

# Traction Transformer



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The traction transformer put the 110 kV AC voltage to a lower value that is appropriate for the traction rectifier. This lower value depends on the type traction transformer that is being applied.

So we distinguish the types A, B, C and D.

The traction transformers types A, B and C have an output voltage of 1326 volts.

Traction transformer type c has an output voltage of 1376V

## Building

We distinguish two different appearances of traction transformer namely:

-the traction transformer with two windings (types A and C);

-the traction transformer with three windings (types B and D).

The traction transformer with two windings forms in combination with one three-phase

rectifier bridge a 6-pulsed traction group with a stream of 2300 A (type A) or 1700 A

(type C). The traction transformer with three windings, together with two three-phase

rectifier bridges a 12 pulsed traction group with a stream of 2300 A (type B) or 1700 A (type D).

The traction transformer (types A, B, C and D) is made up of:

-a transformatorbak;

-a core (windings);

-a measuring and protective device

## Transformer case

The transformer case is an oil-filled container in which a core with core and windings (coils). On the outskirts of this transformatorbak the rest transformer cover. On the transformer cover are the operation of the PTO switch, measuring and protective device, feed-through insulators and sometimes a Curator with air dryer.

On the side of the transformatorbak are the feed-through insulators (high voltage) and the traction transformer coolers. The coolers are equipped with cooling channels that the heat losses in the traction transformer transfer to the ambient air through natural circulation (ONAN).

## Interior

The cartridge of the traction transformer is through hanging rods fixed to the transformer cover.

The Interior consists of a magnetic circuit with two or three windings. These windings are made up of a high-voltage winding and low-voltage winding

The magnetic circuit of the traction transformer consists of three cores with an under-and bovenjuk.

To each core is a high-voltage and low-voltage concentric winding

The high-voltage and low-voltage windings are made, depending on the type of traction transformer in Star or triangle switched '

The high-voltage winding of the transformer is equipped with traction of branching off and a PTO switch.

This allows the voltage range of the traction transformer limited be arranged. The control of the PTO switch is on top of the transformer cover.



### **Measuring and protective device**

To the traction transformer to guard against errors in the traction transformer, this equipped with a measuring and protective device.

To the measuring and protective device include the gasrelay, the topolie temperature relay, oil level gauge, pressure switch and pressure relief valve. The measurement and safety equipment is located mainly on the transformer cover.

### **Description and operation**

This section describes the operation of the various components of the traction transformer.

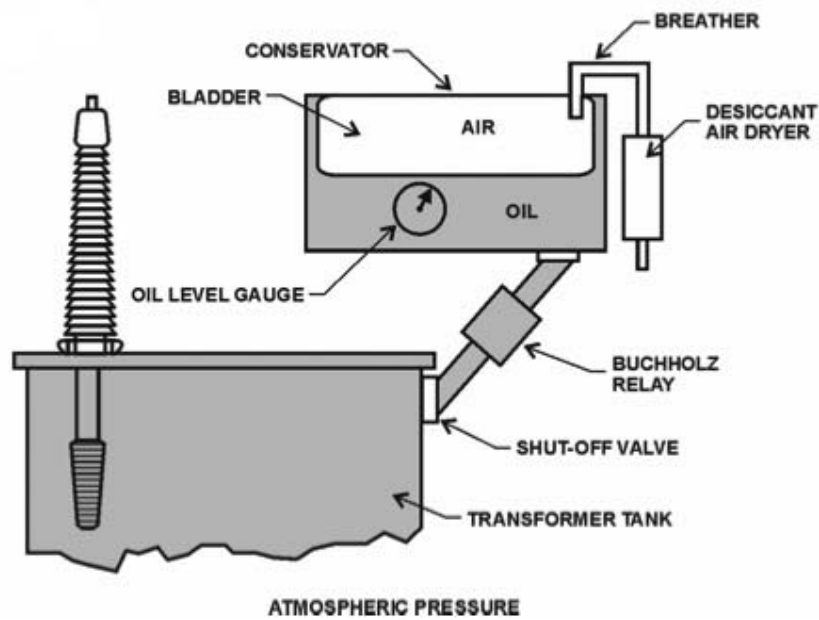
We distinguish between two different designs, namely the traction transformer with an oil barrel (curator) on the transformer cover and the traction transformer without conservator. Come up for discussion:

- the traction transformer with conservator
- the traction transformer with nitrogen filling
- the PTO switch;
- measuring and protective device.

## Traction transformer with conservator

The traction transformer is filled with oil. The oil volume in the traction transformer changes with the temperature of the oil.

The temperature of the oil is again depending on the load of the traction transformer and the ambient temperature. When the traction transformer is taxed increases the oil level. When the load is decreasing drops the temperature drops and the oil level in the traction transformer.



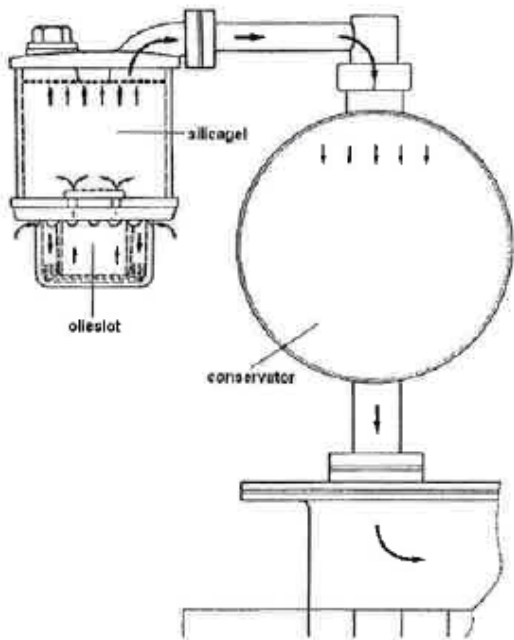
prevent water vapor in the oil is included in an air dryer on the curator connected.

When the load decreases the temperature of the oil drops and creates a vacuum in the conservator. The air is through the oil slot (in the space below the screen) of the air dryer sucked in and flowing through the sieve and the silica gel crystals to the space above the oil mirror of the curator.

The silica gel crystals absorb the moisture from the air. If this does the load on the transformer decreases the air driven out through the air dryer.

## Traction transformer with nitrogen filling

At the traction transformer with stikstofuulling is missing the curator with air dryer. The traction transformer is completely closed from the outside air and above the transformatorjuk with windings filled with oil.

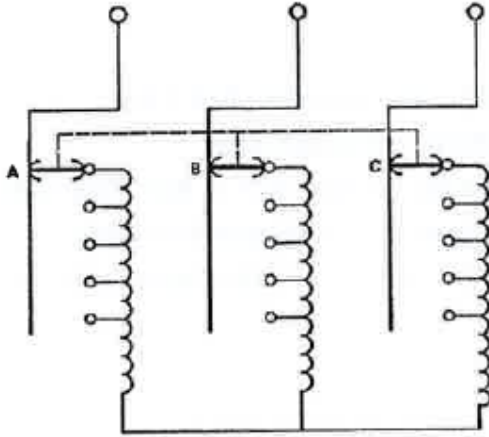


Above rises the expansion Chamber that is filled with nitrogen. At an increase in temperature increases the oil level in the traction transformer and takes the space available to the nitrogen. Because nitrogen the property is that it can shrink the pressure in the traction transformer virtually remain constant.

### PTO Switch

Aspects of the traction transformer with conservator if the traction transformer with stikstofuulling are equipped with a PTO switch . Through the PTO switch traction transformer the transfer ratio is limited. The PTO switch controls the number of windings on the high voltage side or the primary side of the traction transformer. Traction transformer can be adapted to the varied and it is possible to realize a better tax distribution.

The PTO switch has five positions. The State of the PTO switch may only in de-energised state of the traction transformer be changed. The control range of the PTO switch depends on the voltage and the type of traction transformer offered.



### Measuring and protective device

The measuring and protective device of the traction transformer with conservator consists of:

- gasrelay;
- topolie temperature relay;
- oil level meters;

The transformer with nitrogen fill has the added protections:

- pressure switch;
- pressure relief valve

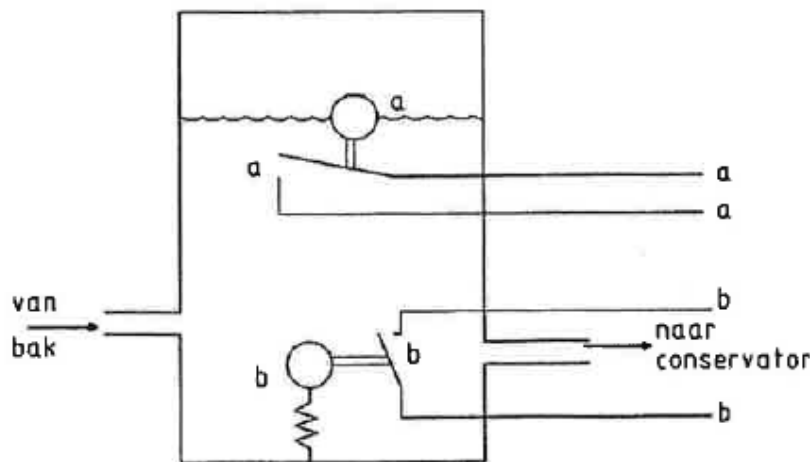
The following is a description of the measurement and safety equipment of the traction transformer.

### Gasrelay

The gasrelay or Buchholzrelais is located between the transformatorbak and the curator. The gasrelay reacts to gases in the transformer created as because of errors in the transformer. Examples of errors that may occur are faulty insulation, reduced breakdown resistance of the oil or oil leakage.



The gasrelay is equipped with two floats and two make contacts. Errors in the traction transformer with a low gas evolution collects the gas in the upper section of the gasrelay. The collected gas expresses the oil level in the gasrelay down. This will float A drop and the no contact A close.



In the event of a serious error with large gas production gas flows from the left pipe and will float b to the right. As a result, the no contact closes when closing this contact b. follows a switch-off command of the circuit breaker of the traction group. To the gas present in the gasrelay to escape is the gasrelay its venting screw.

## Topolie temperature relay

All traction transformers are equipped with a topolie temperature relay. The temperature relay speaks to a high oil temperature. At a temperature above a set value ( $110^{\circ}\text{C}$ ) switches the temperature relay of the circuit breaker the traction group from



## Oil Level Gauge

All traction transformers are equipped with oil level gauge. the oil level meter speaks at by a minimum oil level in the tractietransformator . By the exceeding of this minimum oil level, the oil level meter connects the fortune switch of the tractiegroep out.

## Pressure switch

The traction transformer with nitrogen fill has the added security is a pressure switch. By a defective in the traction transformer increases the temperature of the oil and the oil level. Also the gas pressure increases by gas evolution in the traction transformer.

Because the amount of gas in the expansion chamber increases and the available space for the gas decreases, such a pressure increase that pressure switch appeals to. Addressing the pressure switch gives a shutdown of the traction group.





## Pressure Relief Valve

Apart from the pressure switch, the traction transformer with nitrogen fill pressure relief valve as extra security. The pressure relief valve to speak at too high gas pressure in the traction transformer. The too high gas pressure through the pressure relief valve blown off. Addressing the pressure relief valve does not shut off by the traction group.

## History

The first traction transformer was provided with a curator with air dryer. The traction transformer was in a separate room in the substation. From 1949 (after electrification in Brabant and Limburg) were the traction transformers outdoor next to the substation.

The guard got traction transformer cores for the insulators and cable connections. From 1970 the traction transformer with nitrogen fill applied. The silica gel in the air dryer was originally blue and discolored when moisture absorption to pink.

Because of cobalt in the silica gel was silica gel to environmental reasons replaced by another kind of silica gel. This silica gel discolours at moisture absorption from Orange to white.

The ability of the traction transformer is over the years related to the increasing power demand is greater. The first traction transformer had a ability of 2.0 MVA or 2000 kVA. Then followed the traction transformer with a ability of 3 MVA and 4 MVA. The latest types of traction transformers have a ability of 3.3 and 4.4 MVA MVA.