Transoil Services

Technical Specification

For Insulating Oil Purification Plants

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1. GENERAL

The necessity for regular purification of electrical insulating fluids in electrical apparatus has been recognized for a very long time. Moisture, solids and gaseous contaminants can seriously affect the function of electrical insulating fluids as a coolant and insulator.

This specification describes the equipment as supplied by **TRANSOIL SERVICES** for the processing (degasification, dehydration, filtration and de-acidification) of transformer insulating oil. **TRANSOIL SERVICES** purifiers are designed for processing transformer oil in workshops or in the field,in storage tanks, drums or directly in transformers. Purification of oil in transformers can be carried out off-load or on-load depending on customer's preference. For purification of oil in the field, a mobile type purification plant, mounted on a roadworthy trailer and covered by a weatherproof canopy, is recommended.

2. SCOPE OF SUPPLY

The scope of supply of this specification shall include the design, fabrication and factory testing of Vacuum Oil Purifier Type E. Equipment will be mounted on a common base (open frame) or in a trailer and supplied in the form of a pre-piped and pre-wired package and shall provide a fully workable unit in accordance with this specification when received by the purchaser.

3. DUTY AND PERFORMANCE

Performance in a single pass through the purifier at a full flow rate shall be as follows:

Water Removal:-	From 50 ppm down to less than 5 ppm in a single pass and down to 3 ppm after two passes as measured by the ASTM Method D-1533 with new oil.
Gas Removal:-	From fully saturated with air (10 to 12% by volume) down to less than 0,1 % by volume as measured by the ASTM Method D-2945 with new oil.
Particulate Matter Removal:-	98% of particles over 0,5 micrometer, or over 1 or 5 micrometer at customers preference.
Tan Delta Improvement:-	With the addition of an optional Activated Clay Filter, the Tan Delta value 90°C can be improved to 0,005. The Tan Delta correction pertains to polishing new/regenerated oil and is not recommended for used/old oil.
Dielectric Strength:-	Improvement in dielectric strength up to 70 kV with new oil.

4. PROCESS DESCRIPTION

TRANSOIL SERVICES' process of treatment is based on the available technology:

Spreading of Oil:- Which is vital for easy release of moisture and gaseous containment's is accomplished by porous media cartridge, called a coalesce. In this process, heated or unheated oil passes through the layer of bonded fiberglass, where millions of sharp edges shear oil and expose it to the effect of the vacuum. Spreading of oil by passing through porous media is so efficient that oil can be treated at temperatures as low as 20°C.

Filtration:- Of oil is by filtration cartridges constructed of non-migration type cellulose material featuring a large surface area and dirt holding capacity. Obvious advantage of cartridge type filters is the low cost of filtration, easy and fast change of filter cartridges and no loss of oil or time for back washing etc.

The flow diagram shows the main components of a typical unit for Oil Purification of electrical insulating oils. Insulating oil is drawn in by an Inlet Pump, and is heated up in the Heater and filtered by Fine Filter before it reaches the Processing Chamber where water and gasses contained in the oil are thoroughly exposed to vacuum by efficient by spreading and removed through a Vacuum Pump.

Operation & Maintenance- **TRANSOIL SERVICES** purifiers combine maximum simplicity with high safety standards. A number of sensing devices are built in, continually monitoring all vital parameters (see Alarms & Interlocks). If any of these parameters deviate from normal operation, the purifier will shut down, positively preventing inlet or outlet of oil, and a diagnostic light will remain on to inform the operator what corrective action is required.

5. MAIN COMPONENTS

Inlet Strainer- Solid particles over 90 microns are retained in the Inlet strainer, preventing damage to the inlet pump and other components.

Inlet Pump:- One positive displacement gear type pump complete with mechanical seal direct driven by TEFC motor.

Electric Heater:- A low watt density heater (max. 1,7 watts/em") is used to prevent heat degradation of oil. Heater elements are

	encapsulated in steel tubes thus completely insulated from oil to prevent fire hazard and to provide uniform heating of oil. Heaters are controlled by heavy-duty contractors and a failsafe electronic type temperature controller
Fine Filter:-	Solid contaminants are retained by a cartridge type filter, featuring easy and fast replacement of cartridges.
Processing Chamber:-	Shell and all internal parts are made of carbon steel construction. Vacuum chamber features heavy-duty design, suitable for mobile installation.
Vacuum Pump:-	Mechanical vacuum pump rotary vane type is air-cooled, direct driven by electric motor and is sized to maintain vacuum of less than 1 mbar in vacuum chamber during last pass.
Oil Discharge Pump:-	A centrifugal pump featuring high suction capability removes oil from processing chamber and discharges it through a flow meter back into the transformer. Pump is direct driven by TEFC motor mounted on a common base.

6. INSTRUMENTATION

Instrumentation and electrical controls are located in a dust proof enclosure. A mimic panel is provided for the convenience of the operator showing the functions of the main components of the plant by way of pilot lights. Although the Purifier features fully automatic operation, a manual override of various functions is provided as standard. Even with manual override vital plant protection such as oil overflow are still in force.

Standard instrumentation and controls compromising of:

Temperature Controller (1):-	An electronic type, highly sensitive featuring fail safe operation. Therefore a separate high temperature cut out is not required.
Vacuum Indicator (1):-	Absolute (capsule type) has a measuring range of 0-25 mbar.
Pressure Gauges (2):-	Installed before and after oil filters with measuring range of 0-400 KPa.
Vacuum Gauges (2):-	Before and after coalesces with measuring range of -100 to 0 KPa.
Flow Meter (1):-	With totalizer up to 999 990 Liters

Level Control (1):-	Continuously maintains level in vacuum chamber within 10 mm of normal
Flow Control (1);-	Manually adjustable from 10 to 100% of normal flow or intermittently down to 0%.
Foam Control (1):-	Occasional frothing or foaming oil can develop, especially if oil contains high amount of moisture or during initial heat up stage. If high foam is detected, vacuum will be reduced automatically and foaming reduced to acceptable level. Plant operation is not affected, unless severe foaming conditions persist for more than 3 seconds. After that the plant will shut down (see par. Alarms & Interlocks)

7. ALARMS & INTERLOCKS –mounted in instrument panel

The following alarms and interlocks ensure simple and safe operation of purifier:

Heater:-	Heater switches on only when flow of oil is positively ensured.
Foam / Overflow:-	Foam or oil overflow to vacuum pump positively prevented by photoelectric sensor.
Vacuum Break:-	Automatic break in vacuum chamber to pressurize and to protect vacuum pumps.
Low Level Alarms:-	Indicates absence of oil and will shut down plant.
Overloads;-	All motors are protected by overloads
Sound Alarm:-	In the form of a panel-mounted siren is provided.
Shut Down:-	Automatic and tight plant shut down in the case of any alarm situation

The following alarms and interlocks ensure simple and safe operation of purifier:

In addition to direct alarms a number of interlocks are incorporated for safe operation:

Low Level / High Level Alarm-	a) If the level control system fails, either the High or Low Level Alarm will be activated and will shut down. the plant. b) In the case of the inlet or discharge valve being closed during start-up or operation, no over pressure condition can occur, since High Level Alarm will shut down the plant

8. OPTIONAL EQUIPMENT &ACCESSORIES

Activated Fuller's Earth Filter: Fuller's Earth filters are used to remove a multiple of contaminants from transformer oils.
NOTE:- Activated Fuller's Earth filter option is not designed to be used for regeneration/reclamation of transformer oil but for oil polishing. Activated Fuller's Earth cartridges are of the disposable type and are easy to change. They are only used for small quantities of oil. If the application is for large quantities of oil for regeneration/recycling, a regeneration plant is recommended.

Mobile Installation: Mounted on a roadworthy trailer. Single axle (up to 7000 liter/hour capacity) or a double axel trailer for higher capacities, is of steel weatherproof construction. The trailer is equipped with a 2" ball or pin tow hitch and an over ride brake as standard. Access to the machinery is through two double doors at the rear end of the trailer and side doors are fitted where required. Internal illumination is provided for lighting up the working area.

Portable Installation: Similar to mobile installation, two swivel and two fixed castors are used to move the purifier around the factory floor.

Vacuum Booster: For transformer evacuation and dry out, Vacuum Booster (Roots Rotary Blower) is recommended. Vacuum booster and pump combination is less sensitive in pumping large amounts of water vapor which is the case in transformer dry outs. Oil over flow device is incorporated to prevent oil from transformers entering into the booster.
NOTE: If this option is taken the backing vacuum pump size is then reduced. Please refer to the Flow Schematic

PLC Controls: The purifier can also be equipped with a simple PLC (programmable Logic Controller) to control the operation of the plant. The operator will simply push the "Start" button and the PLC will sequentially start the plant. If the operator pushes the "Stop" button, the plant will sequentially shut down after a 5 minute period to cool the heaters. Further facility exists that the plant can still be controlled manually by operator selecting "Manual Control". Even in manual control the PLC will look after all alarm functions in the plant. PLC type used is OMRON

Power Cable: Plant will be supplied with a 20m four-core flexible trailing cable.

Water Sensor : The plant can be equipped with an in line water in oil monitor. The

monitor will display water content in the transformer oil in ppm (parts per million

9. COMMISSIONING

A Commissioning Engineer will be available for start-up service and training for client's operators at an extra cost. Since **TRANSOIL SERVICES** purifiers are very easy to operate, commissioning is not usually required.

10. DOCUMENTATION

One copy of the Operating and Maintenance Manual is supplied with each purifier in CD format.

11. PLANT PICTURES

Mobile Transformer Oil Purification Plant Model: TE 5000 –MB Double Axel

TRANSOIL SERVICES RESERVES THE RIGHT TO CHANGE ANY PART OF THIS SPECIFICATION WITHOUT NOTIFICATION.

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