

TECHNICAL SPECIFICATION

SPECIFICATION NO.
PROJ-ELEC/C&I-TS-TOFP-0008

REV NO : 00

PRODUCT

TRANSFORMER OIL FILTRATION
PLANT
6000 LPH CAPACITY

DATE : 20/12/2006

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TRANSFORMER OIL FILTRATION PLANT - 6000 LPH CAPACITY

The Plant shall be suitable for treating Transformer & Switchgear oil by first heating it and then passing it through specially designed filter and then subjecting it to high vacuum treatment which dehydrates and degasifies the oil to following specifications after completion of the process.


Parameters	After Processing
Break Down Voltage (Across 2.5 mm Gap)	80 KV
Moisture Content	5 PPM
Suspended Particles	1 Micron
Gas Content	0.1% by Volume
Acidity	0.08 mg KOH/gms of Oil

The Plant shall generally conform to IS:6034-1989 and its latest revision.

The Oil Filtration Plant shall be designed for high vacuum and low temperature of oil for achieving required results.

The Oil Filtration Plant shall be Mobile, mounted on an under carriage with Four Pneumatic wheels. Automatic brakes and towing arrangement shall be provided. The Plant shall be weather proofed and shall be suitable for outdoor use. The casing shall be provided with doors of CRCA Sheets, hinged on fabricated Framework, Angles and Channels to have access to the operational controls and inspection windows etc. The equipment shall be enclosed and protected against climatic conditions. The Screw Jacks for relieving pressure on wheels at stationary conditions, shall be provided.

All components shall have adequate strength and rigidity to withstand normal conditions of handling transport and usage and shall be free from edges or corners to avoid injury to Operating Personnel in normal conditions of use. The design of the Plant shall be such that if required the part/s can easily be replaced. Proper guarding arrangement shall be provided on all such parts which due to their position and nature of operation are liable to cause accidents.

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The Plant shall consist of the following:

01. INLET PUMP

A positive displacement gear type Pump with a capacity of 6000 LPH shall be provided. The Pump shall be thoroughly tested for vacuum and shall be suitable for continuous trouble free operation. The Pump shall be provided with automatic protection against over-pressure build-up.

Interlocking arrangement shall be provided in between the Oil Inlet Pump and the heater so that heater can not be energised unless Inlet Pump is on.

Interlocking arrangement shall be provided in the Filter Plant between the Inlet Pump and High Level Float Switch (located into Degassing Column) to avoid excessive rise of oil in the Degassing Column.

Flow Control Valve for adjustment of flow rate through Filter, a Flow Control Valve shall be provided across the Gear Pump.

The Suction Head of the Inlet Feed Pump at atmospheric condition at Inlet shall be 4 to 5 mtrs.


02. HEATERS

Heaters shall be provided in Protection Tubes to avoid localised overheating, hot spot & breaking oil. Heaters shall be capable of heating oil from 30oC to 60oC. Temperature during degassing and dehydration for good results should not exceed 60oC. Heaters shall be thermostatically controlled. Total Heater Power shall be **132 KW**. Heaters shall be divided into Three Groups.

Heater Elements shall be of Nichrome / Kanthal wire filament, inserted in Refractory Formers which are located in Protection Tubes. Construction of the Heat Exchanger shall be such that the replacement of Heaters shall be easy and shall not require any special tools.

Heaters shall be interlocked with Gear Pump and shall not be in ON position, unless the Inlet Pump is working. Heater Tank shall be adequately thermally insulated to minimise loss of heat.

Heater Pipe surface density shall not be more than 2.0 Watts/cm².

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Each group of Heaters shall be controlled by individual Thermostat. A Safety Thermostat shall be provided to take care of any accidental rise of temperature of oil and shall put off the Heaters in such eventuality. This Thermostat shall be set at slightly higher temperature than that of controlling Thermostats.

One suitable Pressure Relief Valve shall be provided on the Heater Chamber to prevent any pressure rise above the acceptable limit. A Drain Plug for the Heater Tank shall be provided.

03. IONIC REACTION COLUMN (100 KGS)

An Ionic Reaction Column of 100 Kgs capacity shall be provided to reduce the acidity in the oil as mentioned in the specification. First filling shall be provided alongwith the column.

04. FILTRATION SYSTEM

Filtration System shall consist of the following:

A) PRELIMINARY FILTER


The main function of this Filter shall be to prevent any damage to the Inlet Pump. It shall have strainers capable of retaining all particles above 1 mm size and also magnetic particles. Incoming oil shall pass through this Filter. It shall be possible to clean the strainer without dismantling the Filter from the pipeline.

B) FILTER PRESS

Filter Press shall consist of Filters held between Metallic Discs. Filters shall be easily changeable. It shall be suitable for removal of particles bigger than 50 Microns. This shall be useful for removal of sludge content in the used oil. A Drain Plug shall be provided for the Filter.

C) CARTRIDGE FILTER

Non-hygroscopic throw away type Cartridge Filters of one Micron rating shall be provided. This Cartridge Elements shall have large dust holding capacity.

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The replacement of Cartridge Elements is very easy and can be done without any special tools. The Housing / Vessel is suitable for high vacuum and pressure applications. Compound (Pressure / Vacuum) Gauge shall be provided on Filter Vessel for inlet pressure indication in order to ascertain condition of Cartridge Elements. Aeration shall be provided on the Filter Vessel to aerate the Vessel during draining. The Cartridge type Filter shall facilitate to achieve desired value of particle size in micron.

05. DEGASSING AND DEHYDRATION CHAMBER - TWO STAGE

The Degassing Chamber shall function as degasser and dehumidifier & shall be capable of removing dissolved gases and moisture from the oil. It shall be of M.S. and shall have welded construction. The Chamber shall be able to withstand the vacuum to which it shall be subjected.


Efficiently spread Raschig Rings shall be placed in the Degassing Columns. The surface area offered by the Raschig Rings shall be sufficient to form a thin film of oil and shall facilitate removal of dissolved gases and moisture at the rated flow rate of oil. A Sight Glass with Illuminating Lamp shall be provided for observation of oil flow.

One Float Switch on the Degassing Chamber shall be provided for preventing excess rise of level. It shall be electrically interlocked with Inlet Pump. Another Float Switch to control the low level of the oil in Degassing Chamber shall be provided and it shall be electrically interlocked with the Discharge Pump.

Two stages shall be separated by a Siphon Seal.

06. VACUUM PUMPING SYSTEM (FOR DEGASSING COLUMN)

A Roots-Rotary combination of Vacuum Pumps shall be provided for evacuation of Degassing Chamber. The Pumps shall be of imported make. For matching of Vacuum Pump performance both - Roots & Rotary Vacuum Pumps shall be of same manufacturer only. Acceptable makes are Shinko Seiki, Japan / Balzer's, Germany. Manufacturer's specifications for the same are as given below:

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FIRST STAGE - ROTARY OIL SEALED PUMP (1 NO.)

Nominal Pumping Speed	3700 Ltrs/Min.
Ultimate Vacuum with G.B. Closed	5 x 10 ⁻³ Torr
Ultimate Vacuum with G.B. Open	5 x 10 ⁻¹ Torr

SECOND STAGE - MECHANICAL BOOSTER PUMP (ROOTS PUMP) - 1 NO.

Nominal Pumping Speed	1200 M3/Hr
Ultimate Vacuum	10 ⁻⁴ Torr

The Vacuum Pumping System shall have a McLeod Vacuum Gauge (Range: 10 Torr to 10 Microns), a Bourdon Gauge (Range: 0 to 760 Torr), Isolation Valve, Airing Valve Mechanical Non Return Valve and Automatic bypass Valve for Roots Pump.

07. TRANSFORMER EVACUATION SYSTEM

A Roots-Rotary combination of Vacuum Pumps shall be provided for evacuation of the Transformer. The Pumps shall be of imported make. For matching of Vacuum pump performance both - Roots & Rotary Vacuum Pumps shall be of same manufacturer only. Acceptable makes are Shinko Seiki, Japan / Balzer's, Germany. Manufacturer's specifications for the same are as given below:


ROTARY OIL SEALED PUMP (1 NO.)

Nominal Pumping Speed	1500 Ltrs/Min.
Ultimate Vacuum with G.B. Closed	5 x 10 ⁻³ Torr
Ultimate Vacuum with G.B. Open	5 x 10 ⁻¹ Torr

MECHANICAL BOOSTER PUMP (ROOTS PUMP) - 1 NO.

Nominal Pumping Speed	500 M3/Hr
Ultimate Vacuum	10 ⁻⁴ Torr

The Vacuum Pumping System shall have a McLeod Vacuum Gauge (Range: 10 Torr to 10 Microns) and a Bourdon Gauge (Range: 0 to 760 Torr), Isolation Valve, Airing Valve Mechanical Non Return Valve and Automatic bypass Valve for Roots Pump.

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The Transformer Evacuation System shall be mounted on the Plant chassis.

08. DISCHARGE PUMP

A Centrifugal Glandless type Discharge Pump with a capacity of 6000 LPH, suitable for sucking oil from the Degassing Chamber held under vacuum, shall be provided. This shall be fully tested for pressure and vacuum leak rate.

Interlocking arrangement shall be provided between Low Level Float Switch (located in Degassing Column) and Discharge Pump to prevent dry running of Discharge Pump.

The Discharge Head of the Outlet Pump shall be 8 Mtrs.

09. SOLENOID VALVE AT INLET & OUTLET

One no. Solenoid Valve at Inlet and One no. at Outlet shall be provided. Valve at the Inlet & Outlet shall open automatically. The moment oil Inlet & Outlet Pump are switched ON. In case of power failure, these valves shall be capable of preventing the oil from entering into the Plant and thus avoiding the possibility of mixing processed oil with unprocessed oil.

10. OIL SAMPLING VALVE

This valve shall be provided to collect the sample of oil for testing during operation.

11. AIRING VALVE


One Airing Valve for airing the Degassing Chamber shall be provided.

12. GAUGES & INSTRUMENTS

A Dial type Thermometer shall be provided at Outlet & Inlet at the Heater Tank for indication of oil temperature.

PRESSURE GAUGE

One Pressure Gauge before Cartridge Filter and One Compound Gauge shall be provided near Degassing Column.

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INDEPENDENT DRIVES

Independent Drives for Oil Discharge Pump, Oil Inlet Pump & Vacuum Pumps shall be provided.

Motors shall conform generally to IS:325 (Testing) shall be of Class 'F' Insulation. Starters shall be of direct On-line type. Motors shall be of NGEF / JYOTI (JMP) / ALSTOM / ABB / CROMPTON /SIEMENS make.

13. CONTROL PANEL

All Electrical Control Gear, Mains Isolating Arrangement, Starters, Contactors, Pilot Lamp, Push Buttons, HRC Fuses, Relays, Indicating Lamps and Interlocking shall be housed in a Compact Control Panel and made of CRCA Sheets.

A Mimic diagram with Indicating Lamps shall be provided on the Control Panel.

All Wiring shall be neatly routed and all wire termination shall be suitably identified with ferrules.

All HRC Fuses shall be of English Electric make and Switchgear shall be of Telemechanic / ABB /BCH / SIEMENS / L&T / GE POWER make. Mains Isolating Switch shall be of ICTPN type.

The Plant shall be suitable for operation on 415 V, 3 Ph, 4 Wire, 50 Hz, A.C. Supply.

14. OIL HOSES - 2 NOS.


Two Nos. Nitrile Rubber Hoses each 10 Mtrs long with flanged end connection on both sides shall be provided. One for Oil Inlet & one for Oil Outlet. Oil Hoses shall be capable of handling the transformer oil at 100oC (max.) and vacuum.

15. PIPE LINE & VALVES

The Valves in Oil Line & Vacuum Line shall be of Ball type.

All Pipes shall be of ERW and all joints in Oil & Vacuum Line shall be flanged & shall have 'O' Ring Sealing. 'O' Rings shall be of Nitrile Rubber & shall be of round shape.

The entire Plant alongwith all components mounted shall be tested for a total vacuum leak rate of less than 1 torr Ltrs/Sec

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The supplier should confirm availability of testing facilities at their works for carrying out the following tests on the oil:

1. Break Down Voltage
2. Moisture Content
3. Suspended Particles
4. Gas Content
5. Acidity
6. Plant flow rate confirmation

16. LIFTING HOOKS

Lifting Hooks for Plant shall be provided to facilitate ease of Plant Loading / Unloading.

17. ADDITIONAL REQUIREMENTS

- Additional one Vacuum pump of same capacity for evacuation of transformer.
- Online PPM Measurement.
- BDV Test kit upto 100kV.


18. OTHER DETAILS

A. CLEANING & PAINTING

Before despatch from Supplier's works, all exposed surfaces shall be cleaned off Rust, Dirt, Scale and foreign matter and shall be applied with a coat of rust preventive compound before being painted in single paint from outside.

B. INSPECTION & TESTING

The Plant shall be offered for Inspection & Testing with Transformer Oil at Supplier's works. Supplier shall demonstrate the Plant performance as per parameters mentioned in the specifications.

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C. INSTRUCTION MANUAL

Two copies Instruction Manual containing details of Plant Operation & Maintenance alongwith all relevant drawings shall be supplied with the Plant.

D. COMMISSIONING

Vendor shall depute their Engineer to our site for commissioning of the Plant. The oil to be processed and the Electrical Supply will be kept ready at site by BHEL.

E. PERFORMANCE GUARANTEE

We give guarantee for performance of the Plant for a period of 12 months from the date of commissioning of the Plant or 18 months from the date of despatch, whichever is earlier. During guarantee period we undertake upon written request of the purchaser to repair or replace at our discretion & as soon as possible any parts of goods delivered which can be proved to be damaged or unfit due to bad material, faulty design or poor workmanship. This guarantee does not cover damages resulting out of normal wear & tear, improper maintenance, failure to observe the operating instructions, incorrect operation, excessive loading, the use of unsuitable material, & other reasons beyond our control. The guarantee does not cover Consumables, Rubber parts (including Oil/Vacuum Hoses) & Electrical Components-Motors.