SF_6 gas insulated instrument transformers

General description of SF_6 gas insulated instrument transformers for voltages from 100 kV to 800 kV

Technical characteristics common to all SF_6 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)

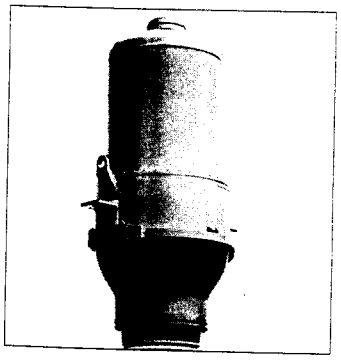
The inner insulation consists of SF_6 (sulphur hexafluoride). The high-voltage potential and the ground potential are formed with round electrodes with smooth surfaces. The production and assembly shops are clean rooms to avoid degradation of the insulation caused by any particles.

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

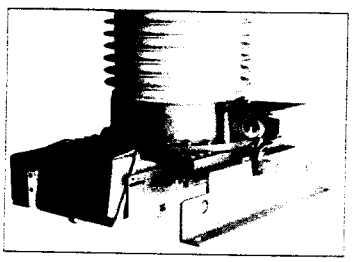
A metal rupture disk is located on the top of the head housing. In case of a powerful internal flashover, the sudden increasing pressure will release the rupture disk. Its releasing pressure of 9 bar considers a well calculated safety margin between an operation pressure of 5 bar and the routine test 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 1½". 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 µV 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 $16^2/_3$ 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

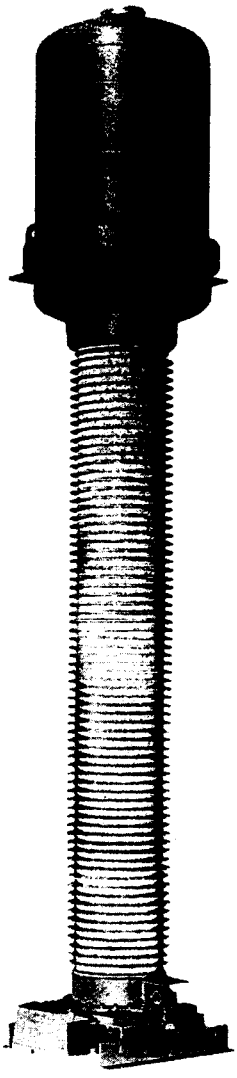
After delivery of the units to the site (with a transport pressure of 1,5 bar) and prior to energization, the gas pressure has to be increased to the operation pressure. Filling can be done by a RITZ service inspector or the client. Further commissioning tests are not required.

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.

Voltage transformer

General description on pages 16 and 17.



Type SKEF 420

Design

At voltages of U_m 245 kV and above core and windings are found in the head housing. At U_m 170 kV and below core and windings are in a base tank.

Core and windings

The primary winding is made of a high-grade double enamelled copper wire with an additional high-temperature resistant plastic coating. During the winding process, an electric sensor monitors the quality of the wire insulation. The layer insulation consists of a high temperature and voltage resistant dielectric foil. The primary winding and one or more secondary windings are positioned on a laminated rectangular core. The laminations are permanently bolted and pressed by a solid frame.

Neutral end

The end of the primary winding is led into the terminal box. It is insulated against ground to withstand a power-frequency test with 3 kV (1 min) according to IEC-standard or to withstand the power-frequency test with 19 kV (1 min) according to IEEE/CAN-standards.

Windings and ratings

The voltage transformers are manufactured according to a modular system. This generally meets all requirements for measurement and protection up to three windings and a separate ground-fault winding as an option.

The maximum burden of an accuracy class always refers to the sum of the burdens of all measuring and protecting windings with the exception of the ground-fault winding.

Accuracy class		Max. rated burden, VA	
		50 Hz	60 Hz
IEC	IEEE	IEC	IEEE
0.1		100	
0.2	0.3	300	400[1)]
0.5	0.6	600	800
1	1.2	1200	1200

[1)] also WXYZ and ZZ

Thermal burden rating

2000 to 4000 VA (and up to 7000 VA acc. to IEEE/CAN).

Discharging of capacitor banks and open lines

The voltage transformers can be used as discharging reactors. If required, please state capacity and voltage.

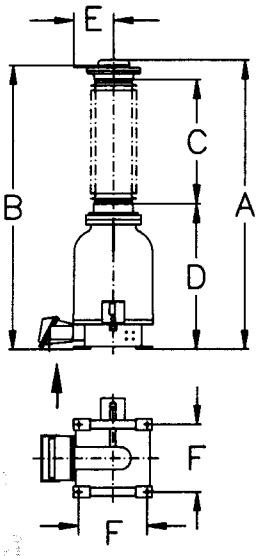
Nominal voltage factor

All standard values are possible, e.g. 1.5 U_N for 30 s or 1.9 U_N for 8 h, but also e.g. 2.2 U_N for 8 h.

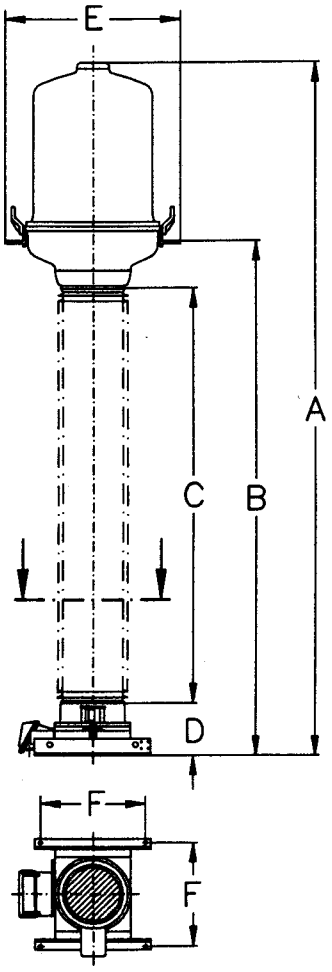
Dimensions

The following dimensions refer to standard versions. Other U_m values effect other dimensions.
The size of the 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' wishes.

STEF ...



SKEF ...



Type		STEF 123	STEF 145	STEF 170
Design			Base tank	
Maximum system voltage (U_m)	kV	123	145	170
Impulse test voltage (BIL)	kV	550	650	750
Minimum creepage distance	mm	2460	2900	3400
Dimensions mm	A	2480	2580	3080
	B	2420	2520	3020
	C	1100	1200	1700
	D	1280	1280	1280
	E	350	350	400
	F	450	450	450
Total weight (approx.)	kg	420	435	485
Weight of gas (approx.)	kg	10	11	16

Type		SKEF 245	SKEF 362	SKEF 420	SKEF 525	SKEF 765[1)]
Design				Head housing		
Maximum system voltage (U_m)	kV	245	362	420	525	765
Impulse test voltage (BIL)	kV	1050	1300	1425	1550	2100
Minimum creepage distance	mm	4900	7204	8400	10500	15300
Dimensions mm	A	4400	5000	6000	6200	
	B	3070	3470	4470	4670	
	C	2200	2600	3600	3800	
	D	460	460	460	460	460
	E	1240	1500	1500	1500	
	F	600	600	900	900	1200
Total weight (approx.)	kg	1150	1590	1785	1860	
Weight of gas (approx.)	kg	28	33	37	47	

1) *for details contact RITZ*