



Installation, Operation and Maintenance Manual For Dry-Type Transformers

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Section 1 - Introduction

1.1 General Information

These instructions are applicable to all Sunbelt Transformer dry type, ventilated or encapsulated transformers either single phase or three phase, including general purpose, substation style and padmount transformers.

The transformers and related equipment covered by these instructions are intended to be installed, operated and serviced by qualified technicians familiar with the relevant electrical codes and practices which apply to equipment of this type.

In addition to the use of these instructions, Sunbelt Transformer should be consulted for recommendations on special conditions and applications.

Further information regarding the installation, application and maintenance of dry-type transformers may be found in ANSI/IEEE C57.94.

1.2 Inspection

Upon receipt, the equipment should be thoroughly inspected for any damage which may have occurred during transit. The inspection should include all auxiliary components such as fans, meters, current and/or potential transformers, etc.

In the event of damage, or if any indication of rough handling is visible, a claim must be filed immediately with the transport company and Sunbelt Transformer should be notified of the damage.

Locate and remove any special packaging or blocking that may have been inserted for protection during transit.

The equipment should be checked for loose connections or bolts, and these should be tightened if necessary to the appropriate torque value (see Appendix A).

1.3 Storage

If it is necessary to place the equipment in storage, this must be in a warm, dry location with uniform temperature. Condensation and moisture absorption must

be prevented during storage, by the addition of heaters if necessary. Enclosure ventilation openings should be covered to keep out dust and rodents. The floor of the storage area should ideally be flat and level.

If the transformer must be stored outdoors, it should be thoroughly protected to prevent the entry of moisture and foreign material.

Section 2 - Safety

It is essential to protect personnel from coming into contact with live parts. Access to these parts should be prevented. Before any work is carried out on the transformer, the supply should be isolated and safeguards introduced to prevent inadvertent energization during the work period.

The unit must be operated within its design limits at all times. Rated values are shown on the rating plate attached to the unit. This plate should not be permanently removed.

The total weight of the unit is shown on the rating plate and on the drawing of the transformer. Before attempting to lift the unit, check that lifting equipment is rated for at least the weight of the unit.

Section 3 - Installation

3.1 Location - Ventilated units

When selecting the location for a ventilated dry type transformer, factors such as ventilation, accessibility for maintenance and atmospheric conditions should be carefully considered.

Adequate ventilation is essential for the proper cooling of transformers. Clean, dry air is desirable. When transformers are installed in restricted spaces, sufficient ventilation must be provided in order to hold the air temperature within the design limits, when measured near the transformer ventilation inlets. This will usually require approximately 100 cu.ft/min of air per 50kVA of transformer rating.

Transformers should be so located that there are sufficient clearances from walls and other obstructions to permit the opening of doors and the removal of covers and panels for the purpose of inspection, testing and maintenance.

Unless specified otherwise, transformers are designed to operate continuously at their rated kVA in an ambient temperature which does not exceed 30 deg.C average in any 24 hour period and does not exceed a maximum of 40 deg.C, at an altitude which does not exceed 3300 feet. De-rating factors are applied for conditions which do not fall within the above parameters.

Transformers specified for use in outdoor locations will be supplied with weather resistant enclosures.

3.2 Location - Encapsulated units

Sunbelt Transformer encapsulated transformers are designed for use in outdoor locations in harsh environmental conditions and for hazardous atmospheres.

The heat generated within the transformer during normal operation must be dissipated by the transformer enclosure and so adequate ventilation is essential for proper cooling.

Unless specified otherwise, transformers are designed to operate continuously at their rated kVA in an ambient temperature which does not exceed 30 deg.C average in any 24 hour period and does not exceed a maximum of 40 deg.C, at an altitude which does not exceed 3300 feet. De-rating factors are applied for conditions which do not fall within the above parameters. In particular, de-rating must be considered in applications where the transformer is subjected to long periods of operation in direct sunlight.

3.3 Preparation for service

If the transformer has been stored prior to installation, the inspection detailed in section 2 of this manual should be repeated.

3.4 Installation

During installation, use only the lifting and jacking facilities supplied by the factory. See Appendix B for the recommended method of lifting for substation and outdoor compartmentalized padmount transformers.

All Sunbelt Transformer ventilated transformers are supplied in knock-down enclosures which may be removed if necessary to facilitate installation in areas with restricted access.

After the transformer has been placed in its permanent position, all special packaging and blocking must be removed. For ventilated units, the core and coil holding down bolts should be loosened one half turn, to allow the anti-vibration pads to perform correctly.

All electrical connections should be tightened to the appropriate torque value in accordance with the table in Appendix A.

Verify that the correct primary tap has been selected for the available supply voltage. All transformers are shipped with the nominal tap connected, but this should be changed as required to match the supply voltage. Information regarding the available taps is shown on the rating plate attached to the transformer.

The core and enclosure of the transformer should be permanently grounded with a properly sized strap or conductor in accordance with the National Electrical Code.

Before energization, check all wiring and operation of cooling fans and any other auxiliary devices which may be fitted.

3.5 Pre-service Tests

It is recommended that the following pre-service tests be carried out before the transformer is placed in service, to ensure that the transformer is in satisfactory condition and to provide a reference for future comparison:

1. Insulation resistance test.
2. Voltage ratio test.
3. Applied voltage test.

3.6 Operation

When the transformer is initially switched on, it is desirable that the load be increased gradually where this is possible, checking that the rating is not exceeded. If there are no visible or audible signs or stress during this process, full load may be applied.

Check the temperature indicator (if fitted) at intervals after placing the transformer in service.

If it should be necessary to change the primary tap position, this may be carried out by changing the position of all links as required. Information regarding the available taps is shown on the rating plate attached to the transformer.

IT IS ESSENTIAL THAT ALL THREE LINKS ON THREE PHASE TRANSFORMERS ARE IN IDENTICAL POSITIONS.

Section 4 - Maintenance

4.1 Routine maintenance

The maintenance interval for dry-type transformers will be dependant upon the loading of the transformer the environmental conditions. It is suggested that a maintenance check be carried out after the first three months of operation and then at twelve month intervals after that. This interval may be increased or decreased according to site conditions.

It is essential to protect personnel from coming into contact with live parts. Before any maintenance is carried out on the transformer, the supply should be isolated and safeguards introduced to prevent inadvertent energization during the work period.

The following maintenance items should be carried out:

1. Accumulated dust or other contamination should be removed from all insulating surfaces. This should preferably be carried out using a vacuum cleaner followed by wiping with a dry cloth.
2. Check that all winding air ducts are free from dust and foreign material. These must be kept free by blowing out with dry compressed air.
3. All terminals and connections, accessible nuts and bolts and fittings should be checked for tightness. Refer to Appendix A for recommended torque values.
4. Measure and record the insulation resistance.
5. Check the integrity of all auxiliary wiring.

4.2 Drying of core and coil assembly

If it should be necessary to dry a transformer following an extended period of shutdown or after flooding, proceed as follows:

Remove excess moisture using clean dry cloths.

External heat should be applied to the transformer by one of the following methods:

1. By placing the core and coils assembly in a suitably ventilated oven.
2. By directing heated air into the bottom air inlets of the transformer enclosure.
3. By placing the core and coil assembly in a nonflammable enclosure with openings at the top and bottom through which heated air can be circulated.

Drying time will depend on several factors and the insulation resistance should be monitored during the drying process in order to determine when drying is complete. Measurements should be made before starting the drying process and at two hour intervals during drying. As the transformer is heated, the insulation resistance will drop to a minimum value and then gradually increase until a relatively constant value is obtained. When the value has remained constant at an acceptable level for three to four hours, drying will be complete.

Constant attendance is advisable during the drying process.

4.3 Troubleshooting

In the event of a fault condition occurring within the transformer, the unit should be isolated from the incoming supply and the following procedure should be carried out:

1. Visually inspect the transformer for damage such as overheating or arcing.
2. Carry out as many of the following tests as possible in order to determine the nature of the fault:
 - a) Insulation resistance test.
 - b) Voltage ratio test.
 - c) Winding resistance measurement.
 - d) Applied voltage test.

Section 5 – Warranty information

5.1 Standard Warranty Information

Sunbelt Transformer warrants the transformer(s), switch(es) and reactor(s) [manufactured] to be free of defects in materials and workmanship for the period of one (1) year from the date of original shipment. If within the applicable period of warranty buyer discovers that the transformer(s), switch(es) or reactor(s) was (were) not as was (were) warranted, Sunbelt Transformer agrees to correct such defect at Sunbelt Transformer's facilities, or to send at Sunbelt Transformer's discretion, either competent personnel to repair or remedy a defect, or to furnish a replacement transformer(s), switch(es) or reactor(s) without charge. Buyer shall pay freight costs to return a transformer(s), switch(es) or reactor(s) to Sunbelt Transformer's facilities and Sunbelt Transformer shall pay freight costs to return a transformer(s), switch(es) or reactor(s) to the buyer within the continental United States. The correction of any default shall constitute a fulfillment of all Sunbelt Transformer's liabilities with respect to said transformer(s), switch(es) or reactor(s). This warranty shall not apply to any transformer(s), switch(es) or reactor(s) subjected to accident, abuse, negligence or any conditions beyond Sunbelt Transformer's control, or to improper operations, abnormal use, use under other than ordinary conditions, or any use other than the task for which it is designed.

5.2 Liabilities

This warranty does not include expenses for transportation except as previously stated, removal, installation, losses or damages due to a transformer(s), switch(es) or reactor(s) failure, or any other expenses that may be incurred in relation with repair or replacement. In no instance shall Sunbelt Transformer be liable for any consequential damages, secondary charges, expenses of installation or disconnecting, or losses of damages resulting from an alleged defect of Sunbelt Transformer's product(s). Sunbelt Transformer's liability shall be limited to cost of repairs, or cost of the product, whichever is the lesser.

Sunbelt Transformer shall not be subject to any other liabilities of any kind, except as specifically noted in writing by Sunbelt Transformer in relation to transformer(s), switch(es) or reactor(s) which Sunbelt Transformer has manufactured. UNDER NO CIRCUMSTANCES SHALL SUNBELT TRANSFORMER BE LIABLE FOR ANY CONSEQUENTIAL DAMAGE OR ANY SPECIAL INDIRECT OR INCIDENTAL DAMAGES, WHETHER ARISING OUT OF ANY BREACH OF

ANY EXPRESS OR IMPLIED WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, OR ANY DEFECT IN, OR MALFUNCTION OF, ANY TRANSFORMER(S), SWITCH(ES) OR REACTOR(S).

5.3 Exclusivity

This warranty is exclusive and in lieu of all other written, oral, express, implied or statutory warranties except warranties of title, including but not limited to warranties of merchantability and fitness for a particular purpose.

SUNBELT TRANSFORMER DISCLAIMS ALL OTHER EXPRESS WARRANTIES AND ALL IMPLIED WARRANTIES AS TO THE QUALITY OF ANY PRODUCTS, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES.

<p>The equipment has been sold based on the purchaser's independent determination that is appropriate for purchaser's intended application. The giving or failure to give any advice or recommendation by seller shall not constitute any warranty or impose any liability upon seller.</p>

5.4 Returned Transformer(s), Switch(es) or Reactor(s)

Returns accepted only with prior written approval from Sunbelt Transformer. All transformer(s), switch(es), and reactor(s) accepted for credit shall be subject to a service charge of 25% of the invoice price.

Only transformer(s), switch(es) and reactor(s) in a salable condition that are regularly carried in Sunbelt Transformer's stock shall be accepted for credit. The buyer will be charged any costs required to return the transformer(s), switch(es) and/or reactor(s) to a salable condition. It is also the responsibility of the buyer to pay any freight costs brought about by the returning of a transformer(s), switch(es) or reactor(s).

Appendix A

Recommended Torque Values for Connection Bolts

The following values are based on grade 2 steel bolts with dry threads.

<u>Bolt size</u>	<u>Torque (Ft-Lb)</u>
1/4 - 20	5.5
5/16 - 18	11
3/8 - 16	20
1/2 - 13	50

Appendix B

Recommended Method of Lifting Substation (shown) and Padmount Style Transformers

For proper and safe lifting and handling of a Sunbelt Transformer substation or outdoor compartmentalized padmount style transformer, an appropriately rated lifting beam and straps MUST be used. The “Lifting Details” drawing below illustrates the proper method of lifting the transformer utilizing this equipment. Failure to handle the transformer in this manner may result in damage to the transformer or more critically, injury to handling personnel.

Point of information: The transformer weight may be found on the information nameplate located on the transformers enclosure.

