Innovative SF₆ solutions
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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Applications

High voltage/medium voltage

Examples of SF₆ 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)
Proper operation of the SF$_6$-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.

**Who we are**

WEgrid Solutions is the only supplier on the market that offers a complete product portfolio and customized complete solutions for plants filled with SF$_6$.

**Innovation is our passion – quality our principle**

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.
What we do

WEgrid Solutions stands for intelligent SF₆ solutions tailored to your needs. With our three segments, we offer products and services for all areas of interest in the industry.

WEgrid Products

Our comprehensive product portfolio covers all areas of a SF₆-filled plant:

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

WEgrid Services

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

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 SF₆ gas monitoring as simple and safe as possible.
For safety reasons, the filling volume of SF\textsubscript{6} gas is defined for each gas compartment and monitored using an SF\textsubscript{6} 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\textsubscript{6} 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\textsuperscript{®} protocol.

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

\textbf{WEgrid Products – SF\textsubscript{6} instrumentation ensures plant safety}

\textsuperscript{6}SCADA: Supervisory control and data acquisition
Proactive plant monitoring and service for high-voltage switchgear

The online monitoring of SF₆ 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 SF₆ 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 SF₆ detection instruments and repairs undertaken.

Analysis

With the help of WIKA gas analytic instruments, the condition of the SF₆ 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.

Connecting parts

For the filling or evacuation procedure for SF₆ 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.

Handling

Filling and handling equipment can be used for the filling, refilling and preparation of SF₆ 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 vary.
**SF₆ gas density monitoring**

**SF₆ 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 SF₆ density measuring instruments are especially durable.

<table>
<thead>
<tr>
<th>Long-term advantages</th>
<th>Technology</th>
<th>WIKA product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant indication with temperature changes</td>
<td>Temperature compensation</td>
<td>• Density monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density transmitter</td>
</tr>
<tr>
<td>No condensation problems on the window</td>
<td>Hermetically sealed case</td>
<td>• Density monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density switch</td>
</tr>
<tr>
<td>No influence due to altitude or atmospheric pressure</td>
<td>Hermetically sealed case</td>
<td>• Density monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density transmitter</td>
</tr>
<tr>
<td>Measuring system will not leak or corrode</td>
<td>• Welded measuring system from 316L stainless steel</td>
<td>• Density monitor</td>
</tr>
<tr>
<td></td>
<td>• Helium leak rate &lt; 1 x 10⁻⁸ mbar x l/s</td>
<td>• Density indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density transmitter</td>
</tr>
<tr>
<td>Reliable switch point setting</td>
<td>Fixed setting through laser-welded point</td>
<td>• Density monitor</td>
</tr>
<tr>
<td>Sealed, tamper-resistant case</td>
<td>Case secured with weld spot</td>
<td>• Density monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Density indicator</td>
</tr>
</tbody>
</table>
Gas density monitoring

Temperature compensation of pressure measuring instruments

The principle reason for pressure changes in SF₆ 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 SF₆ 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 SF₆ density measurement delivers a temperature-compensated output signal.
Product overview
SF₆ gas density monitoring

The components and processes for manufacturing WIKA’s SF₆ 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 SF₆ 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

<table>
<thead>
<tr>
<th>Model</th>
<th>GDI</th>
<th>GDM</th>
<th>GDM</th>
<th>GDS-MV, GDS-HV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>Gas density indicator NS 63 and NS 100</td>
<td>Gas density monitor NS 63 und NS 100</td>
<td>Gas density monitor NS 100 with test port and shut-off valve</td>
<td>Gas density switch, medium, high voltage</td>
</tr>
<tr>
<td>Output</td>
<td>–</td>
<td>NS 63: max. 2 switch contacts NS 100: max. 4 switch contacts</td>
<td>max. 4 switch contacts</td>
<td>max. 4 switch contacts</td>
</tr>
<tr>
<td>Special features</td>
<td>■ Bimetal compensation ■ Dial layout to customer requirements</td>
<td>■ Bimetal compensation ■ Magnetic snap-action contacts ■ Dial layout to customer requirements ■ NS 100: Variant-TS with external temperature probe</td>
<td>■ Shut-off valve for blocking the gas tank ■ Test port for recalibration of the density monitor ■ Bimetal compensation magnetic snap-action contacts ■ Dial layout to customer requirements</td>
<td>■ Reference chamber compensation ■ Micro switch ■ High switching accuracy</td>
</tr>
<tr>
<td>Data sheets</td>
<td>SP 60.21, SP 60.03</td>
<td>SP 60.70, SP 60.02</td>
<td>AC 20.01</td>
<td>SP 60.32, SP 60.30</td>
</tr>
</tbody>
</table>
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 SF₆ gas - on site and in the control room.

Electronic measuring instruments

<table>
<thead>
<tr>
<th>GDI-100-D</th>
<th>GD10</th>
<th>GDT-20</th>
<th>GDHT-20</th>
<th>GDM-100-TI/TA</th>
<th>GDM-100-TI-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital gas density indicator NS 100</td>
<td>Gas density transmitter</td>
<td>Transmitter for gas density, temperature and pressure with Modbus® output</td>
<td>Transmitter for gas density, temperature, pressure and humidity with Modbus® output</td>
<td>Gas density monitor with additional analogue output (GDM-100 + GD10)</td>
<td>Gas density monitor with Modbus® output (GDM-100 and GDT-20)</td>
</tr>
<tr>
<td>Bluetooth®</td>
<td>4 … 20 mA</td>
<td>Modbus® RTU via RS485</td>
<td>Modbus® RTU via RS485</td>
<td>max. 3 switch contacts + 4 … 20 mA</td>
<td>max. 3 switch contacts + Modbus® RTU via RS485</td>
</tr>
</tbody>
</table>

- Calculation and on-site display of gas density, pressure and temperature
- Integrated data logger for up to 20,000 measured values
- Data export by means of Bluetooth®
- Battery powered
- Electronic compensation
- Various connection variants: Field case -F, cable -C, connector -L
- Variants with temperature probe-FT or transmitter -F2
- Calculation of the gas density values
- Up to 247 transmitters on one master
- Calculation of the gas density or gas humidity values
- Up to 247 transmitters on one master
- Optionally available with adapter or measuring chamber
- Variants with integrated GD10 gas density transmitter TI or attached transmitter TA
- On-site display with switch contacts and digital output
- Online monitoring with high measurement accuracy
- Live availability of pressure, temperature and gas density measured values

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 SF₆ 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 dismounted.

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.

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 dismounting.

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.
Connecting parts

A suitable connection technology is essential for conducting the SF₆ 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 SF₆ 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 SF₆ gas compartments from the environment is made possible. In this way, not only is the escape of SF₆ 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.

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 SF₆ 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 SF₆ 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.

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 SF₆ 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.

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

Discharges during switching operations in plants filled with SF₆ 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 SF₆ 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 SF₆ gas decomposes into reactive and corrosive products such as SF₄ and other compounds (see illustration “Formation of decomposition products”). From the reactants of air and humidity in the gas, further decomposition products are formed.

Without reactant

Further decomposition products are built with reactants

(M = variable for electrode material)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Stability in air</th>
<th>End products</th>
<th>usual Limit values [ppmv]</th>
<th>Odour</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₂F₁₀ disulphur decafluoride</td>
<td>stable</td>
<td>SF₆, SF₆</td>
<td>0.01</td>
<td>acrid</td>
</tr>
<tr>
<td>SF₄ sulphur tetrafluoride</td>
<td>fast decay</td>
<td>HF, SO₂</td>
<td>0.3</td>
<td>acrid, sour</td>
</tr>
<tr>
<td>SO₂F₂ sulphuryl fluoride</td>
<td>stable</td>
<td>SO₂F₂</td>
<td>0.3</td>
<td>odourless</td>
</tr>
<tr>
<td>SOF₄ Thionyl tetrafluoride</td>
<td>stable</td>
<td>SO₂F₂</td>
<td>0.5</td>
<td>sour</td>
</tr>
<tr>
<td>SiF₄ Silicon tetrafluoride</td>
<td>fast decay</td>
<td>SiO₂, HF</td>
<td>0.5</td>
<td>pungent</td>
</tr>
<tr>
<td>SO₂ sulphur dioxide</td>
<td>stable</td>
<td></td>
<td>1.0</td>
<td>acrid</td>
</tr>
<tr>
<td>SOF₃ Thionyl fluoride</td>
<td>slow decay</td>
<td>HF, SO₂</td>
<td>1.5</td>
<td>acrid, pungent</td>
</tr>
<tr>
<td>HF Hydrogen fluoride</td>
<td>stable</td>
<td>HF, SO₂</td>
<td>2.0</td>
<td>sour</td>
</tr>
<tr>
<td>SF₆ sulphur hexafluoride</td>
<td>stable</td>
<td></td>
<td>1,000</td>
<td>odourless</td>
</tr>
</tbody>
</table>

Quality directives

The IEC and CIGRE organisations develop criteria and limit values for SF₆ gas. These specify the limits at which a contamination exists, and how the correct handling of the SF₆ 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 (SF₆)”.

Maximum concentration of contaminants in SF₆ gas for re-use (in accordance with IEC 60480):

- Air and/or CF₄: 3 %
- Gaseous decomposition products: 50 ppmv
- Humidity: Dew point:
  - -23 °C (filling pressure < 200 kPa abs.) or
  - -36 °C (filling pressure > 200 kPa abs.)
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 ppmv**

The IR-Leak, with a measuring range of 2,000 ppmv 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 SF₆ 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 SF₆ gas could escape within a short period of time.
Leak testing

**Tracer and IR-Leak 50 ppm vol**

Measuring instruments specifically for the measurement of small SF₆ concentrations to detect the smallest of leaks.

The quantitative gas measurement of SF₆ 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 SF₆-Tracer achieves a very high accuracy with a detection rate of 6 ppb vol. The IR-Leak, with 50 ppm vol, has a detection rate of 0.6 ppm vol.

**Infrared technology measurement principle**

**Non-dispersive infrared technology**

\[
A = -\lg \frac{\Phi}{\Phi_0} = \varepsilon \cdot c \cdot l
\]

- \( A \): Absorption
- \( \Phi \): Light intensity after absorption of SF₆ gas
- \( \Phi_0 \): Light intensity without absorption
- \( \varepsilon \): Extinction coefficient
- \( c \): Concentration
- \( l \): Length of the irradiated chamber (sample gas chamber)
## Product overview for SF₆ analysis

### Quality measurement

<table>
<thead>
<tr>
<th>Model</th>
<th>GA11 SF₆ in N₂/CF₄</th>
<th>GA11 3M™ Novec™ 4710 Insulating Gas in CO₂</th>
<th>GA11 N₂ in SF₆/He</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>SF₆-Q-Analyser</td>
<td>Analyser for Novec 4710 Insulating Gas</td>
<td>Analyser for nitrogen</td>
</tr>
<tr>
<td>Parameters</td>
<td>Frost point/Dew point SF₆ percentage SO₂, HF, H₂S</td>
<td>Frost point/Dew point Novec 4710 Insulating Gas in CO₂ Percentage O₂</td>
<td>Frost point/Dew point N₂ percentage, O₂ Helium in nitrogen SF₆ in nitrogen</td>
</tr>
<tr>
<td>Special features</td>
<td>■ SF₆ quality measurement with pump-back function ■ Battery/mains operated</td>
<td>■ Novec 4710 Insulating Gas quality measurement with pump-back function ■ Battery/mains operated</td>
<td>■ Nitrogen quality measurement with pump-back function ■ Battery/mains operated</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 62.11</td>
<td>SP 62.11</td>
<td>SP 62.11</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Model</th>
<th>GFTIR-10</th>
<th>GA05</th>
<th>GA45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>FTIR-Analyser</td>
<td>MV Pressure-Regulator</td>
<td>SF₆-Recovery-Bag Gas recovery bag</td>
</tr>
<tr>
<td>Parameters</td>
<td>SO₂, HF, SF₆, SOF₂, SOF₄, SO₂F₂, S₂F₁₀, SiF₄, CO, COS, CF₄, C₂F₆, C₃F₈ concentration</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Special features</td>
<td>■ Laboratory measuring system with spectrometer, PC and software ■ Mains operated</td>
<td>■ Pressure increase for low process pressures ■ Compatible with all analytic instruments</td>
<td>■ Space-saving as foldable ■ 110 l capacity ■ Overpressure safety</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 62.17</td>
<td>SP 62.14</td>
<td>SP 62.08</td>
</tr>
</tbody>
</table>

3M and Novec 4710 are registered trademarks of 3M.
## Leak location/leak test

<table>
<thead>
<tr>
<th>Model</th>
<th>GA65</th>
<th>GIR-10</th>
<th>GPD-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>SF₆-Tracer</td>
<td>SF₆-IR-Leak</td>
<td>SF₆ detection instrument</td>
</tr>
<tr>
<td>Parameters</td>
<td>6 … 60,000 ppbᵥ</td>
<td>0 … 50 ppmᵥ&lt;br&gt;0 … 2,000 ppmᵥ</td>
<td>–</td>
</tr>
<tr>
<td>Special features</td>
<td>■ High-precision photo-acoustic infrared spectroscopy&lt;br&gt;■ Extensive programme of accessories</td>
<td>■ Non-dispersive infrared sensor&lt;br&gt;■ Portable battery-operated instrument&lt;br&gt;■ Switchable to leak rate</td>
<td>■ Based on the negative corona principle&lt;br&gt;■ Portable battery-operated instrument&lt;br&gt;■ Adjustable sensitivity&lt;br&gt;■ Acoustic signal</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 62.13</td>
<td>SP 62.02</td>
<td></td>
</tr>
</tbody>
</table>

## Emission monitoring

<table>
<thead>
<tr>
<th>Model</th>
<th>GA35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>SF₆-IR-Monitor</td>
</tr>
<tr>
<td>Parameter</td>
<td>0 … 2,000 ppmᵥ</td>
</tr>
<tr>
<td>Special features</td>
<td>Non-dispersive infrared sensor</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 62.06</td>
</tr>
</tbody>
</table>
Filling and handling equipment for SF\textsubscript{6} 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\textsubscript{6} equipment. Furthermore, the instruments support the plant operator with the recording of the SF\textsubscript{6} 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\textsubscript{6} 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

<table>
<thead>
<tr>
<th>Model</th>
<th>GPF-10</th>
<th>GVC-10</th>
<th>GTU-10</th>
<th>GWS-10</th>
<th>GVP-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>Portable SF\textsubscript{6} filter unit</td>
<td>Portable SF\textsubscript{6} vacuum compressor</td>
<td>Portable SF\textsubscript{6} transfer unit</td>
<td>Portable SF\textsubscript{6} gas cylinder scale</td>
<td>Portable vacuum pump</td>
</tr>
<tr>
<td>Process</td>
<td>Filtration</td>
<td>SF\textsubscript{6} extraction</td>
<td>SF\textsubscript{6} filling</td>
<td>Determining the transferred SF\textsubscript{6} gas mass</td>
<td>Air evacuation</td>
</tr>
<tr>
<td>Description</td>
<td>Filtering out of particles, humidity and decomposition products</td>
<td>In order to extract SF\textsubscript{6} 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</td>
<td>SF\textsubscript{6} gas compartments are directly filled from the gas cylinder or the SF\textsubscript{6} gas is stored in a gas cylinder. During storage of the SF\textsubscript{6} gas, the compressor can liquefy the gas in the storage vessel</td>
<td>Measuring the gas cylinder weight before and after the filling/extraction</td>
<td>Preparation for filling following plant maintenance</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 63.11</td>
<td>SP 63.13</td>
<td>SP 63.07</td>
<td>SP 63.09</td>
<td>SP 63.12</td>
</tr>
</tbody>
</table>
Criteria for plant definition

1. How much SF₆ 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

<table>
<thead>
<tr>
<th>Model</th>
<th>GFU08</th>
<th>GFU10</th>
<th>GPU-x-x000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model designation</td>
<td>SF₆ filling cart</td>
<td>SF₆ handling and filling equipment</td>
<td>SF₆ handling and filling equipment</td>
</tr>
<tr>
<td>SF₆ storage vessel</td>
<td>Gas cylinder</td>
<td>Gas tank</td>
<td>Gas cylinder/gas tank</td>
</tr>
<tr>
<td>Description</td>
<td>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. An optionally available balance allows the user to check the transferred SF₆ gas volume. A wide range of optionally available vacuum pumps allows you to evacuate air from the gas compartment before filling it with SF₆.</td>
<td>Model GFU10 allows you to carry out the complete range of tasks when handling SF₆. This SF₆ preparation and filling station is ideally suited for maintenance of small SF₆ gas compartments. It is also possible to dry the gas by means of the built-in dry filters and the internal circuit.</td>
<td>The WIKA-GPU-x-x000 platform offers the highest level of comfort due to ease of operation and extremely long maintenance cycles. The main functions include filling, extraction and cleaning of SF₆, evacuation and filling of switchgear, linear accelerators and other SF₆ gas-filled equipment. This plant can also be easily consolidated with SF₆ gas cylinders and tanks. 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 SF₆ gas sensor, thus making it impossible for larger amounts of SF₆ to be emitted unnoticed.</td>
</tr>
<tr>
<td>Data sheet</td>
<td>SP 63.08</td>
<td>SP 63.01</td>
<td>SP 63.16</td>
</tr>
</tbody>
</table>
**GPU-x-x000 platform**

<table>
<thead>
<tr>
<th>Feature</th>
<th>GPU-B-2000</th>
<th>GPU-S-2000</th>
<th>GPU-B-3000</th>
<th>GPU-S-3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully automatic operation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Intuitive operation by means of a 10&quot; IntelliTouch touchscreen</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Fast SF₆ gas recovery for large gas compartments</td>
<td>✗</td>
<td>✗</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Additional SIL 2 safety control with SF₆ gas warning device</td>
<td>✗</td>
<td>✔</td>
<td>✗</td>
<td>✔</td>
</tr>
</tbody>
</table>

**Safety at WIKA**

Safety for people and the environment is the highest priority of WIKA. Preventing or detecting emission of the SF₆ 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.

**WKA is the only provider of SF₆ 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 SF₆ to the atmosphere are technically impossible.
“Everything that can be digitized will be digitized.” (Carly Fiorina, former CEO HP). There is a good reason why this also applies to the SF₆ 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 SF₆ gas industry and an innovation-driven expert team are our tools for this turnkey concept.

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

Online monitoring of the insulating gas in your SF₆-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.

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

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

**Data warehouse**

Our online sensors measure the condition of your SF₆ gas at short intervals. The transmitted values are collected, managed and stored in our data centre.

**Data evaluation**

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**

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

**Service trigger**

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**

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.
Due to the immense climatic effects, SF₆ 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 SF₆ 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.

WEgrid Services – Service, consulting and training

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 SF₆ lifecycle management and gain insight into best practices. Imagine you could get a demonstration of instruments from the product portfolio for SF₆ gas solutions from the manufacturer themselves.

To ensure a higher transfer of knowledge, the SF₆ 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 SF₆ gas can be made. This is also possible, through our experts, for highly corrosive SF₆ 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 SF₆ 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

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.
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 (SF₆ 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 SF₆ 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.

---

Certificate


The certification authority
WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
D-63911 Klingenberg, Germany

certifies

Mr. Max Musterman

Date of birth 22.03.1988

the acquisition of knowledge for carrying out activities in connection with recovery of certain fluorinated greenhouse gases from high-voltage switchgear

Certification has been issued on 13.10.2015 in accordance with Article 4 Paragraph 1, Article 6 Paragraph 2 and ANNEX to the Commission Regulation 305/2008 of April 2nd, 2008 and covers the required skills and knowledge.

Certificate No.: WIKA00001 - 2015
Around the globe, WIKA employees are available to you for SF₆ 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 SF₆ density monitoring of plants within the electricity transmission and distribution is assured.

Within the WIKA SF₆ 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 SF₆ gas

SF₆ gas, the strongest known greenhouse gas

In the atmosphere, SF₆ 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 SF₆ 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 SF₆ gas and other fluorinated gases (F-gases) were established.

Gas losses on a component filled with SF₆ 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 SF₆ 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 SF₆ 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 N₂
- Climate-effecting CO₂ equivalent: 22,800
- Lifetime in the atmosphere: 3,200 years

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 SF₆ 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 SF₆ 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 SF₆ condition transmitters of the “Smart Grid” generation

2015  Recognition as testing and certification body for personnel certification in the handling of SF₆

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