CENTURY INFRAPOWER PVT.LTD.

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Distribution Transformer

Instruction Manual

For Domestic Use

Introduction:-

The three phase pad mounted distribution transformer is designed to provide electrical service on underground distribution systems. The transformer is designed for outdoor mounting on a pad. Primary and secondary cables enter the transformer compartment from below, through openings in the pad. All exposed live parts are completely enclosed in temper – resistant cabinets with provisions for padlocking.

The transformers described herein are designed for the conditions normally encountered on electric utility power distribution systems. As such, they are suitable for use under the "usual service conditions" described in ANSI C57.12.00 (General Requirements for Liquid –Immersed Distribution, Power and Regulating Transformers). All other conditions are considered unusual service and should be avoided.

The transformer should be operated and serviced only by competent personnel, familiar with good safety practices. These instructions are written for such personnel and are not intended as a substitute for adequate training and experience in the use of this equipment. Should clarification or further information be required, or should problems arise which are not covered sufficiently for the user's purpose, refer the matter to manufacturers. When communicating with manufacturers regarding the product covered by this Instruction Book, always include the following items of information from the transformer's name plate: serial number, style number, KVA rating, high voltage and low voltage rating additionally, all applicable safety procedures such as OSHA requirements, regional and local safety requirements, safe working practices and good judgment must be used by such personnel.

TRANSPORTATION

Distribution transformers are transported completely sealed& ready for installation. Core and coils are assembled in a tank with the transformer oil covering the coils.

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

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1. Transportation by Lorry

The transformers must be tightly secured at the top and bottom on the lorry. At the bottom by nailing down the base for the rollers or carriage. Fixed rollers should be clamped. At the top the transformer must be tightly secured via the lifting lugs or via special transport clamping lugs. If securing straps are used, make sure they do not pull on the lips or lip reinforcements. If the transformer is fitted with an expansion tank and a silica gel breather, the infiltration of air during transportation and storage is prevented by:

- Either placing a gasket in the de-aerator (breather) (**which must be removed before the transformer is energized)**
- Or replacing the silica gel air breather with a blind flange that prevents the infiltration of air. In that case the air breather is supplied separately. Assembly instructions are included with the air breather.

1.3 Moving Distribution Transformers

In order to move a transformerthe following accessories are required, depending on its size and the directions.

- A set of rollers, the wheels of which can be moved very simply in a longitudinal or diagonal direction.
- Lifting lugs on the main cover.
- Reinforcement of the bottom of the transformer tank allowing transportation by lift truck.
- If necessary, upon special request, jacking bosses and/or (fixed or detachable) lifting lugs on the roller base or carriage.

Attention: - A transformer must never be lifted at the lower side of the cooler fins. Never use the bushing (high voltage (HV) or low voltage (LV) insulators) to guide the transformer when moving it. Nor should the fins or fin reinforcements (round bar on top and bottom of the fins) be pulled on.

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 does 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.

The following points should be checked:-

1. IS there any damage should be checked.
2. IS there any accessories damaged? Accessories includes arcing horns, lifting lugs, bimetallic clamps for HV & LV, breathers etc.
3. IS the transformer tank damaged? Oil filling cap should be checked for its weldedness (U Clamp)
4. Are there any leaks?

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5. If the liquid level is visible in oil level gauge & whether it is high enough?

6. Is the delivery complete? Check the number of transformers, the number of boxes of accessories and check that all accessories are fitted or present.

7. Check the information on the nameplate.

8. Before giving receipt, IR values of Transformer wdgs may be checked & in case it is found zero or short, delivery should not be accepted & lorry transport vehicle should not be allowed to go back. Immediately inform to suppliers.

All deviations should be reported immediately to the manufactures/suppliers.

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 transported 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.

N.B:- Unloading of distribution transformers should never be done through ramp or manually. It should be either with the help of crane or through chain pully block/crane, so that internal parts of transformers are not disturbed/damaged.

B. LIFTING WITH SLINGS

Lifting lugs and eyes are designed to be lifted with a maximum sling angle of 30 degree from the vertical. For lift angles of greater than 30 degree 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.

Note:- 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.

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. In a upright position. The oil level of the stored transformers should be checked periodically (weekly) for checking the oil leakage.

Locationof Stored Transformers

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.

Loading of transformer for carrying to site of installation: - While loading the transformer for carrying to site of installation, all precautions must be taken as per transportation clause already mentioned. IR values & complete accessories must be checked.

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 40 KV? If tests are less, filter the liquid.
11. Check IR value of Transformer.
12. Bleeding of Transformer through HV bushings may be ensured.
13. Check earth resistance, which is of prime importance. Also ensure that three separate earths i.e. one for neutral of transformer, 2nd for 11 KV LAS & 3rd for transformer body

have been provided & earth resistance in each case must be less then 2 ohms.

14. 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 degree or average more than 30 degree 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, 19.00 for derating factors when installed at higher elevations.

Reason for damage of transformers

1. Poor Insulation: - Due to poor storage, moisture may ingress in transformers. Even some miscreants may remove oil & put water in it

2. Poor handling during transportation /loading/unloading, which may cause disturbance of core/wdgs.
3. Putting up of unbalance load on transformer.
4. Over loading of transformer. It must be ensured that power factor of system on which it is being connected is above 0.8. Also please note that KW = KVA x factor& hence power factor is of prime importance.
5. Poor/ No earthing.

6. Energizing the transformer in close vicinity of fault.

7. Frequent try of feeder on faults.

Returning back to store after damage:- While receiving the damaged transformer back in store, please check the following:-

1. Oil level

2. Water content

3 Seal breaking

4. Shortage of material

5. Opening of transformer at site etc.

PERIODIC INSPECTION

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

A. Annual External Check

This maintenance check can be carried out while the transformer remains energized.

Attention: - Keep **a safe distance** from energized (live) parts.

This type of maintenance comprises the following:-

- Assessing the various noises coming from the transformer.
- Checking the ambient temperature and ventilation of the premises.
- Checking for leaks, rust and damage.
- Checking for dirt on the bushings, apparatus and control units.
- Checking the color of the silica gel (if applicable)
- Checking the liquid level via the oil level gauge (if present)
- Checking the liquid temperature (if thermometer present), checking local temperature rises due to contact resistances on HV and LV connections (infrared temperature measurement, discolorations.)
- Checking the operation of the pressure relief calve (if present)

B. Two- yearly maintenance

This type of maintenance should be carried out while the transformer is **de-energised** and **earthed** at the HV and LV sides. Do not forget to also switch off the auxiliary voltage for the accessories.

Two- yearly maintenance comprises the following:-

- Performing the annual external check (see A)
- Remedying the comments from the yearly external inspection.
- Checking the compound level in the HV cable junction box (if applicable)
- Opening the HV and LV air cable boxes (if applicable), checking for condensation and water penetration.
- Checking the auxiliary devices and accessories (correct operation, setting and checking of the contacts, cabling, checking of test equipment).
- Checking the correct operation of the tap changer. The tap changer is tested whilst the transformer is de-energised by switching the tap changer into various positions and by measuring there is continuity in the internal connections.

We advise transformer users to adjust the above maintenance frequency if the transformers are located in severs climatological conditions and if the operating conditions allow or require a different frequency.

C. Liquid sampling and analyses

Analysis of the sample of cooling liquid enables us to determine the condition of the transformer liquid and can also give an indication of the condition of the windings, (tap changer) switch and internal connections.

Various liquid test and analyses can be performed upon request.

Sampling should best be left up to qualified personnel.

The sampling procedure, described in standards IEC 60475 and IEC 60567, must be followed strictly.

After a sample of the liquid has been taken, the level must be checked and, if necessary, it must be adjusted.

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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.

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 requiredfor 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 40 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.