

SF₆ gas insulated instrument transformers

General description of SF₆ gas insulated instrument transformers for voltages from 100 kV to 800 kV

Technical characteristics common to all SF₆ gas insulated instrument transformers are briefly described on pages 16 and 17. Specific details of current, voltage and combined instrument transformers follow on pages 18 to 23.

Gas insulation (inner insulation)

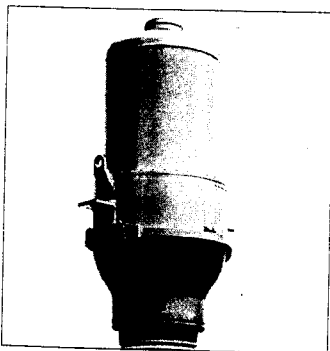
The inner insulation consists of SF₆ (sulphur hexafluoride). The high-voltage potential and the ground potential are formed with round electrodes with smooth surfaces. The production and assembly shops are clean rooms to avoid degradation of the insulation caused by any particles.

Gas pressure

The minimum gas filling pressure for the insulation routine tests is 3,5 bar which is lowered to 1,5 bar for transport. Prior to the start of operation the unit is to be filled on site with the maximum operation pressure (3,5 ... 5 bar). The leakage rate is considerably lower than the permissible maximum of 1 % per year as specified in international standards.

Insulator (outer insulation)

Composite insulator consisting of a glass fiber reinforced resin tube with sheds of silicone rubber. The colour is light grey C 70 according to ANSI Z 55.1. Standard creepage distances in accordance to dimension tables. Larger creepage distances on request. Aluminum connection flanges are bonded to the insulator by means of a special thin-film-glueing.



Head housing of 245 kV combined instrument transformer

Housing

The head housing of the instrument transformer consists of a corrosion-proof aluminum alloy. It is manufactured and tested in compliance with required national pressure vessel standards. The routine test pressure amounts to approx. 12 bar, type tests are performed with 35 bar.

Gas-tightness, gas density control

All components are subjected to a routine tightness test performed with a helium leak detection device, followed by a routine pressure test. A special dual-type gasket system including single piece moulded O-rings provides an excellent gas-tightness. The density of the gas is checked by a temperature compensated density meter giving a visual control on the status of the transformer. The density meter can be equipped with alarm contacts for centralized control.

Protection against bursting

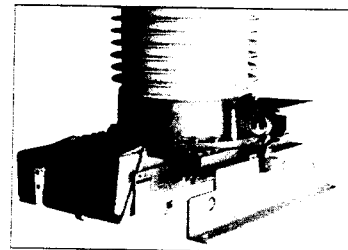
A metal rupture disk is located on the top of the head housing. In case of a powerful internal flashover, the sudden increasing pressure will release the rupture disk. Its releasing pressure of 9 bar considers a well calculated safety margin between an operation pressure of 5 bar and the routine test pressure of 12 bar.

Primary terminals

Standard versions of primary terminals consist of aluminum flat terminal pads with 4, 6, 8, or more holes for constant currents up to 5000 A. On request, single or double round terminals made of nickel-plated copper can be provided, as standard with a diameter of 30 mm and a length of 130 mm. Other customer specifications can be considered.

Base

At the base there are mounting brackets of hot dip galvanized steel. Terminal box and density monitor are mounted to the base plate.



Base with density monitor, mounting brackets and terminal box

Secondary terminal box

The terminal box is very spacious and has a removable plate located at the bottom which allows for in-factory or on-site drilling of the conduit entrances for the insertion of a number of cable glands, up to 4 units PG 29 or 1 1/2". The type of protection is IP 54 in accordance with IEC 529.

Rating plate

Each transformer is provided with a name plate of metallic anodized weather-proof aluminum or etched stainless steel.

Grounding

Each transformer is provided with two grounding connections with two or four 14 mm diameter holes. The ground pads are located on the left side of the terminal box and on the right at the base.

Coat of paint

Instrument transformers are maintenance-free without paint because:

- All hardware is made of stainless steel
- All metallic parts are corrosion-proof:
 - Housings, flanges and base plate are of seawater-resistant aluminum alloy.
 - Angle brackets are of hot-dip galvanized steel.

Upon request, a polyurethane coat of paint is provided, according to RAL 7033 (green-grey) or ANSI C 70 (light grey).

Radio Influence Voltage (RIV):

Less than 2500 μ V at 1.1 U_m

Inner partial discharge:

Less than 10 pC at 1.2 U_m
Less than 5 pC at 1,2 $U_m / \sqrt{3}$

Transient overvoltage:

Less than 1000 V related to $\frac{\sqrt{2}}{\sqrt{3}} \cdot U_m$

Frequency:

50 Hz, 60 Hz or 16²/₃ Hz.
Other values on request.

Ambient temperature:

-30 °C ... +35 °C on a 24 h average.
Other values are possible on request,
e.g. -50 °C ... +50 °C.

Mechanical stability:

Static test force, 1 minute (engaged in any direction on one primary terminal or in total on both primary terminals): 5000 N
Working load: 2900 N
Short-time load: 7100 N

Seismic withstand capability:

0.5 g
Higher value possible on request.

Specifications

RITZ manufactures according to all national and international standards, such as AS, CAN/CSA, IEC, IEEE, NBN, NEN, ÖVE, SEN, UTE, VDE and on request according to customers' special requirements.

Tests

In conformance with national and international standards. Along with the power-frequency test the capacitance and the inner partial discharges are also measured as routine tests. Test certificates are issued and supplied.

Transportation and storage

In the horizontal position (terminal box to the side). Transport in the vertical position is also possible depending on the permitted transport height, e.g. up to $U_m = 123$ kV.

Spare parts

Spare density meter and rupture disc are available.

Commissioning

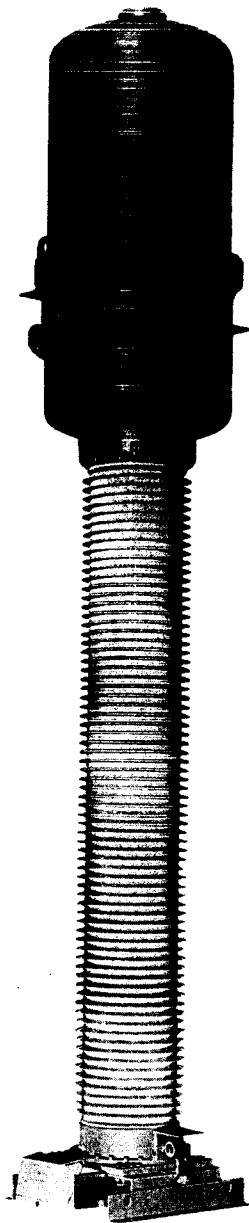
After delivery of the units to the site (with a transport pressure of 1,5 bar) and prior to energization, the gas pressure has to be increased to the operation pressure. Filling can be done by a RITZ service inspector or the client. Further commissioning tests are not required.

Operation and maintenance

Gas pressure monitoring of the instrument transformer is of significant importance for the trouble-free operation. For this purpose a temperature compensated density monitor at the base of the unit is provided which must be checked at regular intervals. The density monitor can be used for remote control and is equipped with contacts for different pressures. It should be inspected for proper calibration about every 5 years.

Combined current and voltage transformer

General description on pages 16 and 17.



Type KSKEF 420

Design

Current transformer and inductive voltage transformer are assembled in the same way as the single units but with one common composite insulator. Both active parts are located in the head housing, with the voltage transformer above the current transformer part. The base dimensions are the same as with current and voltage transformers of the same nominal voltage.

All characteristics such as

- insulation (SF₆ gas)
- mechanical stability
- electric data
- protection against bursting
- service life
- transport, etc., etc.

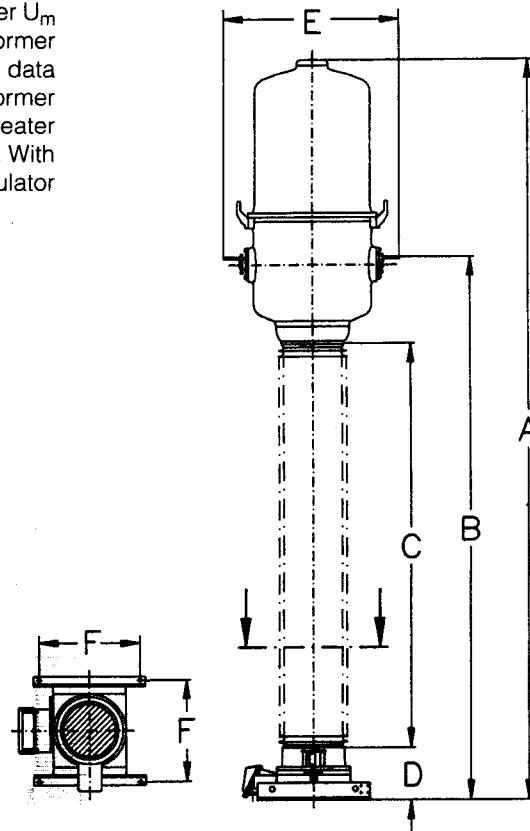
are the same as with the individual transformers which are described on the previous pages.

Advantages of combined units compared with separate current and voltage transformers

- Price advantage
- Saving on space : only one base
- Saving on assembly
- Saving with the primary terminal
- Simplification of the secondary wiring
- Keeping a spare
- Saving on transport

Dimensions

The following dimensions refer to standard versions. Other U_m values effect other dimensions. With the current transformer part, the head size can change depending on the core data and the primary nominal current. With the voltage transformer part, the size of the head housing can change with greater burden requirements and/or frequencies less than 50 Hz. With regard to the creepage distance and clearance, the insulator can be adapted to customers' requirements.



Type		KSKEF 123	KSKEF 145	KSKEF 170	KSKEF 245	
Head Size		1	1	1	2	3
Maximum system voltage (U_m)	kV	123	145	170	245	
Impulse test voltage (BIL)	kV	550	650	750	1050	
Minimum creepage distance	mm	2460	2900	3400	4900	
Dimensions mm	A	3240	3340	3840	4865	5205
	B	2045	2145	2545	3390	3670
	C	1100	1200	1700	2200	
	D	360	360	360	460	
	E	1015	1015	1015	1375	1560
	F	450	450	450	600	
Total weight (approx.)	kg	750	800	950	1400	2000
Weight of gas (approx.)	kg	12	13	18	39	51

Type		KSKEF 362		KSKEF 420		KSKEF 525	KSKEF 765 ¹⁾
Head Size		2	3	2	3	3	
Maximum system voltage (U_m)	kV	362		420		525	765
Impulse test voltage (BIL)	kV	1175		1425		1550	2100
Minimum creepage distance	mm	7204		8400		10500	15300
Dimensions mm	A	4885	5905	6285	6605	6800	
	B	3790	3970	4790	4970	5170	
	C	2600		3600		3800	
	D	460		460		460	460
	E	1375	1560	1375	1560	1560	
	F	600		900		900	1200
Total weight (approx.)	kg	1500	2100	1600	2200	2250	
Weight of gas (approx.)	kg	43	56	47	60	61	