



OTEF

Voltage Transformers 36 kV to 362 kV

GE manufactures a complete range of high voltage oil-filled voltage transformers (VTs). OTEF is a tank-type potential transformer with post insulator.

Thousands of Grid Solutions' voltage transformers are in service worldwide, some for more than 30 years. In all types of climates and under the most severe conditions, they give full satisfaction to the most exacting customers.

Design

GE's design incorporates a primary coil housed in the tank at the unit's base. Internal insulation is provided by hermetically sealed oil and oil-impregnated paper system. Outer insulation consists of a post-type insulator.

High Quality Paper-Oil Insulation

The insulation paper is applied mechanically using special machines, ensuring a homogenous, high-density paper insulation. Defined grading layers with field-optimized electrode rings achieve a uniform field distribution along the insulator between line and ground. Most of the insulation is from Kraft paper.

The coil insulation is a closed style design resulting in a compact unit with good dielectric withstand characteristics. Surge arrestors are not necessary.

High quality mineral oil with aging stability and gas-absorbing properties is used. The oil meets IEC 60296 and IEEE C57.106 requirements and contains no PCBs. Controlled vacuum and temperature treatments withdraw humidity and gas from the paper insulation and insulation oil. The impregnation process results in a high-grade dielectric system.

Built for Long Life

OTEF is built based on Grid Solution's quality and technology. It is designed for system voltages up to 362 kV.

Long life insulation integrity is assured by a metallic diaphragm assembly that hermetically seals the oil from the atmosphere. All external parts are manufactured from corrosion-resistant material. No painting is required.

Key Benefits

- Extensive field experience
- Operational security
- Easy installation – no special tools required
- Leak proof design and rugged construction for long service life
- Maintenance free





Insulator

The outer insulation is manufactured from high-quality aluminum oxide porcelain in RAL brown or ANSI grey. Composite insulators are available on request.

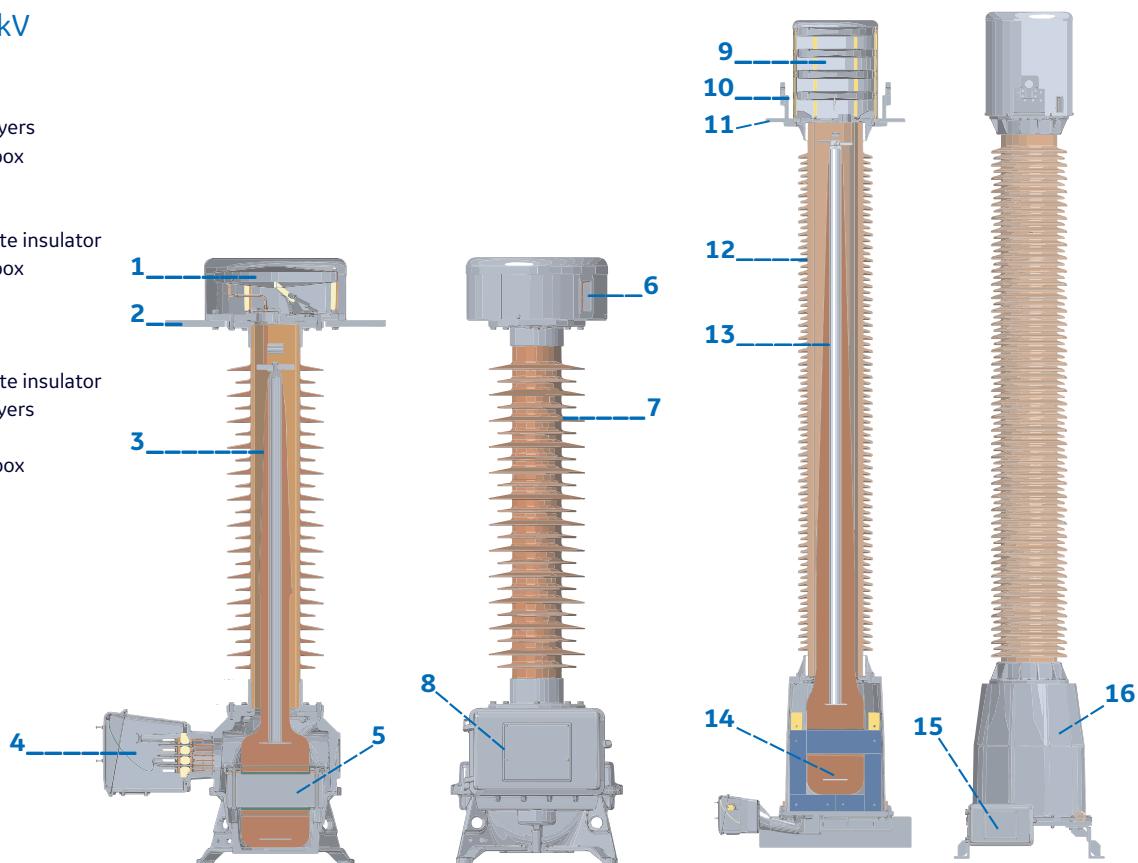
Windings and Ratings

During the winding of the primary coil, the double-enameled copper wire is continuously monitored by an electronic detector seeking faults in the insulation varnish. One or two secondary windings can be provided for metering and protection purposes, and optionally a separate winding can be supplied for ground fault detection. A double ratio achieved by a secondary tap is standard.

All IEEE accuracy classes or to other standards for metering and protection purposes can be provided. Accuracies beyond the requirements of normal standards like 0.15% Z can be provided.

OTEF 36 to 362 kV

- 1 Expansion bellow
- 2 Primary terminal H1
- 3 Capacitive grading layers
- 4 Secondary terminal box
- 5 Core / coil assembly
- 6 Oil-level indicator
- 7 Porcelain or composite insulator
- 8 Secondary terminal box
- 9 Expansion chamber
- 10 Lifting eye
- 11 Primary terminal
- 12 Porcelain or composite insulator
- 13 Capacitive grading layers
- 14 Core/Coil assembly
- 15 Secondary terminal box
- 16 Transformer tank



Secondary Terminal Blocks

The terminal box is spacious and can accommodate all required connections. The secondaries of windings are brought out through an oil/air seal block assembly and terminated on separate terminal blocks with 8-32 screws. Other terminals on request.

An aluminum gland plate is provided to accommodate customer conduit hubs. The door can be made lockable on request.

The neutral end of the primary winding is terminated in the secondary box. It is grounded with a lead and can be used to perform on site tests up to 4 kV.

Thermal Burden Rating

The thermal burden rating is 3,000 to 7,500 VA (please see table on the last page). The VT can sustain that load continuously, however cannot be used for metering during the same time.

Hermetic Sealing System

The active part of the transformer is hermetically sealed. Changes in oil volume, resulting from temperature variations, are compensated for by one or more stainless steel expansion chambers. Movements in the compensation system are registered by an oil level indicator located behind a window in the transformer head. Effectively oil maintenance, change or inspection is eliminated and the VT operates pressure free. All seals are formed by single piece O-Rings in fully machined grooves. All housings are helium leak tested before using in the manufacturing process. An overall leak up test is performed on every completely assembled VT prior to oil filling.

Optimal Protection Against Bursting

Optimized insulation structures and appropriate mechanical designs ensure a long life and high quality insulation. The following additional measures are taken to prevent the insulator from bursting in the event of an inner insulation breakdown (e.g., in case of lightning strikes):

- The active part is located below the insulator in an aluminum tank
- There is an internal fault current connection between the primary terminal and the primary winding. This connection can withstand the full short circuit current for one second
- The capacitive grading in the high voltage insulation is designed to withstand transient overvoltages to be expected during service life.
- A pressure relief plate is located in the area of the expansion assembly on the top
- Upon customer request: a composite insulator consisting of a fiberglass reinforced tube and silicone rubber sheds can be supplied.

Service Life and Maintenance

OTEF voltage transformers have been designed for a 30 year plus life-time. They have no specific maintenance requirements and no painting is required:

- All hardware is made of stainless steel
- Housings are made of marine grade aluminum alloy.
- Porcelain fittings are made from cast iron and hot dip galvanized.

Besides regular transformer surface cleaning, no routine maintenance is required. The hermetic seal alleviates the need for oil sampling or moisture checks unless unusual operating conditions occur.

Transportation and Installation

OTEF can be transported and stored horizontally. Vertical transportation is possible for lower voltage units depending on the permitted transportation height. The OTEF is supplied ready for energizing. No special tools are required to connect to the system. Instruction manuals are provided with the units.

Additional Information

Rating plates are made from metallic anodized weather-proof aluminum or etched stainless steel.

Ambient Temperature

-40 °C...+40 °C on a 24 hour average.

Other values are available on request

VT up to 362 kV can be provided meeting seismic requirements per IEEE 693. Other values possible on request.

Transient Overvoltages

All VT's are designed for a standard overvoltage factor of 1.2 continuous and 1.73 for one minute (below 245 kV) and 1.4 for one minute (245 kV and above). Other values on request.

Frequency

60 Hz. Other values on request.

Radio Influence Voltage (RIV)

Tested to ANSI/NEMA C93.1.

Dielectric Loss Factor

Tan δ smaller than 0.005 up to the power-frequency test voltage.

Inner Partial Discharge

- Less than 10 pC at 1.2 U_m

- Less than 5 pC at 1.2 $U_m / \sqrt{3}$

Mechanical Strength

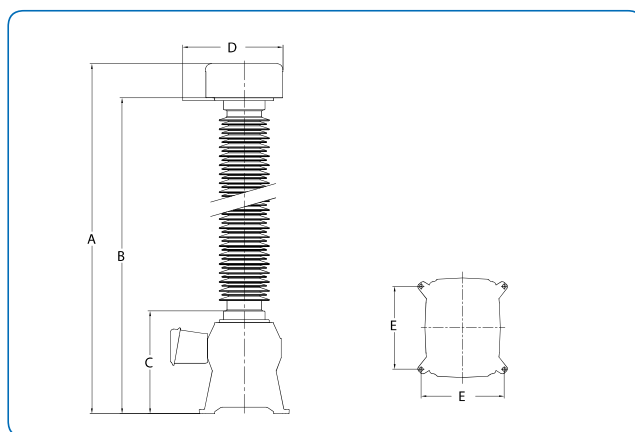
According to IEEE C57.13.5. Other values on request.

Dimensions

The following dimensions refer to standard versions. Other Um or BIL values affect the dimensions. The size of the base tank might change with higher output requirements and/or frequencies smaller than 60 Hz. Creepage and insulator strike distances can be adapted to customer's needs.

Type		OTEF 36		OTEF 48		OTEF 72		OTEF 123		OTEF 145		OTEF 170	
Highest voltage for equipment (U _m)	kV	36.5		48.3		72.5		123		145		170	
Lightning impulse withstand voltage (BIL)	kV	200		250		350		550		650		750	
Thermal Burden	VA	3000		3000		3000		5000		5000		5000	
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
Minimum creepage distance		1813	71.4	1813	71.4	1813	71.4	3150	124.0	3750	147.6	4583	180.4
Dimensions	A	1501	59.1	1501	59.1	1501	59.1	1881	74.1	2121	83.5	2531	99.7
	B	1310	51.6	1310	51.6	1310	51.6	1690	66.5	1930	76.0	2283	89.9
	C	566	22.3	566	22.3	566	22.3	566	22.3	641	25.2	758	29.8
	D	576	22.7	576	22.7	576	22.7	576	22.7	576	22.7	950	37.4
	E	450	17.7	450	17.7	450	17.7	450	17.7	450	17.7	500/600	19.7/23.6
		kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
Total weight (approx.)		235	518	235	518	235	518	265	585	335	739	552	1216
Oil volume (approx.)	gal.	10.0		10.0		10.0		11.3		14.8		37.8	

Type (Continued)		OTEF 245		OTEF 362	
Highest voltage for equipment (U _m)	kV	245		362	
Lightning impulse withstand voltage (BIL)	kV	1050		1300	
Thermal Burden	VA	5000		5000	
		mm	in	mm	in
Minimum creepage distance		6300	248.0	10418	410.2
Dimensions	A	3116	122.7	4507	177.4
	B	2868	112.9	4013	158.0
	C	758	29.8	1240	48.8
	D	950	37.4	950	37.4
	E	500/600	19.7/23.6	900	35.4
		kg	lb	kg	lb
Total weight (approx.)		590	1300	1180	2602
Oil volume (approx.)	gal.	41.7		106.0	



Inquiry Check List

- Applicable standards
- Rated frequency
- Highest system voltage
- Power-frequency withstand test voltage
- Lightning impulse test voltage
- Switching impulse test voltage, if applicable (above 245 kV)
- Overvoltage factor (eg. 1.73 U_n 1 min)
- Voltage ratio
- Number of secondaries

- Accuracy class and rated burden for each secondary winding
- Thermal burden
- Required creepage distance in mm or in mm/kV
- HV terminal (material and dimensions)
- Composite insulator (light grey)
- Environmental conditions (altitude, temperature, site pollution, seismic conditions...)
- Secondary terminal box heater or fuses
- High voltage and ground connectors
- Options as required

For more information please contact
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