

Gas supply equipment

Cylinder pressure regulators and gas supply systems for specialty gases



Gases are usually stored compressed, liquefied or dissolved in suitable cylinders. For withdrawing gases from their containers the use of appropriate components play a key role in order to ensure safety and preserve the quality of gases.

There are basically two types of supply to choose from: individual cylinders at the point of use with cylinder pressure regulators or a central gas supply system.

In case only one instrument has to be supplied with gas and the cylinder can be placed right next to the point of use cylinder pressure regulators can be used.

The cylinder pressure regulator is directly connected to a gas cylinder and reduces the pressure to the required level.

With a central gas supply system, consisting of pressure control panels, pipelines and tapping points at the various points of use, the gas cylinders are safely stored outside of workplaces.

Messer offers the full range of components for any application. We will be glad to support you in finding the optimal form of supply.



Individual cylinder at the point of use with cylinder pressure regulator

Pressure control

The most important function of the withdrawal equipment is to reduce the cylinder pressure to the appropriate level for each application. Pressure regulators are used for this. Due to physical restrictions the inlet pressure of the pressure regulator drops, i.e. as the connected gas cylinder is being emptied and the outlet pressure increases if the setting of the adjusting screw remains unchanged. In many cases this effect is not acceptable. In the case of single stage regulators with „compensated main valve“ or the new exact-technology the outlet pressure is much less depended on the inlet pressure.

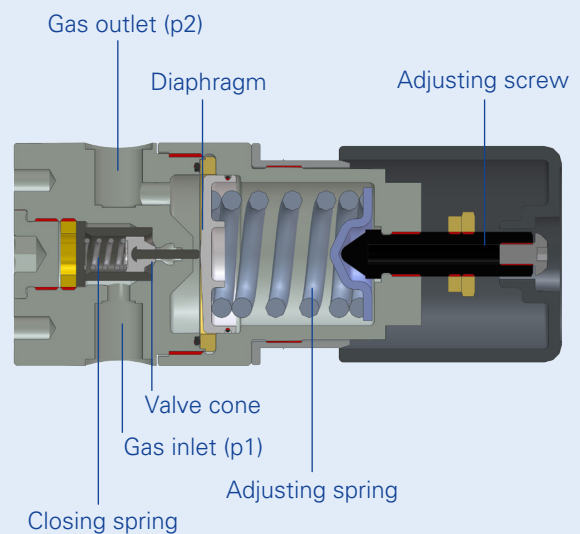
If there are high pressure stability requirements and low outlet pressures, the use of a two-stage regulator is recommended. The first stage reduces the inlet pressure to a factory set intermediate pressure (i.e. 20 bar) and the desired outlet pressure is adjusted via the second stage. Two-stage pressure regulators guarantee a very constant outlet pressure, practically independent from the decreasing cylinder pressure.

All pressure regulators are equipped with relief valves to protect the connected equipment and two pressure gauges indicating the cylinder and outlet pressure. The display range of the pressure gauges depends on the relevant pressure levels.

Cylinder pressure regulator

In the simplest case of an individual cylinder supply the pressure regulator can be directly connected to a cylinder valve.

The principle is based on the equilibrium of the forces acting on the valve cone. These are, on the one side, the forces of the closing spring and cylinder pressure p_1 and on the other the forces of the adjusting spring and outlet pressure p_2 . The adjusting spring force, and therefore the required outlet pressure, can be adjusted by means of the adjusting screw. The diaphragm ensures that the gas filled compartment is sealed from atmosphere.





Central gas supply system

Central gas supply

For a central gas supply the gas cylinders are set up in a location, e.g. in a separate room or outside the building, and connected to a pressure control panel consisting of a pressure regulator which reduces cylinder pressure to line pressure, e.g. to 10 bar, pressure gauges for indication of cylinder and outlet pressure, blocking and purge valves. Fixed pipelines supply the gas to individual points of use, where the gas consumers are connected via tapping points. At the tapping point line pressure is reduced to required working pressure. A pressure gauge indicates the current working pressure.

For continuous gas supply the parallel connection of two containers is recommended. In this case, gas is always withdrawn from one container, with the other one connected on standby. In the simplest case, changeover from one cylinder to the other is done manually. However, there are also pressure control panels available which provide automatic changeover between the containers (see table). Pressure control panels are complete with pressure gauges for indication of the cylinder and outlet pressure. The pressure control panels can be supplied with contact pressure gauges which give a signal if the cylinder pressure drops below a certain preset level. This signal can be passed to a low pressure alarm panel.

It is also possible to connect and empty several cylinders at the same time using extension modules.

Key advantages of a central gas supply are:

- Reliability due to location of gas cylinders outside the actual operating areas
- Uninterrupted gas supply with automatic changeover
- Quality ensured by integrated purge valve
- Supply of several gas consumers from one common source
- Increased operational safety due to reduced handling of gas cylinders
- Enhanced pressure stability by two-stage pressure regulation

Selection of equipment

Type of gas

The type and quality of gas basically determine the selection of materials for gas supply equipment. For non-corrosive, high-purity gases up to 6.0 grade and mixtures the use of brass equipment (chrome plated) with metal diaphragms (e.g. stainless steel, Hastelloy) and corresponding sealing materials (e.g. Viton, PVDF, PCTFE) are recommended. Diaphragm type valves should be used (Spectrolab product line).

For corrosive gases and sensitive, low-concentration gas mixtures we recommend stainless steel components (Spectrochem product line). It is also important to indicate the type of gas, as sealing materials have to be adapted.

Liquefied gases under pressure with a boiling pressure below 40 bar can also be withdrawn without reduction of pressure by using a valve (e. g. Spectrochem V6E).

Type of supply (cylinder pressure regulator/central gas supply)

For low gas consumptions often single cylinders equipped with a cylinder pressure regulator are used. A central gas supply, consisting of pressure control panels, pipelines and tapping points, meets a greater need for gas, including also different consumers.

Cylinder pressure/ if appropriate line pressure/ working pressure

Most of the pressure regulating devices are designed for a cylinder pressure of 300 bar. For complex applications also special fittings are available. The requirements on working pressure and its consistency determine whether to choose a single-stage or two-stage regulator.

Additional requirements (purging capability, flow rate ...)

Equipment for corrosive or toxic gases should principally be equipped with a purge valve in order to ensure safe exchange of a cylinder. Flow meter, control and blocking valves complete the program.

| Type of gas | Formula | Pressure (bar) 20 °C | Property | spectrolab | spectrochem |
|--------------------------------------|---------------------------------|----------------------|----------|------------|-------------|
| Acetylene | C ₂ H ₂ | 18 | F | x | |
| Ammonia | NH ₃ | 8,6 | FTC | | x |
| Argon | Ar | 200/300 | I | x | |
| Butane | C ₄ H ₁₀ | 2,1 | F | x | |
| Chlorine | Cl ₂ | 6,8 | TC | | x |
| Hydrogen chloride | HCl | 42,6 | TC | | x |
| Nitrous oxide | N ₂ O | 50,6 | O | x | |
| Ethane | C ₂ H ₆ | 37,6 | F | x | |
| Ethylene | C ₂ H ₄ | - | F | x | |
| Ethylene oxide | C ₂ H ₄ O | 1,5 | FT | | x |
| Fluorine (< 10% in gas mixture) | F ₂ | - | TC | | x |
| Helium | He | 200/300 | I | x | |
| Carbon dioxide | CO ₂ | 57,3 | I | x | |
| Carbon monoxide | CO | 200 | FT | x | |
| Krypton | Kr | approx. 150 | I | x | |
| Methane | CH ₄ | 200 | F | x | |
| Propane | C ₃ H ₈ | 8,4 | F | x | |
| Test gas without corrosive component | - | max. 200 | | x | |
| Test gas with corrosive component | - | max. 200 | C(T) | | x |
| Oxygen | O ₂ | 200/300 | O | x | |
| Sulfur dioxide | SO ₂ | 3,3 | TC | | x |
| Nitrogen | N ₂ | 200/300 | I | x | |
| Nitrogen dioxide | NO ₂ | 0,96 | TC | | x |
| Nitrogen monoxide | NO | 50,5 | TC | | x |
| Synthetic air | - | 200/300 | O | x | |
| Hydrogen | H ₂ | 200/300 | F | x | |
| Xenon | Xe | approx. 60 | I | x | |

Selection of materials (C=corrosive, F=flammable, I=inert, O=oxidizing, T=toxic)

Equipment for non-corrosive gases and gas mixtures up to 6.0 grade**spectrolab**

| Product line | Inlet pressure (bar) | Outlet pressure (bar) | Product |
|---------------------------------------|-----------------------------|------------------------------|-----------------------|
| Cylinder pressure regulator | | | |
| single-stage | max. 300 | 1,5/4/10/20/50/100/150/200 | Spectrolab FM 51 |
| single-stage with balanced main valve | max. 230 | 0,1 - 10 | Spectrolab FM 45 |
| single-stage with exact-technology | max. 300 | 1,5/4/10/20 | Spectrolab FM 52exact |
| two-stage | max. 300 | 1,5/4/10/20 | Spectrolab FM 53 |
| Gas supply systems | | | |
| pressure control panel | | | |
| for one cylinder | max. 300 | 10/20/50/100 /200 | Spectrolab BM 55-1 |
| for one cylinder, two-stage | max. 300 | 1,5/4/10 | Spectrolab BM 56-1 |
| for two cylinders, manual | max. 300 | 10/20/50/100/200 | Spectrolab BM 55-2 |
| with automatic change-over | max. 300 | 10/20/50/100/200 | Spectrolab BM 55-2U |
| with automatic change-over | max. 300 | 10/20/50/100/200 | Spectrolab BM 55-2A |
| for two cylinder, two-stage | max. 300 | 1,5/4/10 | Spectrolab BM 56-2 |
| with automatic change-over | max. 300 | 1,5/4/10 | Spectrolab BM 56-2U |
| extensions | max. 300 | | Spectrolab BM 55-E |
| tapping point | max. 300 | 1,5/4/10/20/50 | Spectrolab EM 55 |
| Accessories | | | |
| control valve | max. 50 | without regulator | Spectrolab V6M |
| blocking valve | max. 300 | | Spectrolab MV 3 |
| flowmeter | 1,4/4 | | Spectrolab FLM 32 |

Equipment for corrosive and/or toxic gases and gas mixtures up to 6.0 grade**spectrocem**

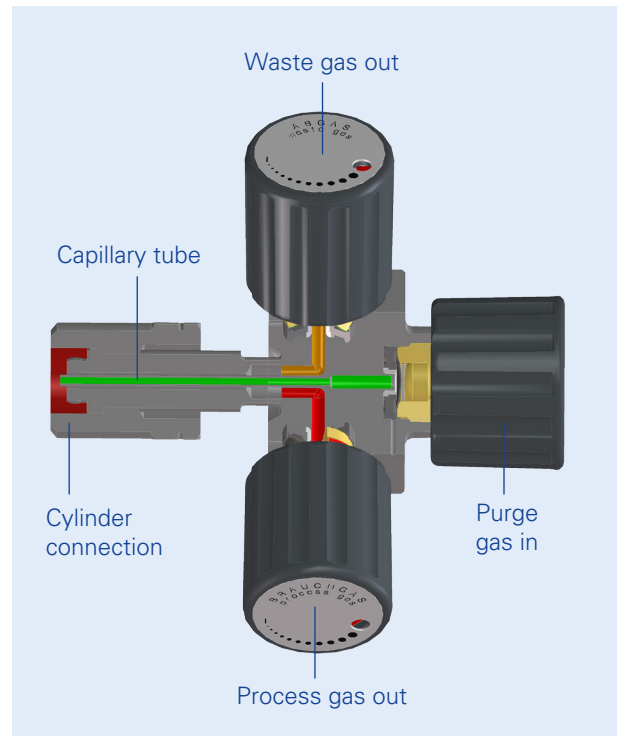
| Product line | Inlet pressure (bar) | Outlet pressure (bar) | Product |
|---------------------------------------|-----------------------------|------------------------------|-----------------------|
| Cylinder pressure regulator | | | |
| single-stage | max. 25 | 0,05 - 1,5 | Spectrocem FE 121 |
| with purge valves | max. 25 | 0,05 - 1,5 | Spectrocem FE 121 SP |
| single-stage | max. 300 | 1,5/4/10/20/50/100/150/200 | Spectrocem FE 51 |
| single-stage with balanced main valve | max. 230 | 0,1 - 10 | Spectrocem FE 45 |
| single-stage with exact-technology | max. 300 | 1,5/4/10/20 | Spectrocem FE 52exact |
| two-stage | max. 300 | 1,5/4/10 | Spectrocem FE 53 |
| Gas supply systems | | | |
| pressure control panel | | | |
| for one cylinder | max. 300 | 10/20/50/100/200 | Spectrocem BE 55-1 |
| for one cylinder, double stage | max. 300 | 1,5/4/10 | Spectrocem BE 56-1 |
| for two cylinders, manual | max. 300 | 10/20/50/100/200 | Spectrocem BE 55-2 |
| with automatic change-over | max. 300 | 10/20/50/100/200 | Spectrocem BE 55-2U |
| for two cylinders, double stage | max. 300 | 1,5/4/10 | Spectrocem BE 56-2 |
| with automatic change-over | max. 300 | 1,5/4/10 | Spectrocem BE 56-2U |
| extension | max. 300 | | Spectrocem BE 55-E |
| tapping point | max. 200 | 1,5/4/10/20/50 | Spectrocem EE 55 |
| Accessories | | | |
| control valve | 40 | without regulator | Spectrocem V6E |
| blocking valve | max. 300 | | Spectrocem MV 3-E |
| flowmeter | 1,4/4 | | Spectrocem FLE 32 |
| purge- and connection-block | max. 200 | | Spectrocem SBE3 |

Cylinder connection

With each exchange of a cylinder, a certain volume of ambient air is introduced into the system. In order to prevent contamination of the gas and the entire system the connection has to be purged before using the new cylinder. With non-corrosive gases, this can be done by means of multiple pressure build-up purging using the gas from the gas cylinder. With corrosive and toxic gases or sensitive gas mixtures, a special purging device with a separate purge gas is required.



All our pressure control panels for specialty gases are equipped with integrated purge valves. Spectrochem cylinder pressure regulators can be supplied with optional purge valves. The best results are achieved with the SBE/3 purge block, as it uses a separate purge gas and a capillary to purge right into the cylinder valve area.



Service and support

Details of all the equipment can be found in our data sheets. We will be glad to help you planning your gas supply system and will ensure that any installation is carried out professionally and meets the relevant standards and regulations.



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