



## GUIDE FOR OPERATION AND MAINTENANCE OF DRY TYPE INDOOR AND OUTDOOR VENTILATED TYPE TRANSFORMERS COOLED BY NATURAL OR FORCED DRAFT

This guide covers general recommendations for the operation and maintenance of dry type distribution and power transformers. The successful operation of a transformer is dependent on proper installation, loading, and maintenance. As with all other electric apparatus, neglect of certain fundamental requirements may lead to loss of equipment, and / or serious injury.

In addition to the use of this guide, Power Magnetics should be consulted for specific recommendations on special conditions. Reference may also be made to other publications and local codes.

### 1. INSTALLATION

#### 1.1 Location

Factors that should be considered when locating dry type transformers are accessibility, ventilation and atmospheric conditions. Enclosures are designed in accordance with NEMA and UL standards. Dry type NEMA1 transformers designed for indoor installations should be in dry locations. Suitable protection should be provided to prevent water from entering the transformer enclosure. Dry type NEMA3R transformers are designed for outdoor installations.

Filtered air may reduce maintenance if the location presents a particular problem. When transformers are installed in vaults or other restricted spaces, sufficient ventilation should be provided. Transformers generally require approximately 100 cubic feet of air per minute per kilowatt of losses.

Ventilated dry type transformers should be installed in locations free from unusual dust-producing mediums, flammable materials or chemical fumes and must comply with local codes.

**Transformers shall be located at least 12 inches away from walls or other obstructions that might prevent free circulation of air through and around unit.** The distance between adjacent transformers should not be less than 12 inches.

The impulse strength (BIL) of dry type transformers is less than that of liquid immersed units of the same voltage class. If there is any likelihood the transformer will be exposed to lightning or severe switching surges, adequate protection must be provided. For derating factors which apply to installation at high altitudes, refer to ANSI C57.12.01-1979.

#### 1.2 Inspection

New transformers should be inspected upon receipt for damage incurred during shipment. After a transformer is moved, or if it is stored before installation, inspection should be repeated before placing the transformer in service. The operation of fans, thermal relays and other auxiliary devices should be checked.

#### 1.3 Handling

Ventilated dry type transformers should be thoroughly protected against the entrance of rain or snow when handled outdoors in inclement weather.

When lifting a transformer, the lifting cables must be held apart by a spreader to avoid bending of the structure. Transformers may be skidded or moved on rollers but care must be taken not to damage the base or tip it over. When rollers are used under large transformers, skids must be used to distribute the stress over the base.

#### 1.4 Grounding

The enclosure and core assembly of transformers must be permanently and adequately grounded in accordance with NEMA and local codes.

### 2. STORAGE

Condensation and moisture absorption must be prevented during storage. Ventilated dry type transformers should be stored in a warm, dry location. Ventilation openings should be covered to keep out dust. If outdoor storage cannot be avoided, transformers must be protected to prevent entrance of water, moisture, and foreign material.

### 3. MAINTENANCE

**CAUTION:** Do not remove covers, panels, or any transformer enclosure parts while the transformer is energized.

#### 3.1 Periodic Inspection and Maintenance

Transformers require periodic maintenance to assure successful operation. Inspection should be made at regular intervals depending on environment and operating conditions. Inspection should be made for dirt, especially accumulations on insulating surfaces or those which tend to restrict air flow, loose connections, condition of tap changers or terminal boards, and general condition of the transformer. Observation should be made for signs of overheating.

Evidence of rust, corrosion or deterioration of the paint should be checked and corrective measures taken as necessary. Fans and other auxiliary devices should be inspected and serviced during these inspection periods.

#### 3.2 Cleaning

Excessive accumulations of dirt on the transformer windings or insulators should be removed to permit free circulation of air and to guard against the possibility of insulation breakdown. Particular attention should be given to cleaning the top and bottom ends of the winding assemblies and to cleaning out ventilating ducts. Windings should be cleaned with a vacuum cleaner, blower or compressed air. The use of a vacuum is preferred as the first step in cleaning followed by the use of compressed air or nitrogen. The compressed air or nitrogen should be clean, dry and should be applied at a relatively low pressure not exceeding 25 psi. Lead supports, tap changers and terminal boards, bushings, and other major insulating surfaces should be brushed or wiped with a dry cloth. The use of liquid cleaners is not recommended due to deteriorating effects on most insulating materials.

#### 3.3 Drying of Core and Coil Assembly

**CAUTION:** Constant attendance during the drying process is recommended. When it is necessary to dry a transformer before installation or after an extended shutdown under relatively high humidity conditions, internal and/or external heat can be used.

It is important that most of the heated air pass through the winding ducts and not around the sides. Good ventilation is essential in order that condensation not take place in the transformer itself or inside the case. A sufficient quantity of air should be used to assure approximately equal inlet and outlet temperatures.

Air temperature should not exceed 110°C.

### 4. OPERATION

**CAUTION:** Do not remove covers, panels, or any transformer enclosure parts while the transformer is energized.

#### 4.1 Effect of Humidity

While the transformer is in service humidity conditions are generally not important. If a shutdown exceeding 24 hours occurs during a period of high humidity, particularly if atmospheric conditions are such as to cause condensation within the housing, precautions should be taken. Small strip heaters may be energized in the bottom of the unit shortly after shutdown to maintain the temperature of the unit a few degrees above that of the outside air. If such precautions are not taken the transformer should be inspected for evidence of moisture and dried if necessary (refer to maintenance section).

#### 4.2 Loading

Dry type transformer rated loads are in accordance with the nameplate ratings. For other operating conditions refer to ANSI C57.96-.01.250, or Power Magnetics.