

**TRADITION** - MANUFACTURING INSTRUMENT TRANSFORMERS SINCE 1947

**EXTENSIVE SERVICE EXPERIENCE** - OVER 5.000 CTVT UNITS INSTALLED WORLDWIDE

**INNOVATION** - UNIQUE AND ORIGINAL DESIGN

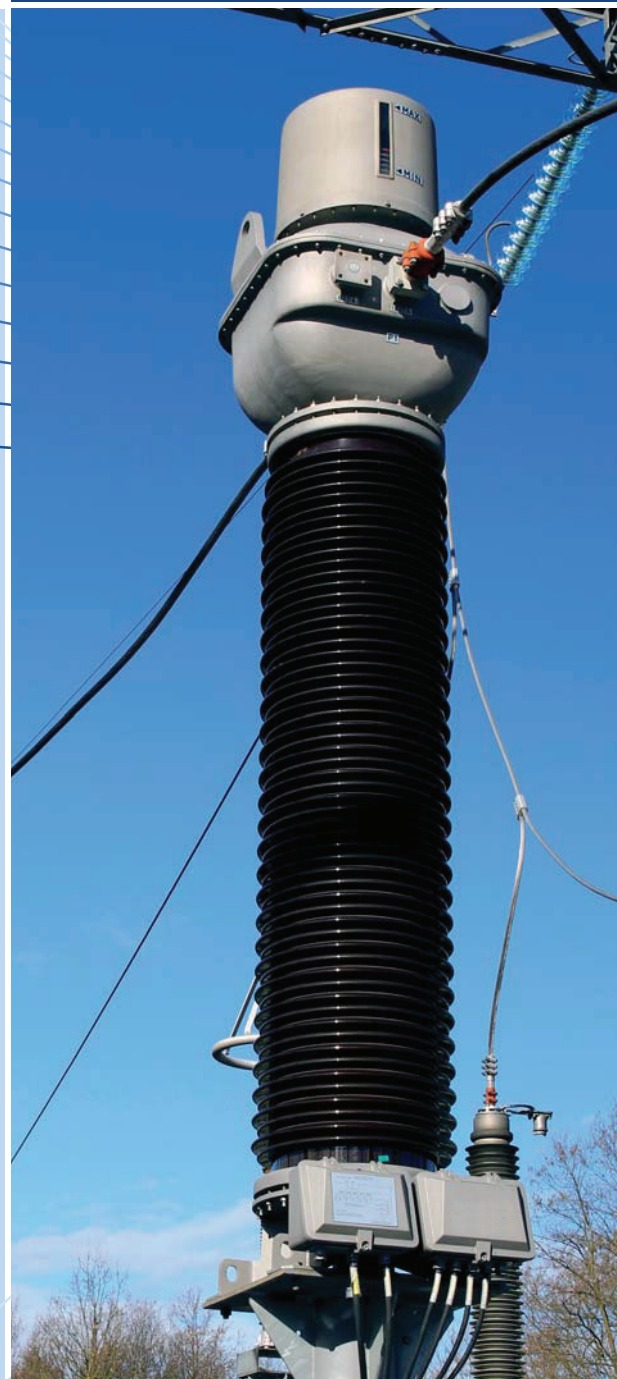
**FLEXIBLE DESIGN** - READINESS AND WILLINGNESS TO COMPLY WITH CUSTOMER REQUIREMENTS

**LONGEVITY AND RELIABILITY** - DESIGNED FOR AT LEAST 50 YEARS OF SERVICE LIFE

## CTVT

### COMBINED INSTRUMENT TRANSFORMERS

72,5 to 550 kV





### Accessories

- Terminal for measuring dielectric dissipation factor ( $\tan\delta$ )
- Oil level indicator
- Fuses or Micro Circuit Breakers (MCB) for secondary winding protection (optional)
- Revenue metering secondary terminals can be separately sealed
- Transport shock indicators (standard for  $U_m \geq 362$  kV, optional for other voltage levels)
- Internal overpressure indicator (optional)

### Application

The combined instrument transformer essentially consists of two measuring units: the inductive voltage transformer and the current transformer.

Combined instrument transformers are used to step-down current and voltage to defined values, and thus provide standardized, useable levels of current and voltage in a variety of power monitoring, measurement and protection applications while insulating the measurement and protection equipment from high system voltage.

### Performance

- $U_m$ : 72,5 to 550 kV
- $I_n$ : up to 6000 A
- Short circuit: up to 100 kA ( $I_{dyn}$ : 250 kA peak)
- Secondary cores: up to 10
- Secondary windings: up to 6
- All metering and protection classes

### Main Features

- High quality paper-oil insulation
- Partial discharge free on power-frequency withstand voltage
- High-precision measurement accuracy and protection classes with superior transient response
- Stainless steel bellows oil expansion system
- Sealing for life - every single transformer is vacuum tested with helium
- Nitrogen free
- Standard ambient temperatures from -35 to +40 °C (extreme ranges upon request)
- High quality porcelain or composite (silicone shed) insulator
- Extensive experience in seismically active regions
- Minimum oil design and PCB free - environment friendly
- Non-corrosive hardware
- Maintenance free
- Explosion-safe design
- Space and cost savings

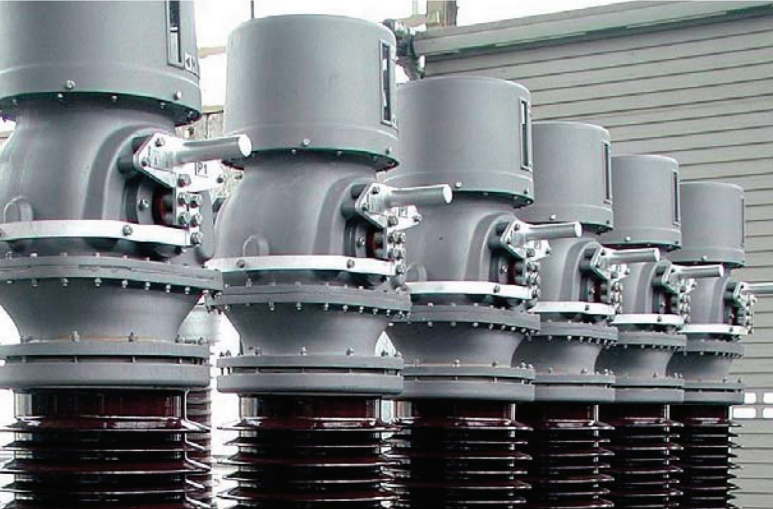
### Current Transformer

- Top core design - ensuring low primary winding losses
- Primary and/or secondary transformation ratio selection
- Low leakage reactance type

### Voltage Transformer

- Unique design with an open type magnetic core - ensuring ferroresonance immunity
- High thermal burden - up to 2500 VA with standard design, higher ratings on demand
- Fault-resistant primary winding design





## Voltage Transformer

The magnetic core is made of stacked silicone steel sheets. The open core (single limb) ensures a linearized transformer magnetizing characteristic and thus eliminates the possibility of ferroresonance within the power system.

Secondary windings are wound with high-grade enamelled copper wire directly onto the core, ensuring uniform flux density along the core height as well as phase displacement compensation. Furthermore, the large winding cross-section makes it capable of withstanding a secondary short circuit, thus contributing to transformer safety.

One of the significant advantages of the open core design lies in having the primary winding composed of multiple independent and insulated sections uniformly stacked vertically along the transformer height. This ensures controlled distribution of dielectric stress on internal and external insulation as well as excellent cooling properties which allow for high thermal outputs.

Being composed of independent and insulated sections, the primary winding is explosion safe. In an unlikely case of a between-turns or between-layers failure within primary winding, fault remains localized to only one section and cannot spread to the entire primary winding. This ensures inherent explosion safety of CTVT combined transformers.

## Paper-Oil Insulation

The high voltage primary side is insulated from the low voltage secondary side by means of oil impregnated paper of high dielectric strength. The open-core type voltage transformer allows for a design in which the current and voltage active parts both use the same paper-oil insulation.

At first, a substantial number of semi-conductive capacitive screens are inserted into the layers of paper insulation so as to adequately distribute the high-frequency overvoltages. The paper insulation is then dried in high vacuum and impregnated with high grade inhibited and degassed (moisture content of no more than 2 ppm) mineral transformer oil. We guarantee the oil in our transformers not to contain polychlorinated biphenyls and terphenyls (PCB & PCT).

The paper-oil insulation is closed in and hermetically sealed off from ambient air by means of a stainless steel bellows. The stainless steel bellows compensates the thermal oil expansion and thus also serves as an expansion mechanism and an oil level indicator.

All of the above ensure excellent and long lasting dielectric properties of the transformers main insulation.

## DESIGN

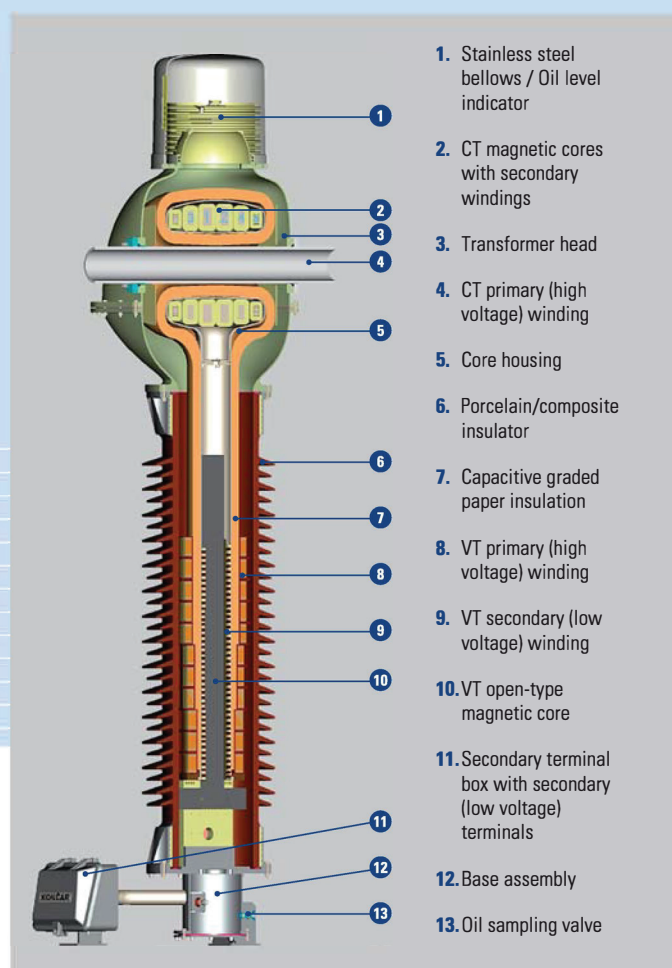
### Current Transformer

The active part of the top core current transformer comprises of wound toroidal cores, an aluminium or copper primary winding passing through them and paper insulation. As such, the top core transformer has its minimal length primary directly cooled by oil inside the transformer head and, unlike in other design types, it only has the low voltage part insulated in paper. Another benefit of this design is that local saturation is avoided and minimal losses and leakage reactance are ensured.

Variable transformation ratios are achieved through reconnection on either the primary (HV) and/or secondary (LV) side.

The transformer can accommodate several independent cores of various size and material type. The cores can, depending on required accuracy class, be made of cold-rolled grain-oriented magnetic steel, soft magnetic materials and nanocrystalline alloys. The cores and secondary winding reside inside an aluminium cast protective housing which is designed to safely lead the fault current to ground without danger of an arc occurring within the external insulator.

### Cross-section Drawing



## Insulator

As per request, the external insulation can be either porcelain or composite. The porcelain insulators are made of highest quality C130 aluminous porcelain, while the composite insulators are composed of a glass-fibre reinforced resin tube and silicone rubber sheds.

The insulator creepage distance is based on ambient air pollution and is to be quoted in the inquiry.

The **CTVT** combined transformer has been seismically tested and meets all of the IEEE Standard 693-2005 requirements.



## Housing

The transformer housing consists of a base, insulator, head and bellows cover.

The current active part is located inside the aluminium cast head which is designed in such a way so as to achieve minimal oil capacity.

During production, before the oil-filling process, a vacuum sealing test is performed on every transformer, ensuring perfect hermetical sealing of the enclosure.

The transformer base is made of high quality steel, which is hot dip galvanized and additionally painted for long-lasting corrosion resistance, or of cast aluminium. The secondary terminal boxes are located on it, along with various other accessories, such as name plate, oil sampling and filling valve, lifting lugs, earthing terminals and an optional oil overpressure indicator.

Earthing terminal size and type are to be defined in the inquiry. The standard connection is screw type (M12 x 35) or a stranded copper conductor clamp.

## Terminals

The primary terminals are made of aluminium or, alternatively, of corrosion protected (tin or silver plated) electrolytic copper. The terminal shape and type are both designed according to the current ratings and applicable standards, unless specified otherwise in the inquiry.

Standard secondary terminals are M8 in size and are of the threaded bolt type. They are made of stainless steel. Other terminal types, materials and dimensions are available on request.

The secondary terminals, along with protective devices and tariff terminal sealing, reside in the secondary terminal boxes. Cable glands or plates provide entry to the box and are designed in accordance with customers needs.

## Dimensions

Type	Maximum System Voltage	Total Height	Terminal Height	Total Weight	Oil Weight	Base Mounting	Minimal Creepage Distance
	kV	mm	mm	kg	kg	mm	mm
CTVT-72,5	72,5	2500	1900	500	85	520x520	1815
CTVT-123	123	2550	2100	520	85	520x520	3075
CTVT-145	145	2700	2200	550	105	520x520	3625
CTVT-170	170	3100	2400	660	160	520x520	4250
CTVT-245	245	3720	3120	900	220	520x520	6125
CTVT-300	300	3900	3300	1100	250	520x520	7500
CTVT-362	362	4700	3860	1300	330	520x520	9050
CTVT-420	420	5330	4550	1600	400	650x650	10500
CTVT-525	550	6150	5170	2500	600	650x650	13750

The given indicative values refer to our standard porcelain versions and vary depending on electrical, mechanical and environmental parameters specified in the customers' inquiry.

The values are susceptible to change in the course of technical developments.