



FILTERALL Limited

INDUSTRIAL FILTRATION AND ALLIED SERVICES

Technical Specification Number S210 for Stationary Transformer Oil Regeneration Plant,
Type SPR rev Q 2013 www.filterall.com

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1. GENERAL

The **SRP** (Stationary Regeneration Plant) has been designed for the complete regeneration of transformer oil (Regeneration", "Reclamation" or "Recycling" of old [aged], used transformer oil is the physical, not chemical process, usually including 'clay treatment', that will restore the used oil to its original as new state, as defined by the BS 148 or IEC 296 specifications). Whilst oil purification will degas and dehydrate oil efficiently, it will not remove contaminants such as acidity, sludge and other decaying products. **Regeneration** on the other hand will remove all the above contaminants as well as improve colour and oxidization stability. Treated oil will exceed quality requirements for new oil.

The unique feature which distinguishes **Filterall's SRP** from conventional oil regeneration plants is the ability to reactivate clay within percolating columns (Conventional regeneration plants will use Fullers Earth (clay) only once. Oily and contaminated clay then must be disposed of which in most developed countries is classified as environmental hazard. "Reactivation" - of the clay, is the process whereby the "activity" or adsorbitive properties of the clay are restored to their original active state). Reactivation of clay is fully automated and enables **SRP** to process oil again and again using the same clay. Clay need not be removed from **SRP** for a period of up to two years. When finally removed (as a dry, neutral sand) it can be used for building materials or similar.

The complete SRP is mounted on a steel, leak proof base and can be operated under weatherproof shelter, inside the factory or can be installed and operated in a sea freight container.

2. The PERMASORB Process

The main philosophy behind the development of the **SRP** was and still is the ability to economically regenerate used transformer oil to the same quality standards as for new oil. The regeneration or reclamation process requires that the deteriorated transformer oil be passed through an adsorbent 'bed' such as fuller's earth or an activated clay.

As the 'clay treatment' removes the contaminants from the oil, the clay gradually becomes saturated and its regeneration capability decreases rapidly.

At this point, the clay in the conventional plant must be replaced, in Filterall's **SRP** it will be reactivated. Since the spent clay retains its own weight of oil, clay replacement is wasteful, requires handling and is environmentally detrimental and costly to dispose of. **Reactivation** is preferable.

The **SRP** contains clay in columns and the **PERMASORB** process is the mechanism and control system that allows the clay in the columns to be repeatedly reactivated. Permasorb clay reactivation process is environmentally safe and clean.



3. PROCESS DESCRIPTION

The oil inlet to the **SRP** is connected to the used transformer oil (**UTO**) tank and discharged to the regenerated transformer oil (**RTO**) tank. Free water should be drained from **UTO** prior to commencement of regeneration. Inlet connection on **UTO** should be at least 200mm above the drain connection. **SRP** process contains two operations, namely oil regeneration and clay reactivation.

Oil regeneration :-

The oil is pumped from **UTO** into (clay) percolating columns by pump P1 via the inlet strainer, electric heater and 30 micron filter F1, and flow meter FM. Oil percolates through clay columns. Correct oil treatment temperature and optimum contact time with the clay is controlled automatically. Solid and liquid contaminants are removed from the oil and retained in clay. In the process of regeneration, oil is also dehydrated down to 5 ppm. Oil is not degassed in the process of regeneration. If oil degassing is required an **option (P)** can be supplied. Regenerated oil is then transferred to **RTO** tank via 0,5 micron filter. After having processed an amount of oil corresponding to the capacity of the **SRP**, clay in columns will be reaching saturation point and its regeneration capacity will be reduced.

Reactivation :-

At this point an operator will give a command to discontinue oil regeneration and to commence clay reactivation. The clay is reactivated in the columns and the contaminants trapped by the clay are collected in a form of an oily sludge, representing less than 0,1% of processed oil. (The 'clay columns' consist of a structured bed of various activated clays and activated alumina. The 'structuring' addresses the need to maintain constant repetitive percolation characteristics and residence times through many reactivation cycles). After the reactivation phase, which last for 16 hours, the processing phase is re-instated by pressing a single function key on the key board.

Controls and Instrumentation :-

Operation and control of the regeneration plant is by PLC IBM compatible, programmable process control system interfaced with a Data supervisory management system. This enables the plant to run virtually unattended but where required, the operator interfaces with the plant by means of a standard computer. Plant status such as (alarms, flow rate, pressures, litres processed etc...) are constantly displayed, as well as logged on a 200 mb disk. Employing the above control system enables Filterall to offer the following **optional** extra features to improve safety of operation during regeneration.

- a) Accurate level monitoring of storage tanks.
- b) Oil test data storage facility example (di-electric strength, water content , acidity, etc...)
- c) Modem facility to Filterall operational centre for on-line control, software updates and fault finding.

All associated instrumentation and pneumatic controlled equipment is of the highest and proven quality.



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Precautions :-

In the event of temporary power failure, emergency shutdown procedures are automatic, and restart is automatic once power is restored. All motors are overload protected and alarms and interlocks ensure safe and simple operation.

Oil Spillage Contingency:-

Filterall have developed unique double oil spillage contingency for maximum environmental protection.

4. TECHNICAL DATA

Leak proof skid :- The SRP is mounted on a steel, leak proof base.

Inlet Pump :- Self-priming positive displacement type.

Inlet oil strainer :- Gross particle removal; porosity 125 micron.

Oil Heating :- Low watt density heaters are supplied (max 1.7 watt/cm² heating capacity).

Clay Treatment :- Mild steel columns are filled with structured activated clay packing.

Polishing Filter :- Porosity, 0.5 micron

Gas Scrubber :- Closed system, will remove noxious odours from vacuum pumps discharge

Electrical Supply :-

3-ph 50Hz, 380/420V OR

3-ph 60Hz, 600V OR

3-ph 60Hz, 460V

Effluent Air and neutral gases :-

SRP75 - 30M³/HR.

SRP150 - 60M³/HR.

SRP225 - 90M³/HR.

SRP300 - 120M³/HR.

Plant Efficiency :- Oil loss, max 0,2% of initial volume.

Environment SRP :- should operate inside the building with minimum temperature of +5°C.

5. PERFORMANCE

Plant Efficiency :- High and consistent efficiency of **SRP** ensures complete treatment of oil to comply with IEC publication 296 for new oils, **in a single pass**.

Plant Capacity :- Capacities of **SRP** plants as shown are based on:

- Continuous operation 30 days per month.
- Initial oil acidity of 0,2 mg KOH/g of oil.
- At different initial acidity, new capacity will be in inverse
- Proportion to new initial acidity.



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Test as per BS 148	Test	Unit	Initial oil condition	SRP Single pass quality
Moisture	IEC 733	ppm	less than 2000	5
Breakdown volt	IEC 156	KV	less than 30	greater than 70
Acidity	IEC 296	mg KOH/g	0.25	less than 0.03
Tan Delta (90c)	IEC 247		less than 0.01	less than 0.005
IFT *	ASTM	Dynes/cm	less than 15	greater than 35
Colour Appearance		Visual	Brown / Cloudy	Clear / Light / Yellow
Gas content with Option P	GC	%v/v	8	0.01
Oxidation Stability	IEC 74 (164 hrs)		Depleted	Restore D

* A lowering of interfacial tension indicates contamination by POLAR contaminants. There is a great deal of data that would seem to link increased acidity with a lowering IFT. See "A Guide to Transformer Maintenance", S.D. Myers, J.J. Kelly, R.H. Parrish (Publ. S.D. Myers Inc. 2nd ed. 1988)



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6. OPTIONAL EQUIPMENT

Oil Purifier (Option P):- Oil purifier/degasser can be supplied on the same base as SRP and used to degas oil discharged from SRP or oil in storage tanks.

Twenty Foot Container (Option 20):- Installation in a 20 foot dry sea freight container with doors, windows and operators space.

Forty Foot Container (Option 40):- Installation in a forty foot sea freight container with space for laboratory and accommodation.

Cold and hot weatherproofing (Option W2):- Weatherproofing for operation above 35°C or below 0°C. Heat insulation, and ventilation is included with this option in the laboratory area.

7. GUARANTEES

Mechanical Warranty :- Filterall warrants the machinery supplied under this specification against defects in material and workmanship under normal use and service for a period of 12 months from date of shipment. Filterall's obligation under this warranty is limited to repairing or furnishing without charge, F.O.B. point of manufacture similar part to replace any part which within warranty period is proven defective. Filterall shall not in any event be held responsible for any specials, indirect or consequential damages.

Performance Guarantee :- Filterall guarantees that the performance of the equipment will be within limitations as detailed in "Duty and Performance" in this specification.

*FILTERALL RESERVES THE RIGHT TO CHANGE ANY PART
OF THIS SPECIFICATION WITHOUT NOTIFICATION*