

Gas density monitoring  
Gas analysis  
Gas handling  
Asset protection

# Innovative SF<sub>6</sub> solutions



**WE**grid  
Solutions

**WIKAI**  
Part of your business



Alexander Wiegand,  
Chairman and  
CEO, WIKA

## About us

As a family-run business acting globally, with over 9,300 highly qualified employees, the WIKA group of companies is a worldwide leader in pressure and temperature measurement. The company also sets the standard in the measurement of level, force and flow, and in calibration technology.

Founded in 1946, WIKA is today a strong and reliable partner for all the requirements of industrial measurement technology, thanks to a broad portfolio of high-precision instruments and comprehensive services.

With manufacturing locations around the globe, WIKA ensures flexibility and the highest delivery performance. Every year, over 50 million quality products, both standard and customer-specific solutions, are delivered in batches of 1 to over 10,000 units.

With numerous wholly owned subsidiaries and partners, WIKA competently and reliably supports its customers worldwide. Our experienced engineers and sales experts are your competent and dependable contacts locally.

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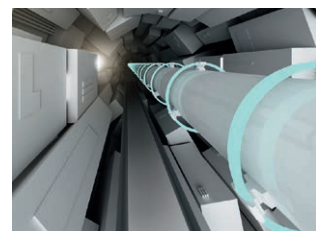
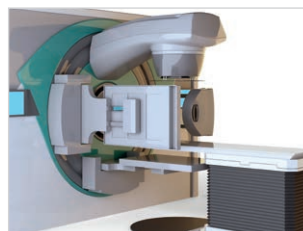
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# Applications

## High voltage/medium voltage

Examples of SF<sub>6</sub> gas-filled components in power transmission and distribution

- Switchgear (GIS)
- Disconnectors
- Switch-disconnectors
- Circuit breakers (Live & Dead Tank)
- Transducers
- Transmission lines (GIL)
- Transformers (GIT)
- Ring main units (RMU)



# WEgrid Solutions

## Who we are

Proper operation of the SF<sub>6</sub>-filled plants requires a large number of special instruments and specialist know-how. WEgrid Solutions is an expert team, consisting of WIKA employees specialised in specific requirements of the power transmission industry.

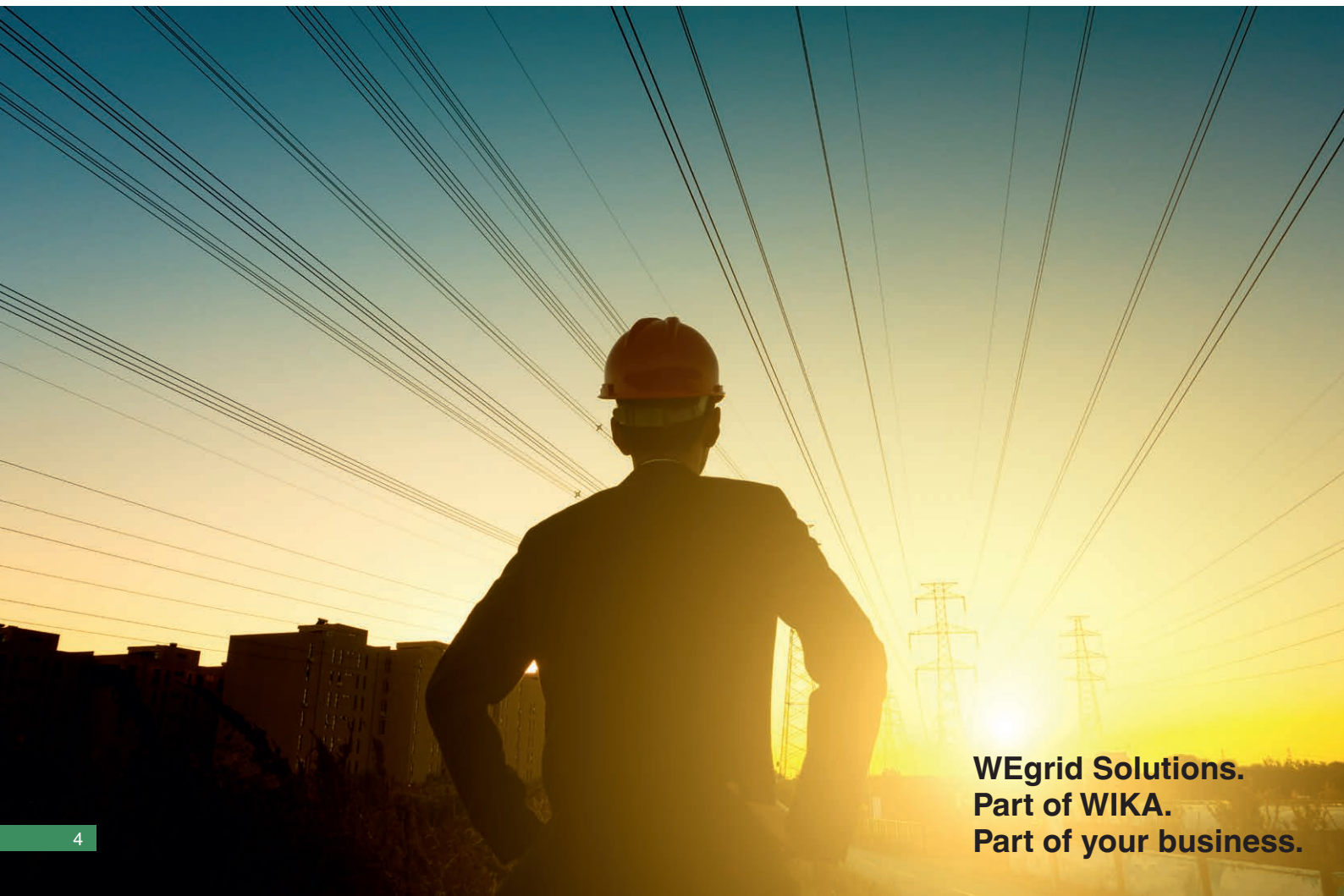
WEgrid Solutions is the only supplier on the market that offers a complete product portfolio and customized complete solutions for plants filled with SF<sub>6</sub>.

## Innovation is our passion – quality our principle

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Our daily motivation is to constantly improve the protection of people, machinery and not least the environment. To accomplish this, we use our passion for technological progress. We are a versatile team of creative people with extensive expertise and innovative capacity.

As all WIKA employees, we attach great importance to the fundamental principles of our family-run company and are guided by them in our everyday working life. That is why the highest quality is a matter of course for us at all times.



**WEgrid Solutions.  
Part of WIKA.  
Part of your business.**

## What we do

WEgrid Solutions stands for intelligent SF<sub>6</sub> solutions tailored to your needs. With our three segments, we offer products and services for all areas of interest in the industry.

### WEgrid Products

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Our comprehensive product portfolio covers all areas of a SF<sub>6</sub>-filled plant:

- Gas density monitoring
- Gas analysis
- Connecting parts
- Gas handling

### WEgrid Services

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We see ourselves not only as a product supplier, but also as a long-term partner of our customers. That is why we support you for a long time after commissioning of our products.

- Repair and maintenance
- Commissioning
- Rental service
- On-site gas analysis
- Seminars and consulting

### WEgrid Asset Protection

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Maximum plant safety through digitised gas monitoring embedded in intelligent overall solutions – everything from one source. This is WEgrid Asset Protection. Our high-quality products are combined with adapted data transfer technology and intelligent software. We plan and implement the entire project. Thus, we design your SF<sub>6</sub> gas monitoring as simple and safe as possible.

**WE**grid  
Solutions

**WE**grid  
Products

**WE**grid  
Asset Protection

**WE**grid  
Services



# WEgrid Products – SF<sub>6</sub> instrumentation ensures plant safety

**For safety reasons, the filling volume of SF<sub>6</sub> gas is defined for each gas compartment and monitored using an SF<sub>6</sub> density measuring instrument.**

WIKA's gas density determination is made with pressure measurement that has been specifically adapted to the 'real gas' behaviour of SF<sub>6</sub> gas by compensating for the effects of temperature changes. Measurement uncertainties, resulting from the fluctuating ambient pressure, are also eliminated by the hermetically sealed case.

Should the gas density decrease due to leakage, defined alarm contacts in the gas density monitor provide a warning or, if the lower limit is reached, shut the plant down. Modern plant monitoring in the era of the "Smart Grid" requires the use of gas density transmitters with analogue or digital signal output.

The transmitters allow a more precise, continuous and central signal monitoring.

The signals or data packets sent are permanently monitored by SCADA systems with integrated data storage and data processing.

In addition to the gas density measurement, the GDHT-20 multi-sensor can provide pressure, temperature and humidity signals in Modbus® protocol.

Alongside the instrumentation, WIKA offers analytic and handling products and connecting parts.



## Proactive plant monitoring and service for high-voltage switchgear

The online monitoring of SF<sub>6</sub> gas with trend analysis reduces the risk of failure and the operating costs. The continuous visibility of the plant status enables operators to move away from the previously used preventive or reactive maintenance strategies. In the future, the electricity grid operators will be able to implement a condition-based SF<sub>6</sub> gas service and maintenance strategy. Unnecessary work within defined maintenance cycles is eliminated. Thus, the number of service calls for fault rectification and the associated plant downtime is reduced significantly. If a leak has been detected with the gas density measuring instruments, its exact location can be determined with the portable SF<sub>6</sub> detection instruments and repairs undertaken.

## Connecting parts

For the filling or evacuation procedure for SF<sub>6</sub> tanks, reliable connection technology is required in order to prevent gas leakage and to enable efficient operation. WIKA connecting parts fulfil the highest customer requirements, and include valves, couplings, hoses and other components.

## Analysis

With the help of WIKA gas analytic instruments, the condition of the SF<sub>6</sub> gas in the plant can be determined directly in the field. Within 5 to 10 minutes, directly on site, the user is able to decide whether the equipment needs repair. Depending on the instrument version, the quality parameters of purity, humidity and concentration of decomposition products are measured. Operation is very simple, since after the connection of the gas compartment, the measurement must simply be started manually. The automatic flow control provides for precise and reproducible results. Following the measurement, the result is compared to the applicable benchmarks in accordance with IEC or CIGRE, and, depending on the instrument version, can be saved.

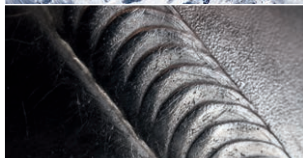
## Handling

Filling and handling equipment can be used for the filling, refilling and preparation of SF<sub>6</sub> gas. Depending on the application, equipment is used in manufacture, installation and maintenance. The size of the plants depends on the volume of the gas compartment being worked upon. Depending on the customer requirements, the operation and form of the equipment varies.

# SF<sub>6</sub> gas density monitoring

SF<sub>6</sub> gas-filled plants are often exposed to harsh conditions, including, for example, extreme temperature fluctuations, strong winds, high air humidity and ambient pressure changes.

In the face of this, to ensure optimal operational safety of the plants, the correct interpretation of the gas density measurement is of central importance. WIKA's SF<sub>6</sub> density measuring instruments are especially durable.

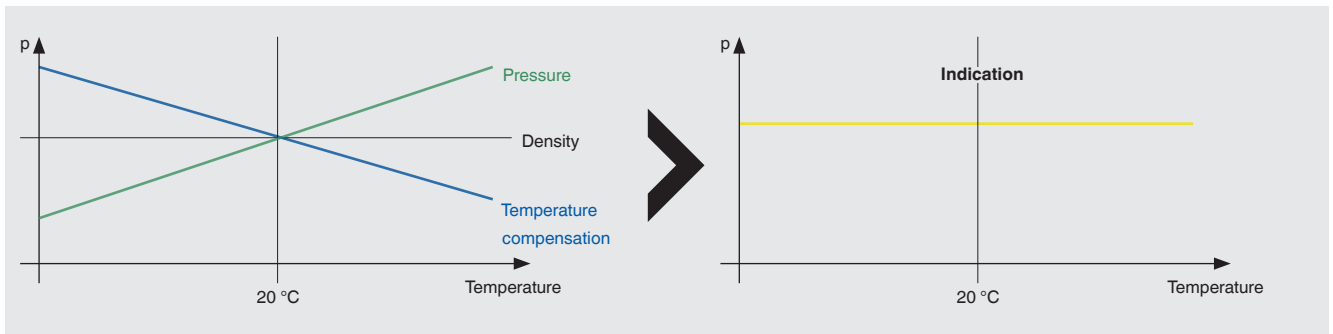


Long-term advantages	Technology	WIKA product
Constant indication with temperature changes	Temperature compensation	<ul style="list-style-type: none"> <li>■ Density monitor</li> <li>■ Density indicator</li> <li>■ Density switch</li> <li>■ Density transmitter</li> </ul>
No condensation problems on the window	Hermetically sealed case	<ul style="list-style-type: none"> <li>■ Density monitor</li> <li>■ Density indicator</li> <li>■ Density switch</li> </ul>
No influence due to altitude or atmospheric pressure	Hermetically sealed case	<ul style="list-style-type: none"> <li>■ Density monitor</li> <li>■ Density indicator</li> <li>■ Density switch</li> <li>■ Density transmitter</li> </ul>
Measuring system will not leak or corrode	<ul style="list-style-type: none"> <li>■ Welded measuring system from 316L stainless steel</li> <li>■ Helium leak rate &lt;math&gt;&lt; 1 \times 10^{-8}&lt;/math&gt; mbar x l/s</li> </ul>	<ul style="list-style-type: none"> <li>■ Density monitor</li> <li>■ Density indicator</li> <li>■ Density switch</li> </ul>
Reliable switch point setting	Fixed setting through laser-welded point	<ul style="list-style-type: none"> <li>■ Density monitor</li> </ul>
Sealed, tamper-resistant case	Case secured with weld spot	<ul style="list-style-type: none"> <li>■ Density monitor</li> <li>■ Density indicator</li> </ul>



## Temperature compensation of pressure measuring instruments

The principle reason for pressure changes in SF<sub>6</sub> gas-filled plants are changes in the ambient temperature. With known gas pressure and temperature, the gas density can be calculated exactly.



In the diagram on the left, the black horizontal line represents the current gas density. The green line shows the rising pressure due to rising temperature measured with a standard pressure gauge. So that the correct gas density may be determined using a pressure measuring instrument, the pressure increase resulting from the rise in temperature must be compensated in the indication.

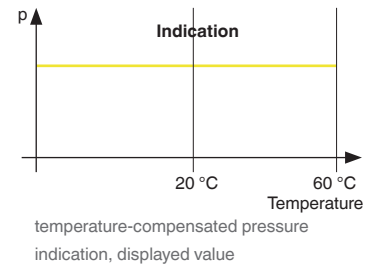
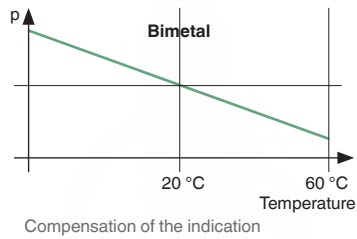
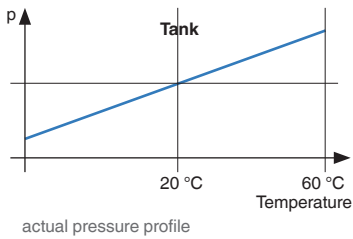
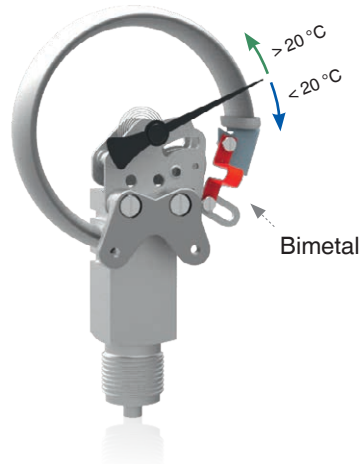
In the diagram on the right, the temperature-compensated pressure indication, corresponding to the gas density of the gas tank, is shown.



## Temperature compensation principles

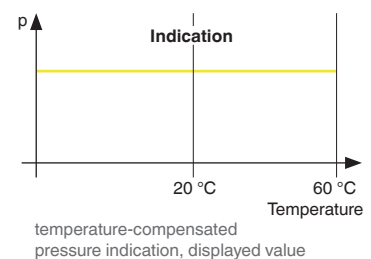
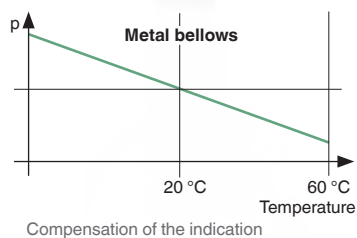
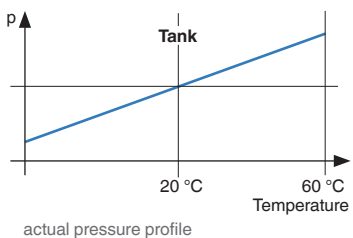
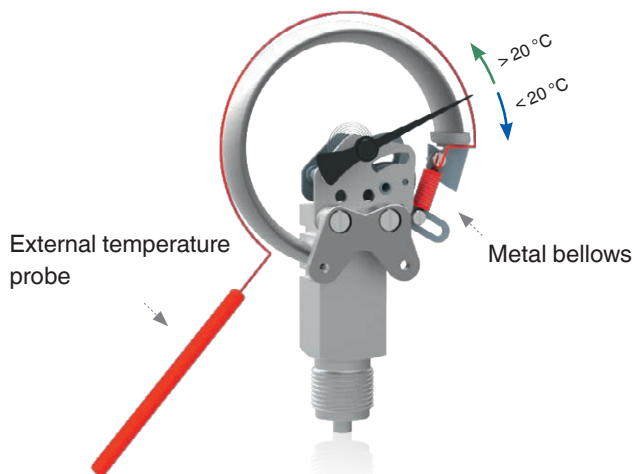
### Bimetal: Density monitor and density indicator

A bimetal between the movement and the measuring tube converts temperature changes into changes in length. The indication on the dial is constant, despite the temperature-induced pressure variations. Only declining pressure due to loss of gas is displayed.



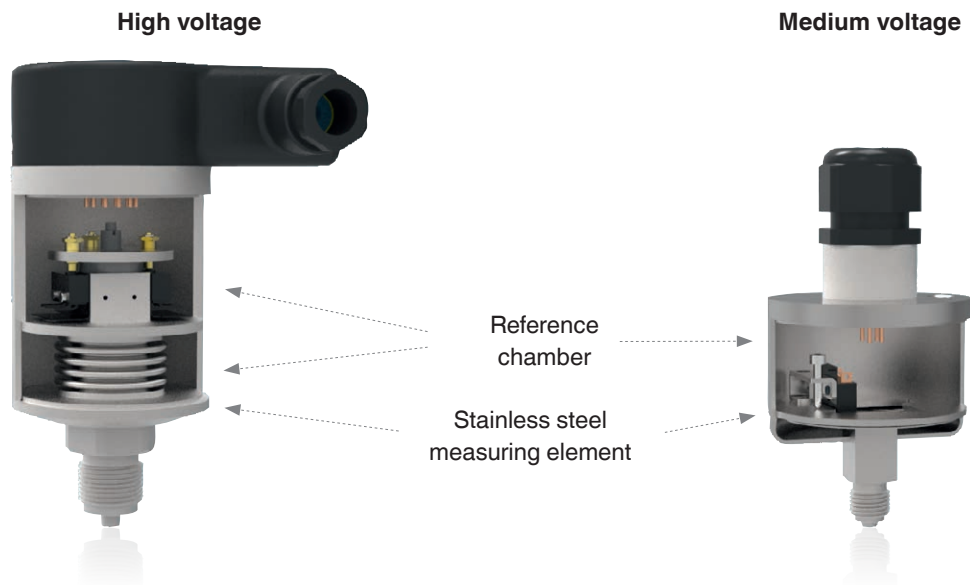
### Metal bellows: Density monitor with external temperature probe

The temperature compensation with external capillary sensor enables temperature measurement directly in the tank.



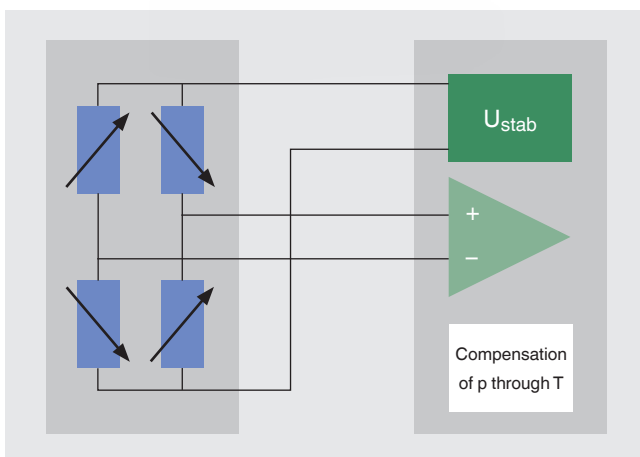
### Reference chamber: Density switch

A chamber filled with SF<sub>6</sub> gas serves as a reference. With environmental influences, the reference chamber behaves the same as the tank and thus does not cause any change in the switching status.



### Electronic sensor: Density transmitter

A pressure transmitter specifically developed for SF<sub>6</sub> density measurement delivers a temperature-compensated output signal.



Wheatstone measuring bridge with temperature compensation for SF<sub>6</sub> gas



# Product overview

## SF<sub>6</sub> gas density monitoring

The components and processes for manufacturing WIKA's SF<sub>6</sub> measuring instrument family have proven themselves in the widest variety of industries and applications. With the help of WIKA's extensive modular system for measurement technology, the instruments have been specifically designed and optimised for SF<sub>6</sub> gas applications.

This results in synergies that benefit the customer in the long run. With the wide range of instrument variants, different customer requirements are served, in terms of equipment, measurands, measuring ranges, accuracy and alarm functionality.

### Mechanical and mechatronic measuring instruments



Model	GDI	GDM	GDM	GDS-MV, GDS-HV
<b>Model designation</b>	Gas density indicator NS 63 and NS 100	Gas density monitor NS 63 und NS 100	Gas density monitor NS 100 with test port and shut-off valve	Gas density switch, medium, high voltage
<b>Output</b>	–	NS 63: max. 2 switch contacts NS 100: max. 4 switch contacts	max. 4 switch contacts	max. 4 switch contacts
<b>Special features</b>	<ul style="list-style-type: none"> <li>■ Bimetal compensation</li> <li>■ Dial layout to customer requirements</li> </ul>	<ul style="list-style-type: none"> <li>■ Bimetal compensation</li> <li>■ Magnetic snap-action contacts</li> <li>■ Dial layout to customer requirements</li> <li>■ NS 100: Variant -TS with external temperature probe</li> </ul>	<ul style="list-style-type: none"> <li>■ Shut-off valve for blocking the gas tank</li> <li>■ Test port for recalibration of the density monitor</li> <li>■ Bimetal compensation magnetic snap-action contacts</li> <li>■ Dial layout to customer requirements</li> </ul>	<ul style="list-style-type: none"> <li>■ Reference chamber compensation</li> <li>■ Micro switch</li> <li>■ High switching accuracy</li> </ul>
<b>Data sheets</b>	SP 60.21, SP 60.03	SP 60.70, SP 60.02	AC 20.01	SP 60.32, SP 60.30

## Mechanical and mechatronic gas density measurement

While gas density indicators only show the temperature-compensated filling status on a colour-coded dial, gas density monitors offer additional alarm signals at pre-defined switching thresholds for equipment monitoring. Offering only the switching function, gas density switches complete the portfolio for this sector.

## Electronic gas density and gas condition measurement

The analogue and digital transmitters provide continuous signals or data packets for evaluation in the SCADA control rooms of modern transformer and distribution stations. Through the combination of transmitter and gas density monitor, in addition to the signal redundancy, it is possible to read the status of the SF<sub>6</sub> gas - on site and in the control room.

### Electronic measuring instruments



GDI-100-D	GD10	GDT-20	GDHT-20	GDM-100-TI/TA	GDM-100-TI-D
Digital gas density indicator NS 100	Gas density transmitter	Transmitter for gas density, temperature and pressure with Modbus® output	Transmitter for gas density, temperature, pressure and humidity with Modbus® output	Gas density monitor with additional analogue output (GDM-100 + GD10)	Gas density monitor with Modbus® output (GDM-100 and GDT-20)
Bluetooth®	4 ... 20 mA	Modbus® RTU via RS485	Modbus® RTU via RS485	max. 3 switch contacts + 4 ... 20 mA	max. 3 switch contacts + Modbus® RTU via RS485
<ul style="list-style-type: none"> <li>■ Calculation and on-site display of gas density, pressure and temperature</li> <li>■ Integrated data logger for up to 20,000 measured values</li> <li>■ Data export by means of Bluetooth®</li> <li>■ Battery powered</li> </ul>	<ul style="list-style-type: none"> <li>■ Electronic compensation</li> <li>■ Various connection variants: Field case -F, cable -C, connector -L</li> <li>■ Variants with temperature probe-FT or transmitter -F2</li> </ul>	<ul style="list-style-type: none"> <li>■ Calculation of the gas density values</li> <li>■ Up to 247 transmitters on one master</li> </ul>	<ul style="list-style-type: none"> <li>■ Calculation of the gas density or gas humidity values</li> <li>■ Up to 247 transmitters on one master</li> <li>■ Optionally available with adapter or measuring chamber</li> </ul>	<ul style="list-style-type: none"> <li>■ Variants with integrated GD10 gas density transmitter TI or attached transmitter TA</li> </ul>	<ul style="list-style-type: none"> <li>■ On-site display with switch contacts and digital output</li> <li>■ Online monitoring with high measurement accuracy</li> <li>■ Live availability of pressure, temperature and gas density measured values</li> </ul>
SP 60.07	SP 60.10, SP 60.11, SP 60.12, SP 60.13	SP 60.09	SP 60.14	SP 60.05, SP 60.06	SP 60.23



# Periodic checking of leakage detection systems

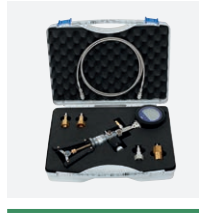
**Gas density monitors and gas density transmitters reliably warn the plant operator in case of leaks and loss of the insulation gas.**

As a result of the significant contribution to operational safety offered by gas-insulated instruments and within the meaning of the sustainable climate protection, many plant operators already check their gas density monitors on a regular basis.

With the entry into force of Regulation (EU) No. 517/2014 on fluorinated greenhouse gases, under specific conditions these regular checks have become mandatory. WIKA offers blocking solutions that allow you to check your leakage detection system even when it is installed. In addition to the gas density monitor with an integrated test port and a shut-off valve, retrofit valves are available. They can be installed between the gas tank and the existing leakage detection system. This enables simple retrofitting to a system which can be calibrated in the future when installed. The entire check can also be carried out in form of a service supplied by us - whether in laboratory or on site.

## Model BCS-10

The robust modular calibration system model BCS-10 serves for the inspection of SF<sub>6</sub> gas density measuring instruments. Both pressure-based mechanical measuring instruments and electronic measuring instruments can be checked quickly and easily.



The combination of the temperature-compensated precision digital gas density indicator model GDI-100-D and the test pump allows precise setting of the measuring point and representation of measured values in different units. External temperature and pressure fluctuations do not affect the measurement. The calibration system model BCS-10 is delivered in a robust service case made of plastic.

## Connecting parts

WIKA developed special connecting parts in order to combine a secure checking of gas density monitors and transmitters with an efficient handling. The self-sealing DN 20 connection ensures a high gas flow during filling and evacuation of the plant and prevents the gas from escaping unintentionally. With the help of a blocking mechanism, the gas density monitor can be safely disconnected from the gas compartment. A special wrench is necessary for actuating the system, so that an unintentional actuation can be avoided. The self-sealing connection for the gas density monitor prevents any loss of the insulating gas when the measuring instrument is dismantled.

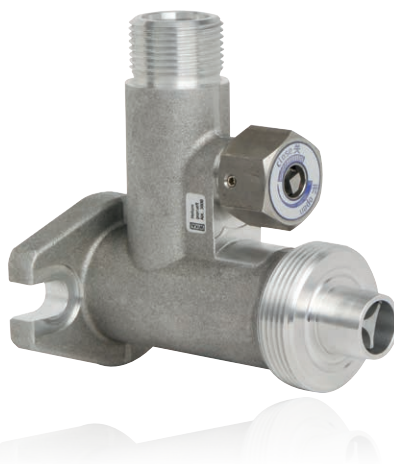
If the gas density monitors are used in combination with a test connection, the checking can also be carried out when the instrument is installed.

## Service

The WIKA calibration vans compliant to DIN EN ISO/IEC 17025 allow us to check your instruments directly on site. Alternatively, you can also send your instruments to our calibration & service centre. All operations will be carried out by certified service technicians.



If no test connection is available on the gas density monitor or transmitter, this connection can be retrofitted using an adapter. It will be positioned between the measuring instrument and the gas compartment. Depending on the requirement, the connection threads can also be changed or adapted. The shut-off valve allows the measuring instrument to be safely disconnected from the gas compartment. The checking of the instrument can be carried out through the connection without dismantling.

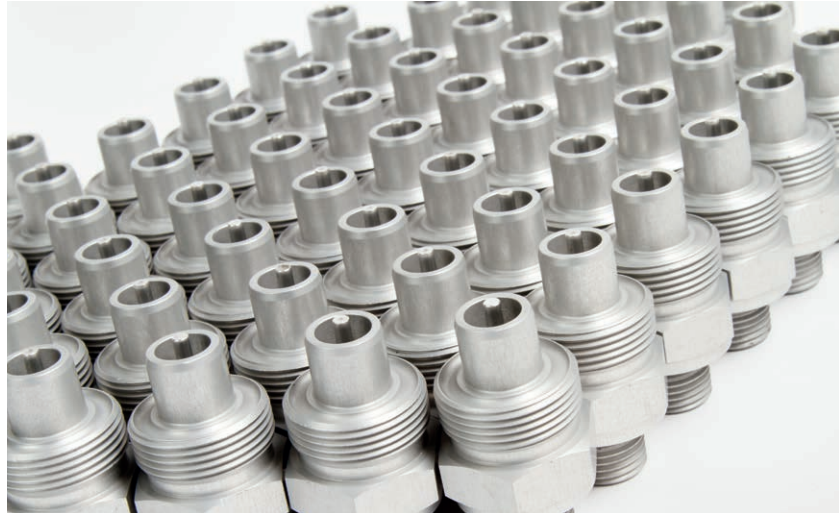


# Connecting parts

**A suitable connection technology is essential for conducting the SF<sub>6</sub> gas from one gas compartment to another without losses and in an efficient manner.**

WIKA's connecting parts enable the secure storage and handling of environmentally hazardous SF<sub>6</sub> greenhouse gas in the equipment provided for this. The connections have been precisely and specifically optimised for this application.

By using WIKA's connecting parts, the maintenance-free and reliable separation of SF<sub>6</sub> gas compartments from the environment is made possible. In this way, not only is the escape of SF<sub>6</sub> gas prevented, but also the ingress of moisture.

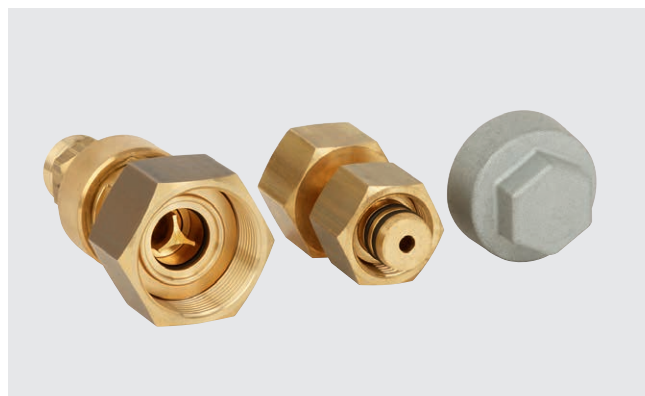


## Valves (GCV) and couplings (GCC)

Self-sealing valves and couplings reliably prevent accidental emissions. The two-stage sealing principle with O-ring and metal contour seal enable safe connection and disconnection under pressure. The connecting parts are manufactured in nominal widths from DN 6 to DN 20. They are manufactured from high-quality aluminium, brass and stainless steel. A material certificate can be provided on request.



Valves and couplings



Adapters and protection caps

## Adapters (GCA), fittings (GCF) and protection caps (GCP)

In addition to valves and couplings, the standard delivery program also includes adapters, fittings and protection caps. WIKA also manufactures customer-specific designs or assemblies according to individual requirements. To ensure a long-term reliable quality, all connecting parts have a robust design, are produced with high-quality materials and are thoroughly checked against leaks.



## Hoses (GCH)

These hoses ensure safe handling of the greenhouse gas SF<sub>6</sub> which is harmful to the environment. Each hose is fitted with self-sealing couplings and is 100% leak tested. It is thus ensured that no SF<sub>6</sub> gas can escape into the atmosphere. A distinction is made between rubber hoses and stainless steel hoses. The rubber hoses are lighter and handier than the stainless steel hoses which are more stable and more robust due to the additional steel mesh.



Product image gas handling hoses



Service sets for SF<sub>6</sub> handling

## Adapter and filling sets

In addition, there are adapter sets which enable connection to switches of different manufacturers. The adapters are made of brass and stainless steel to ensure a long service life in the field.

Furthermore, there are portable filling sets which allow filling and topping up the SF<sub>6</sub> gas plants directly from a gas cylinder.

Our entire equipment is supplied in robust transport cases and is thus a perfect companion for service personnel.

Model	GCV	GCC	GCA	GCF	GCP	GCH	Sets
Function	Valve	Coupling valve	Adapter	Solder and weld-in connection	Protection cap	Hose	Adapter and filling equipment
Nominal diameter	DN 6 ... DN 20	DN 6 ... DN 20	DN 6 ... DN 20	DN 6 ... DN 20	DN 6 ... DN 20	DN 6 ... DN 20	-
Materials	Al, SS, brass	Al, SS, brass	Al, SS, brass	Al, SS, brass	Al, SS, brass	SS, rubber	Al, SS, brass
Data sheets	SP 61.12, SP 61.13, SP 61.14	SP 61.12, SP 61.13, SP 61.14	SP 61.12, SP 61.13, SP 61.14	SP 61.12, SP 61.13, SP 61.14	SP 61.12, SP 61.13, SP 61.14	SP 61.15	SP 61.16



## Gas analysis

**Discharges during switching operations in plants filled with SF<sub>6</sub> gas or an alternative gas lead, over time, to increased concentrations of toxic and highly corrosive decomposition products.**

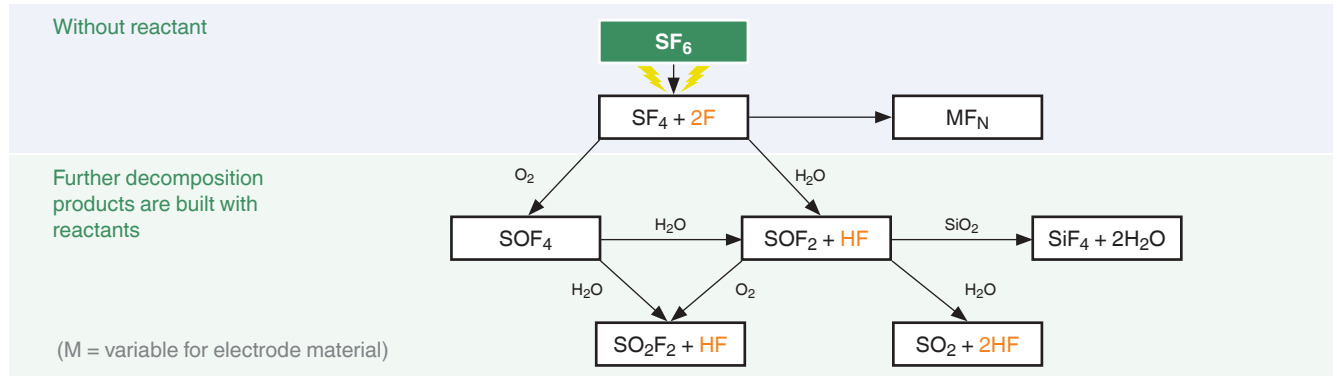
The formation of decomposition products is dependent on the amount of air and humidity reactants in the SF<sub>6</sub> gas or an alternative gas during the discharge. These contaminants (air, humidity and decomposition products) prevent the

continued safe operation of the switchgear. In particular, the decomposition products strongly attack and corrode the surfaces within the tank. This progressively reduces the dielectric strength of the insulation materials in the switchgear.

The use of gas analysis instruments is absolutely necessary to monitor the concentration of harmful decomposition products, thus ensuring long-term plant safety.

## Formation of decomposition products

With energy input during plant operation, the otherwise stable SF<sub>6</sub> gas decomposes into reactive and corrosive products such as SF<sub>4</sub> and other compounds (see illustration “Formation of decomposition products”). From the reactants of air and humidity in the gas, further decomposition products are formed.



Chemical	Stability in air	End products	usual Limit values [ppm <sub>v</sub> ]	Odour
S <sub>2</sub> F <sub>10</sub> disulphur decafluoride	stable	SF <sub>4</sub> , SF <sub>6</sub>	0.01	acid
SF <sub>4</sub> sulphur tetrafluoride	fast decay	HF, SO <sub>2</sub>	0.3	acid, sour
SO <sub>2</sub> F <sub>2</sub> sulphuryl fluoride	stable		0.3	odourless
SOF <sub>4</sub> Thionyl tetrafluoride	stable	SO <sub>2</sub> F <sub>2</sub>	0.5	sour
SiF <sub>4</sub> Silicon tetrafluoride	fast decay	SiO <sub>2</sub> , HF	0.5	pungent
SO <sub>2</sub> sulphur dioxide	stable		1.0	acid
SOF <sub>2</sub> Thionyl fluoride	slow decay	HF, SO <sub>2</sub>	1.5	acid, pungent
HF Hydrogen fluoride	stable		2.0	sour
SF <sub>6</sub> sulphur hexafluoride	stable		1,000	odourless

## Quality directives

The IEC and CIGRE organisations develop criteria and limit values for SF<sub>6</sub> gas. These specify the limits at which a contamination exists, and how the correct handling of the SF<sub>6</sub> gas used in switchgear should be made.

The permissible standard values are stated in IEC 60480, the “Guidelines for the checking and treatment of sulphur hexafluoride (SF<sub>6</sub>)”.

### Maximum concentration of contaminants in SF<sub>6</sub> gas for re-use (in accordance with IEC 60480):

- Air and/or CF<sub>4</sub>: 3 %
- Gaseous decomposition products: 50 ppm<sub>v</sub>
- Humidity: Dew point:
  - 23 °C (filling pressure < 200 kPa abs.) or
  - 36 °C (filling pressure > 200 kPa abs.)



Colour changes in cast resin samples as a result of decomposition products in SF<sub>6</sub> gas

# Detection instruments

Leakage in switchgear can cause high maintenance costs and, depending on the size, can quickly become a safety risk. Thus, gas leaks must be pinpointed promptly and reliably and then eliminated.



## Leak location

### IR-Leak 2,000 ppm<sub>v</sub>



The IR-Leak, with a measuring range of 2,000 ppm<sub>v</sub> is the ideal measuring instrument for locating the leak on site and for making a quantitative measurement of it.

Thus specific repair measures can be taken. The leak location using infrared spectroscopy is neither distorted by humidity or common volatile organic compounds, nor by wind.

## Emission monitoring

### IR-Monitor

Stationary measuring instrument for the monitoring of the concentration of SF<sub>6</sub> gas in the ambient air to guarantee occupational safety in enclosed spaces.



The instrument continually checks the room air with a non-dispersive infrared sensor. Via a high-volume alarm, there is an immediate warning of any hazardous gas concentrations in the air. Usually, samples are taken continuously, close to gas tanks or gas-insulated switchgear, from which large quantities of SF<sub>6</sub> gas could escape within a short period of time.

## Leak testing

### Tracer and IR-Leak 50 ppm<sub>v</sub>

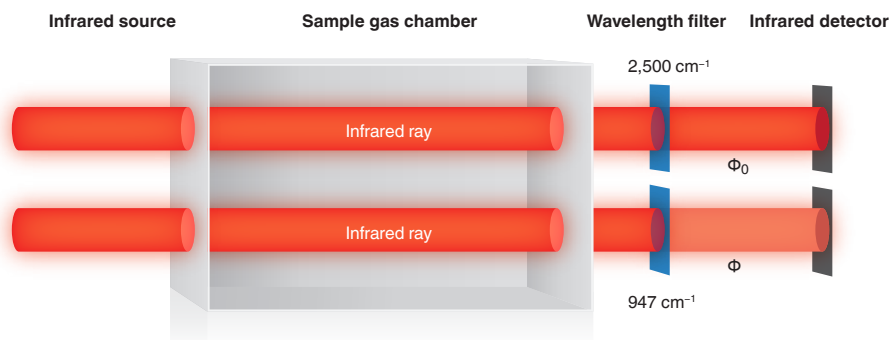
Measuring instruments specifically for the measurement of small SF<sub>6</sub> concentrations to detect the smallest of leaks.

The quantitative gas measurement of SF<sub>6</sub> gas in the air is carried out reliably and reproducibly even at the smallest quantities. The technology used is based on photo-acoustic infrared spectroscopy. The SF<sub>6</sub>-Tracer achieves a very high accuracy with a detection rate of 6 ppb<sub>v</sub>. The IR-Leak, with 50 ppm<sub>v</sub>, has a detection rate of 0.6 ppm<sub>v</sub>.



## Infrared technology measurement principle

### Non-dispersive infrared technology



#### The Lambert-Beer Law

$$A = -\lg \frac{\Phi}{\Phi_0} = \epsilon \cdot c \cdot l$$

- A: Absorption
- Φ: Light intensity after absorption of SF<sub>6</sub> gas
- Φ<sub>0</sub>: Light intensity without absorption
- ε: Extinction coefficient
- c: Concentration
- l: Length of the irradiated chamber (sample gas chamber)

# Product overview for SF<sub>6</sub> analysis

## Quality measurement



Model	GA11 SF <sub>6</sub> in N <sub>2</sub> /CF <sub>4</sub>	GA11 3M™ Novoc™ 4710 Insulating Gas in CO <sub>2</sub>	GA11 N <sub>2</sub> in SF <sub>6</sub> /He
Model designation	SF <sub>6</sub> -Q-Analyser	Analyser for Novoc 4710 Insulating Gas	Analyser for nitrogen
Parameters	Frost point/Dew point SF <sub>6</sub> percentage SO <sub>2</sub> , HF, H <sub>2</sub> S	Frost point/Dew point Novoc 4710 Insulating Gas in CO <sub>2</sub> Percentage O <sub>2</sub>	Frost point/Dew point N <sub>2</sub> percentage, O <sub>2</sub> Helium in nitrogen SF <sub>6</sub> in nitrogen
Special features	<ul style="list-style-type: none"> <li>■ SF<sub>6</sub> quality measurement with pump-back function</li> <li>■ Battery/mains operated</li> </ul>	<ul style="list-style-type: none"> <li>■ Novoc 4710 Insulating Gas quality measurement with pump-back function</li> <li>■ Battery/mains operated</li> </ul>	<ul style="list-style-type: none"> <li>■ Nitrogen quality measurement with pump-back function</li> <li>■ Battery/mains operated</li> </ul>
Data sheet	SP 62.11	SP 62.11	SP 62.11

## Quality measurement

## Accessories



Model	GFTIR-10	GA05	GA45
Model designation	FTIR-Analyser	MV Pressure-Regulator	SF <sub>6</sub> -Recovery-Bag Gas recovery bag
Parameters	SO <sub>2</sub> , HF, SF <sub>4</sub> , SOF <sub>2</sub> , SOF <sub>4</sub> , SO <sub>2</sub> F <sub>2</sub> , S <sub>2</sub> F <sub>10</sub> , SiF <sub>4</sub> , CO, COS, CF <sub>4</sub> , C <sub>2</sub> F <sub>6</sub> , C <sub>3</sub> F <sub>8</sub> concentration	–	–
Special features	<ul style="list-style-type: none"> <li>■ Laboratory measuring system with spectrometer, PC and software</li> <li>■ Mains operated</li> </ul>	<ul style="list-style-type: none"> <li>■ Pressure increase for low process pressures</li> <li>■ Compatible with all analytic instruments</li> </ul>	<ul style="list-style-type: none"> <li>■ Space-saving as foldable</li> <li>■ 110 l capacity</li> <li>■ Overpressure safety</li> </ul>
Data sheet	SP 62.17	SP 62.14	SP 62.08

Leak location/leak test



Model	GA65	GIR-10	GPD-1000
Model designation	SF <sub>6</sub> -Tracer	SF <sub>6</sub> -IR-Leak	SF <sub>6</sub> detection instrument
Parameters	6 ... 60,000 ppb <sub>v</sub>	0 ... 50 ppm <sub>v</sub> 0 ... 2,000 ppm <sub>v</sub>	–
Special features	<ul style="list-style-type: none"> <li>■ High-precision photo-acoustic infrared spectroscopy</li> <li>■ Extensive programme of accessories</li> </ul>	<ul style="list-style-type: none"> <li>■ Non-dispersive infrared sensor</li> <li>■ Portable battery-operated instrument</li> <li>■ Switchable to leak rate</li> </ul>	<ul style="list-style-type: none"> <li>■ Based on the negative corona principle</li> <li>■ Portable battery-operated instrument</li> <li>■ Adjustable sensitivity</li> <li>■ Acoustic signal</li> </ul>
Data sheet	SP 62.13	SP 62.02	

Emission monitoring



Model	GA35
Model designation	SF <sub>6</sub> -IR-Monitor
Parameter	0 ... 2,000 ppm <sub>v</sub>
Special features	Non-dispersive infrared sensor
Data sheet	SP 62.06

# Filling and handling equipment

Filling and handling equipment for SF<sub>6</sub> gas are the central tools for the maintenance of gas-insulated equipment. Both for the installation as well as for the maintenance of gas-insulated equipment in electricity transmission and distribution, WIKA delivers the complete product range of efficient filling and handling equipment.

The core processes are the evacuation, initial filling, extraction, gas preparation and refilling of SF<sub>6</sub> equipment. Furthermore, the instruments support the plant operator with the recording of the SF<sub>6</sub> gas volumes and emissions, as is prescribed in the F-gas regulation (EU), No. 517/2014, for specified equipment.

WIKA is a specialist for safe SF<sub>6</sub> gas handling and simple user guidance which is especially reflected in the products of the fully automatic series GPU-x-x000. The motto: Simple and intuitive for more safety!

## Portable instrument series



Model	GPF-10	GVC-10	GTU-10	GWS-10	GVP-10
<b>Model designation</b>	Portable SF <sub>6</sub> filter unit	Portable SF <sub>6</sub> vacuum compressor	Portable SF <sub>6</sub> transfer unit	Portable SF <sub>6</sub> gas cylinder scale	Portable vacuum pump
<b>Process</b>	Filtration	SF <sub>6</sub> extraction	SF <sub>6</sub> filling	Determining the transferred SF <sub>6</sub> gas mass	Air evacuation
<b>Description</b>	Filtering out of particles, humidity and decomposition products	In order to extract SF <sub>6</sub> gas compartments up to a residual pressure of 5 mbar abs., the model GVC-10 vacuum compressor is combined with the model GTU-10 transfer unit	SF <sub>6</sub> gas compartments are directly filled from the gas cylinder or the SF <sub>6</sub> gas is stored in a gas cylinder. During storage of the SF <sub>6</sub> gas, the compressor can liquefy the gas in the storage vessel	Measuring the gas cylinder weight before and after the filling/extraction	Preparation for filling following plant maintenance
<b>Data sheet</b>	SP 63.11	SP 63.13	SP 63.07	SP 63.09	SP 63.12



## Criteria for plant definition

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1. How much SF<sub>6</sub> gas should be transferred and in what time? ✓ Air flow or mass flow
2. Which container should be installed? ✓ Tank or gas cylinder
3. Which equipment should be maintained? ✓ Hose lengths and connecting parts
4. Which operating concept? ✓ Automatically programmed control or manual control
5. Into which region will the plant be delivered? ✓ Applicable standards
6. Where will the plant be used? ✓ Indoor or outdoor switchgear



In accordance with the above definition, WIKA can offer standard plants or – with special processes and further definition – engineer special plants.

# Filling and handling equipment

## Filling stations





Model	GFU08	GFU10	GPU-x-x000
Model designation	SF <sub>6</sub> filling cart	SF <sub>6</sub> handling and filling equipment	SF <sub>6</sub> handling and filling equipment
SF <sub>6</sub> storage vessel	Gas cylinder	Gas tank	Gas cylinder/gas tank
Description	<p>The filling cart model GFU08 enables simple and comfortable transport of the gas cylinders to the site of operation. The desired target pressure can be set using a pressure reducer.</p> <p>An optionally available balance allows the user to check the transferred SF<sub>6</sub> gas volume.</p> <p>A wide range of optionally available vacuum pumps allows you to evacuate air from the gas compartment before filling it with SF<sub>6</sub>.</p>	<p>Model GFU10 allows you to carry out the complete range of tasks when handling SF<sub>6</sub>. This SF<sub>6</sub> preparation and filling station is ideally suited for maintenance of small SF<sub>6</sub> gas compartments. It is also possible to dry the gas by means of the built-in dry filters and the internal circuit.</p>	<p>The WIKA-GPU-x-x000 platform offers the highest level of comfort due to ease of operation and extremely long maintenance cycles.</p> <p>The main functions include filling, extraction and cleaning of SF<sub>6</sub>, evacuation and filling of switchgear, linear accelerators and other SF<sub>6</sub> gas-filled equipment. This plant can also be easily consolidated with SF<sub>6</sub> gas cylinders and tanks.</p> <p>Optional and unique in the market is the additional SIL 2 safety control which, in addition to the redundant pressure measurement system, also includes a SIL 2 SF<sub>6</sub> gas sensor, thus making it impossible for larger amounts of SF<sub>6</sub> to be emitted unnoticed.</p>
Data sheet	SP 63.08	SP 63.01	SP 63.16

GPU-x-x000 platform



GPU-x-x000

	GPU-B-2000	GPU-S-2000	GPU-B-3000	GPU-S-3000
Fully automatic operation	✓	✓	✓	✓
Intuitive operation by means of a 10" IntelliTouch touchscreen	✓	✓	✓	✓
Fast SF <sub>6</sub> gas recovery for large gas compartments 	✗	✗	✓	✓
Additional SIL 2 safety control with SF <sub>6</sub> gas warning device 	✗	✓	✗	✓

Safety at WIKA



Safety for people and the environment is the highest priority of WIKA. Preventing or detecting emission of the SF<sub>6</sub> gas during handling and ensuring safe operation is of the utmost importance not only for reasons of climate protection, but also because of personnel safety. The aim is to provide a safe system that limits emissions to a minimum and at the same time almost excludes any faults in application.

**WIKA is the only provider of SF<sub>6</sub> handling equipment with a safety control in accordance with SIL 2 / PL d.**

This unique safety concept is an integral part of the GPU-S-x000 series. Therefore, errors during handling and the resulting emission of SF<sub>6</sub> to the atmosphere are technically impossible.

# WEgrid Asset Protection – everything from one source



**“Everything that can be digitized will be digitized.”  
(Carly Fiorina, former CEO HP). There is a good reason  
why this also applies to the SF<sub>6</sub> gas-filled systems.**

WEgrid Solutions is committed to perfect the protection of people, machinery and the environment in the power transmission industry. A significant step in this mission is digitisation of gas monitoring.

WEgrid Asset Protection is the solution.  
We offer intelligent overall solutions to our customers.  
Over 40 years of experience in the SF<sub>6</sub> gas industry and an innovation-driven expert team are our tools for this turnkey concept.

Online monitoring of the insulating gas in your SF<sub>6</sub>-filled plant is the core of WEgrid Asset Protection.

Our highly modern sensors constantly communicate with a data centre which analyses the transmitted values and alarms you as soon as leaks occur or humidity in the insulating gas increases. Of course, you can call these values yourself at any time.

In addition, our intelligent system gets to know your plant. The collected data is extrapolated, which allows the system to determine trends. This enables you to take a look into the future according to the motto: Act rather than react.

This means for you transition from time-based maintenance to condition-based maintenance.

- ✓ Remote monitoring
- ✓ Early detection of the smallest leaks
- ✓ Attributing emissions to a measuring point

- ✓ Online trends and analyses in real time
- ✓ Documentation of emission rates
- ✓ Change from time-based to condition-based maintenance

## Products

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Our digital sensors are the foundation of WEgrid Asset Protection. Due to the RS485 interface and the use of the widely used Modbus® protocol, these transmitters can be employed virtually anywhere, including retrofitting. Thanks to the advanced technology, up to 247 sensors can be queried from a single BUS master.

## Installation

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Our expert team commissions our products and the entire system on site at your premises.

## Data warehouse

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Our online sensors measure the condition of your SF<sub>6</sub> gas at short intervals. The transmitted values are collected, managed and stored in our data centre.

## Data evaluation

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Our data system constantly analyses the collected values for unusual deviations. In future, the data will be additionally projected and forecasts will be made.

## Visualisation

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On our online platform, the entire data will be prepared and made available to you in graphical form.

## Service trigger

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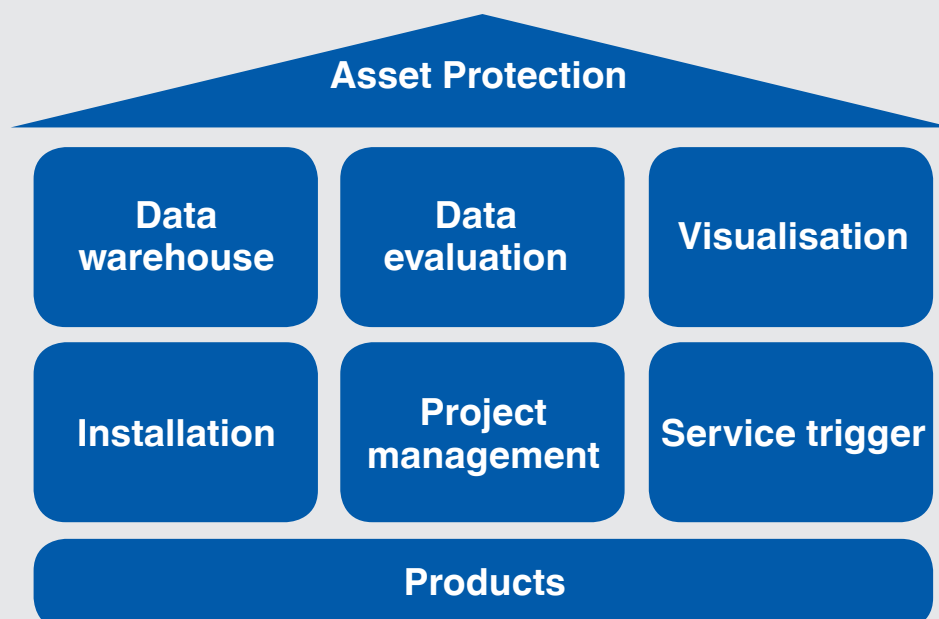
If gas density decreases or humidity content increases, rapid action can be the key solution. Therefore, our intelligent data centre will immediately inform you in case of value deviations.

## Project management

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We are a reliable long-term partner for you. We will take care of planning and implementation of your digitisation project and assist with our advice.

**We appreciate individuality of our customers and their wishes. That is why we offer flexible models of our concept and we will be glad to advise you about possible module combinations.**





## WEgrid Services – Service, consulting and training

**Due to the immense climatic effects, SF<sub>6</sub> gas is an important topic worldwide, on which there is a need for action to eliminate emissions.**

**The consequences are governmental controls with the requirement for verification of the SF<sub>6</sub> filling volumes in plants. In the seminars, WIKA informs about the applicable regulations coupled with practical knowledge for the selection and operation of the right equipment.**

We offer many different topics

- Basics
- Rules and regulations
- Emission monitoring
- Density measurement and humidity measurement
- Connecting parts
- Filling and handling equipment
- Analysis
- Detection

Imagine you could bring together certified experts from the field of SF<sub>6</sub> lifecycle management and gain insight into best practices.

Imagine you could get a demonstration of instruments from the product portfolio for SF<sub>6</sub> gas solutions from the manufacturer themselves.

To ensure a higher transfer of knowledge, the SF<sub>6</sub> trainings also include a practical part or are illustrated with live demonstrations.

Consulting or training can be carried out within our own company training centre or on site at your premises.



### International service network with system calibrations

To keep your machine and instrument availability at a high level, simply have your instrument calibrated in a WIKA service hub. Our worldwide service offer has appropriate options for you.

### Repair and maintenance service

Depending on the level of work required, we can offer our customers a repair and maintenance service, either at WIKA or on site.

### Rental service

Should our customers only require analytic and measuring instruments for a specific period of time or a first test, these can be rented from us.

### Digitalisation

We provide you with a turnkey concept which allows you to monitor your plants in real time, to preset leakage rates and better plan your service operations. Regardless of whether it is a new project or an existing plant.

### Commissioning service

On request, we also undertake the commissioning of new instruments for our customers. This usually involves a detailed functional testing and detailed instruction and training of operating personnel.

### Spare parts service

Order any spare parts for machines and instruments in a quick and reliable manner, thus increasing your availability of machines.

### Analysis service

Thanks to our experience, we are also able to offer a comprehensive analysis service to our customers. Using non-destructive measurement methods, an identification and precise qualification of the main decomposition products of SF<sub>6</sub> gas can be made. This is also possible, through our experts, for highly corrosive SF<sub>6</sub> samples. Furthermore, we are also available for the analysis and detection of any leakages you may have.

### Consulting

Due to our presence worldwide, with over 43 subsidiaries, and through our personnel with specialist training in the handling of SF<sub>6</sub> gas, we are able to provide you with advice and assistance.

Do you require further information or have a specific inquiry? Then simply contact us at [SF6-sales@wika.com](mailto:SF6-sales@wika.com)

# Certification

EU regulation No. 517/2014 on fluorinated greenhouse gases replaced the previous (EC) 842/2006 with effect from 1 January 2015. The new regulation stipulates training measures for personnel who carry out work in connection with sulphur hexafluoride (SF<sub>6</sub> gas).

In particular, this work includes:

- Installation, service, maintenance, repair or shutdown of gas-insulated electrical switchgear
- Performing leak testing on plants that fall under the F-gas regulation
- Recovery of SF<sub>6</sub> gas

As a testing and certification body recognised by the Bavarian state office, WIKA offers competence training with subsequent examination, so personnel can be certified across all of Europe. The training and certification is carried out in accordance with the EC 305/2008 European regulations as well as the chemicals climate protection regulation.

Certified WIKA instructors pass on their extensive know-how for daily, practical application. Among those we train are installers, service technicians and maintenance personnel.





# Worldwide consulting



Around the globe, WIKA employees are available to you for SF<sub>6</sub> gas applications. Our engineers and service technicians offer you the best solutions for your application from a diverse portfolio.

With well over a million WIKA measuring instruments in the field, the SF<sub>6</sub> density monitoring of plants within the electricity transmission and distribution is assured.

Within the WIKA SF<sub>6</sub> gas academy, our customers gain practical information and training on this complex subject.

In our academy, we educate and train customers on site or within our subsidiaries. Wherever you are located, we can assist you.

# Facts about SF<sub>6</sub> gas

## SF<sub>6</sub> gas, the strongest known greenhouse gas

In the atmosphere, SF<sub>6</sub> gas is undesirable due to its high global warming potential and it was listed, along with five other gases, in the Kyoto Protocol.

Its climatic impact is 22,800 times greater than that of carbon dioxide, and its residence time in the atmosphere is approximately 3,200 years. Worldwide there are strict regulations that demand emission reductions in SF<sub>6</sub> gas.

In the EU, the F-gas regulation, (EC) No. 517/2014 on the limitation of greenhouse gas emissions, came into force in 2014. In this, the general requirements for the specific handling of SF<sub>6</sub> gas and other fluorinated gases (F-gases) were established.

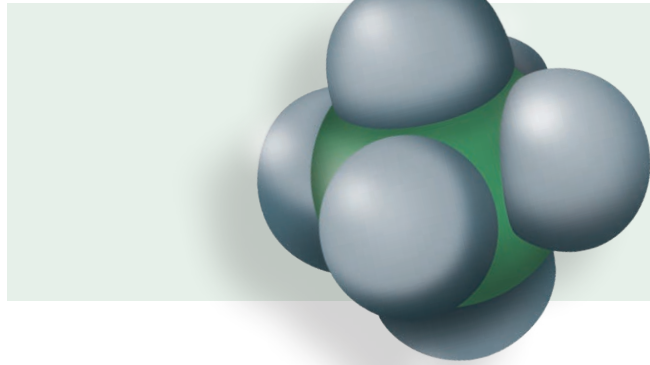
Gas losses on a component filled with SF<sub>6</sub> gas are both an environmental problem as well as a safety risk, with the associated production or plant shutdown and/or costly service call-outs.

In Germany, the producers of SF<sub>6</sub> gas and the manufacturers and operators of gas-filled switchgear have thus joined forces and signed a voluntary undertaking including emission limits.

The current state of the art for SF<sub>6</sub> gas-filled plants is mature and is constantly evolving to take account of climate-related problems.

## Characteristics

- Chemical name: Sulphur hexafluoride
- Colourless, odourless, non-toxic, non-flammable, chemically inert
- High dielectric strength, almost 3 x higher than air or N<sub>2</sub>
- Climate-affecting CO<sub>2</sub> equivalent: 22,800
- Lifetime in the atmosphere: 3,200 years



Model of a sulphur hexafluoride molecule (one sulphur atom bound with six fluorine atoms)

## Applications

- For over 50 years in various segments of industry
- Switchgear and switch-disconnectors in electricity transmission and distribution
- Particle accelerators
- Radar systems
- X-ray equipment
- MRI instruments

In medium and high-voltage switchgear of the electricity grid operators, the gas acts as an extremely efficient insulation medium and operates as the arc quenching during the switching process.

The gas provides the ideal solution due to its high dielectric strength and its ability for recombination. Due to its superior properties in comparison with other media, such as air or nitrogen, plants can be built with much more compact dimensions.

# Milestones in the SF<sub>6</sub> gas division at WIKA

- 1976** Introduction of the first gas density monitor with temperature compensation
- 1990** Introduction of the first gas density monitor with an external temperature probe
- 1992** The first generation of “Online monitoring” with a gas density transmitter
- 2000** Introduction of the first gas density indicators, gas density switches and gas density monitors for medium-voltage systems
- 2004** Introduction of a gas density switch with small drift
- 2005** Introduction of the second generation of “Online monitoring” with a gas density transmitter with field case
- 2009** Acquisition of the SF<sub>6</sub> division of the gas analysis specialists G.A.S. in Dortmund
- 2010** Extension of the portfolio with valves and gas handling instruments
- 2013** Introduction of digital SF<sub>6</sub> condition transmitters of the “Smart Grid” generation
- 2015** Recognition as testing and certification body for personnel certification in the handling of SF<sub>6</sub>
- 2016** Introduction of the new generation of groundbreaking handling instruments
- 2017** Renaming the company division to WEgrid Solutions and extension of the portfolio with WEgrid Asset Protection



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