



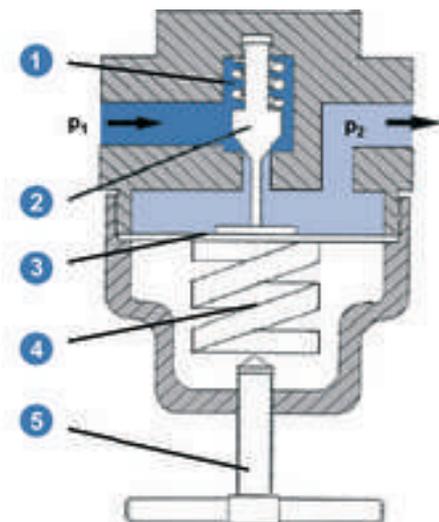
## Gas supply systems and components for specialty gases

Gases are usually stored compressed or liquefied in suitable cylinders. It is always important to use the right equipment for withdrawing the gases from their containers in order to ensure safety and preserve the quality of the gases.

### 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.

The principle is based on the equilibrium of the forces acting on the valve cone. These are the closing spring and cylinder pressure  $p_1$  on the one side and the adjusting spring and outlet pressure  $p_2$  on the other. 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.



- 1) Closing spring
- 2) Valve cone
- 3) Diaphragm
- 4) Adjusting spring
- 5) Adjusting screw

In this equilibrium of forces, the outlet pressure is also dependent on the inlet pressure. This means that when the inlet pressure drops, i.e. as the connected gas cylinder is being emptied, 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/or 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.

### Selection of equipment

The selection of appropriate equipment basically depends on the following parameters:

- Type/quality of gas
- Type of supply (single cylinder/central gas supply)
- Max. cylinder pressure/operating pressure/flow rate
- Special requirements (pressure stability, purgability, ...)

### Selection of materials

The type and quality of gas basically determines the selection of materials for gas supply equipment. Whereas it is perfectly acceptable to use brass regulators with rubber diaphragms (Messer Spectrotec line) in technical applications with lower gas quality requirements, rubber and similar plastics should always be avoided when dealing with specialty gases.

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

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

For non-corrosive, high-purity gases and mixtures up to 6.0 grade, 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. The Messer **Spectrolab** product line meets all these requirements and can be used for all non-corrosive, high-purity gases and gas mixtures.

For corrosive gases and sensitive, low-concentration gas mixtures, it is required to use stainless steel components. On the one hand, it is necessary to protect the equipment against corrosion, and on the other, especially with low-concentration gas mixtures (ppb-range), it prevents the trace compounds from being absorbed by the surface and significantly affecting the composition of the gas mixtures. It is also important to indicate the type of gas, as sealing materials have to be adapted. All the components for this type of applications are covered by the Messer **Spectrocem** product line.

Special equipment for use with medical gases are in our **Spectromed** product line. To meet the highest demands on quality, for example in the semiconductor sector, we have developed the **Spectropur** product line. Please contact us for more information!

#### **Type of supply: cylinder pressure regulator or central gas supply?**

Irrespective of the application, 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 distribution system.

#### **Cylinder pressure regulators**

Cylinder pressure regulators are mainly used where only one instrument has to be supplied with gas and the cylinder can be placed right next to the point of use. The cylinder pressure regulator is directly connected to a gas cylinder and reduces the pressure to the required level.

Pressure regulators are included in the Spectrolab and Spectrocem product lines and are available in single-stage or two-stage versions or with compensated main valve (see table). All pressure regulators are complete 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 outlet valve**

For liquefied gases under pressure with low vapor pressure a pressure regulator may not be required. In such cases the gas can be withdrawn by means of an outlet valve which is connected directly to the gas cylinder. The Spectrocem RVE6 cylinder control valve can be used for up to 40 bar maximum pressure.



*Central gas supply - the safe solution*

Product line	Inlet	Outlet pressure	Product
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### Equipment for non-corrosive gases and gas mixtures up to 6.0 grade

Cylinder pressure regulator			
single-stage	max. 300 bar	4/10/20/50/100/150/200 bar	Spectrolab FM 51
single-stage	max. 300 bar	10/20/50/100 bar	Spectrolab FM 61
single-stage with balanced main valve	max. 230 bar	0,1 - 10 bar	Spectrolab FM 45
single-stage with exact-technology	max. 300 bar	1,5/4/10/20 bar	Spectrolab FM 52 exact
two-stage	max. 300 bar	1,5/4 bar	Spectrolab FM 62



Gas supply systems			
Pressure control panel			
for one cylinder	max. 300 bar	10/20/50/100 bar	Spectrolab BM 65-1
for two cylinders, manual	max. 300 bar	10/20/50/100 bar	Spectrolab BM 65-2
with automatic change-over	max. 300 bar	10 bar	Spectrolab BM 65-2U
with automatic change-over	max. 300 bar	20/50/100 bar	Spectrolab BM 65-2L
Extension	max. 300 bar		Spectrolab BM 65-E
Tapping point	max. 40 bar	1,5/4/10/20 bar	Spectrolab EM 65
Tapping point	max. 40 bar	1,5/4/10/20 bar	Spectrolab plus EM55



Accessories			
Control valve	40 bar	w/o regulator	Spectrolab V 6M
Line pressure regulator (single-stage)	max. 300 bar	1,5/4/10/20 bar	Spectrolab LM 52 exact
Flowmeter	1,4/4 bar		Spectrolab FLM 32



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



Cylinder control valve	max. 40 bar	w/o regulator	Spectrocem RVE6
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Cylinder pressure regulator			
single-stage	max. 25 bar	0,05 - 1,5 bar	Spectrocem FE 121
with purge valves	max. 25 bar	0,05 - 1,5 bar	Spectrocem FE 121 SP
single-stage	max. 300 bar	4/10/20/50/100/150/200 bar	Spectrocem FE 51
single-stage	max. 200 bar	10/20/50/100 bar	Spectrocem FE 61
with purge valves	max. 200 bar	10/20/50/100 bar	Spectrocem FE 61 SP
single-stage with balanced main valve	max. 230 bar	0,1 - 10 bar	Spectrocem FE 45
single-stage with exact-technology	max. 300 bar	1,5/4/10/20 bar	Spectrocem FE 52 exact
two-stage	max. 200 bar	1,5/4 bar	Spectrocem FE 62
with purge valves	max. 200 bar	1,5/4 bar	Spectrocem FE 62 SP
purge- and connection-block	max. 200 bar		Spectrocem SBE/3



Gas supply systems			
Pressure control panel			
for one cylinder	max. 300 bar	10/20/50/100 bar	Spectrocem BE 65-1
for two cylinders, manual	max. 300 bar	10/20/50/100 bar	Spectrocem BE 65-2
with automatic change-over	max. 300 bar	max. 13 bar	Spectrocem BE 65-2U
Control panel with purge block	max. 2 bar	w/o regulator	Spectrocem SE 40
	max. 25 bar	1,5/4 bar	Spectrocem SE 120
	max. 200 bar	10 bar	Spectrocem SE 60
Extension	max. 300 bar		Spectrocem BE 65-E
Tapping point	40 bar	1,5/4/10/20 bar	Spectrocem EE 65
Tapping point	40 bar	1,5/4/10/20 bar	Spectrolab plus EE 55



Accessories			
Control valve	40 bar/200 bar	w/o regulator	Spectrocem V 6E
Line pressure regulator (single-stage)	max. 300 bar	1,5/4/10/20 bar	Spectrocem LE 52 exact
Flowmeter	1,4/4 bar		Spectrocem FLE 32





### Central gas supply

Gas cylinders should always be located outside of working places. This is achieved by a central gas distribution system consisting of pressure control panels, pipelines and tapping points at the various points of use.

The main advantages of a central gas supply are:

- **Quality:** High-purity gas equipment with the required cleanliness, leak rate and integrated purge valves guarantee preservation of the gas quality from the source to the point of use.
- **Reliability:** Automatic change-over control panels with a low pressure alarm guarantee uninterrupted gas supply. Double stage pressure reduction (first stage is the cylinder control panel, second stage is the tapping point) guarantee stable working pressure at the point of use.
- **Cost savings:** Gas cylinders at a central location result in less handling. Cylinder control panels ensure more efficient use of the gas cylinders. More than one point of use can be supplied by only one centralized cylinder control panel.
- **Safety:** Gas cylinders within a working space are always a safety risk, they may fall down and cause damage or injuries or, for example in case of fire, dangerous situations. Additionally the cylinders take quite some space inside the laboratory.

The gas cylinders are set up in a location, e.g. outside the building or in a separate room, and connected to pressure control panels. A pressure control panel is a unit consisting of pressure regulators, valves and a mounting plate, which is connected to one or several cylinders (bundles) by means of high pressure hoses or stainless steel pigtails. The line pressure is adjusted as required.

Pressure control panels are available in the Spectrolab and Spectrochem product lines for connection to a single gas container (e.g. single cylinder or bundle) as well as for two or even more cylinders.

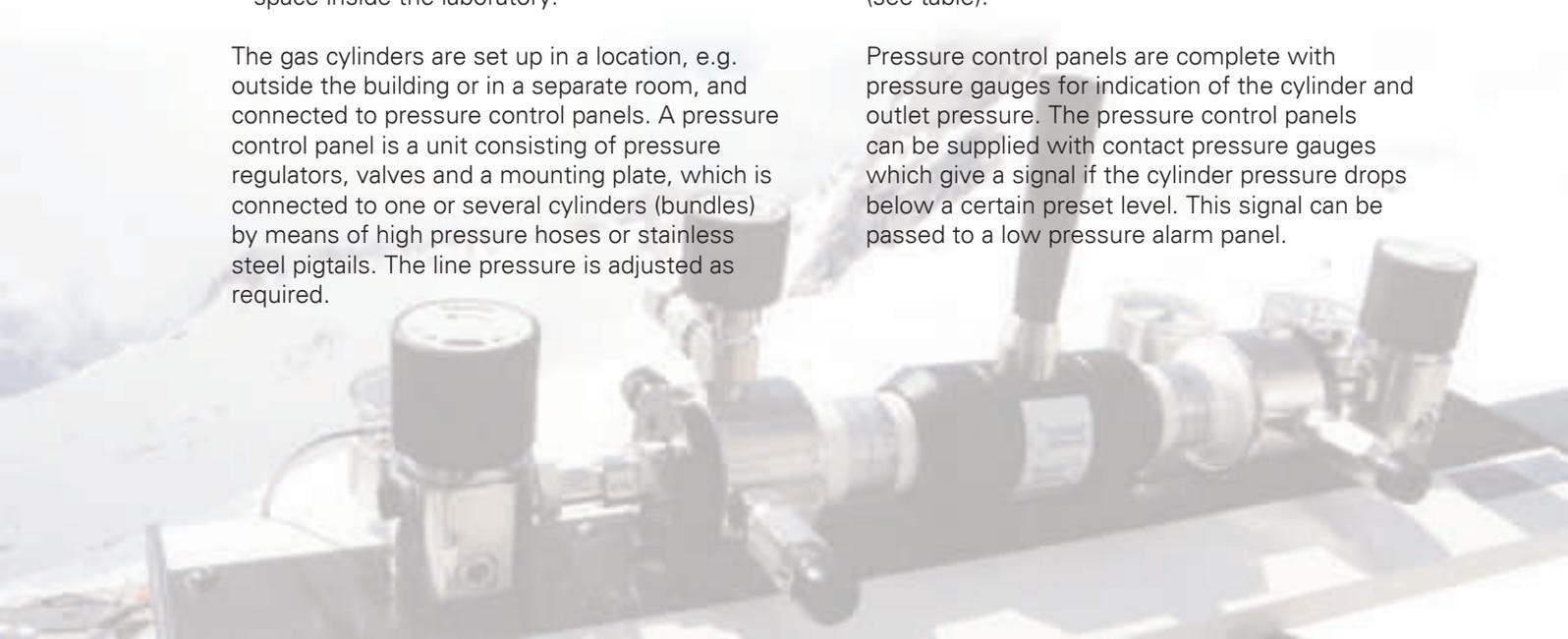


*Pressure control panel with automatic change-over Spectrolab BM 65 - 2U*

For uninterrupted 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 stand-by. In the simplest case, changeover from one cylinder to the other is done manually. However, there are also options available which provide automatic change-over 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.

Fixed pipelines supply the gas to individual points of use, where the gas consumers are connected via tapping points. Tapping points consist of an inlet valve and a pressure regulator for setting the required operating pressure. The pressure gauge at the tapping point indicates the current operating pressure.

We offer **Spectrolab plus** range of tapping points for direct installation in laboratory furniture (see separate information).

The combination of pressure control panel and tapping point means that central gas supply systems are always two-stage, since the pressure control panel represents the first pressure stage and the tapping point the second.

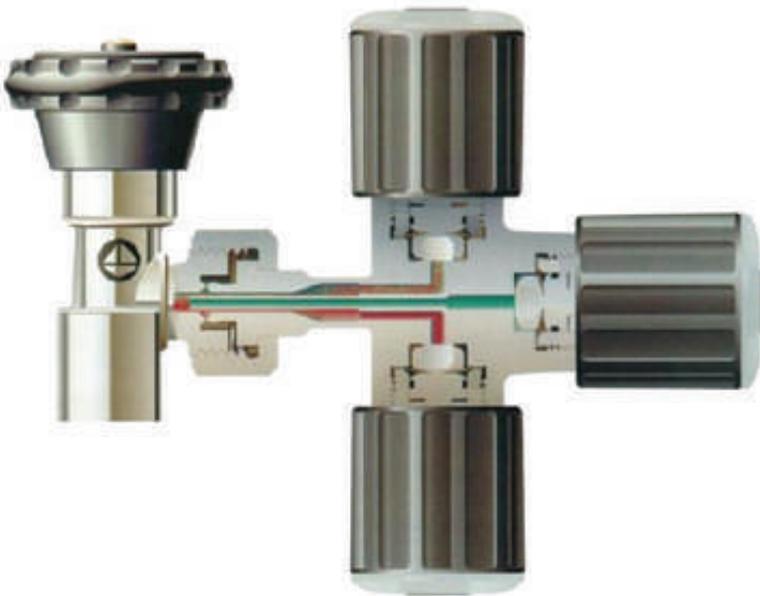


*Spectrolab EM 65 and Spectrolab plus EM 55 tapping points*

All our pressure control panels for specialty gases are complete 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

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



*Spectrochem SBE/3 purge block*

### 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/or toxic gases or low-concentrated gas mixtures, a special purging device with a separate purge gas is required.



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