



Vertrieb von Filtertechnik  
 für Luft  
 für Öle  
 für Wasser  
 für Emulsion

**A.B.O. Umweltservice**  
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## Lifetime Extension for Power Transformers

### Needs and problems with power transformers:

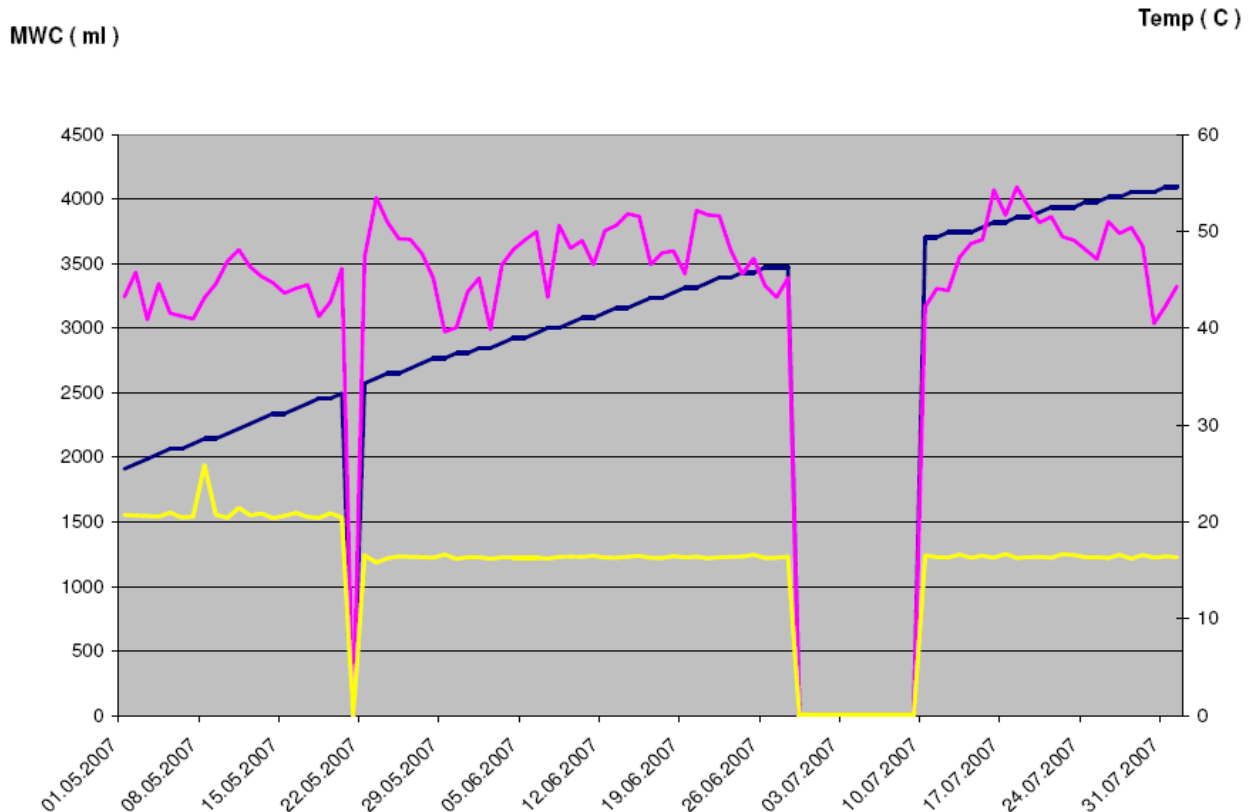
- they have to work 24h and 7 days per week (*no rest allowed*)
- they have bad availability all over the world (*waiting time on new transformers up to 3 years*)
- if they break down – it causes downtime of production (*worst case for every company or power station*)
- they have accelerated rising prices
- insurance companies don't pay a damage, if a company could't not verify, that every security and care for the transformer was done. If they find any carelessness they will **not pay** the damage!

### Solution:

- the main problem why transformers break down is if Cellulose is dissolving in case of bad transformer-oil quality.
- Lifetime extension technology for power transformers secures a stabilized quality of the transformer-oil. (*normally no necessary transformer-oil change forever*)
- the principle is to abstract water from the transformers oil to raise breakdown voltage and for this extend lifetime of cellulose
- The output of the solution is a detailed "oil-quality-protocol", which is **to document** the insurance company in case of damage, **that everything was done to save the transformer**. (*monitoring can be done remote*)

— MWC [ml]	=> water
— TTS [C]	=> temperature
— P2S ( kpa )	=> pressure

Here you can see how many water was abstracted from a transformer from May to July 2007:





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### What transformers can be treated with this technologies?

- Wet Power-Transformers between 5kVA – 900 MVA

### cost-effectiveness calculation:

- Transformer-Oil costs 2,50 – 3,00 Euro per litre
- Transformers with 5 kVA have approximately 1.200 – 1.300 litre oil
- Transformers with 80 KVA have approximately 15.000 litre oil

This "life extension" solutions cost approximately 64.000,- Euro + service cost + other cost like transport etc. On the other side are minimum 25.000 litre of new bought transformer-oil.

But – what is better?

- new transformer oil is no guaranty for secured cellulose (*mostly water is in cellulose*)
- new transformer oil must be monitored also, to guarantee "up-time"
- new transformer oil causes down time to leave out, clean and fill up etc. and life extension technology causes no downtime

### How the solution looks:



### How it works?

The basic rule for any treatment of the oil inventory is to remove only the *undesired* substances from the oil. The "soft" removal of the diluted water from the oil is easily achieved (without a high vacuum and high temperature, which potentially deteriorate the oil), by freezing up the water vapour under low vacuum and by reaching oil temperature rates at only about 60C, because the water removal process is simultaneously intensified by a so-called bubble bed procedure. A continuous degassing of the oil without the undesired removal of light oil fractions enables the liquid piston principle simultaneously. In the first stage (evacuation), the sinking oil level acts as a piston and creates the vacuum necessary to separate gases and vapours from the oil. In the second stage (compression), the liberated gas mixture is gradually compressed by the rising oil level. The condensation of oil vapours takes place and the light fractions get mixed back in the oil. Only non-condensable substances are then expelled from the drier into surroundings.

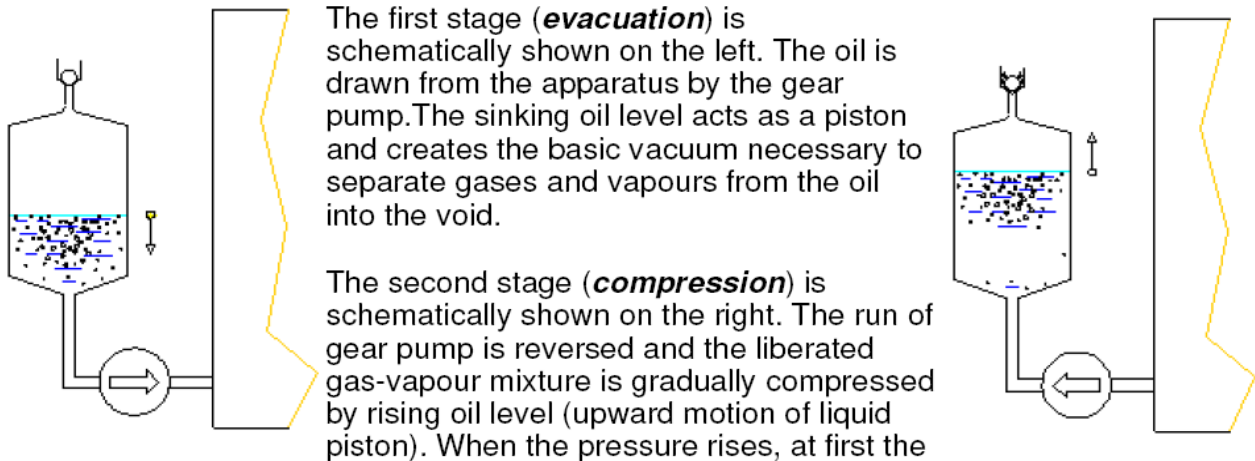


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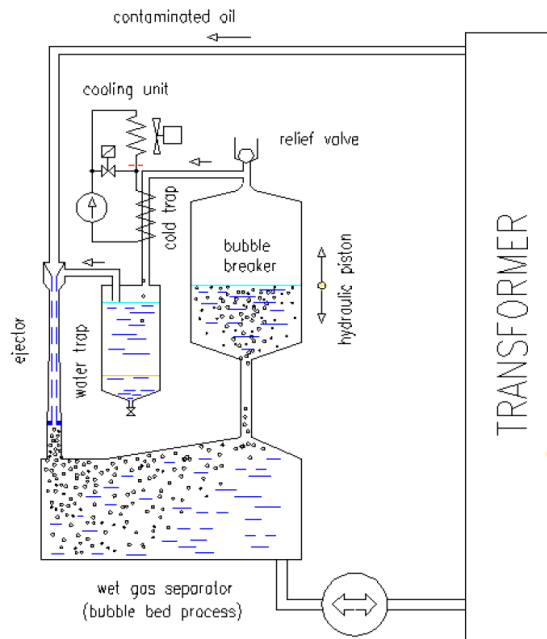
## What Is a Liquid Piston ?

The liquid piston is created by rising and falling oil level due to the cyclic operation of robust gear pump.



condensation of oil vapours takes place (**only this way can be guaranteed "no-impact on oil properties" - condensing light fractions are automatically mixed back in the oil**) and then are the gases relieved via non-return valve into atmosphere. This process continues until the whole apparatus is filled with oil, then is the gear pump switched on into direct run again and new evacuation stage begins.

## How Are Vapours And Gases Separated From Oil ?





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Vacuum, temperature and large interfacial area are essential for efficient separation.

Contaminated oil from transformer is locally adjusted to an optimum temperature and hot oil is under vacuum mixed via ejector with the gas (previously separated from oil) to produce bubbles with a large interfacial area (bubble bed).

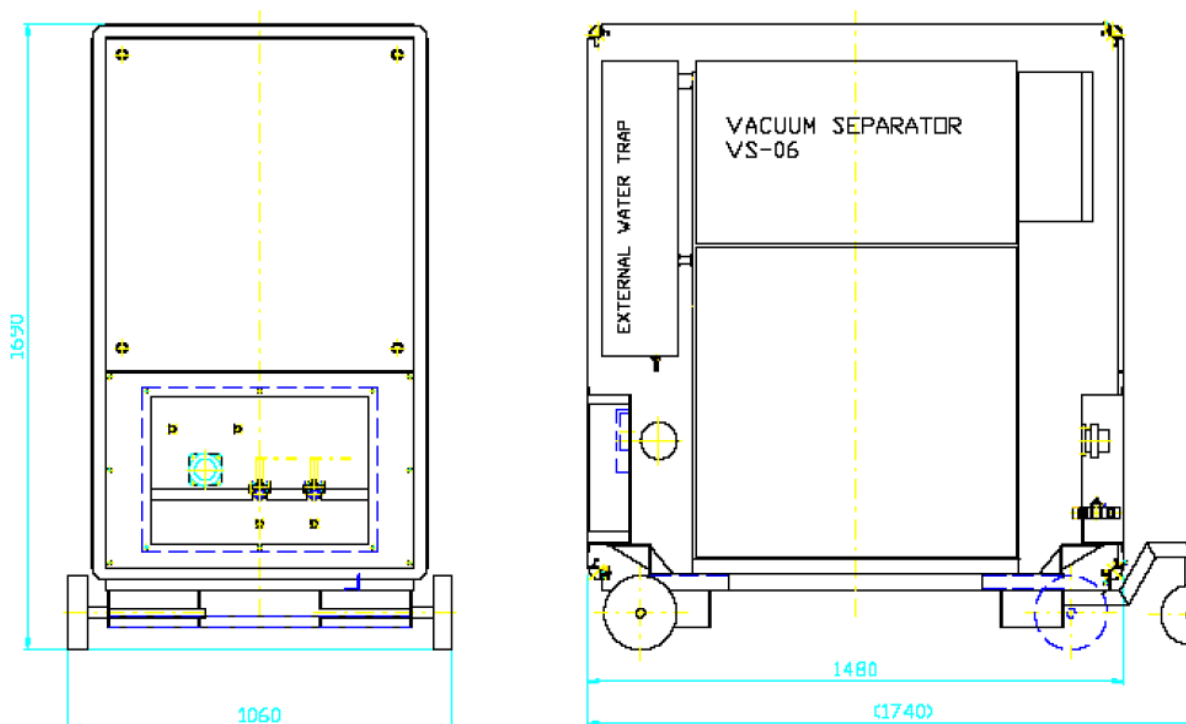
The intense diffusion of moisture from oil is enhanced by minimizing the partial pressure of water vapour. This is achieved by sub-cooling the carrier gas to condense and freeze-out all traces of moisture prior to mixing with the contaminated oil.

Dissolved gases and vapours diffuse into bubbles which are then agglomerated, collected and broken.

The water vapours is collected as an ice in the cold trap, periodically defrosted and collected as a liquid in the water trap.

Note that only a simplified schematics is shown here for clarity.

## Dimensions & Specification





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Power supply voltage	400 V (or on request)
Power supply frequency	50 Hz (or on request)
<b>Power consumption:</b>	
without oil heater	850 W
with oil heater PO-01	6200 W maximum
Oil throughput	10 m <sup>3</sup> per day maximum
Outlet water content	10 ppm nominal , 4 ppm minimum
Outlet gas content	1% nominal, 0.3 % minimum
Outlet filtering grade	1 µm
<b>Weight - universal version (separator, heater ultrafilter, external water trap)</b>	
Dry weight ( without oil)	520 kg
Operating weight (oil filled)	580 kg
Hydraulical connection	2 x flexible 1/2" hose
Communication:	faxmodem, GSM modem or LAN link

**A movie about lifetime extension you can see here:**

<http://www.a-b-o-umweltservice.com/TransformatorenReinigung-english.wmv>