Manual for installation and operation HB 605/05 en

Use of SF_6 insulating gas in ZX-Switchgear
Gas-insulated medium voltage switchgear

Power and productivity
for a better world™

Your safety first - always!

That‘s why our instruction manual begins with these recommendations:

– Operate the switchgear as prescribed for its intended purpose.

– Ensure that the technical data on the name plate and in the specification are not exceeded during operation of the switchgear.

– Only install the switchgear in enclosed rooms suitable for electrical equipment.

– With the aim of a smooth installation sequence and ensuring a high quality standard, have installation at site performed by specially trained personnel or managed and supervised by the ABB Service Department.

– Ensure that installation, operation and maintenance are only performed by specialist electricians familiar with this manual.

– Comply in full with the legally recognized standards (IEC / DIN EN), the connection conditions of the local electrical utility and the applicable safety at work regulations.

– Follow the instructions in the documentation when performing any work on switching devices and switchgear.

– Keep all documentation accessible to all persons concerned with installation, operation and maintenance.

– The user’s personnel bear unlimited responsibility in all matters affecting safety at work and the correct handling of the switchgear in accordance with EN 50110 and national regulations.

– Always observe the five safety rules set out in EN 50110 on establishing and securing the off-circuit condition at the place of work for the duration of work on the switchgear. Gas-insulated switchgear are notable for maximum safety, as the circuit-breaker performs the earthing switch function in conjunction with the three position disconnector. The sequence of safety rules therefore deviates from that proposed in the standard as follows:

Isolate,

Check the off-circuit condition,

Earth and short-circuit,

Secure to prevent reconnection,

Cover or guard off adjacent live parts.

If you have any further questions on this manual, the members of our field organization will be pleased to provide the required information.

Content

This manual serves as a supplement to the manuals for ZX0 block design, ZX1.2 and ZX2 switchgear. It contains safety and environmental topics concerning the insulating gas and describes the use of insulating gas and its handling.

Hazard warning, meaning in this manual that death or serious injury and considerable damage may occur if the actions described are not performed.

Fundamental notes on this manual

Read the relevant sections of this manual through in full before performing work, so as to ensure correct handling.

Paragraphs in this manual are marked in accordance with their significance. The markings mean the following:

Important note, meaning in this manual that injury and damage may occur if the actions described are not performed.

Take particular account of the relevant standards listed below. Observe the national technical specifications and the accident prevention regulations of the country in which the switchgear is operated.

IEC 60376	Specification of technical grade sulphur hexafluoride (SF_6) for use in electrical equipment
IEC 60480	Guidelines for the checking and treatment of sulphur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use
IEC 62271-4	High-voltage switchgear and controlgear – Use and handling of sulphur hexafluoride (SF_6)
National technical accident prevention regulations e.g. for electrical systems and equipment, SF_6 installations and requirements for pressurized gas bottles.	

1 General

ZX panels contain sulphur hexafluoride gas (chemical formula SF_6) as the insulating medium. After leakage testing and evacuation at the works, the gas compartments are filled with SF_6 up to the rated filling pressure for insulation, and delivered to site in that condition, where they can as a rule be installed without any gas work.

The gas compartments meet the requirements for sealed pressure systems to IEC 62271-1. No further gas or vacuum treatment is necessary during the expected service life of the switchgear. The leakage rate of the switchgear is less than 0.1 % per year.

The SF_6 gas density in the gas compartments is permanently monitored during operation of the switchgear by means of density sensors [1] (= temperature-compensated pressure sensors). In the most unlikely event of leakage from a gas compartment, a signal is issued when the warning signal for insulation level is reached (see technical data).

1.1 General information on sulphur hexafluoride (SF_6)

SF_6 is an inorganic chemical compound of the elements sulphur and fluorine. It is a non-toxic, colourless and odourless inert gas. As SF_6 is heavier than air it displaces the oxygen in the air if it is inadvertently set free. The dielectric strength of SF_6 is 2.5 times that of air. It is therefore excellently suitable for use as an insulating gas in electrical equipment.

SF_6 is approximately five times heavier than air and can accumulate in low-lying spaces. If large quantities escape into the working area, SF_6 leads to a displacement of oxygen from the air people breathe (danger of asphyxiation). SF_6 concentrations of over 19 % by volume reduce the oxygen content of the air to below 17 % by volume and special protective measures are therefore required.

The use of SF_6 has made it possible to construct new, more efficient switchgear. The change from conventional insulation to the non-combustible, chemically inactive and non-toxic heavy gas sulphur hexafluoride has led to considerable savings in space and materials, and to greater safety of the systems.

1.2 Influence of SF_6 on the environment

The high infrared absorption of SF_6 and its long life in the environment are the reasons for its high GWP (Global Warming Potential), which, according to the latest IPCC Report (IPCC: Intergovernmental Panel on Climate Change) is 22200 times higher than that of CO_2 (carbon dioxide).

The GWP of a greenhouse gas indicates the amount by which a certain quantity of the gas released into the atmosphere contributes more or less strongly to the greenhouse effect than the same quantity of CO_2. The GWP is based on the average warming effect over a period of 100 years. CO_2 has a GWP of 1.

The total contribution of SF_6 to the global greenhouse effect is approx. 0.2 %.

The GWP of SF_6 represents only one indicator of the environmental impact of electrical equipment containing SF_6. Life Cycle Assessments [2] show that the use of equipment containing SF_6 also allows the CO_2 emissions of the entire system to be reduced as a result of the reduction in network losses.

1.3 Voluntary commitment

ABB AG in Germany has, together with other manufacturers and operators in the associations VIK, ZVEI and VDN which represent the power engineering industry in Germany, committed itself in a voluntary agreement on electrical equipment > 1 kV in the Federal Republic of Germany to avoiding SF_6 emissions wherever possible. The agreement sets out sustainable strategies, including both the responsible handling of equipment containing SF_6 on decommissioning and the entire process of return, recovery and reuse.

The efforts of the industry are directed at maintaining a closed life cycle. Especial importance is attached to the environmentally sound recycling of the individual components of electrical equipment and to reuse of the normally reusable sulphur hexafluoride. All the businesses involved in the life cycle process must therefore comply with the voluntary commitment.

Recovered SF_6 is as a rule either reused directly at site, or returned in a closed system to the manufacturer for reuse.

[1] In the case of the ZX0 without auxiliary voltage, pressure gauges are used

[2] E.g. the Life Cycle Assessment "SF_6 GIS Technology in Power Distribution – Medium Voltage" by various manufacturers and operators of gas-insulated switchgear in 2003

2 Insulating gas systems of ZX switchgear

The fundamental structure of the insulating gas system depends on the switchgear type. The insulating gas systems of switchgear types ZX0 in block design, ZX0.2, ZX1.2 and ZX2 are presented below.

2.1 Switchgear type ZX0 block design

Several panel modules form a common gas compartment (figures 2.1.1 and 2.1.2). This block can consist of up to six panel modules. Each block is equipped with a filler valve and a density sensor or pressure gauge.

The busbars of the panel blocks are connected together at site by means of plug-in busbar connectors, without any gas work being required.

Fig. 2.1.1: Sectional view of an example panel in ZX0 block design

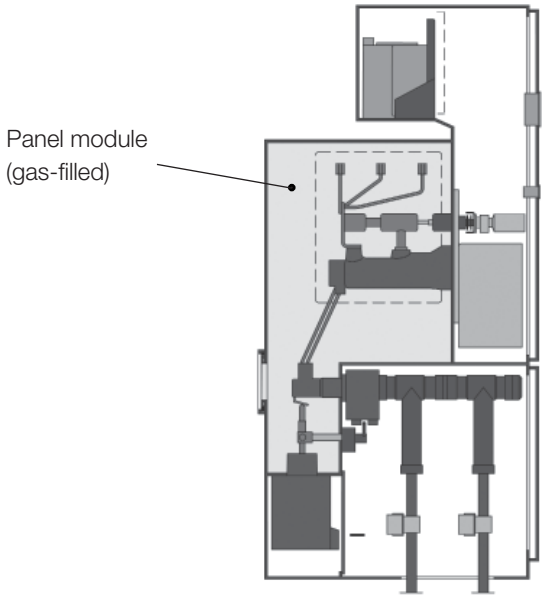
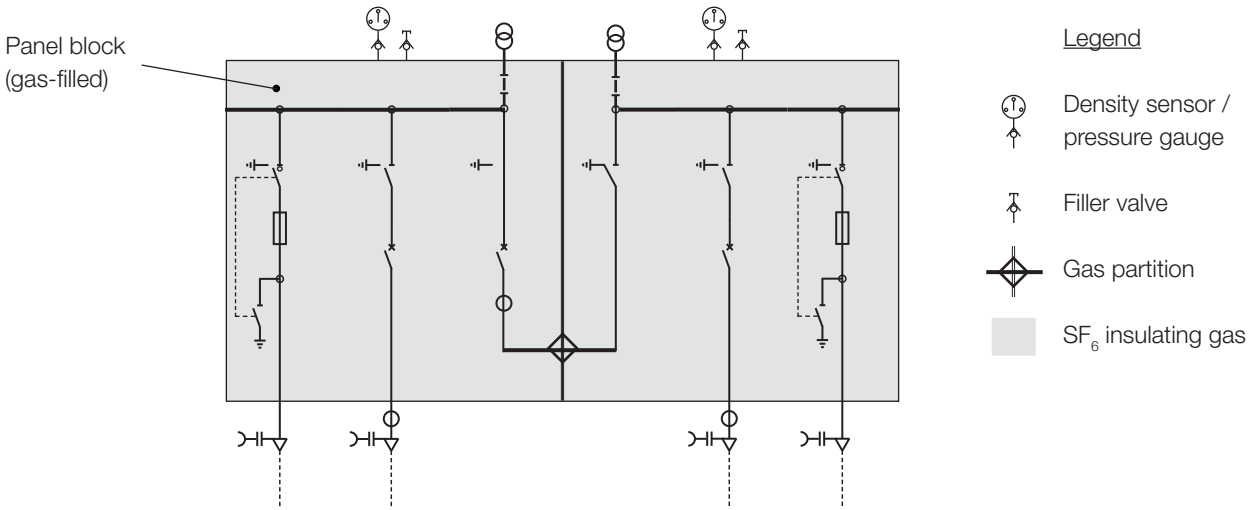


Fig. 2.1.2: Gas diagram of an example ZX0 switchgear installation consisting of 2 panel blocks with 3 panels each



2.2 Switchgear type ZX0.2

The gas compartments of adjacent panels are not connected together (figures 2.2.1 and 2.2.2).
Each panel is equipped with a filler valve and a density sensor.

Fig. 2.2.1: Sectional view of an example ZX0.2 panel

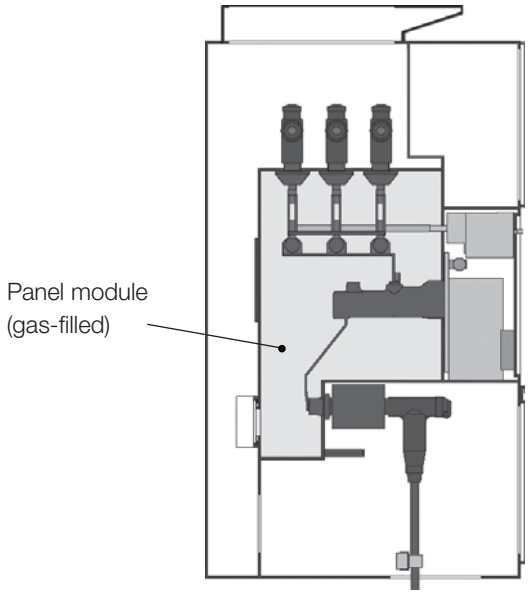
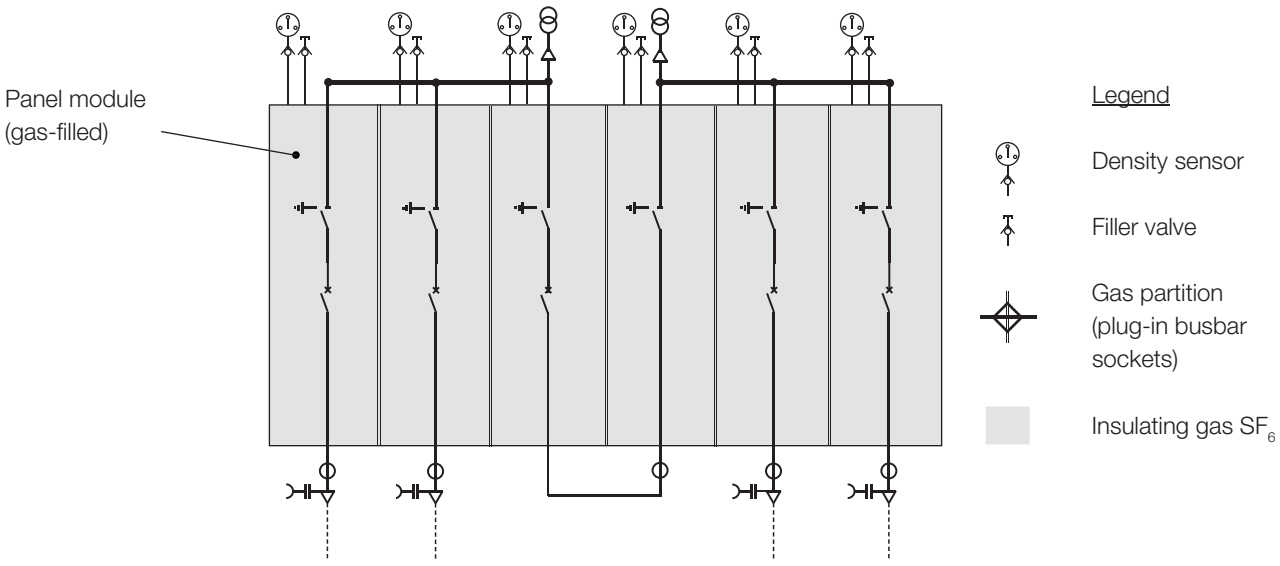


Fig. 2.2.2: Gas diagram of an example ZX0.2 switchgear installation



2.3 Switchgear type ZX1.2

The circuit-breaker compartment and the busbar compartment each form separate gas compartments (figures 2.3.1 and 2.3.2) and are filled and monitored by their own filler valves and density sensors. The gas compartments of the individual panels erected side by side are not connected together.

Fig. 2.3.1: Sectional view of an example ZX1.2 panel

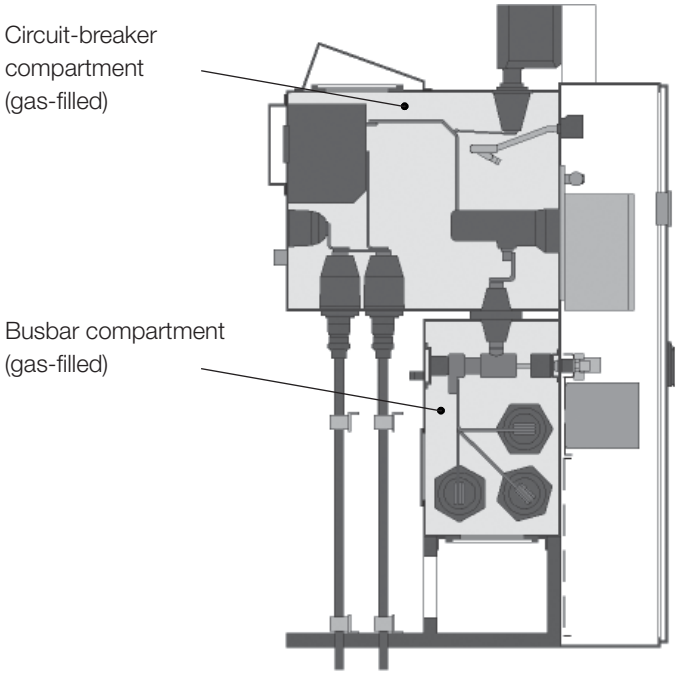
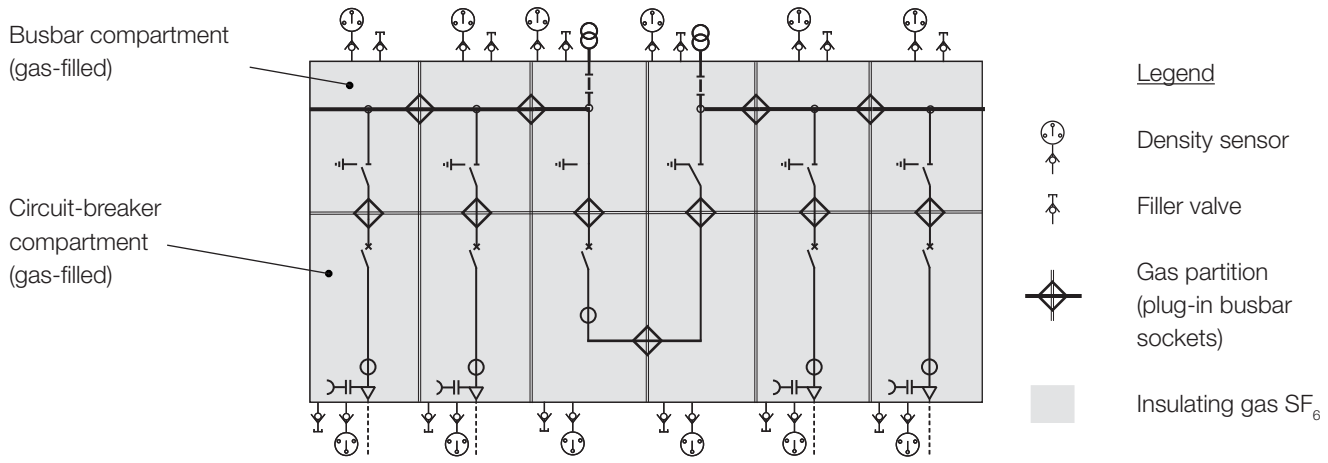


Fig. 2.3.2: Gas diagram of an example ZX1.2 switchgear installation



2.4 Switchgear type ZX2

Panels with one feeder and coupler panels

The circuit-breaker compartment and the two busbar compartments each form separate gas compartments (figures 2.4.1 and 2.4.2) and are filled and monitored by their own filler valves and density sensors. The gas compartments of the individual panels erected side by side are not connected together.

Double feeder panels

The busbar compartment for the two feeders in a double feeder panel is a continuous gas compartment extending over the panel width of 800 mm. The two circuit-breaker compartments in a double feeder panel are two independent units.

Fig. 2.4.1: Sectional view of an example ZX1.2 panel

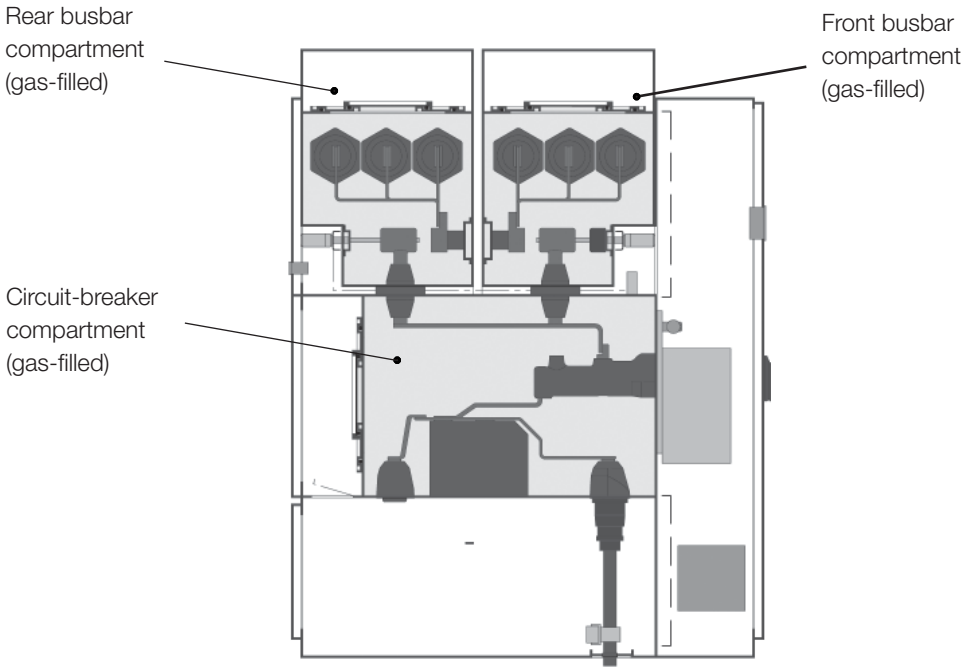
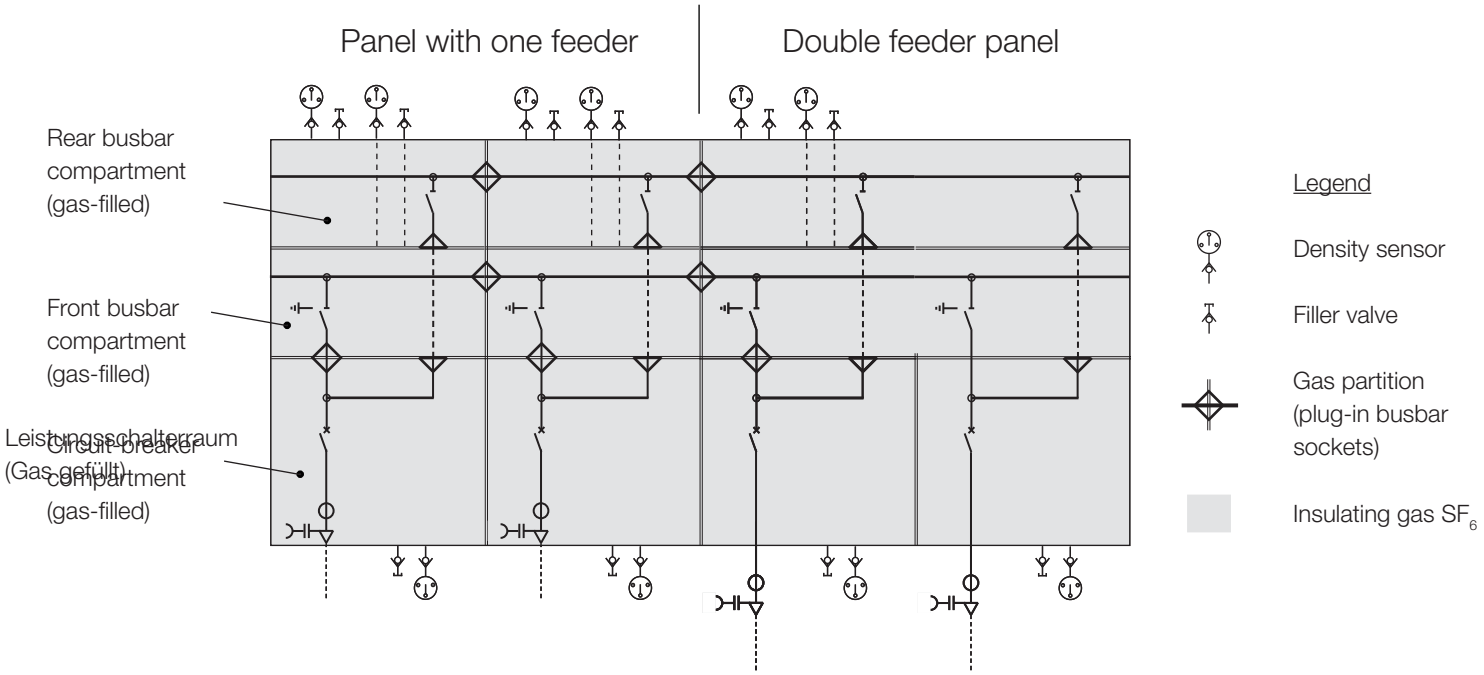


Fig. 2.4.2: Gas diagram of an example ZX2 switchgear installation, double busbar version



2.5 Gas monitoring

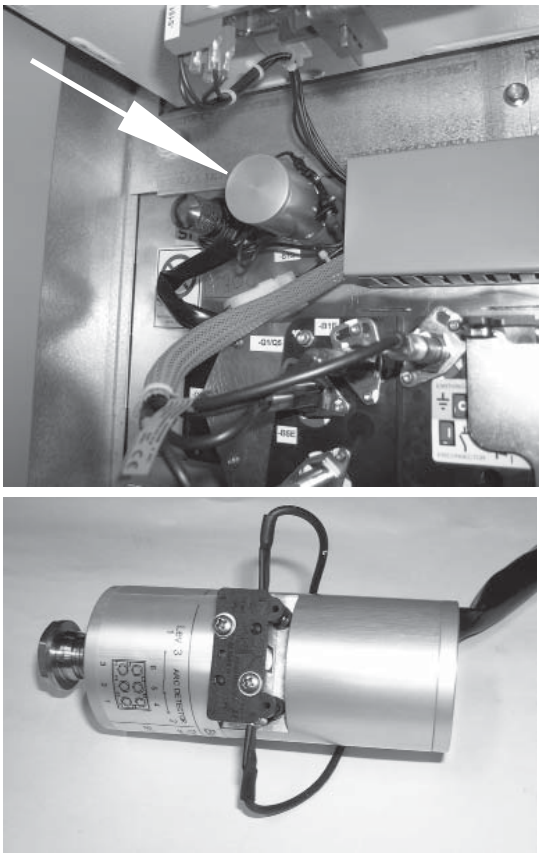
2.5.1 Gas monitoring with density sensors

Gas monitoring with density sensors (figure 2.4.1.1) is used in systems with auxiliary power supply. If the gas pressure falls below the level for a warning signal, a signal to top up the insulating gas is issued. In circuit-breaker systems the signal is displayed by a warning lamp or on a panel control unit. In switch-disconnector systems, the signal is displayed by a warning lamp.

Note that wire breakages, defective plug-in and terminal connections for the sensor and defective sensors will also lead to a signal.

When isolating systems for a relatively long period, maintain the auxiliary power supply to monitor the insulating gas density.

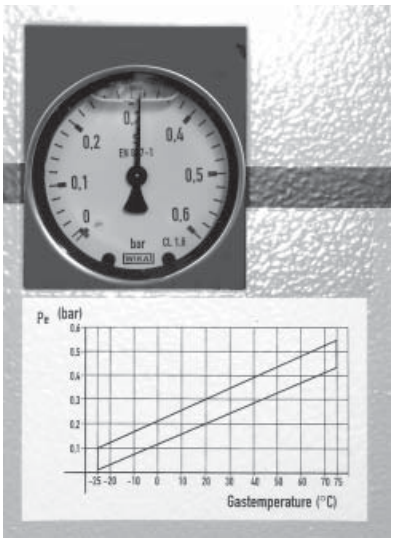
Fig. 2.5.1.1: Density sensor



2.5.2 Gas monitoring with pressure gauges

Gas monitoring with pressure gauges (figure 2.5.2.1) is used in systems of type ZX0 in block design without auxiliary power supply. The pressure gauges are located in the low voltage compartment of the relevant panel and can be read even when the low voltage compartment door is closed.

Fig. 2.5.2.1: Pressure gauge with operating pressure diagram.1:



Check the insulating gas pressure at regular intervals. The insulating gas pressure must be within the limits shown in the operating pressure diagram (in relation to the temperature in the low voltage compartment).

The pressure gauge is not temperature-compensated. Note that the temperature in the gas compartment is assumed to be equal to the temperature in the low voltage compartment. Deviations in temperature can lead to inaccurate readings.

2.6 Drying agent

The gas compartments contain a drying agent in the form of drying agent bags. These are used to bind the residual moisture in the gas compartments. The drying agent is maintenance-free. Replacement of drying agent bags is only necessary when a gas compartment has been opened for repair purposes.

3 Handling sulphur hexafluoride (SF_6)

3.1 Safety at work

Observe IEC 62271-4 and the accident prevention regulations issued by the relevant professional bodies. Keep these accident prevention regulations accessible to all staff who perform work on SF_6 gas compartments.

Compile instructions for work on SF_6 gas compartments and display them at a clearly visible location in the switchgear room. Sample instructions can be found at the end of this document.

Use the instruction sheets to instruct staff performing work on SF_6 gas compartments on the possible hazards and protection required before they commence their activities and then at least once each year.

3.2 Hazards to health

- Pure SF_6 is non-toxic, colourless and odourless.
- The limit for SF_6 in air is 1000 ml / m^3 or 6100 mg / m^3.
- Observe IEC 62271-4.

SF_6 is around five times heavier than air. SF_6 therefore displaces the oxygen in the air we breathe. It can lead to a risk of asphyxiation in opened, non-ventilated SF_6 gas compartments, or when relatively large quantities of SF_6 escape from SF_6 gas compartments or pressure vessels and there is insufficient ventilation at the floor level of constricted, enclosed switchgear rooms or spaces beneath switchgear rooms, e.g. basements or cable ducts. If SF_6 accumulates in low-lying spaces, remove it immediately.

Avoid generating heat, e.g. by smoking or performing welding work, when handling SF_6.

SF_6 decomposition products are created by arc faults in an SF_6 gas compartment. These decomposition products can be toxic or hazardous to health when inhaled, swallowed or allowed to come into contact with the skin, or can cause irritation or even possibly acid burns to the eyes, respiratory organs or skin.

Decomposition products can be detected at an early stage by a pungent, unpleasant odour (like rotten eggs).

Do not enter the switchgear room when an arc fault has occurred, or leave it immediately. Ventilate the switchgear room sufficiently before entering it without protective equipment.

Details of first aid procedures after inhaling or contact with SF_6 decomposition products can be found in the technical report IEC 62271-4.

Do not smoke, eat, drink or weld while performing cleaning work.

Observe the requirements for wearing protective equipment as set out in IEC 62271-4 and national regulations.

4 Gas work

Panels of the ZX range are tested for gas-tightness at the works (leakage rate measurement by the integrated leakage testing system) and then filled with insulating gas. Topping up of insulating gas during the expected service life of the switchgear is therefore not necessary.

As a result of the plug-in busbar technology, no gas work is required during installation at site in the majority of cases.

Gas work during installation of the switchgear is only necessary when

- heat sinks are used (panels with I_r > 2000 A and cooling with heat sinks; the heat sinks are fitted at site and filled with SF_6),
- the panels have been transported by air freight,
- application of integrated busbarmetering equipped with isolating device at ZX2-switchgear.

4.1 General notes

- We recommend calling in ABB after-sales service personnel for work in gas compartments.
- Never discharge SF_6 into the atmosphere.
- Replacement of the insulating gas in the system is not necessary. SF_6 can be considered as good as new even after long periods of use as an insulating gas.
- A two stage vacuum pump with a delivery of at least 6 m^3 / h is required for evacuation of a gas compartment prior to filling with insulating gas.
- An SF_6 gas filling unit is required for filling and topping up the insulating gas.
- A leakage tester and a dew point measuring instrument are required for filling of insulating gas when the gas compartment has previously been opened.
- A gas service unit with the facility for recovery of the gas is required for removal of SF_6.
- Protect the gas hoses on the equipment from moisture. Use hose fittings with non-return valves to prevent the ingress of humid air into the hoses. Close off the hose fittings with caps after use.
- Limit the ingress of ambient air during work on emptied and opened gas compartments so as to minimize any increase in humidity in the gas compartment. Temporarily apply drying agent in opened gas compartments during any unavoidable extended breaks in work and seal the gas compartments at least provisionally with plastic sheeting.

4.2 Minimum requirements and the conditions for the certification of personnel recovering SF_6

It is to be noted that together with general qualifications, safety and work and environmental considerations and electrical engineering knowledge, statutory minimum requirements (in national law) are now also applicable conditions for personnel recovering SF_6 from high voltage switchgear and switching devices (referred to below simply as switchgear).

Under the terms of Article 4, “Recovery” and Article 5, “Training and certification” of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases, precautions are to be taken to ensure that the SF_6 is properly recovered solely by certified personnel who meet the relevant minimum requirements.

In that context, evidence is to be provided that the personnel involved in gas removal (recovery) activities from switchgear have passed a theoretical and practical examination.

This qualification / training can be performed in relation to our switchgear technology by our corresponding training departments and certified by means of an examination certificate within the parameters of our quality assurance system.

Minimum requirements as to the skills and knowledge to be covered by the evaluation bodies

The examination shall comprise the following:

a) a theoretical test with one or more questions testing that skill or knowledge, as indicated in the column “Test Type” by (T);

b) a practical test where the applicant shall perform the corresponding task with the relevant material, tools and equipment, as indicated in the column “Test Type” by (P).

No.	Minimum Knowledge and Skills	Test Type
1	Basic knowledge of relevant environmental issues (climate change, Kyoto Protocol, Global Warming Potential), the relevant provisions of Regulation (EC) No 842/2006 and of the relevant Regulations implementing provisions of Regulation (EC) No. 842/2006.	T
2	Physical, chemical and environmental characteristics of SF_6	T
3	Use of SF_6 in electric power equipment (insulation, arc quenching)	T
4	SF_6 quality, according to the relevant industrial standards [1)]	T
5	Understanding of the design of electric power equipment	T
6	Checking the SF_6 quality	P
7	Recovery of SF_6 and SF_6 mixtures and purification of SF_6	P
8	Storage and transportation of SF_6	T
9	Operation of SF_6 recovery equipment	P
10	Operation of tight drilling systems - if necessary [2)]	P
11	Re-use of SF_6 and different re-use categories	T
12	Working on open SF_6 compartments	P
13	Neutralising SF_6 by-products	T
14	Monitoring of SF_6 and appropriate data recording obligations under national or Community legislation, or international agreements	T

The staff must fulfil the following conditions for the handling of SF_6:

- General knowledge of the medium SF_6
- General qualification in the fields of health and safety at work / environmental protection
- Electrical engineering knowledge
- Knowledge of the statutory minimum requirements for handling SF_6
- Technical knowledge of the system or device types concerned

This qualification can be obtained in our training department on the relevant ABB switchgear. On passing the examination, a certificate will be issued for each participant as specified in our quality assurance system. The minimum requirements for the training modules can be found in the current issue of IEC 62271-4 and the national training regulations.

The training courses apply to all personnel performing SF_6 recovery work.

The operators of high voltage switchgear are responsible for ensuring that the fluorinated greenhouse gas SF_6 is properly recovered by certified personnel so as to ensure its reuse, recycling, reclamation or disposal/destruction in a professional and environmentally sound manner.

The once and for all certification covers not only training and qualification for the work involved, but also corresponding knowledge of the applicable regulations and standards and the necessary expertise in emission avoidance, recovery of SF_6 and safe handling of the relevant equipment.

1) For instance IEC 60376 and IEC 60480
2) Recommended by the Regulation. This procedure for gas removal does not apply to ZX switchgear, as the gas compartments are always accessible via a filler valve (see sections 4.4 and 4.6).

4.3 Delivery form of SF_6 in gas cylinders

If required in exceptional cases, SF_6 is delivered in liquid form in pressure vessels (gas cylinders). Only use SF_6 which complies with IEC 60376 or IEC 60480. Handle, store and use the gas vessels in accordance with IEC 62271-4 and the local regulations.

A gas analysis is available for every gas delivery.

Store the pressurized gas vessels in a dry, clean place protected from direct sunlight at a maximum temperature of 50 °C. If temperatures of over 50 °C cannot be ruled out during storage or transport, order gas vessels with a correspondingly reduced filling factor.

As a rule, no deliveries of gas cylinders are required.

4.4 Notes on the filler valve

Figure 4.4.1 shows the filler valve with protective cap. The protective cap can be unscrewed by turning it counter-clockwise (figure 4.4.2).

Do not press the valve pin (2) in, as gas would flow out of the valve.

A coupling is necessary to connect a hose to the filler valve (figure 4.4.3). The coupling has an M 20 x 1.5 thread. If the union nut on the hose set has a different thread, use an appropriate adapter (figure 4.4.4).

Fig. 4.4.1: Filler valve with protective cap

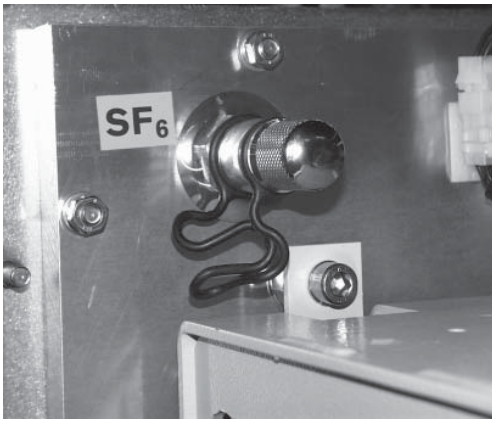
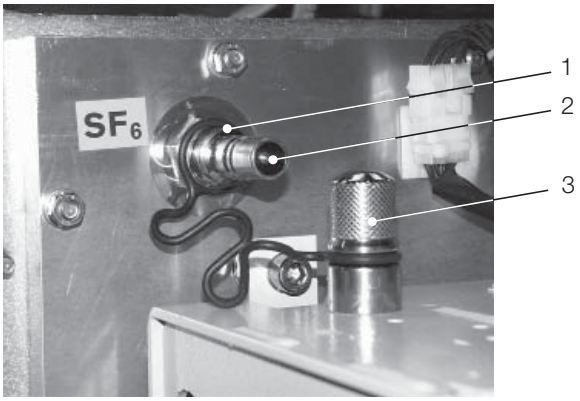
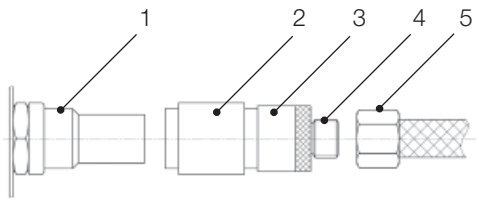


Fig. 4.4.2: Filler valve, protective cap removed



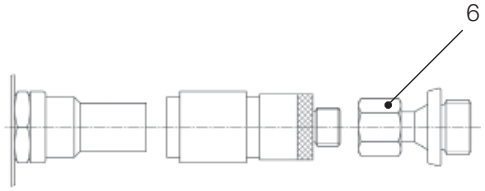
1 Filler valve
2 Valve pin
3 Protective cap

Fig. 4.4.3: Filler valve with coupling for hose connection



1 Filler valve
2 Locking ring
3 Coupling
4 M 20 x 1.5 thread
5 Union nut on the hose set

Fig. 4.4.4: Using an adapter to fit the union nut on the hose set



6 Adapter

4.5 Topping up insulating gas

Erection of the switchgear

If the panels are to be transported by air freight (an exceptional case), the gas compartments are delivered with a reduced SF_6 pressure. In such cases, the pressure is to be increased to the rated filling pressure prior to installation of the panels.

Switchgear in service

It is not necessary to top up the insulating gas during the expected service life of the system. Should a pressure loss signal nevertheless be issued, the following procedure is to be adopted:

– Record the time of the pressure loss signal.

– Clarify the cause of the pressure loss signal. A pressure loss signal may also result from a defective electrical connection in the secondary circuit or a defective density sensor.

– Measure the pressure in the gas compartment concerned with a temperature-compensated pressure gauge.

– Notify the ABB service department immediately and agree the further action to be taken.

– **Note:** Temporary operation of the panels at atmospheric pressure (> 100 kPa) is in principle possible if the SF_6 content of the insulating gas is at least 95 %. (Exceptions: double feeder panels with a rated voltage of 24 kV, panels with a rated voltage of 40.5 kV, switching of the switch-disconnector and panels with switch-disconnectors and fuses. See section 6.1.)

Topping up the insulating gas

– Connect the hose of the gas filling unit to the coupling (figure 4.4.3). Use an adapter if necessary to fit the thread of the connecting hose to the M 20 x 1.5 thread of the coupling (figure 4.4.4).

– Unscrew the protective cap from the filler valve (figure 4.4.2). A fastening cord prevents the cap from being lost.

Do not press the valve pin in, as gas would flow out of the valve!

– Fit the coupling (figure 4.4.3) to the filler valve by pulling the locking ring on the coupling back and pressing the coupling onto the filler valve.

– Allow the insulating gas to flow into the gas compartment as described in the operating instructions for the SF_6 gas filling unit used. The required filling pressure is equivalent to the rated filling pressure for insulation.

– Monitor the pressure rise during the topping up process. Perform the checks during temporary interruptions to the gas feed.

– Remove the filler hose. In that process the locking ring is to be pulled back and the coupling withdrawn from the filler valve.

– Finally refit the protective cap to the filler valve.

4.6 Removal of insulating gas

Removal of insulating gas from the gas compartments in the switchgear system is only necessary

– before repair work inside a gas compartment, and

– at the end of the service life of the switchgear.

SF_6 must never be discharged into the atmosphere. The gas can be removed, tested and stored using a gas recovery unit.

Procedure

– Connect the hose of the gas recovery unit to the coupling (figure 4.4.3). Use an adapter if necessary to fit the thread of the connecting hose to the M 20 x 1.5 thread of the coupling (figure 4.4.4).

– Unscrew the protective cap from the filler valve (figure 4.4.2). A fastening cord prevents the cap from being lost.

Do not press the valve pin in, as gas would flow out of the valve!

– Fit the coupling (figure 4.4.3) to the filler valve by pulling the locking ring on the coupling back and pressing the coupling onto the filler valve.

– Test the gas, remove and store it in accordance with the operating instructions for the gas recovery unit.

– Remove the filler hose. In that process the locking ring is to be pulled back and the coupling withdrawn from the filler valve.

– Finally refit the protective cap to the filler valve.

4.7 Filling compartments with insulating gas

Filling of individual gas compartments with insulating gas is only necessary

– after fitting of heat sinks and/or to-mounted boxes for the busbar metering system with isolating devbice at ZX2 and

– after repair work inside a gas compartment.

The air or the N_2 transport gas is removed from the gas compartment. The gas compartment concerned can be filled with SF_6 at a pressure of ≤ 1 kPa (= 10 mbar).

New drying agent must always be used in the gas compartments when they are filled with insulating gas (see section 4.9).

Procedure

– Connect the hose of the vacuum pump to the coupling (figure 4.4.3). Use an adapter if necessary to fit the thread of the connecting hose to the M 20 x 1.5 thread of the coupling (figure 4.4.4).

– Unscrew the protective cap from the filler valve (figure 4.4.2). A fastening cord prevents the cap from being lost.

– Fit the coupling (figure 4.4.3) to the filler valve by pulling the locking ring on the coupling back and pressing the coupling onto the filler valve.

– Evacuate the gas compartment to a pressure of ≤ 1 kPa (= 10 mbar). Perform pressure measurements during the evacuation process with the pump or hose valves temporarily closed. Leave the pump switched on for a further 30 minutes.

– Connect an SF_6 gas filling unit to the filler valve in place of the vacuum pump.

– Allow the SF_6 to flow into the gas compartment as described in the operating instructions for the SF_6 gas filling unit used. The required filling pressure is equivalent to the rated filling pressure for insulation.

– Remove the filler hose. In that process the locking ring is to be pulled back and the coupling withdrawn from the filler valve.

– Refit the protective cap to the filler valve.

– Carefully check the tightness of the gas compartment and the filler valves with a gas leakage tester. The scanning speed should not exceed 1-2 cm / s.

4.8 Testing of insulating gas

We recommend you to conduct dew point measurement of the insulating gas after gas work at site. The dew point measurement can take place during operation of the panel concerned, and should be performed a few weeks after filling it with gas. After that period, a constant gas humidity has been established.

Testing of the insulating gas is not necessary during normal operation of the ZX switchgear.

Procedure for dew point measurement

Connect the filler valve of the gas compartment to a dew point measuring instrument. Determine the dew point of the gas as described in the operating instructions for the measuring instrument.

In connection with the operating conditions for indoor switchgear, the dew point must not exceed a value of -5 °C [1]. For safety reasons, we recommend a minimum value for the dew point of -15 °C [1].

4.9 Handling of the drying agent

Replacement of drying agent bags is not necessary while the switchgear is in service.

Replace the existing drying agent bags after work in opened gas compartments. Consult the tables in section 6.3 for the number of drying agent bags.

Replace the drying agent bags immediately before sealing the gas compartment. Fill the gas compartment with SF_6 immediately after sealing.

Notes:

– The drying agent bags are heat-sealed in film to protect them from moisture. An indicator inserted in the protective bag shows the moisture content, as follows:

  – When the indicator is blue in colour, the drying agent bags are dry and usable.

  – When the indicator is pink in colour, the drying agent bags are moist and not usable.

[1] For a ZX0 switchgear installation without auxiliary voltage at an ambient temperature of -25 °C, a correspondingly lower value is required. In this case we recommend a minimum dew point of -35 °C.

– Only open the protective bags immediately before the drying agent bags are to be placed in the gas compartment.

– Drying agent bags which have not been contaminated with SF_6 decomposition products can be disposed of as residual waste.

– Follow the regulations of the responsible local authorities when disposing of drying agent bags which are contaminated with SF_6 decomposition products.

5 Actions at the end of the switchgear service life

SF_6 must never be discharged into the atmosphere.

ABB can be appointed to decommission and dismantle the switchgear. The switchgear system is then professionally dismantled by ABB and the SF_6, which is normally reusable, removed before the switchgear is broken down into its remaining components. In ZX systems, the SF_6 can be removed at site after decommissioning with appropriate equipment connected to the filler valves. If it complies with IEC 60480 (DIN EN 60480) standard after removal, it can be directly reused by the operator. If it is in accordance with the gas manufacturer's "Re-use Specification" according to IEC 62271-4, it can be returned to ABB or the gas manufacturer as a product.

Drying agent bags which have not been contaminated with SF_6 decomposition products can be disposed of as residual waste.

Follow the regulations of the responsible local authorities when disposing of drying agent bags which are contaminated with SF_6 decomposition products.

6 Technical data

6.1 Ratings

The following table applies to all ZX0 block design, ZX1.2 and ZX2 panel types.

Table 6.1.1: ZX0, ZX1.2, ZX2 Ratings

Site altitude		m	≤ 1000			> 1000 (only ZX2)
Rated voltage	U_r	kV	...24	...36	...40.5	...36
Alarm level for insulation	p_{ae}	kPa [1) 2)]	120			100
Rated filling level for insulation	p_{re}	kPa	130			110
Minimum functional level for operation [5)]	p_{mm}	kPa	120	-		-
Rated filling level for switch [5)]	p_{sw}	kPa	130			
Insulating gas density, relative to the rated filling level for insulation		g / dm³	7.9			6.7
Dew point service level		°C	≤ -5 [4) 5)]	≤ -5 [5)]		≤ -5 [5)]
Response level of pressure relief system		kPa	> 200			> 200
Set points of the density sensors (= temperature-compensated pressure sensors)						
Lower threshold (= alarm level for insulation)	p_{ae}	kPa	120			100
Upper threshold for optional rapid shutdown		kPa	190			170

The following table applies to all ZX0.2 panel types.

Table 6.1.2: ZX0.2 Ratings

Site altitude		m	≤ 1000		> 1000
Rated voltage	U_r	kV	...24	...36	...24
Alarm level for insulation	p_{ae}	kPa [1) 2)]	120 [6)]	140	100
Rated filling level for insulation	p_{re}	kPa	130 [7)]	150	110
Minimum functional level for operation [6)]	p_{mm}	kPa	140	-	-
Rated filling level for switch [6)]	p_{sw}	kPa	150		
Insulating gas density, relative to the rated filling level for insulation		g / dm³	7,9 [8)]	9,1	6,7
Dew point service level		°C	≤ -5 [5)]		
Response level of pressure relief system		kPa	> 240		
Set points of the density sensors (= temperature-compensated pressure sensors)					
Lower threshold (= alarm level for insulation)	p_{ae}	kPa	120 [6)]	140	100
Upper threshold for optional rapid shutdown		kPa	190 [9)]	210	170

1) All pressures stated are absolute pressures at 20 °C
2) 100 kPa = 1 bar
3) Only relevant to three position switch disconnector (ZX0)
4) ≤ -25 °C for ZX0 without auxiliary voltage (pressure gauges without contacts instead of density sensors), we recommend: ≤ -35 °C
5) We recommend: ≤ -15 °C.
6) Panels with three position switch disconnector: 140 kPa
7) Panels with three position switch disconnector: 150 kPa
8) Panels with three position switch disconnector: 9.1 g / dm³
9) Panels with three position switch disconnector: 210 kPa

6.2 Insulating gas capacities

The insulating gas capacities stated below are maximum capacities. The actual values vary according to the equipment fitted in the panels. The exact capacities can be found in the test records for the panels supplied.

Table 6.2.1: Insulating gas capacities for switchgear type ZX0 block design

Panel width [mm]	400	600
	Gas weight [kg]	
Panel module	1.4	2.7

Table 6.2.2: Insulating gas capacities for switchgear type ZX0.2

Panel width [mm]		450	600	600 (panels with three position switch disconnector and fuses)	900	1200
			Gas weight [kg]			
Panel module	Rated voltage: ... 24 kV	2.4	3.5	3.9	4.5	6.9
	Rated voltage: ... 36 kV	-	4,0	-	5,2	8,0

Table 6.2.3: Insulating gas capacities for switchgear type ZX1.2

Top of floor topping to top of circuit-breaker compartment [mm]		-	1800		2070	
Panel width [mm]		2 x 400 [1]	600	800	600	800
			Gas weight [kg]			
Circuit-breaker-compartment	Panel depth 1300 mm		2.2	2.9	3.2	4.3
	Panel depth 1500 mm	2 x 1.6	2.7	3.6	4.0	4.5
	Panel depth 1800 mm			4.6		6.9
Busbar compartment		2.5	1.9	2.6	1.9	2.6
Heat sink, low (Height 210 mm)						0.3
Heat sink, high (Height 670 mm)						1.1

Table 6.2.4: Insulating gas capacities for switchgear type ZX2

Panel width [mm]	2 x 400 [1]	600	800
	Gas weight [kg]		
Circuit-breaker-compartment	2 x 2.0	3.4	4.6
Busbar compartment I	2.2	1.7	2.3
Busbar compartment II	2.2	1.7	2.3
Heat sink circuit-breaker-compartment			0.7
Heat sink busbar compartment			1.4

[1] Double feeder panel with two outgoing feeders

6.3 Number of drying agent bags

Table 6.3.1: Number of drying agent bags for switchgear type ZX0 block design

	Number of panel modules	Number of drying agent bags
Block design	1 and 2	1
	3 and 4	2
	5 and 6	3

Table 6.3.2: Number of drying agent bags for switchgear type ZX0.2

Panel width [mm]	450	600	900	1200
		Number of drying agent bags		
	2	1	2	2 [1]

Table 6.3.2: Number of drying agent bags for switchgear type ZX1.2

Top of floor topping to top of circuit-breaker compartment [mm]		-	1800		2070	
Panel width [mm]		2 x 400 [2]	600	800	600	800
		Number of drying agent bags				
Circuit-breaker compartment	Panel depth 1300 mm		2	2	3	3
	Panel depth 1500 mm	2 x 2	2	2	4	4
	Panel depth 1800 mm			2		5
Busbar compartment		1	1	1	1	1

Table 6.3.4: Number of drying agent bags for switchgear type ZX2

Panel width [mm]	2 x 400 [2]	600	800
	Number of drying agent bags		
Circuit-breaker compartment	2 x 2	4 [1]	5 [1]
Busbar compartment I	1	1	1
Busbar compartment II	1	1	1

[1] Maximum number; quantity dependent on equipment fitted.
[2] Double feeder panel with two outgoing feeders

7 Sample works instructions

The sample works instructions shown are intended to serve as examples for the compilation of instructions in your company. Adjustments to national technical standards and the accident prevention regulations of the country in which the switchgear is operated might be necessary.

Fig. 7.1: Sample work instruction, "Handling of uncontaminated SF_6"

Works department:	**Work Instruction**	Issue date:
Working area:		
Responsible Person: _____ Sign	Work place: Activity: Handling of uncontaminated SF_6	

HAZARDOUS MATERIAL DESIGNATION

Sulphur hexafluoride (SF_6)

HAZARDS TO PERSONS AND THE ENVIRONMENT

Uncontaminated SF_6 is odourless, tasteless, colourless and non-toxic. It contains no contaminants which are harmful to health. On contact with liquid SF_6 there is a risk of freeze burns.

SF_6 is approximately five times heavier than air, and can accumulate in low-lying spaces. If a large quantity escapes into the working environment, SF_6 displaces the oxygen in the air people breathe (danger of asphyxiation). SF_6 is a greenhouse gas, and emissions of SF_6 are therefore to be avoided.

PROTECTIVE MEASURES AND RULES OF BEHAVIOUR

Do not discharge SF_6 into the atmosphere.

Use an SF_6 servicing unit with _____ filler system.

Check the connections for gas-tightness.

Work which generates strong heat, e.g. welding, is prohibited.

Do not smoke, eat, drink or store foodstuffs in the switchgear room.

Protect your hands: Wear protective gloves to avoid physical injury and contact with liquid gas.

PROTECTIVE ACTION AND RULES OF BEHAVIOUR

Leakage: Turn off the gas supply. Ensure that valves and connections are tight and ventilate the room well with fresh air.
SF_6 does not burn, but fire will create decomposition products. Wear protective equipment when firefighting.
Move cylinders/equipment out of the hazard zone or cool them.

FIRST AID

For all first aid actions: Ensure that you yourself are adequately protected, and contact a doctor immediately.
On inhalation: Provide fresh air immediately. Lay the person in an inclined position with the head downwards, and if they have breathing problems ensure they receive medical treatment.

First Aid staff_____ Emergency tel.: _____

CORRECT DISPOSAL

Return to the manufacturer if necessary.

Fig. 7.2: Sample works instruction, "Handling of contaminated SF_6"

Works department: **Work Instruction** Issue date:

Working area:

Work place:

Responsible Person: _____ (Sign)

Activity: Handling of contaminated SF_6

HAZARDOUS MATERIAL DESIGNATION

Sulphur hexafluoride (SF_6) with decomposition products (contaminated SF_6)
SF_6 in electrical systems may contain decomposition products – gaseous sulphur fluorides and sulphur oxyfluorides, solid (dust-form) metal fluorides, sulphides and oxides, hydrofluorides and sulphur dioxide – as a result of arcing effects.

HAZARDS TO PERSONS AND THE ENVIRONMENT

- Decomposition products can be toxic or hazardous to health on inhalation, swallowing or contact with the skin or eyes. They can irritate the respiratory organs or skin or cause acid burns. On inhalation of large quantities there is a risk of lung damage (pulmonary oedema) which may only become apparent at a much later date.
- On escape of gas, there is a danger of asphyxiation due to displacement of oxygen, especially at floor level and in deeper spaces.

PROTECTIVE MEASURES AND RULES OF BEHAVIOUR

Filling, emptying or evacuation of SF_6 systems:

- Check the condition of the SF_6 (e.g. humidity, proportion of air, decomposition products).
- Do not discharge SF_6 into the atmosphere. Use servicing equipment and check the connection for tightness after connecting.
- Only channel contaminated SF_6 into marked SF_6 pressure vessels.
- Work generating strong heat and smoking are prohibited in the system room.

Opening of and working on or in opened SF_6 gas compartments
(additional measures; please complete and delete where not applicable)

- Only open SF_6 gas compartments after complete emptying and equalization with atmospheric pressure.
- Use personal protective equipment:

Protective gloves, acid resistant	Disposable goggles
Protective overalls with hood	Overshoes
Breathing mask (filter or closed-circuit type)	Skin protection
Safety shoes	Helmet

- Remove dust with industrial vacuum cleaner _____ .
- Remove adhering decomposition products with _____.
- Before breaks and after work, thoroughly clean the face, neck, arms and hands with large amounts of water.
- Do not store foodstuffs or smoke, eat or drink in the system room.

PROTECTIVE ACTION AND RULES OF BEHAVIOUR

On escape of gas or perception of an unpleasant, pungent odour (like rotten eggs) indicating SF_6 decomposition products, immediately leave or do not enter the system room or spaces below. Only re-enter the room after thorough ventilation or with breathing apparatus (isolating equipment _____).

First Aid

- When decomposition products come into contact with the skin or eyes, immediately rinse the skin with ample water,
- Thoroughly rinse the eye with water, covering the unaffected eye.
- Move persons with breathing difficulties out of the hazardous area into the fresh air, ensure they rest, cover them with blankets and call in a doctor (risk of toxic pulmonary oedema).
- First Aid staff_____ Emergency tel.: _____

Correct disposal

- Only dispose of decomposition products, cleaning fluids and materials, disposable overalls and filters (e.g. from SF_6 systems, maintenance units, industrial vacuum cleaners or breathing masks) in _____ waste containers.

SULPHUR HEXAFLUORIDE

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the substance/preparation

Product name	:	SULPHUR HEXAFLUORIDE
Chemical name	:	Sulphur hexafluoride
Molecular formula	:	SF_6
Molecular weight	:	146 g/mol

1.2. Use of the Substance/Preparation

Recommended use	:	- Electrical industry - Metallurgy

1.3. Company / Undertaking Identification

Adress	:	SOLVAY FLUOR GmbH HANS-BOECKLER-ALLEE 20 D- 30173 HANNOVER
Tel.	:	+495118570
Fax	:	+495118572146

1.4. Emergency and contact telephone numbers

Emergency telephone	**:**	**+44(0)208 762 8322 [CareChem 24] Europe)**
E-mail-adress	**:**	**sdstracking@solvay.com**

2. HAZARDS IDENTIFICATION

Appearance	**:**	**compressed liquefied gas**
Colour	**:**	**colourless**
Odour	**:**	**odourless**

- This substance is not classified as dangerous according to Directive 67/548/EEC..
- Hazardous decomposition products formed under fire conditions.
- Gaseous hydrogen fluoride(HF)

3. COMPOSITION / INFORMATION ON INGREDIENTS

Substance name	Concentration	Classification	R-phrase(s)
(CAS-Nr./ EG-Nr./ Anhang-1	**(W/W)**		
Sulphur hexafluoride (2551-62-4 / 219-854-2) / --	**≥ 99,9%**		

4. FIRST AID MEASURES

4.1. Inhalation

- Remove to fresh air
- Oxygen or artificial respiration if needed.
- If symptoms persist, call a physician.

4.2. Eye contact

- Keep eyelids open to allow evaporation of product.
- Rinse thoroughly with plenty of water, also under the eyelids.
- -If eye irritation persists, consult a specialist.

4.3. Skin contact

- Allow to evaporate.
- Rinse with lukewarm running water.
- If symptoms persist, call a physician.

4.4. Ingestion

- Not applicable

5. FIRE-FIGHTING MEASURES

5.1. Suitable extinguishing media

- Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Extinguishing media which shall not be used for safety reasons

- None.

5.3. Special exposure hazards in a fire

- The product is not flammable.
- Heating can release hazardous gases.

5.4. Special protective measures equipment for fire-fighters

- Wear self-contained breathing apparatus and protective suit.
- Fire fighters must wear fire resistant personnel protective equipment.
- Wear chemical resistant oversuit
- Protect intervention team with a water spray as they approach the fire.
- Clean contaminated surface thoroughly.

5.5. Other information

- Approach from upwind.
- Evacuate personnel to safe areas.
- Keep containers and surroundings cool with water spray.
- After the fire, proceed rapidly with cleaning of surfaces exposed to the fumes in order to limit equipment damage.

6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions

- Refer to protective measures listed in section 7 and 8
- Approach from upwind.
- Suppress (knock down) gases/vapours/mists with a water spray jet.
- Avoid spraying the leak source.
- Try to re-position leaking containers, to have the leak in the gaseous phase.
- Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
- Prevent further leakage or spillage if safe to do so.
- Keep away from open flames, hot surfaces and sources of ignition.
- Keep away from incompatible products

6.2. Environmental precautions

- Should not be released into the environment.

6.3. Methods for cleaning up

- Allow to evaporate.
- Prevent product from entering drains.

7. HANDLING AND STORAGE

7.1. Handling

- Used in closed system
- Use only in well-ventilated areas.
- Use only equipment and materials which are compatible with the product.
- Prevent product vapours decomposition from contacting hot spots.
- Never return unused material to storage receptacle.
- Keep away from incompatible products
- Keep away from heat.

7.2. Storage

- Keep in a cool, well-ventilated place.
- Keep away from heat and sources of ignition.
- Keep container tightly closed.
- Store in original container.
- Keep away from Incompatible products.

7.3. Special use(s)

- For further information, please contact: Supplier

7.4. Packaging material

- Steel drum

7.5. Other precautions

- Refer to protective measures listed in sections 7 and 8.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1. Exposure Limit values

Sulphur hexafluoride

– UK. EH40 Workplace Exposure Limits (WELs) 2005
time weighted average = 1,000 ppm
time weighted average = 6,070 mg / m3
– UK. EH40 Workplace Exposure Limits (WELs) 2005
Short term exposure limits = 1,250 ppm
Short term exposure limits = 7,590 mg / m3
– US. ACGIH Threshold Limit Values 01.2006
time weighted average = 1,000 ppm

8.2. Exposure controls

– Provide appropriate exhaust ventilation at machinery.
– Apply technical measures to comply with the occupational exposure limits.
– Refer to protective measures listed in sections 7 and 8.

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

– Self-contained breathing apparatus in medium confinement/insufficient oxygen/ in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection.
– Use only respiratory protection that conforms to international/ national standards.
– In the case of vapour formation use a respirator with an approved filter.

8.2.1.2. Hand protection

– Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).
– Protective gloves
– Heat insulating gloves
– Suitable Material : PVC, Neoprene, Natural Rubber

8.2.1.3. Eye protection

– Chemical resistant goggles must be worn.
– If splashes are likely to occur, wear:
– Face-shield

8.2.1.4. Skin and body protection

– Wear suitable protective clothing.
– In case of contact through splashing:
– Apron
– Boots
– Neoprene

8.2.1.5. Hygiene measures

– Use only in an area equipped with a safety shower.
– Eye wash bottle with pure water
– When using do not eat, drink or smoke.
– Gloves, overalls and boots have to be double layered (protection against cold temperature).
– Handle in accordance with good industrial hygiene and safety practice.

8.2.2. Environmental exposure controls

– Dispose of rinse water in accordance with local and national regulations.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information (appearance, odour)

Form	:	Compressed liquefied gas
Colour	:	colourless
Odour	:	odourless

9.2. Important health, safety and environment information

pH	:	*Remarks:* neutral
Boiling point/boiling range	:	-63,8 °C *Remarks:* Sublimation point
Flash point:	:	*Remarks:* does not flash
Flammability	:	*Remarks:* This product is not flammable.
Explosive properties	:	Explosion danger: *Remarks:* See section 10
Oxidizing properties	:	*Remarks:* Non oxidizer
Vapour pressure	:	21.4 bar *Temperature*: 20 °C
	:	37.1 bar *Temperature*: 45 °C
Relative Density / Density	:	1.56
Solubility	:	Water 0.04 g / l *Remarks:* slightly soluble *Temperature:* 20 °C
	:	Alcohol
	:	Ether
Partition coefficient		log P o/w
n-octanol/water	:	1.68
Vapour density (air = 1)	:	5.1

9.3. Other data

Freezing point	:	-50.8 °C
Decomposition temperature		200 °C *Remarks:* Decomposition under influence of moisture is highly accelerated by heating. 800 °C *Remarks:* Dry air

10. STABILITY AND REACTIVITY

10.1. Stability

– Stable under recommended storage conditions.
– Vapours are heavier than air and may spread along floors.
– Hazardous Polymerisation/Polymerization: no

10.2. Conditions to avoid

– Heat

10.3. Materials to avoid

– Oxidizing agents

10.4. Hazardous decomposition products

– Gaseous hydrogen fluoride (HF)., Sulphur dioxide, Sulphur compounds

11. TOXICOLOGICAL INFORMATION

11.1. Toxicological data

Acute inhalation toxicity
– NOEC, 24 h, rat, > 4.777 g / l

Acute dermal toxicity
– LC50, Remarks: not applicable

Skin irritation
– Rat, no skin irritation

Eye irritation
– Rat, no eye irritation

Sensitisation
– No data available

Irritation (other route)
– No irritation signs noted during toxicity testing.

Chronic toxicity
– Inhalation, Prolonged exposure, Human experience, no observed effects

Genetic toxicity in vitro
– In vitro tests did not show mutagenic effects

Possible hazards (summary)
– Health injuries are not known or expected under normal use

11.2. Health Effects

Inhalation
– Symptoms: narcosis.
– (in case of higher concentration): Asphyxia.

Eye contact
– gas
– Irritation
– Liquefied gas
– Severe eye irritation
– Lachrymation
– Redness
– Swelling of tissue
– Frostbite
– Causes burns

Skin contact
– Gas
– None
– Liquefied gas
– Cold sensation followed by redness of the skin.
– Frostbite.
– Prolonged skin contact may defat the skin and produce dermatitis

Ingestion
– gas
– not applicable

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Acute toxicity

– *Remarks:* no data available

12.2. Mobility

– Air, Henry's law constant (H) = 452 kPa · m^3 / mol
  Conditions: calculated value
  Remarks: considerable volatility
– Soil/sediments
  Remarks: Non-significant adsorption.
– Water, Evaporates, $t_{1/2}$ = 3.5 h
  Conditions: calculated value

12.3. Persistence and degradability

Abiotic degradation

– Air, $t_{1/2}$ > 1000 years
  Result: not significant photolysis
– Water/soil, $t_{1/2}$ > 1000 years
  Result: Non significant hydrolysis

Biodegradation

– *Remarks:* The methods for determining biodegradability are not applicable to inorganic substances.

12.4. Bioaccumulative potential

– Bioconcentration: Bioconcentration factor (BCF) = 89
  Remarks: Calculated value

12.5. Other adverse effects

– Global Warming Potential
  = 23,900
  Remarks: GWP (ITH 100 y), Source IPCC (International Panel on Climate Change)

12.6. Possible hazards (summary)

– This product has no known eco-toxicological effects.
– Product is persistent in air.
– Other dangerous properties can not be excluded.

13. DISPOSAL CONSIDERATIONS

13.1. Waste from residues / unused products

– In accordance with local and national regulations.
– Refer to manufacturer/supplier for information on recovery/recycling.

13.2. Packaging treatment

– To avoid treatments, as far as possible, use dedicated containers.

14. TRANSPORT INFORMATION

UN-Number **1080**

IATA-DGR

Class 2,2
ICAO-Labels NON-FLAMMABLE COMPRESSED GAS
Proper shipping name: SULPHUR HEXAFLUORIDE

IMDG

Class 2,2
IMDG-labels NON-FLAMMABLE COMPRESSED GAS
HI/UN-No. 1080
EmS: F-C,S-V
Proper shipping name: SULPHUR HEXAFLUORIDE

ADR

Class 2
ADR/RID-Labels 2,2
HI/UN-Nr. 20/1080
Proper shipping name: SULPHUR HEXAFLUORIDE

15. REGULATORY INFORMATION

15.1. EG-Label

– This substance is not classified as dangerous according to Directive 67/548/EEC.

15.2 Inventory Informations

Australian Inventory of Chemical Sustances	: - In compliance with inventory
Canadian Domestic SubstancesList (DSL)	: - In compliance with inventory
Inventory of Existing Chemical Substances (China)(IECS)	: - In compliance with inventory
Japan (ENCS) List (ENCS((JP))	: - In compliance with inventory
New Zealand Single ComponentSub. List (NZ CLSC)	: - In compliance with inventory
Toxic Substance Control Act -Liste (TSCA)	: - In compliance with inventory
Liste der EU-Altstoffe (EINECS)	: - In compliance with inventory
Korea Existing Chemicals Inv. (KECI) (KECI(KR))	: - In compliance with inventory
Philippines PICCS (PICCS (PH))	: - In compliance with inventory

15.3. Other regulations

– European Waste Catalogue, Decision (2000/532/EC), Hazardous waste, Waste codes should be assigned by the user based on the application for which the product was used.

16. OTHER DETAILS

16.1. Administrative information

– General revision
– Distribute new edition to clients

This SDS is only intended for the indicated country to which it is applicable. The European SDS format compliant with the applicable European legislation is not intended for use nor distribution in countries outside the European Union with the exception of Norway and Switzerland. Safety data sheets applicable in other countries/regions are available upon request. The information given corresponds to the current state of our knowledge and experience of the product, and is not exhaustive. This applies to product which conforms to the specification, unless otherwise stated. In this case of combinations and mixtures one must make sure that no new dangers can arise. In any case, the user is not exempt from observing all legal, administrative and regulatory procedures relating to the product, personal hygiene, and protection of human welfare and the environment.

For your notes…

Contact us

Note: We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

Your sales contact: www.abb.com/contacts
More product information: www.abb.com/productguide

Power and productivity
for a better world™