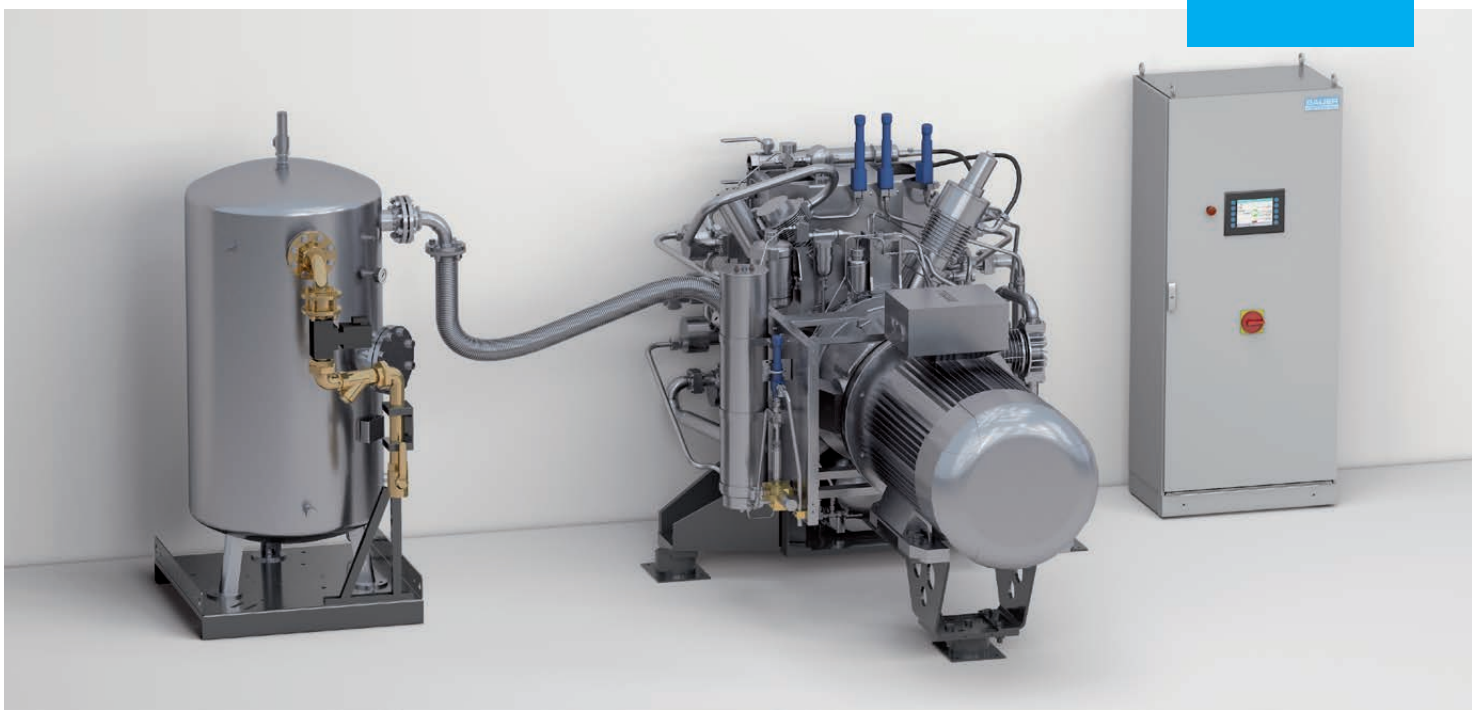
BAUER KOMPRESSOREN

Quality. Our DNA

EQUIPMENT AND OPTIONS

COMPRESSORS FOR INDUSTRY



INDUSTRY

CONTENTS

TECHNICAL ANNEX

4th edition
12.2015

AIR-COOLED INDUSTRIAL COMPRESSOR UNITS

BAUER KOMPRESSOREN offers two product lines for industrial use:
The standard range K 22 – K 28 and the range BK 23 – BK 52 for pre-compressed air & gas.

This range is designed for industrial environment applications, including extreme conditions. The compressors are air-cooled horizontal versions. An optional Super Silent version reduces operating noise and is suitable for installation in noise-sensitive areas.

FEATURES

- **Range K 22 – K 28 – air-cooled**
- **Standard industrial compressors for compression of air and nitrogen, helium and argon.**
- **Intake pressure: atmospheric up to 100 $mbar_g$**

Air & nitrogen:	**930 – 3500 l/min**	**33 – 126 cfm**
	30 – 500 bar	**435 – 7250 psig**
Helium & argon:	**580 – 1800 l/min**	**20 – 64 cfm**
	90 – 350 bar	**1300 – 5100 psig**

K 22 open version

K 22 Super Silent

K 25 / K 28 Super Silent

K 25 / K 28 open version

K 23 open version

WATER-COOLED INDUSTRIAL COMPRESSORS & BOOSTER

When special applications demand extreme reliability, our water-cooled industrial unit range comes into its own.

The BK 23 - BK 52 range is equipped for demanding applications for heavy-duty industrial use.
These include oil and gas compression in continuous operation.
Water cooled and direct coupled[1], single-acting plunger pistons and twin ferrule compression-type fittings result in the highest reliability and robustness.

FEATURES

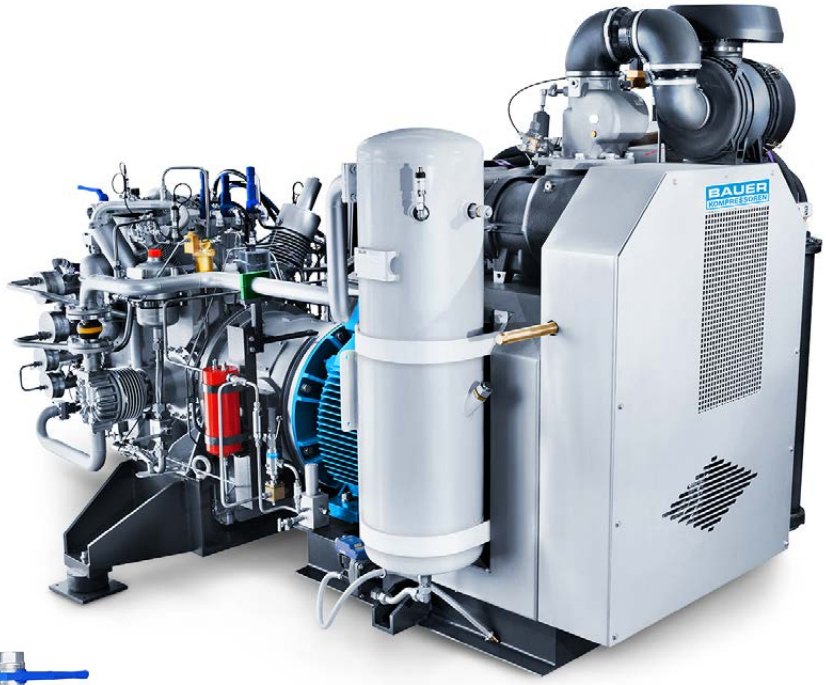
- **Range BK 23 – BK 52 – water-cooled.**
- **Industrial compressors for air and nitrogen, helium and argon, CNG and biomethane.**
- **Intake pressure: atmospheric up to 16 bar_g**

- **Air & nitrogen:** **1330 – 23,400 l/min | 47 – 826 cfm**
  25 – 420 bar | 360 – 6100 psig
- **Helium & argon:** **740 – 22,230 | 26 –785 cfm**
  25 – 420 bar | 360 – 6100 psig

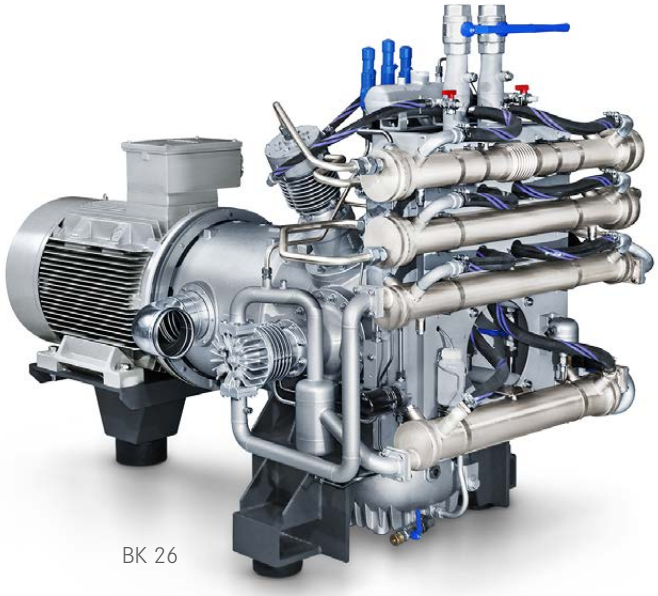
BK 23

BK 24

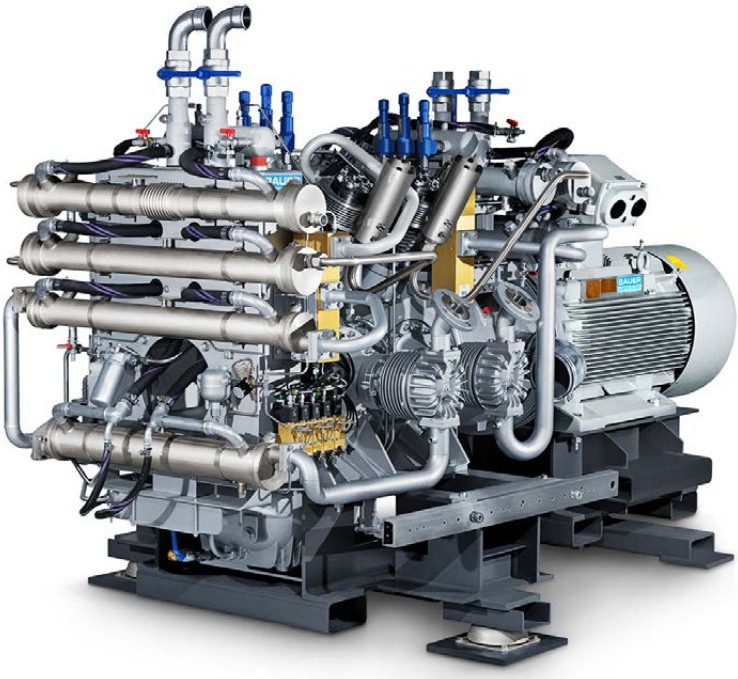
1 As of BK 24



GIB 26.12-SP



BK 26



BK 52

			I 22.0-22	I 23.0-30	I 23.0-37	I 25.0-45	I 28.0-75	I 22.0-22-420	I 25.9-45	I 25.18-55
			Air & Nitrogen							
		FAD [m³/h] (50 Hz)*	55,8	78	89	114	210	48	114	138
		Speed [rpm] (50 Hz)	1320	1200	1400	1180	1180	1180	1180	1100
		Pressure max. with air & nitrogen (bar)	350	350	350	350	350	420	500	500
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	22	30	37	45	75	22	45	55
			90 - 350 BAR					420/500 BAR		
		OPTIONS								
UNIT CORE COMPONENT	**Medium**	Air	●	●	●	●	●	●	●	●
		Nitrogen[1]	○	○	○	○	○	○	○	○
		Helium & argon[1]	–	–	–	–	–	–	–	–
	Configuration	Water-cooled - horizontal (direct coupled)	–	–	–	–	–	–	–	–
		Water-cooled - horizontal (v-belt)	–	–	–	–	–	–	–	–
		Water-cooled - vertical (v-belt)	–	–	–	–	–	–	–	–
		Air-cooled - horizontal (v-belt)	●	●	●	●	●	●	●	●
	Design	Open version	●	●	●	●	●	●	●	●
		Super Silent[2]	○	○	○	○	○	○	○	○
	Screw fitting	Cutting ring fitting	●	●	●	●	●	●	●	●
		Twin ferrule compression fitting, stainless steel	–	–	–	–	–	–	–	–
	Colour finish	BAUER Standard (CYAN, RAL9006, RAL7024)	●	●	●	●	●	●	●	●
		Offshore[3]	○	○	○	○	○	○	○	○
	Compressor oil	BAUER compressor oil synthetic N28355 for air	●	●	●	●	●	●	●	●
		BAUER special compressor oil[4]	○	○	○	○	○	○	○	○
	Voltage	400 V	●	●	●	●	●	●	●	●
		Other voltage	○	○	○	○	○	○	○	○
	Frequency	Frequency 50 Hz	●	●	●	●	●	●	●	●
		Frequency 60 Hz	○	○	○	○	○	○	○	○
	Energy efficiency class [5]	IE3	●	●	●	●	●	●	●	●
	Explosion protection	Explosion-proof[6]	○	○	○	○	○	○	○	○
	Safety valves	Final pressure safety valve, type-examined	●	●	●	●	●	●	●	●
		Final pressure safety valve, TÜV-certified	○	○	○	○	○	○	○	○
		Safety valves, encapsulated & gas-tight	–	–	–	–	–	–	–	–
AUTOMATION	**Compressor control**	Basic version (B-CONTROL MICRO)[7]	●	●	●	●	●	●	●	●
		Standard version (B-CONTRO MICRO)[8]	○	○	○	○	○	○	○	○
		Premium version (B-CONTROL II)	○	○	○	○	○	○	○	○
	Startup configuration	Star/delta[10]	●	●	●	●	●	●	●	●
		Soft starter[9]	○	○	○	○	●	○	○	○
		Speed control & soft startup[9]	○	○	○	○	○	○	○	○

B 22.5-15	B 23.4-30	B 25.4-45	B 28.2-55	B 28.3-110	E 22.5-15	E 23.4-30	E 25.4-45	B 26.4-55	G 22.0-18.5	G 23.1-22	G 23.1-30	G 25.9-45	G 25.9-45
Air & Nitrogen									He & Ar				
57	104	171	204	408	51	102	156	198	43	50	64	114	99
1310	1200	1270	1050	1050	1150	1200	1200	1050	1050	990	1250	1180	1050
63	63	63	63	63	75	75	75	75	220	220	220	220	350
atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
15	30	45	55	110	15	30	45	55	18.5	22	30	45	45
30-68 BAR					64-85 BAR				90-220 BAR				350 BAR
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			I 22.0-22	I 23.0-30	I 23.0-37	I 25.0-45	I 28.0-75	I 22.0-22-420	I 25.9-45	I 25.18-55
			Air & Nitrogen							
		FAD [m³/h] (50 Hz)*	55,8	78	89	114	210	48	114	138
		Speed [rpm] (50 Hz)	1320	1200	1400	1180	1180	1180	1180	1100
		Pressure max. with air & nitrogen (bar)	350	350	350	350	350	420	500	500
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	22	30	37	45	75	22	45	55
			90 - 350 BAR					420/500 BAR		
		OPTIONS								
AUTOMATION	**Interconnected operation**	Lead compressor (active & passive)[9]	●	●	●	●	●	●	●	●
		Lag compressor (active)[9]	●	●	●	●	●	●	●	●
		Lag compressor (passive)	●	●	●	●	●	●	●	●
	Electronic monitoring	Final pressure	●	●	●	●	●	●	●	●
		Oil pressure	●	●	●	●	●	●	●	●
		Intermediate pressure[9]	○	○	○	○	○	○	○	○
		Intake filter[9]	–	○	○	○	○	–	○	○
		Intake pressure[11]	○	○	○	○	○	○	○	○
		Temperature final stage	●	●	●	●	●	●	●	●
		Cooling air temperature[9]	●	●	●	●	●	●	●	●
		Interstage temperature[9]	○	○	○	○	○	○	○	○
		Oil level[9]	–	–	–	–	–	–	–	–
	Analogue pressure gauge	for intermediate stage pressure, with shut-off valve	○	○	○	○	○	○	○	○
	Pre-lubrication pump	Automatic pre-lubrication of the slide bearings	–	–	–	–	–	–	–	–
AMBIENT CONDITION	**Inclined position**	10° in all directions	●	●	●	●	●	●	●	●
		30° roll	–	–	–	–	–	–	–	–
		30° in all directions	–	–	–	–	–	–	–	–
	Intake temperature	+5...+45 °C	●	●	●	●	●	●	●	●
	Ambient temperature	+5...+45 °C	●	●	●	●	●	●	●	●
		+5...+55 °C	○	○	○	○	○	○	○	○
		-10...+45 °C[12]	○	○	○	○	○	○	○	○
INTAKE COMPONENTS	**Intake buffer vessel**	Intake buffer vessel (necessary for N_2, Helium & Argon)	○	○	○	○	○	○	○	○
	Intake device	Intake device (for gas)	○	○	○	○	○	○	○	○
	Intake pressure reduction[13]	Intake pressure reduction 1-stage	○	○	○	○	○	○	○	○
	Condensate collecting tank	Condensate collecting system 60-litre[14]	○	○	○	○	○	○	○	○
		Condensate collecting system (pressure vessel)[15]	–	–	–	–	–	–	–	–
	Intake-condensate tank	Combined intake buffer and condensate tank	–	–	–	–	–	–	–	–
	Coalescence filter	Coalescence filter	○	○	○	○	○	○	○	○

B 22.5-15	B 23.4-30	B 25.4-45	B 28.2-55	B 28.3-110	E 22.5-15	E 23.4-30	E 25.4-45	B 26.4-55	G 22.0-18.5	G 23.1-22	G 23.1-30	G 25.9-45	G 25.9-45
Air & Nitrogen									He & Ar				
57	104	171	204	408	51	102	156	198	43	50	64	114	99
1310	1200	1270	1050	1050	1150	1200	1200	1050	1050	990	1250	1180	1050
63	63	63	63	63	75	75	75	75	220	220	220	220	350
atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
15	30	45	55	110	15	30	45	55	18.5	22	30	45	45
30-68 BAR					64-85 BAR				90-220 BAR				350 BAR
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			I 22.0-22	I 23.0-30	I 23.0-37	I 25.0-45	I 28.0-75	I 22.0-22-420	I 25.9-45	I 25.18-55
			Air & Nitrogen							
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		Speed [rpm] (50 Hz)	1320	1200	1400	1180	1180	1180	1180	1100
		Pressure max. with air & nitrogen (bar)	350	350	350	350	350	420	500	500
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	22	30	37	45	75	22	45	55
			90 - 350 BAR					420/500 BAR		
		OPTIONS								
ACCEPTANCE & DOCUMENTATION	**Testing of pressure vessel**	Pressure vessel compliance to PED	●	●	●	●	●	●	●	●
	Documentation	Standard operating instructions (EG languages)	●	●	●	●	●	●	●	●
		Spare parts list (DE, EN, FR)	●	●	●	●	●	●	●	●
		EC Declaration of Conformity	●	●	●	●	●	●	●	●
		EC Pressure Vessel Certificate according to PED	●	●	●	●	●	●	●	●
		Further documentation (material certificates, ITP, 3D-drawings, etc.) - please refer to price list	○	○	○	○	○	○	○	○
	Acceptance	Final check according to BAUER Standard	●	●	●	●	●	●	●	●
		Final check (FAT) according to customer requirements	○	○	○	○	○	○	○	○
		Acceptance organisation (3rd party)	○	○	○	○	○	○	○	○
	Packing	Packaging standard for truck/air freight	●	●	●	●	●	●	●	●
		Packaging for sea freight	○	○	○	○	○	○	○	○
	External accessories									
ACCESSORIES	**Accessories water cooling**	Ball valve for heat exchanger (compressor)	–	–	–	–	–	–	–	–
		Filter for cooling water	–	–	–	–	–	–	–	–
		Radiator set (radiator, water pump, etc.) [160951-Sx]	–	–	–	–	–	–	–	–
		Plate heat exchanger set [127983-S01; -S02]	–	–	–	–	–	–	–	–
PURIFICATION	**Air and gas purification**	Seccant III	○	○	○	–	–	○	–	–
		Seccant IV[16]	○	○	○	○	○	○	○	○
		P 120[15]	○	○	○	○	–	–	–	–
		P 140[15]	○	○	○	○	○	–	–	–

Unit core components
Automation
Ambient conditions
Intake components
Purification
Acceptance & documentation
Packing
Accessories

B 22.5-15	B 23.4-30	B 25.4-45	B 28.2-55	B 28.3-110	E 22.5-15	E 23.4-30	E 25.4-45	B 26.4-55	G 22.0-18.5	G 23.1-22	G 23.1-30	G 25.9-45	G 25.9-45
Air & Nitrogen									He & Ar				
57	104	171	204	408	51	102	156	198	43	50	64	114	99
1310	1200	1270	1050	1050	1150	1200	1200	1050	1050	990	1250	1180	1050
63	63	63	63	63	75	75	75	75	220	220	220	220	350
atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
15	30	45	55	110	15	30	45	55	18.5	22	30	45	45
30-68 BAR					64-85 BAR				90-220 BAR				350 BAR
●	●	●	●	●	●	●	●	●	●	●	●	●	●
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● Standard ○ Option – Not available

* Valid for air; correction factor for helium & argon:
Helium: FAD x 0.8; Argon: FAD x 0.95

1 Intake device / intake pressure reduction required; for some models restrictions apply for helium and argon
2 Available only in combination with B-CONTROL II
3 Details see section 5
4 Please refer to lubricating oil list
5 IE3: compulsory from 2015 within Europe, also in other countries
6 Explosion protection (e.g. according to ATEX)
7 Basic version: B-CONTROL MICRO for wall mounting; supplied without complete cabling; compressor control not preassembled; w/o cable; only for air-cooled compressors
8 Standard version: B-CONTROL MICRO supplied completely cabled, for wall mounting, 5 m cable incl.; for air-cooled compressors
9 Only in combination with B-CONTROL II
10 From 75 kW: soft starter standard in combination with B-CONTROL II
11 Standard with intake device or intake pressure reduction option
12 Only in combination with Super Silent housing and heating device
13 Intake pressure reduction includes intake device
14 With / without connection for external SECCANT
15 Separate intake buffer vesser required
16 Limitation of pressure / FAD possible

			B 26.4-55	B 26.4-90	IB 23.0-30	IB 23.0-37	I 24.0-55	I 26.0-55	I 26.0-75	I 52.0-110	I 52.0-160	GIB 26.12-SP-365	GIB 26.12-SP-420	GB 23.2-30
			Air & Nitrogen											He & Ar
		FAD [m³/h] (50 Hz)*	214	324	78	90	126	135	204	270	408	624	624	40
		Speed [rpm] (50 Hz)	985	1485	1210	1420	1485	985	1485	985	1485	1485	1485	1420
		Pressure max. with air & nitrogen (bar)	63	63	350	350	350	350	350	350	350	350	420	220
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	55	90	30	37	55	55	75	110	160	250	250	30
			25 - 68 BAR		90 - 365 BAR								90 - 420 BAR	90 - 230 BAR
		OPTIONS/EQUIPMENT	COMPRESSOR (ATMOSPHERIC INTAKE)											
UNIT CORE COMPONENT	**Medium**	Air	●	●	●	●	●	●	●	●	●	●	●	–
		Nitrogen[1]	○	○	○	○	○	○	○	○	○	○	○	–
		Helium & argon[1]	–	–	–	–	–	–	–	–	–	–	–	●
	Configuration	Water-cooled - horizontal (direct coupled)	●	●	–	–	●	●	●	●	●	●	●	–
		Water-cooled - horizontal (v-belt)	–	–	○	○	–	–	–	–	–	–	–	○
		Water-cooled - vertical (v-belt)	–	–	●	●	–	–	–	–	–	–	–	●
		Air-cooled - horizontal (v-belt)	–	–	○	○	–	–	–	–	–	–	–	○
		Air-cooled - vertical (v-belt)	–	–	–	–	–	–	–	–	–	–	–	–
	Design	Open version	●	●	●	●	●	●	●	●	●	●	●	●
		Super Silent[2]	–	–	–	–	–	–	–	–	–	–	–	–
	Screw fitting	Cutting ring fitting	–	–	–	–	–	–	–	–	–	–	–	–
		Twin ferrule compression fitting, stainless steel	●	●	●	●	●	●	●	●	●	●	●	●
	Colour finish	BAUER Standard (CYAN, RAL9006, RAL7024)	●	●	●	●	●	●	●	●	●	●	●	●
		Offshore[3]	○	○	○	○	○	○	○	○	○	○	○	○
	Compressor oil	BAUER compressor oil synthetic N28355 for air	●	●	●	●	●	●	●	●	●	●	●	●
		BAUER special compressor oil[4]	○	○	○	○	○	○	○	○	○	○	○	○
	Voltage	400 V	●	●	●	●	●	●	●	●	●	●	●	●
		Other voltage	○	○	○	○	○	○	○	○	○	○	○	○
	Frequency	Frequency 50 Hz	●	●	●	●	●	●	●	●	●	●	●	●
		Frequency 60 Hz	○	○	○	○	○	○	○	○	○	○	○	○
	Energy efficiency class 5	IE3	●	●	●	●	●	●	●	●	●	●	●	●
	Explosion protection	Explosion-proof[6]	○	○	○	○	○	○	○	○	○	–	–	○
	Safety valves	Final pressure safety valve, type-examination	●	●	●	●	●	●	●	●	●	●	●	●
		Final pressure safety valve, TÜV-certified	○	○	○	○	○	○	○	○	○	○	○	○
		Safety valves encapsulated & gas-tight	–	–	○	○	○	○	○	○	○	○	○	●
AUTOMATION	**Compressor control**	Basic version (B-CONTROL MICRO)[7]	–	–	–	–	–	–	–	–	–	–	–	–
		Standard version (B-CONTRO MICRO)[8]	–	–	–	–	–	–	–	–	–	–	–	–
		Premium version (B-CONTROL II)	●	●	●	●	●	●	●	●	●	●	●	●
	Startup configuration	Star/delta[10]	●	●	●	●	●	●	–	–	–	–	–	●
		Soft starter[9]	○	○	○	○	○	○	●	●	●	●	●	○
		Speed control & soft startup[9]	○	○	○	○	○	○	○	○	○	○	○	○

GIB 23.8-37	GIB 23.7-37	GIB 24.20-90	GIB 26.7-132	GIB 26.8-160	GIB 23.10-37	GIB 23.12-37	GIB 23.13-37	GIB 24.11-75	GIB 24.12-75	GIB 24.13-55	GIB 26.10-132	GIB 26.12-132	GIB 26.13-132	GIB 52.10-315	GIB 52.12-250	GIB 52.13-250	GIB 23.5-37	GIB 26.12-160-420
					Air & Nitrogen, Helium & Argon													
168-370	124-321	560-684	390-858	552-1224	146	185	197	132-314	150-330	148-282	294-564	306-612	456-744	588-1128	612-1224	912-1488	145-170	390-552
1140	1140	1485	1485	1485	1140	1140	1140	1485	1485	1485	1485	1485	1485	1485	1485	1485	1140	1485
40-63	40-80	100	100	75	350	350	350	350	350	350	350	350	350	350	350	350	420	420
4-10	4-12	8-10	4-10	4-10	2-4.5	4.5-10	8-14	1-4	4-10	8-16	2-4.5	4.5-10	10-17	2-4.5	4.5-10	10-17	10-12	6-9
37	37	90	132	160	37	37	37	75	75	55	132	132	132	315	250	250	37	132
25 —110 BAR					90—365 BAR												420 BAR	
BOOSTER (ELEVATED INTAKE PRESSURE)																		
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
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			B 26.4-55	B 26.4-90	IB 23.0-30	IB 23.0-37	I 24.0-55	I 26.0-55	I 26.0-75	I 52.0-110	I 52.0-160	GIB 26.12-SP-365	GIB 26.12-SP-420	GB 23.2-30
			Air & Nitrogen											He & Ar
		FAD [m³/h] (50 Hz)*	214	324	78	90	126	135	204	270	408	624	624	40
		Speed [rpm] (50 Hz)	985	1485	1210	1420	1485	985	1485	985	1485	1485	1485	1420
		Pressure max. with air & nitrogen (bar)	63	63	350	350	350	350	350	350	350	350	420	220
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	55	90	30	37	55	55	75	110	160	250	250	30
			25 - 68 BAR		90 - 365 BAR								90 - 420 BAR	90 - 230 BAR
		OPTIONS/EQUIPMENT	COMPRESSOR (ATMOSPHERIC INLET)											
AUTOMATION	Interconnected operation	Lead compressor (active & passive)[9]	●	●	●	●	●	●	●	●	●	●	●	●
		Lag compressor (active)[9]	●	●	●	●	●	●	●	●	●	●	●	●
		Lag compressor (passive)	●	●	●	●	●	●	●	●	●	●	●	●
	Electronic monitoring	Final pressure	●	●	●	●	●	●	●	●	●	●	●	●
		Oil pressure	●	●	●	●	●	●	●	●	●	●	●	●
		Intermediate pressure[9]	○	○	○	○	○	○	○	○	○	○	○	○
		Intake filter[9]	○	○	○	○	○	○	○	○	○	○	○	○
		Intake pressure[11]	○	○	○	○	○	○	○	○	○	○	○	○
		Temperature final stage	●	●	●	●	●	●	●	●	●	●	●	●
		Cooling air temperature[9]	●	●	●	●	●	●	●	●	●	●	●	●
		Interstage temperature[9]	○	○	○	○	○	○	○	○	○	○	○	○
		Oil level[9]	○	○	○	○	○	○	○	○	○	○	○	○
	Analogue pressure gauge	For intermediate stage pressure, with shut-off valve	○	○	○	○	○	○	○	○	○	○	○	○
	Pre-lubrication pump	Automatic pre-lubrication of the slide bearings	○	○	○	○	○	○	○	○	○	○	○	○
AMBIENT CONDITION	Inclined position	10° in all directions	●	●	●	●	●	●	●	●	●	●	●	●
		30° roll	●	●	●	●	–	●	●	●	●	●	●	●
		30° in all directions	●	●	●	●	–	●	●	●	●	●	●	●
	Intake temperature	+5...+45 °C	●	●	●	●	●	●	●	●	●	●	●	●
	Ambient temperature	+5...+45 °C	●	●	●	●	●	●	●	●	●	●	●	●
		+5...+55 °C	○	○	○	○	○	○	○	○	○	○	○	○
		-10...+45 °C[12]	○	○	○	○	–	–	–	–	–	–	–	○
INTAKE COMPONENTS	Intake buffer vessel	Intake buffer vessel (necessary for N_2, helium & argon)	○	○	○	○	○	○	○	○	○	○	○	○
	Intake device	Intake device (for gas)	○	○	○	○	○	○	○	○	○	○	○	○
	Intake pressure reduction[13]	Intake pressure reduction 1-stage	○	○	○	○	○	○	○	○	○	○	○	○
	Condensate collecting tank	Condensate collecting system 60-litre[14]	○	○	○	○	○	○	○	○	○	○	○	–
		Condensate collecting system (pressure vessel) 200-litre[15]	○	○	○	○	○	○	○	○	○	○	○	○
	Intake-condensate tank	Combined intake buffer and condensate tank	–	–	–	–	–	–	–	–	–	–	–	●

GIB 23.8-37	GIB 23.7-37	GIB 24.20-90	GIB 26.7-132	GIB 26.8-160	GIB 23.10-37	GIB 23.12-37	GIB 23.13-37	GIB 24.11-75	GIB 24.12-75	GIB 24.13-55	GIB 26.10-132	GIB 26.12-132	GIB 26.13-132	GIB 52.10-315	GIB 52.12-250	GIB 52.13-250	GIB 23.5-37	GIB 26.12-160-420
					Air & Nitrogen, Helium & Argon													
168-370	124-321	560-684	390-858	552-1224	146	185	197	132-314	150-330	148-282	294-564	306-612	456-744	588-1128	612-1224	912-1488	145-170	390-552
1140	1140	1485	1485	1485	1140	1140	1140	1485	1485	1485	1485	1485	1485	1485	1485	1485	1140	1485
40-63	40-80	100	100	75	350	350	350	350	350	350	350	350	350	350	350	350	420	420
4-10	4-12	8-10	4-10	4-10	2-4.5	4.5-10	8-14	1-4	4-10	8-16	2-4.5	4.5-10	10-17	2-4.5	4.5-10	10-17	10-12	6-9
37	37	90	132	160	37	37	37	75	75	55	132	132	132	315	250	250	37	132
25—110 BAR					90—365 BAR												420 BAR	
BOOSTER (ELEVATED INTAKE PRESSURE)																		
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			B 26.4-55	B 26.4-90	IB 23.0-30	IB 23.0-37	I 24.0-55	I 26.0-55	I 26.0-75	I 52.0-110	I 52.0-160	GIB 26.12-SP-365	GIB 26.12-SP-420	GB 23.2-30
			Air & Nitrogen											He & Ar
		FAD [m³/h] (50 Hz)*	214	324	78	90	126	135	204	270	408	624	624	40
		Speed [rpm] (50 Hz)	985	1485	1210	1420	1485	985	1485	985	1485	1485	1485	1420
		Pressure max. with air & nitrogen (bar)	63	63	350	350	350	350	350	350	350	350	420	220
		Intake pressure [barg]	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.	atm.
		Motor power [kW]	55	90	30	37	55	55	75	110	160	250	250	30
			25 - 68 BAR		90 - 365 BAR								90 - 420 BAR	90 - 230 BAR
		OPTIONS/EQUIPMENT	COMPRESSOR (ATMOSPHERIC INLET)											
	Coalescence filter	Coalescence filter	○	○	○	○	○	○	○	○	○	○	○	○
ACCEPTANCE & DOCUMENTATION	**Testing of pressure vessel**	Pressure vessel compliance with PED	●	●	●	●	●	●	●	●	●	●	●	●
	Documentation	Standard operating instructions (EG languages)	●	●	●	●	●	●	●	●	●	●	●	●
		Spare parts list (DE, EN, FR)	●	●	●	●	●	●	●	●	●	●	●	●
		EC Declaration of Conformity	●	●	●	●	●	●	●	●	●	●	●	●
		EC Pressure Vessel Certificate according to PED	●	●	●	●	●	●	●	●	●	●	●	●
		Further documentation (material certificates, ITP, 3D drawings, etc.) - please refer to price list	○	○	○	○	○	○	○	○	○	○	○	○
	Acceptance	Final check according to BAUER Standard	●	●	●	●	●	●	●	●	●	●	●	●
		Final check (FAT) according to customer requirements	○	○	○	○	○	○	○	○	○	○	○	○
		Acceptance organisation (3rd party)	○	○	○	○	○	○	○	○	○	○	○	○
	Packing	Packaging standard for truck/ air freight	●	●	●	●	●	●	●	●	●	●	●	●
		Packaging for sea freight	○	○	○	○	○	○	○	○	○	○	○	○
	External accessories													
ACCESSORIES	**Accessories, water cooling**	Ball valve for heat exchanger (compressor)	○	○	○	○	○	○	○	○	○	○	○	○
		Filter for cooling water	○	○	○	○	○	○	○	○	○	○	○	○
		Radiator set (radiator, water pump, etc.) [160951-Sx]	○	○	○	○	○	○	○	○	○	○	○	○
		Plate heat exchanger set [127983-S01; -S02]	○	○	○	○	○	○	○	○	○	○	○	○
PURIFICATION	**Air and gas purification**	Seccant III	–	–	○	○	–	–	–	–	–	–	–	○
		Seccant IV[16]	–	–	○	○	○	○	○	–	–	–	–	○
		P 120[15]	–	–	○	○	○	○	○	–	–	–	–	○
		P 140[15]	–	–	○	○	○	○	○	–	–	–	–	○

Unit core components
Automation
Ambient conditions
Intake components
Purification
Acceptance & documentation
Packing
Accessories

GIB 23.8-37	GIB 23.7-37	GIB 24.20-90	GIB 26.7-132	GIB 26.8-160	GIB 23.10-37	GIB 23.12-37	GIB 23.13-37	GIB 24.11-75	GIB 24.12-75	GIB 24.13-55	GIB 26.10-132	GIB 26.12-132	GIB 26.13-132	GIB 52.10-315	GIB 52.12-250	GIB 52.13-250	GIB 23.5-37	GIB 26.12-160-420
					Air & Nitrogen, Helium & Argon													
168-370	124-321	560-684	390-858	552-1224	146	185	197	132-314	150-330	148-282	294-564	306-612	456-744	588-1128	612-1224	912-1488	145-170	390-552
1140	1140	1485	1485	1485	1140	1140	1140	1485	1485	1485	1485	1485	1485	1485	1485	1485	1140	1485
40-63	40-80	100	100	75	350	350	350	350	350	350	350	350	350	350	350	350	420	420
4-10	4-12	8-10	4-10	4-10	2-4.5	4.5-10	8-14	1-4	4-10	8-16	2-4.5	4.5-10	10-17	2-4.5	4.5-10	10-17	10-12	6-9
37	37	90	132	160	37	37	37	75	75	55	132	132	132	315	250	250	37	132
25–110 BAR					90–365 BAR												420 BAR	
BOOSTER (ELEVATED INLET PRESSURE)																		
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○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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–	–	–	–	–	○	○	○	○	○	○	–	–	–	–	–	–	○	–

● Standard ○ Option – Not available

* Valid for air; correction factor for helium & argon:
helium: FAD x 0.8; argon: FAD x 0.95

1 Intake device / intake pressure reduction required; for some models restrictions apply for helium and argon

2 Available only for horizontal compressor configuration

3 Details see section 5

4 Please refer to lubricating oil list

5 IE3: compulsory from 2015 within Europe, also in other countries

6 Explosion protection (e.g. according to ATEX)

7 Basic version: B-CONTROL MICRO for wall mounting; supplied without complete cabling; compressor control not preassembled; w/o cable; only for air-cooled compressors

8 Standard version: B-CONTROL MICRO supplied completely cabled, for wall mounting, 5 m cable incl.; for air-cooled compressors

9 Only in combination with B-CONTROL II

10 From 75 kW: soft starter standard in combination with B-CONTROL II

11 Standard with intake device or intake pressure reduction option

12 Only in combination with Super Silent housing and heating device

13 Intake pressure reduction includes intake device

14 With / without connection for external SECCANT

15 Separate intake buffer vesser required

16 Limitation of pressure / FAD possible

1 MEDIUM

AIR

- Normal ambient air can be compressed.
- Acidic intake air (e.g. containing H_2S, CO_2) causes wear to the compressor; in this case, it is necessary to pre-purify the air.

NITROGEN

- Nitrogen coming from a generator, cylinder rack or vaporiser can be compressed.
- Observe the list of recommended oils.

HELIUM & ARGON

- Rare gases such as helium and argon require special compressors adapted to the different specific characteristics of the gases (compression ratios, valves, coolers, leak tightness). These gases heat up more during compression and, therefore, require more cooling and better cooling performance.
- For these rare gases, BAUER offers an adapted compressor range (G range).

NATURAL GAS & (BIO)METHANE

- Compression of natural gas, methane and biomethane is basically possible using the BK 23 – BK 52 range (in explosion-proof version).
- Unit version, options etc. on request.

Compression of other gases as well as mixed gases on request.
When ordering a compressor, gas type must always be indicated.
Intake conditions: max. 100 % saturation within the admissible intake temperature range of the gas to be compressed. In the case of higher water content, a preseparator or gas dryer is required.

Concrete housing incorporating water-cooled helium compressor uith water-cooling

2 CONFIGURATION

2.1 DESIGN

HORIZONTAL VERSION (DIRECTLY COUPLED)

- Recommended for capacities from approx. 55 kW
- Rotational speed of the compressor block at 50 Hz = 1450 1/min, a 60 Hz reduced to 1450 1/min by means of an FC; variation of speed possible by using an FC.
- Low centre of gravity allowing for extreme inclinations.

BK 26 – unit directly coupled

HORIZONTAL VERSION (V-BELT DRIVE)

- Low height
- Suitable for different motor concepts (e.g. electric, diesel).
- Low centre of gravity, allowing for extreme inclinations
- Customer-specific adaptation of compressor block speed is possible.

K 28 – unit with V-belt drive

VERTICAL VERSION

- Less floor space required.
- Construction method reduces oscillation when using a belt drive.
- Ease of maintenance due to good accessibility.
- Three-phase motor as standard power unit (as special version with combustion engine).
- Customer-specific adaptation of compressor block speed is possible.

BK 23 – vertical unit

2.2 COOLING

There are two basic types of cooling

2.2.1 AIR-COOLING

- The compressor is cooled directly using ambient air.
- The cooling medium exists everywhere and does not incur any direct costs.
- The compressor requires correctly positioned intake and exhaust air vents, along with ducts of a sufficient size.

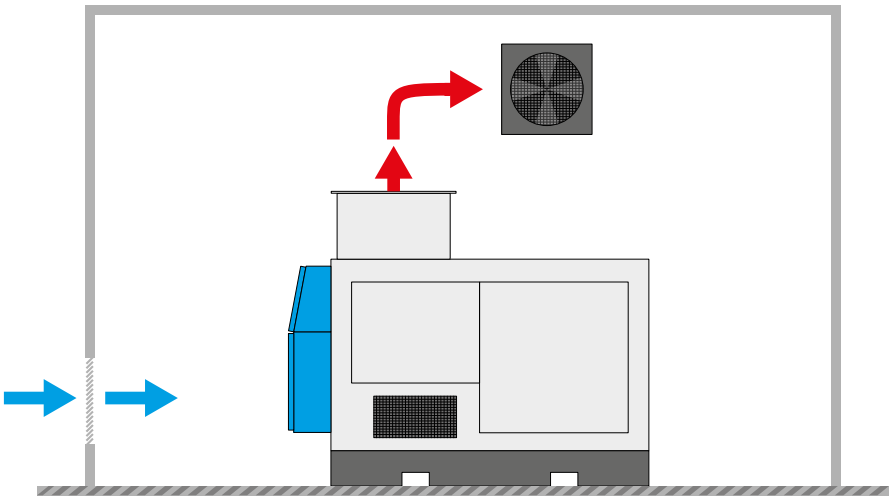
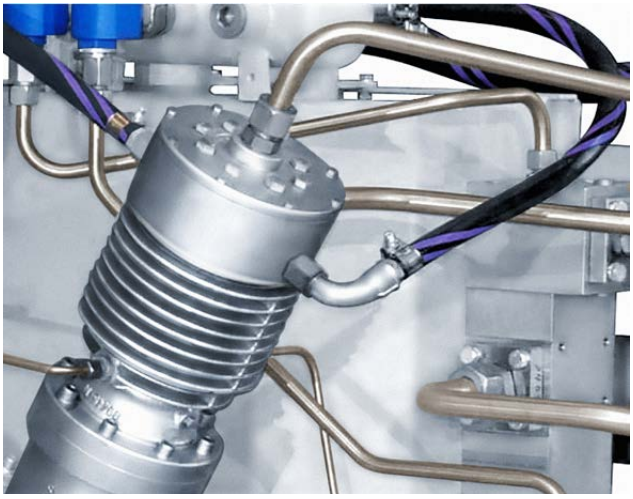


Diagram: Installation of an air-cooled unit

2.2.2 WATER-COOLING

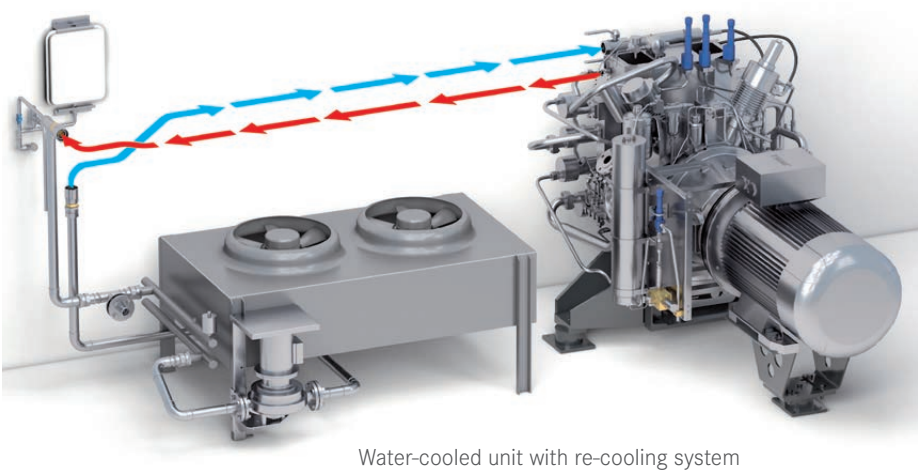
Water-cooling is recommended when the compressor ventilation is insufficient due to local conditions, or when the required size of the connected air ducts cannot be met.

- The compressor block (interstage and final stage coolers, valve heads) is systematically cooled by water.
- Efficient heat dissipation.
- By cooling the valve heads, the valves are subjected to less thermal stress ▸ This increases the lifespan of the valves and causing less wear.
- Minimal ventilation of the room is still required (for cooling motor and cylinder).
- Waste heat can be unsed for heating / washing water.
- Minimal oil consumption.
- Greater operational safety and longer lifespan.
- Lower noise level of the compressor unit
- Cooling water requirements: please refer to the installation manual



Water-cooled valve head

2.2.2.1 CLOSED COOLING WATER CIRCUIT



Water-cooled unit with re-cooling system

The following guidelines apply

Water values	Range
pH value (at 25 °C)	7.0 - 8.0
Total hardness	<15 °dH
Chloride (Cl-)	<130 mg/l
Sulphate (SO4 2-)	<150 mg/l

Open Cooling Towers

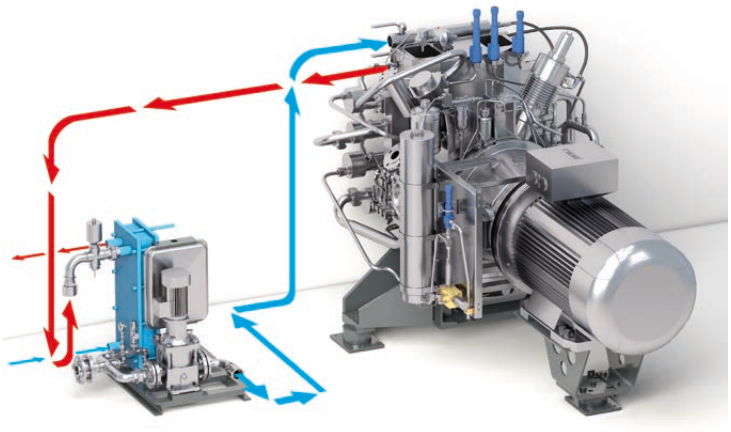
- Basically as above, but it require that the heat exchangers on the compressor will not become choked by microorganisms/ other impurities.
- If necessary, a plate heat exchanger should be used.

Closed Re-Cooling System (Radiator Set), Purified In-House Cooling Water Supply

- Additional requirement: “normal” drinking water quality, with at least 20 % of anti-corrosive agent added.
- Unsuitable water: demineralised, distilled, brackish or salt water, or industrial waste water.

FURTHER IMPORTANT INFORMATION

regarding water cooling is provided in the “Installation Manual for Water-Cooled Compressor Units”.



Water-cooled unit with plate heat exchanger

2.2.2 ONCE-THROUGH COOLING

(Open system., river water, sea water, etc.)

- Here, a plate heat exchanger is used so that the compressor is provided with its own closed cooling water system. Otherwise, there is risk of corrosion, silting up, inorganic deposits and formation of microbe growth coatings.
- Please find detailed information in the separate data sheet: Plate Heat Exchanger Set.

3 DESIGN TYPES

OPEN VERSION

- Standard version for air-cooled and water-cooled compressors.
- Recommended for locations where noise levels are not important.
- Ease of maintenance owing to good accessibility.
- Generated warm cooling air must be dissipated from the compressor room.
- For information on noise levels please see compressor data sheet.

SOUNDPROOF VERSION

- Recommended for locations requiring reduced sound level.
- Closed version enables cooling air throughput to be managed.
- Large doors enable easy access for maintenance purposes.
- Exhaust air duct is easily connected.
- For information on noise levels please see compressor data sheet.

K 28 – unit in open version

K 28 – unit in Super Silent version

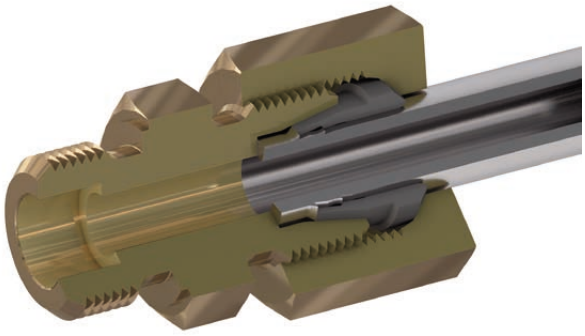
4 SCREW FITTINGS

BAUER KOMPRESSOREN offers two different types of pipe fitting

4.1 COMPRESSION RING-TYPE FITTING

Used in K 22 - K 28 range

- This fitting type is a proven industrial version.
- Corrosion protection due to zinc-nickel coating.
- Especially suitable for use in higher-vibration loading and alternating flexure stresses.

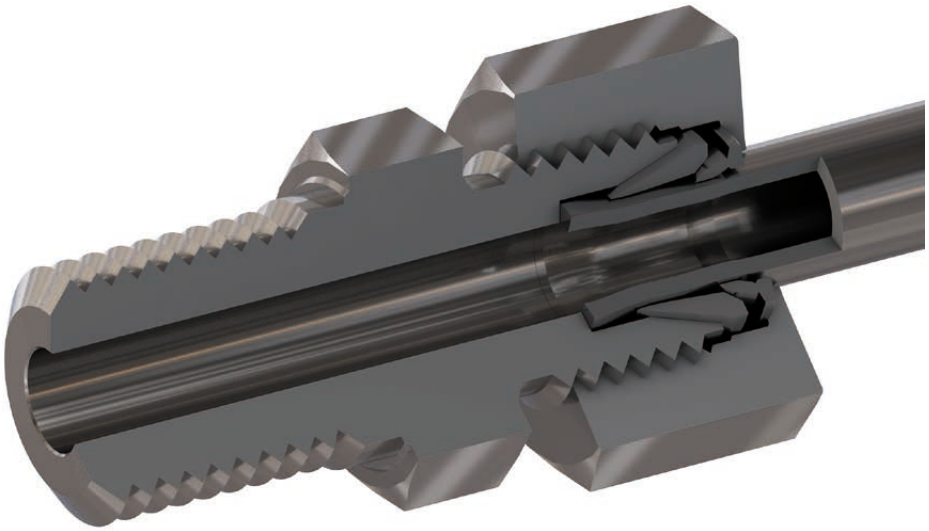


Schematic diagram: compression ring-type fitting

4.2 TWIN-FERRULE COMPRESSION FITTINGS

Used as standard in BK 23 - BK 52 range

- Compression fitting for demanding requirements.
- Mounting without oil or lubricant.
- Reusable
- Construction materials: stainless steel
  - Material: austenitic chromium-nickel-molybdenum stainless steel with low carbon content
  - Corrosion-resistant
- Especially suitable for gas-tight connections and extreme pulsation stress and vibrational loading.



Schematic diagram: twin-ferrule compression fitting

5 PAINT & COLOURS

BAUER STANDARD

- Compressors for indoor installation are finished in either liquid paint or powder coating in accordance with corrosivity category C2-C3.
- In general, the base frame and the panels are painted in RAL 7024 (graphite grey), the compressor block in RAL 9006 (white aluminum) and the compressor control unit in CYAN.

OFFSHORE

- For aggressive and high-salt environments, the compressor block, frame with housing, compressor control housing and motor are painted in offshore quality according to BAUER company standard BS Coat 5001 quality.

Compressor control unit CYAN

Base frame/panels RAL 7024

Compressor block RAL 9006

Environmental condition according to DIN EN ISO 12944-2

Corrosivity category of the environment	Loss of thickness in 1st year [µm]		Examples of typical environments	
	Carbon steel	Zinc	Outdoor	Indoor
C 1 Low	≤ 1.3	≤ 0.1	-	≤ 60% relative air humidity, heated buildings (with neutral atmosphere)
C 2 Light	> 1.3 - 25	> 0.1 – 0.7	Slightly polluted atmosphere. dry climate. e.g. rural areas	Non-insulated buildings with intermittent condensation
C 3 Moderate	> 25 - 50	> 0.7 – 2.1	Atmosphere in towns and industry with moderate SO_2 pollution or temperate coastal climate	Room with high relative air moisture and some pollution
C 4 High	> 50 - 80	> 2.1 – 4.2	Industrial atmosphere and coastal atmosphere with moderate salt load	E.g. production halls in chemical industry, swimming baths
C 5 Very high I	> 80 - 200	> 4.2 – 8.4	Industrial atmosphere with high relative air moisture and aggressive atmosphere	Buildings or areas with almost permanent condensation and high pollution
C 5 Very high M	> 80 - 200	> 4.2 – 8.4	Coastal and offshore areas with high salt load	

6 COMPRESSOR OIL

Due to thermal stress in the compressor, it is necessary to use high-quality oils. In order to assure smooth operation, we recommend exclusively using oils specified in the operating instructions or in the list of recommended oils which are tested and approved by BAUER. When other types of oil are used, the legal warranty is rendered void.

SYNTHETIC COMPRESSOR OIL N28355 FROM BAUER

› The standard, a fully synthetic high-end branded compressor oil.

SPECIAL COMPRESSOR OIL FROM BAUER

› For (dry) gases, BAUER also recommends other types of compressor oil tested by BAUER, depending on the individual application or use.

MINERAL OIL FROM BAUER

› Use of mineral oil is not recommended in the industrial field, due to the risk of high coking of the cooler valves and pipes.

› Among other things, moisture content and temperature have an influence. Particularly at high temperatures, additives are “extracted” from the oil.

FOR FURTHER TYPES OF OIL

and details regarding their use, please refer to the current list of recommended oils.

Compressor oil in canister (1, 5 and 20-litre)

7 VOLTAGE AND FREQUENCY

VOLTAGE

› Standard voltage is 400 V ± 10 %

› Other voltages are available.

FREQUENCY

› Standard frequency is 50 Hz ± 2 %

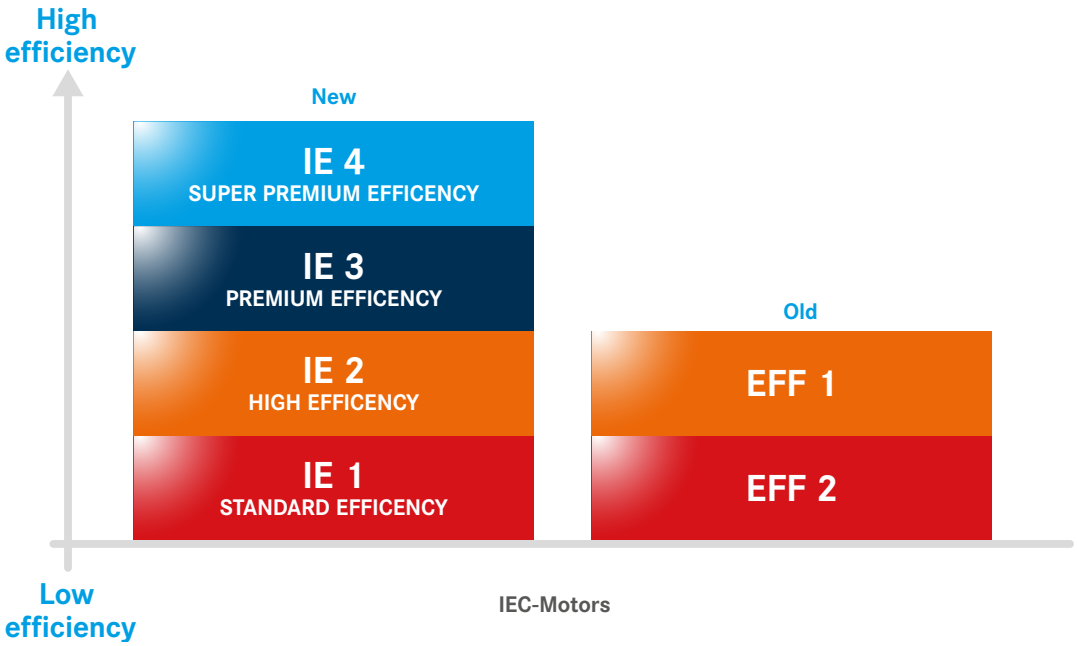
› 60 Hz is available as an option

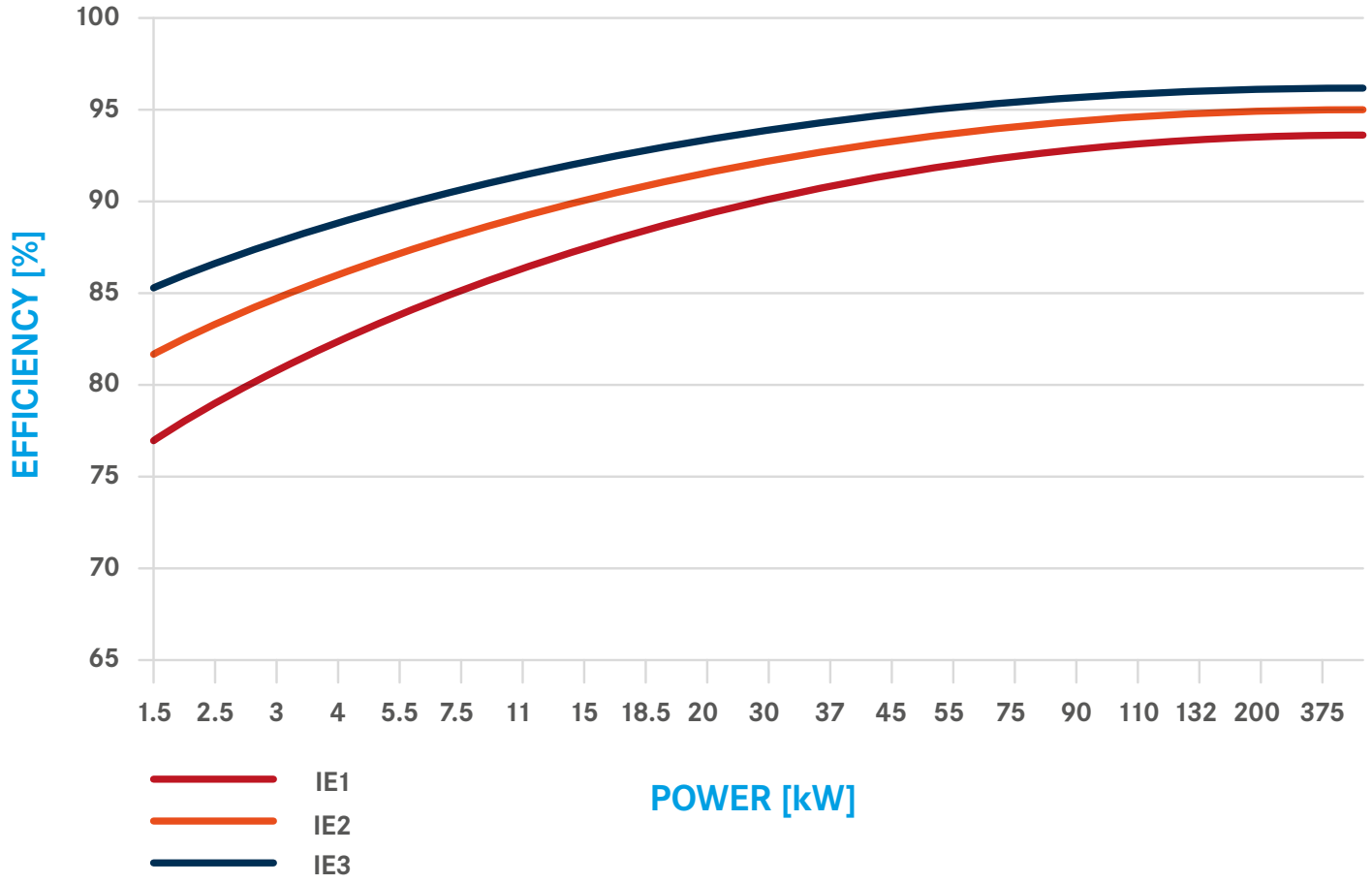
8 ENERGY EFFICIENCY CLASS

The European Union passed numerous laws aiming at reducing energy consumption, and thereby CO_2 emissions.

The IEC 60034-30: 2008 standard defines efficiency factors or classes at 50 and 60 Hz and provides global specification of which electric motors are affected and what rules for exceptions are valid. The EU regulation is based for the main part on this standard.

› The standard energy efficiency class for industrial compressors (≥ 7.5 kW) at BAUER KOMPRESSOREN is IE3.





9 EXPLOSION PROTECTION

Caution: If compressors are installed in an explosive environment or an inflammable medium is to be compressed, the compressors must be equipped according to the valid rules and standards.

- Complete equipment with explosion-proof components (motor, condensate valves, sensors, solenoid valves, etc.)
- Compressor control B-CONTROL is installed in the “safe area”, separate from the compressor.

Even for use in safe areas, e.g. urea plants and fertilizer applications, BAUER compressors can be additionally equipped with explosion-proof components.

ATEX is a widely used abbreviation for the European Union’s ATEX Directive. The Directive currently comprises two directives addressing the field of explosion protection.

The term ATEX comes from the French abbreviation for “**AT**mosphère **Ex**plosible” (Explosive Atmosphere).

10 SAFETY VALVES

BAUER compressors are equipped with a safety valve installed after each compressor stage.

FINAL PRESSURE SAFETY VALVE CE TYPE-EXAMINED

- Final pressure safety valves used as standard are EC type-examined (Modul B) according to Directive 97/23/EC.
- Definition of the CE type examination: “a one-off type approval according to which the manufacturer can produce the device in series without requiring another individual unit verification.”

THE RESPONSIBLE

monitoring organisations carry out unannounced visits to BAUER KOMPRESSOREN.

TÜV CERTIFIED

- The safety valve is tested and adjusted and has a seal applied by the TÜV authorised expert (TÜV Süd lead seal).
- Set pressure, material, operating medium and test medium are certified.
- Advantage: During commissioning on site, the safety valve is not tested as it was already adjusted at the BAUER KOMPRESSOREN factory (TÜV lead seal, TÜV certificate). This simplifies testing before commissioning at the installation site.

Gas-tight safety valve

THE FINAL PRESSURE SAFETY VALVE IS ADJUSTED - AT AN OPERATING PRESSURE OF

Shut-down pressure	Set pressure of final pressure safety valve
up to 64 bar	+ 5 bar above shut-down pressure
up to 340 bar	+ 10 bar above shut-down pressure
up to 350 bar	+ 15 bar above shut-down pressure
up to 420 bar	+ 20 bar above shut-down pressure
up to 500 bar	+ 25 bar above shut-down pressure

but not higher than the admissible pressure of the vessel (= final separator or downstream pressure equipment).

At operating pressure = shut-down pressure	Set pressure of final pressure safety valve	Admissible pressure of vessel
220 bar	230 bar	> 230 bar
340 bar	350 bar	> 350 bar
350 bar	365 bar	> 365 bar
400 bar	420 bar	> 420 bar
475 bar	500 bar	> 500 bar
500 bar	525 bar	> 525 bar

The permissible pressure vessel pressure must correspond at minimum to the set pressure of the final pressure safety valve. Shutdown pressure is always lower than the set pressure of the final pressure safety valve and permissible pressure vessel pressure.

GAS-TIGHT SAFETY VALVES

When using encapsulated gas-tight safety valves with connected gas recovery, the gas can be collected in the event of valve discharge: and therefore gas does not escape into the environment.

RECOMMENDED FOR

- Helium & argon: prevents loss of expensive gas.
- Nitrogen: possible suffocation hazard from high nitrogen concentrations.
- CNG: inflammable gas must not escape into the environment.

For nitrogen and inflammable gases a blowout line can be used to discharge the gas outside the building within a safe area.

11 COMPRESSOR CONTROL

B-CONTROL MICRO

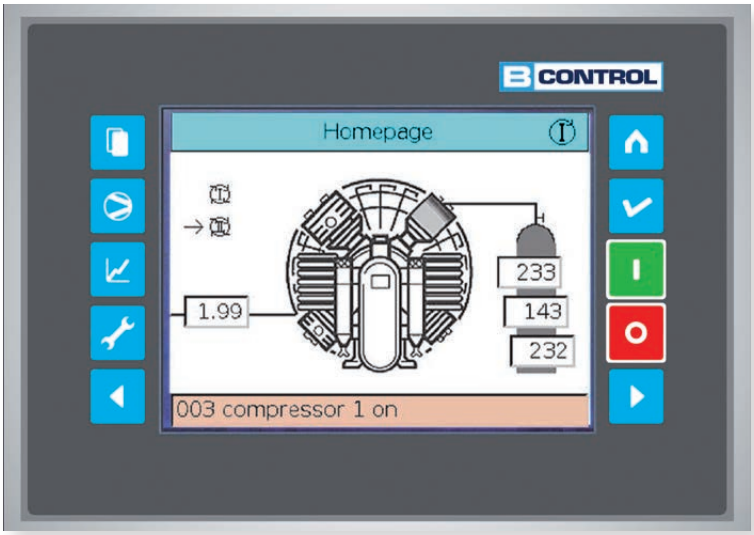
B-CONTROL MICRO

The B-CONTROL MICRO is a modern, easy-to-use compressor control unit with colour display for intelligent control and reliable monitoring of all basic functions.

Interaction between operator and control is user-friendly and logical. The pioneering, convenient display and navigation concept is practically identical for both the B-CONTROL MICRO and the B-CONTROL II.

- 3.5“ TFT colour display with plain text
- Fully automatic monitoring of relevant parameters, compressor shutdown when values are outside the permissible range
- Language selection (German, English, French, Italian, Dutch, Polish, Spanish, Czech, Portuguese, Chinese, Japanese, Russian and others)
- Oil pressure monitoring to protect against incorrect direction of rotation, for example
- Remote on/off (dry contact)
- Collective fault message (dry contact)
- Maintenance management: Maintenance information in the display
- Logbook to record event history
- Password protection for different menu levels
- Integration into interconnected operation (lag) supported
- Cycle counter to record the load cycles of the final separator
- Easy software update via SD card
- External options for the connection of: B-SECURUS, SECCANT, B-KOOL, B-DETECTION, external display, external instrument panel, fill level gas balloon, external gas measuring system

B-CONTROL II



B-CONTROL II

The BAUER B-CONTROL II is the advanced version of the basic compressor control unit B-CONTROL MICRO.

As well as supporting the control and monitoring of important unit functions, the B-CONTROL II also offers user-friendly additional features such as data logger, USB port and accessible interfaces like Modbus, CAN Bus or Profibus. It can also be used for integrated control of an interconnected system with up to four compressors. Additional sensors and devices can be connected for tasks including monitoring of intermediate pressures and temperatures, remote data transfer via B-MESSENGER (SMS), remote control instrument panel, VNC-remote control via Ethernet, etc.

- 5.7“ TFT colour touch screen display with plain text
- Fully automatic monitoring of relevant parameters, compressor switch-off when values are outside the permissible range
- Language selection (English, German, French, Italian, Dutch, Polish, Spanish, Czech, Portuguese, Chinese, Japanese, Russian and more)
- Oil pressure monitoring to protect against incorrect direction of rotation, for example
- Maintenance management: Maintenance information on the display
- Logbook to record event history
- Password protection for different menu levels
- Basic load cycle and interconnected operation for up to 4 compressors
- Integrated data logger
- Cycle counter to record the load cycles of the final separator
- Interface: USB 2.0, Ethernet 10/100, CAN bus layer 2, Modbus RTU RS485, Profibus DP slave (optional)
- Remote on/off (dry contact)
- Collective fault message (dry contact)
- Straightforward software update via CF card
- External options for the connection of: B-SECURUS, SECCANT, B-KOOL, B-DETECTION, external display, external instrument panel, fill level gas balloon, external gas measuring systems

B-CONTROL: FEATURES AND OPTIONS

	B-CONTROL MICRO	B-CONTROL II
Monitoring of final pressure	●	●
Monitoring of intake pressure[1]	●	●
Monitoring of oil pressure	●	●
Monitoring of temperature final stage	●	●
Monitoring of cooling air/ambient temperature	●	●
Monitoring of interstage pressure / temperature	–	○
Helium application: Analogue start signal (4-20 mA) from gas balloon level indicator[2]	●	●
Motor with PTC monitoring instead of separate motor protection switch	●	–
Software upload/update	SD card/ B-Messenger	CF card / B-Manager
Customised software modification	–	○

INTERFACE (BUS CONNECTION)

	B-CONTROL MICRO	B-CONTROL II
Connection with external display[3]	○	○
B-Messenger II[3]	–	○
B-DETECTION basic / mobile[3]	●[4]	●
B-DETECTION Pro[3]	–[5]	●
Modbus RTU	–	●
Profibus DP	–	○
CAN Bus (L2)	●[6]	●

● Standard ○ Option – Not available

1 Only in combination with intake line (for gas compression)
2 Connection of B-CONTROL MICRO only possible when final pressure 2 is not used
3 Hardware (e.g. external display) must be ordered separately.
4 With optional RS232 interface
5 Fault message only, no value shown in display
6 For internal use only (e.g. SECCANT, B-SECURUS, interconnected operation)

INTERFACE (DIGITAL INPUT / OUTPUT)

Digital Inputs (Selection)	B-CONTROL MICRO	B-CONTROL II
Remote start/stop	●	●
Emergency stop	●	●
Condensate vessel full (external)	●	●
Oil level to low	●	●
B-KOOL fault	●	●
SECCANT fault	●	●
Gas measurement system (external)	●	●
Intake filter monitoring	●	●

Digital Outputs (Selection)	B-CONTROL MICRO	B-CONTROL II
Collective fault message	●	●

B-CONTROL's software and hardware undergo continuous advancement and improvement. The information shown here was correct at the time of going to press and may be subject to change (also without notice).

12 STARTUP CONFIGURATION

STAR-DELTA

› Standard starting of compressors up to about 75 kW drive power.
› Starting current approx. 7- to 12-fold

SOFT START

› Gentle start of the (directly coupled) compressor.
› Recommended for motor output of 75 kW and over.
› Starting current approx. 4.5- to 6.5-fold (cf.: star-delta: 7- to 12-fold).

SPEED CONTROL & SOFT STARTUP (VIA FREQUENCY CONVERTER)

› The compressor F.A.D. can be adapted to consumption (in the range of approx. 68 % to 100 %).
› Gentle startup of the compressor.
› Soft startup: Starting current can be decreased to a factor of 1.1.

13 INTERCONNECTED OPERATION

Interconnected operation with up to five compressors for pressure-dependent base and peak load operation or stand-by duty; the base load of the compressors in interconnected operation changes automatically.
A B-CONTROL II or a B-CONTROL SUPERIOR is required as minimum.

PRESSURE-DEPENDENT BASE AND PEAK LOAD OPERATION

Two or more compressors are interconnected. One or more of these compressors is in operation depending on the required air/gas consumption. This is done automatically depending on the final pressure. Thus, there is always sufficient air/gas available for the customer. The starting sequence of the compressors changes on a rolling basis or according to the operating hours (adjustable from 10 to 250 operating hours). Thereby, thus guaranteeing that all compressors are subject to a balanced number of operating hours. If a compressor fails (e.g. for maintenance), another available compressor will automatically be switched on.

This is also called lead-lag or master/slave operation

STAND-BY DUTY

One compressor is in operation, while the second compressor serves as “back-up” in case the first compressor is being serviced. After a defined period of time (e.g. 10 to 250 operating hours), they are switched so that compressor 2 is in operation and compressor 1 serves as “back-up”. Thus it is guaranteed that there is always sufficient air quantity available and that both compressors are subject to an equal number of operating hours.

ACTIVE INTERCONNECTED OPERATION (VIA CAN BUS):

- For base load change, the operating hours of the individual interconnected compressors are monitored periodically and evenly spread. The lead compressor recognises interconnected compressors which are malfunctioning or being serviced and starts another compressor instead.
- The CAN bus module required for this type of operation is included in the standard shipment of the B-CONTROL II.

PASSIVE INTERCONNECTED OPERATION (VIA HARD-WIRED CABLING)

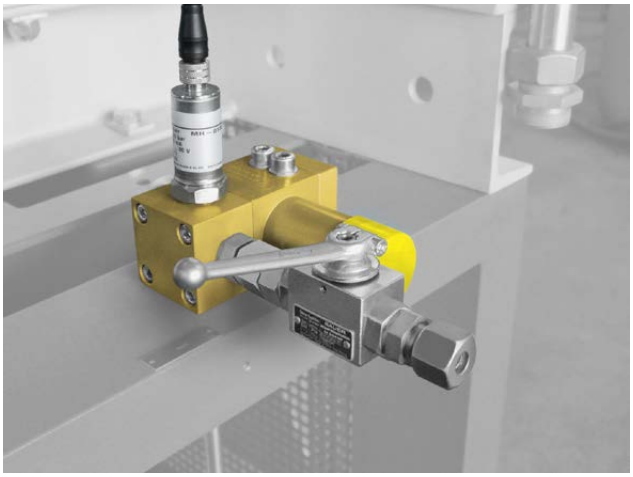
- Compressors which are not supplied with a control unit with interconnected operation (active) can also be operated as interconnected systems.
- The module for interconnected operation (passive) is only required for the lead compressor unit and is supplied as standard in the B-CONTROL II.
- The compressors belonging to the interconnected array can be activated via a potential-free remote on/off contact.
- The lead compressor (B-CONTROL II) measures the operating hours of the other compressors.

	B-CONTROL MICRO	B-CONTROL II
Active (CAN Bus) interconnected operation (Lead)	–	●
Active (CAN Bus) interconnected operation (Lag)	●	●
Passive interconnected operation (Lead)	–	●
Passive interconnected operation (Lag)	●	●

14 ELECTRONIC MONITORING

MONITORING OF SHUT-DOWN PRESSURE

- The shut-down and restart pressures are adjusted in the compressor control.
- The air/gas pressure is strictly monitored by a pressure sensor (4 to 20 mA).
- The set pressure of the final pressure safety valve is adjusted, observing the necessary tolerance, to some bars higher than the shut-down pressure ▸ See section 10.
- The smaller the difference between compressor on-off, the larger the downstream storage has to be.
  ▸ See Annex section T14



Final pressure sensor

Oil pressure sensor

MONITORING OF OIL PRESSURE

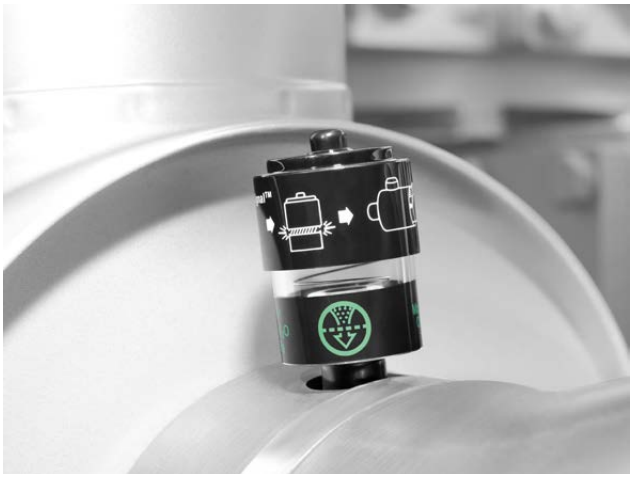
- Oil pressure is monitored by a pressure sensor (4 to 20 mA).
- Oil pressure value is indicated in the compressor control.
- If the value falls below the minimum, the compressor is shut off.
- When the compressor is started, monitoring is delayed for some seconds, as the oil pressure needs some time to build up.

MONITORING OF INTERMEDIATE PRESSURES AND TEMPERATURES

This type of monitoring is recommended for continuous operation, fully automatic operation or compressor units which are not regularly maintained by specialised staff.

- The minimum value of the first stage (intermediate pressure only) and the maximum value of all compressor stages is monitored.
- Shutdown of the compressor unit in the event of values outside the permissible ranges.
- Measuring by means of pressure resp. temperature sensor (Pt1000), display in the B-CONTROL II compressor control.

Pressure sensor



Optical under-pressure indication

MONITORING OF INTAKE FILTER AT ATMOSPHERIC INTAKE

Under-pressure in the intake area causes higher oil consumption and damages the compressor.

An optical under-pressure indication is standard for air compressors.

Under-pressure monitoring by means of a low pressure switch:

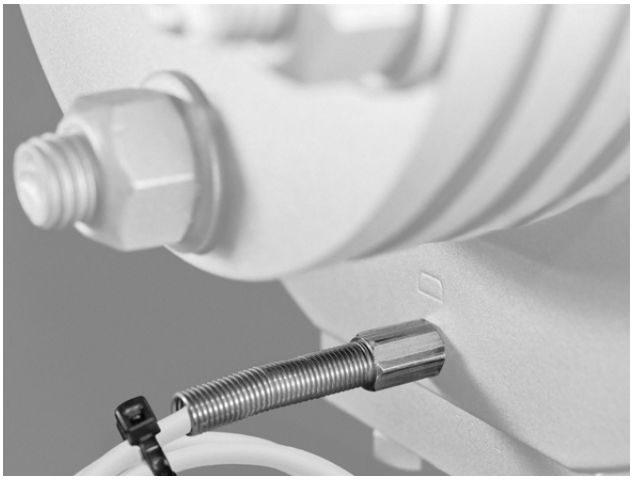
- Strongly recommended for dusty environments.
- For particularly dusty air, an additional prefilter is necessary.
- Shutdown of the compressor in the event of under-pressure of approx. –50 mbar ▸ intake filter heavily soiled.

MONITORING OF INTAKE PRESSURE FOLLOWING PRIMARY COMPRESSION

- Required for compression of air and gas with elevated primary pressure.
- Excessive intake pressure will cause excessive power consumption, resulting in overload or damaging the compressor.
- If the intake pressure is lower than designed, the compressor will be damaged.
- Shutdown of the compressor unit in the event of values outside the permissible ranges.

MONITORING OF OIL LEVEL

- Monitoring by means of an optical sensor
- Provides additional safety to ensure that there is sufficient oil available in the crankcase for the oil circulation.
- Recommended for continuous operation of the compressor unit.



Temperature sensor

MONITORING OF TEMPERATURE FINAL STAGE

- Improves operational safety.
- Temperature sensor: Pt1000.

MONITORING OF COOLING AIR TEMPERATURE

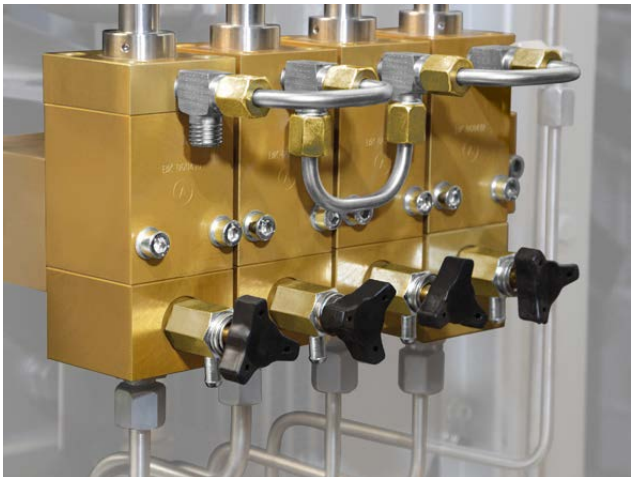
Allows for a reliable operation within the permissible temperature range (standard: +5 to +45 °C).

15 AUTOMATIC CONDENSATE DRAIN DEVICE

BAUER INDUSTRIAL COMPRESSORS ARE EQUIPPED WITH AN AUTOMATIC CONDENSATE DRAIN DEVICE

During compression, the water and compressor oil in the air/gas condense out and are collected in the interstage or final separator. All interstage separators and the final separator are automatically drained during compressor operation. Drainage times can be set in line with operating conditions.

In addition, the separators are automatically drained and the system depressurised every time the compressor unit is shut down, enabling the system to restart without counterpressure.

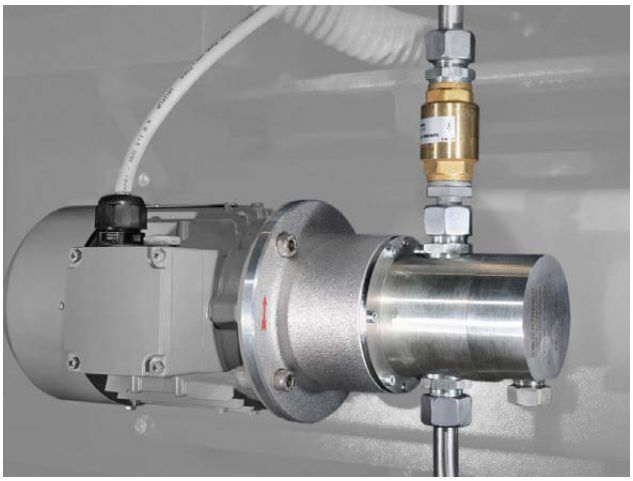


Automatic condensate drain device

Sectional drawing of interstage separator

16 PRE-LUBRICATION PUMP

- Should the compressor be idle for 2 weeks or more, a pre-lubrication pump is required.
- This affects models BK 23, BK 24, BK 26 and BK 52, which have plain bearings.
- The pump is necessary to ensure sufficient oil lubrication for the sliding bearings prior to start-up after a long idle period.
- The Pre-lubrication is then carried out automatically prior to starting up the compressor by B-CONTROL II.



Pre-lubrication pump

17 ANALOGUE PRESSURE GAUGE

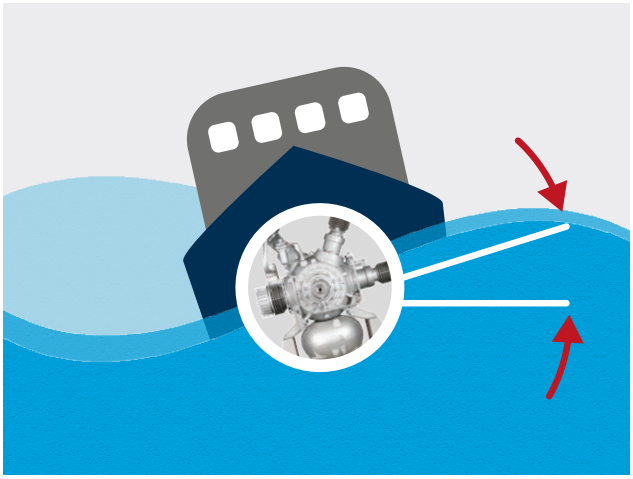
MANOMETER FOR INTERMEDIATE STAGE PRESSURES

- Makes reading pressure simple and easy.
- Mandatory in some countries.
- Diameter of manometer: 63 mm.
- Indication in bar and psig.
- Generally filled with glycerine for dampening the display.
- The Manometers are supplied with a shut-off valve.

Pressure Gauge

18 INCLINED POSITION

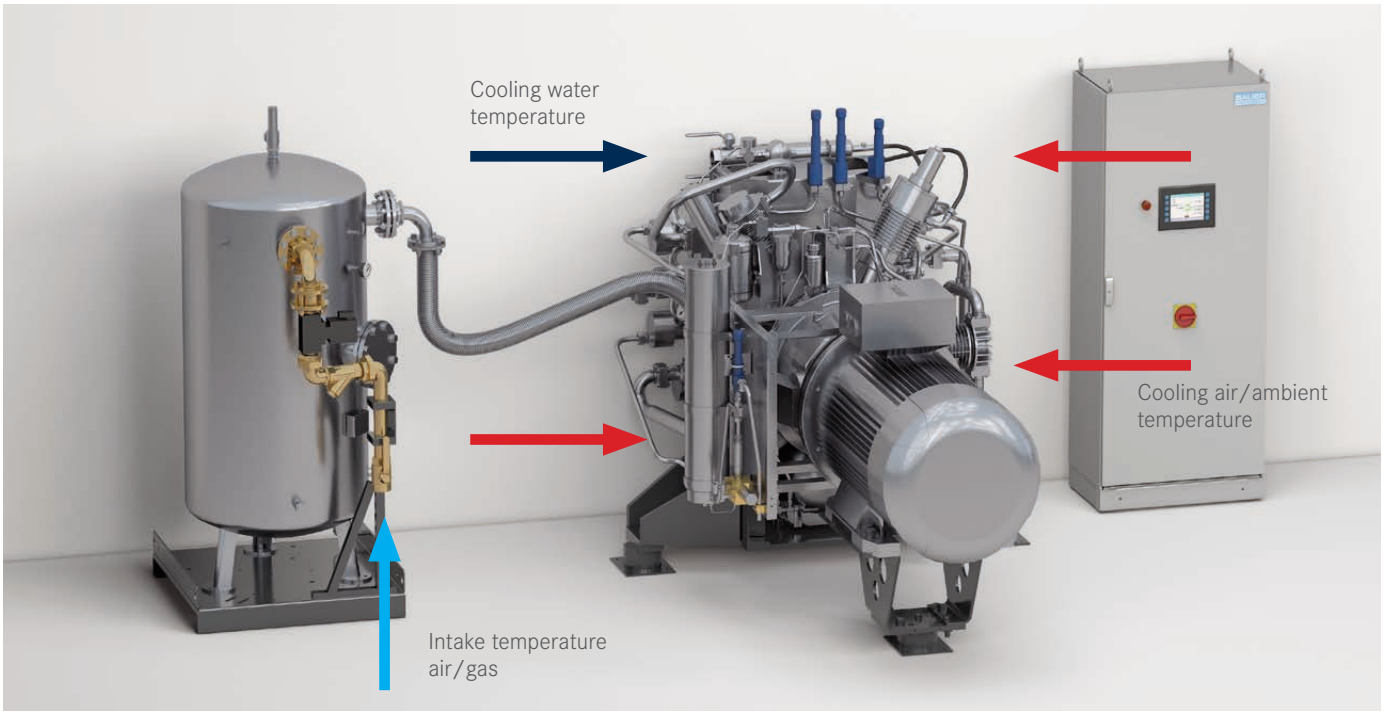
- Max. standard inclined position on rollers: 10 degrees
- Some compressor systems can be fitted with different vibration dampers that allow inclined positions of up to 30 degrees. In this case the estimated acceleration, mass and excitation frequency must be given.
- Inclined positions of up to 30 degrees are sometimes necessary in offshore applications or compressor installations on vehicles.



Representation of an inclined position

19 INTAKE TEMPERATURES

- The standard intake temperature is -10 to +45 °C (14 to 113 °F) for air-cooled and -10 to +55 °C (14 to 130 °F) for water-cooled compressors.
- In the event of intake temperatures lower than –10 °C (14 °F), it is necessary to preheat the gas.



GIB26 with intake device and buffer vessel

20 AMBIENT TEMPERATURE

The standard compressor units are designed for an ambient temperature (= cooling air temperature) of +5 to +45 °C (40 to 113 °F).

TEMPERATURE BELOW +5 °C (40 °F):

- Since the oil becomes (highly) viscous at lower temperatures, thus impeding the piston movement in the cylinder at startup, heating the room is a cost-saving and practical solution. Moreover, thick oil causes higher initial torque during startup of the unit and can also damage the compressor.
- The gas temperature should not be under –10 °C (14 °F), so that lubrication of the pistons and mechanical clearance between piston and cylinder are guaranteed.

HIGHER TEMPERATURE RANGE +45 °C TO +55 °C (113 TO 130 °F)

The warmer the intake air, the lower the air/gas mass flow directed through the compressor.
This temperature range can prevail on some compressor units. Following assemblies will be influenced by this:

Final separator approved for high temperatures

COMPRESSOR BLOCK

› At higher temperatures, generally only 4- or 5-stage compressor blocks should be used in order to guarantee low compression ratios and therefore low compression temperatures.

PRESSURE VESSEL

› Interstage and final separators as well as downstream purification systems and other pressure equipment must be approved for use for the corresponding operating temperatures.

DRIVE

› The 3-phase motor which is used must be designed for temperatures up to +55 °C (130 °F). The motors used by BAUER KOMPRESSOREN are designed up to +45 °C (113 °F) as standard.

COMPRESSOR CONTROL

› Generally, it is necessary to air-condition the electric cabinet in order to assure adequate heat dissipation, so that overheating of the electronic components will be prevented.

AIR PURIFICATION

› As a basic rule, the adsorption power of the molecular sieve which is necessary for drying the air/gas is reduced by about 60 % at high temperatures, compared to +25 °C (77 °F) ambient temperature. Consequently, the lifespan of the filter is reduced accordingly.

› At ambient temperatures > +35 °C (95 °F), we recommend the use of a refrigeration dryer / afterstage cooler in order to reduce the intake temperature for the purification system.

EXTERNAL INSTALLATION IN CONTAINER / CONCRETE HOUSING AT EXTREME TEMPERATURES

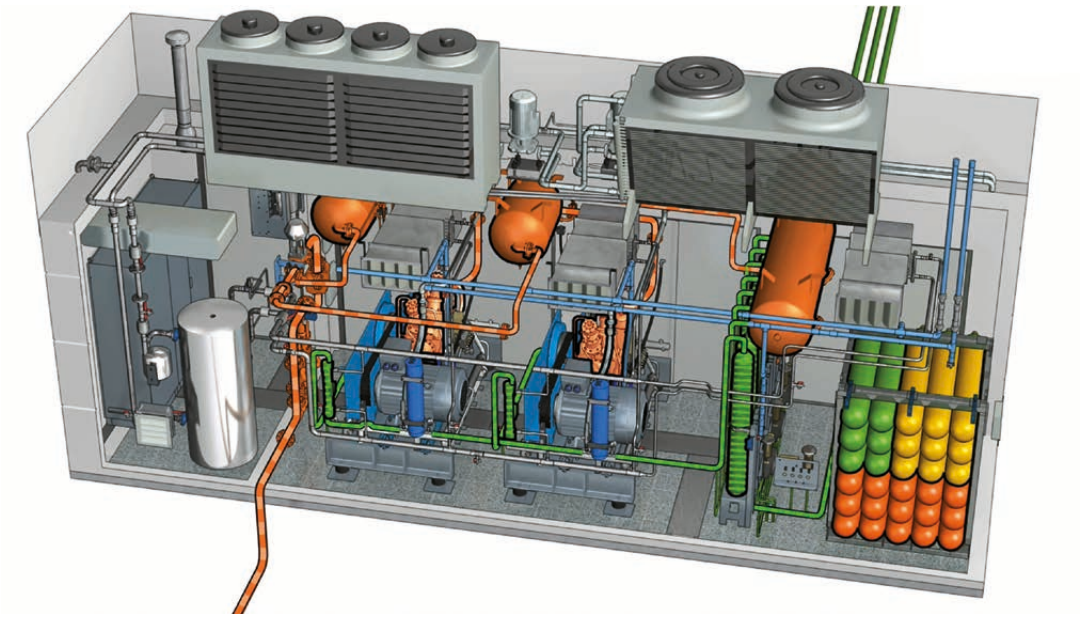
In external installations it is recommended to install the compressor in a container or concrete housing to protect it from environmental influences (sand, snow, dust). The compressor can then be operated at very low or very high ambient temperatures.

AMBIENT TEMPERATURES OF UP TO -40 °C (- 40 °F)

- The container / concrete housing is insulated and heated, e.g. with ribbed tubular heating elements or infrared heating, to ensure a constant temperature of min. +5 °C (40 °F).
- A gas preheater is recommended. The preheater heats the gas intake for compression to a minimum of -10 °C (14 °F), or better + 5 °C (40 °F). This ensures that the compressor operates under permissible operating conditions.
- When the compressor reaches a temperature of approx. 30 °C (86 °F) the fans are activated to consistently maintain this temperature. This applies for air-cooled and water-cooled compressors.
- The cooling air is exchanged through automatically opening blinds at the air intake and exhaust outlet.

AMBIENT TEMPERATURES EXCEEDING APPROX. +40 °C (104 °F)

- At these high ambient temperatures the container / concrete housing is equipped with air-conditioning to reduce the interior temperature to approx. 25 °C to 30 °C (77 °F to 86 °F) while simultaneously reducing humidity.
- The container / concrete housing forms a closed system; heat is removed exclusively through the air-conditioning.
- In general only water-cooled compressors are suitable for these applications.
- The heat exchangers for the air-conditioning and compressor systems are installed outside the container / concrete housing (e.g. on the roof).
- This system is recommended for temperatures from approx. +40 °C (104 °F).



Compressor and high pressure storage inside a concrete housing with air conditioning

21 INTAKE BUFFER VESSEL

When are gases compressed by means of a piston compressor, pulsation is generated. This pulsation is transferred from the intake area to the upstream fittings. An intake buffer tank is therefore generally required to act as a pulsation damper during gas compression.

There are several reasons and advantages to using an intake buffer during gas compression:

- Protects the upstream fittings from pulsation.
- Reduces the oil consumption of the compressor by recirculating the crankcase ventilation into the intake buffer vessel.
- On helium compressors in connection with a gas balloon, the transmission of pulsation noise is considerably reduced.

Intake buffer vessel (K22-K28)

22 INTAKE DEVICE

The intake device is the pipe connection (with fittings) between the gas network and intake buffer.

Standard:

- Amongst other things, the intake device contains a tubular filter, an intake pressure sensor, a manometer, piping, a connector (internal thread or flange), a safety valve, and – depending on the unit version – an intake solenoid valve.

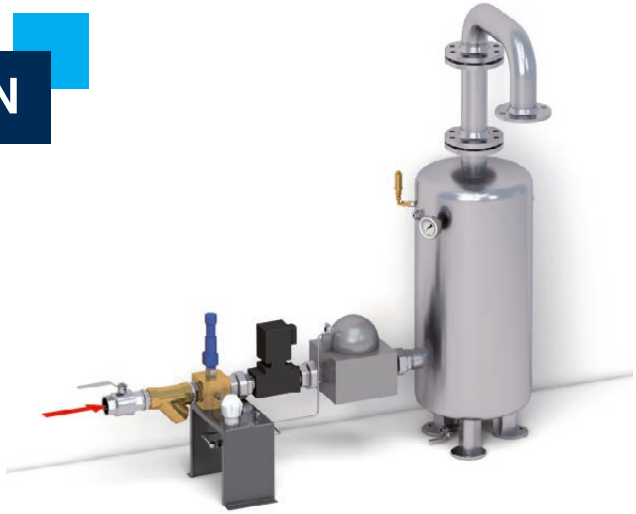
Intake device (K22)

23 INTAKE PRESSURE REDUCTION

When the gas intake pressure exceeds the maximum permissible pressure for the compressor unit, the gas pressure must be reduced.

1-stage:

- A single-stage intake pressure reduction is used for up to 15 bar primary pressure on compressors with atmospheric intake or in the case of low pressure.
- Scope of delivery: Intake line + pressure reducer (if necessary control pressure reducer + domed pressure regulator).



Intake buffer vessel with intake pressure reduction (K22-K28)

24 CONDENSATE COLLECTING TANK

CONDENSATE COLLECTING SYSTEM, 60 LITRES

For air and nitrogen

- This system can collect 40 litres of condensate.
- Optical filling level indication.
- A built-in electrical level switch stops the compressor as soon as the max. condensate level is reached.
- A filter unit adsorbs the air escaping with the condensate, so that it can be purified before release to the environment.

CONDENSATE COLLECTING TANK:

- This closed tank made of steel is required for gas units in order to prevent gas losses.
- Volume: 200 to 750 litres, depending on the compressor unit
- This tank also allows for the collection of about 40 litres of condensate.
- The remaining “empty volume” is required to collect the gas coming from the intermediate filters and the final separator. Afterwards, this gas is recirculated to the compression process.

60-litre condensate collecting tank

25 COMBINED INTAKE BUFFER AND CONDENSATE TANK

FOR HELIUM & ARGON COMPRESSORS

- A combined tank performs the function of intake buffer and condensate collecting tank.
- Advantage: Little space required, cost-effective solution
- Only possible in connection with a gas balloon provided on-site by the customer (for collecting the release gas accompanying condensate drain/ compressor switchoff).

26 COALESCENCE FILTER

FOR REMOVING PARTICLES AND SEPARATING AEROSOLS

- High-pressure filter housings up to 100 bar, 350 bar and 420 bar[1].
- Filter mounted at the compressor unit.
- Licences for pressure equipment: Pressure Equipment Directive 97/23/EC for fluid group 2
- TÜV approval at extra charge

Coalescence filter

Applications: Filter			
FLOW MEDIUM	**OPERATING PRESSURE**	**OPERATING TEMPERATURE**	
Compressed air and gaseous nitrogen	max. 100 bar, 350 bar resp. 420 bar	1.5 to 80 °C	using element type V, ZP, XP
		1.5 to 40 °C	using element type A

Performance data: Element types				
	V	**ZP**	**XP**	**A**
Removal	Solid particles	Solid/liquid particles	Solid/liquid particles	Oil vapour
Flow	From outside to inside	Inside to outside	Inside to outside	Inside to outside
Pre-filter required	--	Separator (for wall flow)	ZP	XP
Particle grain size	3 µm	1 µm	0.01 µm	Not applicable
Residual oil content at 20 °C	Not applicable	0.5 mg/m³	0.01 mg/m³	0.003 mg/m³
Differential pressure, dry	< 300 $mbar_g$	< 300 $mbar_g$	< 300 $mbar_g$	< 300 $mbar_g$
Differential pressure, wet	< 350 $mbar_g$	< 370 $mbar_g$	< 400 $mbar_g$	Not applicable
Change of element recommended	600 to 700 $mbar_g$	600 to 700 $mbar_g$	600 to 700 $mbar_g$	Quarterly, 1500 h max.
Temperature range	1.5 to 80 °C	1.5 to 80 °C	1.5 to 80 °C	1.5 to 40 °C

MIN OPERATING PRESSURE IN BAR	50	60	70	80	90	100
Correction factor CFP	1.5	1.4	1.33	1.24	1.14	1

MIN OPERATING PRESSURE IN BAR	125	150	175	200	225	250	275	300	325	350
Correction factor CFP	1.5	1.48	1.45	1.43	1.37	1.3	1.24	1.15	1.07	1

OPTIONS

- Connection to the automatic condensate drain (necessary with wet gas)
- Differential pressure gauge

Note: Residual oil content (element ZP and XP) is based only on liquid oil, not on oil vapour. These measurements are made directly at the filter stage. Residual oil content downstream of the filter may vary depending on the compressor's installation location, pressure and temperature.

1 Operating pressure valid for the filter (= max. pressure safety valve of compressor unit). With deviant minimum operating pressures, the actual flow rate must be multiplied by the relevant correction factor CFP

27 TESTING OF PRESSURE VESSELS

- All pressure equipment installed in the compressor complies with the EC Directive DGRL97/23/EG (based on the EC certificate) depending on the category and upon its relevance. The calculations/dimensioning are carried out according to the Technical Rules AD2000.
- The Directive DGRL97/23/EG stipulates the requirements for pressure equipment of this kind when it is placed on the market within the European Economic Community (EEC).
- In English the Directive is known as “Pressure Equipment Directive“ (PED).

BAUER KOMPRESSOREN holds approvals for manufacturing pressure equipment according to DGRL97/23/EG up to category 4.

Pressure testing of filter housings

28 DOCUMENTATION

STANDARD OPERATING INSTRUCTIONS

- The standard operating instructions in CE language are included as hardcopy in the scope of delivery.
- Other languages are available as an option.

SPARE PARTS LIST

- The spare parts list forms an integral part of the standard operating instructions and contains exploded views of the respective compressor unit.
- The parts list is supplied in the three languages German, English and French.
- As an option, the operating instructions and spare parts list can also be obtained in electronic version in PDF format (e.g. DVD).

EC DECLARATION OF CONFORMITY

- With the Declaration of Conformity, we confirm that our products offer the characteristics specified in the declaration and that they comply with the essential health and safety requirements.
- The EC Declaration of Conformity is enclosed in German and English.
- The TR CU certificate is enclosed in Russian language.

FURTHER DOCUMENTATION

- On request and according to the price list.

29 ACCEPTANCE

FINAL CHECK ACCORDING TO BAUER STANDARDS

› At BAUER KOMPRESSOREN, each compressor goes through a final check following a defined test plan as standard. This check includes complete functional and leakage detection testing, an electrical check according to VDE, testing of the safety valve, inspection of the performance data and other details.

FINAL CHECK (FAT) ACCORDING TO CUSTOMER REQUIREMENTS

› A “Factory Acceptance Test” can be carried out additionally to the standard final check by BAUER. The items to be tested can be proposed by us or defined individually.

ACCEPTANCE ORGANISATION (3rd PARTY)

› If desired, the standard final check by BAUER or the FAT can be attended by a neutral inspector of an acceptance organisation.

Final check

30 PROTECTIVE STORAGE & PACKING

› BAUER standard packing:
Industrial compressors are wrapped in plastic foil in an open wooden crate or, if necessary, packed in a wooden box. This complies with the normal shipping requirements via a forwarding agency or by air freight. If the compressor is loaded into a consolidated container by the forwarder for sea freight, the standard packaging such as for truck/air freight is normally sufficient.

› In sea shipping (not in consolidated containers) or delivery to tropical regions, we recommend sea freight packaging with appropriate protective storage measures.

› If compressors or compressor blocks are out of operation for over 6 months (e.g. during transport and subsequent storage before installation) appropriate protective storage measures should be taken.

Overview Protective Storage & Packing					
	S	S PLUS	M	M PLUS	L PLUS
Protective storage up to	6 months	6 months	18 months	18 months	24 months
Standard packing	●		●		
Sea freight packing		●		●	●

SCOPE OF SUPPLY: STANDARD PACKING

› Compressor is packed in plastic foil, protected against water droplets, in an open wooden crate or, if necessary, in a wooden box.

SCOPE OF SUPPLY: SEA FREIGHT PACKAGING

› Compressor is protected and packed in a closed wooden box.

› This complies with the German packing guidelines HPE and the IPPC specifications.

› The wooden box is labelled according to the customer specification.

› In order to assure protection against corrosion and moisture, the compressor is shrink-wrapped in an aluminium-coated film including addition of a drying agent.

The maximum storage period for a compressor system / block in unopened packing is 24 months (packaging L PLus). After this time the compressor must be started up and the protective storage measures renewed depending on the planned further storage period.

Types BK 23, BK 24, BK 26 and BK 52: before startup, oil pressure must be established using the optional pre-lubrication pump.

See the operating manual for details of removing from protective storage.

WHEN ORDERING YOUR COMPRESSOR,

please specify the period between ex-works delivery and operation startup, and the ambient climate under which the compressor will operate.

TECHNICAL ANNEX

T1 OPERATING CONDITIONS

General Operating and Basic Conditions	
ATTRIBUTE	**INFORMATION**
Ambient temperature	+5...+45°C
Intake temperature	Standard: +5...+45°C; lower temperature range -10...+5°C on request
Installation	Indoor installation; see “Installation Manual”
Required cooling air (air-cooled units) [m³/h]	Motor power [kW] × 360
Required cooling air (water-cooled units) [m³/h]	On request
Operating mode	Big block range (from > 15 kW): Min. working time: 30 min

The volume flow rate and power consumption figures given in this brochure apply under the following conditions (unless otherwise stated):

ATTRIBUTE	**INFORMATION**
Medium	Air or nitrogen
Gas intake temperature	+ 20°C
Cooling air temperature	+ 25°C
Cooling water temperatur	+ 35°C
Inlet pressure	According to compressor table resp. 1013 mbar
Working pressure	Max. allowed pressure

The volume flow rate of a compressor depends on various framework conditions, specifically the intake temperature, coolant medium temperature and medium to be compressed. If actual conditions vary from the reference conditions given here, the volume flow rate and power consumption will differ. In individual systems installation of a larger motor may be necessary. Correction factors are given on the next page.

All volume flow rate figures given are subject to tolerance variations as per ISO 1217: 1996 (PN2 CPT)	
VOLUME FLOW RATE	**TOLERANCE**
< 30 m³/h	± 7 %
30 – 90 m³/h	± 6 %
90 – 900 m³/h	± 5 %
> 900 m³/h	± 4 %

T2 COMPRESSOR - BOOSTER

COMPRESSOR

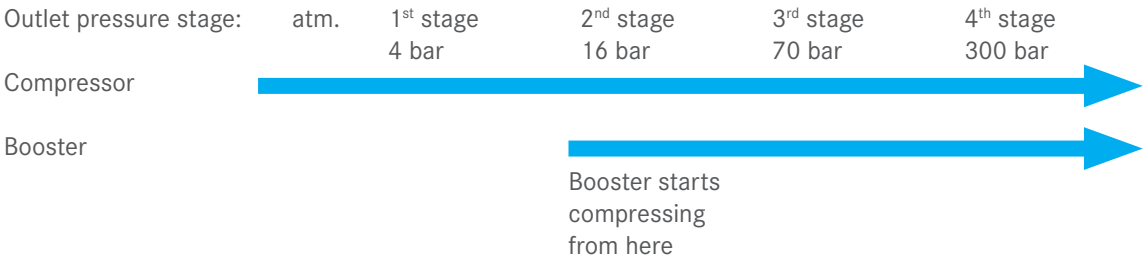
A medium / high-pressure-compressor comprises multiple compressor stages. Air or gas is taken in at atmospheric pressure and compressed by approximately the same factor. Each compressor stage thus delivers roughly the same output.

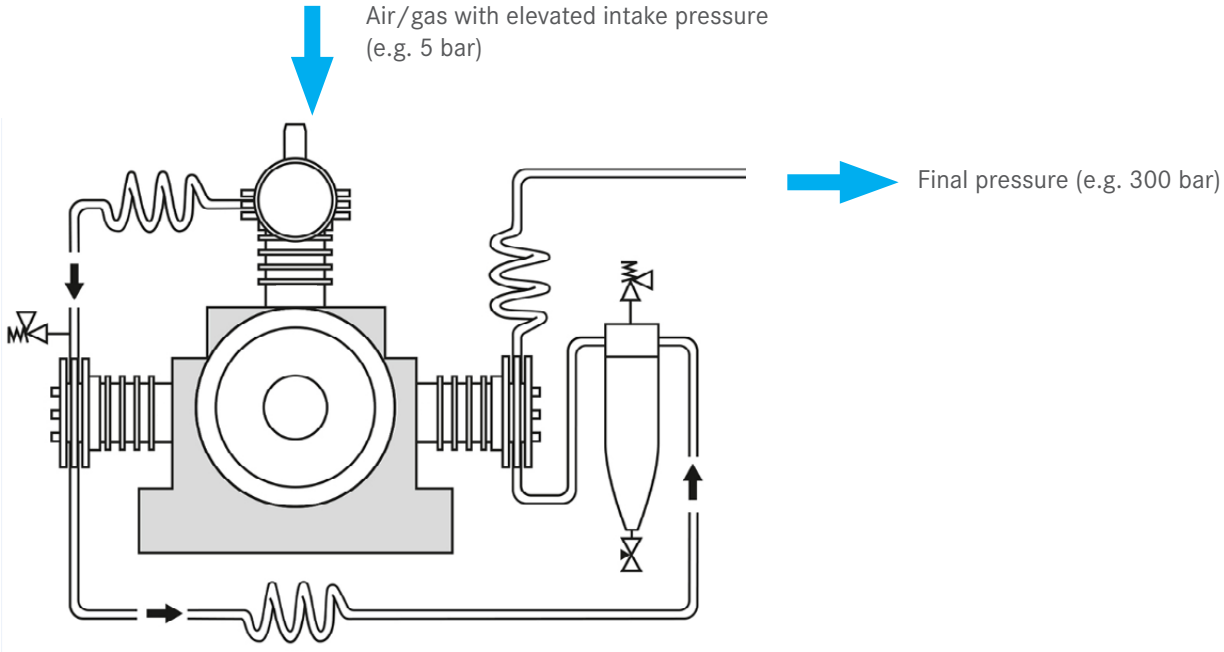
BOOSTER

A booster also comprises multiple compressor stages; however, the air or gas is not taken in at atmospheric pressure. Instead, the booster makes direct use of existing primary pressure (generally approx. 5 – 10 bar), eliminating the need for the first stage. The medium is compressed in multiple parallel stages depending on the booster model.

The existing pressure level does not need to be reduced, thus saving energy.

Example:





Schematic representation of a booster

T3 MEASURING OF FLOW RATE

Compressors can be compared on the basis of their F.A.D. and power consumption. But F.A.D. is not a constant. The distinction must be made between:

Intake volume (air throughput in litre) = theoretical swept volume flow rate:

› This is the volume flow rate which is theoretically taken in by the compressor.

› This does not correspond to the volume flow rate at the outlet of the compressor ▸ therefore this indication is misleading and cannot be used as a measured value, as it does not reveal anything about the effective free air delivery.
The deviation from the effective F.A.D. is of the order of 30 to 50 percent.

FREE AIR DELIVERY (F.A.D.)

› The F.A.D. is measured at the compressor outlet at final pressure against the ambient pressure. This indication relates to the norm according to ISO1217: 1 bara, 20 °C, 0 % humidity. This is common for industrial applications/ compressors. When gases are compressed, it is referred to as “Free Gas Delivery” (FGD); here, the gas-specific correction factor “Z” is taken into account.

CHARGING RATE – “CYLINDER FILLING“

› This is the common indication in the field of scuba diving/ breathing air compression.
The time measured is that which is required, for instance, for filling a 12-litre breathing-air cylinder from 0 to 200 bar. The average delivered volume is calculated from this data. This value is higher than the effective free air delivery (F.A.D.), as effects such as cylinder heating, compressibility factor and, during the initial phase, the lower final pressure etc. have an influence on the result.

Schematic representation of “free air deliveries”

The air intake temperature is directly related to the effective F.A.D.; at BAUER, it is based on ISO1217 (+20 °C, 1 bara, 0 % rH).

T4 CORRECTION FACTOR

FLOW RATE

Volume flow rate correction factor for deviations in medium: L_{Me}					
MEDIUM	HELIUM	ARGON	AIR	NITROGEN	METHANE
L_{Me}	0.8	0.95	1	1	0.9

Volume flow rate correction factor for deviations in intake temperature: L_{Te}									
TEMPERATURE (°C)	5	10	15	20	25	30	35	40	45
L_{Te}	1.04	1.027	1.013	1	0.987	0.975	0.962	0.950	0.939

Volume flow rate correction factor for deviations in cooling medium temperature: L_{Km}												
TEMPERATURE (°C)	5	10	15	20	25	30	35	40	45	50	55	60
L_{Km}	1.008	1.006	1.003	1	0.997	0.995	0.992	0.989	0.987	0.984	0.981	0.979

Volume flow rate correction factor for deviations in altitude: L_{alt}					
ALTITUDE (M), ABOVE SEA LEVEL	0	500	1000	1500	2000
L_{alt}	1	0.95	0.89	0.84	0.78

Numerical correction factor as reference value. Not applicable to boosters.
Compressor operation at altitudes > 2000 m: on request

The expected actual volume flow rate is calculated as follows: Volume flow rate × L_{Me} × L_{Te} × L_{Km} × L_{alt}

EXAMPLE CALCULATION

Compressor Unit I 22.0-22

FAD: 800 l/min | Medium: Nitrogen | Gas inlet temperature: +5 °C

Ambient / cooling air temperature: + 30 °C | Altitude: 500 m (above sea level)

Expected volume flow rate in real terms: 800 l/min × 1 × 1.04 × 0.992 × 0.95 = 784 l/min

The altitude above sea level is irrelevant when the gas intake is pressurised. This only applies to air or gas intake under ambient pressure.

For water-cooled compressors the coolant medium temperature is equal to the cooling water temperature. The cooling air temperature can be ignored.

POWER CONSUMPTION

Power consumption correction factor for deviations in medium: K_{Me}					
MEDIUM	HELIUM	ARGON	AIR	NITROGEN	METHANE
K_{Me}	1.06	1.12	1	1	0.9

Power consumption correction factor for deviations in intake temperature: K_{Te}									
TEMPERATURE (°C)	5	10	15	20	25	30	35	40	45
K_{Te}	1.028	1.018	1.01	1	0.99	0.98	0.975	0.965	0.955

Power consumption correction factor for deviations in cooling medium temperature: K_{Km}												
TEMPERATURE (°C)	5	10	15	20	25	30	35	40	45	50	55	60
K_{Km}	0.975	0.983	0.992	1	1.008	1.015	1.023	1.030	1.038	1.049	1.054	1.061

Power consumption correction factor for deviations in altitude: K_{alt}					
ALTITUDE (M), ABOVE SEA LEVEL	0	500	1000	1500	2000
k_{alt}	1	0.97	0.93	0.89	0.85

Numerical correction factor as reference value. Not applicable to boosters.

The expected actual volume flow rate is calculated as follows: Volume flow rate × K_{Me} × K_{Te} × K_{Km} × K_{alt}

EXAMPLE CALCULATION

Compressor Unit I 22.0-22

FAD: 800 l/min | Power consumption: 22.5 kW | Medium: Nitrogen | Gas inlet temperature: +5 °C

Ambient / cooling air temperature: + 30 °C | Altitude: 500 m (above sea level)

Expected power consumption in real terms: 20.5 kW × 1 × 1.028 × 1.015 × 0.97 = 20.8 kW

T5 OPERATING MODES

CONTINUOUS OPERATION

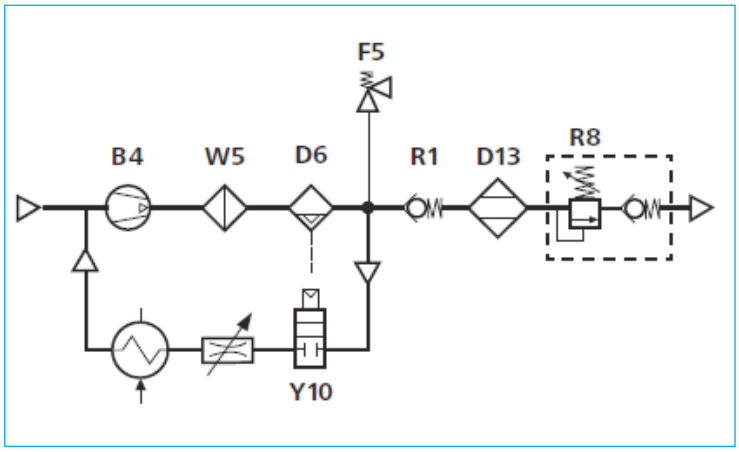
- The compressor unit can be operated continuously (24/7).
- Shutdown of the compressor unit is only necessary for periodic maintenance and oil refilling.
  (On boosters with pressure-resistant crankcase, it is possible to refill oil even during operation.)

INTERMITTENT OPERATION

- The compressor unit starts and stops a number of times per day/hour.
- The minimum operating time per cycle should be at least 30 minutes or over.
- The number of startups per hour is limited to a maximum of two.
  The reason for this is the contactors (starting power of motor) and the fact that normal operating temperature is only reached after several minutes.

FURTHER MODES OF OPERATION

In cases where the gas volume flow rate and compressor delivery do not necessarily match or the required gas volume flow rate varies, the following solutions are available:

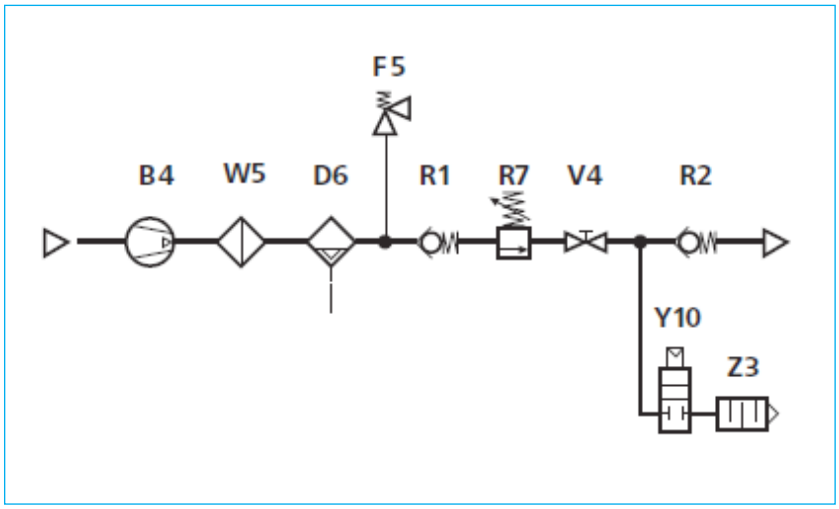


Schematic illustration of cycle operation

CYCLE OPERATION

Instead of stopping the compressor at regular intervals, any unused compressed gas can be returned to the compressor intake unit.

- This generally only applies to compressors used for gas compression.
- If required, a heat exchanger can be used to cool or heat the decompressed gas.



Schematic illustration of idle operation (Y10 solenoid valve; Z3 sound absorber)

IDLE OPERATION

The compressor system runs continuously; when switched to idle mode it operates against the pressure maintenance valve pressure setting. The air is released into the environment.

- Advantage: Air is immediately available when required – motor operates continuously
- But: Relatively inefficient energy consumption when idling.

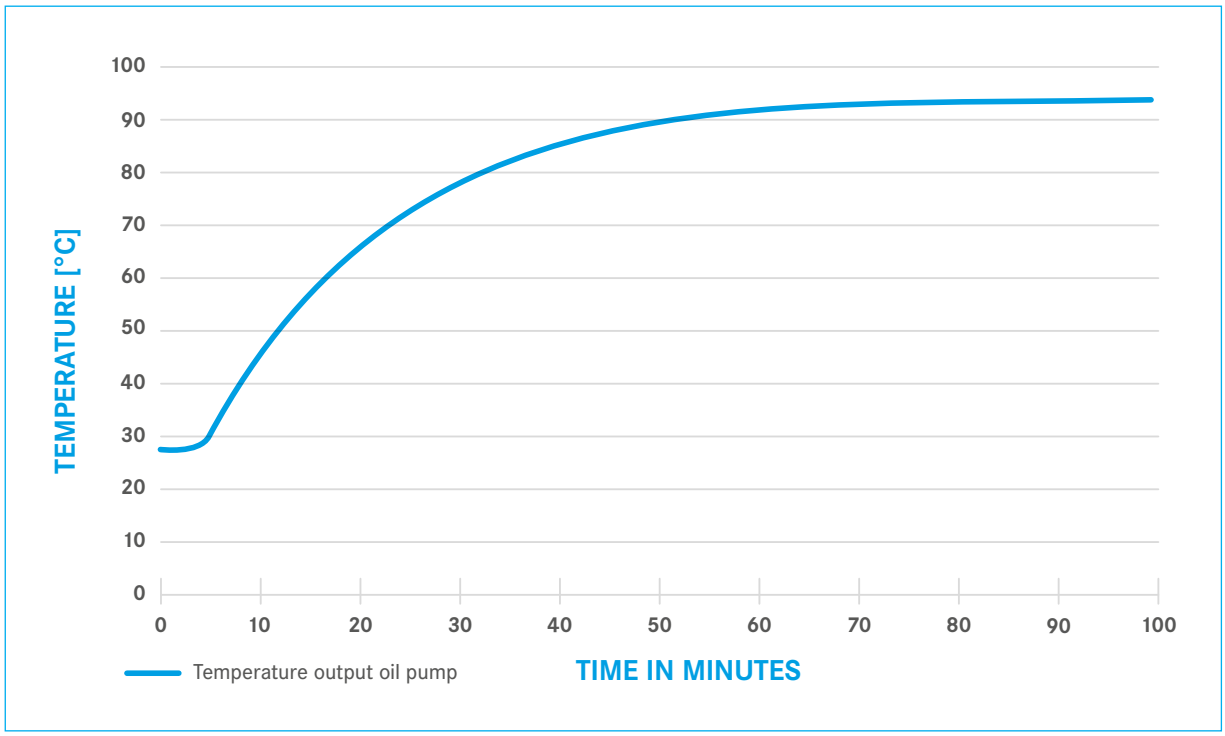
SPEED CONTROL

- Conventional start-stop operation consumes more energy than speed-controlled operation as the compressor undergoes more energy-intensive start cycles.
- Speed control adjusts the compressor output to compressed air use; the compressor uses only the amount of power needed to produce the volume of compressed air actually required.
- Unlike screw compressors, rpm regulation in multi-stage piston compressors is only possible in a relatively narrow rpm range from approx. 70 to 100 % for technical reasons.
- A frequency converter enables the motor to be started in soft start mode, avoiding costly power peaks and reducing wear and tear on moving parts by lowering acceleration.

T6 TEMPERATURE DEVELOPMENT

Temperature development and stable operating temperature of a large-scale block compressor

THE LARGER THE COMPRESSOR,
the longer the time until the stable operating temperature is reached.



Example: Temperature development of compressor block

T7 GAS DATA

The most important data of some gases					
		AIR	NITROGEN	HELIUM	ARGON
Density	kg/m³	1.292	1.250	0.179	1.784
Specific heat capacity	J/(kg*K)	1000	1040	5193	5200
Kappa	κ	1.4	1.4	1.66	1.66

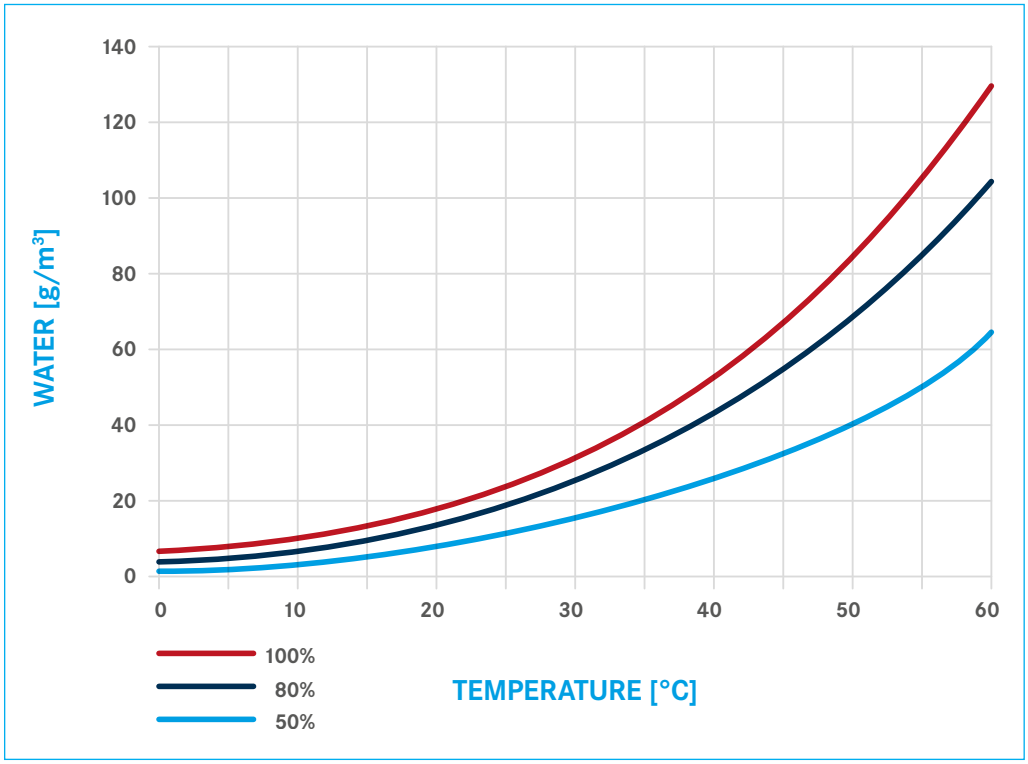
This provides information on the compression temperature and required power.

T8 PRESSURE UNIT CONVERSION CHART

Pressure unit conversion chart								
	Pa N/m^2	bar daN/cm^2	mbar	Kp/cm^2 at	atm	mmWS	Inch WC	PSI $lbs/inch^2$
N/m^2=Pa	1	$1 \cdot 10^{-5}$	0.01	$1.02 \cdot 10^{-5}$	$9.869 \cdot 10^{-6}$	0.10197	$4.015 \cdot 10^{-3}$	$1.45 \cdot 10^{-4}$
bar=daN/cm^2	$1 \cdot 10^{5}$	1	$1 \cdot 10^{3}$	1.01971	0.98692	$1.02 \cdot 10^{4}$	401.47	14.5037
mbar	100	$1.000 \cdot 10^{-3}$	1	$1.02 \cdot 10^{-3}$	$9.869 \cdot 10^{-4}$	10.1971	0.40147	0.0145
Kp/cm^2=at	$9.807 \cdot 10^{4}$	0.98066	980.66	1	0.96784	$1 \cdot 10^{4}$	393.71	14.2233
atm	$1.013 \cdot 10^{5}$	1.01325	$1.013 \cdot 10^{3}$	1.03322	1	$1.033 \cdot 10^{4}$	406.79	14.6959
mmWS	9.806^{6}	$9.807 \cdot 10^{-5}$	0.09807	$1 \cdot 10^{-4}$	$9.678 \cdot 10^{-5}$	1	0.03937	$1.422 \cdot 10^{-3}$
Inch WC	249.1	$2.491 \cdot 10^{-3}$	2.491	$2.54 \cdot 10^{-3}$	$2.458 \cdot 10^{-3}$	25.4	1	$3.613 \cdot 10^{-2}$
PSI=$lbs/inch^2$	$6.895 \cdot 10^{3}$	0.06895	68.9475	0.07031	0.06805	703.069	27.681	1

T9 MOISTURE CONTENT

Moisture content of the air, dependent upon temperature (at atmospheric pressure)



T10 DEWPOINT

The dewpoint of moist air or moist gas is the temperature below which the water vapour of the air/gas condenses into dew or mist at the same pressure. The dewpoint temperature is related to the water content of the air and is thus used as a measurement of absolute humidity. The higher the water vapour content of the air, the higher the dewpoint temperature.

As the dewpoint temperature also depends on pressure, a distinction is made between dewpoint and pressure dewpoint.

Pressure dewpoint is the temperature to which compressed air or compressed gas can be cooled before condensate develops. Pressure dewpoint depends on compression pressure. The higher the pressure in the compressor, the higher the pressure dewpoint.

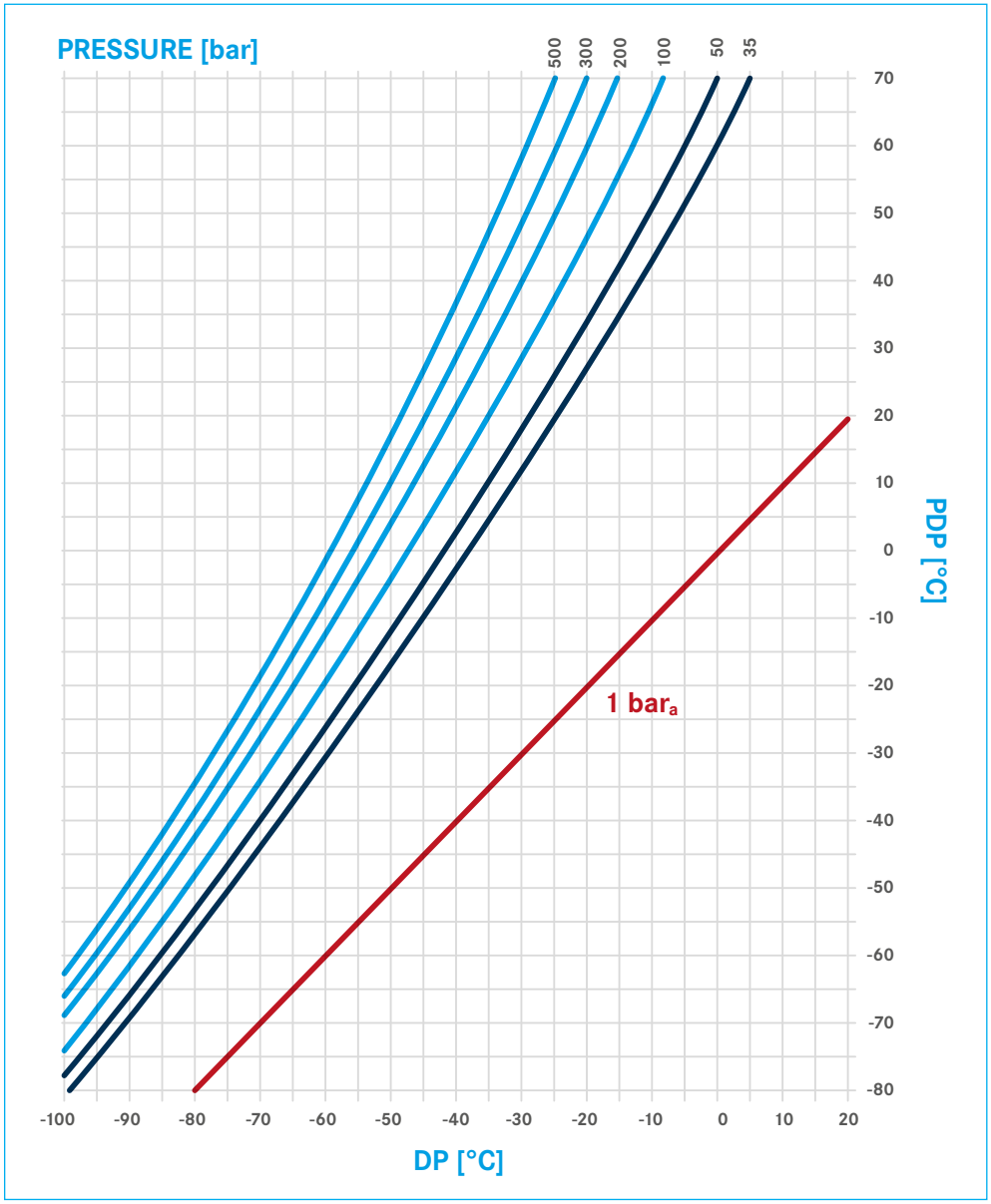


Diagram of dewpoint and pressure dewpoint in relation to compression pressure

DP = Dewpoint; PDP = Pressure dewpoint

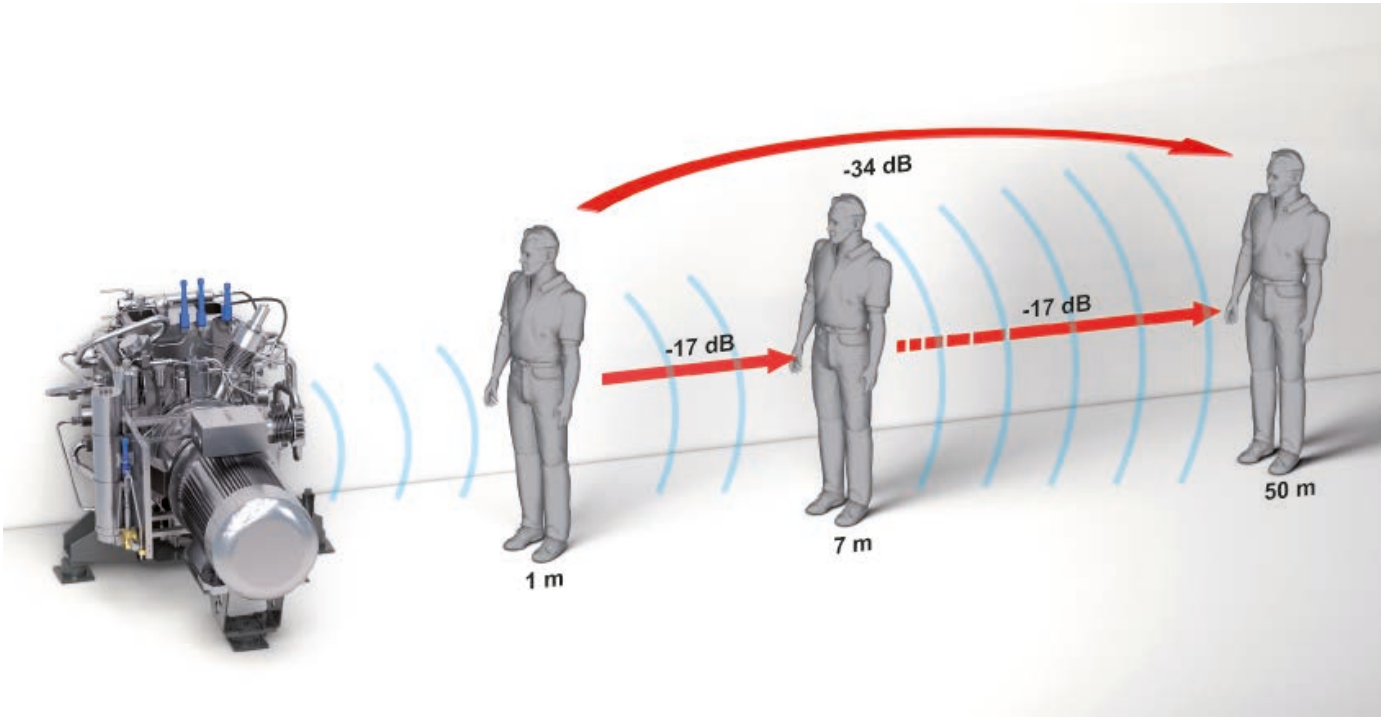
T11 HUMIDITY OF AIR

Temperature [°C] / Humidity [g/m³ at 1013 mbar] at 100% saturation (acc. DIN ISO 7183)										
[°C]	0	1	2	3	4	5	6	7	8	9
100	597.5	617.7	638.5	659.8	681.7	704.2	727.3	751.1	775.4	800.4
90	423.4	438.7	454.4	470.6	487.2	504.3	522.0	540.1	558.7	577.8
80	293.4	304.7	316.3	328.3	340.7	353.5	366.7	380.2	394.2	408.6
70	198.2	206.4	214.4	223.6	232.6	241.9	251.6	261.5	271.8	282.4
60	130.3	136.1	142.0	148.2	154.7	161.3	168.2	175.3	182.7	190.3
50	83.08	87.03	91.14	95.41	99.85	104.5	109.3	114.2	119.4	124.8
40	51.21	53.83	56.57	59.43	62.41	65.52	68.75	72.12	75.63	79.28
30	30.40	32.08	33.85	35.70	37.63	39.65	41.76	43.97	46.28	48.64
20	17.31	18.35	19.44	20.59	21.80	23.07	24.40	25.79	27.26	28.79
10	9.405	10.02	10.67	11.35	12.08	12.84	13.64	14.49	15.38	16.32
0	4.487	5.196	5.563	5.952	6.364	6.802	7.265	7.756	8.275	8.824
-10	2.139	1.964	1.803	1.653	1.515	1.367	1.269	1.160	1.060	0.9678
-20	0.8835	0.8053	0.7336	0.6678	0.6075	0.5521	0.5015	0.4551	0.4127	0.3739
-30	0.3385	0.3061	0.2767	0.2494	0.2254	0.2032	0.1820	0.1646	0.1480	0.1392
-40	0.1192	106.9×10^{-3}	95.70	85.65	76.56	68.36	60.98	54.33	48.37	43.01×10^{-3}
-50	38.21×10^{-3}	33.90	30.05	26.60	23.53	20.78	18.34	16.16	14.23	12.51×10^{-3}
-60	10.98×10^{-3}	9.633	8.438	7.381	6.449	5.627	4.903	4.267	3.708	3.218×10^{-3}
-70	2.789×10^{-3}	2.414	2.085	1.799	1.550	1.331	1.145	0.9824	0.8413	0.7191×10^{-3}
-80	0.6138×10^{-3}	52.30×10^{-5}	44.49	37.78	32.03	27.10	22.89	19.30	16.24	13.65×10^{-5}
-90	11.44×10^{-5}	9.574	7.996	6.668	5.544	4.002	3.812	3.150	2.599	2.139×10^{-5}

Max. possible humidity [g/m³] of air at atmospheric pressure [1013 mbar]

T12 ACOUSTIC NOISE

For punctiform sound sources (sources emitting sound equally in all directions, i.e. roughly similar to compressors), sound pressure level decreases by a relatively precise 6 dB per doubling of distance, i.e. sound pressure halves when the distance to the sound source is doubled.



- Sound pressure level is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. The sound pressure level is measured in decibels (dB).
- Sound pressure level [dB(A)]: To take into account the ear‘s sensitivity to specific frequencies, actual sound pressure level is adjusted by applying corrective values for which there are internationally valid evaluation curves; the most common of these is the A evaluation.
- Sound pressure level of BAUER compressors is given in dB(A) at 1 m (3‘) distance (according to ISO 3744)

Δ 10 dB(A) = double noise

Δ 3 dB(A) = 2 units (sound sources) with the same noise level

Δ 5 dB(A) = 3 units (sound sources) with the same noise level

The actually measured / perceived sound pressure level depends strongly on the environment, i.e. how the sound is reflected or absorbed.

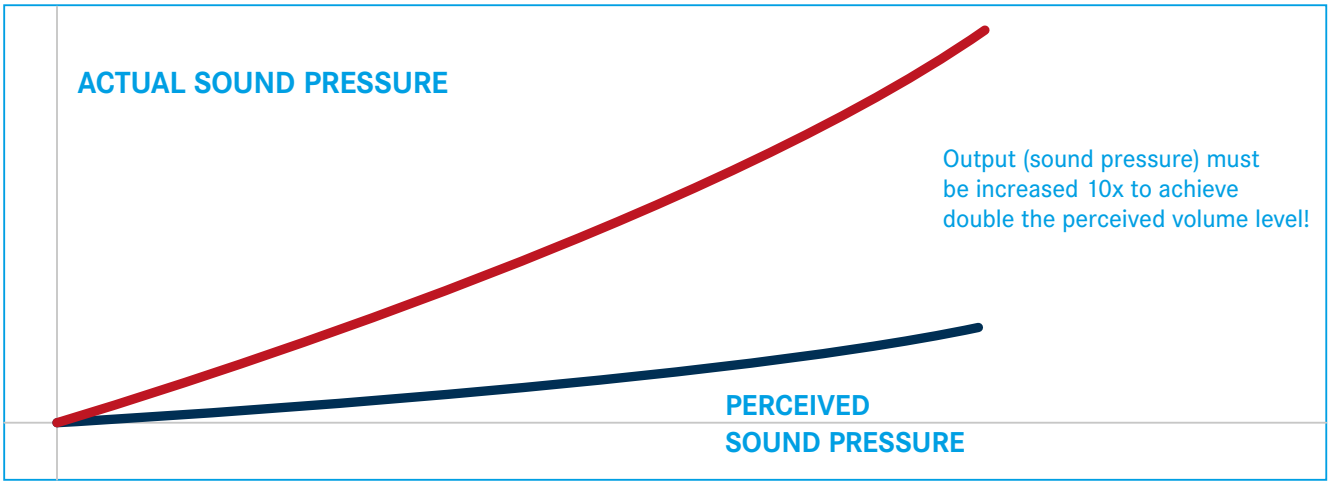
The greatest influence on sound pressure levels is therefore not the distance, number of sound sources or perception of sound volume, but simply the space or room containing the sound source.

For example, concrete has a sound absorption level of approx. 2 % while acoustic panels can reach a maximum of approx. 60 %; here too, part of the sound is measured multiple times and thus increases the equivalent sound pressure level in the room.

- Sound measurements in compliance with standards can therefore only be performed in a neutral free field[1] or in suitable and previously surveyed rooms enabling measurements to be extrapolated to free field measurements.

- The perceived volume of the sound event only doubles from an increase in sound pressure level of approximately 10 dB and not when the sound pressure is doubled, which corresponds to a 6 dB increase in sound pressure level. This is caused by psychoacoustic phenomena which do not fully obey the laws of pure physics.

- Compressor operating noise is generally measured on the basis of the ISO 3744 standard using the A evaluation curve. Sound levels are therefore given in **dB(A)** as equivalent sound pressure level $\mathbf{L_{peq}}$, the mean sound pressure level throughout the measurement period.



Sound pressure levels of BAUER compressors are available on request or can be found in the data sheets and operating instructions.

1 In acoustics a free field is a situation which is completely free from sound reflection. In a free field, all sound perceived by a listener is supplied by direct sound from a sound source.

T13 PROTECTION CLASSES

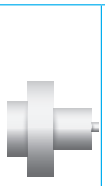
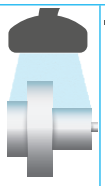
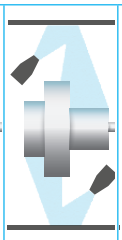
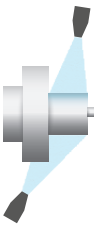
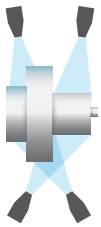
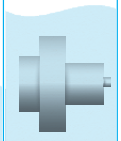
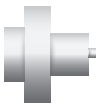
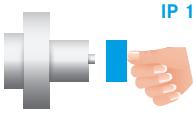
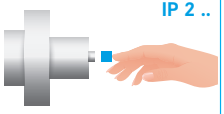
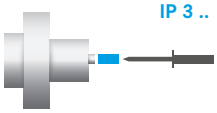
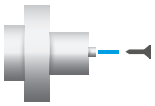
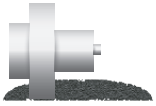
The type of protection required by electrical equipment is classified under DIN EN 60529 according to the equipment‘s exposure to stress from foreign bodies and water. These protection types are also known as IP Codes (IP stands for “International Protection” or also “Ingress Protection”).

› IP types refer exclusively to protection against contact and penetration of solid foreign bodies and dust (designated by the first digit in the IP code) and against harmful ingress of water (designated by the second digit in the IP code).

Electrical components used in compressors comply with the following IP protection class as standard

	MOTOR	B-CONTROL MICRO	B-CONTROL II	CONTROL BOX	PRESSURE SENSOR	TEMPERATURE SENSOR	AUTOMATIC CONDENSATE DRAIN DEVICE (COIL)	INTAKE SOLE-NOID VALVE
K 22 – K 28	IP 55	IP 65	IP 65	IP 45	IP 65	IP 55	IP 65	IP 65
BK 23 – BK 52	IP 55	--	IP 65	IP 45	IP 65	IP 55	IP 65	IP 65

PROTECTION CLASS ACCORDING TO EN 60529

2nd char, numeral: Protection against ingress of water / 1st char,numeral: Protection against solid foreign objects									
PROTECTION AGAINST...	**NON PROTECTED**	**FALLING WATER DROPS VERTICAL / 15***		**SPRAYING WATER**	**SPLASHING WATER**	**WATER JETS**	**POWERFUL WATER JETS**	**TEMPORARY IMMERSION**	**CONTI-NUOUS IMMERSION**
DIN EN 60529	IP .. 0	IP .. 0	IP .. 2	IP .. 3	IP .. 4	IP .. 5	IP .. 6	IP .. 7	IP .. 8
IP 0 ..  Non protected	**IP 00**								
IP 1 ..  Solid foreign objects diameter ≥ 50 mm (2”)	**IP 10**	**IP 11**	**IP 12**						
IP 2 ..  Solid foreign objects diameter ≥ 50 mm (1/2”)	**IP 20**	**IP 21**	**IP 22**	**IP 23**					
IP 3 ..  Solid foreign objects diameter ≥ 2,5 mm (1/8”)	**IP 30**	**IP 31**	**IP 32**	**IP 33**	**IP 34**				
IP 4 ..  Solid foreign objects diameter ≥ 1 mm (3/2”)	**IP 40**	**IP 41**	**IP 42**	**IP 43**	**IP 44**	**IP 45**			
IP 5 ..  Dust-protected	**IP 50**		**IP 52**	**IP 53**	**IP 54**	**IP 55**			
IP 6 ..  Dust-tight	**IP 60**				**IP 64**	**IP 65**	**IP 66**	**IP 67**	**IP 68**

* Depth and duration of immersion must be specified!

BAUER KOMPRESSOREN uses components with IP protection class ratings (grey fields) as standard.

T14 DIMENSIONING OF PRESSURE VESSELS

Recommended storage cylinders / tank sizes for high pressure, taking into account 2 cycles of compressor operation per hour, according to the compressor F.A.D. and the various ON/OFF switching differentials.

The following information answers this important question and will help you to find the right storage system for your requirements.

A correctly dimensioned (storage) vessel is one of the most important components of the entire system. It will reduce pressure fluctuations when large amounts of air are consumed and minimise the number of compressor on/off cycles by providing the correct storage capacity.

For high-pressure compressors, remember that the final separator in the compressor and the storage vessel are only dimensioned for a certain number of load cycles, i.e. the fewer compressor switching cycles, the longer the service life of these components.

To optimise the performance of the unit and maximise the service life of the final separator based on the number of permissible load cycles, the operation of the compressor should be regulated so that there are no more than 2 ON cycles every hour.

For your safety, cycle counters are installed in BAUER industrial compressors as standard to record the number of cycles actually completed.

The size of the storage system is determined by:

- Free air delivery (l/min) of the compressor
- Air consumption of the application concerned
- Pressure difference between start and stop (hysteresis)
- Compressor run time
- Real gas factor

Simplified formula for the configuration of a high-pressure storage system (without consideration of the real gas factor):

$$V_{St} = \frac{(\dot{V}_k - \dot{V}_A) \times t}{\Delta p}$$

$\dot{V}_K$ (l/min) = Flow rate of the compressor in litres per minute
$\dot{V}_A$ (l/min) = Air consumption of the application (average)
V_{st} (Litre) = Storage volume in litres (water volume)
Δ p (bar) = Start/stop pressure difference (hysteresis) in bar
t (min) = Compressor run time (> 30 min)

We recommend a pressure difference Δp up to max. 60 bar. Up to this difference, stationary HP storage bottles are generally permitted for use in continuous operation. Above this level, vessel types are limited with regard to the number of filling cycles

Example:

a) Flow rate compressor $\dot{V}_K$: 1000 l/min
Air consumption application $\dot{V}_A$: 700 l/min
Hysteresis Δp: 20 bar
Compressor run time t: 30 min

$$V_{St} = \frac{(1000 - 700\ l/min) \times 30\ min}{20\ bar}$$

V_{St} = 450 litres

b) Flow rate compressor $\dot{V}_K$: 3500 l/min
Air consumption application $\dot{V}_A$: 200 l/min
Hysteresis Δp: 50 bar
Compressor run tim t: 60 min

$$V_{St} = \frac{(3500 - 200) \times 60\ min}{50\ bar}$$

V_{St} = 1800 litres

NOTES

ARE YOU INTERESTED IN OUR PRODUCTS?

CONTACT US – WE ARE HAPPY TO PROVIDE INFORMATION AND ASSISTANCE.

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N37247
03.2016