INTERPLANT STANDARD - STEEL INDUSTRY		
	SPECIFICATION FOR CONTROL TRANSFORMERS (*FIRST REVISION*)	**IPSS:1-04-013-02**
IPSS	Based on IS 12021 : 1987	Formerly: IPSS:1-04-013-84

0. FOREWORD

1.

0.1 This Inter Plant Standard has been prepared by the Standard Committee on Switchgears & Controlgears, IPSS 1:4 with the active participation of the representatives of the steel plants, reputed consulting organizations and manufacturers of control transformers, and was adopted in January 2002.

0.2 Inter Plant Standards for steel industry primarily aim at achieving rationalization and unification of parts and sub-assemblies used in steel plant equipment and accessories, for guidance in indenting stores for existing equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes (or types) from among those mentioned in this standard for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1. SCOPE

1.1 This Inter Plant Standard covers the performance requirements and tests for air-cooled control transformers used in steel plants for control and protective circuits for single phase with rated supply voltage not exceeding 415 V and output not exceeding 2 kVA, and three phase with rated supply voltage of 415 V and output not exceeding 5 kVA.

1.2 This Inter Plant Standard does not cover the following small and special purpose transformers:

a) Transformers for static power converters,
b) Instrument transformers,
c) Testing transformers,
d) X-ray transformers,
e) Mining transformers,
f) Transformers for electronic equipment,
g) Reactors, and
h) Transformers used for power packs for digital circuits

2. TERMINOLOGY

3.

2.1 For the purpose of this standard, the definitions given in IS 1885 (Part 38):1993 `Electrotechnical vocabulary: Part 38 Power transformers and reactors (*second revision*)' and IS 3156 (Part 1):1992 `Voltage transformers: Part 1 General requirements (*second revision*)' shall apply.

3. SERVICE CONDITIONS

3.1 The following shall constitute the normal site conditions for the purpose of this standard:

a) *Ambient Temperature* - The reference ambient temperature shall be 50^{o}C.

b) *Altitude* - The altitude shall not exceed 1000 m.

c) *Ambient Air* - The ambient air may contain fair amount of conductive dust; &

d) *Humidity* - the maximum relative humidity shall be 100%. However, maximum temperature and 100% relative humidity may not occur simultaneously.

3.1 The control transformers shall be suitable for operation on mobile equipment prone to vibrations, such as cranes, coke oven battery machines etc.and shall be able to withstand vertical impact 4g and horizontal impact 1g.

4. RATINGS

4.1 **Rated Frequency** - The rated frequency shall be the standard frequency of 50 Hz$\pm$6%.

4.2 **Rated Voltage** - The preferred rated primary and secondary voltages shall be as follows:

	Rated Primary Voltages	*Rated Secondary Voltages*
Single phase	415, 240 V	415, 250, 240, 127, 110, 55, 24 and 12 V (see Note)
Three phase	415 V	220, 167 and 85 V, the connection should be Δ /Y with N taken out.

NOTE: 250, 127 and 55 V rated single phase secondary voltages have been retained to take care of rectified dc voltages to 220, 110, 167 and 85 V respectively.

4.3 **Variation of Voltage and Frequency** - VA rating of the control transformer shall withstand a permissible variation of supply voltage from 110 to 85% of rated primary voltage, with a permissible variation of $\pm$ 6%.

5. MATERIALS, CONSTRUCTION AND WORKMANSHIP

5.1 **Materials** - The components shall be constructed from materials free from flaws and other defects. As far as possible, the materials used for construction shall be non-flammable, non-explosive and non-corrosive. The insulating material shall be of Class `B' or Class `F'.

5.1.1 Insulating materials like enamel, varnish and leatheroid and other materials like steel stampings shall conform to relevant Indian Standards.

5.1.2 Unless otherwise mentioned, the material of transformer winding shall be electrolytic grade copper.

5.2 **Construction**

5.2.1 *Terminations* - All the primary and secondary terminations including the tappings shall be brought and connected to the studs/screws fixed on the terminal board. Terminal studs/ screws of suitable size shall be so mounted to enable easy connection and disconnection of wires of external circuits. The input and the output terminals shall be brought out on the opposite sides. Neutral should be brought out on the secondary side. Terminals shall be of brass studs of appropriate size with check-nuts. The insulating board shall be unbreakable and anti-tracking.

5.2.1.1 *Tappings* – Offload tap changer shall be provided on primary side with four 2.5% taps two above & two below the base voltage.

5.2.2 ***Earthing*** - All transformers shall be provided with two separate earthing terminals. These terminals shall be provided over and above all other means provided for securing metallic frame work or chasis.

5.2.3 Unless otherwise mentioned, all control transformers shall be of double wound type.

5.3 **Mounting**

5.3.1 All transformers shall be foot mounted/wall mounted as asked for. In case of wall mounting, fixing bracket shall be of adequate strength and be an integral part of the transformer frame or cover, as the case may be.

5.3.2 Control transformer shall have overall dimension (LxWxH) limited to three sizes only depending on their kVA ratings and same fixing dimensions for each size :

	Size-A	Size-B	Size-C
For single phase	Upto 0.5 kVA	0.5 kVA & upto 1 kVA	1 kVA & upto 2 kVA
For three phase	Upto 1.5 kVA	1.5 kVA & upto 2.5 kVA	2.5 kVA & upto 5 kVA

NOTE : Dimension for each sizes shall be as per **Annexure-I**.

5.4 **Finish** - All exposed metal parts, such as edges of laminations, brackets and other hardware shall be plated, painted or otherwise protected to prevent corrosion. The transformers shall be given a suitable finish by impregnation and/or moulding as required.

6. PERFORMANCE REQUIREMENTS

6.1 **Limits of Temperature-Rise** - The temperature-rise of any part of the control transformer shall not exceed 50^{o}C over the reference ambient temperature. The class of insulation shall be Class `B' or better.

6.2 **Voltage Regulation** - The noload output voltage shall not exceed 105% of rated voltage when the control transformer is supplied with the rated primary voltage at the rated frequency.

6.3

6.4 **Efficiency** - The efficiency of control transformers when calculated from measurements of input and output at unity power factor made during the temperature-rise test shall not be less than 90%.

6.5

7. MARKING

7.1 **Rating Plate** - Each control transformer shall have a rating plate, permanently secured to it, carrying the following particulars which shall be indelibly marked:

a) Manufacturer's name or trade-mark,
b) Manufacturer's type designation and Serial No./year of manufacture,
c) Rated primary and secondary voltage(s) with tapping voltage in V.
d) Number of phases and method of connection,
e) Rated output in VA for each secondary windings,
f) Class of insulation,
g) Reference to this IPSS, that is, IPSS:1-04-013-02,
h) Vector group, and
j) Temperature rise.

7.2 **Terminal Marking** - The terminal markings shall be done in accordance with Appendix D of IS 3156 (Part 1):1992. Earthing terminal shall also be suitably marked. The different primary and secondary voltages shall be distinctly and permanently marked at the terminal board to avoid any mistake during continuous use.

7.3 All the technical details of the control transformer shall be preferably given in a separate leaflet which shall include, in addition to other details, the following:

a) Number of turns of the primary winding/secondary winding(s), gauge of wire used with type of insulation and resistance of these windings,

b) No load current taken by the transformer, and

c) Weight of the control transformer.

8. TESTS

8.1 **Type Tests** - The following shall comprise the type tests:

a) dc resistance of windings;

b) No-load test for input current, power, voltage ratio and tapping voltage;

c) Full-load test for input current, power, voltage ratio, tapping voltage;

d) Test for short-circuit voltage, impedance and load losses;

e) Temperature rise test.

8.2 **Routine Tests** - The following shall comprise the routine tests:

a) Visual examination and inspection,

b) Verification of terminal markings and polarity,

c) Winding continuity,

d) Insulation resistance test, and

e) High voltage test (power frequency and induced voltage),

f) Ratio test, and

g) Vector group / Polarity test.

8.3 All above tests shall be conducted in accordance with IS 11171:1985/IS 2026:1997.

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ANNEXURE – I

OVER ALL DIMENSION (L x W x H) OF CONTROL TRANSFORMER

For Single phase Control Transformer	
Capacity	**Dimension in mw (L x W x H)**
Up to 0.5 KVA	180 x 180 x 185
More than 0.5 KVA and up to 1 KVA	200 x 160 x 200
> 1 KVA and up to 2 KVA	260 x 175 x 225
For 3 phase Control Transformer	
Up to 1.5 KVA	300 x 180 x 260
> 1.5 KVA and up to 2.5 KVA	320 x 160 x 250
> 2.5 KVA and up to 5 KVA	400 x 250 x 400

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