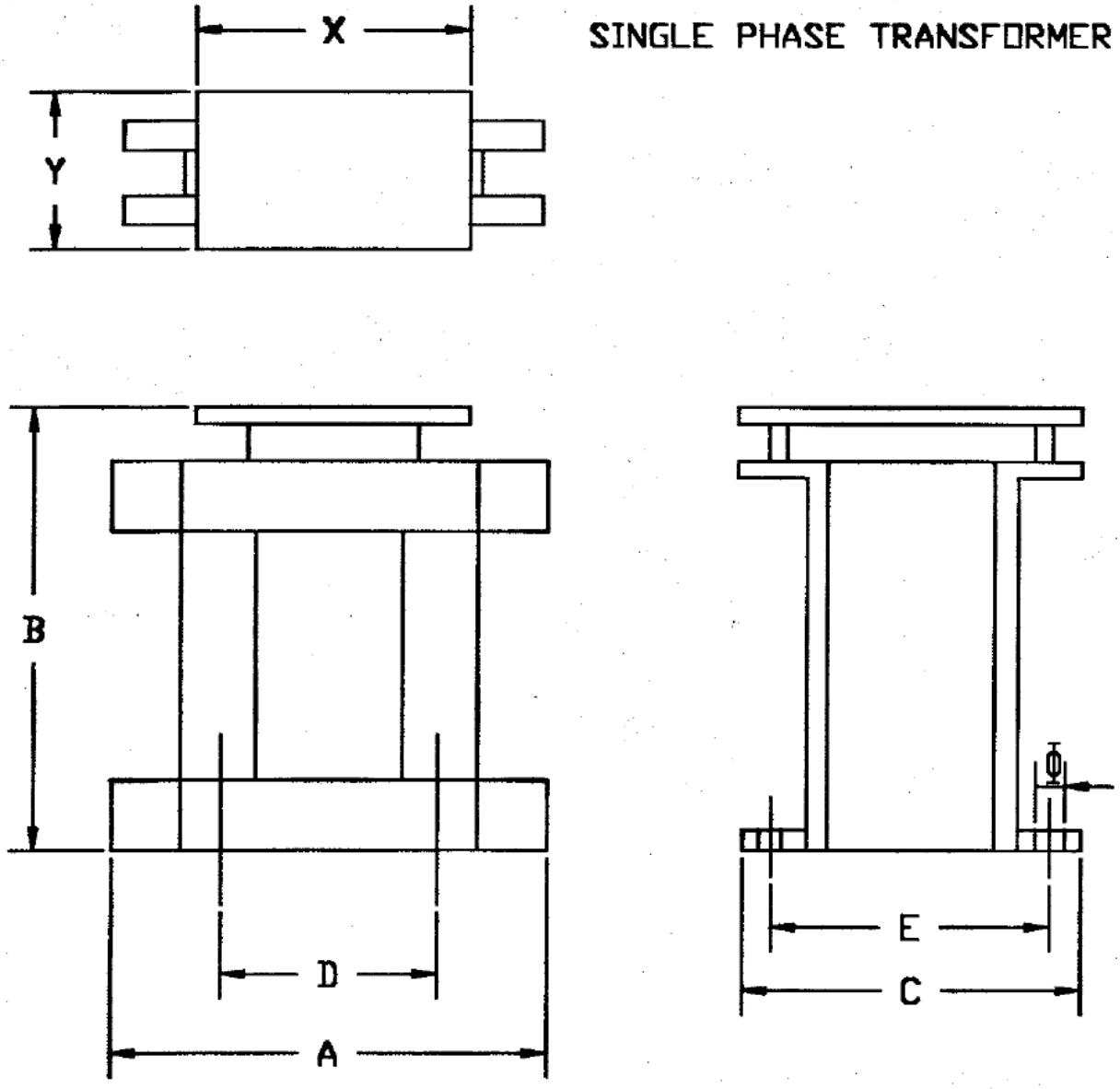


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

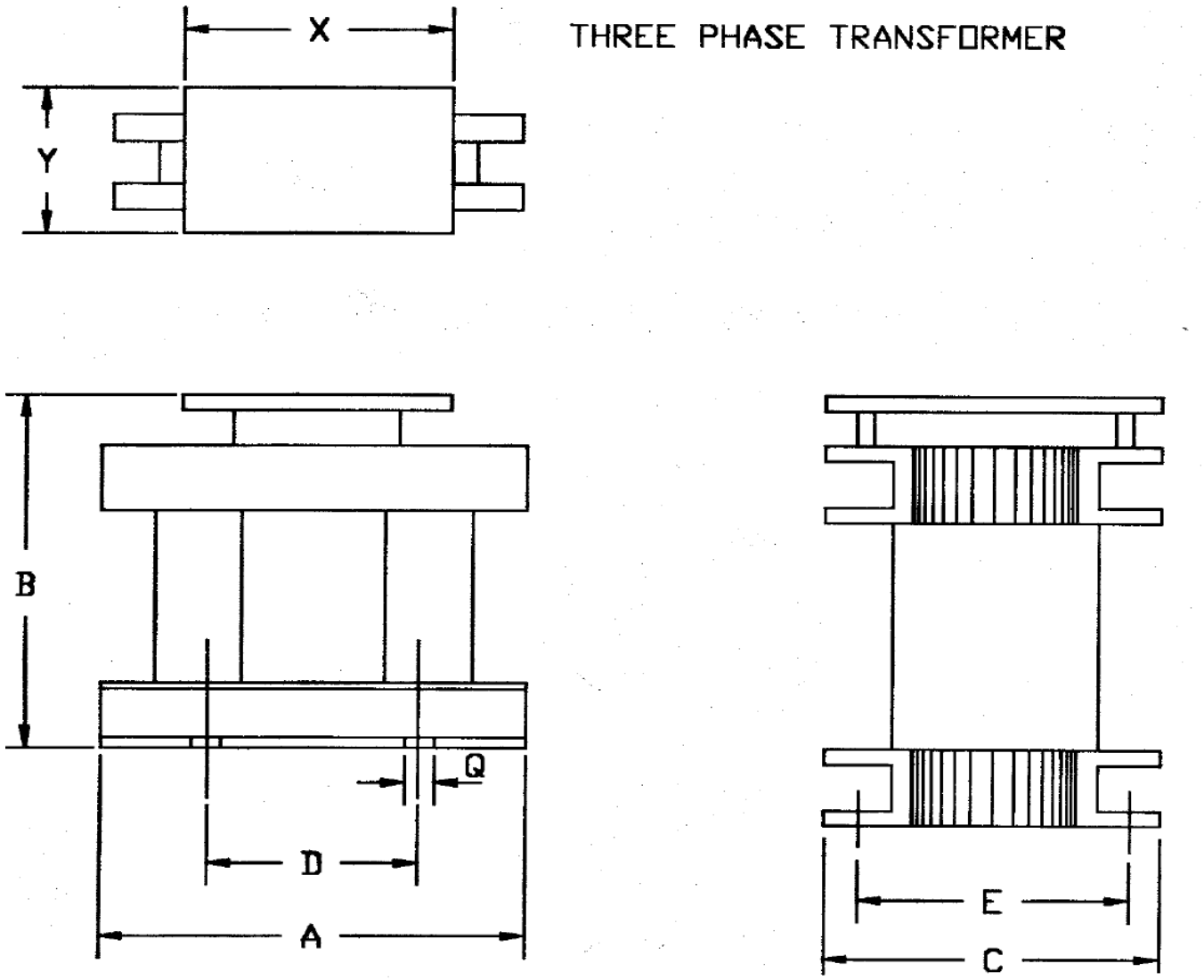


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0481929010

Material Description: TRFMR 2KVA,3PH,220/85V,YNYNO

TRANSFORMER PWR DRY 2 KVA ,3PHASE, FREQUENCY:50-400HZ HV: 220;LV: 85V

VECTOR GROUP: YNYNO HV TAP :+/-5%, +/-10% IMPEDANCE: 4%

INSULATION CLASS: B INSULATION LEVEL: 4KV 50HZ FOR 1MIN

TRANSPARENT POLY-CARBONATE 8MM SHEET ABOVE TERMINALS.

NICKEL PLATED BRASS TERMINALS. EARTHED SCREEN BETWEEN HV & LV IS REQUIRED.

NO LOAD CURRENT SHALL BE LESS THAN 15% OF RATED CURRENT.

REF STD: IS2026, IS11171 & ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
600V	19.0	19.0
3300V	50.8	50.8
6600V	63.5	88.9
11KV	76.2	127.0

12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

13. ADDITIONAL INFORMATION

The following are the materials recommended to be used for constructions of transformers

A. Core: CRGO grade 41/51 or any equivalent grade.
B. Winding: Pure copper of appropriate grade and with suitable insulation.
C. Insulation, Varnish etc: Shall be to appropriate class of insulation.

14. DIMENSIONAL DETAILS

All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

15.1 Following are the tests for power transformers

A. Type tests :
1. Temperature rise test
2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
TT-08	4.00	400	425	250	250X200	10	350	180
TT-09	5.00	450	425	250	250X200	10	350	200
TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

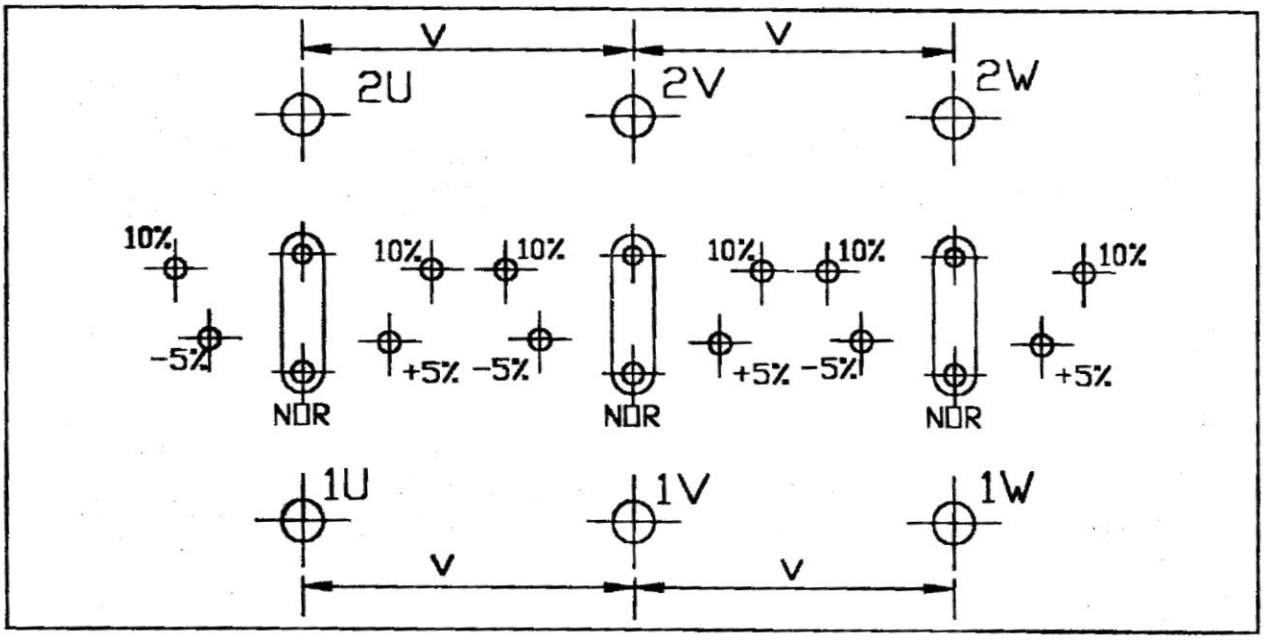
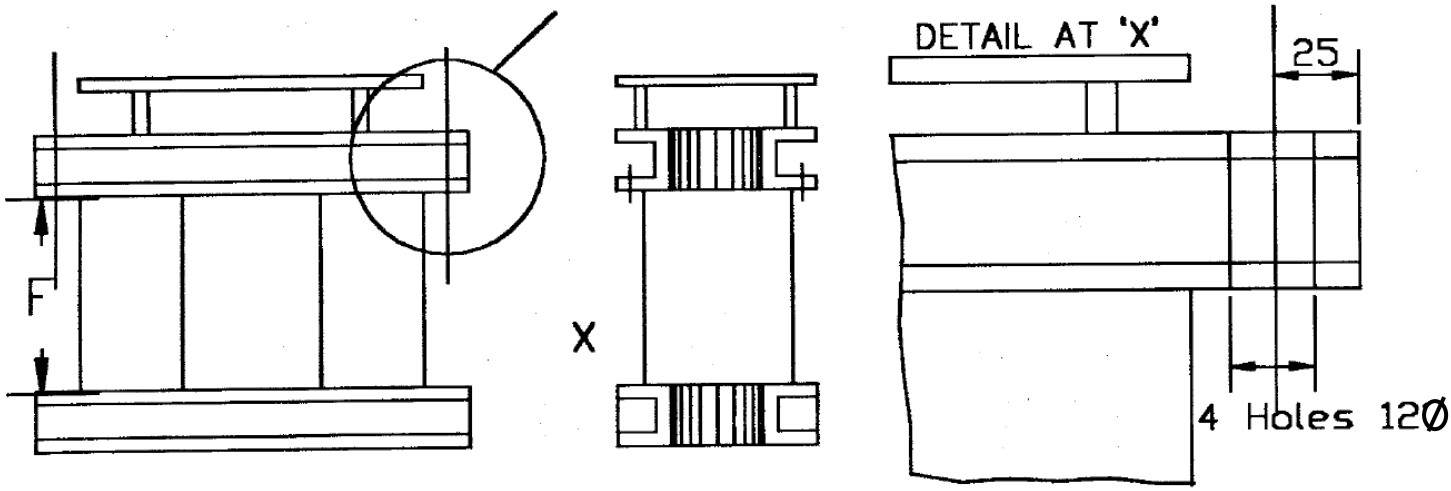


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

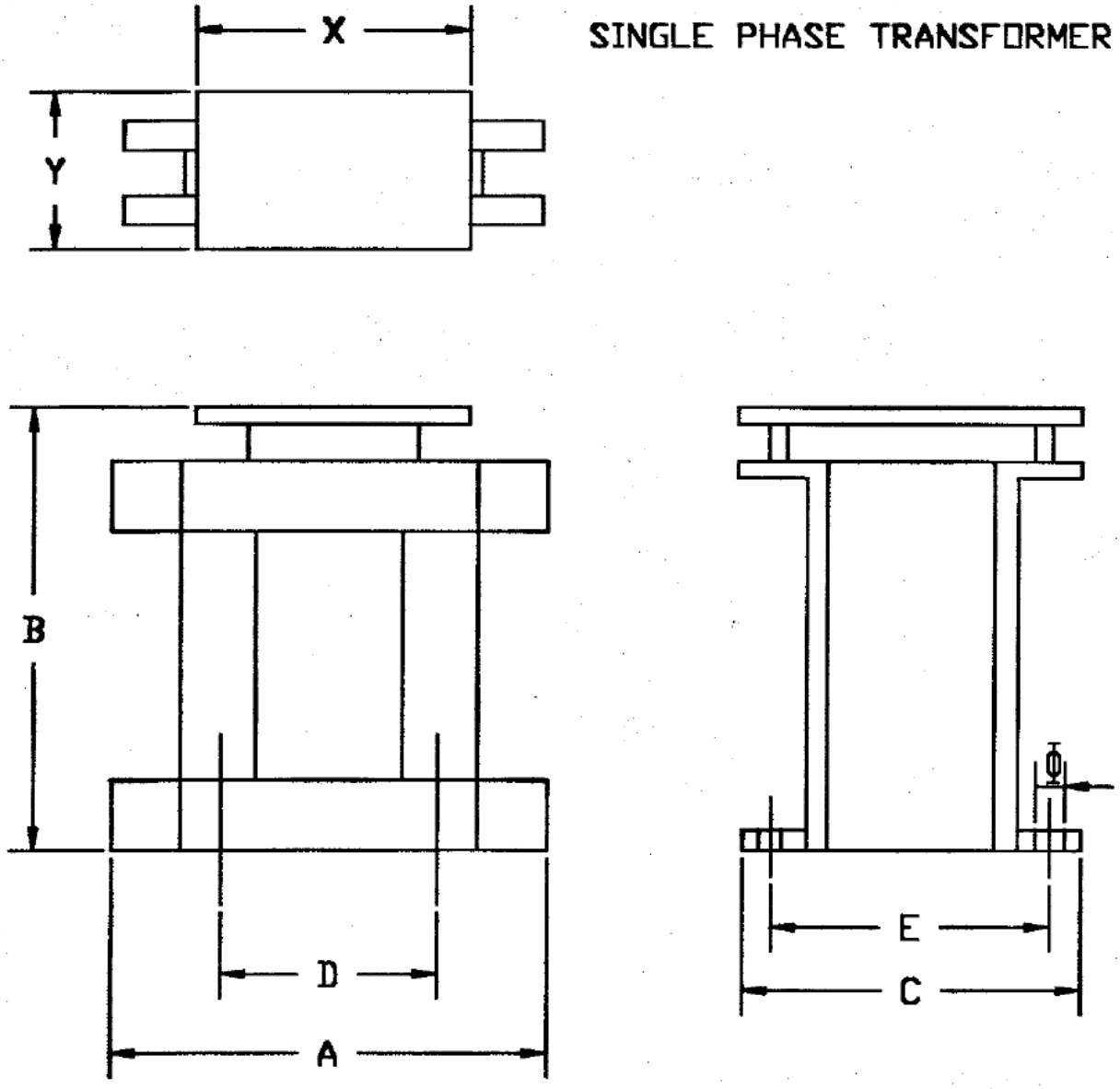


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

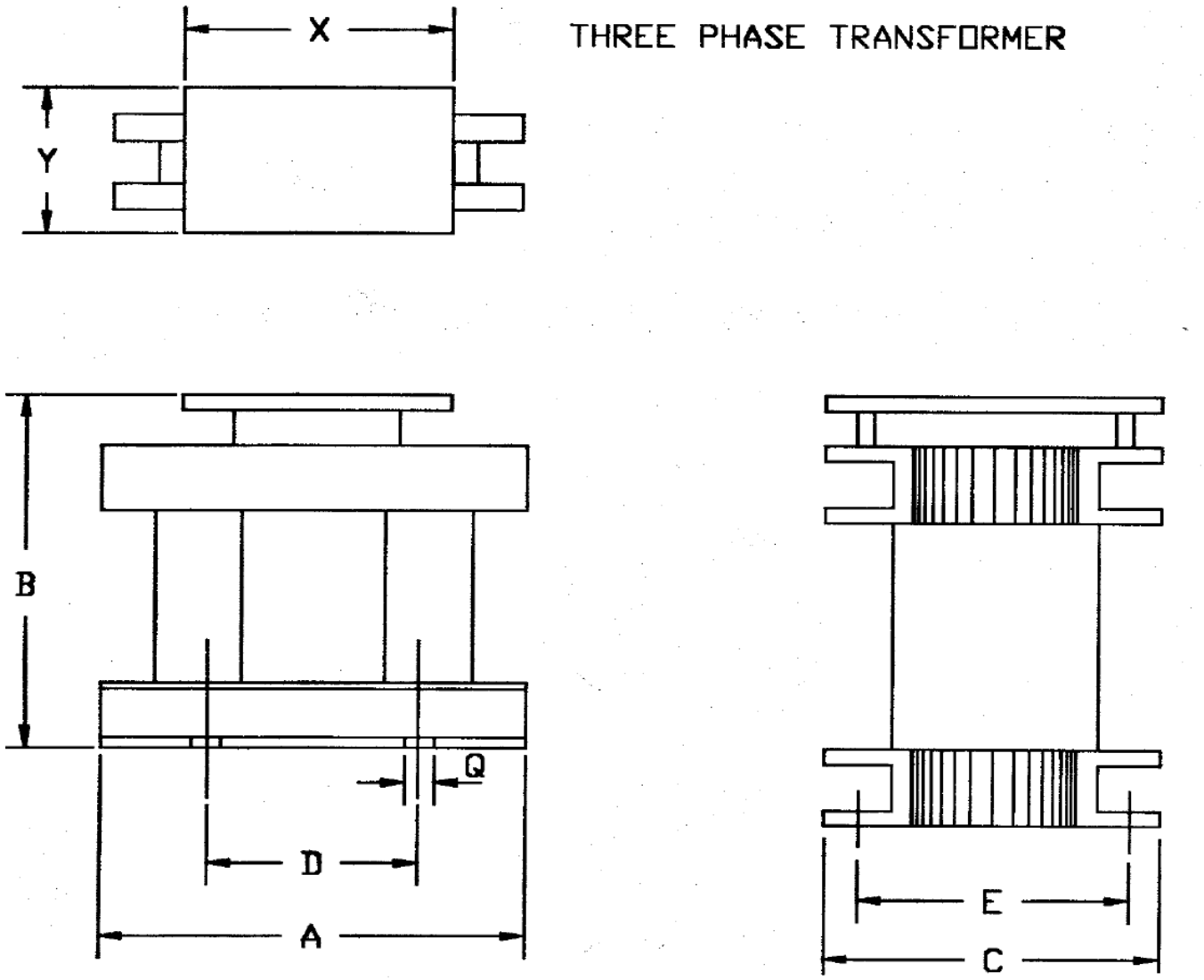


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0481929029

Material Description: TRFMR 3KVA,3PH,220/100V,YNYNO

TRANSFORMER PWR DRY 3 KVA ,3PHASE, FREQUENCY:50-400HZ HV: 220;LV: 100V

VECTOR GROUP: YNYNO HV TAP :+/-5%, +/-10% LV TAP : 85V IMPEDANCE: 4%

INSULATION CLASS: B INSULATION LEVEL: 4KV 50HZ FOR 1MIN

TRANSPARENT POLY-CARBONATE 8MM SHEET ABOVE TERMINALS.

NICKEL PLATED BRASS TERMINALS.

EARTHED SCREEN BETWEEN HV & LV IS REQUIRED.

NO LOAD CURRENT SHALL BE LESS THAN 15% OF RATED CURRENT.

REF STD: IS2026, IS11171 & ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
600V	19.0	19.0
3300V	50.8	50.8
6600V	63.5	88.9
11KV	76.2	127.0

12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

13. ADDITIONAL INFORMATION

The following are the materials recommended to be used for constructions of transformers

A. Core: CRGO grade 41/51 or any equivalent grade.
B. Winding: Pure copper of appropriate grade and with suitable insulation.
C. Insulation, Varnish etc: Shall be to appropriate class of insulation.

14. DIMENSIONAL DETAILS

All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

15.1 Following are the tests for power transformers

A. Type tests :
1. Temperature rise test
2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
TT-08	4.00	400	425	250	250X200	10	350	180
TT-09	5.00	450	425	250	250X200	10	350	200
TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

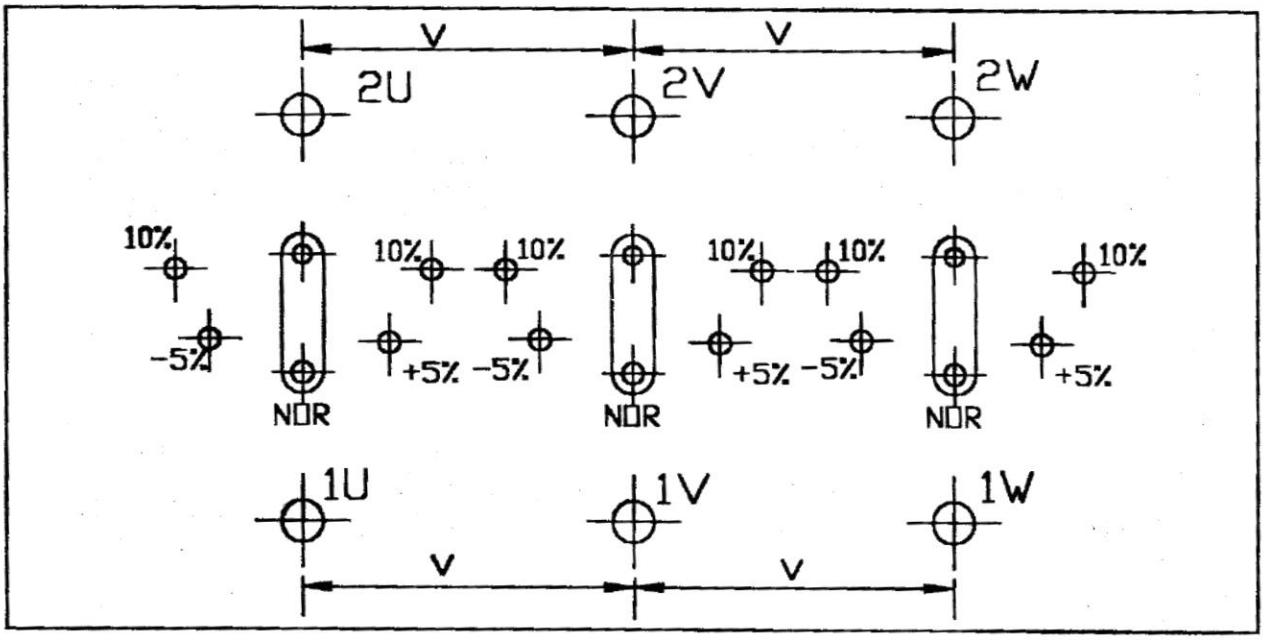
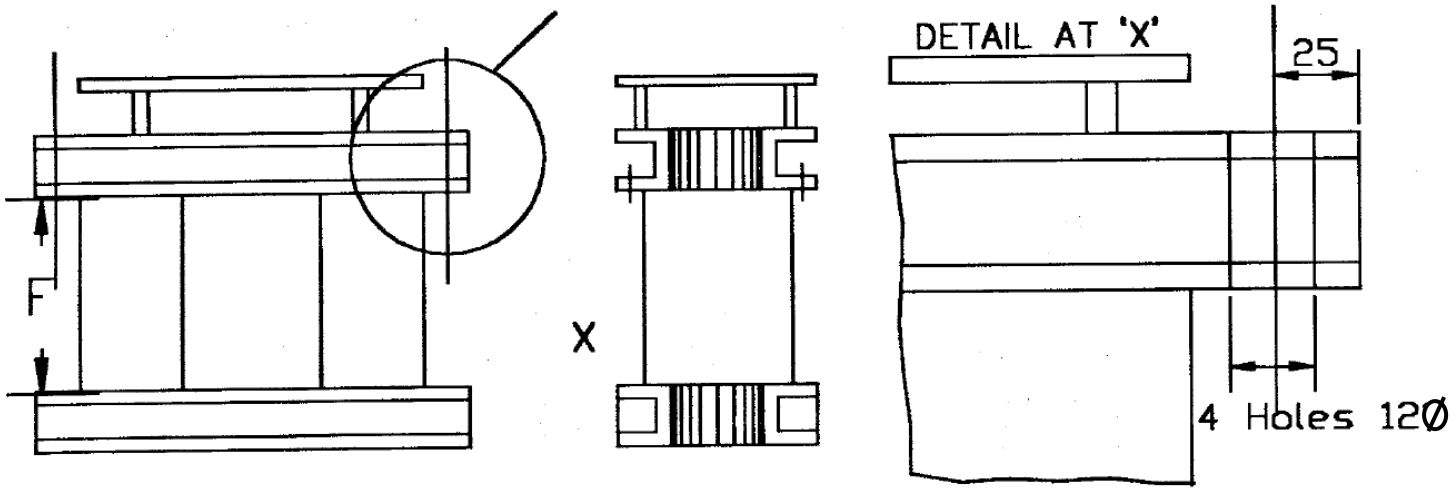


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

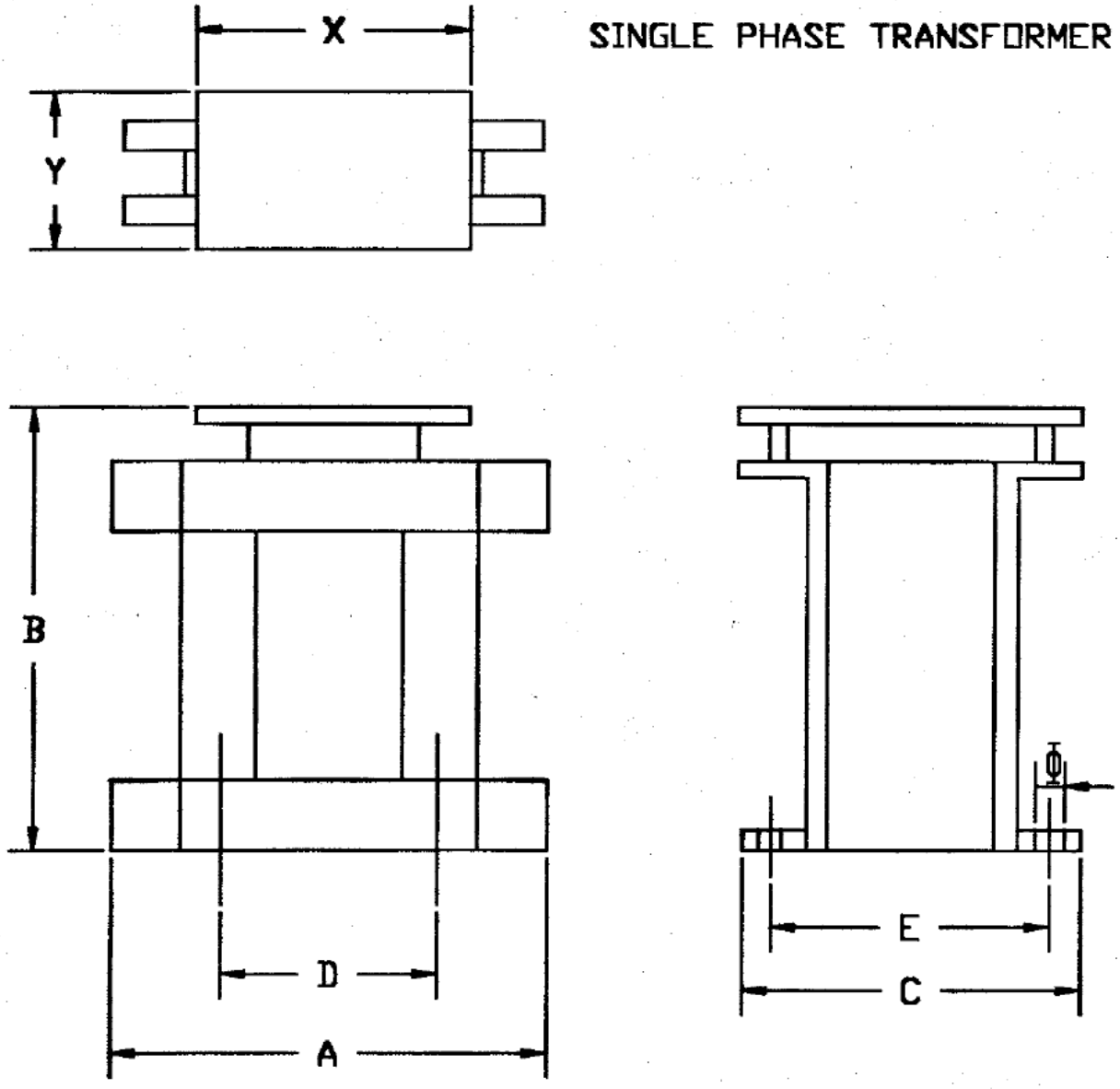


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

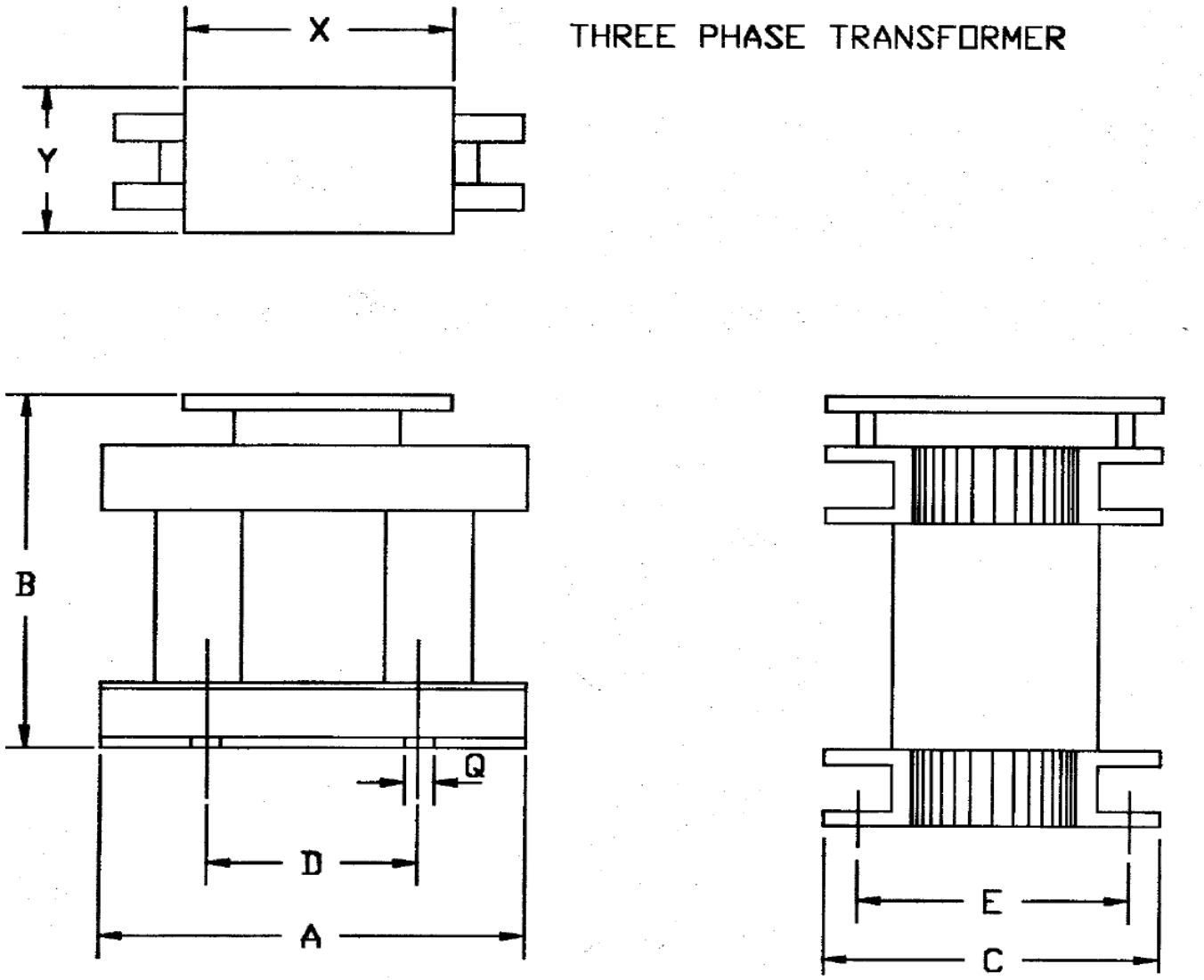


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0482905034

Material Description: TRFMR PWR 5KVA 3PH YNYN0 220/415V

TRANSFORMER PWR DRY

RATING : 5KVA, 3 PHASE, 50 HZ,YNYN0

HV : 415 V

LV : 22O V

TAP ON HV : +/-5%

+/-10%

IMPEDENCE : 4%

INS. CLASS : B, INS. LEVEL : 4 KV 50HZ FOR 1 MIN.

NICKEL PLATED BRASS STUD TERMINALS

PERSPEX SHEET OF 8MM THICKNESS OVER TERMINAL BOARD.

SCREEN BETWEEN HV & LV TO BE PROVIDED.

NO LOAD CURRENT LESS THAN 15% OF RATED CURRENT.

REF.STANDARD: IS 2026, IS 11171 AND ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
600V	19.0	19.0
3300V	50.8	50.8
6600V	63.5	88.9
11KV	76.2	127.0

12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

13. ADDITIONAL INFORMATION

The following are the materials recommended to be used for constructions of transformers

A. Core: CRGO grade 41/51 or any equivalent grade.
B. Winding: Pure copper of appropriate grade and with suitable insulation.
C. Insulation, Varnish etc: Shall be to appropriate class of insulation.

14. DIMENSIONAL DETAILS

All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

15.1 Following are the tests for power transformers

A. Type tests :
1. Temperature rise test
2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
TT-08	4.00	400	425	250	250X200	10	350	180
TT-09	5.00	450	425	250	250X200	10	350	200
TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

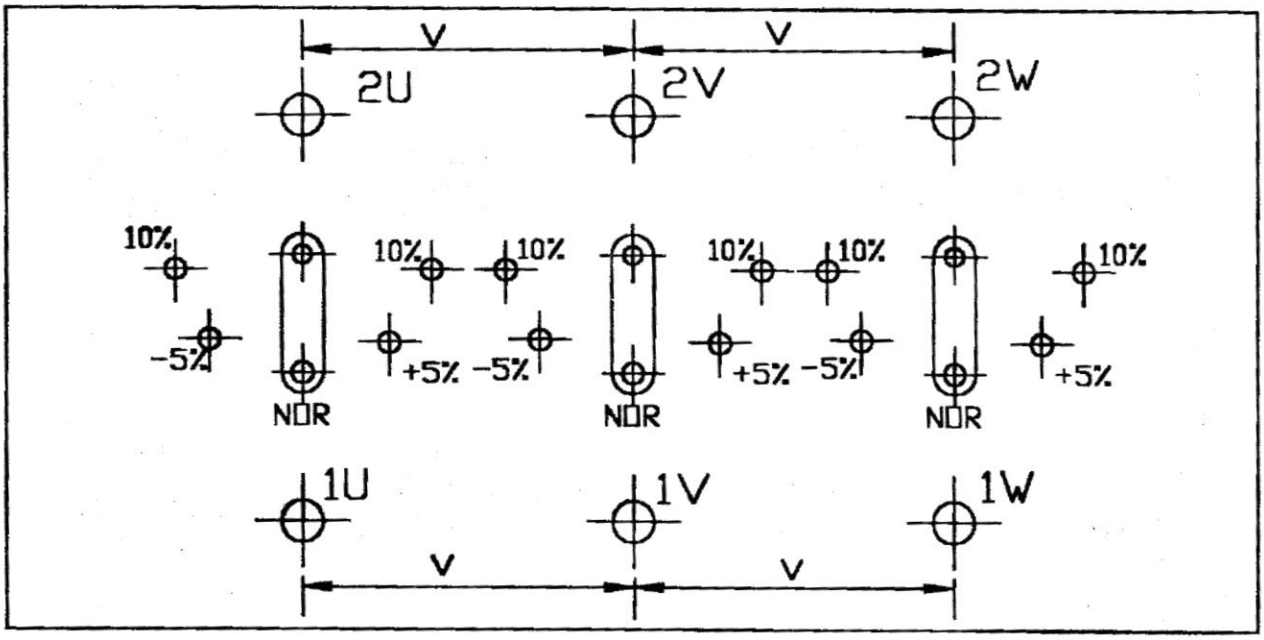
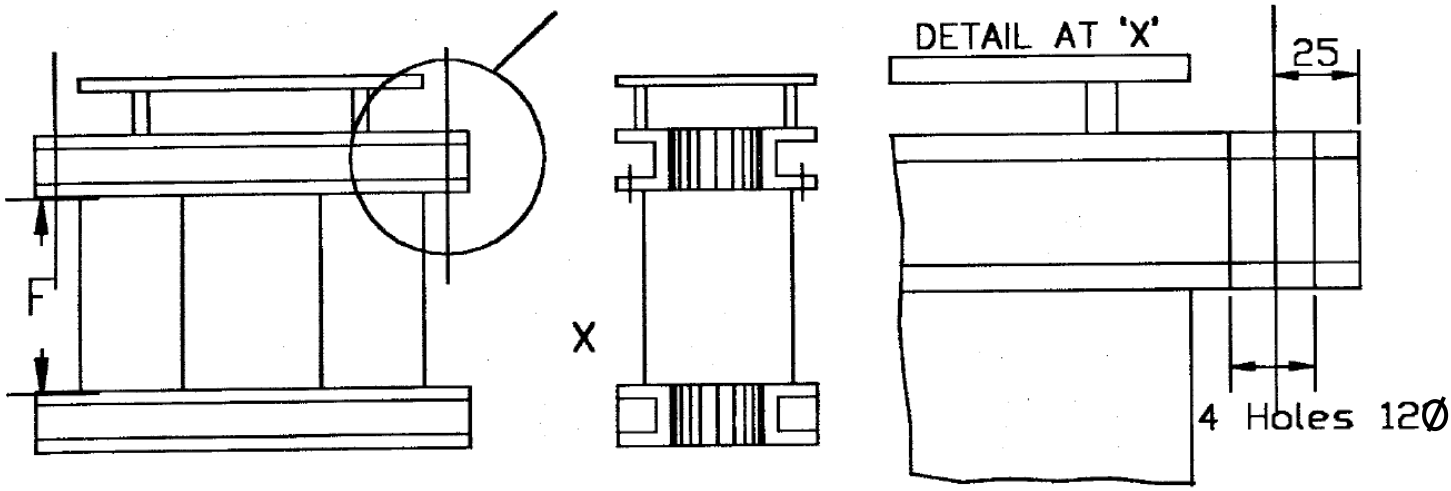


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

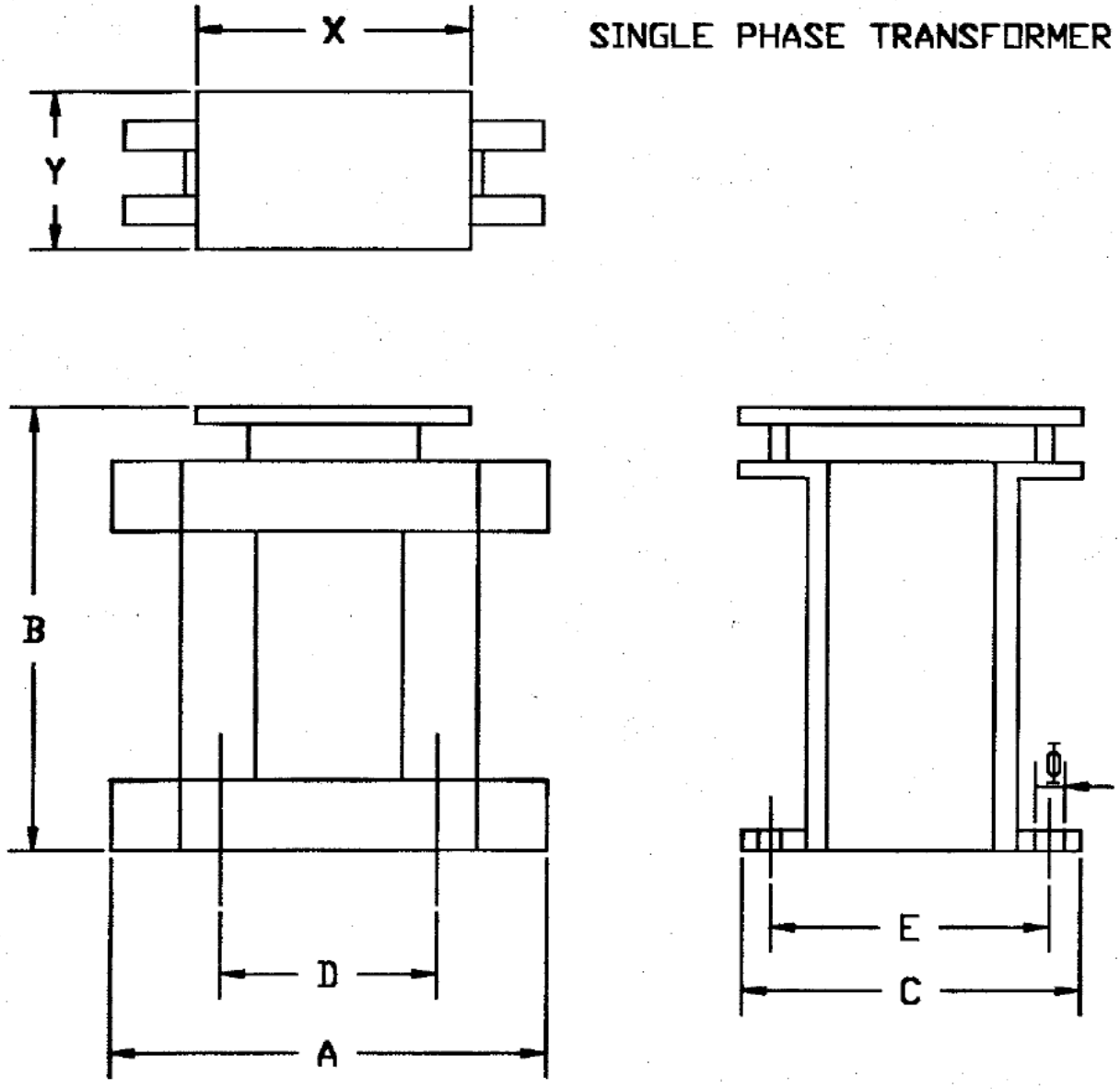


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

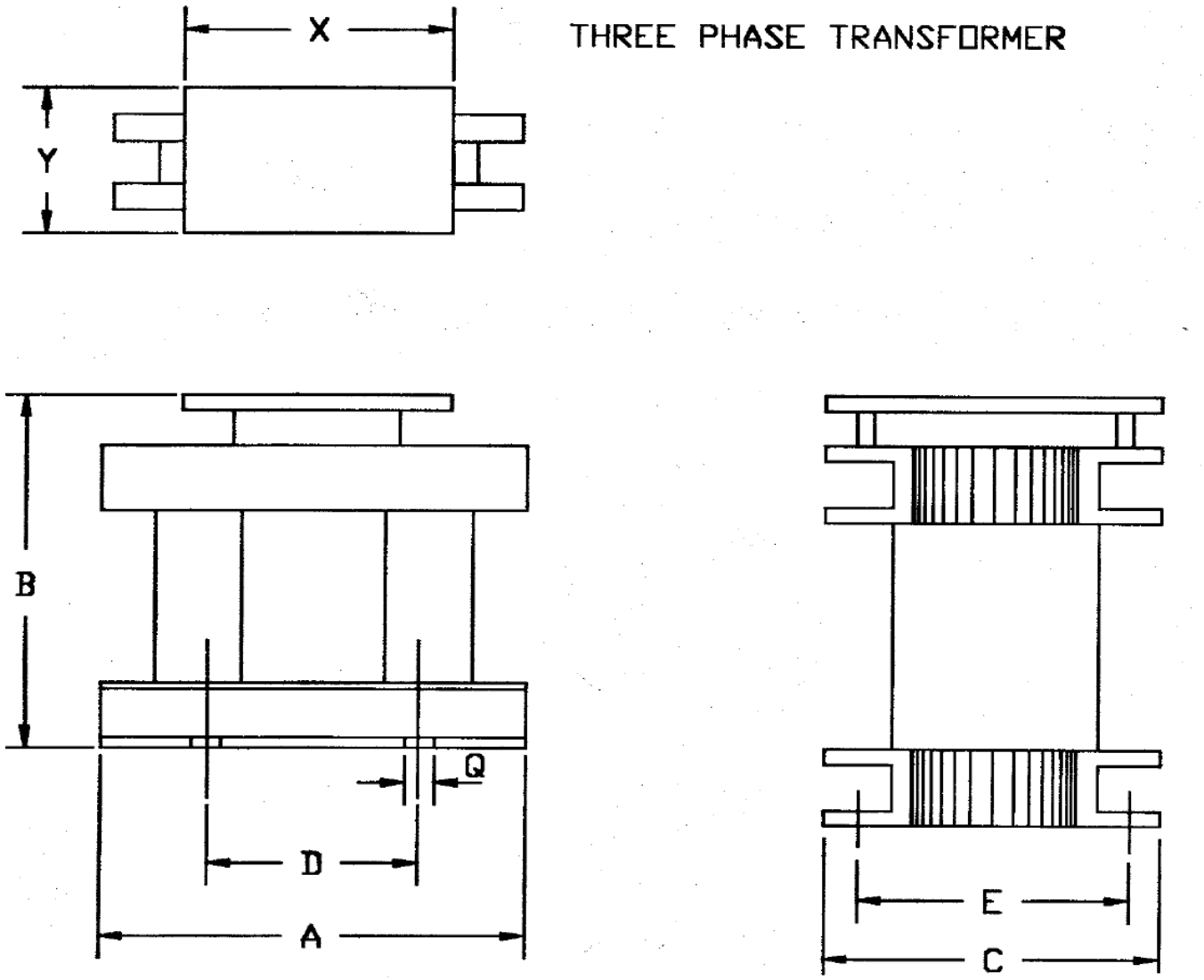


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'

PRE-QUALIFICATION CRITERIA FOR SMALL RATING TRANSFORMER

Sl.No.	CRITERIA	DOCUMENT REQUIRED
1.	The bidder should be a manufacturer / supplier of small rating transformers (up to 15KVA) for two years or more.	Self-certification for OEM/OEM authorization for dealers.
2.	The bidder shall fully comply with all the clauses mentioned in the latest revision of specification ED7461195 (Current revision number is REV No..03).	Conformance for complying.
3.	The Bidder shall submit the documents indicated during bidding stage. OR The bidder should have supplied the item to BHEL against an earlier purchase order.	a) At least one end user performance certificate. b) Reference list of customers for dry type transformers. c) Relevant purchase order copies along with invoice and delivery challans. OR If supplier had already supplied transformer to BHEL, then supplier shall provide relevant purchase order details.
4.	On –site service support shall be provided at purchaser's works within 6 working days, if it is observed that the item requires rework /rectification.	Conformance for complying.

BHEL Material Code: SA0482969130A

Material Description: TRFMR PWR 4KVA, 3PH YNYN0, 415V / 165V

TRANSFORMER PWR DRY, RATING:4 KVA, 3 PHASE, FREQ : 50 HZ

VECTOR GROUP: YNYN0

HV : 415 V

LV : 165 V

TAP ON HV : +/-5%,

+/-10%

IMPEDENCE : 4%

INS.CLASS : B, INS.LEVEL : 4KV 50HZ FOR 1 MIN.

NICKEL PLATED BRASS STUD TERMINALS

PERSPEX SHEET OF 8MM THICKNESS OVER TERMINAL BOARD.

SCREEN BETWEEN HV & LV TO BE PROVIDED.

NO LOAD CURRENT LESS THAN 15% OF RATED CURRENT

REF.STANDARD: IS 2026, IS 11171, ED7461195

SPECIFICATION FOR POWER AND CONTROL TRANSFORMER

1. SCOPE

1.1. This Standard details the specifications for single and polyphase drytype, power and control transformers.

1.2. This Standard shall be read in conjunction with IS:11171 and IS:2026

2. DEFINITIONS

For the purpose of this Standard following definitions shall apply.

2.1 Power transformer: Single phase transformer rated above 1KVA and 3 phase transformer rated above 5KVA shall be designated as power transformer.

2.2 Control transformer : Single phase transformer below 1KVA and 3 phase transformer below 5 KVA shall be designated as control transformer

3. SERVICE CONDITIONS

3.1 Max ambient temp	: 50°C
3.2 Cooling	: Air natural
3.3 Humidity	: 100 percent
3.4 Ventilation	: Restricted as it is mounted inside a cubicle (IP 21)

4. RATING

4.1 KVA Rating:
The rated KVA assigned taking into account the service condition as specified in 3.0

APPROVED:		
R Rukmani		
PREPARED:	ISSUED:	DATE:
Anusri S	ENGG. SERV,	17/11/21

The following shall be the preferred rated KVA
3 Phase Transformers:
0.25,1,1.5,2,2.5,3,4,5,6,7.5,10,12.5,15,20,25,30,35,40,45,
50,55,60,65,75,80,100,135,160,200,250,300,350 & 400 KVA

Single Phase Transformers:
50, 100, 150, 200, 300, 500, 750 VA
1,1.25,1.5,2,3,4,4.5,5,6,7.5,10,12.5,15,20 & 25 KVA

4.2 Rated Voltages :
The rated voltages assigned to the windings of the transformers may be operated at its rated KVA at any voltage within +/-10% of rated voltage.

4.3 No Load Current

SlNo.	Rating	Value
1.	up to 1KV	Less than 20% of Rated current
2.	above 1KVA to less than 5KVA	less than 15% of rated current
3.	above 5KVA to less than 10KVA	less than 10% of rated current
4.	Rating higher than above subject to approval of iron and copper losses by EDN.	

4.4 Rated Frequency
The frequency for the purpose of this standard shall be 50 Hz unless otherwise specified, with a tolerance of +/-3%.

5. TEMPERATURE RISE

The Transformer shall conform to the requirements of Temperature Rise specified in IS:2026 part II.

6. INSULATION LEVELS

The Transformer shall conform to the requirements of insulation Levels Specified in IS:2026 part III.

7. TAPPING

Unless otherwise specified all transformers shall be provided with off load tapings on +/-5% and+/-10% on primary.

8. CONNECTION

For the purpose of this standard the winding connections shall be in accordance with IS:2026 part - IV.

9. IMPEDANCE

Unless otherwise specified transformers shall have the following impedances.

Up to and including 250VA	-	6%
Above 250VA up to and including 150KVA	-	4%
Above 150KVA up to 400 KVA	-	5%

The tolerance for the impedance values shall be +/-10%

10. TERMINAL MARKINGS

For the purpose of this standard the various terminal markings shall be as stated below

10.1 The windings of the transformers shall be denoted by HV & LV. HV refers to high voltage winding and LV refers to low voltage winding.

10.2 Line terminals shall be marked as

For 3 phase transformers
1U, 1V, 1W for HV windings and
2U, 2V, 2W for LV windings

For Single phase Transformers
P1, P2 for HV winding and
S1, S2 for LV winding

The markings shall be started from left hand-side as viewed for HV side.

Neutral Terminal shall be marked as 1N for HV side and 2N for LV side.

10.3 The tapings shall be marked with natural ascending sequence as shown in the figure-1. The tapings shall be through tap selector for all transformers rated above 250VA.

10.4 The rated voltage of the transformer shall be marked by the side of respective terminals.

10.5 Earthing terminals shall be marked with earthing mark ( )

11. TERMINALS

All terminals except Bar type shall be of nickel plated Brass. Bar terminal shall be of pure copper of appropriate grade. Nut & Bolt shall be secured with vibration proof washers. The

appropriate size of the terminals shall be as given in Table-III.

TABLE – III

Type of terminal	Current rating							
	5A	10A	20A	50A	100A	200A	300A	500A
Screw/Stud	M6	M6	M8	M10	M12	-	-	-
Bar	-	-	-	-	-	20X6 1 hole M8	25X6 1 hole M8	40X6 1 hole M12

Note: All the terminals including hardware shall be free from rusting. After tightening the bolt, minimum 3 threads of bolt shall project outside the nut. Adequate clearances between phases shall be ensured and indicated in the drawing. Proper fixing arrangement with insulators shall be provided to ensure same clearances for the entire quantity of a purchase order.

12. FITTINGS

All transformers shall be provided with following fittings

12.1 Rating plate:

Transformers shall be provided with rating plates of weatherproof material. Rating plate shall be fixed along the breadth of the transformer & a provision shall be made to fix it along the length of the adjacent side.

For transformer rated 250VA & below rating plate shall be fixed along the breadth

The rating plate shall be marked legibly with following markings

A. Transformers rated above 250VA
   1) KVA rating
   2) Voltage Ratio
   3) HV/LV Current
   4) Tapings
   5) No. of Phases
   6) Vector grouping
   7) System Frequency
   8) Insulation Level
   9) Insulation Class

10) % Impedance
11) Reference Standard : IS:2026
12) Ambient temperature
13) Weight
14) Sl. No. & Year of manufacture
15) Manufacturer Name

B. Transformers rated below 250VA
1) KVA rating
2) Voltage ratio
3) Phase
4) Connection
5) Insulation class
6) Frequency

12.2 Diagram Plate:

Transformers shall be provided with diagram plate and shall be fixed along the breadth along with rating plate. It shall be legibly marked with a connection diagram.

12.3 Terminal board:

All the terminations of the transformers shall be brought out and fixed on the terminal board which is fixed on the top. The dimensions shall be as specified in corresponding Annexure for 1ph or 3ph transformer.

The material of the terminal board shall be of PRBC sheets (or any other better insulator) insulated and varnished. It shall be designated to take up the required torque. The terminals shall be rigidly fixed on the board with suitable fasteners, with adequate clearance as per table-IV.

Note: 8mm thick perspex cover shall be provided over the terminal board

TABLE -IV CLEARANCE DISTANCES

Rated Voltage	To earth in air (mm)	Between phases in air (mm)
415V	15.8	19.0
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12.4 Lifting lugs:

Lifting lugs shall be provided for transformers weighing more than 50Kgs. Two lifting lugs shall be provided at two ends diagonally opposite to each other for transformers weighing more than 50 Kgs but below 100 Kgs. For transformers weighing more than 100 Kgs four lifting lugs shall be provided at each end.

12.5 Earthing terminals:

Two earthing terminals shall be provided on all the transformers. The size of the earthing terminals may be less than the rated conductor size.

12.6 Top Supports

4 holes each of 12mm dia shall be drilled on the lower portion of the top frame of transformer, to facilitate rigid fixing to the enclosure. However, this shall be provided for transformers rated 10KVA and above. The details are shown in Fig.2.

Note: 'F' is taken approximately as 75% of 'B'

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A. Core: CRGO grade 41/51 or any equivalent grade.
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All transformers should conform to dimensions specified in corresponding Annexure for 1ph or 3ph transformer. The values mentioned for overall dimensions are maximum values. The values for mounting holes are exact values. The dimensions shall be within tolerance mentioned therein.

15. TESTS

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2. Lightning impulse test

B. Routine tests:
1. Measurement of winding resistance
2. Voltage ratio test
3. Check on vector grouping
4. Measurement of losses : Load & No load loss
5. Induced over voltage test
6. Measurement of short circuit Impedance (% Impedance)
7. High voltage test

15.2 Following are the test for control transformers

A. Type test :
1. Temperature rise test

B. Routine test:
1. Measurement of winding resistance
2. Voltage ratio and polarity check
3. Vector grouping test
4. Measurement of loss: Load & No load loss
5. Induced over voltage test
6. Insulation resistance test.

15.3 The manufacturer shall submit the test certificates for tests on transformers.

16. ACCEPTANCE CRITERIA

16.1 Conducting Routine tests and Submission of reports

16.2 Inspection/Acceptance by BHEL-EDN Quality Services

16.3 Conducting Type tests and Submission of reports (On one transformer)

16.4 Test certificates for major bought out items

17. SUPPLY CONDITIONS

Following information are to be supplied by the supplier

17.1 Iron and copper losses at specified temperature

17.2 Flux density in the core

17.3 Current density of the coil : HV & LV

17.4 Winding resistance

17.5 Supplier shall submit 6 copies of test guarantee certificates along with the materials

17.6 Transformers shall be suitably packed in wooden carters such that no damage is caused during transportation and handling.

Annexure-1

SINGLE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
ST-1	0.05	100	130	85	80X60	5X10	95	85
ST-02	0.10	120	130	90	80X60	5X10	95	90
ST-03	0.15	120	150	90	95X60	5X10	115	90
ST-04	0.20	120	175	100	95X75	6X12	115	100
ST-05	0.25	120	175	100	95X90	6X12	115	100
ST-06	0.30	120	175	125	95X100	6X12	120	125
ST-07	0.50	150	190	150	125X100	8X15	150	145
ST-08	0.75	200	250	150	150X120	8X15	185	150
ST-09	1.00	200	250	160	160X130	8X15	185	160
ST-10	1.25	200	250	160	160X130	8X15	185	160
ST-11	1.50	280	300	175	160X130	10	200	160
ST-12	2.00	280	300	175	180X130	10	220	160
ST-13	3.00	300	350	200	200X150	10	220	180
ST-14	4.00	320	360	200	240X150	10	220	180
ST-15	4.50	320	400	200	240X170	10	250	200
ST-16	4.50	350	450	200	240X170	10	250	200
ST-17	5.00	350	450	200	240X170	10	250	200
ST-18	6.00	350	475	200	260X170	10	300	200
ST-19	7.50	350	500	240	290X200	10	300	250
ST-20	10.00	400	500	240	290X200	10	300	250
ST-21	12.50	400	600	250	330X200	10	300	250
ST-22	15.00	450	600	250	250X200	10	300	250
ST-23	25.00	500	600	250	400X200	10	300	250

Annexure-2

THREE PHASE TRANSFORMER

TYPE	KVA	A	B	C	KXE	O	X	Y
TT-01	0.25	250	220	150	150X100	10	230	120
TT-02	0.05	280	250	190	200X150	10	250	150
TT-03	1.00	300	280	200	200X150	10	280	160
TT-04	1.50	300	320	200	200X150	10	300	180
TT-05	2.00	320	300	200	200X150	10	300	180
TT-06	2.50	340	350	200	200X150	10	300	180
TT-07	3.00	380	350	200	200X150	10	350	180
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TT-10	6.00	450	480	250	250X200	10	350	200
TT-11	7.70	450	480	250	250X200	10	350	200
TT-12	10.00	500	525	250	300X200	10	400	250
TT-13	12.50	620	550	250	350X200	10	450	250
TT-14	15.00	620	600	250	350X200	10	450	250
TT-15	20.00	650	600	300	400X250	10	450	250
TT-16	25.00	650	600	300	400X250	10	450	250
TT-17	30.00	700	600	300	400X250	10	450	250
TT-18	35.00	700	600	300	400X250	10	450	250
TT-19	40.00	700	650	300	400X250	10	450	250
TT-20	45.00	700	650	300	400X250	10	450	250
TT-21	50.00	750	650	300	450X250	10	500	300
TT-22	55.00	750	700	300	450X250	10	500	300
TT-23	60.00	750	700	300	450X250	10	500	300
TT-24	65.00	750	800	300	450X250	10	500	300
TT-25	75.00	800	850	300	500X300	10	600	300
TT-26	80.00	800	850	350	500X300	10	600	300
TT-27	100.00	850	900	350	550X300	10	600	300
TT-28	135.00	850	900	400	550X300	10	600	300
TT-29	160.00	1000	1000	400	600X400	10	600	400
TT-30	200.00	1100	1250	450	650X500	12	700	550
TT-31	250.00	1150	1400	600	650X550	12	700	550
TT-32	300.00	1200	1600	600	700X600	12	750	600
TT-33	350.00	1300	1700	650	800X600	12	800	650
TT-34	400.00	1400	1750	750	800X630	12	850	650

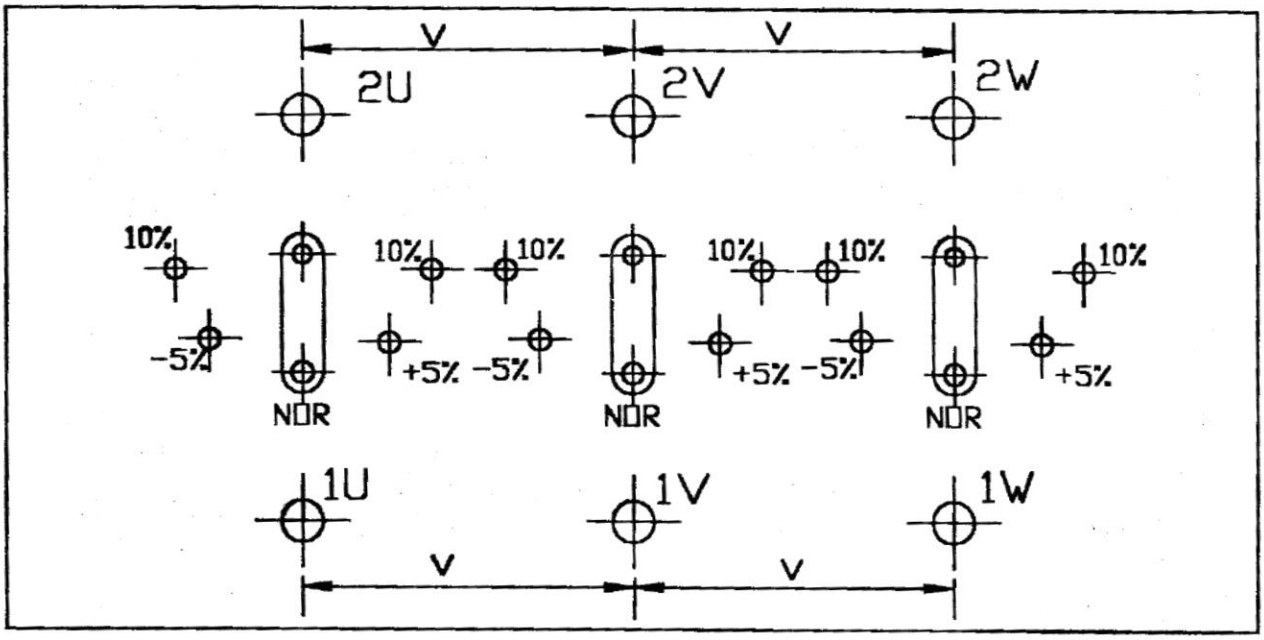
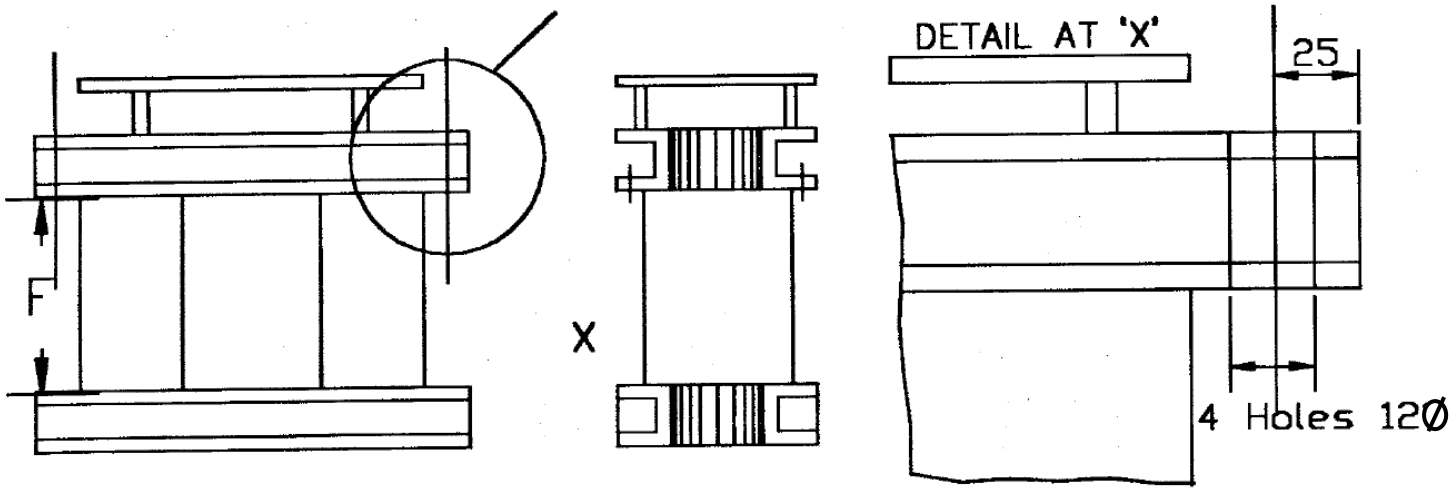


Fig. 1

FIG – 2



Note: 'F' is taken approximately as 75% of B

SINGLE PHASE TRANSFORMER

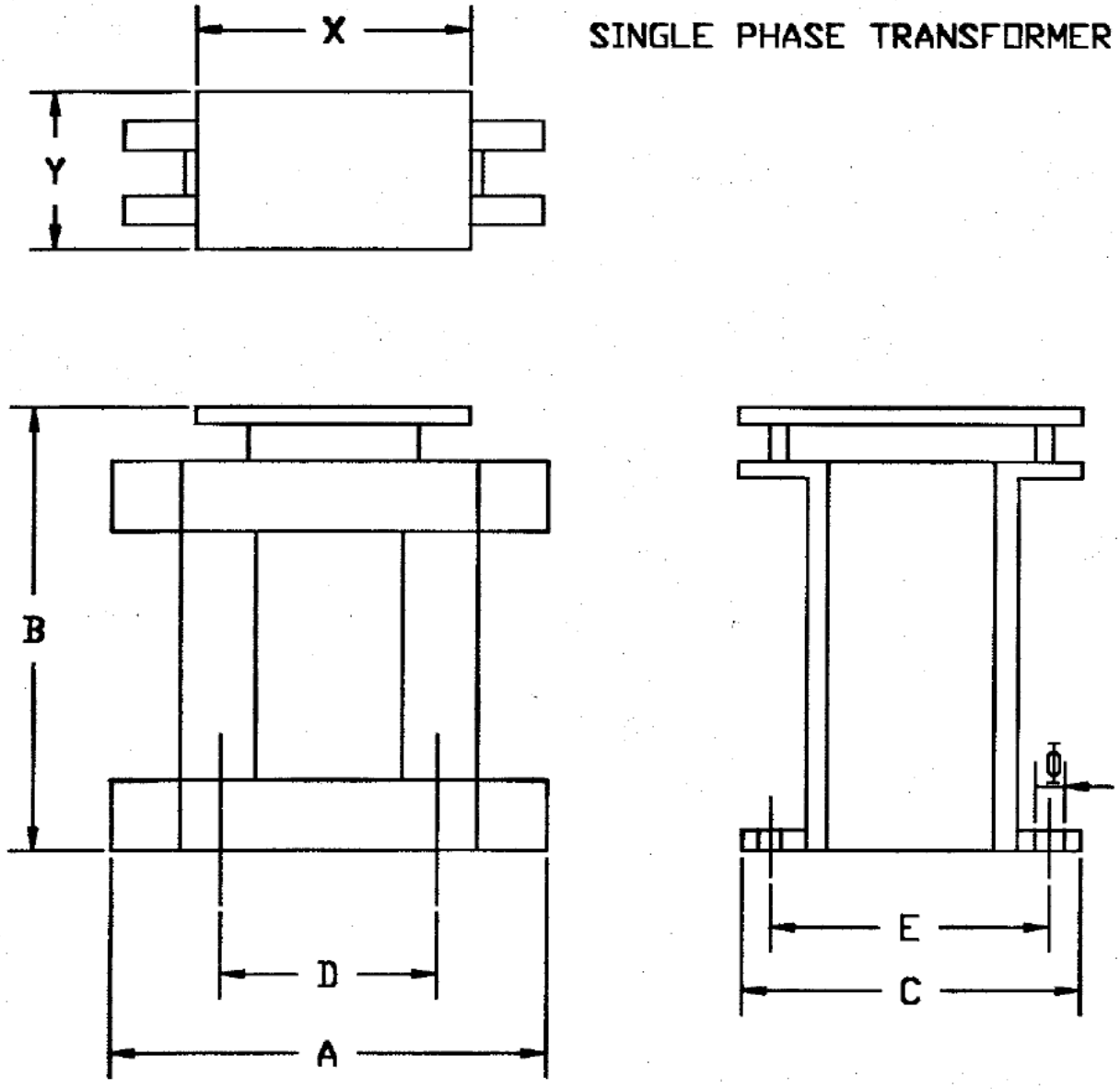


FIG – 3

NOTE: The tolerences for variosus dimensions shall be as per IS:2102 'coarse'

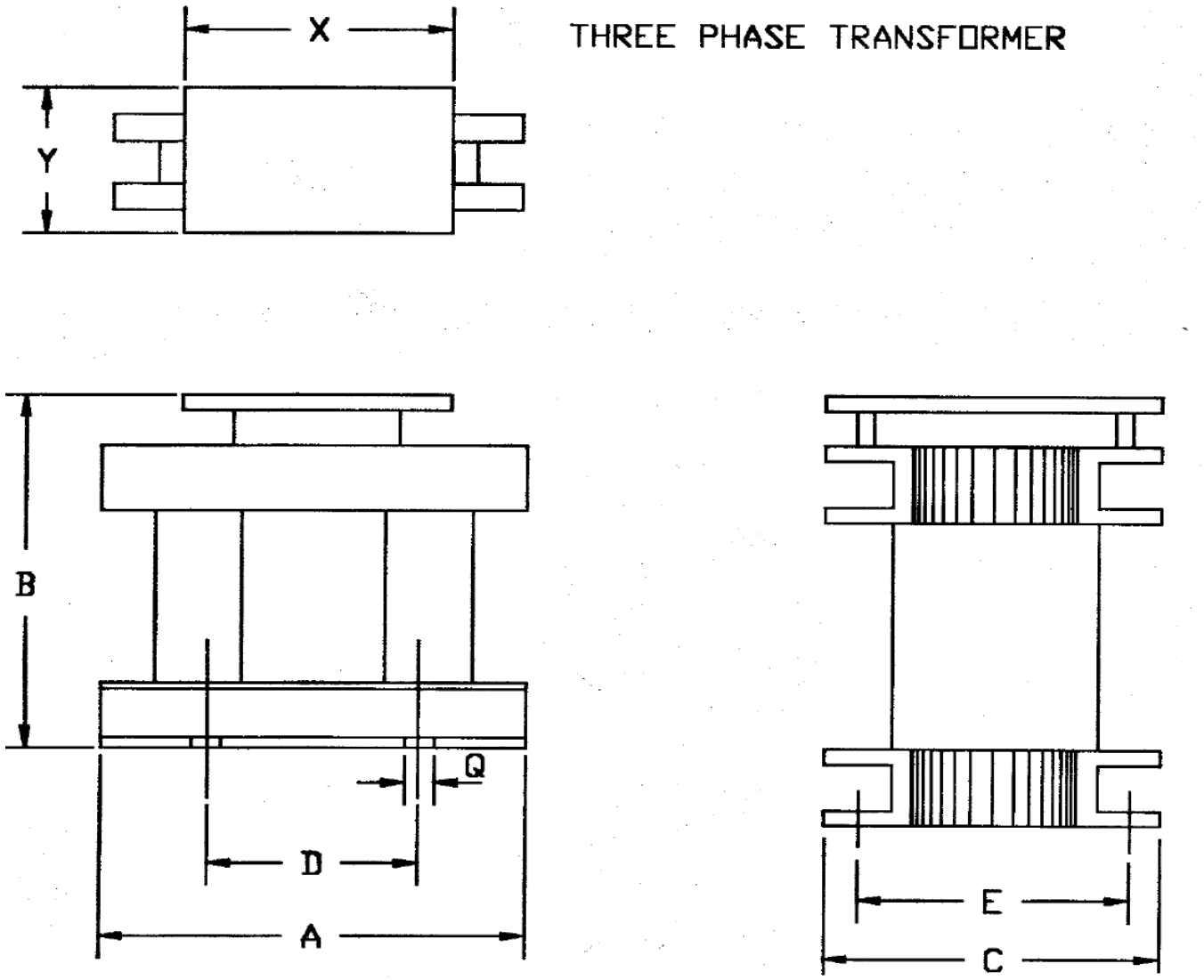


FIG - 4

NOTE: The tolerances for various dimensions shall be as per IS: 2102 'coarse'