

FILTERALL LIMITED

Technical Specification S212

Stationary Transformer Oil PCB Decontamination Plant Type "PCB- D"

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1. General

Polychlorinated biphenyls (PCB) also known generically as askarel was used for nearly 50 years in insulating electrical equipment in applications requiring a highly fire resistant fluid. Maintenance of electrical insulating fluids is an ongoing process and the possibility of cross contamination with other electrical fluids is always possible.

This specification describes Filterall stationary plant type PCBD that has been designed for treatment of transformer oils contaminated with up to 1000-PPM polychlorinated biphenyls.

2. Scope of Supply

NOTE:

Oil after decontamination requires oil regeneration to return it to usable condition. Oil regeneration is not included in this specification. See optional equipment on page 5 of this specification.

The scope of supply of this specification shall include the design, fabrication and factory testing of stationary PCB decontamination plant. Equipment will be mounted on a leakproof base in a fully pre-piped, pre-wired package, ready for immediate operation. A few site installation requirements are necessary to complete the full installation details in technical spec.

3. Process Description

The decontamination process involves a sodium-based reagent. Sodium metal by its nature is a volatile material. In order to eliminate the possibility of any violent reaction the Filterall process incorporates some inherent safety features namely:

- 3.1 Reagent will not react violently when in contact with moist materials or even directly with water.
- 3.2 The Filterall process is not a batch process but a continuous one. This means that only a few milligrams of reagent are involved in the reaction at any time as compared to a few kilograms in a batch process. Reagent remains in contact with the oil for less than 30 seconds.
- 3.3 Further, to enhance safety and reliability of continuous decontamination process, the whole operation is controlled and monitored by process logic controller. All vital operating criteria are displayed on a computer screen and logged to hard drive for analysis and retrieval as and when required.
- 3.4 During decontamination process treated oil is exposed to maximum temperature of 120°C and only for a short time, less than 60 seconds. Since moisture and oxygen are kept away from the oil no deterioration of oil can take place. As a result no damage is caused to physical and chemical properties of the oil.

Waste from Filterall PCBD plant process are non-toxic, non acidic and contain less than 2 PPM PCB. All waste is of liquid nature consisting of water and dissolved salts and therefore easy to dispose of.

Once the oil has been dehydrated and degassed by the on board 2 stage degasser, the oil is drawn by pump No. 1 either from the return line or oil storage tank to the process part of the plant. A flow meter measures the amount of processed oil and logs to the PLC. After the flow meter the heated oil (heated by degasser) the oil is further heated by a low watt density heater to the correct temperature. With the correct temperature the oil enters the progressive reactor.

The unique design of the reactor provides vigorous mixing of the oil with the reagent. Mixing is in a progressive manner and each oil particle will be exposed to equal mixing and equal contact time with the reagent. Because of this uniformity, a consistent decontamination will take place. An optimum amount of reagent is injected into the oil

stream by a highly accurate metering pump.

Decontaminated oil is pumped to the settling tank where a centrifuge separates the sludge from the decontaminated oil. Liquid waste is drained off and the oil passes through a final separation tank before being discharged to the holding tank for regeneration.

4. Duty and Performance

Performance in a single pass through the PCBD plant at full flow rate will be as follows:

Degasser	Water removal from 100 PPM to less than 20 PPM in a single pass (as measured by ASTM Method D-1533).
PCB Removal	PCB decontamination from 1000 PPM to less than 2 PPM as measured by gas chromatograph.

5. Instrumentation and Control

Instrumentation as well as PLC control and interface are housed in a dust proof enclosure. Plant operation is fully controlled by the operator interfacing via a computer monitor and computer mouse. Plant mimic is fully displayed on the screen showing the operator the status condition of the plant. If an alarm should occur the alarm will be displayed on the monitor as well as an audible alarm will sound. All alarm and operating conditions are logged to the hard drive for analysis and retrieval. Although the plant features automatic control operator input is constantly necessary to ensure that the contaminated oil is dry as well as reagent and booster vessels are at their correct levels.

In the event of a **FATAL ALARM** plant will automatically shut down.

6. Technical Data

Base	The PCBD plant is installed on a leak proof base of mild steel construction, equipped with a leak detector.
Inlet Pump	Self-priming pump is positive displacement pump, to ensure a constant flow rate.
Inlet Oil Strainer	Cleanable type, solids retention 125 micron.
Oil Heater	Oil is heated by low watt density heating elements, max. 1.7 watt/square cm.
Oil Treatment Vessel	It is equipped with observation window, level and foam control. The material of construction is stainless steel.
Electric Supply	400V/3PH/50HZ OR 460V/3PH/60HZ OR 600V/3PH/60HZ

<i>Plant Efficiency</i>	A total destruction of PCBs in transformer oil down to less than 2 PPM, from max. 1000 PPM. There is no residual PCB in treated oil nor in effluent.
<i>Operating Environment</i>	Plant is intended for operation inside well ventilated building with minimum temperature of 5°C and maximum of 45°C.
<i>Fire Fighting Equipment</i>	This will be recommended by Filterall and supplied by the client, as the applicable rules and regulations differ from country to country.
<i>Control Computer</i>	Pentium type computer 16-MB ram c/w CD-ROM. Operating system Windows NT.
<i>Printer</i>	Hewlett Packard 670c
<i>Scada Systems</i>	FIX Intellution based on Windows NT
<i>Programmable Controller</i>	Omron C200HS

7. Optional Equipment

<i>Oil dehydrator/ purifier</i>	Depending on size of oil preparation tanks and oil contamination levels. Filterall will recommend either two stage dehydrator/purifier (single pass operation) or a purifier for circulation of oil within a preparation tank.
<i>Oil regeneration plant</i>	To ensure top quality of oil before its reuse as an electrical insulating media, decontaminated oil must be treated with a regeneration plant. Filterall will recommend either stand alone, or integrated regeneration plant, depending on clients situation.
<i>Installation in a container</i>	If PCBD plant is to be positioned away from existing buildings, an installation of the plant in a sea freight type container makes PCBD plant self contained and capable of operating in a harsh environment. This option is highly recommended.

8. Commissioning

A Commissioning Engineer will be available for start up and training of client's operators at client's premises for a period of 1 week. It is highly recommended that 1 week prior to shipping 2 operators are sent to Filterall during the final testing of the plant to familiarise themselves with the operation and maintenance of the plant. All costs are for the client, local training at no cost.

9. Guarantees

Filterall warrants the machinery supplied under this specification against defects in material and workmanship under normal use and service for twelve months from date of shipment. Filterall obligation under this warranty is limited to repairing or furnishing without charge, FOB point of manufacture similar part to replace any part which within the warranty period is proven defective. Filterall shall not in any event be held responsible for any special, indirect or consequential damages.

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