Metal Diaphragm Compressors and Compressor Units

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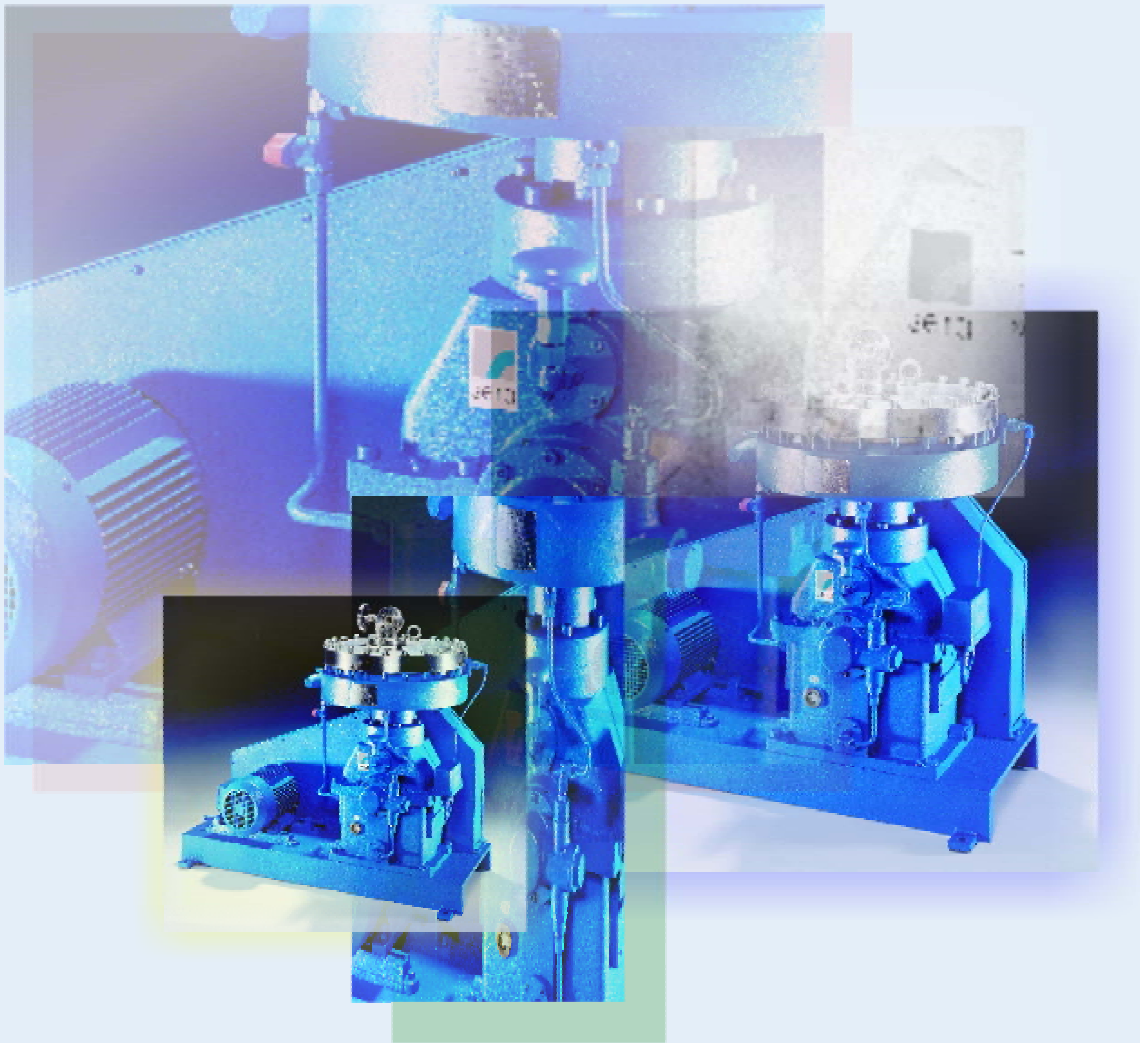

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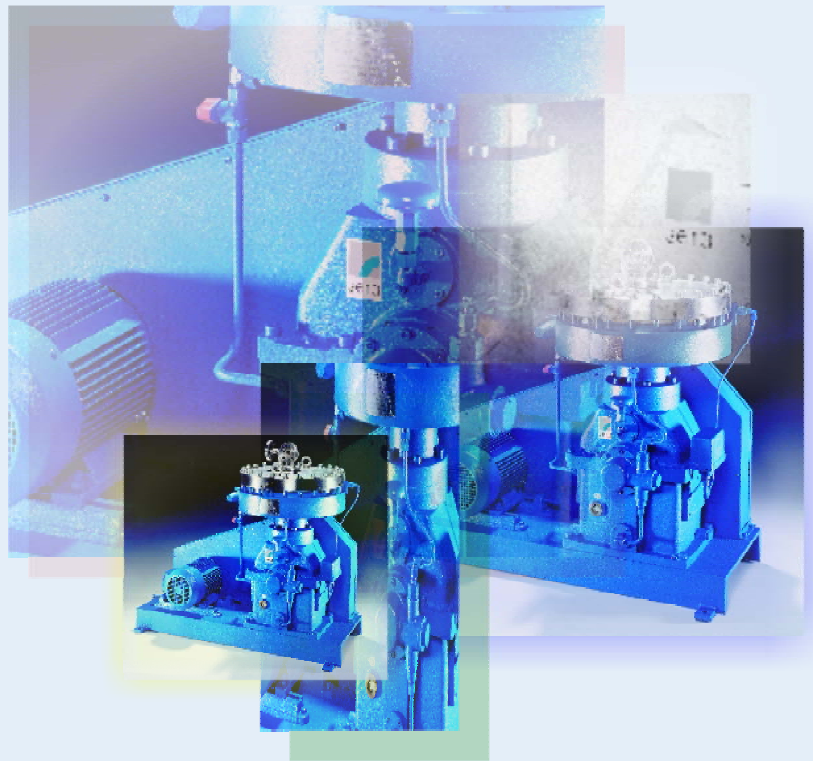
In General

s e r a metal diaphragm compressors and compressor units are oscillating diaphragm compressors to compress gases of all kinds oil-free and free of solids.



Operative range

Gaseous media with inflammable, aggressive, inert, toxic or radioactive properties.

Advantages

- Absolutely oil-free
- Optimum compression ratios
- Maximum leak-proofness
- High-grade CrNi steels in the section in contact with gas
- Easy maintenance
- Careful treatment of gas while compressing due to good heat dissipation via the large contact surfaces
- Free of impurities

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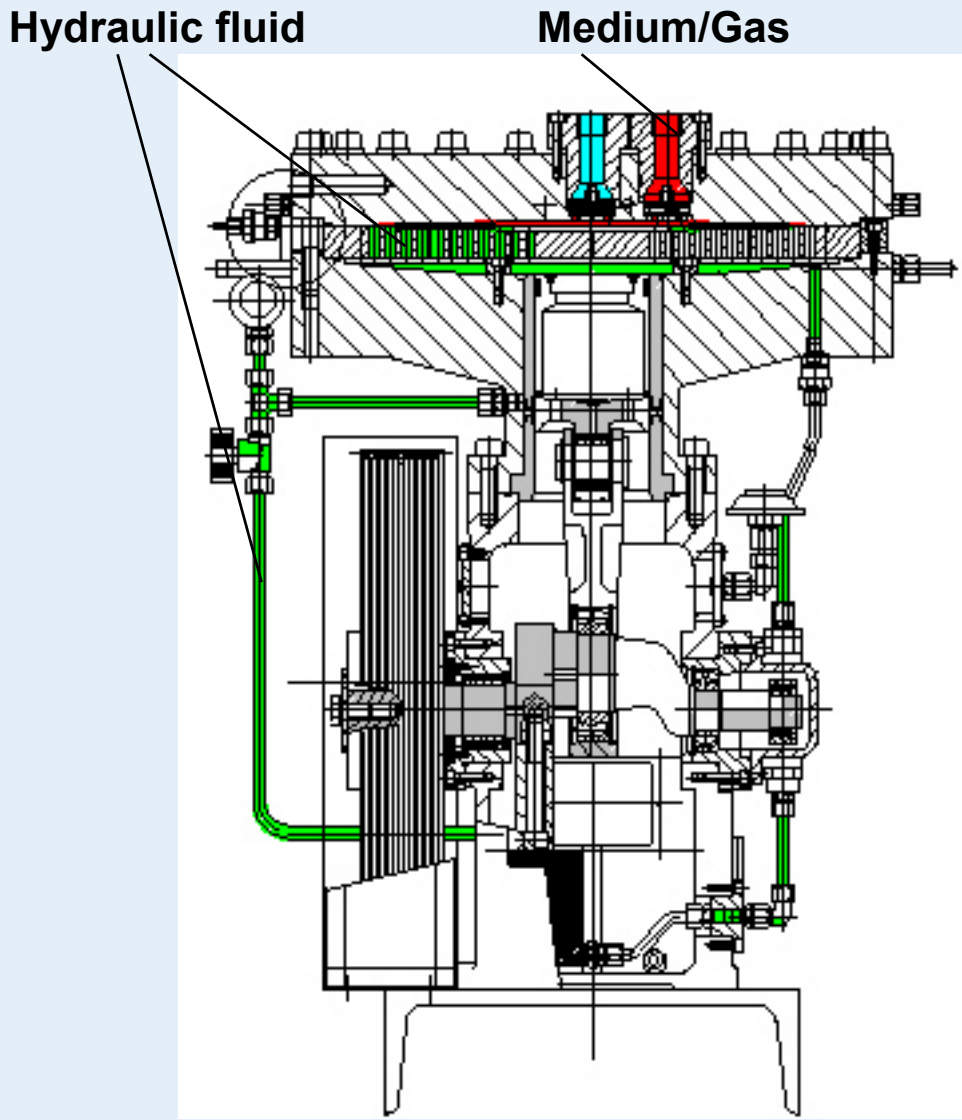
Construction

Main structural components of compressors and compressor units:

- Hydraulic- and lubrication circuit designed as closed system (compensating pump)
- Diaphragms made of 1.4310, 1.4571 or Monel
- Leak-proofness up to 10^{-6} mbar l s^{-1}
- Water cooling
- Driven by electric motor and antistatic V-belt
- Integrated relief valve
- Suction and pressure valve executed as plate valves



Function Principle

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Function principle:

- The stroke movement of the piston is transferred hydromechanically onto the set of diaphragms.
- The hydraulic part is separated from the gas by the set of diaphragms (this way the gas remains free from oil or solids).
- The gas is taken in by the suction valve, compressed as required and then exhausted by the pressure valve.
- An oil compensation pump replaces the small amount of oil which is pressed through cylinder wall and piston with each stroke.
- As the pump always conveys more oil than is lost by leakage the surplus amount of oil is fed back to the drive housing by a relief valve (adjustable with the help of a set screw).
- During the feedback the oil is additionally used to lubricate the piston.

Constructions

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Single stage compressors

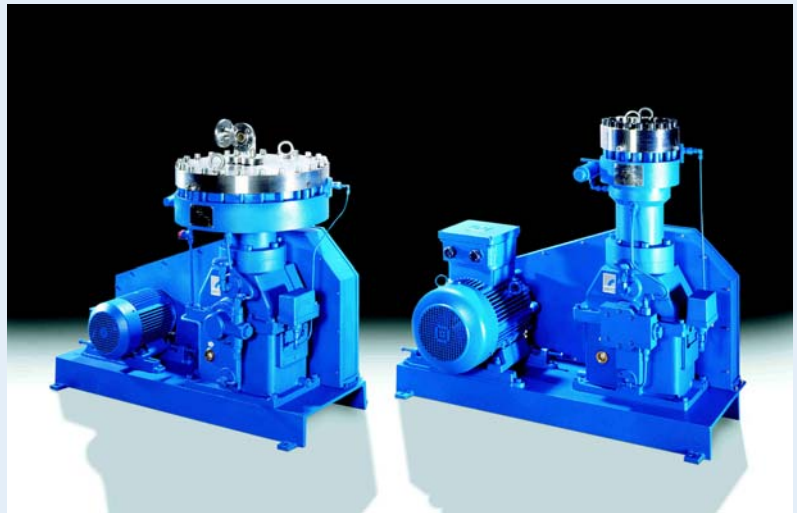
Multi-stage compressor units

- 2 – stage
- 3 – stage
- Tandem - units

Final pressure up to 500 bar

Conveying capacities depend on pre-pressure and gas features

Notice: Special designs for higher pressures on request.



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Type Code

Example: M V 1 1 8 1 K

Type:

MV	Metal diaphragm compressor

Diaphragm diameter:

e.g. 18 = 180 mm

Special constructions:

K	with cooler
H	Helium tight
II	2-stage unit
III	3-stage unit

Compressor size / design:

Compressor size	1
Compressor size	2
Compressor size	3
Compressor size	4
Compressor size	5
Compressor size	6

Pressure stages:

1	to 20	bar abs.
2	21-41	bar abs.
3	42-65	bar abs.
4	66-101	bar abs.
5	102-161	bar abs.
6	162-251	bar abs.
7	252-321	bar abs.
8	322-501	bar abs.
9	as of 502	bar abs.

Which Gases and Gas Mixtures can be Compressed?

Please find in the following a rough survey of the media which can be conveyed:

Gas	Chem. not.
Ammonia	NH_3
Argon	Ar
Ethane	C_2H_6
Ethylene	C_2H_4
Boron trifluoride	BF_3
Hydrogen bromide	HBr
Butane	C_4H_{10}
Chlorine	Cl_2
Hydrogen chloride	HCl
Natural gas	---
Fluorine	F_2
Freon / Frigen	---
Helium	He
Carbon dioxide	CO_2
Carbon monoxide	CO

Gas	Chem. not.
Hydrocarbon	HC
Krypton	Kr
Methane	CH_4
Methyl chloride	CH_3Cl
Neon	Ne
Propane	C_3H_8
Propylene	C_3H_6
Oxygen	O_2
Sulphur dioxide	SO_2
Sulphur hexafluoride	SF_6
Hydrosulphide	H_2S
Nitrogen	N_2
Dinitrogen monoxide	N_2O
Vinyl chloride	C_2H_3Cl
Hydrogen	H_2

Further gases on request!

Diaphragm Rupture Early Warning System

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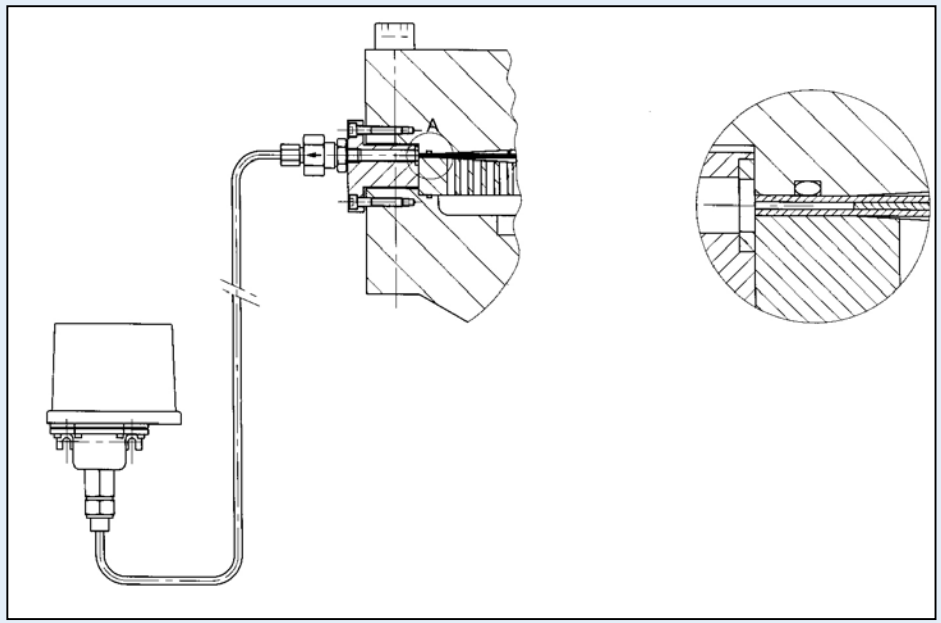
The diaphragms in the s e r a – compressors are wearing parts. In spite of their long service-life a diaphragm might break during operation.

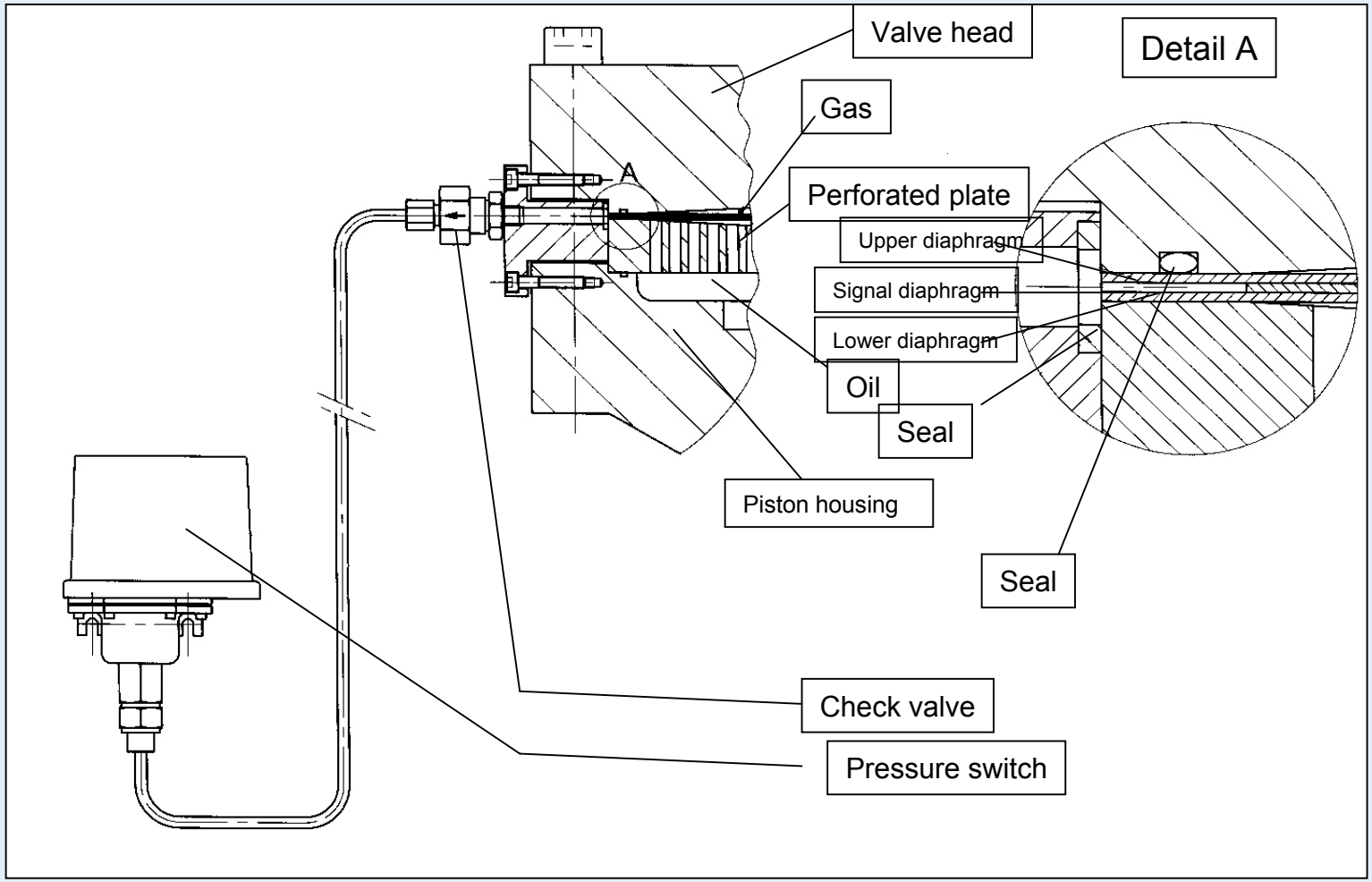
The diaphragm rupture early warning system indicates the rupture of a diaphragm in the initial phase and thus avoids a contamination of the gas.

Functioning

- The set of diaphragms consists of three single diaphragms
- The signal diaphragm is slotted.
- In case the upper or the lower diaphragm breaks a pressure is build up in the slot of the signal diaphragm
- This change in pressure is collected by the mounted-on pressure switch
- This signal can be used to shut down the compressor and as an alarm signal



Details of Diaphragm Rupture Early Warning System



Notice: All s e r a – metal diaphragm compressors are equipped with this monitoring system

Accessories / Mechanics (optional)

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Mechanical accessories (optionally available):

- Oxygen-resistant hydraulic fluid for the compression of O_2
- Pulsation dampers for smoothing the gas flow
- Cooling aggregate for cooling the compressor
- Gas cooler to reduce the gas temperatures
- Special connections for the gas and hydraulic circuit

Further mechanical accessories on request.

Accessories / Mechanics (optional)

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Mechanical accessories (optionally available):

- Suction filter for contaminated gases
- Vibration damper for absorbing the solid-borne sound
- Noise hood for absorbing the air-borne sound
- Heating of compressor for outdoor installation
- Accessories like safety valves, shut-off valves, manometers, thermometers

Further mechanical accessories on request.

Cooling Aggregate

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Cooling aggregate for circulation cooling:

- More flexible application of a compressor with cooling aggregate (independent from place of installation)
- Application without cooling system on site
- Lower operating expenses in comparison to open cooling systems

Components of cooling aggregate:

- Coolant tank made of CrNi-steel
- Coolant pump
- Flow monitoring
- Air/water cooler with ventilation
- Fittings

Process measuring and control accessories (optional):

- Central control by relays or PLC-system
- Terminal box mounted to compressor or compressor unit
- Temperature monitoring (gas, cooling water and oil)
- Flow monitoring for cooling water
- Pressure measuring in gas area
- Pressure measuring in hydraulic area (oil)

Further process measuring and control accessories on request.

Process Measuring and Control Technology

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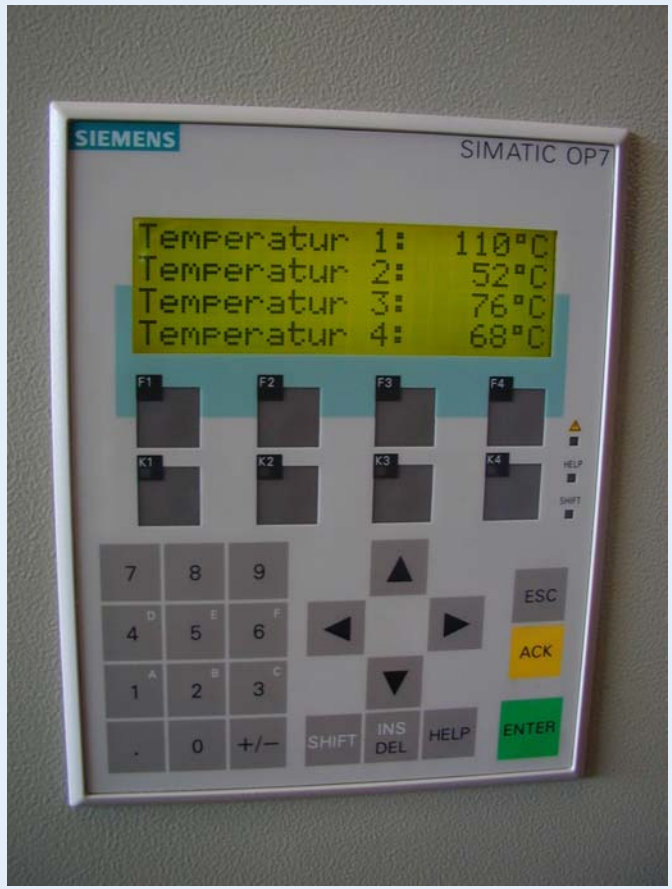
Control:

- All important operation parameters can be monitored with the help of the control devices
- Possible malfunctions can be recognised at an early stage
- The safety of process is increased
- The control unit can be executed in relay or PLC-technology
- Operation of system and indication of all important operating parameters in plain text on an operator display (only with PLC-execution)

Temperature monitoring

- All temperatures at the compressor or compressor unit can be monitored
- Process safety is enhanced
- The single temperature values measured are used to determine the limiting values
- If necessary the unit can be shut off automatically

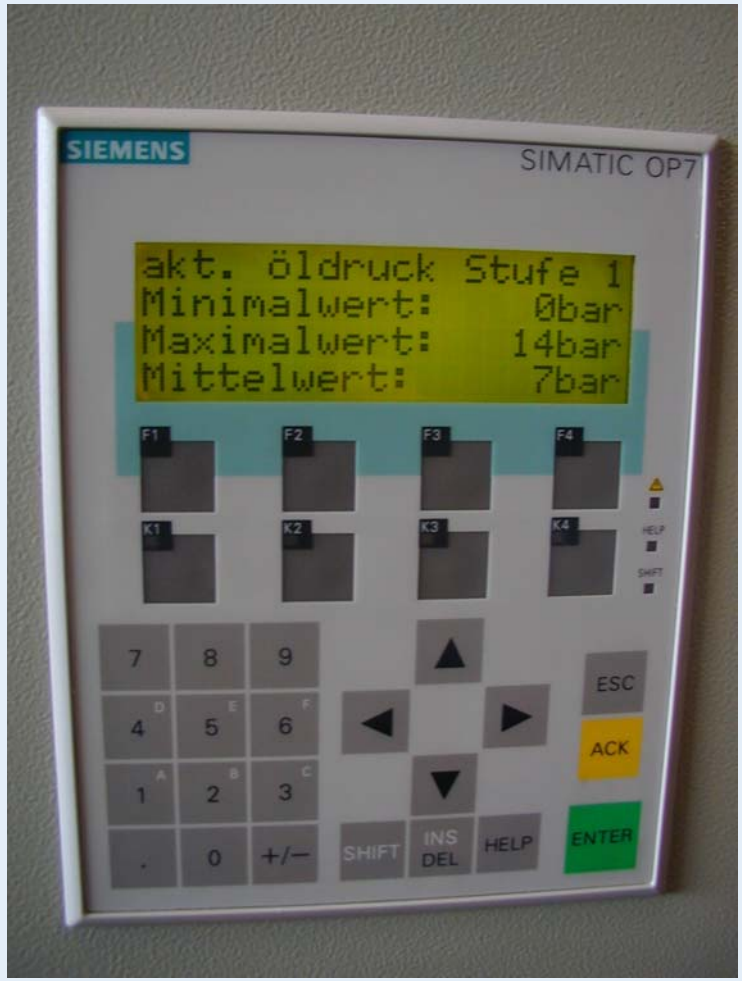


Example:

Monitoring of temperatures at gas inlet and outlet, at compressor head (at both heads in case of a 2-stage compressor)

Pressure monitoring:

- All pressures at the compressor or compressor unit can be monitored (see on the right)
- Besides the oil pressure also the gas pressure at suction and pressure side can be measured
- Process safety is enhanced
- The single temperature values measured are used to determine the limiting values
- If necessary the unit is shut off automatically and a fault indication given



Fields of Application

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Chemical and petrochemical industry:

- Air separation
- Reactor supply
- Hydrogen recycling and burnable gas processing
- Booster for the storing and blanketing of extremely dry nitrogen
- Polyethylene, polypropylene and further polymer processes
- Hydrogenating processes
- Fluoric gases (TFE, BF_3, SIF_4, HF, etc.)
- Corrosive, toxic, explosive gases (H_2S, CO, etc.)
- Oil drilling simulation

Fields of Application

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Energy:

- **Gas:** biogas compression, natural gas storage
- **Power supply:** Cooling of turbine-type generators with helium or hydrogen
- **Coal:** gasification and methane enrichment
- **Nuclear power:** recycling and preparation of radioactive gases, research

Deep diving:

- Breathing gas-mixtures
- Diving simulators
- Pressurized cabins

Fields of Application

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Industrial gases and special mixtures:

- Bottling
- Gas decanting
- Recycling of liquid gas vaporization
- All applications with a high demand as to the purity of the gas and absolute tightness

Metal working:

- Hot isostatic pressing
- Gas screening for surface treatment
- H_2 or He for metal hardening
- Laboratory tests
- Cathode depositing of particles

Fields of Application

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Electronics:

- Noble gas lamps and tubes (neon, krypton, xenon)
- Very thin deposits in epitaxial reactors under high-purity nitrogen
- High pressure nitrogen injection in coaxial cables to enhance their properties
- All applications with high requirements as to gas purity and absolute tightness

Defence / Space travel:

- Leak test with high pressure helium
- Pneumatic tests with high pressure
- Test stands for rocket drives

Fields of Application

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Various industries:

- Production of electrolysis systems
- Test stands (pneumatic high pressure tests, leak tests)
- Mobile oxygen generation systems for civil and military purposes
- CO_2-compression for beverages containing carbon dioxide, packaging, conservation and water treatment
- Dinitrogen monoxide bottling for anaesthesia
- Extraction in supercritical phase
- Helium cooling for nuclear magnetic resonance systems
- Hydrochloric gas compression or storage for cotton treatment

Advantages of s e r a - Metal Diaphragm Compressors

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Advantages of s e r a - compressors
• Oil-free compression
• Starting against max. pressure (no bypass required)
• Applicable for corrosive, aggressive and toxic gases
• Solid-free/abrasion-resistant compression
• Leakage-free
• Few wear and tear parts (therefore insensitive to failures)
• Simple construction
• Simple handling / maintenance
• Good heat dissipation
• Low noisepollution (please refer to noise level measurement)
• High pressure
• Long service-life
• Compact construction
• Monitoring of all essential compressor functions

Noise Level Measurement

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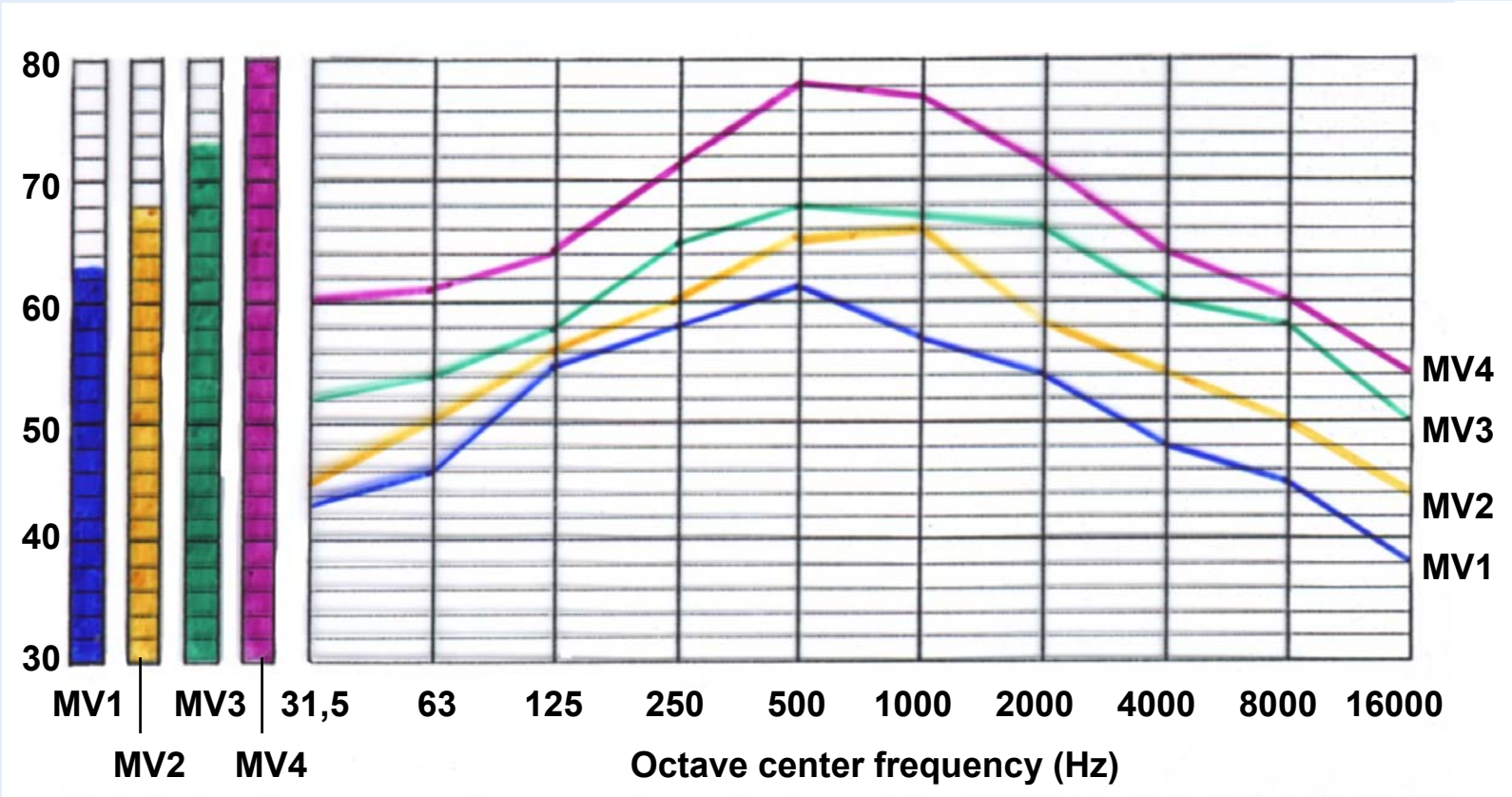
Diagram on noise level measurement of MV 1 – MV 4:



Notice: Diagram only for driving power up to max. 18,5 kW

P & I Flow Chart (2-Stage Compressor Unit)

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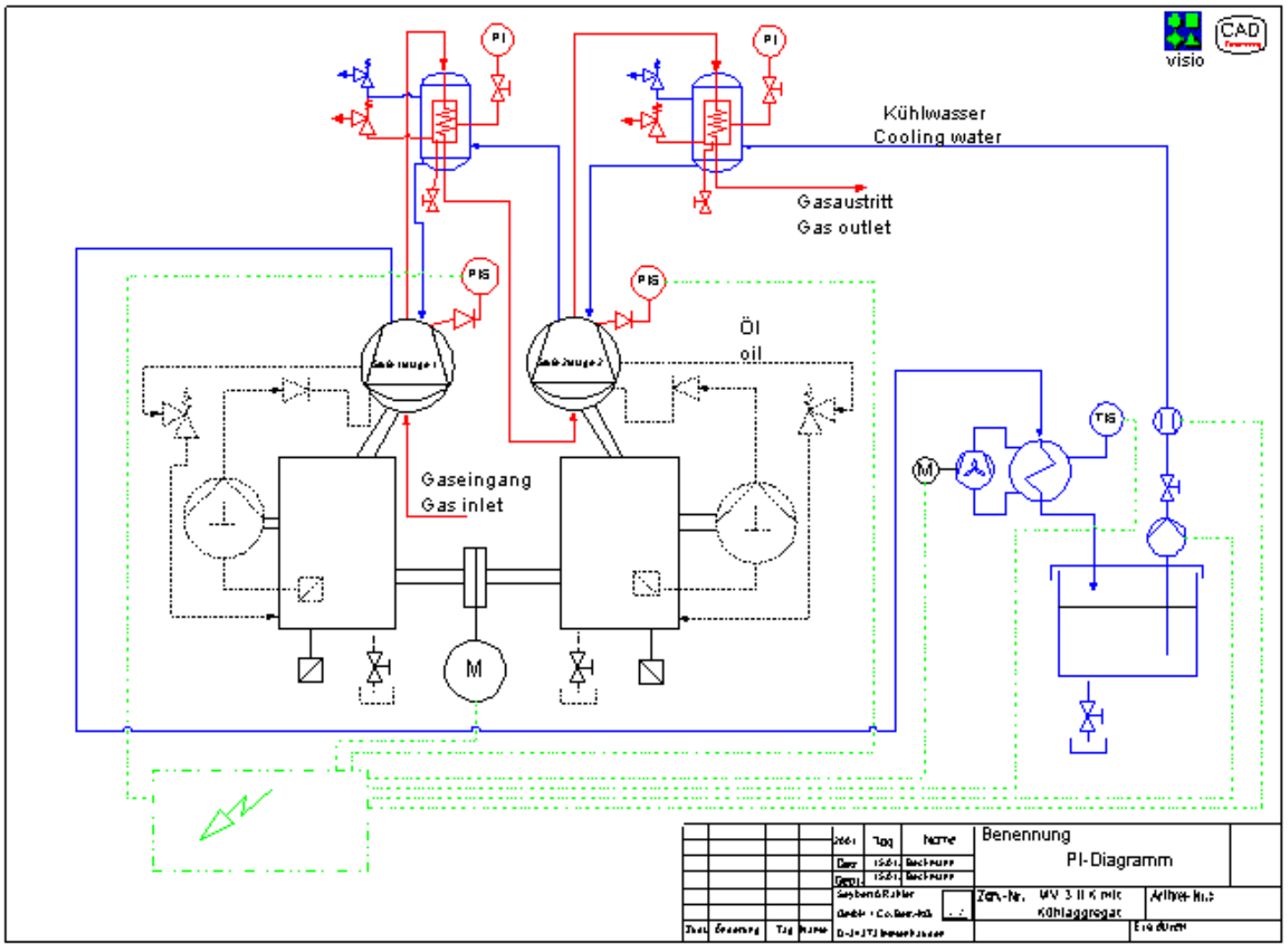
Example:



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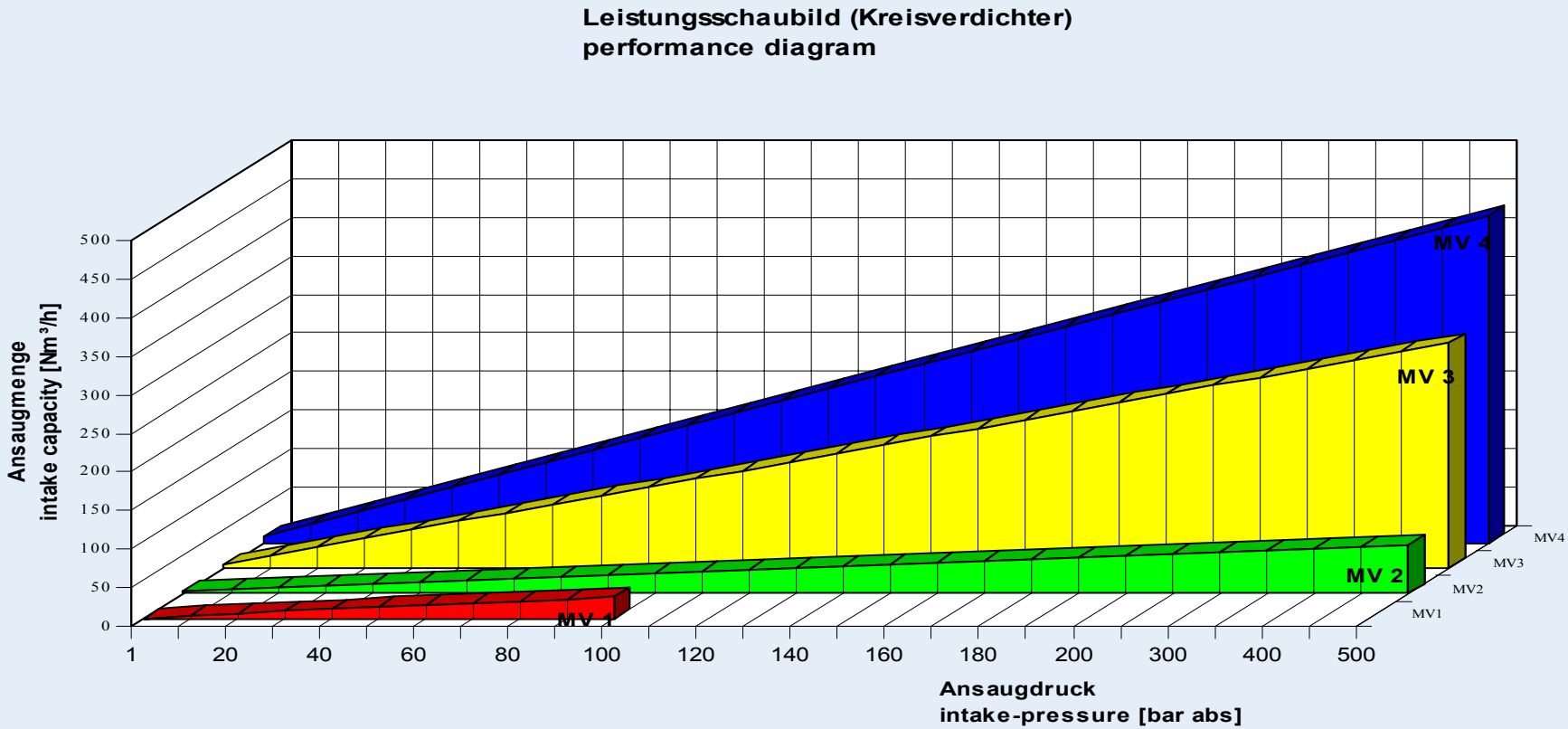
Selection Diagram



- The intake capacity doubles when a tandem unit is chosen
- This performance diagram gives only a rough survey
- The compressors are individually designed for each application

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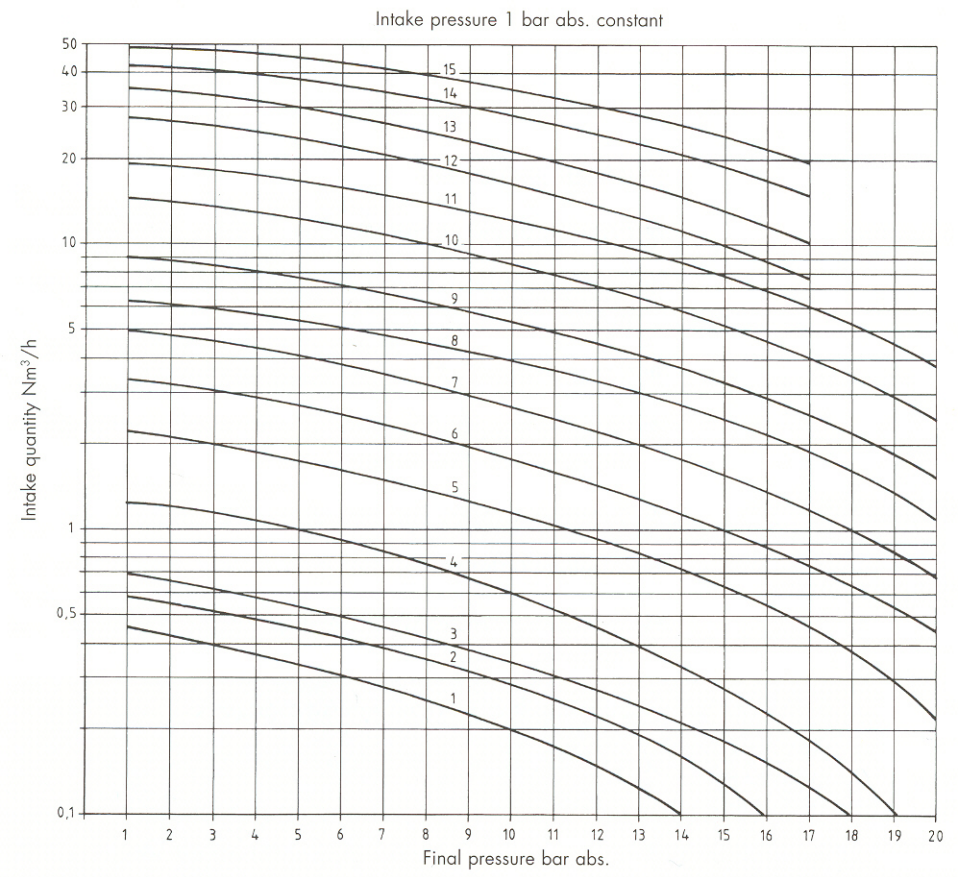
Performance Diagram: Low Pressure Compressor

Performance curve	Type
1	MV 1181
2	MV 1201
3	MV 1211
4	MV 2231
5	MV 2321
6	MV 2351
7	MV 2381
8	MV 3401
9	MV 3451
10	MV 3501
11	MV 3531
12	MV 4651
13	MV 4711
14	MV 4731
15	MV 4751



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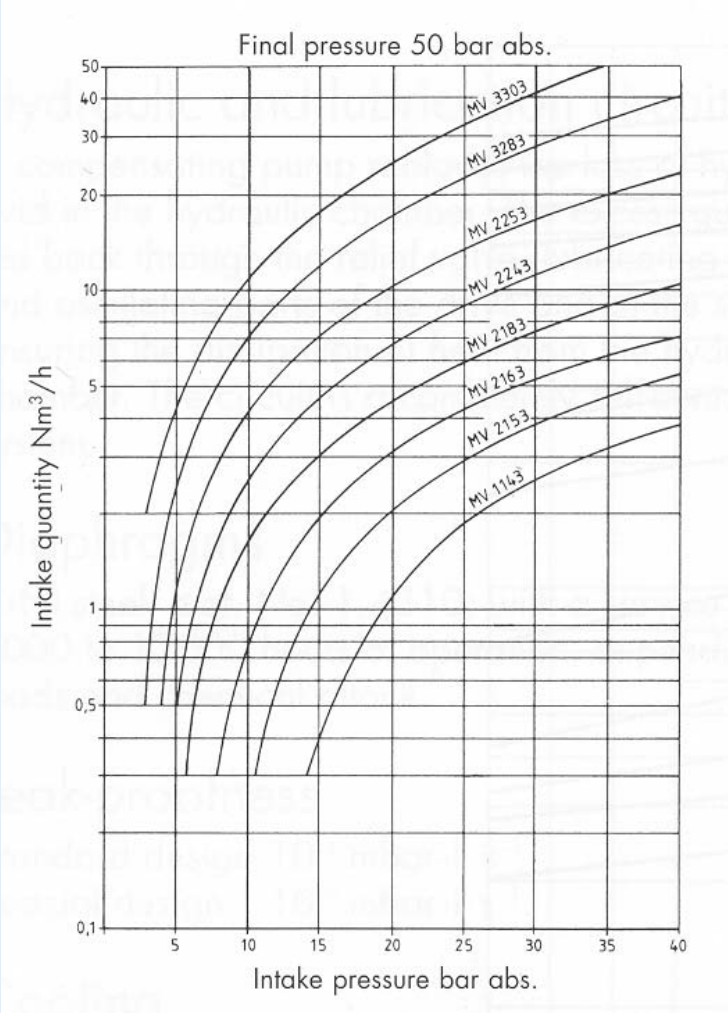
Performance Diagram: High Press. – Final Press. 50 bar abs.

Type
MV 1143
MV 2153
MV 2163
MV 2183
MV 2243
MV 2253
MV 3283
MV 3303



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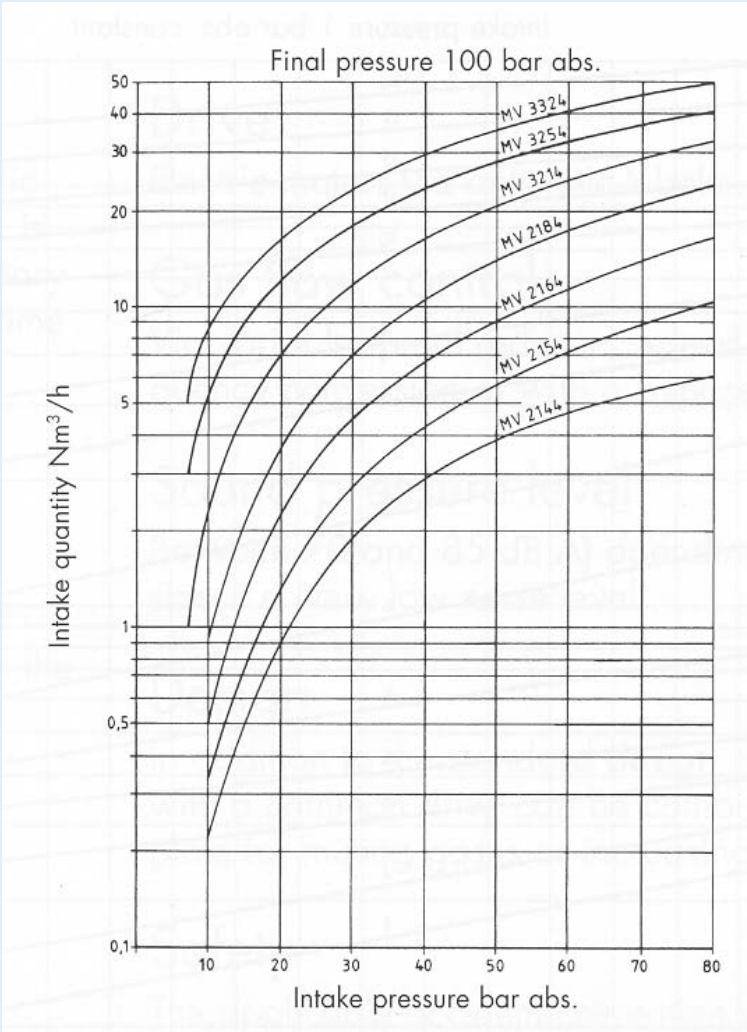
Performance Diagram: High Press. – Final Press. 100 bar abs.

Type
MV 2144
MV 2154
MV 2164
MV 2184
MV 3214
MV 3254
MV 3324



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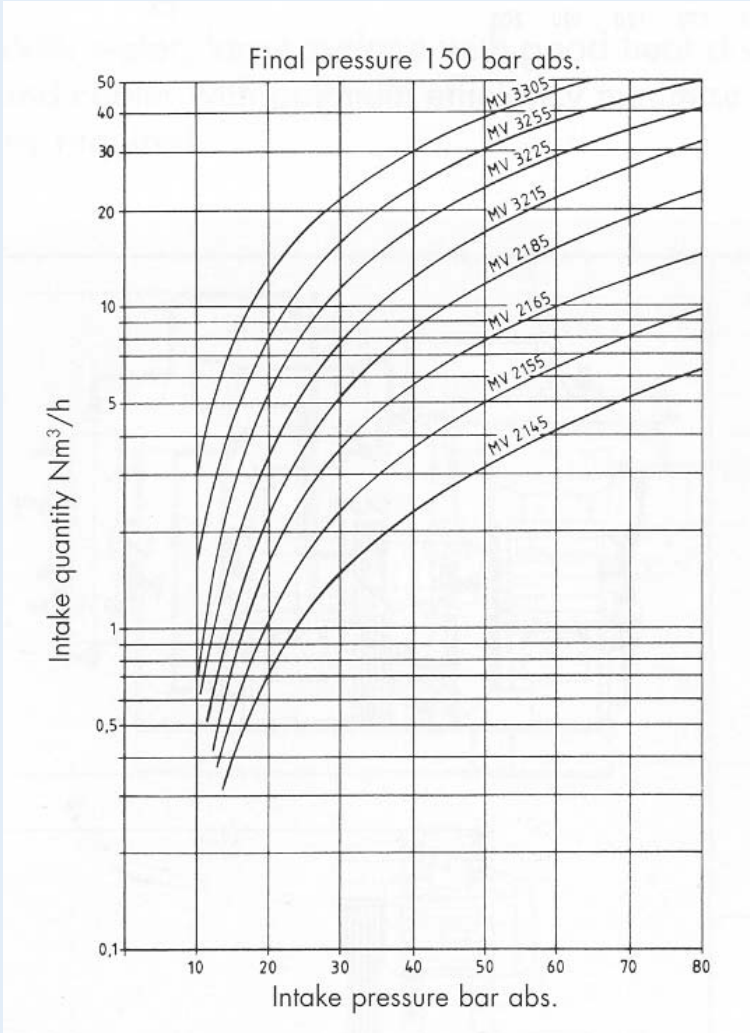
Performance Diagram: High Press. – Final Press. 150 bar abs.

Type
MV 2145
MV 2155
MV 2165
MV 2185
MV 3215
MV 3225
MV 3255
MV 3305



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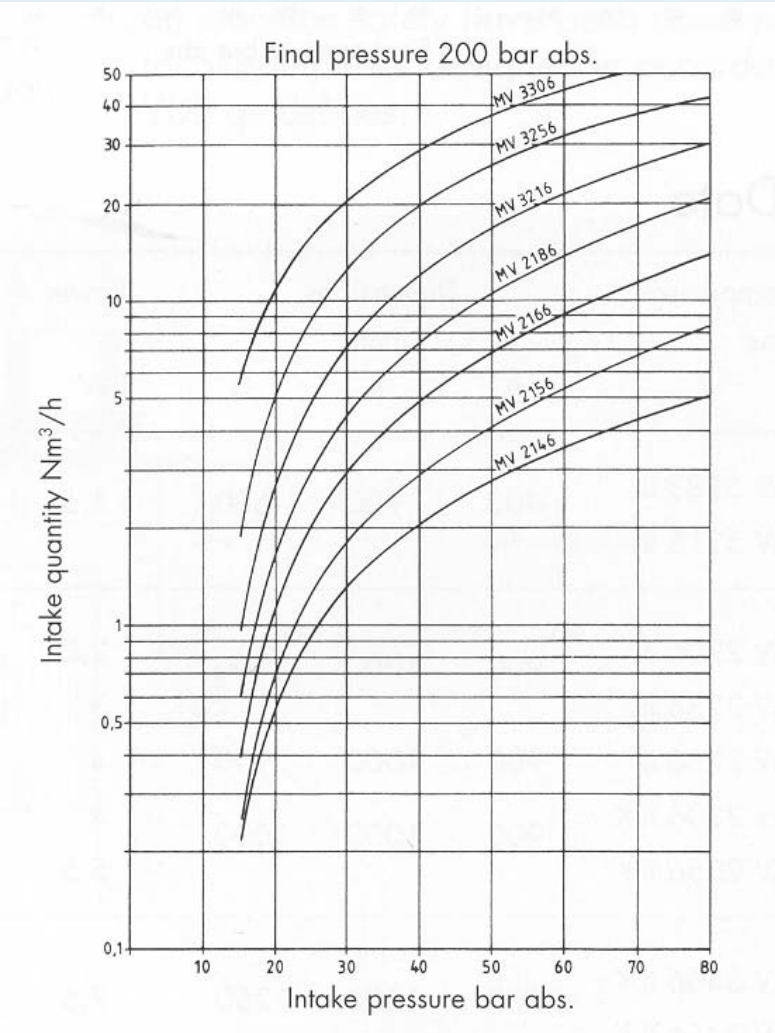
Performance Diagram: High Press. – Final Press. 200 bar abs.

Type
MV 2146
MV 2156
MV 2166
MV 2186
MV 3216
MV 3256
MV 3306



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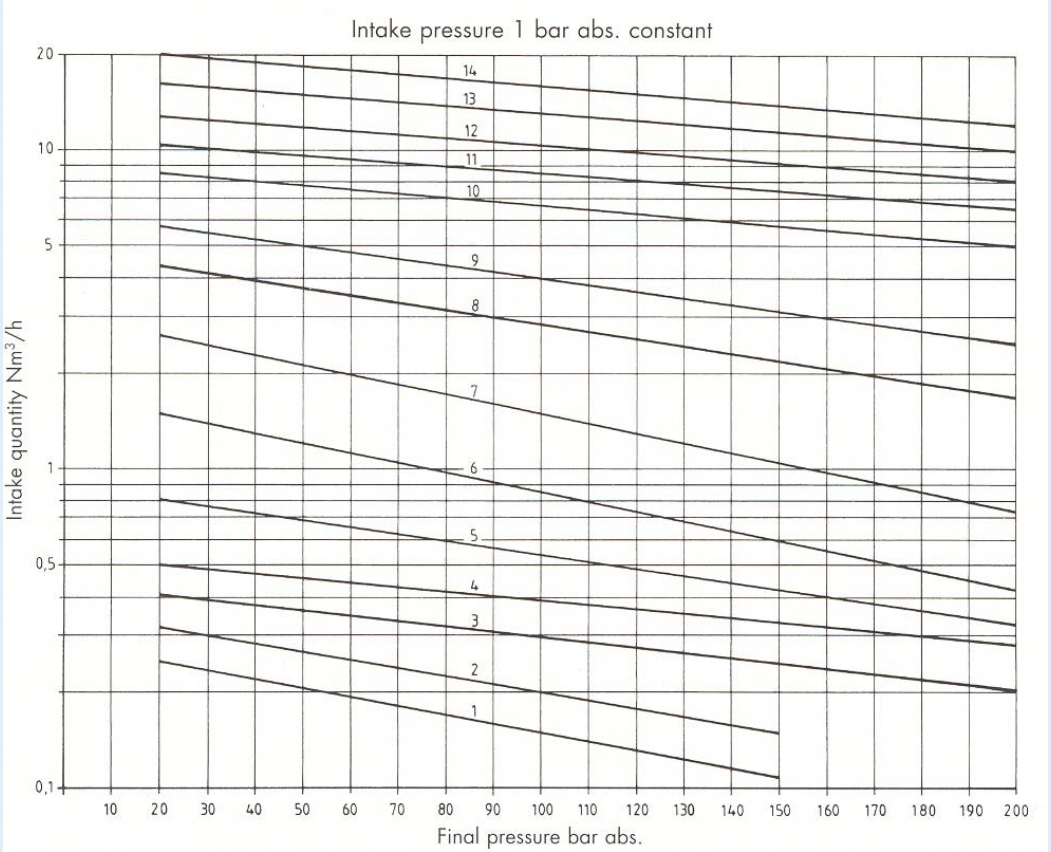
Performance Diagram: Compressor Units

Performance curve	Type
1	MV 5183 II
2	MV 5213 II
3	MV 2206 II
4	MV 2236 II
5	MV 2256 II
6	MV 2306 II K
7	MV 2356 II K
8	MV 3406 II K
9	MV 3456 II K
10	MV 3506 II K
11	MV 3536 II K
12	MV 3566 II K
13	MV 4656 II K
14	MV 4716 II K



List of Compressor Customers and Realized Projects

Metal Diaphragm Compressors and Compressor Units

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An Insight into our List of Compressor Customers:

Countries with Locations of s e r a - Compressors

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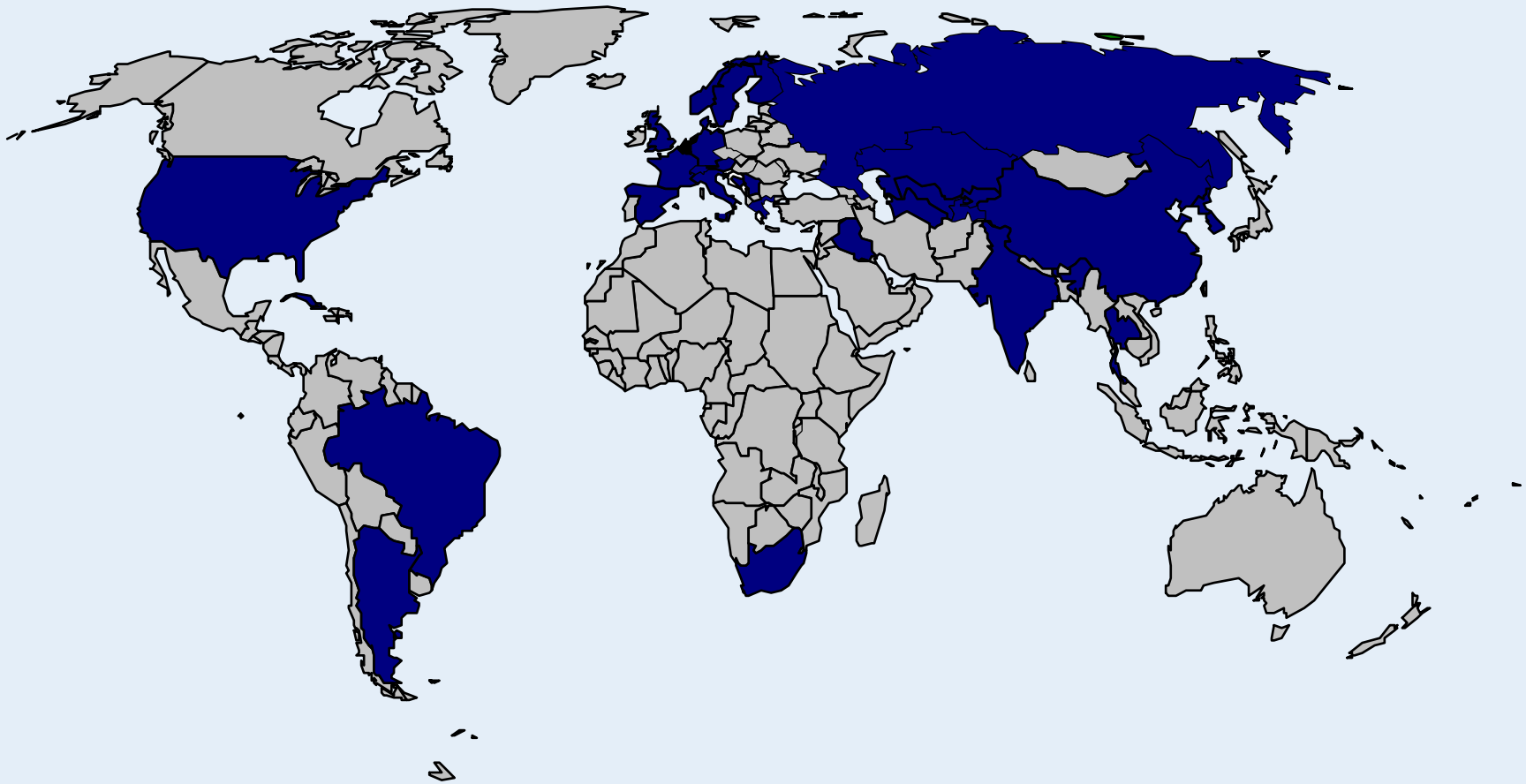

Countries with s e r a - compressors

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Realized Projects

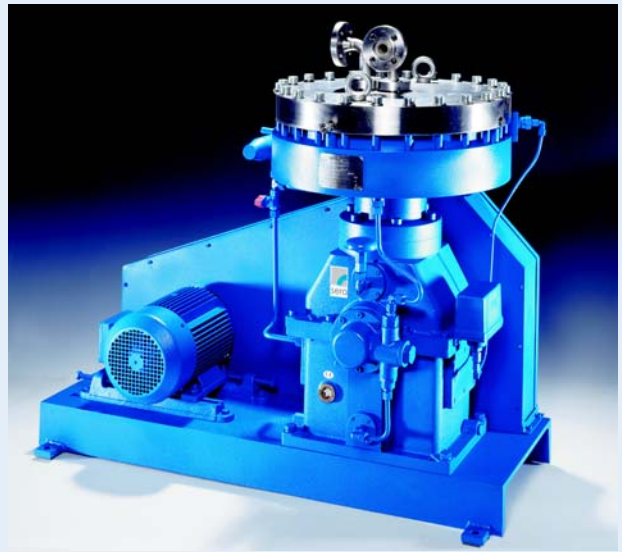
Type MV 3501

Low pressure compressor

p_A: 1 bar abs.

p_E: 5 bar abs.

Q: 10 Nm³/h



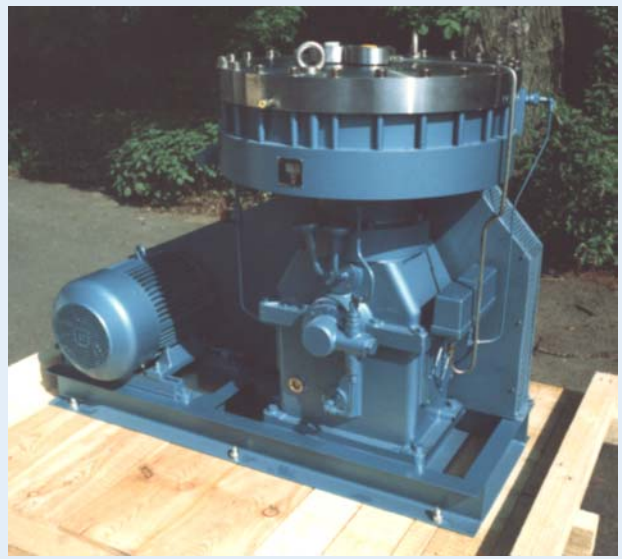
Type MV 4651

Low pressure compressor with final pressure monitoring

p_A: 1 bar abs.

p_E: 10 bar abs.

Q: 16 Nm³/h



Realized Projects

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Type MV 3226

High pressure compressor

p_A: 65 bar abs.

p_E: 141 bar abs.

Q: 27 Nm³/h

Realized Projects

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Type MV 3458 III K

High pressure compressor unit (3-stages)

p_A: 7 bar abs.

p_E: 350 bar abs.

Q: 15 Nm³/h

Type MV 3296 II K

High pressure compressor unit (2-stages)

p_A: 2...30 bar abs.

p_E: 200 bar abs.

Q: 28 Nm³/h