# Comparison of hermetization methods of power transformers

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## 1. Bag-In-Tank

Description:

The hermetization is provided by a **„rubber“** barrier . This , the most frequently used hermetization method , uses the flexible element (rubber bag, rubber membrane etc. ) as an impermeable barrier between the surrounding air and the oil inventory of a transformer.
The barrier is usually situated in the conservator of a transformer.

Advantages:

- if tight: very good hermetization effect

Disadvantages:

- relatively high aquisition price
- the tighthess of the flexible element must be steadily monitored,
- limited service life
- if defective, in most cases the whole conservator must be changed
- high repair costs – irreparable in situ
- fault gases cannot freely escape the transformer

## 2. Inert-gas pressure type

Description:

The hermetization is provided by a **„gas“** barrier.The space above the oil in the main tank or conservator is filled with an inert gas, usually nitrogen supplied under positive pressure from a gas cylinder. The innert gas cushion in the conservator then hampers the free access of air gases and humidity into the oil.

Advantages:

- relatively low aquisition price,
- good hermetization effect (if steadily supplied by an inert gas)
- unlimited service life
- reparable in situ
- easy retrofit of old transformers
- fault gases can freely escape from the transformer

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Disadvantages:

- continuous supply of an inert gas necessary
- continuous monitoring of the positive pressure of an inert gas necessary
- potentially dangerous oversaturation of oil filling by an inert gas - a failure of the gas supply or the strong change of the transformer temperature can induce Buchholz alarms (in the best case).

## 3. Sealed-tank type

Description:

The hermetization is provided by a **„metal“** barrier. The dilatation of the oil filling is compensated by special flexible (metal) elements most usually being special flexible radiator walls.

Advantages:

- if tight: very good hermetization effect

Disadvantages:

- relatively high aquisition price
- the tightess of flexible elements and of the transformer as a whole must be steadily monitored,
- limited service-life
- strong changes of internal pressure by temperature changes inevitable due limited flexibility of dilatation compensators
- dangerous release of gases from the oil possible
- if defective, irreparable in situ
- high repair costs
- fault gases cannot freely escape the transformer
- retrofit of old transformers impossible
- generally suitable only for small transformers

## 4. TRAFOSEAL

Description:

The hermetization is provided by a natural **„liquid “** barrier in the external TRAFOSEAL tank situated between the main tank and the conservator.
The hermetization element represents here a horizontal temperature stratification layer(s), spontaneously created on the boundary between the cold and hot oil.
The stratification layer acts here as a „virtual“ membrane between the cold (contaminated) oil from the conservator and hot (protected) oil from the main tank.
The dilatation of the oil filling is automatically, without any pressure peaks, compensated by the vertical shift of the stratification layer in the TRAFOSEAL tank.

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Advantages:

- good hermetization effect
- relatively low aquisition price
- unlimited service-life (hermetization element - the stratication layer is virtually undestructible because it is inherently self-reparable)
- maintenance not necessary
- supervising not necessary
- no consumables
- no strong changes of internal pressure due temperature changes
- no dangerous release of gases from the oil due pressure changes
- fault gases can freely escape from the transformer
- easy retrofit of old transformers
- generally suitable for any kind or size of a transformer

Disadvantages:

- a potential „perforation“ of the TRAFOSEAL.
  *The TRAFOSEAL can be „perforated“ only by a very strong dynamic temperature change which exceeds its dimensioning.*
  *The dilatation of the oil filling is then so strong that the stratification layer is simply forced out of TRAFOSEAL tank and the transformer behaves itself, for a very limited time-period, as an open one.*
  *After the stabilization of operational temperature the stratification layer is then, as a pure natural phenomenon, immediately and spontaneously re-created and the hermetization effect of the TRAFOSEAL is fully restored*.

Conclusion:

The hermetization of power transformers should generally prolong the service life and improve the operational reliability , especially of heavily loaded units , e.g. oven or block transformers.
The corresponding hermetization methods have to , therefore , radically decrease the intensity of the oxidation ageing and especially the ageing of cellulose insulants , by means of a radical decrease of the O2- and H2O external contamination.

All the above mentioned methods are able to do the hermetization job, but their comparison clearly shows that only the TRAFOSEAL embodies maximum advantages and minimum drawbacks due its simplicity , and the suitable utilization of inherent physical features in the oil inventory.

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