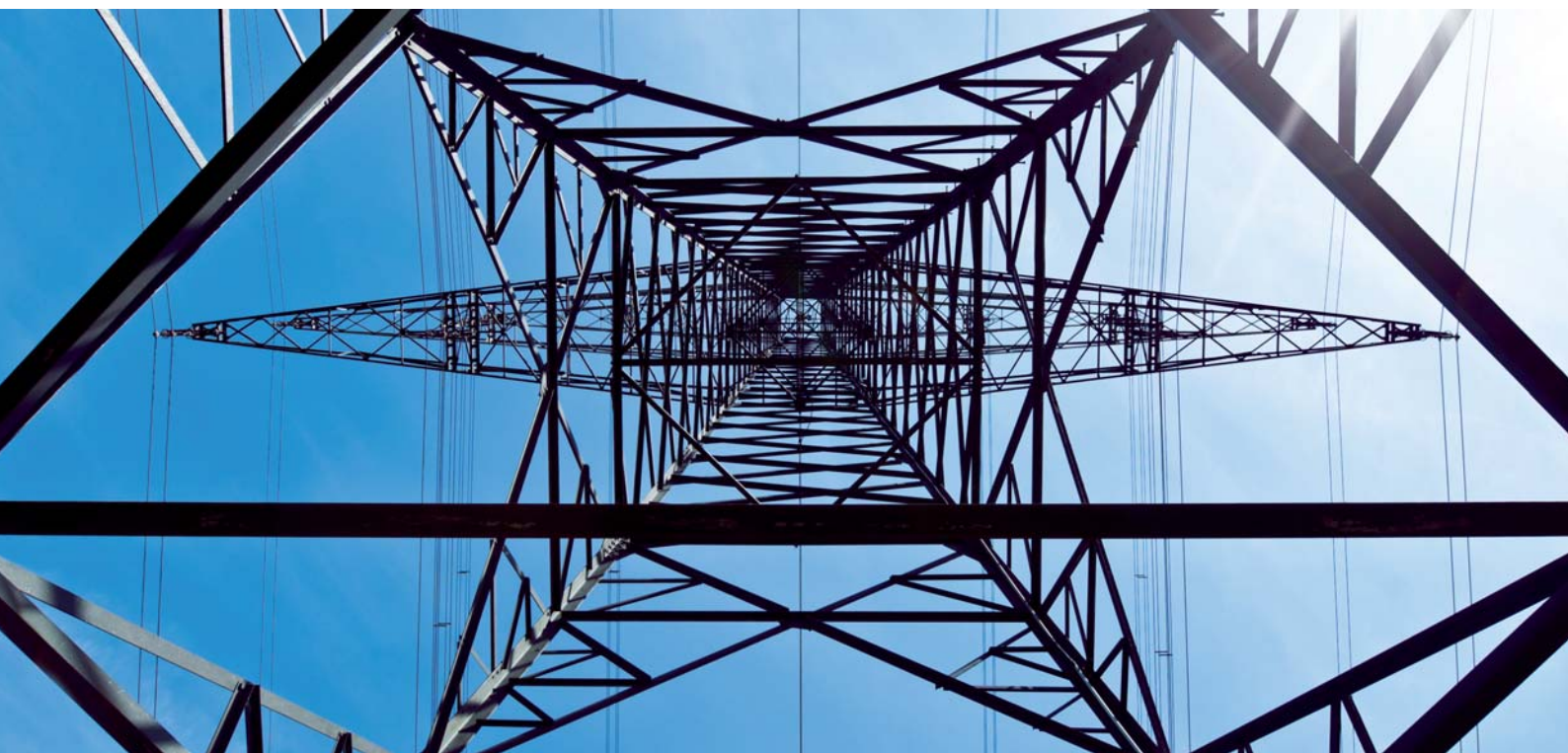




SF₆ Gas Handling



DILO. Sustainably tight.

Made ■
in ■
Germany ■



DILO SF₆ gas handling

Zero emissions and maximum gas re-use is our goal

For more than 40 years it has been our aim to meet customer requirements for first-class products and services for emission-free SF₆ gas handling – consistently and without any compromises.

Our ambitions, strategies and the courage to design innovative products have turned DILO into the world's leading brand in SF₆ gas handling.

The path for the DILO brand in SF₆ gas handling was laid out in 1967 when the complete piping system for installation of the first SF₆ gas insulated switchgear was supplied by DILO.

A good feel for the enormous market potential made DILO invest in SF₆ gas technology, launching the world's first SF₆ service cart only a few years later. As a result, the product portfolio has successively been developed to the widest product range of emission-free gas handling equipment worldwide.

Thus we pursue three central aims: Environmental protection, low running costs and compliance with legal regulations.

In addition to innovative product solutions we also offer comprehensive and product combined services, generating considerable added value for our customers.

This is the reason why switchgear manufacturers and utility companies all over the world have been confident in DILO as a brand for decades.



Why SF₆ gas handling?

SF₆ is a non-toxic, inert insulating and quenching gas of high dielectric strength and thermal stability.

Due to its first-class properties it is used in enclosed medium and high voltage switchgear as an arc quenching and insulating gas.

As SF₆ is a major greenhouse gas with high global warming potential listed in the Kyoto protocol it is among the six gases being subject to monitoring.

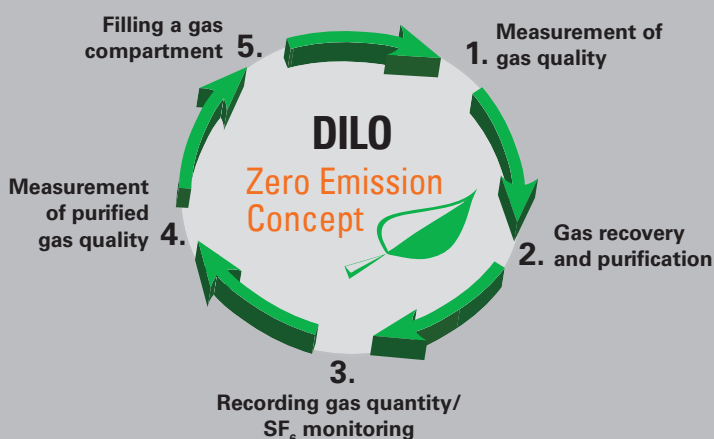
SF₆ has to be used in closed systems in order to avoid emissions.

Our philosophy is based on “Zero Emission” and “Maximum Gas Re-use” in a fully integrated cycle.

For this purpose, high-tech devices and equipment with the best efficiency are available.

Thus, you benefit from:

- Emission-free SF₆ gas handling
- Use of only oilfree and gas tight compressors
- Highest economic efficiency and reliability
- Specialists with 40 years experience
- Wide range of products from small devices to large equipment
- Individual solutions for customer specific requirements
- Comprehensive technical services
- Training and certification for the authorisation to recover SF₆ gas.



DILO Service Carts

“We are convinced by DILO’s high technical standard and individual solution competence.”

Markus Schraudolph,
ABB Schweiz AG



DILO SF₆ service carts

Simplified maintenance of SF₆ switchgear

Nowadays, most emissions are generated by inadequate SF₆ gas handling. But that can be avoided, since DILO offers emission-free and safe solutions for each individual process step.

We continually combine the leading technology of our service carts developed with many years of experience with the latest customer or market requirements.

No matter whether maintenance works are carried out on medium voltage switchgear, high voltage switchgear or on gas-insulated lines, our service carts allow very easy, safe and economic maintenance.

DILO's product range is divided into different series with various performance parameters which are designed to meet the varying requirements in SF₆ gas handling.

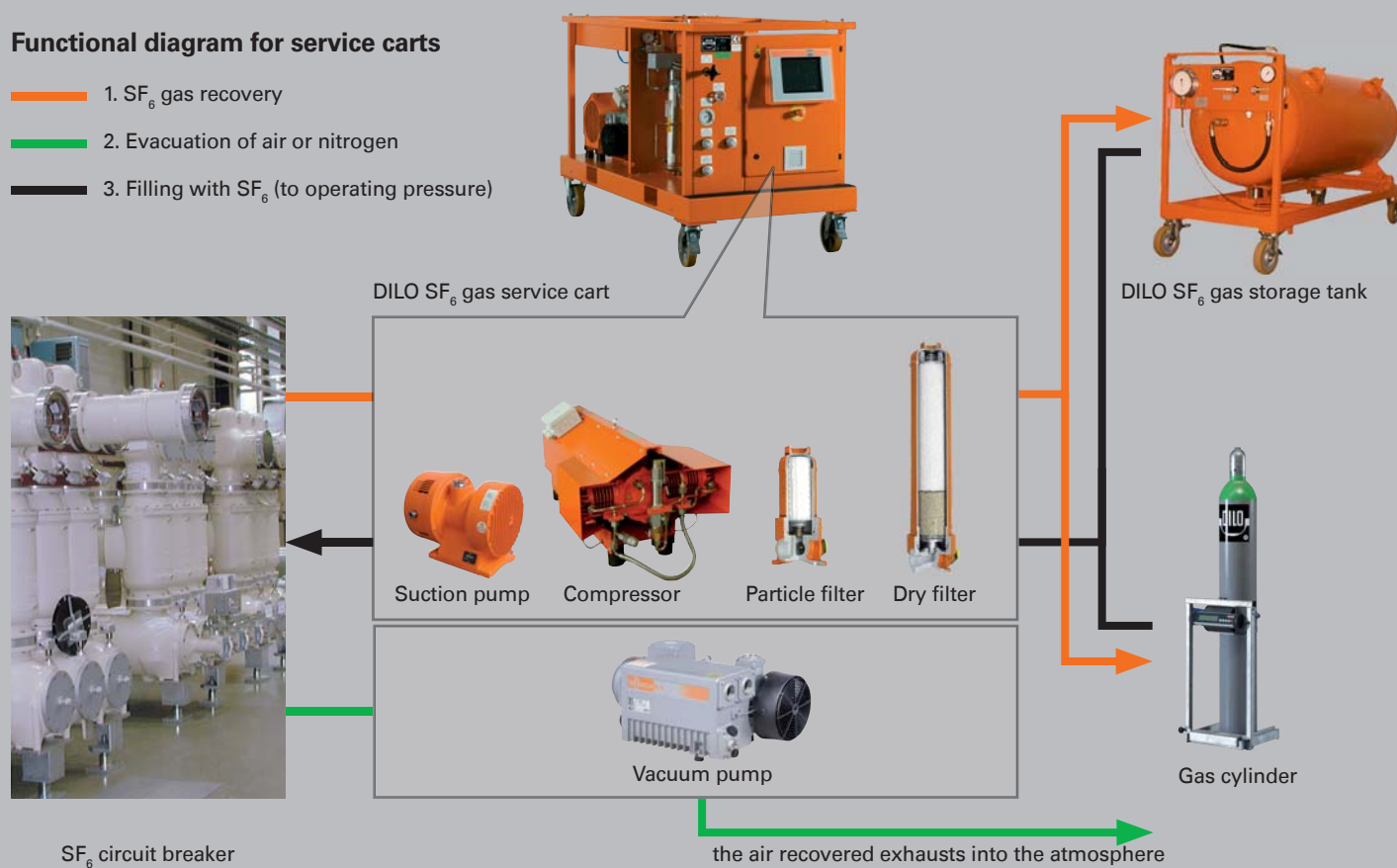
Our specialists would be pleased to assist you with the selection of the right equipment for your application.

No matter whether you are interested in small devices or large equipment: DILO products will always give you the best technology, emission-free SF₆ gas handling and utmost economic efficiency.



Functional diagram for service carts

- 1. SF₆ gas recovery
- 2. Evacuation of air or nitrogen
- 3. Filling with SF₆ (to operating pressure)



DILO Service Carts



SF₆ gas refilling and evacuating devices

Evacuation of air and filling of gas compartments from SF₆ gas cylinders by overpressure

For evacuating and filling DILO offers a wide range of gas refilling devices, evacuating devices and mobile vacuum pumps.

- Achievable final vacuum when evacuating air < 1 mbar
- Mobile and portable versions
- Electronic weighing scales 0–150 kg (option)
- Compact, mobile vacuum pumps for small compartments
- High-performance, mobile vacuum pumps for large switchgear compartments



Mini-Serie

For efficient SF₆ gas handling on small gas compartments

Perfectly suited for gas handling with small gas compartments and gas reclaiming to < 5 mbar.

The Mini Series includes two versions:

- Portable single components for liquid storage which can be assembled to complete units
- B143R11 small service cart as a compact and mobile unit for liquid storage of SF₆ gas





Piccolo Series

Recommended for outdoor switchgear

Simple and cost-efficient solution for large gas quantities

- SF₆ recovery, dependent on model, to < 5 mbar or < 1 mbar
- Liquid storage of SF₆ gas

“New Generation” type L030 in the Piccolo Series: This service cart has been developed for SF₆ gas handling on switchgear with reduced filling quantities.

- Compact unit which can be transported on a euro pallet
- SF₆ gas recovery to better than 5 mbar
- Liquid storage of SF₆ gas
- With integrated evaporator, digital weighing scales and 3.5" screen
- Operation via selector switches and start/stop key



Compact Series

For easy maintenance of high voltage switchgear

Various compact versions with many options.

- SF₆ recovery to < 5 mbar
- Manual control with gas flow diagram
- Devices for gaseous and liquid storage
- Available with different tank sizes



DILO Service Carts



Economy Series

This series is universally applicable for all requirements

Easily accessible components allow simple and user-friendly gas handling.

- Recovery of SF₆ gas down to < 1 mbar
- Liquid storage of SF₆ gas
- Suction pump instead of vacuum compressor
- Integrated digital weighing scales
- Automatic process control and operation via 10" touch screen or functional selectors
- 300 l or 600 l pressure tanks are available which can be trailer-mounted.



Mega Series

SF₆ maintenance devices for large and extra large gas compartments

Our Mega Series offers leading technology for SF₆ gas handling in different power ranges.

- Gas recovery down to < 1 mbar
- Liquid SF₆ storage
- Depending on type of device two- or three-stage compressor and suction or screw pump
- DN20 and DN40 connections
- Digital weighing scales
- Automatic process control and operation via 10" touch screen
- 300 l or 600 l pressure tanks are available which can be trailer-mounted.



Special DILLO Equipment



Special equipment

Intelligent SF₆ gas handling in customer specific versions

Automated production process with permanent monitoring of the SF₆ quality requires intelligent and innovative SF₆ gas handling to achieve the highest economic efficiency and exemplary environmental protection.

We offer high-performance, customer-specific special equipment for GIS, GIL and GIT applications.

SF₆ leak testing units for quick and precise leak detection

- Integral leak measurement on GIS components within a few minutes
- Detection limit of leak system $1 \cdot 10^{-9}$ l/s
- Different chamber sizes and configuration options



Z761R.. SF₆ leak testing unit

Additional customised solutions:

- SF₆ gas handling equipment with automatic process control for the production of SF₆ filled plant and components
- High-performance plant for gas handling on accelerator units
- Complete product range for gas handling on gas-insulated lines (GIL)
- Separation plants for the preparation of SF₆ gas mixtures with separation efficiency of 99 %
- Cooling systems for SF₆ insulated transformers (GIT)
- High capacity storage vessels and pressure tanks for gaseous storage of SF₆ from 1,000 to 20,000 litres
- Construction of complete shop floor piping for GIS production



Gas handling plant in switchgear fabrication

DILO Accessories



Accessories

A complete range of accessories for perfect SF₆ gas handling

Apart from service carts, measuring devices, valves and couplings DILO offers all accessories needed for all SF₆ gas handling operations.

Pre-filter and separation filter unit

For safe absorption of moisture, gaseous and solid particle decomposition products during gas recovery in order to protect the service carts from contamination, portable and mobile versions.

SF₆ cylinder heater blankets

Used to heat up SF₆ gas bottles to avoid freezing when removing large quantities of SF₆ gas.

Precision pressure gauges

For checking pressure in gas compartments.

Digital vacuum gauges (battery-operated 2 x 9V)

For checking vacuum with an indicating range of 0–400 mbar

Separate storage vessels for SF₆ gas

Available in different sizes for gaseous storage to 25 bar and for liquid storage to 50 bar.



1000 l SF₆ storage vessel



Pre-filter unit for decomposition products



Working protection kit / Dry vacuum cleaner

For protection of staff in accordance with IEC directives regarding working on open gas compartments.

Adapter kit in a plastic case

The standard equipment includes adapters and transition pieces for all types of standard SF₆ switchgear.

Oil-free suction pump units and retrofit kits

Retrofit models adapted to all SF₆ maintenance devices for gas recovery < 1 mbar. Mobile units or retrofitting on to existing devices.



Oil-free suction pump unit

SF₆ gas monitoring

Devices for recording of SF₆ gas quantities

Weighing scales

For 600 l SF₆ gas container
Weighing range to 1,500 kg, indication switchable between kg/lbs

Electronic bottle trolleys

Versions with digital display
Weighing range: 0–150 kg

Mass flow measuring system

For recording gas quantity flowing from and into the circuit breaker, optionally available with automatic filling control and data transmission.



Weighing scales for 600 l container

DILO Measuring Instruments



Measuring instruments

A range for all requirements

Measuring instruments are used to monitor ambient air, trace leaks and to measure the SF₆ quality in medium and high voltage switchgear.

The SF₆ gas must always be pure since humidity and toxic or corrosive decomposition products in circuit breakers impair the insulating properties of the gas.

The gas quality has to be monitored in accordance with the EC 842/2006 directive on fluorinated gases. The IEC 60480 directive also stipulates the limit values for the re-use of SF₆ gas.

It is absolutely necessary to know the gas quality before carrying out maintenance works on a circuit breaker in order to be able to decide on preparation, re-use or disposal of the SF₆ gas.

The essential quality criteria for SF₆ gas in circuit breakers are as follows:

- Humidity (dew point)
- Decomposition products
- Gas purity in %

DILO offers a complete range of measuring devices for all applications including: room monitoring systems, leak detectors, measuring devices to determine the SF₆ quality as well as relevant accessories for simple on-site measurement and retrofit kits for old measuring devices.



Instruments to determine the SF₆ quality

Determining the important parameters

DILO offers a full range of state of the art technology measuring devices and analysing instruments required to determine all the main SF₆ parameters.

SF₆ Multi Analyser with gas return system

User-friendly and compact device which allows determination of up to four parameters with only one measurement. No SF₆ gas is released into the atmosphere.

The following parameters are measured:

- SF₆ concentration (%)
- Moisture concentration
- SO₂ concentration (ppm_v)
- Option: HF concentration (ppm_v)

Limit values can be set on the colour touch screen. Results of up to 100 measurements can be stored and can be transmitted to a USB stick or PC.



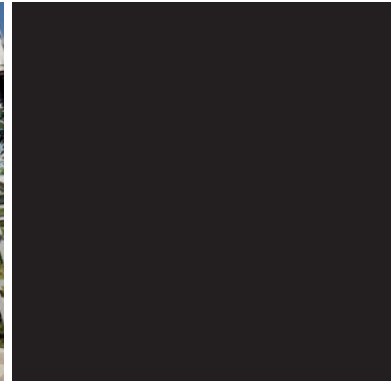
SF₆ Analyser 973

For high precision measurement of purity, moisture and SO₂ concentration.

- Precise measurement by dew mirror measuring principle
- Measuring range freeze point / dew point -50 °C to +20 °C
- Measuring accuracy: freeze point / dew point ≤ ± 0.5 °C
SF₆ volume percent ± 0.5 %, SO₂ < 2 % from the measuring range
- Internal measuring gas storage vessel with measuring gas return system
- Operation via integrated touch screen



DILO Measuring Instruments



Instruments to determine SF₆ gas quality

Determining the important parameters

Electronic moisture measuring instrument

For measuring of moisture content in SF₆ gas.

- Measuring range -60 °C to +10 °C dew point
- Measuring accuracy ± 2 °C
- Input pressure p_a 0.5 bar–10 bar
- High resistance against contamination and SF₆ decomposition products
- Minimized long time drifting



SF₆ Volume percentage measuring instrument

For measurement of SF₆ volume percentage in air and nitrogen mixtures.

- Measuring principle based on the velocity of sound
- Measuring range 0–100 volume % SF₆
- Measuring accuracy ± 1 volume % SF₆
- Input pressure p_a (absolute) 1.7–10 bar
- Response time about 1 minute

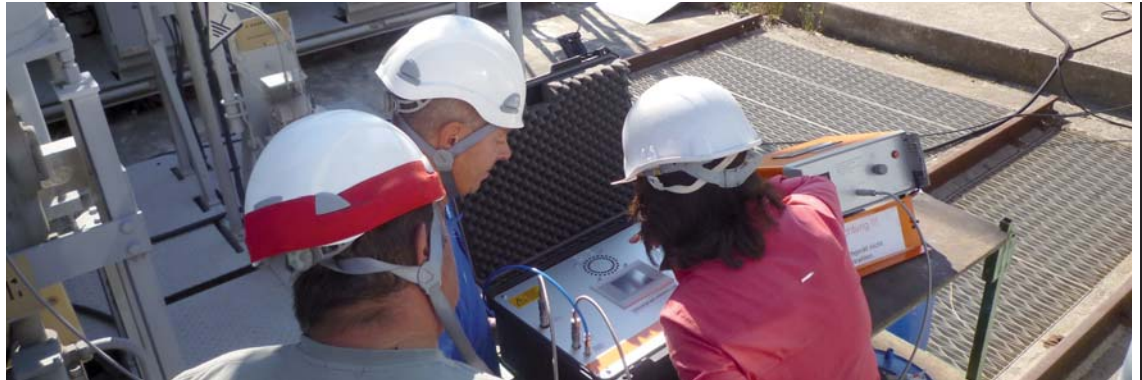


Portable SO₂ measuring instrument

For measurement of SO₂ concentration in gas mixtures.

- High resistance against contamination and SF₆ decomposition products
- Minimized long-term drifting
- Measuring ranges 0–20 / 100 / 500 ppm_v
- Measuring accuracy $\leq \pm 2$ % of the measuring range





Leak Detectors

For detection of gas leaks

SF₆ Leakcheck

For quick tracing of even smallest SF₆ leaks on SF₆ filled components.

- No radioactive source is used
- No carrier or rinsing gas is required
- Detection limit of leak system (dependent on the type) up to $1 \cdot 10^{-8}$ mbar / l/s or 0.1 ppm_v



Gas leak detector

For quick detection of gas leaks.

- With seven levels of sensitivity
- Tricolour visual LED display and audible signal
- Suitable for continuous operation



Room monitoring devices

For monitoring the air in SF₆ indoor switch rooms continuously

SF₆ Air Sensor

Triggers an alarm in case SF₆ is detected in the air.

- Measuring range 0 to 1,000 ppm_v SF₆
- Can only be used in combination with the SF₆ Network Monitor



SF₆ Air Sensor

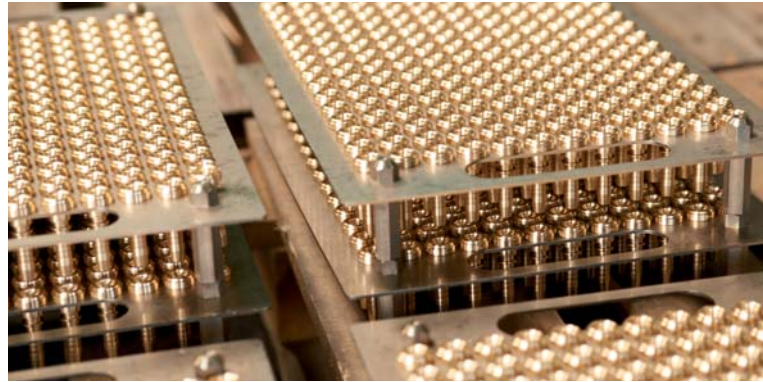


SF₆ Network Monitor

SF₆ Network Monitor

Central administration and indication of measured values of up to five SF₆ Air Sensors connected via a bus system

DILO Valves and Couplings



Valves and Couplings

Hermetically sealing connections on gas compartments

Are you looking for pressure and vacuum tight valves and couplings for SF₆ gas use? DILO is the right choice! We offer the largest range of products worldwide. Whether for medium voltage switchgear, high voltage switchgear or gas-insulated lines (GIL) our products always meet your requirements.

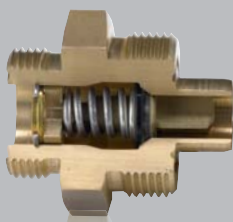
When using the DILO coupling system a leak rate of better than 1×10^{-8} mbar l/sec. is achieved corresponding to less than 1 cm³ in 30 years.

The DILO sealing principle prevents the loss of SF₆ gas and moisture from penetrating the SF₆ gas system. DILO couplings will eliminate the loss of SF₆ gas by incorrect gas handling. Thanks to their reliability, quality and durability DILO couplings are the world's most widely used connecting system for SF₆ switchgear.

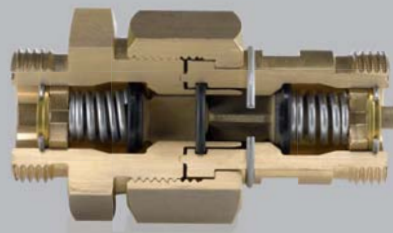
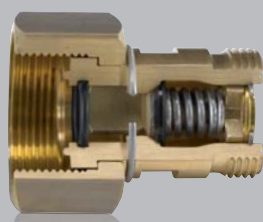
Advantages of application:

- Self-closing coupling system
- Pressure and vacuum-tight even when coupling and uncoupling
- Permanent tightness even when frequently connected and disconnected
- Applicable up to PN 64 bar
- Suitable for temperatures from -40 °C to +80 °C
- Direct connection to DILO service carts without adapter
- Available in different materials even for outdoor switchgear

DILO sealing principle:



open coupling



closed coupling

DILO couplings allow a connection to be made by simply screwing the two coupling parts together. Before the metal to metal seal closes the pressure and vacuum tight coupling is sealed inside by

means of an O-ring. When loosening the coupling parts again the same O ring prevents gas loss whilst the self seal valves close.



Product range:

- Couplings available in DN 6 to DN 40 nominal diameters with different flange shapes, screw-in versions or as plug-in couplings
- Soldering unions, screw-in stubs and gauge connections for gas tight piping
- Ball valves in different versions and pressure ranges
- Pressure and vacuum-tight rubber and wire braided hoses in different nominal diameters, lengths and finishes,
- Transition pieces and adapters for different nominal diameters
- Connections for SF₆ gas cylinders
- Distribution panels and piping as well as customer specific special solutions

Approvals and tests:

- Certification according to ISO 9001:2008
- HPO approval as pressure equipment manufacturer
- Production control in accordance with EC 97/23 regulations



DILO Services and Training



Services and training

with additional benefits

Do you fancy a complete range of services for SF₆ gas handling? We can offer it all! An all-inclusive service package of perfectly matched modules! In addition to technical services we have systematically enlarged our offer of customer specific training and certification training in the past few years.

In summary, we offer solutions perfectly adapted to each customer's requirements, generating additional benefits for you as our customers and partners.

■ Comprehensive on-site service

Our competent and experienced engineers and technicians are at your disposal on site, supported by the trained personnel of our 50 agents worldwide. In addition our personnel will also put new devices into service, including all functional tests as well as training of the operating personnel, if required.

■ Preventative maintenance works

We also carry out preventative maintenance works recommended at regular intervals such as overhauling of compressors, vacuum pumps or filter units.

■ Flexible spare parts logistics

Wear parts such as filter cartridges, gaskets or valves are always available immediately in our central stock as well as in our service centers all over the world. For spare parts, DILO offers guarantees availability for a period of at least 10 years after purchase.

■ Online registration of devices

New devices can be registered online (web-based portal).



■ Rental equipment

A comprehensive pool of rental devices is at your disposal in case service and measuring devices are needed temporarily.

■ Retrofit

Save money and protect the environment: Use our special modules to retrofit older service and measuring devices in accordance with latest IEC directives.

■ SF₆ gas handling on site

On request, we also offer SF₆ gas handling as a complete service.

■ Preparation of SF₆ gas

DILO offers different services, depending on the customer's requirements, such as separation plants for rental and support with certified personnel.

■ Leak tests of GIS components

Testing of GIS components in our works complete with test certificate.

■ Service centers

Authorized DILO service centers all over the world guarantee proximity to customers and quick after-sales service.

■ Training and certification

Customer specific training is offered, adapted to individual or special requirements.

Training can be held on site, in the DILO training center or in the service centers of our foreign agents. The following topics are included: safety, transport regulations, gas handling, environmental protection and practical work.

■ SF₆ certification

We offer training courses for the acquisition of the permission to carry out the recovery of SF₆ gas in accordance with article 5 of the EC 842/2006 regulation since we are accredited for SF₆ certification.

A large number of participants from power utilities and switchgear manufacturers have been qualified for the recovery of SF₆ gas in our company's training center.

Further information on our comprehensive programme for emission-free SF₆ gas handling is available at www.dilo-gmbh.de or simply request our complete catalogue on CD.

High pressure tube unions

High pressure tube unions are DILO's second core competence. For further information please ask for our special leaflet.

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