

**INSTALLATION, COMMISSIONING,
OPERATION & MAINTENANCE INSTRUCTIONS FOR
DRY TYPE TRANSFORMERS**

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- 3) During rectification period any liability for hiring/production loss etc are not in Raychem RPG scope.
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1) Introduction:

This **O & M Manual** gives guidance for **installation, operation and Maintenance to ensure trouble free performance** of Dry Type Distribution Transformers.

2) Applicable Standards: (IS 2026, IS 11171, IEC 60076-1, IS10028.)

2.1) Inspections & Un-Loading

The unloading of the Transformer should be done using nonmetallic ropes with crane of capacity more than transformer weight. Please refer Rating & Diagram plate drawing for total weight.

Shortage/damage to be immediately reported within 24 hrs of transformer receipt, to our works.

The following points to be checked at site at the time of receipt of the transformer & should be reported to our works:

- a) Winding Temperature sight glass condition
- b) Enclosure condition
- c) Any damage to fittings
- d) Bushing cracked or broken (HV/LV)
- e) Bolts loose etc

Lifting should be done using all lifting lugs located on transformer e.g. transformer having 4 lugs shall not be lifted using Two Lugs".

Dragging shall be avoided. If necessary, where rollers are fitted suitable rails or tracks should be used and the wheels should be locked to prevent accidental movement of the transformer

2.2) Storage:

Dry Type Transformers must be stored in a dry, well-ventilated room, free from fire and explosion hazard & covered with a plastic sheet. The transformers must be cleaned of dust etc. before putting into service.

After receipt of Transformer at site & Inspection for damages etc, it should be immediately put on the plinth where it is meant to be installed.

Transformer should be installed on an elevated platform high enough, so that water should not enter the enclosure during rains and should be above highest flood level of that area.

2.3) Installation:

The Electrical installation compiles with the following points:

- a) The latest Indian Electricity Act.
- b) Local utility rules & regulations
- c) IS 10028: Code of practice for Selection, Installation & Maintenance of Transformer.
- d) The electrical installation should be carried out by Govt. approved/Licensed persons competent to undertake such work. Details of agency with certificate shall be sent to us for the validity of warranty and guarantee.

After unpacking, the transformer should be cleaned and dusted-off, taking special care. Clean the air-cooling ducts between the windings and between the low Voltage coils and the magnetic core for transformer room by dry air blower. Once in final position, ensure that the transformer is secured by locking the rollers.

The following conditions are important:

- a) Avoid stagnation of hot air above the transformer, to ensure efficient Cooling.
- b) Obtain a diagonal airflow in transformer room.

The fresh air should enter by lower part and the hot air should exit from the upper part . The room size shall be as per IS rules, with minimum 1.8 mtr distance from wall to transformer.

Accessories, which are removed for transport purposes, should be fixed in their respective places according to the relevant drawings.

2.4) Location of Transformer:

The transformer position should be such that the Winding temperature indicator, Rating and Diagram plate, etc., can be safely examined with the transformer energized. It should also be possible to have access to Tap changing links or the operating mechanism of the on load tap changer/off circuit tap switch, marshalling box etc.

2.5) Foundation:

Special foundation is not required for the installation of a transformer, except a level floor, strong enough to support the weight and to prevent accumulation of the water.

2.6) Protection of Dry Type Transformer:

Transformers shall be provided with protection scheme as per Latest Indian Electricity Rules and CBIP guidelines, not less than below.

Transformer Rating	Protection		
	Primary	Secondary	Additional
Upto 900KVA	Load break switch with trip coil or Circuit breaker with IDMT type overcurrent & earth fault relay	MCCB/ ACB for each Feeder	Winding temperature Indicator with alarm & trip contact
1000KVA & Above	Circuit Breaker with IDMT type overcurrent & earth fault relay	MCCB/ACB for each Feeder	Winding temperature Indicator with alarm & trip contact

3) WTI Setting:

For a self cooled (AN) transformer having a guaranteed temperature rise at rated KVA, of 90 °C average winding rise, the recommended setting of the alarm and trip contacts of the Winding Temperature indicator (WTI) is as follows:

	ALARM	TRIP
WTI	130°C	140°C

The above settings are only indicative. However depending on ambient temperature, and temperature rise guaranteed, the settings can be changed as per requirement. For forced air cooled (ANAF) transformers, the recommended setting of the contacts of the WTI for control of cooling fans and the setting of the alarm and trip contact of the WTI, shall be obtained from plant. For class F, Fans shall start at 120 °C (at temperature 10 °C below alarm setting).

4) Ordering of Spares:

When ordering spares, please provide full name plate details of transformer with detailed description of spares .

5) Format for reporting site failure:

The following information to be provided along with photographs during any failure of transformer

- | | | |
|----------------------------------|---|---|
| a) KVA | e) Date of supply | i) Accessories / Instruments damage details |
| b) Voltage ratio | f) IR Values | j) Log book record |
| c) Serial No. of the Transformer | g) Tap Links / OLTC failure: OLTC Name plate details required | k) Breaker tripping details |
| d) Date of Commissioning | h) HV/LV Bushing cracked or damaged | l) Data logger's details |

6) Records:

Record the transformer rating, serial number, I.R.Values & date of installation

7) Insulation Resistance:

As a safe general rule the following values may be considered as Satisfactory.

Rated Voltage kV	Minimum safe I.R. in Mega Ohms at 30°C	Voltage of megger (V)
33 / 22	500	2500
11 / 6.6	250	1000

8) Recommended Maintenance Schedule for Transformers:

Inspection Frequency	Item to be inspected	Inspection notes	Action required, if inspection finds unsatisfactory conditions
Monthly	1. Ambient Temp. 2. Winding Temp. 3. Load (amperes) 4. Voltage	Check the temp. Rise. Check against rated figures	Shut down the transformer & investigate if it is persistently higher than normal
Quarterly	1) Bushings/Insulators	Examine for cracks & dirt deposits	Clean or replace.
Yearly	1) Winding 2) Earth resistance	Check for insulation value Check for earth resistance	Ensure proper megger value Take suitable action, if earth Resistance is high

9) LV/HV Connections

All External Connections must be tight & mechanically secure. It is recommended to use torque wrenches for better symmetry to avoid overstressing Tightening torque for brass or copper hardware should be as below.

Size	Torque in NM
M8	10
M12	13
M20	30
M30	70

10) Trouble shooting chart for transformer:

Trouble	Cause	Remedy
Rise in temperature High temperature	Over Fluxing Over Current Short circuited core Defects in the calibration or contact of the thermometer.	Check voltage and frequency to avoid over excitation. Reduce the load. Improving the power factor of load can often reduce heating. It persist check magnetic balance Examine & set right the defects. Calibrate the thermometer
Electrical Troubles: Winding failure / arc	Lightening, short circuit, overload, entry of foreign matter, ageing of insulation, and loose contact in jumpers tap Links or bushings, moisture condensation internal arc	Usually, when a transformer winding fails , the transformer is automatically disconnected from the power source by opening the supply breaker or fuse. Disconnect LT Connection. Never reenergise without magnetic balance test. When there is any such evidence of a winding failure, the transformer should not be re-energized at full voltage, because this might result in additional internal damage. Also it would introduce a fire hazard in transformer. After disconnection from both source and load, the following observations and tests are recommended: a) External b) Mechanical or electrical damage to bushing leads, disconnecting switches or other accessories. c) Maintain all protective systems in healthy conditions so that the transformer is isolated in case of sudden overload. Check up the insulation co-ordination gaps and do the needful.
Core failure	Core insulation break-down (core, clamps, or between laminations) Short circuited core Open core joints	Test core loss, if high, it is probably due to a short-circuited core. Test core insulation. Repair if damaged. Core loss test will show no appreciable increase re-tighten clamping structure.
Audible internal arc Bushing flashover Moisture condensation	Isolated metallic part Loose connection Lighting Dirty bushings Improper or insufficient ventilators	The source should be immediately determined. Make certain that all normally grounded parts, such as clamps and cores are grounded intact. Same as above. Tighten all connections. Provide adequate lighting protection Clean bushing porcelains. Make sure that all ventilator openings are free.
Audio noise: Fractured metal or porcelain parts of bushings.	Accessories and external transformer parts are set into resonant vibration giving rise to noise. Unusual strain on terminal connections	In some cases, parts may be stressed into resonance. Releasing pressure and shimming will remedy this problem. Cables & bus bars attached to transformer terminal should be adequately supported. In the case of heavy loads. Flexible connections should be provided to remove strain on the terminal and bushing porcelain.
Other Troubles: H.T. Fuses blowing off (if applicable)	a. Internal defect b. Jumper defects c. External fault not cleared by protective switch gear. d. Size of the fuse inadequate. e. Overload f. Excessive motor starting current.	Examine and rectify the defect. Test first before re-energise. Replace the fuse with suitable size. Reduce the overload. Check motor circuit and check fuse characteristics.

11) DO'S AND DON'T'S:

Don'ts for Transformer:

- 1) Do not leave cover of off- circuit tap links open.
- 2) Do not operate off-circuit tap Links when the transformer is energised.
- 3) Do not energise transformer without conducting pre-commissioning checks.
- 4) Do not energise without through investigation and configuration by us of the transformer whenever any alarm of protection has operated.
- 5) Do not parallel transformer, which do not fulfil the paralleling condition.
- 6) Do not overload the transformer other than the specific limits as per IEC: 905/IS 6600
- 7) Do not leave any connection loose.
- 8) Do not do not allow unauthorised entry near the transformer.
- 9) Do not leave secondary terminal of an unloaded CT open (If applicable).
- 10) Do not touch any terminal of transformer after switching off before it is earthed.
- 11) Use suitable rated and approved protective Gloves & equipment while working with transformer.
- 12) Do not leave open any door of Enclosure which may have been opened for inspection. Rats, lizards can enter the enclosure from open door and cause damage.
- 13) Do not touch the terminals or Cast Resin Transformers if in Energized condition. It may cause serious damage or death.
- 14) While changing the tap link care to be taken while tightening the bolts on tap links, it should not damage / break the insert.
- 15) Do not touch/ remove the WTI sensors.
- 16) Except Transformers with IP55 enclosures, "ALL TRANSFORMERS TO BE INSTALED IN SHADE."

Dos for Transformer:

- 1) Check the protection circuit periodically
- 2) Check the door seals of marshalling box. Change the rubber lining if required.
- 3) Inspect the painting and if necessary retouching should be done.
- 4) Check & clean the relay and alarm contacts. Check also their operation and accuracy and if required, change the setting.
- 5) If inspection covers are opened or any gasket joint is to be tightened, then tighten the bolts evenly to avoid uneven pressure.
- 6) Check and thoroughly investigate the transformer and inform us before reenergising whenever any alarm or protection is operated.
- 7) Examine the bushing / Insulators for dirt deposits on coats and clean them periodically.
- 8) Check that, all connections are properly tightened and there is no oxidation at contact points.

12) Maintenance:

In general, Cast Resin type transformers do not need any maintenance unless the accumulation of dust and high humidity is there. When necessary, it is advisable to clean the transformer. It is essential that dust or other deposits, which may impede cooling airflow, do not obstruct the cooling ducts.

13) Pre Commissioning Tests (Refer Pre-commissioning Checklist):

- 1) Insulation Resistance Test:
 - a) Control wiring E
 - b) HV-E
 - c) HV-LV
 - d) LV-E

2) Voltage Ratio Test: Ratio at all taps is to be checked. Start the tap changer from lowest tap and then go on increasing, instead of starting from normal tap.

Tap no.	Voltage Applied			Voltage Measured			Ratio Obtained			Cal. Ratio from R & D Plate
	U-V	V-W	W-U	U-V	V-W	W-U	U-V	V-W	W-U	
1										
to										
16										

- 3) Continuity test: Continuity between line and neutral (For neutral end) or line to line (for line end) with multimeter on all taps and phases to be confirmed.
- 4) Measurement of Winding resistance (H.V. and L.V.)

Winding	Tap no.	Phase - U	Phase - V	Phase -W	Temp.	Remark
	1					
	to					
	16					

- 5) Magnetization Tests:
Apply 400V from HV Side and check current per phase in milliamps.
- 6) Magnetic Balance Test:
Apply 230 Volts AC between each HV phase, keeping LV open.
Measure HV Voltage for other remaining phases & record. For voltage $\geq 22\text{KV}$, it is recommended to do the test at higher voltages.

A matrix will be formed as follows:

Applied voltage	U-V	V-W	W-U
	230	xxx	xxx
	xxx	230	xxx
	xxx	xxx	230

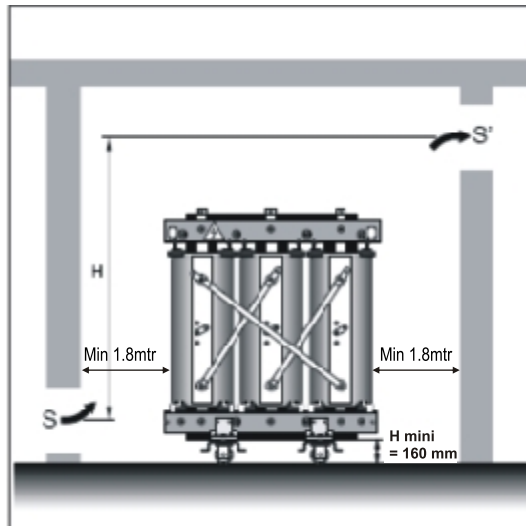
The "XXX" denotes the place to record measured readings. Current to be recorded separately for each phase.

- 7) Other Testing: WTI: Check Alarm, Trip, fan ON, Fan OFF settings.
- 8) Checks for operation of temperature sensor to be done.
- 9) Other Testing: (Please refer Fitting & accessories manufacturers catalogues)

14) Ventilation Requirement for Transformer (Inlet area S and outlet area S')

- $S = \frac{0.18 P}{\sqrt{H}}$ P = Sum of the transformer's no-load and load losses expressed in kW at Ambient + 90 deg C for class 'F' and ambient +115 Deg C for class 'H'
- S = Area of the lower air intake opening (allow for mesh factor) expressed in sq m.
- S' = Area of the air outlet opening (allow for mesh factor) expressed in sq m. (1.15 xS)
- H = Height difference between the two openings expressed in metres.

This formula is valid for an average ambient temperature above 20 deg C.
For small room or badly ventilated room, forced ventilation shall be provided



15) Disposal:

All steel components, CRGO & Copper is to be disposed through authorized re- cyclers.
For further detail & guidance for the waste disposal you can contact concerned sales person or management representative of Raychem RPG



Chakan

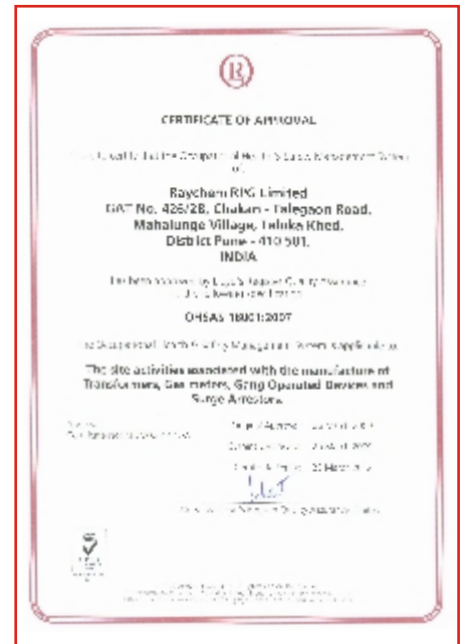


Nalagarh

ISO:9001-2008

ISO:14001- 2004

OHSAS:18001-2007



Raychem RPG (P) Ltd

(A TE Connectivity - RPG Enterprises JV)

HEAD OFFICE / REGISTERED OFFICE

Mumbai : RPG House 463, Dr. Annie Besant Road Worli, Mumbai – 400 030. Phone: 91-22-24937485/6

SALES OFFICES

Bangalore : Namdev Garnet, 37/7, Ground Floor Aga Abbas Ali Road, off Halasur Road Bangalore – 560 042. Tel: 91-80-40676666

Chennai : T-8, 3rd Floor, Apollo Dubai Plaza 100 Mahalingapuram Main Road Nungambakkam, Chennai – 600 034. Tel: 91-44-65718441/65718437

Kolkata : Bengal Intelligent Parks, Omega Bldg., 1st Flr. Plot A2, M2 & N2, Block EP & GP, Sector V, Kolkata – 700 091. Tel – 91-33-40044081 - 83

New Delhi : 1107-1114, Vishwa Deep, 11th Floor, District Centre, Janakpuri, New Delhi – 110 058. Tel: 91-11-45753700

Thane : Sun Magnetica, A Wing, 101, 1st Floor Near LIC Bld., Eastern Express H/W, Thane (W) 400 604. Tel: 91-22-64577800-831

FACTORIES

Chakan : GAT No. 426/2B Chakan-Talegaon Road, Mahalunge Village Taluka Khed, Dist. Pune - 410 501. Tel: 91-2135-662300 / 01 / 23

Nalagarh : Village Plasra Nihla, Nalagarh Swarghat Road Nalagarh, District Solan, Nalagarh - 91-174101 - HP. Tel: 91-1795-220035

Email : transformer@raychemrpg.com

Website : www.raychemrpg.com

Note : Due to constant improvement in the product, Raychem RPG (P) Limited reserves the right to change specification and details mentioned this brochure

For detail information or specific enquiries on Transformer products

Write us at : transformer@raychemrpg.com

Visit us at : www.raychemrpg.com

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