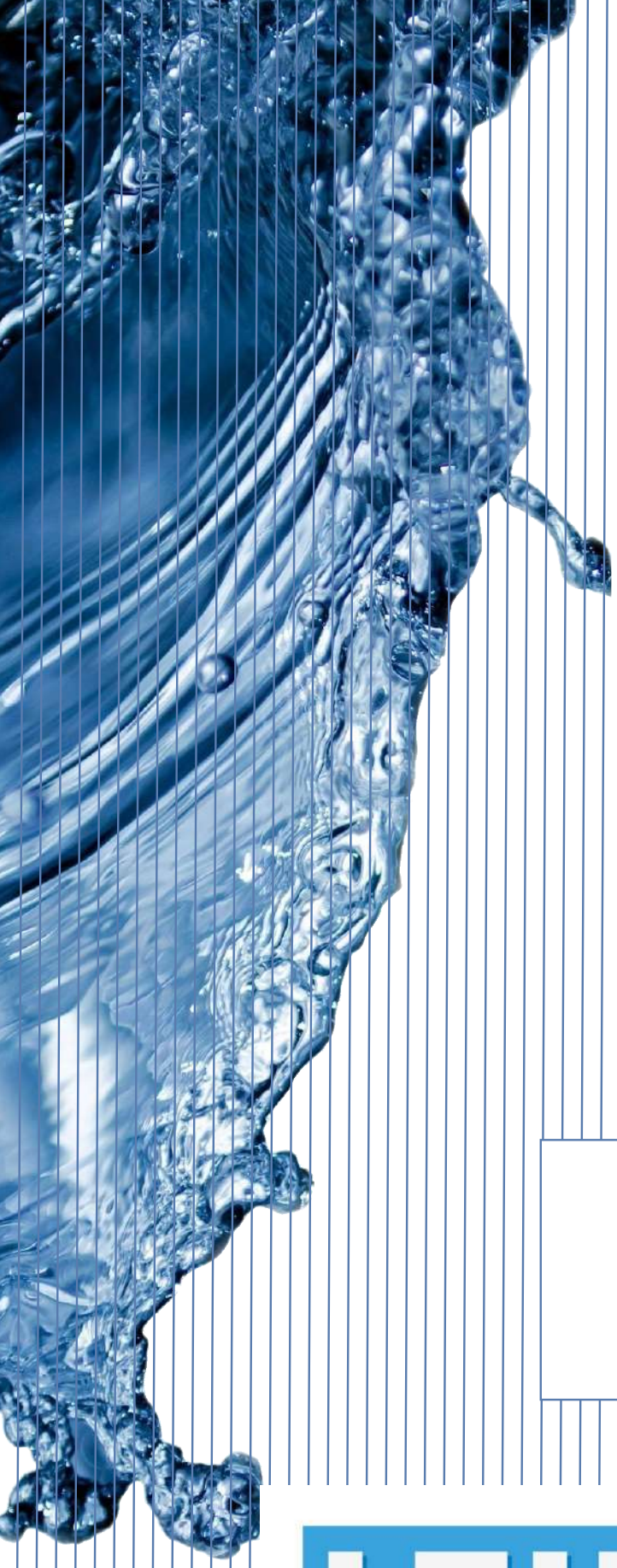


PALL

FILTRAZIONE

HTP070 Depuratore per fluidi dielettrici

LTH

HYDRAULIC
COMPONENTS
& FLUID CONTAMINATION
CONTROL

Pall Corporation

HTP

HTP070 Purifier for Dielectric Fluids

FLUID CONDITIONING PURIFIERS

*Filtration. Separation. Solution.*SM

PIH HTP070b

HTP070 Purifier for Dielectric Fluids
Technical Information

The HTP070 purifier permits treatment of the oil in a power transformer, while on-line and on-load.

Application Areas

The 'PALL' HTP070 oil purifier removes water, solid particles, air and other gases present in the dielectric fluids.

The operation of the HTP070 purifier is based on the principle of vacuum dehydration combined with fine filtration to remove particulate contamination.

The purifier is designed to treat power transformers while on load. It is an integrated unit consisting of a mobile purifier unit mounted on wheels, and incorporates an isolation system and has connection accessories.

In addition to on-load treatment of transformer oil, the purifier can be used for the treatment of bulk fluid.

The nature and detrimental effects of contamination in power transformers

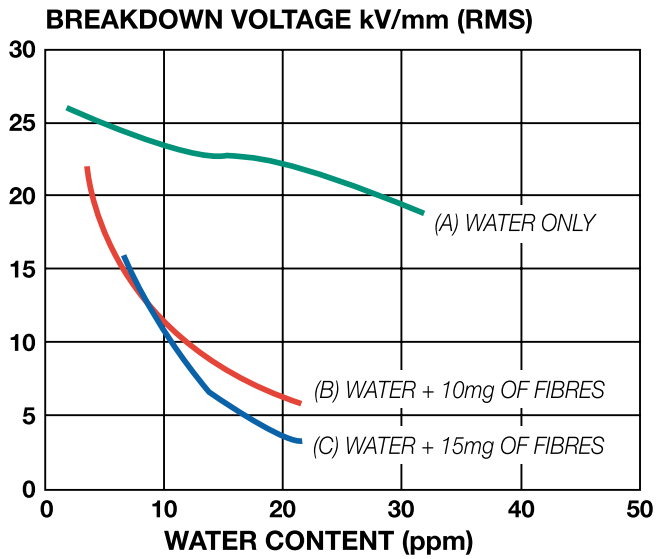
Excessive contamination is detrimental to the optimal performance of power transformers.

This contamination, whether liquid or solid, degrades the dielectric performance of the transformer insulating materials.

Figure 1, below, shows the damaging and costly effects on breakdown voltage of excessive water content, combined with high particle contamination, chiefly composed of cellulose fibres originating from paper and pressboard.

In addition, the water, which is a product of the decomposition of the cellulose insulation under thermal stress, is also a factor in accelerated ageing of the insulation paper.

Figure 1:
Effect of contamination on breakdown voltage of oil (Source RGE January 1965)



HTP070 Purifier for Dielectric Fluids
Technical Information

Figure 2:
Typical specification for a new transformer

Water content at 20°C	< 10 ppm
Particle count according to ISO 4406	< 12/10
Particle count according to NAS 1638	< 4
Dielectric strength	> 75 kV

It is absolutely essential to keep the overall contamination level of the transformer oil in service at low levels to ensure the dielectric strength of the oil and to minimise the risk of transformer breakdown.

The table above shows typical values for a new transformer. They must be adapted to suit the type of transformer, its age, and technology.

A new approach to the treatment of transformers

A new method of treating transformers while on-load has been developed by **Pall** and EDF, working in partnership and departing from conventional technology. This process is the subject of an agreement between **Pall** and EDF which covers the treatment of power transformers under load using the HTP070 purifier, a specially designed unit for this application. The HTP070 purifier permits extremely high performances to be reached, without manual supervision except during connecting and disconnecting operations.

The development of this type of treatment offers the following advantages:

- A substantial reduction in direct and indirect treatment costs.
- Better control of the water content in both the transformer oil and the paper insulation.

The process allows treatments lasting several weeks and can therefore be much more efficient. Since such treatments do not require the transformer to be taken out of service, a major cost factor has been eliminated.

Remote Monitoring Package

The HTP 070 can be equipped with a remote monitoring package. The system involves the use of a Global Satellite Modem (GSM) or landline connected to the purifier PLC together with all necessary pressure transducers and moisture sensors.

This allows the operator

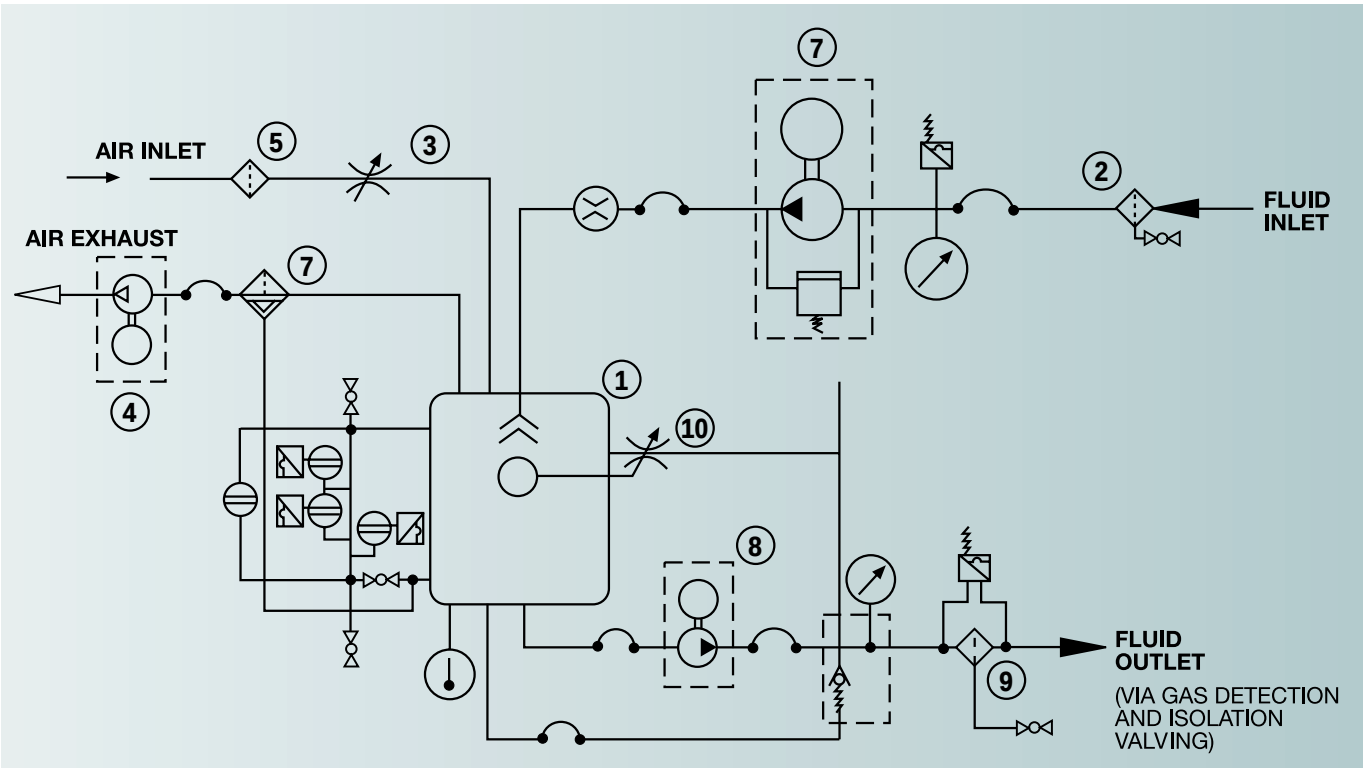
- access to the system data from the ‘Home Base’
- Allows the operator to down-load system history from base
- The monitor will ‘Ring Home’ in the event of a system alarm and indicate the nature of the alarm
- It can also be used to flag service points

This option has proved its value as the HTP 070 has to operate in remote ares for long periods.

HTP070 Purifier for Dielectric Fluids
Technical Information

Operating principles of purifier

Flow schematic



Operation

The fluid is pumped into the vacuum chamber (1) through the inlet strainer (2) by the inlet pump (7). A spray nozzle at the top of the chamber produces a cone of fluid with a thin film and a large surface area.

The vacuum chamber is maintained at approximately 10 mbar absolute by the vacuum pump (4). Air entering the chamber passes through an air breather (5), removing airborne contamination to avoid adding dirt to the system. The air expands rapidly through a restriction (3) to approximately 100 times its ambient volume which decreases the relative humidity inside the chamber to a fraction of the ambient level.

Gases and water vapour are transferred from the fluid surface to the upward flowing air thereby drying and degassing the fluid. The wet air is then exhausted via the oil mist separator (7) and vacuum pump (4) to atmosphere.

The purified fluid collects at the bottom of the chamber and is returned to the transformer or reservoir via the discharge pump (8) through the ß5(c)≥1000 high Beta performance ‘Ultipor III’ filter element (9). When the discharge filter element reaches the pre-set differential pressure a warning beacon is illuminated.

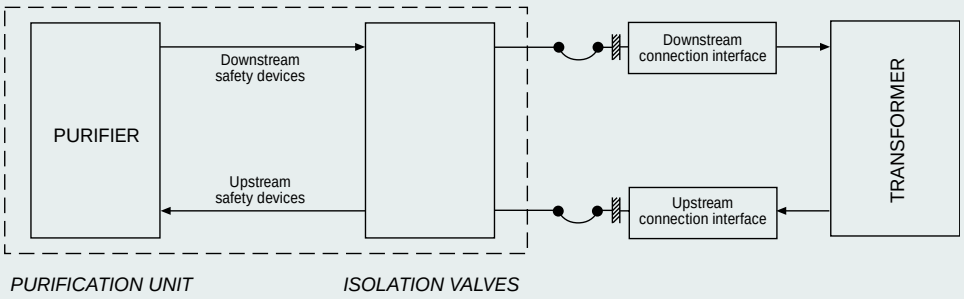
The fluid level in the vacuum chamber is maintained by a level sensor (10) which allows some of the fluid to circulate back to the chamber.

A sight glass is fitted to give visual confirmation of the fluid level in the chamber.

Downstream of the discharge filter (9) is a second vessel and associated valving (not shown) for the detection and removal of air bubbles in the transformer oil.

Transformer connection requirements

Schematic



In order to carry out the transformer treatment under load in complete safety, the purifying installation comprises the following elements:

- The isolation valves providing the connection of the HTP070 purifier to the transformer.
- Special connections providing the venting of pipework connecting the purifier to the transformer.
- Special equipment providing both air bubble and oil leak detection.

Operational sequence

- **Connection phase (transformer off-line)**
- **System powered-up**
- **Hose and purifier filling**
- **System safety checks**
- **Purifier run with isolation valves closed**
- **Isolation valves opened**
- **Transformer treatment phase**

The safety of the treatment is the combination of protection incorporated into the purifier, and the transformer's existing protective devices. The purifier's protective devices enable any irregular functioning to be detected by the PLC which controls the process and continuously monitors all critical aspects of the operation including the absence of bubbles in the treated fluid, and leaks in the system.

Checking the correct function of these safety devices is carried out by the operator prior to the start of the treatment, following a routine controlled by the PLC. System safety checks can be overridden only through a password protection function. The PLC has an on-line manual and a step by step user guide.

During the treatment of the transformer fluid, the automatic controls allow treatment to continue if required for several weeks with only routine weekly inspection.

Purifier performance

The purifier treatment will remove water, gases, and solid particles from the transformer oil.

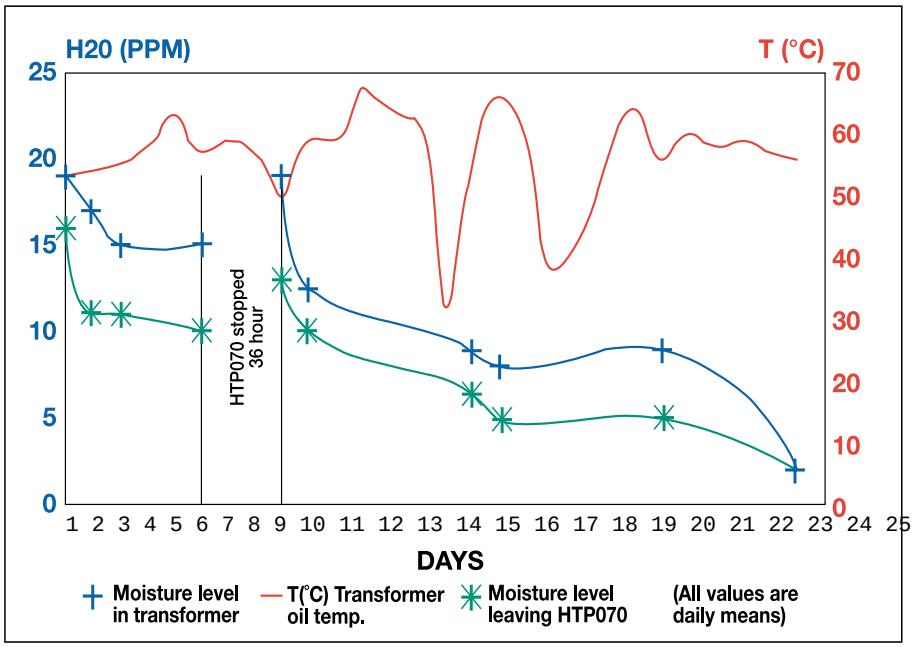
The purifier treats all three types of contamination at the same time.

The on-load method of treatment is preferred as during operation the oil is at a higher than ambient temperature which enhances water migration from the paper insulation into the oil where it can be removed by vacuum dehydration.

HTP070 Purifier for Dielectric Fluids
Technical Information

Figure 3:
Experience in treating a typical 23 MVA transformer

Since 1994, EDF has carried out a number of on-load transformer treatments with the **PALL** purifier on transformers containing between 6.5 and 35 tonnes of oil.



The above example shows the treatment of a transformer of 23 MVA containing 8.5 tonnes of oil. The water content before treatment was 30 ppm at 20°C and the water content several months after the treatment remained at 6 ppm at 20°C.

The treatment enabled some ten litres of water to be extracted from the transformer.

Comparison between on-load and conventional treatments

- The conventional treatment necessitates that the transformer is unavailable during treatment. On-load treatment requires minimum downtime, i.e. only during connecting and disconnecting of the treatment equipment.
- The direct cost of a treatment under load with the HTP070 purifier is very much less, since no special manning is required during the treatment period and no high energy heaters are used.
- The effectiveness of conventional treatment performed without a vacuum in the transformer is very limited, even with high fluid temperatures. On-load treatment with the HTP070 purifier enables the water contained in the transformers paper insulation to be extracted efficiently and remain effective in the long term.

HTP070 Purifier for Dielectric Fluids
Instrumentation and Controls

Special features and advantages

Special features	Advantages
Max. 32 A, 400 V, 3-phase supply. Hydraulic connections on isolating valves.	Simplicity and speed of electrical and hydraulic connections. Low electrical power. No need for water or compressed air.
Treatment without use of additional heaters.	Economy of operation, elimination of risks of thermal degradation of the oil and excessive thermal stresses on the equipment.
Fluid level and pressure sensors together with filter clogging indicators.	Simple and reliable functioning in the automatic mode.
Filter element rating ß5(c)≥1000.	Very rapid removal of fine particulate without risk of static build-up in the fluid.
Substantial frame fitted with wheels.	Mobility and safety when relocating.
Remote monitoring package available.	Allows the purifier performance to be monitored from the ‘Home Base’.

Ordering information

Purifier reference: HTP07040050UPHC

Replacement elements:

Air filter: HC0293SEE5

Suction filter: HC8900EOS16H

Outlet filter: HC0363FUZP39H

Vacuum pump coalescer filter: HS75089 (4 off)

Air filter: HS75088 (2 off)

HTP

FLUID CONDITIONING PURIFIERS

HTP070 Purifier for Dielectric Fluids
Specifications

General specification	Max viscosity at purifier:	70 cSt
	Temperature of fluid:	Temperature at base of transformer: 5°C to 70°C (intermittent 80°C)
	Weight of purifier alone:	1600 kg
	Dimensions of purifier:	Width: 1400mm Length: 2560mm Height: 1950mm
	Oil capacity of purifier:	Approx. 300 litres
Purifier circuit	Flow:	70 litres/minute
	Filter Rating:	ß5(C)≥1000 in compliance with ISO 16889
Materials	Frame:	Carbon steel
	Vessels and pipework:	Stainless steel
	Filter housing:	Aluminium alloy
Electrical requirements	Power supply:	Available in a range of voltages from 220 to 575V, three phase. Please specify preference.
	Power consumption:	Max. 8 kW
	Current supply:	Max. 32A

Note: For on-load treatment, the initial state of the oil and paper must allow normal and safe operation of the transformer. The PALL HTP070 purifier must not be used on fluids contaminated by toxic or volatile products, the vapours emitted being liable to present risks of explosion or otherwise endanger personnel. Strict compliance with the Safety Rules and with the Regulation in force at the point of use must be observed.

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Filtration. Separation. Solution.SM

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