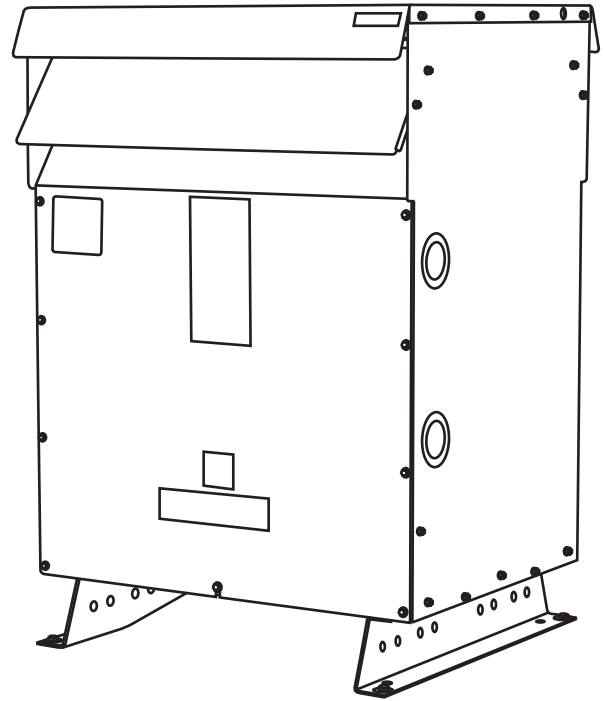


# LOW VOLTAGE DRY-TYPE MANUAL

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## SAFETY PRECAUTIONS

1. Fully inspect the transformer before unloading and unpacking.
2. Only trained, experienced personnel utilizing suitable equipment should perform these tasks. Lifting provisions are included on many transformer sizes on the core and coil. Remove the top of the transformer to access them.
3. Use only UL listed dual rated terminals for electrical connections. When connecting to busway flexible, connectors are recommended.
4. Connections should conform to nameplate drawing or connection diagrams.
5. When servicing the transformer, always make sure that the source of power has been disconnected.
6. Assure that all line terminals, selected tap settings and ground connections are completed. Make sure that all are torqued to proper tolerances, prior to energizing the transformer.
7. Do not change any primary or secondary connections as well as tap positions, while the transformer is energized.
8. Do not attempt to change any connection while the transformer is energized.
9. Do not tamper with alarms, interlocks, control panels, or control circuits.
10. Do not adjust or remove any cover plates or accessories, while the transformer is energized.

## GENERAL

This Transformer is made to provide high levels of performance for a lifetime of uninterrupted and trouble free service. Please pay careful attention to the instructions, to ensure safe and reliable operation.

Only trained and authorized personnel should perform installation, operation and maintenance of transformer. They should be well versed with electrical apparatus and the potential hazards involved.

**Danger! Power must be shut off before any work is performed on the transformer. There is the potential of electric shock.**

These transformers must be installed according to the requirements of the national and local electrical codes. ANSI/IEEE C57-94 may also be referred to for recommended installation, application, operation and maintenance of dry-type transformers.

## HANDLING

Transformers can either be lifted via a forklift truck or hoisted by the lifting lugs provided.

Appropriate lifting equipment, including spreader bars, should be used in relation to the size of each transformer. For safety purposes and to protect the transformer, no attempt should be made to lift or move a transformer from any points on the unit other than those indicated.

## RECEIVING & INSPECTION

As part of the receiving process, the transformer should be inspected for any damage and for correctness against the shipping documents. The transformer should be examined for any packaging abnormalities, dented or damaged enclosures. Special attention should be paid to the feet, to insure that it was handled properly. Also, check for missing parts from the packing list.

Note any damage on the shipping documents. A claim should be filed immediately with the carrier and an additional copy of all relevant information to the order and the circumstances should be filed with the local sales office. If the examination of the unit takes place outdoors, care should be taken that inclement weather does not create further hazard.

## STORAGE

Transformers that will not be immediately installed and energized, should be stored in a clean, dry and warm area away from any environmental airborne contaminants.

It is recommended that transformers be stored in a heated building, but they can be stored in temperatures of  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ). Transformers that are to be energized after being stored at a low temperature must be warmed to  $-25^{\circ}\text{C}$  ( $-13^{\circ}\text{F}$ ) with warm air or radiant heat. Once the transformer reaches this temperature, it is safe to energize.

## INSTALLATION

**Enclosures are designed and approved in accordance with specifications CSA 22.2 No. 47 (General Purpose), CSA 22.2 No. 94 (Specialty Enclosures), NEMA 250 and UL 50.**

### Indoor/Outdoor Dry-Type Transformers with Enclosures

Transformers are supplied with NEMA type 3R enclosures. Units may be installed indoors, or outdoors as the code requires.

Ventilated enclosures are recommended for indoor installation but can be installed outdoors where weather conditions allow a type 3R ventilated enclosure to be installed.

For any outdoor location, the appropriate applicable codes must be followed including cable installation and hardware suitable for outdoor service.

Water tight couplings must be used, and any holes in the enclosure must be drilled below any uninsulated live parts.

Transformers may be placed in an upright position on walls, floors, posts, beams or other locations capable of supporting their weight with the proper accessories.

Ventilated transformers should be installed in a dry area where the ambient air is clean and free of dust, dirt, corrosive fumes. Ventilated transformers should not be installed in a place having the possibility of high moisture, excessive heat or other adverse conditions. If a transformer has been subjected to moisture or dampness before installation, make sure that it is completely cleaned and dried before energization. Blowing warmed air through the transformer is recommended to dry internal components.

## VENTILATION

Transformers are required to be installed in an area where they can be cooled by means convection, where the average ambient temperature is  $30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ) and should not exceed  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) at any time. Adequate ventilation is essential for transformers to meet their nameplate kVA capability and to assure long life. The distance a transformer should be located away from any wall or any other obstruction is stated on the nameplate. Follow these distance measurements to allow free, clean circulation of air through the ventilation openings or around a non-ventilated unit.

## ACCESSIBILITY

NEC standards require that transformers be accessible for inspection. However, transformers should not be located in areas where stored items are likely to interfere with either natural air convection or the capability to have them inspected. Passageways or other areas where people could be exposed to live parts during inspection should also be avoided. Protection should be provided under all circumstances.

## TRANSFORMER SOUND LEVELS

Transformers are electrically energized equipment and it is their nature to emit sound. Transformers are required to meet NEMA standards for the maximum sound levels permissible. These sound level standards vary from 40 to 60 DB and hence, can be an annoyance if located in close proximity to where people work or reside. Care should be taken in selecting sites for transformers particularly to avoid noise sensitive areas like hospitals, classrooms, medical or office facilities.

### Guidelines for minimizing noise:

- Transformers should be mounted away from corners.
- Hard wall, ceiling, and floor surfaces reflect and amplify noise. Softer, sound absorbing material should be used when possible and practical.
- Hard piping directly into the transformer should be avoided. Cable or other flexible conduit should be considered to make connections.
- Transformers are provided with isolation rubber mounts between the core and coil assembly and the enclosure. However, sound absorbing vibration isolators may also be installed between the transformer and its mounting surface.
- The Transformer should be located as far as practical from areas where higher sound levels could be considered undesirable.
- Transformers should be securely anchored to the floor, to help mitigate vibration.

## CABLE CONNECTIONS

The connecting cable size is determined from the line current rating of the transformer's primary and secondary windings. Cables should be

rated for at least 90°C (194°F). The use of ALC9CU lugs is recommended. Appropriate cable connectors suitable for the application must be used.

**DANGER : Do not attempt to change connections or taps unless the transformer is de-energized and all windings grounded.**

Side entry of cables is recommended as it leaves the ventilated areas unobstructed. The use of electrical joint compounds is recommended for use on all electrical connections. Refer to the transformer nameplate for primary and secondary voltage connection combinations and primary and/or secondary tap positions as applicable.

#### CHANGING TAP LEADS

Transformers received from the factory will have tap leads installed on the nominal, or 100%, voltage position. The balance of the tap positions will still be coated with impregnation material and insulation. To change taps, it is necessary to gently remove all contaminants and insulation from the surface of the top and bottom of the taps (eye loop or lugs) by sanding the lugs clean.

The surface of the tap lead should be cleaned and subsequently coated with electrical compound to all non-plated contacts between the jumper terminal and the tap. Assemble jumpers to taps.

**ALWAYS CHECK: After installation of cables and connectors, a minimum of 1" clearance must be maintained from energized parts to all case parts.**

#### GROUNDING

All core and coil assemblies are internally grounded to the enclosure to ensure that all conductive metal parts have the same potential. The enclosure should also be securely and effectively grounded as a safety precaution. This grounding should be in accordance with national electrical code standards.

#### INSPECTION BEFORE ENERGIZATION

**For the safe and proper operation of the transformer, please check the following before energizing:**

1. The insulation resistance, core to primary, core to secondary and primary to secondary, should be greater than 10k ohms.
2. Prior to connecting to any loads, please measure and verify the output voltage matches nameplate specifications.
3. Ensure correct phase connections. Refer to the nameplate vector diagram.
4. On a delta secondary winding with a 120 volt center tap, the load should never exceed the normal current rating of the winding. This center tap is designed for the maximum of 5% of the nameplate kVA.
5. When windings are connected in parallel (as in the case of dual voltage primaries), ensure that the primary taps for all coils are connected to the identical percentage tap positions to avoid the shorting of turns. For tap positions, refer to the nameplate on the transformer.
6. The enclosure should be grounded with the appropriately sized conductor.
7. The total load among all the phases should be balanced as much as possible for optimum performance of the transformer's windings. Any three phase or single phase load may be connected to the transformer but the kVA loading on each phase must never exceed 33% of the nameplate kVA rating.

8. The clearance and tightness of all electrical connections should be checked.

9. If there is any reason to suspect that the transformer has been exposed to moisture during transit or storage, it should be checked for dryness before energization. This can be done by making an insulation resistance test. Dry-out procedures are detailed in this manual.

#### OPERATION

For all normal and clean installations, transformers will operate correctly under conditions within the nameplate rating of energization and load. A fully loaded dry-type transformer may feel or even hot to the touch, particularly on the top of the unit. Industry standards permit the temperatures of the cover to be 65°C (149°F) over ambient. This represents normal loading and should not be of concern.

Dry-type transformers are designed to operate continuously at their full nameplate kVA rating.

**ANSI C57.96 provides guidelines for loading transformers under other conditions including:**

1. Ambient temperatures that are varied from the ambient temperatures required for transformer operation.
2. Short time overload as it relates to time and temperature and the corresponding loss of life of the transformer.
3. Overload that results in a reduction of life expectancy of the transformer.

**If the transformer is experiencing increased temperatures, the following load characteristics should be considered immediately:**

1. Rigorous motor starting loads "jogging" or other impact type loading for which a specific transformer for that application is required.
2. Over-excitation of unit due to excess supply line voltage or current.
3. High ambient temperatures above standard. A low temperature rise transformer may be required.
4. Overloading the transformer beyond ANSI C57.96 guidelines.
5. Triplen level harmonics on the supply line voltage and currents.

Transformers can be stored for long periods of time without affecting performance. Care must be exercised to clean and dry units prior to energization, as previously outlined.

#### MAINTENANCE

Transformers used under normal operating conditions and environments, do not require maintenance. However, development of a preventative maintenance program with periodic care and inspection is a good practice.

Peripheral inspection and external dust removal may be carried out while the transformer is in operation. Do not open access covers under energized conditions.

**Internal maintenance must be performed with a transformer de-energized, isolated and with the terminals grounded.**

Maintenance would include internal cleaning, tightening of links and bolted connections, servicing and inspection of auxiliary devices. Air ducts should be free of any accumulation of dust and debris and any bolted connections of terminals must be in good condition.

Vacuuming or blowing compressed air from the top down is an

accepted practice for removing dust from the ducts of a transformer coil. Low pressure, dry air should be used to avoid further contamination of the windings by foreign material.

The ground connection should also be checked to ensure a low impedance connection. The accumulation of ice, snow or any other object blocking the ventilation should be cleaned up immediately during the operation of the transformer.

On outdoor units where filters have been installed, being exposed to the outside atmosphere can cause the filters to get dirty quickly. A periodic check of the filters will help avoid filter clogging and thus transformer overheating. Also, never run the transformer without the filters properly in place.

**DRYING OUT OF TRANSFORMERS**

If a transformer was exposed to condensation or rain, it is recommended to dry out any unit before energizing.

Drying the transformer, may be accomplished by using any hot or warmed air, radiant heat or internal heat that is directed through the windings. Heated air should be allowed to rise up through the windings for a minimum of twenty four (24) hours after the evidence of condensation is no longer visible.

In flood conditions, transformers may not be able to be dried out appropriately. Contact the transformer manufacturer for corrective action.

**ACCESSORIES**

**Wall Mounting Brackets**

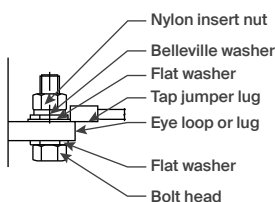
Encapsulated transformers have integral wall mounting capabilities for units up to 285 lbs. Units over 285 lbs. must be floor mounted only. Ventilated dry-type transformers are normally designed to be floor mounted only. However, some ventilated units up to 45 kVA can be wall mounted with the appropriate bracket.

**APPENDIX A  
LUG TIGHTENING TORQUE**

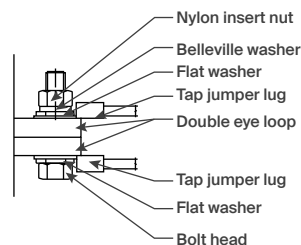
WIRE RANGE	WIRE TIGHTENING TORQUE	LUG TIGHTENING TORQUE
14-2 AWG	50 IN. LBS	6 FT. LBS.
14-2/0AWG	50 IN. LBS	6 FT. LBS.
250 KCMIL-6AWG	275 IN. LBS	11 FT. LBS.
350KCMIL-6AWG	375 IN. LBS	19 FT. LBS
600KCMIL-2AWG	375 IN. LBS	19 FT. LBS

**APPENDIX B  
JUMPER ASSEMBLY DRAWING**

**DRAWING 1**  
Single Conductor Eyeloop Tap Lugs



**DRAWING 2**  
Double Conductor Eyeloop Tap Lugs



**APPENDIX C  
Assembly**

**Notes:**

1. Handling - transformers are designed to be raised by a fork lift from underneath the pallet. Final positioning of the unit with the pallet removed can be via a fork lift under the transformer with the forks between the channels. **(Note: when using fork lift make sure forks are on the outside of legs, never move transformer with fork lift on the inside of legs)**
2. Shipping - transformers are shipped on pallets which are to be removed at installation.
3. Installation - this transformer can be installed indoor or outdoor providing a degree of protection against falling rain, sleet and external ice formation.
4. All general purpose/drive isolation transformers should be located away from any wall or any other obstruction, please refer to the nameplate for the minimum distance.
5. DO NOT block bottom ventilation area.

For final positioning with pallet removed, transformer should be lifted by removing the top panel and accessing the lifting provisions on top of the core and coil.

