INSTRUCTION MANUAL

FOR INSTALLATION,

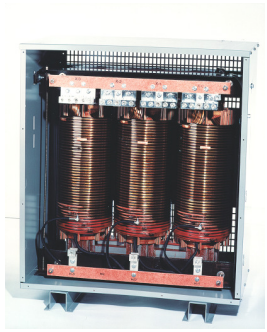
OPERATION

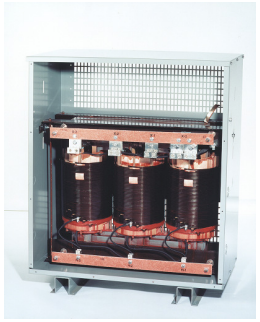
AND

MAINTENANCE OF

DRY TYPE DISTRIBUTION

TRANSFORMERS





WARNING

- Carefully read the instruction manual and get familiar with the equipment you have just received before installation, energizing or maintenance.
- <u>Ensure equipment is de-energized prior to any work</u>.
- **Do not rely on any visual indication like a switch position and take for granted that the transformer is de-energized. Use appropriate voltmeter.**
- Only insulated tools designed to protect against electrical shock should be used.
- Recommended personal protective equipment should be used for any work near this equipment.
- Before any maintenance, ensure static loads have been drained through winding ground using appropriate equipment.
- Reinstall equipment, panels, covers and/or doors before re-energizing equipment.

Non-compliance with these instructions may cause severe injury or death!

Table of contents

1. Introduction

All transformers manufactured are carefully assembled, tested according to CSA standards and inspected before leaving the plant. All transformers are individually packed and placed on appropriate stands to protect them against damage during handling, delivery and storage.

2. Receiving and Inspection

Each transformer should be inspected at receiving for any damage during transportation. In case of damages or evidence of rough handling, claims should be addressed to the carrier. Internal inspection of transformer can be performed by removing front cover or panel. By this inspection, displaced components, broken connection or insulation, dirt, water or moisture will be detected. Before transformer energizing, it is recommended to repeat the above procedure to ensure bolts are well tighten.

3. Transportation and Handling

Operator must use good judgment in handling transformers. He shall use proper equipment, lift truck or hoist capable of lifting the transformer safely and **not push, drag or pull the transformer directly on the floor.**

For larger transformers, lifting eyelets are provided on transformer housing for handling with a hoist. For more larger transformers, use of slings and space bars is strongly recommended.

4. Storage

Transformers should be stored inside a dry and clean area. Vents should be covered to block dust and dirt. If transformer must be stored outside, it should be protected against weather and humidity.

When prolonged exposure to humidity could not be avoided, it is recommended to dry transformer before use. This can be done by admitting hot pulsed air through vents until unit is completely dry.

5. Location and Environment

a. Location

Dry type transformers must be installed inside a building, in an environment where no excessive dust, corrosive fumes, flammable fibers, water dripping and excessive humidity are present.

When floor mounted transformers are located near walls or other structures, minimal clearance must be provided between the housing and the walls. Clearance is normally indicated on top of transformers. Choice of location must provide access to transformers for maintenance. When transformer is installed near combustible materials, refer to applicable Electrical Code.

Generally speaking, transformers should not be located where dripping may occur. When unavoidable, ensure transformer housing offers sufficient protection. Where sprinklers are found, refer to applicable Electrical Code.

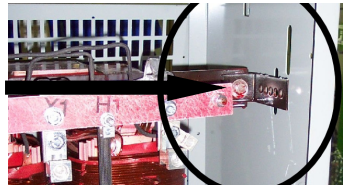
b. Noise Level

Magnetostriction causes transformer to hum, making a low sound twice of fundamental frequency. Humming is a basic property of transformers that cannot be completely neutralized. After installation, a noise increase of 10 to 20 dBA is often witnessed, sometimes too late to take corrective action. Choice of location and installation practice makes all the difference. Recommendations on the choice of transformer location and suggestions prior to transformer commissioning are provided hereunder.

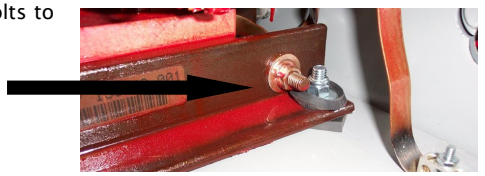
Transformer Location - Recommendations

- Avoid installation near sound reflecting surfaces.
- Select a location away from working areas.
- When installation near sound reflecting surfaces is unavoidable, cover them with soundproofing material.
- Ensure base will support transformer. Avoid installation on a weak surface like wood flooring.
- Use of flexible connections is strongly recommended.
- Transformer must be installed on anti-vibration pads of proper dimensions and properties.
- For aerial or wall-mounted transformers, make sure vibration is not transmitted to the structure.

Before Commissioning



- Remove supporting elements, if any, between top of transformer and housing.
- Check input voltage level with regards to transformer tap position.
- Ensure terminal board are not submitted to excess strain due to connection cables.
- Ensure all components are well tightened.
- Unscrew transformer base anchoring bolts to relieve any excess strain.
- Make sure installation is levelled.



c. Ventilating and Heat

Proper ventilating maintains transformer temperature at an appropriate level. When installed in a confined area, proper ventilating will provide adequate ambient temperature. In any circumstance, ambient temperature shall be less then 30°C nor exceed 40°C over a 24-hour period. Enclosure ventilating area is based on transformer kVA, heat losses in kW, height differential between inlet and outlet louvers and air temperature differential at inlet and outlet. Total area is designed to allow adequate ventilating of transformer and it must be kept free of any obstacles. No nearby object shall impede ventilation.

Off load, a transformer may seem warm at touch. At full load, temperature of transformer housing may reach 65°C above ambient. When ambient is 30°C, housing temperature may attain 95°C.

6. Installation

a. Cable Connection and Installation

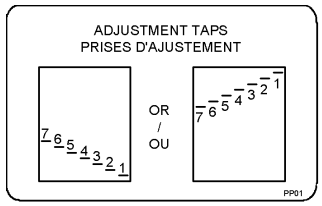
- Cable type and size shall conform to proper Electrical Code.
- Use of flexible connections is recommended.
- Terminal board shall not be submitted to excessive strain by cables.
- Cables shall not block ventilating louvers.

b. Tap Settings

To prevent electrical shock or transformer damage, follow this procedure to change tap connections.

- Ensure transformer is de-energized.
- Short-circuit inlet and outlet terminals and connect them to ground.
- Use two tools to tighten and loosen taps to prevent twisting and damaging cables.
- Clean tap surface with sandpaper.
- Change taps connections by moving jumper to appropriate tap. To do so, refer to "ADJUSTMENT TAPS" label on transformer housing.

Sample Label



c. Load Distribution

Care should be taken when connecting a load to a transformer. First, maximum let-through current of windings shall not exceed allowable current rating of each phase. The practice of maintaining the load at 80% of the nominal current is recommended. This is a preventive measure, should the ambient temperature rise become too high to allow adequate cooling of the unit. Second, it is recommended to counterbalance loads as much as possible for a smooth operation. Whenever a transformer is feeding a rectifier or other applications which impact on current wave shape, it is deemed advisable to use a "true RMS" type ammeter to measure exact current value.

d. Safety Measures Prior Start-Up

- Connect power to primary only as per wiring diagram.
- Energize unit and check if secondary voltage is compatible with load.
- Disconnect power at primary and connect load to secondary.
- Close access panel and re-energize.

e. Transformers Installed in Hazardous Location Class I, Division 2

- Transformers certified to be installed in hazardous location Class I, Division 2 have a specific marking for that purpose on the bottom of the nameplate and the Gas groups as well as the temperature code are indicated for a proper installation.
- **WARNING - EXPLOSION HAZARD -** Substitution of components may impair suitability for Class I, Division 2.
- **WARNING - EXPLOSION HAZARD -** Do not disconnect equipment unless power has been switched off or the area is known to be NON-HAZARDOUS.

7. Maintenance

As for many other electrical equipment, inspection and maintenance of transformer must be performed regularly. These precautionary measures must be taken on a regular basis as well as corrective action, if necessary, as soon as possible. Good transformer maintenance will ensure greater reliability.

Frequency of transformer inspections is dependent of environmental conditions. A transformer may operate for several years without any particular care. Under unfavourable conditions (presence of salt, dust, corrosive fumes, metal particles and other harmful materials in the air), monthly inspections becomes mandatory.

Several maintenance operations can be performed on transformer when energized. It may include visual inspection, external cleaning, external touch-up paint, etc.

Other maintenance must be performed on transformer only when de-energized. It includes tap changes, internal inspection and clean up, troubleshooting of poor performance, replacement of defective parts, internal touch-up paint, etc. These corrective measures must be performed by qualified personnel. During maintenance procedure, the personnel shall:

- Ensure transformer is de-energized.
- Short-circuit inlet and outlet terminals and connect them to ground.
- Check connectors for alignment, strain, oxidation or corrosion. Replace oxidized connectors. Under certain conditions, when oxidation is superficial, restore conductivity to the surface using a fine-grain sandpaper.
- Check condition of hardware.
- Check insulated connectors to detect the presence of heat. In such a case, correct and isolate connections.
- Clean excess dirt on transformer windings or insulation to facilitate airflow and prevent insulation breakage.

Dirt acts like a blanket on the windings and may cause transformer overheating. Operation of transformer at high temperature impacts directly on insulation life. For this reason, special care must be taken to maintain top and bottom of windings and ventilating louvers clean.

Windings can be cleaned with a vacuum cleaner or compressed air. It is recommended to use a vacuum cleaner for the first stage cleaning. If necessary, further cleaning can be performed with vacuum cleaner, compressed air or dry nitrogen. Air pressure should never exceed 25 pounds per square inch. Higher pressures may contribute to introduce metallic particles into insulation. Use a dry cloth to clean terminal plates, brackets, tap

changers and isolators. Liquid cleaners or solvents are not recommended as several impacts negatively on insulation.

Appendix 1

Bolt tightening torques

Bolt Specs	Copper Bus	Aluminum bus
Steel 3/8 – 16 – Grade 5	30.00 ft-pds	30.00 ft-pds
Steel 1/2 – 13 – Grade 5	60.00 ft-pds	60.00 ft-pds

Appendix 2

Noise level table (dBA)

Phases	kVA	Ventilated			Closed
		Up to 1.2 kV	Above 1.2 kV Up to 15 kV	Above 15 kV Up to 25 kV	Up to 15 kV
Single Phase	0-9	45	50	54	45
	10-50	50	55	59	50
	51-100	55	60	64	55
	101-167	60	65	69	57
	168-333	65	68	72	59
	334-1000	68	68	72	61
Three Phase	0-9	40	45	49	45
	10-50	45	50	54	50
	51-150	50	55	58	55
	151-300	55	58	61	57
	301-500	60	60	63	59
	501-700	62	62	65	61
	701-1000	64	64	67	63
	1001-1500	65	65	68	64
	1501-2000	66	66	69	65
	2001-3000	68	68	71	66
	3001-3750	71	71	74	68
	3751-5000	73	73	76	70

This table is based on CSA C9-02 standard. These values are used under maximum test conditions. Installation and environment may impact unfavourably on the latter up to 10-20 dB.