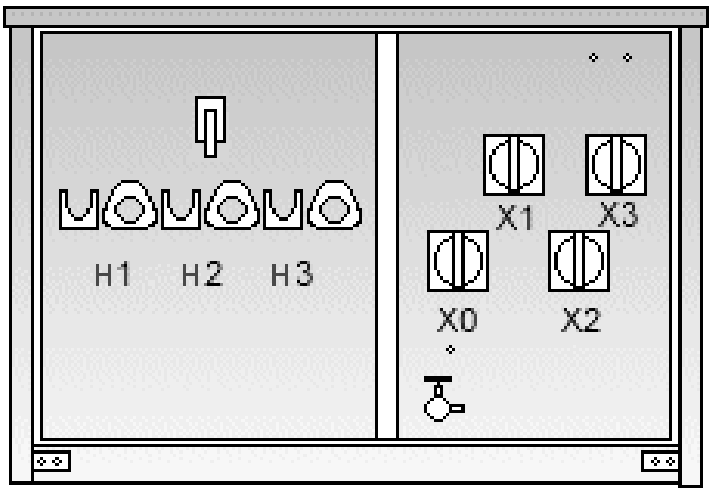

Distribution Transformer
Instruction Manual

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SHIPPING

Distribution transformers are shipped completely sealed. Core and coils are assembled in a tank with the insulating liquid covering the coils.

This method of construction preserves the quality of insulation, the cooling and insulating liquid by preventing contamination from external sources.

INSPECTION ON RECEIPT

When a transformer is received, a thorough external inspection should be made before the unit is removed from the truck. If there is evidence of damage and/or indication of rough handling in transit, an inspector representing the carrier should be requested and the manufacturer immediately notified.

NOTE: An internal inspection is necessary only if internal damage is suspected because of external indications of rough handling.

If the delivering carrier is willing to permit internal inspection of the transformer on the railroad car or truck prior to unloading, without requiring consignee's signature on the delivery slip, a representative of the manufacturer should be called and an internal inspection made as outlined in "Internal Inspection."

If the delivering carrier will not permit internal inspection of the transformer on the railroad car or truck, note on the acceptance slip for the shipment that there are "possible internal and/or hidden damages," and file a claim immediately for possible hidden damage. When the transformer has been moved to the installation site or some other convenient location to permit inspection of the internal assembly for damage in transit, proceed as outlined in "Internal Inspection." Request that a representative of the carrier be present during the inspection.

HANDLING

A. COMPLETE TRANSFORMER

The transformer should always be handled in the normal upright position unless information from the manufacturer indicates that it can be handled otherwise. Where a transformer cannot be handled by a crane, it may be skidded or moved on rollers into place, depending upon compatibility of transformer base design and the type of surface over which it is to be moved. During the handling operation, care must be taken to prevent overturning.

When a transformer is shipped it is usually ready to be set in place after the crating and shipping braces are removed. Bushings and accessories, which are shipped separately, should be thoroughly protected against moisture until they are installed. Proper precaution must be taken during installation of these parts to protect the transformer against the entrance of moisture.

B. LIFTING WITH SLINGS

Lifting lugs and eyes are designed to be lifted with a maximum sling angle of 30* from the vertical. For lift angles of greater than 30* from the vertical, spreader bars must be used to provide a vertical lift on the lugs.

C. RAISING WITH JACKS

Jack bosses are provided on most transformers so that the transformer can be raised by means of jacks. On those transformers not equipped with bosses, the jacks may be placed under the transformer bottom plate at designated points. The manufacturer's drawings should be consulted.

Do not attempt to raise the transformer by placing the jacks under drain valves, pipe connections or other attachments. It is also recommended that these appendages not be subjected to a man's weight.

INTERNAL INSPECTION

WARNING: Avoid possible serious accident. Be sure to relieve tank pressure or vacuum before attempting to loosen and remove manhole cover.

A. INSULATING LIQUID

Before opening a transformer, take samples of the insulating liquid from the top and bottom of tank and test the dielectric strength. The dielectric strength should be 27.5 kv or higher. If it is lower, the transformer should not be placed in service until the dielectric strength has been restored by filtration.

B. CORE-AND-COIL ASSEMBLY

Lower the insulating liquid to the top of the core-and-coil assembly and inspect the interior to see if any damage has occurred. If possible, **DO NOT** permit the coils and insulation to be exposed to the air.

Examine the top of the core-and-coil assembly, all horizontal surfaces and the underside of the cover for signs of moisture. If there are not signs of moisture or damage, proceed with the reassembly of the transformer. If there are signs of moisture inside the tanks steps should be taken to determine the extent of it and the manner in which the moisture entered the transformer. Reassembly should be carried through and the manufacturer of the equipment should be requested to make recommendations concerning further checks and steps for drying out the transformer.

If the transformer appears to have been damaged internally or if it is desirable to remove the core-and-coil assembly for inspection or drying, the transformer may be untanked as follows:

1. Remove the handhole lid and disconnect high and low voltage leads if the bushings are in position. Remove both primary and secondary bushings.

2. Small bushings may be left on the cover if they are protected and the cover is carefully handled. Remove cover. Remove thermometer, tapchanger and oil gauge and all other accessories and associated wells, which project in the tank and which, might interfere with untanking operations.

3. Use slings for removing the core-and-coil assembly.

4. Particular care must be taken in handling tools and other loose articles when working with a transformer. Metallic objects, if dropped in the windings and allowed to remain there, can cause a severe fault.

STORAGE

It is advisable to locate a transformer, complete with liquids in its permanent location even if it will not be placed in service for some time. It is well to check the paint finish and to repair all damaged painted surfaces. If the transformer is shipped and stored in dry inert gas, the gas pressure should be maintained and periodically tested. If an oil-filled, indoor-type transformer is stored outdoors it should be thoroughly covered to keep out rain. A transformer should not be stored or operated in the presence of corrosive vapors or gases, such as chlorine.

Should it become necessary to store accessories for a long period of time, they should be stored in a clean, dry place or the manufacturer should be contacted for explicit instructions on the storage of individual pieces.

LOCATION

Accessibility, ventilation and ease of inspection should be given careful consideration in the location of transformers.

Self-cooled transformers depend entirely upon the surrounding air for carrying away their heat. For this reason, care must be taken to provide adequate ventilation.

For indoor installation, the room in which the transformers are placed must be well ventilated so that heated air can escape readily and can be replaced by cool air. Inlet openings should be near the flow and distributed so as to be most effective. The outlet opening(s) should be as high above the apparatus as the construction of the building will permit. The number and size of the outlets required will depend on their distance above the transformer and on the efficiency and load cycle of the apparatus. In general, about 60 square feet of outlet opening or openings should be provided for each 1000 kva of transformer capacity. Air inlets should be provided with the same total area as the outlets.

Self-cooled transformers should always be separated from one another and from adjacent walls, partitions, etc., in order to permit free circulation of air about the tanks. This separation should not be less than 30 inches.

PREPARING FOR SERVICE

PRELIMINARY INSPECTION: Before any work is done on a transformer in preparation for service, a careful inspection of all external parts is needed to disclose any evidence of mistreatment or damage. This inspection should include a check of all parts required to complete the erection, making certain that all parts have arrived and are in first-class condition. Accessible bolted parts should be checked for tightness. Pressure tests should be taken and the liquid checked to determine both its physical level and dielectric strength. Any indication of leaks, which may have resulted in moisture entering the transformer should be noted and appropriate action taken.

NOTE: Pressurized and sealed at ambient temperature at time of manufacture. It is common that a pressure vacuum gauge if supplied could read negative due to lower temperature at the site of installation. This is not an indication of an abnormality, but in fact an indication that the tank is properly sealed.

PUTTING INTO SERVICE

Before applying voltage to transformer, check the following items:

1. Are feeder cables on bus connected to bushing terminals without stressing the porcelains?

2. Are winding neutral terminals properly grounded or ungrounded as required by system operation?

3. Is tank solidly grounded at grounding pads located near bottom of tank?

4. Are all current transformers connected to a load or short-circuited? CAUTION: Open secondaries can produce voltages dangerous to humans and connected equipment.

5. Is the tapchanger set in desired position to give desired voltage ratio?

6. Have all tools and foreign objects been removed from transformer?

7. Are all openings and joints sealed?

8. Is insulating liquid at proper level in tank? Also level in liquid-filled compartments (if supplied).

9. Are all fans and control circuits (if supplied) operational?

10. Is insulating dielectric strength of oil at least 27.5 kv? If tests are less, filter the liquid.

11. Are all personnel in the clear?

After energizing, watch transformer closely for the first three hours of operation for evidence of abnormal conditions.

LOADING

Transformers are suitable for full-load operation at rated temperature rise without loss of life, providing the following conditions are met:

1. Ambient temperature does not exceed 40*C; or average more than 30*C; in one 24 hour period.

2. Installed elevation does not exceed 3,300 fee (1,000 meters) above sea level. Refer to ANSI standard C57, 19.00 for derating factors when installed at higher elevations.

PERIODIC INSPECTION

1. Sample and test insulating/cooling liquid for dielectric strength.

CAUTION: If a vacuum is indicated on the pressure vacuum gauge, care must be used to eliminate it prior to oil sampling. Failure to do so may result in air being pulled into the tank through the drain valve which may lead to insulation failure if energized or upon re-energization. Contact factory for specific instructions.

2. Check level of liquid in main tank and liquid-filled compartments. Add clean liquid if necessary.

3. Check fan operation on Forced Air units.

CAUTION: Before entering a transformer that has been in service, BE SURE to lock open the line switches on both the HV and LV side, then connect a grounded line to transformer terminals in order to discharge any stored energy in the windings.

DO NOT ENTER THE UNIT UNTIL THE GAS SPACE ABOVE LIQUID HAS BEEN PURGED WITH DRY AIR. BREATHING THE NITROGEN ABOVE THE TRANSFORMER LIQUID CAN CAUSE ASPHYXIATION.

MAINTENANCE DURING PERIODS OF SHUTDOWN

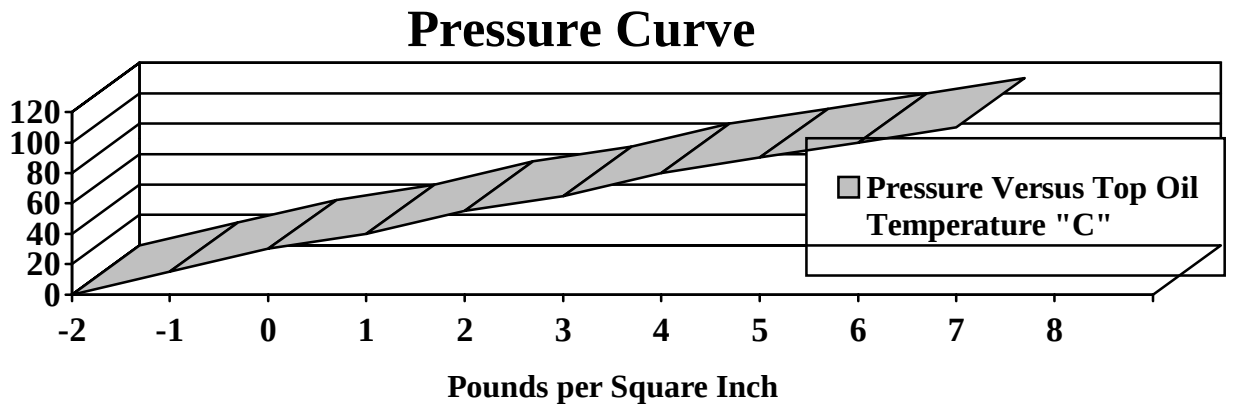
Clean any contamination from bushings

Rotate the tapchanger handle back and forth a few times. This will clean the contacts. Be sure to return the handle to its original position if no change in voltage ratio is desired.

CHECKING FOR LEAKS:

Check pressure vacuum gauge daily the first week of transformer operation. If pressure-vacuum gauge stays at zero reading, it indicates a faulty seal. If transformer cannot be de-energized, be careful to not come into contact with live parts such as bushing terminals and leads.

Slowly add nitrogen or dry air AT LOW PRESSURE until gauge reads 5 PSI. Apply with a paintbrush soapy water or detergent to all seals above liquid level. Small bubbles will indicate the location of the leak.



After leak is repaired, add sufficient dry air or nitrogen to provide 0.5 Psi gauge pressure at 256G (top liquid temperature). Refer to curve for normal pressure at other top liquid temperatures.

ACCESSORIES

PRESSURE RELIEF DEVICE

When required by the specifications, a mechanical automatic resealable type pressure relief device can be supplied. This device requires no adjustment after it operates. After relieving the pressure due to the gas build-up in the tank, it automatically recloses and reseals. Alarm contacts are available if specified.

PRESSURE-VACUUM BLEEDER DEVICE

When required by the specifications, a pressure-vacuum bleeder can be supplied. This device is designed to protect transformer from a slow build-up of pressure. It will either admit air or exhaust internal gases to maintain a safe level of pressure/vacuum.

SUDDEN PRESSURE RELAY

When required by specifications, a sudden pressure relay can be supplied. This relay can generate an electrical signal to either sound an alarm, or cause a breaker to operate when a transformer experiences severe arcing or transformer failure that generates a large quantity of gas that increases pressure in a short period of time. As an option, this device is available with or without a seal-in-relay.

DIAL TYPE THERMOMETER

When required by specifications, a dial type thermometer is mounted in a thermometer well located on the transformer's tank wall and can be easily removed. The thermometer reads the top oil temperature. As an option it is available with or without contacts which can be used to sound an alarm, control fans, and/or actuate circuit breakers when a preset temperature is reached.

The thermometer also has a drag pointer that indicates maximum temperature reached. The drag hand can been reset by turning the reset knob, located on the center face of the gauge counter clockwise until it reaches the temperature pointer.

LIQUID LEVEL INDICATOR

When required by specifications a liquid level gauge is mounted on the tank wall. This device is available with a gear driven float (common with Compartmental Padmount Transformers), and/or a magnetic device (common with Secondary & Unit Sub-Station Transformers). The magnetic gauge is available with or without contacts that can be used for alarm circuits.

METHOD OF DRYING TRANSFORMERS

The most common method is known as the "short-circuit' method. Before applying voltage, the transformer's cooling surfaces must be blanketed with heavy paper, cloth or builder's felt. The amount of surface to be blanketed can only be determined by trial.

The cover must be blanketed to prevent condensation on inside of cover.

Ventilate interior by raising manhole cover. If transformer is inside a building provide good ventilation to remove vapors from room. If outdoors, protect the opening from the weather.

Now short-circuit one winding of transformer and apply sufficient AC voltage to the other winding to give the value of current and temperature needed. The voltage required for this will be a small percent of the rated voltage.

In no case should value of current and temperature in the table be exceeded.

Maximum allowable Short Circuit Ampere in Percent of Full-load Based on Self-Cooled Rating	Maximum Allowable Top-Liquid Temperature "C"
50	100
75	90

DRYOUT CURRENTS AND TEMPERATURES

Drying should continue until seven consecutive tests of liquid samples show a dielectric strength of 27.5 kv. Take samples of oil from bottom of tank, since the water will accumulate there.

FILLING WITH OIL

A. CHECKING OIL

Check the dielectric strength of oil while it is still in containers. If free water is present, drain off the water before putting the oil through the filter press. Continue passing oil through the filter press until the prescribed dielectric strength is met.

B. NON-VACUUM FILLING

In cases where vacuum filling is not required, the tank should be filled through the main drain valve. A second opening at the top should be provided to relieve the air being displaced. Full voltage may not be applied to the transformer for a period of 24 hours.

C. VACUUM FILLING

Entrapped air is a potential source of trouble in all transformers. In general, therefore, it is desirable to fill transformers with oil under as high a vacuum as conditions permit. Particularly is it essential to vacuum-fill high voltage transformers shipped in nitrogen or dry gas in order to develop their full insulation strength before they are energized.

Distribution Transformer Instruction Manual

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