Distribution Transformers

COOPER Power Systems

Instructions for Mineral Oil Filled, Single-Phase Overhead Distribution Transformers

Service Information
S201-10-1

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INTRODUCTION

These instructions have been prepared to assist competent technicians in the installation, operation and service of Cooper Power Systems (CPS) single-phase overhead distribution transformers.

CPS overhead distribution transformers are designed for installation on single-phase above ground systems. All units are constructed for weather exposed mounting on a utility pole. Although every effort has been made to anticipate normal installation, operation and servicing problems, these instructions do not cover all possible variations in equipment or application conditions. All possible installation, operation or service contingencies are not discussed. If additional information is required, contact a factory representative at:

COOPER POWER SYSTEMS
DISTRIBUTION TRANSFORMERS
1900 EAST NORTH STREET
WAUKESHA, WI 53188-3899
262/547-1251 FAX 262/547-7268

SAFETY

These instructions are not intended as a substitute for proper training or adequate experience in the safe operation of single-phase overhead distribution transformers. Personnel using these instructions should be fully acquainted with industry-accepted safe practices and procedures for installing, operating or servicing electrical power system distribution apparatus.

BEFORE YOU START WORK

Check Your Supplies and Equipment

Check your tools and supplies before beginning work. Make sure all needed equipment is in good working order; make sure all necessary materials are available.

WHILE YOU ARE WORKING

Protect Yourself

Observe all safe practices and procedure regulations established by your employer. Wear all protective gear and clothing (boots, helmets, gloves, masks, goggles, safety glasses) supplied by your employer or required for safety on the job.

Follow manufacturer's instructions when installing or using any apparatus or attachments. Observe all precautions recommended in manufacturer's literature.

Handle all electrical equipment with respect. Make sure you know circuit and load current conditions before operating or servicing a system connected transformer.

Lift and Move Transformer With Care

Before moving the transformer, check the total weight of the equipment (see nameplate) and check the condition and capacity of all lifting and hoisting equipment. Do not use worn, frayed or damaged hooks, cables, or slings. Do not use fork lifts or cranes with load capacity less than the weight of the transformer. Do not drop transformer from truck.

Mount Transformer Securely

The transformer must be securely fastened to the utility pole.

WHEN YOU MAKE THE SYSTEM CONNECTION

Make Sure Multiple Voltage Switches & Tap Changers are in the Proper Position.

Make Sure the Tank is Grounded Before Doing Any Other Work.

The transformer tank ground must be connected to a permanent, low-impedance ground.

Clean All Bushings and Terminals Before Making System Connections

Clean bushings, terminal lugs, and all connection points before making connections. Remove all dirt, grease, or foreign material.

Complete the Neutral Connections Before Making other System Connections

Connect all available transformer neutrals to system neutrals before completing other system connections.

Keep Unused Leads Isolated From System Wiring

Insulate all unused leads from ground and from all other leads and connections.

Observe Manufacturer's Instructions When Installing Attachments

Follow manufacturer's instructions for installing accessories or attachments. Make sure all connectors are correctly rated for the application.

These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide direction for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales engineer.

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Check Insulating Fluid Level Before Energizing the Transformer
Make sure the insulating fluid is at the proper level before the transformer is energized.

DURING OPERATION
De-energize the transformer before operating non-load-break accessories.

Tap Changers
The transformer must be de-energized before tap changer settings are adjusted.

Multiple Voltage Switches
The transformer must be de-energized before multi-voltage switch settings are changed. (Check the transformer nameplate for the correct voltage before re-energizing the unit.) Check tap changer position before energizing a transformer with a multi-voltage switch.

CAUTION: When multiple switches are set to connect transformer windings in parallel, tap changers must be in the position shown on the transformer nameplate ratings when transformer windings are connected in parallel. Before re-energizing transformer after resetting multiple switches, check tap changer settings against nameplate information for correct voltages.

WARNING: Disregard of a WARNING may result in serious personal injury and/or serious damage to the equipment.

Internal Fuses
The transformer must be de-energized before it can be opened to service internal fuses.

WARNING: Do not attempt to open an energized transformer.

Do Not Exceed Transformer Ratings
Transformers should be operated only at the ratings specified on the transformer nameplate. Prolonged overload operation will measurably shorten the projected service life of a transformer.

RECEIVING
Immediately upon receipt, the transformer should be inspected for evidence of any damage or mishandling that may have occurred during shipment. Notify your CPS representative of any evidence of damage or defect observed. Claims for shipping damage should be filed with the delivering carrier.

Before the transformer is moved, parts or attachments that may have been loosened or damaged during shipment should be tightened, repaired or replaced.

MOVING THE TRANSFORMER

CAUTION: Before moving the transformer, check the weight of the transformer and the capacity and condition of all hoisting or lifting equipmennt. Do not use worn, frayed or damaged cables or slings. Do not use hoisting machinery with load capacity less than the weight of the transformer as shown on the transformer nameplate.

MOVING TRANSFORMER SHIPPED ON PALLETS
Transformers shipped on pallets may be moved by fork lift trucks of proper capacity. Pallet mounted equipment may also be moved by crane or hoist.

CAUTION: Lifiting a non-palletized transformer with a fork truck may cause damage to the finish. Failure to comply may result in serious personal injury.

Lifting the Transformer by Crane or Hoist
For unloading, lifting lugs are provided near the top of the transformer tank. Cable pull angles should not be over 30° from the vertical. Otherwise, spreaders should be used to hold the lifting cables apart to avoid any bending of the tank or lifting hooks. Do not attempt to lift the transformer by placing a continuous loop of cable or chain around the unit or lifting lugs.

CAUTION: Lift the transformer using all of the lifting pads or lugs provided. Do not use radiators or cooling fins for lifting. Failure to comply may result in damage to the equipment.

STORAGE
Transformers should be stored in an upright position on a pallet to prevent damage from standing water. Do not double stack or store where they will be subject to mechanical damage.

INSTALLATION

WARNING: Make sure you understand the purpose and function of all equipment and accessories. Wear any protective clothing or equipment required. Use a hotstick for all grounding, testing, disconnect, or reconnect operations when possible. Treat the transformer as energized until you are certain of its condition.

CAUTION: Transformers contain flammable mineral oil. Severe damage may cause fire or possible explosion. When a transformer must be installed in close proximity to buildings or public thoroughfares, R-Temp® or Envirotemp® FR3™ fluid should be used in place of mineral oil.

PRE-SERVICE INSPECTION

New transformers or transformers energized after a period of storage, should be thoroughly inspected before being connected to the system.

1. The transformer exterior should be inspected for nicks, dents, and scratches. Any damage to weather-resistant finishes should be repaired promptly.
2. The tank cover, cover seals and all gaskets or seals at operating devices should be inspected for evidence of insulating fluid seepage. Leaking or improperly tightened gaskets and seals must be repaired before the transformer is placed in service.
3. CPS transformers are shipped ready for installation, with the insulating fluid at the 25°C level. On units which are not gauge equipped, the fluid level can be determined by removing the oil-level plug, or removing the tank cover.

WARNING: The transformer tank must be vented to zero pressure before the oil-level plug is removed. Vent by manually pulling the pressure relief device with a hotstick. Failure to properly vent the transformer to atmospheric pressure before and after moving, prior to installation, and before initiating any inspection or repair procedures may result in damage to the equipment or in serious personal injury. Care should be taken to avoid bodily contact with oil which may be released from the transformer during the venting procedures.

MOUNTING THE TRANSFORMER

The transformer should be mounted level. The pole must be strong enough to support the weight of the transformer.

NON-LOADBREAK ACCESSORIES

All settings of multiple voltage switches and tap changers should be made prior to any high voltage or low voltage connections.

The multiple voltage switch was set at the factory at the highest voltage position. Check the position of this switch.

The tap changer was set at the factory to the rated nameplate voltage. The tap positions are referenced on the nameplate. Check the position of the tap changer.

CAUTION: High voltage switches and tap changers are no-load devices. Do not operate unless the transformer is de-energized.

EXTERNAL CONNECTIONS

Transformers must be connected and operated as indicated by the transformer nameplate.

CAUTION: Make only those connections indicated by the diagrams and information on the transformer nameplate. Available transformer neutrals must be connected to system neutrals. Leads and connections not in use must be insulated from ground and from all other leads.

CAUTION: Clean all bushings and terminals before making system connections. Remove all dirt, grease, or foreign material.

Ground Connections

The transformer tank must be connected to a permanent, low-resistance ground. CPS overhead transformers are equipped with a grounding nut for making the ground connection.

WARNING: The transformer tank must be grounded before any other electrical connection is made. A transformer which is system connected and not grounded should be regarded as energized. An energized transformer is extremely dangerous. Contact with an energized transformer tank can be fatal. Wye-Wye winding connected transformers (no Delta winding) are designed for use on systems having a grounded neutral connector. All windings designed for grounded neutral operation MUST be permanently and solidly grounded to the system neutral without resistance.

Low Voltage Connections

Eye-bolt terminals are the standard low-voltage connectors on CPS overhead transformers.

Accessories

CPS single-phase overhead transformers may be equipped with a variety of optional equipment. Many types of fuses and switches are available and different gauges and pressure-relief devices may be obtained. Most accessories are factory installed and no field work is required to prepare them for operation. Follow manufacturer's instructions for installing accessories or attachments. Make sure all connectors are correctly rated.

Surge Arresters—Connection

Surge arresters ordered with the transformer are installed at the factory. Arrester and tank ground connections must be completed BEFORE the transformer is connected to the high voltage line. Proper connection places the arrester in a direct shunt relationship to the transformer insulation.

Primary Connections

Primary connections are provided by internally clamped bushings with tin-plated eye bolt terminals suitable for either copper or aluminum conductors.

WARNING: Do not connect primaries until all other connections are made.

OPERATION

CPS transformers are designed to carry a rated load with a temperature rise equal to or less than the value shown on the nameplate. The coil insulation has been carefully made with thermally-upgraded materials to ensure long life at rated loads. Severe and prolonged overloads will result in overheating and accelerated aging of the insulation, which may lead to premature failure.

MAINTENANCE

Disconnection

WARNING: The transformer MUST be de-energized before any service is performed. Working on an energized transformer is extremely dangerous-do not attempt to open or service energized equipment.

EXTERIOR MAINTENANCE

Periodically inspect all exposed surfaces for evidence of tampering, battered metal, etc. Dents or deformities should be repaired at once. Scratched or weathered paint or protective coatings should be touched up promptly. Keep the area around the transformer clean. Do not store tools, materials or equipment on or against the transformer. Inspect plugs and switches. Look for evidence of insulating fluid seepage around tank-wall gaskets, seals, etc. Replacement of gaskets or seals in the tank wall may require that the tank be opened and the insulating fluid be drawn down to the appropriate level.

COVER REMOVAL

To remove a tank cover perform the following:

1. Thoroughly clean the cover. Remove all dirt, grease and moisture.
2. Vent the transformer to atmospheric pressure. A pressure relief valve may be specified for this purpose. If a pressure relief valve is not installed, relieve pressure by slowly removing the vent plug located near the top of the tank. Stand to the side when venting tank.
3. Loosen, then remove the cover band. Remove ground strap from connection.
4. Remove the cover Lift vertically to prevent damage to cover, tank gaskets, or bushings. Remove the cover gently. The high voltage bushing leads are attached with sufficient slack to allow cover to be lifted enough for the leads to be disconnected.

INTERNAL INSPECTION

Internal inspections should note defects or damage which will or might prevent proper operation of the transformer.

Inspect For:

1. Moisture on underside of cover.
2. Loose, shifted, or damaged parts (bushings, fuse holders, etc).
3. Broken or loose connections.
4. Contaminated insulating fluid (sediment or foreign objects on the tank bottom, dirt or air bubbles suspended in the fluid).
   NOTE: If the transformer has been stored outdoors for an extended period of time, a sample of the insulating fluid should be checked for moisture content.

CAUTION: The life of any transformer depends on the absence of moisture in the insulation. Therefore, if a transformer seal is broken for any reason, it is imperative that the transformer be kept free of moisture and resealed carefully.

HANDLING INSULATING FLUID

Mineral Oil-Filled Transformers—Non-PCB(<1ppm) Insulating Fluid

Refer to ANSI C57.106, Guide for Acceptance and Maintenance of Insulating Oil in Equipment, for additional guidelines when testing and handling insulating oil.

R-Temp or Envirotemp FR3 Fluid-Filled Transformers—High Firepoint, Non-PCB (<1 ppm) Insulating Fluid

For information on R-Temp or Envirotemp FR3 fluid, refer to factory.

To Lower the Insulating Fluid Level

1. Prepare a clean, dry storage container to receive the fluid.
2. Use pumps and hoses that have not been contaminated by contact with dissimilar fluids. Use a metal or non-rubber hose as oil dissolves the sulfur found in rubber and will prove harmful to the conductor material.
3. Place the pump intake line in the transformer tank.
4. Place the output line nozzle on the bottom of the storage container. Do not permit the fluid to splash into the receiving container. (Splashing will introduce air and moisture into the fluid.)

To Restore the Insulating Fluid

1. Pump from near the bottom of the temporary storage tank. Do not permit the intake line to suck air.

   NOTE: It may be necessary to add extra fluid to the storage container from a reserve supply to replace the small quantity lost in the pump and lines and to prevent aeration of replacement fluid at the intake.

2. To prevent aeration at the outflow, direct the fluid stream parallel to and along the upper surface of the core clamp.
3. Pump slowly. Fill the transformer tank only to the 25^{O}C level stamped on the tank wall.
4. Sufficient time should be allowed between refilling and energizing the transformer to be sure that any gas bubbles created during the filling process have been dissipated.

Contaminated Insulating Fluid

If moisture is found inside the tank, or there is evidence that the insulating fluid may be otherwise contaminated, a fluid sample should be taken for analysis. Samples should be drawn from the bottom of the tank. If moisture is present in the fluid, the transformer must be dried out. Contact your CPS representative for special instructions on dry-out or other decontamination processes.

NOTE: Fluid samples should be taken when the unit is warmer than the surrounding air to avoid condensation of moisture on the fluid. Samples must be drawn from the bottom of the transformer tank.

A clean and dry bottle is required, Rinse the bottle three (3) times with the fluid being sampled. Make sure fluid being sampled is representative of the fluid in the unit.

Test samples should be taken only after the fluid has settled for some time, varying from several hours to several days for a large transformer Cold insulating fluid is much slower in settling.

Disposal

CAUTION: When disposing of transformer or transformer insulating oil, follow all applicable state and federal regualtions regarding the disposal of oil-filled electrical equipment.

Reinstalling the Transformer Cover

The transformer cover, cover band and nut-bolt assembly should be reassembled immediately after maintenance to minimize the potential for contamination. The cover band nut-bolt assembly should be tightened per the following torque requirements.

COVER BAND TORQUE REQUIRMENTS

Tank Diameter	Torque (in. lb.)*	Torque (in. lb.)*
14”	50-70	120-150
16”	100-120	120-150
17”	120-130	120-150
18”	140-170	120-150
19”	140-170	120-150
20”	140-170	120-150
22”	175-185	120-150
24”	175-185	120-150
26”	175-185	120-150

***Transformers manufactured under the Cooper Power Systems label.**
****Transformers manufactured under the RTE Corporation or Cooper Power Systems label.**

BUSHING REMOVAL AND REPLACEMENT

To remove and replace transformer bushings perform the following:

1. Open the transformer tank and lower the insulating fluid level to expose the bushing.
2. Disconnect all internal and external cables and leads. Note the position of all nuts, flat washers, spring washers, etc. Release the internal bushing clamp bolts and remove the clamp. Remove the bushing and gasket.
3. Install a new bushing and gasket. The original gasket may be reused unless pinched or cut. Center the bushing and gasket to obtain an effective seal. Install the interior bushing clamp and clamp bolts. Tighten the clamp bolts.
4. Reconnect all external and internal cables and leads. Replace all nuts, flat washers, spring washers, etc., in their original positions. Tighten all connections.
5. Restore the insulating fluid to the 25°C level. Inspect the bushing to tank seal for leaks or seepage. Repair as required. Close and reseal the tank.

CAUTION: The life of any transformer depends on the absence of moisture in the insulation. Therefore, if a transformer seal is broken for any reason, it is imperative that the transformer be kept free of moisture and carefully resealed.

TESTING

Surge Arresters

Surge arresters must be disconnected before dielectric tests are run on the transformer. Arresters should be reconnected immediately after tests are completed.

CAUTION: Failure to disconnect arresters during dielectric test may result in failure of the transformer upon energizing.

ACCESSORIES

Accessory items on transformers vary in function and are not generic for simple instruction. Information on accessories can be obtained from your Cooper Power Systems Sales Engineer.

REPLACEMENT PARTS

When ordering replacement parts, please provide:

1. Transformer serial number.
2. Description of replacement part required.

To order parts contact:
Distribution Transformers
Cooper Power Systems
1900 East North Street
Waukesha, WI 53188-3899
Phone: (262) 547-1251
FAX: (262) 547-7268

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