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INSTRUCTION

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ALLIS - CHALMERS

CARE AND MAINTENANCE OF OIL-IMMERSED AND ASKAREL-IMMERSED LOAD CENTER TRANSFORMERS

MONS 072602

INSTRUCTION BOOK
CARE AND MAINTENANCE OF
OIL-IMMERSED AND ASKAREL-IMMERSED TRANSFORMERS

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SHIPPING

Small power 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 and 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 railroad car or 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 removed 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 in its own tank with oil, 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 drawings or manufacturer's instruction book 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 which was shipped in liquid, take samples of the insulating liquid from the top and bottom of the tank and test the dielectric strength. The dielectric strength should be 27.5 kv or higher for oil and 30 kv or higher for askarel. 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 no signs of moisture or damage, proceed with the reassembly of the transformer. If there are signs of moisture inside the tank, 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 large bushings from cover.
2. Small bushings may be left on the cover if they are protected and the cover is carefully handled. Remove cover. Remove thermometer, tapchanger shaft and oil gage and all other accessories and associated wells which project into 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 breakdown.

STORAGE

It is advisable to locate a transformer complete with liquid 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 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 floor 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 air 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.

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 tap changer 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 and askarel 30 kv? If tests are less, filter the liquid.
11. Are all personnel in the clear?

After loading, 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 no more than 30°C in one 24-hour period.
2. Installed elevation does not exceed 3,300 feet (1,000 meters) above sea level. Refer to ANSI Standard C57.12.00 for derating factors when installed at higher elevations.

PERIODIC INSPECTION

1. Sample and test insulating/cooling liquid for dielectric strength.
2. Check level of liquid in main tank and liquid-filled compartments. Add clean liquid if necessary.
3. Check fan operation on F. A. units.

CAUTION: Before entering upon or into 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 WILL 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.

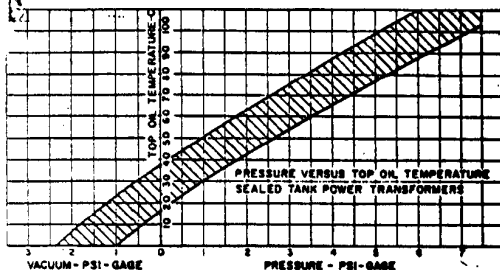
CHECKING FOR LEAKS:

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

Slowly add nitrogen or dry air AT LOW PRESSURE until gage reads 5 PSI. Apply with a paint brush 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 gage pressure at 25°C (top liquid temperature). Refer to curve for normal pressure at other top liquid temperatures.

Curve Chart:



ACCESSORIES

PRESSURE RELIEF DEVICES

Pressure relief devices are of two types, the rupturing diaphragm type (standard) or the mechanical reseal type (optional extra).

1. Rupturing Diaphragm Type - This consists of a diaphragm which ruptures before a damaging pressure builds up in tank should a gas-evolving fault develop. The diaphragm must then be replaced. It will have a protecting cover over the diaphragm. A pipe to vent gas to outside can also be fitted over the device.
2. Mechanical Automatic Reseal Type - This type 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 RELAYS

Severe arcing in transformer liquid can generate large quantities of gas and build up large pressure increases in a short time. A sudden pressure relay can be supplied as an extra option.

This relay can generate an electrical signal to either sound an alarm or cause a breaker operation.

THERMOMETERS

A dial-type thermometer is standard equipment. It is mounted in a well in the transformer and therefore can easily be removed. The thermometer reads top-oil temperature which is ambient temperature plus the top temperature rise of oil.

The thermometer also has a drag pointer which indicates maximum temperature reached. This drag pointer is reset by drawing the magnet (chained to the thermometer) across the face of the thermometer.

Thermometer with alarm contacts is an optional extra. These contacts can be used to sound an alarm, control fans and/or actuate circuit breakers when temperatures for which they are set are reached.

LIQUID-LEVEL INDICATORS

The magnetic liquid-level gages are composed of two sub-assemblies. The internal float mechanism and flange is first bolted to the tank flange with a gasket seal. The bezel assembly which contains dial and pointer is next screwed to the flange. Motion of the float inside the tank is transmitted from internal shaft to the pointer shaft by polarized magnets, located each side of the flange. Because of the seal, no liquid or gas is lost even if gage glass is broken.

The liquid-level gage can also be provided with microswitch for alarm circuits.

METHOD OF DRYING TRANSFORMERS

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

To prevent condensation on inside of cover, blanket outside of cover too. 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 or higher for oil, and 30 kv for askarel.

Take samples of oil from bottom of tank and samples of askarel from top tank.

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.

ASKAREL - PURCHASER'S RESPONSIBILITY

Askarel-filled transformers are sold solely on the basis that the buyer is aware of the nature of askarel and that he will take the necessary precautions to prevent any askarel from entering the environment. A warning nameplate is attached to each askarel-filled transformer. See below:

CAUTION

THE INSULATING LIQUID IN THIS TRANSFORMER CONTAINS POLYCHLORINATED BIPHENYLS (PCB'S). CARE SHOULD BE TAKEN TO PREVENT ENTRY INTO THE ENVIRONMENT. IN CASE OF MALFUNCTION OR LEAKS, CONSULT THE INSTRUCTION MANUAL OR THE MANUFACTURER.

Askarel contains polychlorinated biphenyls (PCB's) which are chemically stable and do not deteriorate when exposed to air. Normal transformer temperatures will not cause askarel to oxidize or sludge. Arcing may cause it to break down.

Detailed instructions for handling and disposing of askarel may be obtained from Monsanto Company, the producer of askarel.

A document titled, "Guidelines for Handling and Disposing of Capacitor and Transformer Grade Askarels - Containing Polychlorinated Biphenyls" is available from ANSI, Committee C107, 155 East 44th Street, New York, New York 10017.

MAINTENANCE OF ASKAREL-FILLED TRANSFORMER

In general, from the standpoint of maintenance, operation and over-current protection, askarel transformers should be treated the same as oil-filled transformers.

Specific instructions on the acceptance and maintenance of askarel-filled transformers are contained in AIEE Guide No. 76, "For Acceptance and Maintenance of Transformer Askarel in Equipment." The guide is published by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, New York 10017.

HANDLING ASKAREL

Transformer askarel may be handled in the same manner as mineral oil. Continued exposure to liquid askarel may produce local skin irritations. Cleanliness among workmen handling askarel constitutes an adequate safeguard against such effects. Ordinary medicinal washes will remove any irritation caused by askarel coming in contact with an open cut or skin abrasion. A drop of castor oil will neutralize any irritation caused by contact of liquid transformer askarel with the eyes. As with most volatile materials, exposure to concentrated askarel vapors in unventilated rooms should be avoided.

Transformer askarel must be handled in containers, pipes, askarel-resistant hose, etc., which are free from oil, grease, pitch, or other foreign materials, since these contaminate the liquid and decrease its non-inflammable properties. It is desirable that all such apparatus used in storing or transporting transformer askarel be maintained for exclusive use with askarel, as it is extremely difficult to remove all traces of oil or other askarel contaminants from equipment of this type.

Flexible hoses must be lined with a material that will not be softened by contact with askarel. Materials lined with silicone, Viton, Teflon or flexible metal materials are suitable.

FILLING TRANSFORMERS

Although all askarel transformers are shipped filled with askarel, it may be necessary to refill a transformer. If so, proceed as follows:

Before filling the transformer, make sure that joints are tight. Open all air vents.

In order to prevent aeration of the askarel, it is preferable to fill the transformer through the drain valve with a filter press. Fill to the 25°C mark on the gage or up to the lower sampling valve if no gage is provided.

Baked-on glyptal paint is resistant to the action of askarel. Air-cured glyptal paint used for touch-up work in the factory and for repainting in the

field, however, requires a rather long curing period. Therefore, care should be taken to remove all traces of askarel that spill or drip on the outside of transformers.

GASKETS

The gaskets installed at the factory are made of materials known to be resistant to askarel and do not require any special maintenance.

If it becomes necessary to replace a gasket or seal, it must be made of a material known to be impervious to askarel. Bushings without grooves should be gasketed with a cork or cork nitrile material. Cork nitrile (Neoglangite SB-300) or equivalent is recommended. Gaskets may be cemented to the flange with G. E. Glyptal 1276 or Westinghouse Shellac style No. 1150419. The weather resistance of cork gaskets can be improved by coating the edges with an epoxy cement after clamping. Typical are:

- (a) Epoxy patch kit #1-C
Hysal Corporation - Olean, New York
- (b) Scotchcast Resin #4
Minnesota Mining & Manufacturing Co. - St. Paul, Minnesota
- (c) Adhesive A-1 and Activator Type B
Armstrong Products Company - Argonne Road
Warsaw, Indiana
- (d) Adhesive 9860-1
Synthetics Organic Company - Cleveland, Ohio

Gaskets for joints with gasket grooves may use cork-nitrile, Viton, or silicone rubber. The silicone material should be Dow Corning No. 50 silastic or equivalent. Gaskets with retaining grooves need not be cemented.

PERIODIC INSPECTION

After the first few days of operation, the top and bottom askarel should be tested for dielectric strength.

Askarel samples may be drawn and tested on the same schedule as transformer oil. The inspection should be systematized and accurate records kept. If, at any time, the askarel tests below 25 kv, at room temperature, a filter press may be used to restore the dielectric strength to above 30 kv.

Keep the level of the askarel in the transformer up to or above the mark on the askarel gage, or up to or above the lower sampling valve.

The condition of the external transformer surfaces should be examined at regular intervals. If it is found that weathering is taking place, the surface should be cleaned thoroughly and repainted with a good grade of durable paint recommended by Standard Transformer Company.

It is recommended that a pressure test be made in accordance with instructions under this subject once a year, or more often for severe operating conditions, to make sure that a complete seal is maintained.

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