



Grid Solutions
a GE and Alstom joint venture

KOTEF

Combined CT/VT

72.5 to 420 kV

The KOTEF is designed to provide both current and voltage measurements from a single device.



Design and advantages

As with separate transformers, the current transformer part is located in the head housing and the voltage transformer part in the base tank. The bushings between high-voltage potential and ground potential are arranged in opposite directions inside the insulator. The base dimensions remain the same as a voltage transformer of the same nominal voltage.

The CT and VT functions are fulfilled within a single unit. KOTEF utilizes the same components as the individual CTs and VTs. Both transformers are combined in a single metering unit and are available in porcelain or composite. This is an excellent solution for adding metering capability to either a new substation installation or a site being upgraded where space is at a premium. Consequently, considerable cost savings are realized in the initial purchase price, transportation, real estate and installation labor and materials compared to the equivalent costs of two separate transformers. The KOTEF Line combines the advantages and design features of the OSKF and OTEF lines.

MAIN FEATURES

- Metering and protection
- Characteristics:
 - High quality paper-oil insulation
 - Oil expansion and hermetic seal by stainless steel diaphragm bellows
 - Oil level indicator
 - Cores in heavy walled aluminum housing
 - Changing of primary ratio by primary connection (single, double or quadruple ratio) or by secondary taps
- Seismic designs available
- Compliance with ANSI/IEEE standards, other standards on request.

LONG SERVICE LIFE AND NEAR ZERO MAINTENANCE

Insulation integrity is assured by the fact that the oil is hermetically sealed from the atmosphere by a metallic diaphragm assembly.

All external parts are of corrosion-resistant material. Therefore, regular painting is not required. KOTEF has been designed for a 30 years plus lifetime.

CUSTOMER BENEFITS

- Price advantage
- Space savings: only one base
- Cost savings on transportation and installation
- Reduction in Inventory
- Protection against bursting
- Maintenance-free



A full range of global expertise to meet your specific and exacting challenges.

CURRENT TRANSFORMER DESIGN

Head type design, with active parts in the head. The primary is normally a straight bar type conductor with low inductance. Therefore primary surge protection is not required. Ratio change can be accomplished either by primary bar series-parallel connection (single, double or quadruple ratio) or by secondary taps. Combinations of series-parallel connection and secondary taps are also possible. The head type design also has the advantage of spreading the primary flux uniformly and symmetrically through the cores, avoiding local saturation and reducing the leakage flux.

Current transformers can have several toroidal laminated cores which are independent of each other. Cores with secondary windings are accommodated in a thick-walled, core made of aluminum.

The core housing is mounted on a heavy gauge metal tube inside the insulator which leads to the base plate. Cross sections and connections have been dimensioned in such way that the current can be led to ground in the event of a short circuit, without an arc occurring in the area of insulator.

VOLTAGE TRANSFORMER DESIGN

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 are available.

Thermal burden

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.

Overvoltage factor

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

RATED CURRENTS

The maximum primary rated current is 5,000 A. The secondary rated current is 5 A. Other ratings like 1 A on request. Metering units have typically only one or two independent secondaries (cores), however per request up to 6 cores including for protection can be fitted.

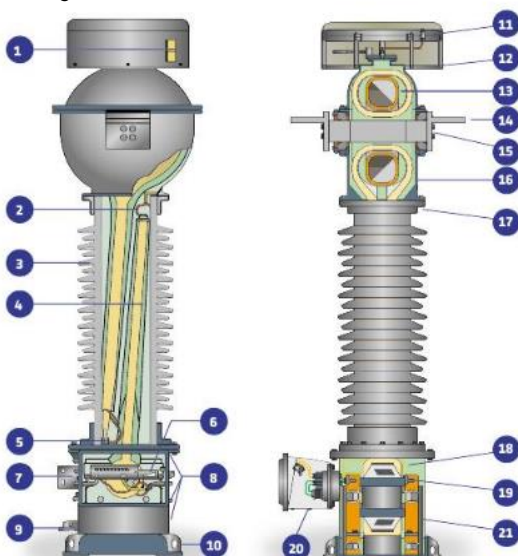
TRANSFORMATION RATIO CHANGE

- Primary reconnection at the ratio of 1:2 (max. 4,800 A)
 - Series connection up to 2,400 A
 - Parallel connection up to 4,800 A
- Primary reconnection at the ratio of 1:2:4 (max. 3,600 A)
 - Series connection up to 900 A
 - Series and parallel up to 1800 A
 - Parallel connection up to 3600 A
- Secondary taps available (multi ratio or dual ratio)

Combinations of the primary reconnection and the secondary taps are possible.

THERMAL AND DYNAMIC RATING

An advantage of the head design is that the primary current takes the shortest path through the CT portion. As a result, a high thermal and dynamic short-circuit capability is achieved: max. 150 kA for one second, dynamic current of max. 375 kA.



KOTEF 72.5 to 420 kV

1. Oil Level indicator
2. Potential connection
3. Insulator
4. Capacitive graded bushing
5. Ground connection
6. Secondary terminals
7. Ground pad
8. Aluminum bases tank, cover plate and terminal box
9. Oil sampling valve
10. Lifting eye (4 x)
11. Stainless steel oil expansion chamber
12. Aluminum flange and cover
13. CT core
14. Primary terminal
15. Primary conductor
16. Core housing
17. Hotdip galvanized gray iron flange (composite insulators use marine grade aluminum flanges)
18. VT high voltage winding
19. VT low voltage winding
20. Access plate
21. Laminated core



HIGH QUALITY INSULATION

The insulation paper is applied mechanically, guaranteeing 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 to protect the KOTEF are not necessary. High quality mineral oil with excellent aging stability and gas-absorbing properties is used. The oil meets IEC 296 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.

HERMETICALLY SEALED

The KOTEF maintains a completely sealed and pressure free system through the use of a stainless steel metallic diaphragm assembly. The diaphragm assembly provides oil expansion and pressure compensation, protects the interior from air and moisture and preserves the dielectric strength of the CT-VT. The movements of the compensation system are registered by an oil level indicator which is visible behind a window fitted in the transformer head. Effectively oil maintenance, change or inspection is eliminated and the KOTEF operates pressure free.

Leakproof design

The head housing is made of corrosion-proof aluminum alloy. Every housing is subjected to a vacuum leak test by helium leak detection. An overall leak test is performed on every completely assembled unit before oil filling. All seals are formed by single piece O-Rings in fully machined grooves.

Primary terminals and grounding

Standardized primary terminals consist of flat busbar aluminum terminal pads with 4, 6, 8, or more holes depending on current rating.

Other terminal designs are available upon request. Two grounding pads on opposite corners of the base are provided.

Secondary terminal box

The terminal box is very spacious and has a re-movable plate located at the bottom which allows for in-factory or on-site drilling of the conduit entrances for the insertion of cable glands as desired. The secondaries are brought out through an oil/air seal block assembly and terminated on separate terminal blocks with 8-32 screws. Other terminals 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.

INSULATOR

The outer insulation consists of aluminum oxide porcelain in grey (ANSI 70). Standard creepage distances are available according to the dimension tables. Larger creepage distances and composite insulators are available on request.

PROTECTION AGAINST BURSTING

The optimized insulation structure and mechanical design ensure a high quality insulation for service lifetime. 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 parts are positioned in aluminum housings above and below the common insulator.
- Internal fault current connections are led through the insulator.
- 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 expansion assembly on the head.
- Upon request, a composite insulator consisting of fiberglass reinforced tube and silicone rubber sheds can be provided instead of the porcelain insulator.

TRANSPORT AND INSTALLATION

KOTEF can be transported and stored horizontally. Vertical transportation is possible for lower voltage units depending on the permitted transportation height. The KOTEF is supplied ready for energizing. No special tools are required for connection.

SERVICE LIFE AND MAINTENANCE

KOTEF 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. Housing are made of marine grade aluminum alloy.
- Porcelain fittings are made from cast iron hot dip galvanized.
- Angle brackets are made from steel 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.

ADDITIONAL INFORMATION

Dielectric loss factor

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

Radio Influence Voltage (RIV)

Less than 2500 μ V at 1.1 Um

Internal partial discharge

Less than 10 pC at 1.0 Um

Frequency

60 Hz. Other values on request

Ambient temperature

-40 °C ... + 35 °C on a 24h average. Other designs can be provided upon request for temperatures ranges falling outside of the mentioned range, i.e. -50 °C to + 50 °C

Mechanical strength

The service load (applied to the terminal in any direction continuously) is 650 lb., the short time load (impulse load like conductor whip) is 1595 lb. Other values upon request

DIMENSIONS

Except the ERCT line current transformers are for specific projects custom made products. The following dimensions refer to certain standard versions. Other requirements might effect the dimensions. The base tank size can vary based on transformer output

requirements and/or frequencies less than 60 Hz. The head size of the CT portion depends on the ratings of the cores, the primary current and the thermal short-time current. Other head sizes and longer creepage distances can be provided.

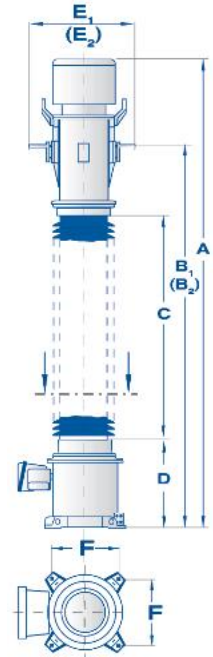
TESTING

Testing is in conformance with national, international and internal quality standards. When performing the power-frequency test, the dielectric loss angle, capacitance and the internal partial discharge level are measured as a routine test. Tests reports are provided with each unit.

DIMENSIONS

TYPE	KOTEF 72.5		KOTEF 123		KOTEF 145		KOTEF 170		KOTEF 245		
Head Size	SK2		SK2		SK2		SK2		SK2		
Maximum system voltage (Um)	kV	72.5	123	145	170	245					
Impulse test voltage (BIL)	kV	350	550	650	750	900					
Minimum creepage distance	mm	2,990	2,990	3,520	4,710	6,250					
	In	117.72	117.72	138.58	185.43	246.06					
Dimensions		mm	In	mm	In	mm	In	mm	In	mm	In
	A	2,547	100.3	2547	100.3	2895	114	3416	134.5	4043	159.2
	B1	2,057	81	2057	81	2273	89.5	2792	109.9	3280	129.2
	(B2)	2,199	86.6	2199	86.6	2413	95	2925	115.2	3412	134.3
	C	990	39	990	39	1115	43.9	1500	59.1	2000	78.7
	D	632	24.9	632	24.9	722	28.4	773	30.4	790	31.1
	E1	810	31.9	810	31.9	810	31.9	810	31.9	813	32
	(E2)	840	33.1	840	33.1	840	33.1	840	33.1	840	33.1
	F	450	17.7	450	17.7	450	17.7	450	17.7	600	23.6
	Total weight (approx.)	kg	603	603	750	917	1237				
Weight of oil (approx.)	kg	126	126	186	237	383					

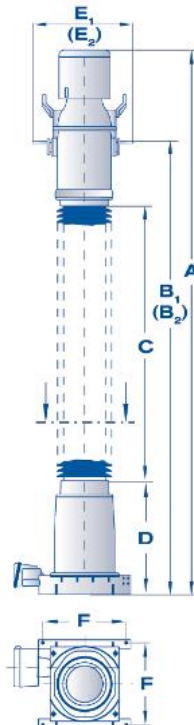
Indicative values only - All indicated dimensions must be confirmed with order. Other values on request



DIMENSIONS

TYPE	KOTEF 362		
Head size	SK3A		
Maximum system voltage (Um)	kV	362	
Impulse test voltage (BIL)	kV	1,300	
Minimum creepage distance	mm	11,590	
	ln	456.3	
Dimensions		mm	ln
	A	6,325	249
	B1	5,310	209.1
	(B2)	5,310	209.1
	C	3,361	132.3
	D	1,200	47.2
	E1	890	35
	(E2)	930	36.6
	F	900	35.4
	Total weight (approx.)	kg	1,676
Weight of oil (approx.)	kg	683	

Indicative values only - All indicated dimensions must be confirmed with order. Other values on request.



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