OPERATION & MAINTENANCE MANUAL
FOR
OIL FILLED DISTRIBUTION TRANSFORMERS
CONNECTION AND MAINTENANCE OF OIL IMMERSED DISTRIBUTION TRANSFORMERS

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1.0 **GENERAL**

The Transformer you have just purchased has been manufactured by Voltamp Transformers Oman LLC at our modern factory at Rusayl Industrial Estate, Sultanate of Oman. This Transformer has been manufactured using modern techniques and some of the best available raw materials internationally. It has been fully tested before leaving our factory.

The Transformer should give you years of trouble free service, provided regular maintenance checks are carried out as prescribed.

However, it is still possible that during shipping, installation or in service some troubles may occur. You are therefore, advised to read the following pages carefully **before commencing installation of your Transformer**.

2.0 **CONDITIONS OF GUARANTEE**

This Transformer is warranted against all manufacturing defects for a period of twelve months from date of commissioning or for eighteen months from date of dispatch, whichever is earlier.

Our Warranty is limited to the repair or the replacement of the defective transformer, at our discretion. Transportation from the site of installation to our Factory and back, if required, will be at clients cost. This Warranty is not valid for reasons other than manufacturing defects such as misuse, overloading, physical damage during handling and transportation, faulty external connections etc. In such cases, the Company will be the final judge of whether the defect is a manufacturing defect.

If you should face difficulties with the use of the transformer at any time during its life, please contact

**VOLTAMP TRANSFORMERS OMAN LLC**
**P.O Box 75, P.C. 124, RUSAYL**
**SULTANATE OF OMAN**
**PHONE : 24446372 FAX 24446371**
3.0 TRANSPORTATION:

Our Distribution Transformers are shipped ready for installation filled with insulating liquid and fitted with, or accompanied by all accessories.

Transformers should always be secured firmly by wedging the wheels and by immobilizing the upper section with nylon straps, threaded preferably through the lifting lugs. Care should be taken to avoid strapping the radiators.

3.1 Unloading or Moving the Transformer:

For lifting the transformer always use the lifting lugs provided on the two corners of the tank near the top cover. Whilst using lifting chains, please ensure that they do not foul with external bushings or accessories.

Jacking lugs are provided on ground mounted transformers where jacks can be applied for lifting.

Skids are provided on the bases of ground mounted transformers in order to enable the transformer to be dragged along the ground for limited distances (upto 10 Metres) only. They should not be used for dragging over longer distances as irreparable damage could occur to your transformer.

A set of rollers which can easily be fitted longitudinally or transversely are available at extra cost as an option, if ordered before hand.

NOTE: Care should be taken not lift a transformer at the lower side of the radiators or to use radiators for pulling.

Care should be taken to avoid damage to porcelain bushings.
3.2 CHECKS ON RECEIPT:

On receipt of the transformer and its accessories a careful inspection should be carried out.

The following items should be checked:

- Is there any physical damage?
- Is the Paint damaged or formation of rust visible on Transformer and accessories?
- Are tank or accessories damaged?
- Is the liquid at the correct level?
- Does the transformer leak?
- Is the delivery complete
- Check the number of delivered transformers and the number of packages with loose parts.
- Check the data of the nameplate, especially the Serial Number

Any abnormality noticed should be reported immediately to the Company.

4.0 STORAGE OF TRANSFORMERS:

4.1 Preparation of transformers before storage:

Our transformers may be stored indoors or outdoors. Before storage, a visual inspection should be carried out. Check for the following:

- Broken or damaged bushings
- Broken or damaged accessories
- Oil leaks on tank gaskets
- Damaged paint work
All damaged or defective parts must be replaced or repaired before storage and if necessary the oil should be topped up.

The transformer can now be put into storage.

There is no further inspection required while the transformer is in storage.

When storing a transformer after taking it out of service, a complete check should be performed as described above. The oil level should be checked and maintained at the appropriate level. The breather should be keep in place and the colour of the silica gel should be blue.

5.0 INSTALLATION OF OIL IMMERSED DISTRIBUTION TRANSFORMERS:

For correct installation, the following should be observed:

a) All the gauges and meters should be clearly visible. Valves and protection systems must be accessible.

b) The site and the security facilities should be as prescribed by the local authorities. Adequate space should be provided around the transformer for access and ventilation.

c) Stagnation of hot air above the transformer should be prevented. A ventilation of about 4 cubic meters of air/minute per kW loss of the transformer should be obtained.

d) When a distribution transformer is installed inside a building or enclosure, fresh air preferably from the outside, should be provided to give sufficient air circulation. The temperature should be as low as possible.

Ensure that free space is provided above the transformer.
5.1 ELECTRICAL CONNECTIONS:

1. All the terminal connections should possess a sufficiently large, solid and clean contact surface. This can be ensured by means of cable lugs, concentric clamps or copper or aluminum bus bars of appropriate size.

The feeder conductors should have an appropriate cross section. For 1000 Amps and above it is recommended to use flexible connections, which allow expansion of the conductors, thus reducing the possibility of cracking of bushings.

2. For Transformers with a Cable Box on the High Voltage side, appropriate Heat Shrink Termination Kits must be used for terminating the high voltage Cable to the Bushing.

3. When connecting the conductors to the stems of high and low voltage bushings, the lower nut (just above the cap) on the bushing must remain in position. There are two spare nuts provided for clamping the connection. The use of two spanners is recommended for tightening.

4. Sharp bends in the high voltage conductors should be avoided.

5. The connections should be made in the correct sequence indicated on the schematic diagram supplied with each transformer.

Extreme care should be taken to ensure satisfactory earthing of the high voltage earthing system. Earthing flags are provided near the base of the transformer tank. The electrical resistance of the earthing terminal should be measured after connection and should be as prescribed by the local authorities.

Case should be taken to ensure scraping and cleaning of connecting surfaces before tightening.
5.2 PARALELLING OF TRANSFORMERS:

When transformers are to work in parallel they must fulfill the appropriate conditions (IEC 76-4 and IEC 60; Chapter 4)

For parallel connection, please ensure the following:

1. Transformers should have the same vector group. Within the vector group the coupling may be difference.

2. Impedance voltages should be same (a tolerance of ± 10% is allowed)

3. Nominal voltages should be equal.

4. When continuously working in parallel, the rating ratio of the transformers should not be greater than 3/1.

The information for the above conditions can be obtained from the date on the name plate.

When the conditions are fulfilled the procedure for parallel operation is as follows:

a) Connect the corresponding high voltage terminals
b) Connect the corresponding low voltage terminals.
c) Execute a common earthing of the transformer tanks when they are installed next to each other.
d) Connect the low voltage neutral terminals together.
e) Connect the transformers to the supply system on the high voltage side. The low voltage main switches should be open.
f) Check for any difference in voltage between the corresponding low voltage phases. The voltmeter should show no readings. If, however, there is a difference in voltage, the cause should be traced.
Only when it is certain that no difference in voltage exists between the corresponding low voltage terminals, the main lower voltage bus bars may be energized by means of the low voltage main switches.

The Company cannot be responsible for any damage caused by wrongly made connections.

5.3 ENERGIZING A TRANSFORMER:

The following steps should be sequentially follows:

1. Installation of the transformer.
   a) All dial plates and control instruments should be visible without entering the transformer bay.
   b) Check the oil sample plug and ensure that it is not leaking.
   c) The bushings should be clean.
   d) The insulating resistance of the transformer should be measured. Check also the continuity of the internal connections.

2. Check the level of the oil. If the oil level is low, then oil of the same quantity (generally to BS 148 or IEC 296) must be added.
   We recommend that you contact the Company before adding extra oil.
   The oil valve connecting conservator and transformer tank should be opened and kept in open position. All other oil valves should be kept closed.

3. The Silica Gel Breather should be connected to the flange provided and transformer oil should be filled in the oil cup of the breather to the mark indicated.
4. The Electrical connections of the transformer and the auxiliary apparatus should be carefully and comprehensively checked. All required tools should be readily available to make the desired couplings.

5. Remove all the tools and foreign bodies from the vicinity of the transformer.

With the off-circuit tap changer in the nominal position, the transformers should be initially energized without load for three to four hours. If a longer soaking period of up to 24 hours is possible, it is recommended to continue soaking for this period. During this period, the oil level and the temperature rise should be monitored.

Check if the voltage on the low voltage side is correct.

If temperature should rise beyond 100 deg C, shut down the transformer immediately and inform the Company.

6. Now, the transformer may be loaded gradually. Intermediate controls should be performed.

**NOTE:** The off-circuit tap changer should under no circumstances be operated while the transformer is energized.

Before re-energizing, ensure that the tap changer handle is properly seated.

7. The low voltage can be regulated as follows:

a) De-energize the transformer at the high and the low voltage side.

b) Loosen the tap changer cap or locking facility.

c) Change the tap changer to the desired position.

d) Ensure that the tap changer knob is properly seated in the desired position and securely fasten the locking cap or locking facility.
6.0 MAINTENANCE:

6.1 Monthly Check up

- Temperature
- Oil Level
- Leaks
- Silica Gel Breather – Gel to be recharged by heating in dry air at 100 deg. C until blue colour is attained.

This check can be done from a safe distance while the transformer remains in energized and loaded in service.

If liquid level has decreased abnormally, isolate the HV and LV Connections to the transformer and identify the source of the oil leak. Ensure that the leak is sealed before filling oil and re-energising the transformer.

6.2 Annual Check-up

In addition to the items given in monthly Check-up above, the following checks must be carried out.

- Oil sampling for checking Break Down Value (to be taken from the oil sampling valve)
- Checking for condition of bushings for cleanliness and cracks if any.

NOTE: The above check-up must be conducted with the transformer de-energized and isolated on HV and LV Sides.
**Testing of Oil:**

Approximately one litre of oil should be taken from the bottom of the tank using the oil sample plug provided, after first having drained out and discarding about five litres. Take care the liquid level remains above the windings. When the dielectric voltage is too low the oil must be filtered and dried. Eventually the oil should be replaced. This should preferably be done under controlled conditions and it is recommended that it be done in our factory, or under the Company’s supervision in order to avoid damage to the transformer.

It is recommended that a sample of oil should be sent to an analyzing laboratory where the degree of ageing can be determined so that replacement of the oil or a more detailed investigation of the active part of the transformer can be performed if deemed necessary.

**6.3 REPAIRS:**

Since these transformers are valuable assets for your organization, and since they do not contain any user serviceable parts, it is recommended that our Company be contacted for any major work to be carried out on the transformers.

Prior to undertaking any repair work, please contact the Company.

**6.3.1 Replacing the high voltage bushings (FOR POLE MOUNTED TRANSFORMERS WITH EXTERNAL BUSHINGS ONLY)**

It is not necessary to un-tank the transformer:

a) Disconnect the transformer (High and Low Voltage side),

b) Drain the liquid into clean dry containers used for transformer liquid, until its level falls just below the lid of the tank.
c) Unscrew the nuts of the bushing stem, remove the washer and/or the cap with the gasket, unscrew the holding down bolts at the bushing foot and remove the damaged porcelain, taking care the system does not fall into the tank.

d) Refix the different parts in the correct sequence,

e) Add the required quantity of liquid

f) Remove the air from the bushings.

6.3.2 Damaged paint work

- All rust and loose paint work must first be removed.

- Under coat the bare metal with a zinc rich primer paint.

- Apply one coat of enamel undercoat paint.

- Finish with one or two coats of top coat finish paint.

Allow a minimum of 24 hours between applications of different coats of paint.

NOTE: All paint used should be fully compatible with the original paint on the transformer.
WARNING

MAINTENANCE WORK OF ANY KIND OTHER THAN THAT LISTED IN THIS MANUAL SHOULD NOT BE ATTEMPTED, EXCEPT BY OUR TRAINED TECHNICIANS, AS IT MAY RESULT IN DAMAGE TO THE TRANSFORMER OR INJURY TO PERSONNEL.

For any further clarifications or queries, please contact:

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RUSAYL
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Please always give the following details when communicating regarding your transformer:

SERIAL NO.
RATING KVA
DATE OF INSTALLATION
NATURE OF PROBLEM ENCOUNTERED