BOGE AIR. THE AIR TO WORK.

BOGE
COMPRESSED AIR SYSTEMS

Operating instructions

Direct-driven screw compressors

Series
SL 270 / SL 340 / SL 430
SL 341 / SL 431 / SL 481
SLF 221 / SLF 271

Separate instructions:
Compressor control
Frequency converter

GLC CERTIFIED ISO 9001

www.boge.com

Operating instructions for direct-driven screw compressors

- **SL 270 (200 kW)**
- **SL 340 (250 kW)**
- **SL 430 (315 kW)**

- **SL 341 (250 kW)**
- **SL 431 (315 kW)**
- **SL 481 (355 kW)**

- **SLF 221 (160 kW)**
- **SLF 271 (200 kW)**

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Part 1: General

Part 2: Product description

1.1 General safety instructions

Caution!

Nonobservance of the following safety instructions may lead to injuries and damage to the compressor.

Also observe the generally valid safety and accident prevention regulations in addition to the information in these operating instructions!

Safety instructions for compressor operation

1. Ensure that no commissioning and maintenance work on the compressor is undertaken until these operating instructions are understood.
2. Only use the compressor for its intended use, as described in these operating instructions.
3. The owner must ensure,
   - that only appropriately trained and authorized personnel work on this compressor,
   - that no persons work on this compressor, whose ability to react is restricted due to misuse of e.g. drugs, alcohol, medication etc.,
   - that the operating, maintenance and repair personnel has been made fully familiar with all safety instructions, and that they are being observed,
   - that the compressor is only operated in a safe operating condition.
4. Avoid any operating method which may impair the safety of the compressor.
5. Always wear your compulsory personal protective equipment as a protection against injuries from sharp corners or edges when working on the compressor.
6. To avoid dangers from debris or parts lying around, the service area of the compressor has always to be kept tiedied up and clean.
7. Always squat when working on components mounted at low height, never stoop. When working on components mounted higher up always stand upright and erect.
8. Do not exceed the limit value for the final compression pressure specified on the type plate.
9. Do not operate the compressor without the attendant protection and safety devices.
   Do not dismantle any built-in safety devices or put them out of operation.

   Ensure that all safety claddings and doors are closed prior to commissioning/starting up the compressor and that they are not opened during operation.
10. Place the compressor out of operation as described in these operating instructions, when dismantling the safety claddings or safety devices for repair or maintenance work. Reattach and close all cladding and safety devices immediately upon completion of the repair or maintenance work.
11. Only operate the compressor using the additional equipment (options) recommended or authorized by the manufacturer.

12. Undertake conversions and modifications of the compressor only in agreement with BOGE, taking all relevant safety regulations into consideration. The manufacturer is not liable for damages resulting from independent modifications on the compressor.
13. Never start the compressor when one or serveral parts (e.g. cable, plug) are damaged, when not in perfect working order and when damage is detected or suspected.
14. Observe all safety and danger signs directly attached on the compressor!
15. The compressed air/oil receiver is a compression device which has to be checked according to the national rules and regulations.
16. To avoid damages, special precautions have to be taken during (re-) operation of compressors with frequency control, if the frequency converter was cut off from the power supply for a longer period of time (> 12 months). In this case please contact the BOGE-Service.

Safety instructions for maintenance and repair of the compressor

Caution!

Only use original spare parts, compressor oils and operating materials released by BOGE during repair or maintenance!

Caution: Voltage!

When working on the electrical system there is a constant danger of getting into contact with live parts!

To avoid such dangers the mains connection must be equipped with a disconnecting device!

The mains disconnecting device has to meet the requirements of DIN EN 60204-1:2007!

1. Ensure that maintenance work is only carried out by appropriately trained persons.
2. Ensure that setting work, malfunction rectification and repair is only carried out by specialists or appropriately trained persons.
3. Prior to maintenance or repair work:
   - Press Emergency Stop button.
   - Open mains disconnecting device.
   - Secure mains disconnecting device against unintentional switching on by means of a padlock.
   - Fix a warning label to the control and fill in the name of the person responsible who is authorized to switch on the machine again.
   - Check to ensure that all parts are currentless.
   - Disconnect the compressor from the compressed air network (relieve or block pressurized lines).

4. Exercise extreme caution during repair or maintenance work requiring the compressor to be operational.
   Ensure that no persons are located in the hazardous area.
5. Ensure that work on the electrical equipment is only undertaken by qualified electricians.
6. Work on parts and devices under current is prohibited. Exceptions are governed by the appropriate regulations, e.g. DIN VDE 0105.
7. Prior to starting work on the electrical system the power supply has to be switched off and secured against unintentional switching on again. Immediately after having finished the work all dismantled claddings and safety devices must be refitted.
8. The operator is responsible to check the compressor daily for externally visible damage and defects, and to immediately report any changes (including operational behaviour).
9. When the automatic restart (Auto-Restart) is activated, the compressor will start automatically following a voltage loss. Prerequisite: The net pressure is lower than the set switch-on pressure.

Special hazard warnings

– Always wear your compulsory personal protective equipment when working on pressure pipes and connections!
– A protective grid serves to prevent you from accidentally reaching into the impeller of the cooling fan.

Caution: Risk of injury!

Never operate the compressor with dismantled protective grid! Never operate the compressor with dismantled protective grid! There is a constant danger of accidentally reaching into the impeller of the cooling fan!

Please note that the cooling fan may run on for a certain time even after the compressor has been switched off!

– When working on the coupling there is a constant danger by bruising, shearing, or being seized or trapped. Any servicing on the coupling may only be carried out during standstill of the compressor! Immediately after having finished the work all claddings, screw connections and safety devices have to be rettached!
– During operation, the compressor generates a high sound pressure level which may cause permanent hearing damage due to continuous noise stress. As a rule, the compressor may only be operated with its housing cover closed. Make sure to additionally wear a hearing protection in case of a noise pressure level above 80 dB(A)!

Electrical energy hazards

Caution: Voltage!

There is danger of life when working on the electrical equipment of the compressor!

- Disconnect mains connection prior to starting to carry out works on the compressor and use padlock to secure against switching on again.
- Only duly authorized professional electricians (e.g. plant electricians) are allowed to carry out works in the electrical area of the machine.
- Make sure to check the electrical equipment of the compressor at regular intervals for defects such as loose connections or scorched cables and have any defects repaired immediately.
- Make sure to have all electrical equipment and fixed electrical installations checked by a professional electrician at least every 4 years.
- Any modifications that may have been carried out after examination must conform to DIN EN 60204-1:2007.
- Make sure to check all safety installations on the machine for proper functioning at regular intervals.
- Only use original fuses.

Obligations of the owner

The owner is obliged to,

- operate the compressor only in technically perfect condition,
- check the Emergency Stop device of the compressor regularly for completeness and functionality,
- assess the hazards of the machine working places in his area of responsibility and to issue the ensuing operating instructions,
- to name a person responsible beeing in charge of the safe operation of the machine as well as the coordination of all service work performed on it,
- avoid stress situations while operating the compressor by means of technological and organizational operation scheduling,
- ensure a proper workplace lighting at the compressor control section according to the local health and safety regulations,
- observe the safety data sheet of the used lubricants and to customize the personnel all information as to said data sheet,
- provide the compulsory personal protective equipment and to stipulate and check the wearing of said protective equipment on a regular basis,
- assign the personnel responsible for various tasks and work on the machine,
- instruct the personnel on a regular basis with respect to all obligations as to compressor related preservation of safety and tidiness.

Personnel requirements

Work on and with the compressor may only be carried out by personnel duly authorized by the owner of the compressor.

The personnel working on the compressor has to observe all industrial safety regulations and operating instructions, properly recognize responsibilities and read and understand the operating instructions. It is essential to wear the compulsory personal protective equipment when working on the compressor!

Personal protective equipment

In general for all work on the compressor

– protective clothing,
– chemicals resistant gloves,
– slip-resistant safety shoes and
– hearing protection, if applicable,

are compulsory.

For special duties

– protective helmets (for transport work with lifting gear) and
– safety goggles (when working on the compressed air system, on the control pneumatics and/or on the cooling system of the built-in dryer)

must be worn.

Before starting work using oils or greases a skin protection cream must be applied. Having finished the work a skin care product must be applied.

Accident prevention regulations

The owner of a compressor plant is responsible to ensure that it is properly installed, operated and maintained.

Prior to commissioning, owners in the Federal Republic of Germany urgently have to read the currently valid regulations of the Main Association of the Industrial Employers' Liability Insurance. Apart from other regulations particularly the Ordinance on Industrial Safety and Health (BetrSichV) is applicable.

The regulations are available at the following locations:

Berufsgenossenschaft (Industrial Employers' Liability Insurance)
Carl-Heymanns-Verlag KG, Luxemburger Straße 449, D-50939 Köln
Beuth Verlag GmbH, Burggrafenstraße 6, D-10787 Berlin

For operation of the compressor plant outside the Federal Republic of Germany, the accident prevention regulations of the country, where the compressor is operated, must be observed in addition to the data contained in these operating instructions. In the event that measures are required above and beyond the legal regulations specified in the Federal Republic of Germany or the data contained in these operating instructions, then it is of utmost importance that these be carried out prior to commissioning the compressor plant.

1.2 Introduction

The purpose of these operating instructions is to familiarize the user with the function and all application possibilities of the compressor.

These operating instructions contain important information on how to operate the compressor safely, economically and according to its intented use. Observing these operating instructions will assist in avoiding danger, to reduce repair costs and down times and to increase the reliability and service life of the compressor. It contains important information concerning the required maintenance and repair measures, assists in case of malfunctions and contains data concerning spare and wearing parts.

The operating instructions must be available to the compressor operating personnel at the place of operation, at all times.

The operating instructions must be carefully read and applied by all persons engaged to undertake the following work on the compressor:

– Operation, including fault rectification and daily care
– Maintenance (service, inspection, repair)
– Commissioning
– Transport

The compressor and its additional equipment must not be installed and commissioned until the operating instructions are understood.

These operating instructions can be supplemented with instructions on the basis of existing national regulations concerning accident prevention and environmental protection.

In the illustrations, the compressor is shown in part without safety cladding or safety devices for better visualization. However, operation without these components is prohibited!

Symbols used

In these operating instructions the most important safety notes and tips are especially characterized by the following symbols:

Caution: Risk of injury!

This symbol indicates information warning of possible danger to life and limb of the operator or other persons.

Attention!

This symbol indicates information warning of dangers to life and limb of the operator or other persons or dangers, which might destroy or damage the compressor.

Caution: Voltage!

This symbol indicates information warning of life threatening electrical voltage levels.

It indicates work which must be exclusively performed by skilled electricians.

Note!

This symbol indicates information and tips concerning the economical and careful operation of the compressor.

Symbols on the compressor

Note!
All warning signs on the compressor and in its surrounding must always be kept in a legible condition. Missing or damaged signs must be replaced at once!

The following symbols and warning signs are fitted on the compressor:

Warning!
Hot surfaces: Do not touch!

Warning!
The unit is operated by remote control, and might start without warning!

Note!
Instructions for the operating personnel must be read!

Prohibited!
Never open the valve before the air hose (connection to the compressed air network) is connected!

Warning of hand injuries!
Only carry out work on the coupling if the compressor is in standstill and secured against unintentional switching on!

Intended use

Caution!

BOGE compressors, including their additional equipment, are exclusively intended for the compression of air. The air taken in must not contain any explosive or chemically instable gases or vapours.
Do not exceed the specified final compression temperature.

BOGE compressors are designed for stationary operation.
Ensure that they are only installed and operated in dry and clean rooms.

Operation and control are designed to be executed by trained and authorized operators.

Foreseeable misuse

Caution!

Never direct the produced compressed air towards persons. Danger to life!

Oil is injected into the pressure rooms of the compressor.
Only use the produced compressed air for breathing or let it come in contact with foods, if it was treated beforehand.

This BOGE compressor is not explosion protected.
Do not operate in explosive areas or in a possibly explosive atmosphere!

Do not operate the compressor in rooms in which extreme dust, toxic or flammable vapours and gases may occur.

The following is not permitted:

- Compression of other media than those mentioned under intended use or compression of air loaded with contaminants.
- Exceeding the final compression pressure indicated on the type plate.
- Altering the safety devices and safety cladding or placing them out of operation.
- Removing or painting over signs and symbols on the compressor.
- Operation of the compressor by unauthorized or untrained persons.

Transport damage

BOGE does not accept any liability for breakage or transport damage. Please inspect the compressor immediately after delivery and direct damage claims to the last haulier – even when the packing is not damaged! To safeguard claims against the haulier we recommend leaving the machine, devices and packing material in the same condition as they were in when the damage was detected.

In the event of any other complaints, please inform us within six days after arrival of the delivery.

Data on the type plate

Enter the data of your compressor from the type plate or enclosed data sheet in the illustration 1.1 below.

This will ensure that in the event of enquiries, you will always have the most important data to hand.

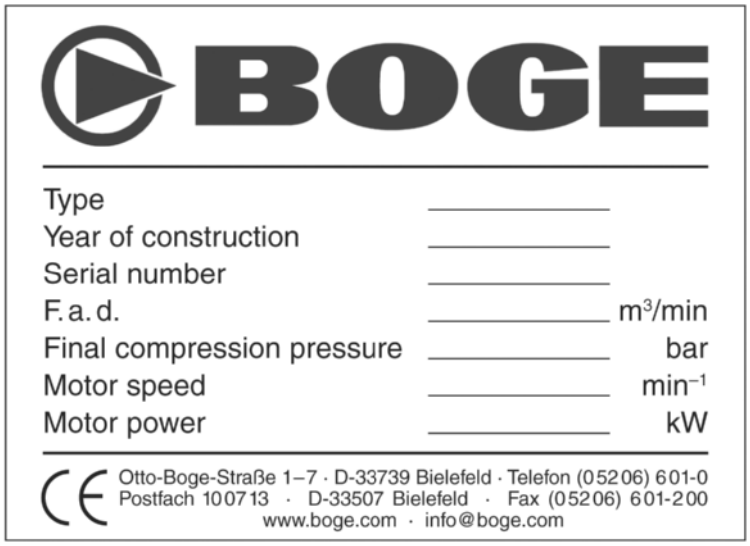


Fig. 1.1: Data on the type plate

Service

Please do not hesitate to contact BOGE service if you have any questions. Please call:

Telephone: +49 5206 601-0

In the event of inquiries, always specify the following data of your compressor to prevent any delays:

– Type
– Year of manufacture
– Machine number

Attention!

Only BOGE service technicians or persons authorized by BOGE in writing may repair or alter the compressor during the warranty period. Otherwise all warranty claims will expire!

2.1 Technical data

SL 270...481 and SLF 221...271, part 1

Type			SL 270	SL 340	SL 430	SL 341	SL 431	SL 481	SLF 221	SLF 271
Dimensions										
– Height (silenced)		[mm]	2145	2145	2145	2145	2145	2145	2145	2145
– Height (super silenced)		[mm]	2645	2645	2645	2645	2645	2645	2645	2645
– Width (silenced)		[mm]	3100	3100	3100	3100	3100	3100	3145	3145
– Width (super silenced)		[mm]	3100	3100	3100	3100	3100	3500	3145	3145
– Depth		[mm]	1910	1910	1910	1910	1910	1910	1910	1910
Weight										
– silenced		[kg]	3900	4500	4600	5000	5000	5600	4500	4700
– super silenced		[kg]	4000	4600	4700	5100	5100	5700	4600	4800
Air cooling	Max. sound pressure level accord. to DIN EN ISO 2151:2009 – silenced / super silenced	[±3 dB(A)] [dB(A)]	87/80	87/80	87/80	88/81	88/81	88/81	80/76	82/76
	Reference surface measure – silenced / super silenced	[dB(A)]	18/19	18/19	18/19	18/19	18/19	18/19	18/19	18/19
	Sound power level – silenced / super silenced	[dB(A)]	105/99	105/99	105/99	106/100	106/100	106/100	98/95	100/95
Water cooling	Max. sound pressure level accord. to DIN EN ISO 2151:2009 – silenced / super silenced	[±3 dB(A)] [dB(A)]	86/79	86/79	86/79	87/80	87/80	87/80	79/75	81/75
	Reference surface measure – silenced / super silenced	[dB(A)]	18/19	18/19	18/19	18/19	18/19	18/19	18/19	18/19
	Sound power level – silenced / super silenced	[dB(A)]	104/98	104/98	104/98	105/99	105/99	105/99	97/94	99/94
Compressor										
max.final compression temperature		[°C]	110	110	110	110	110	110	110	110
Volume flow according to ISO 1217 appendix C at:										
– p_{max} = 8 bar		[m^3/min]	33.3	–	44.2	43.7	–	–	6.46-28.21	6.46-34.7
– p_{max} = 10 bar		[m^3/min]	–	33.2	44.0	–	43.4	–	6.18-25.06	61.8-30.5
– p_{max} = 13 bar		[m^3/min]	–	33.0	–	–	–	42.7	5.46-20.36	5.46-24.7
Drive motor										
Rated power		[kW]	200	250	315	250	315	355	160	200
Rated speed										
– 50 Hz		[min^{-1}]	3000	3000	3000	3000	3000	3000	–	–
– 60 Hz		[min^{-1}]	–	–	–	–	–	–	1800	1800
Protection type		IP	55	55	55	55	55	55	55	55
Design		IMB	35	35	35	35	35	35	35	35
ISO class			F	F	F	F	F	F	F	F
Electrical connection										
Mains voltage [1]		[V]	400	400	400	400	400	400	400	400
Frequency [1]		[Hz]	50	50	50	50	50	50	50	50
Min. fuse protection [2] [3]		[A]	500	630	630	630	630	800	400	500
Recommended fuse protection [2] [3]		[A]	500	630	630	630	630	800	400	500

[1] Standard equipment. Mains voltages and frequencies are specified on a plate in the switch cabinet.

[2] Only for 400 V / 50 Hz. The fuse values change in the case of other mains voltages and frequencies.

[3] Use fuse gL – gG or circuit-breaker with C-characteristic only.

SL 270...481 and SLF 221...271, part 2

Type			SL 270	SL 340	SL 430	SL 341	SL 431	SL 481	SLF 221	SLF 271
Oil filling quantities										
Oil receiver volume		[l]	23	230	230	230	230	230	230	230
Total oil filling quantity		[l]	130	130	130	113	113	113	130	130
Oil topping up quantity between min. + max.		[l]	20	20	20	20	20	20	20	20
Intake air temperature										
– min.		[°C]	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5
– max.		[°C]	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45
Air cooling	Cooling air requirement									
	– free-standing installation	[m^3/h]	56000	64000	64000	66000	66000	66000	48800	56000
	– with supply and exhaust (Hot air quantity)	[m^3/h]	28000	32000	32000	33000	33000	33000	24400	28000
	– free ventilator pressure	[Pa]	60	60	60	60	60	60	60	60
	– free ventilator pressure	[mm WC]	6	6	6	6	6	6	6	6
Water cooling – Series connection	Cooling air requirement									
	– free-standing installation	[m^3/h]	10000	10000	10000	10000	10000	10000	10000	10000
	– with supply and exhaust (Hot air quantity)	[m^3/h]	5000	5000	5000	5000	5000	5000	5000	5000
	Required cooling water quantity									
	– delta t = 15 K	[m^3/h]	10.900	13.600	13.600	13.600	13.600	13.600	8.72	10.900
	– delta t = 30 K	[m^3/h]	6.800	5.450	6.800	6.800	6.800	6.800	4.36	6.800
	Max. cooling water quantity	[m^3/h]	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
	Cooling water inlet temperature									
	– min.	[°C]	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5	+ 5
	– max.	[°C]	+ 30	+ 30	+ 30	+ 30	+ 30	+ 30	+ 30	+ 30
	Cooling water outlet temperature									
	– max.	[°C]	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45	+ 45
	Cooling water pressure									
	– min.	[bar]	2	2	2	2	2	2	2	2
	– max.	[bar]	10	10	10	10	10	10	10	10
Operating pressure transmitter [1] (factory settings)										
– p_{max} = 8 bar:	Switch-off press. p_{max}	[bar]	8	8	8	8	8	8	8	8
	Switch-on press. p_{min}	[bar]	7	7	7	7	7	7	7.8	7.8
– p_{max} = 10 bar:	Switch-off press. p_{max}	[bar]	10	10	10	10	10	10	10	10
	Switch-on press. p_{min}	[bar]	9	9	9	9	9	9	9.8	9.8
– p_{max} = 13 bar:	Switch-off press. p_{max}	[bar]	13	13	13	13	13	13	13	13
	Switch-on press. p_{min}	[bar]	12	12	12	12	12	12	12.8	12.8
Safety valve										
Activation pressure at:										
– p_{max} = 8 bar		[bar]	11	11	11	11	11	11	11	11
– p_{max} = 10 bar		[bar]	11	11	11	11	11	11	11	11
– p_{max} = 13 bar		[bar]	14	14	14	14	14	14	14	14

[1] Compressors for other operating pressures $p_{min} = p_{max} - 1$ bar.

2.2 Function description

Function principle of the air end

The air end operates according to the displacement principle. In the housing, the main and secondary screws are driven by means of an electric motor.

Both screws have screw-shaped profiles, intermeshing without contact. Together with the housing wall, these screws form chambers which gradually reduce in size, seen in air flow direction.

Rotation of the rotors causes the air taken in to be compressed to the final pressure in the chambers.

During compression oil is continuously injected into the air end. This having a cooling, sealing and lubricating function.

Air circuit

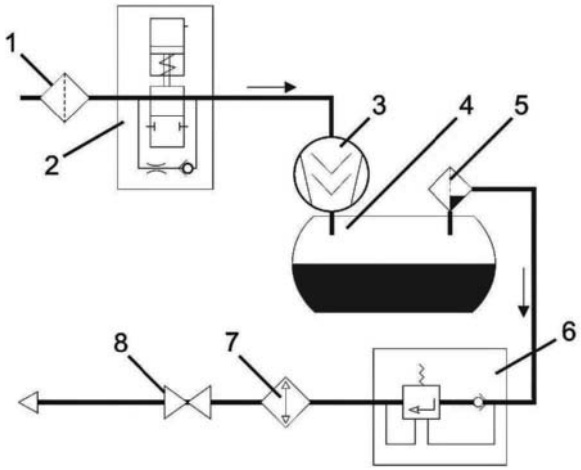


Fig. 2.1: Components of the air circuit

1 Intake filter
The intake filter cleans the air suctioned by the air end.

2 Intake regulator
The intake regulator opens (load operation) or closes (idling operation or standstill) the suction line depending on the operating condition of the compressor.

3 Air end
The air end compresses the suctioned air.

4 Compressed air/oil vessel
The compressed air separates from the oil under the force of gravity in the compressed air/oil vessel.

5 Oil separator
The oil separator separates the residual oil contained in the compressed air.

6 Minimum pressure check valve
The minimum pressure check valve does not open until the system pressure has increased to 3.5 bar. This causes a rapid build-up of the system pressure and ensures lubrication in the starting phase. Once the compressor has been switched off, the check valve prevents the compressed air from flowing back out of the mains line.

7 **Compressed air after-cooler (air or water cooled)**
The compressed air is cooled in the compressed air after-cooler, causing the water contained in the air to condensate.

8 **Stop valve**
The screw compressor may be isolated from the mains by means of the stop valve.

Oil circuit

The oil injected into the air end has the following function:

– It dissipates the compression heat (cooling).
– It seals the gaps between the screws and between the screws and housing.
– It lubricates the bearings.

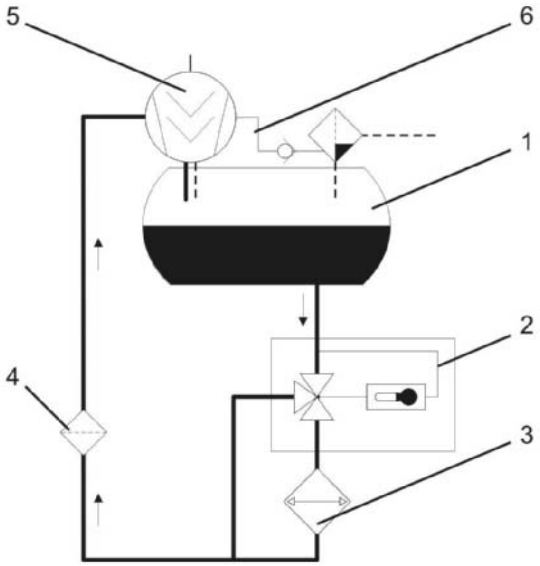


Fig. 2.2: Components of the oil circuit

1 **Compressed air/oil vessel**
The oil separated from the compressed air through the force of gravity collects in the compressed air/oil vessel. The system pressure forces it out of the receiver into the air end.

2 **Thermostatic oil control valve**
Depending on the oil temperature, the thermostatic oil control valve either allows the oil to pass through the oil cooler or through a bypass (e.g. in the starting phase).
Thus the oil constantly maintains its optimum operating temperature.

3 **Oil cooler (air or water cooled)**
The oil cooler cools down the hot oil to operating temperature.

4 **Oil filter**
The oil filter traps impurities in the oil.

5 **Air end**
The injected oil returns to the compressed air/oil vessel together with the compressed air. There, it is separated through the force of gravity.

6 **Drainage line**
The air end suctions the residual oil which collects in the oil separator back into the oil circuit via a drainage line.

2.3 Compressor control

Network pressure

For the compressor, the pressure downstream of the check valve is termed network pressure. The control system switches the compressor on and off during operation depending on the network pressure.

Operating states

All screw compressor controls are based on three basic operating states:

1. **Load operation**
   - The compressor delivers its maximum amount of compressed air.
   - It consumes its maximum energy.
2. **Idling operation**
   - The compressor runs but does not deliver any compressed air.
   - It consumes approx. 75% less energy than in load operation.
   - When compressed air is required, it switches to load operation without delay.
   - Idling operation reduces switching frequencies which can damage the drive motor, and reduces wear of the system.
3. **Standstill ready for operation**
   - The compressor is standing still but ready for operation.
   - When compressed air is required, it switches automatically to load operation.

Operating modes

The two most important operating modes are achieved by combining the three operating states:

1. **Intermittent operation**
   In intermittent operation the energy balance is perfect.
   - The compressor operates in load operation.
   - Upon reaching the switch-off pressure p_{max} the compressor switches to standstill. It does not consume any energy.
   - Once the pressure has dropped to the switch-on pressure p_{min} the compressor switches back to load operation.
2. **Continuous operation**
   Continuous operation limits the drive motor switching cycles and reduces wear to the system.
   - The compressor operates in load operation.
   - Upon reaching the switch-off pressure p_{max} the compressor switches to idling operation.
   - Once the pressure has dropped to the switch-on pressure p_{min} the compressor switches from idling operation back to load operation.

Short operating times

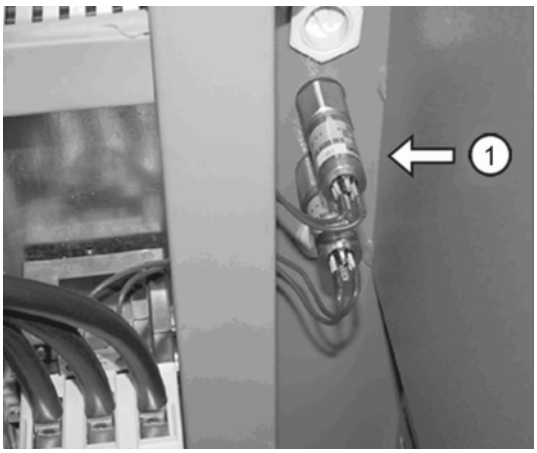
Attention!

During short operating times, the compressor does not reach its operating temperature. It operates below the dew point. The generated condensate mixes with the oil. The lubricating ability of the oil is reduced. This leads to damage on the air end. It is of utmost importance to consult BOGE, if you operate your system with short operating times.

2.4 Control devices

Operating pressure transmitter

The operating pressure transmitter (1) controls the operation of the compressor within the set switching limit.



Switch-on pressure p_{min}

If the net pressure drops to the set switch-on pressure p_{min}, the compressor switches on.

Switch-off pressure p_{max}

If the net pressure increases to the switch-off pressure p_{max}, the compressor either switches off (intermittent operation) or switches to idling operation (continuous operation).

Fig. 2.3: Operating pressure transmitter

Proportional controller (option) (not with SLF)

The proportional controller is an additional control device intervening in the sequences of the intake regulator.

The intake regulator only opens as far as necessary to supply the current compressed air requirement. Thus the compressor saves compression energy.

A compressor with proportional controller is able to supply its 'delivered quantity variable between 0% and 100%. However, the energy consumption does not reduce accordingly. Therefore, a control is only practical between 50% and 100% of the delivered quantity.

The proportional controller is factory set to a delivered quantity between 50% and 100% of the compressor capacity.

The proportional controller closes when the desired delivered quantity has dropped below 50% of the compressor capacity. The compressor then operates in idling operation (continuous operation) or switches off (intermittent operation).

2.5 Safety and monitoring devices

General

The safety devices guarantee a high degree of operational safety, in connection with the BOGE monitoring system.

When one of the safety devices responds, the control system reacts as follows:

– The compressor is immediately switched off.
– A flashing fault number in the left field of the display indicates the cause of the fault.

Caution: Risk of injury!

Do not operate the compressor without built-in safety devices!

Do not dismantle the safety devices or put them out of operation!

Safety temperature limiting device

The safety temperature limiting device switches the compressor off as soon as the max. permissible final compression temperature has been reached. A dropping below the minimum temperature prevents the compressor from starting.

– Switch off the compressor (OFF-button). Fault is acknowledged.
– Rectify the fault.
– Switch on the compressor (ON-button).

Safety valve

Safety valve (1) on the compressed air/oil vessel prevents the maximum admissible pressure being exceeded.

Fig. 2.4: Safety valve

Caution: Risk of injury!

When the maximum pressure is exceeded (e.g. incorrect setting of the operating pressure), the entire delivery volume of the compressor is ejected!

Monitoring the drive and fan motor

The following monitoring devices are standard for BOGE control systems:
The drive motor is monitored by PTC resistors.
The fan motor is monitored by overcurrent/overload release units.

Rotational direction monitoring (option)

The pressure switch checks the rotational direction of the drive motor each time the system starts up.

Safety pressure switch (option)

The safety pressure switch prevents the maximum admissible system pressure being exceeded. The switch-off pressure is below the response pressure of the safety valve.

System pressure build-up (option)

The system pressure build-up unit monitors the system pressure build-up when the compressor starts up.

2.6 Water cooling

Water cooling

BOGE screw compressors are available in water or air-cooled design.

In the standard version, the oil and compressed air after-coolers are connected in series on the water side. A parallel connection is possible as an option.

Serial connection

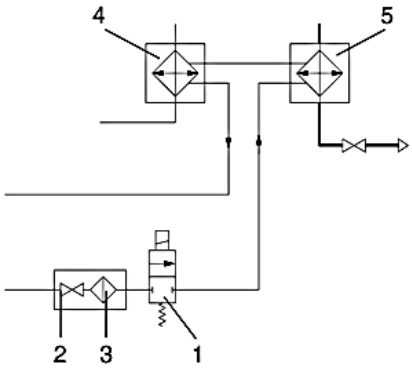


Fig. 2.5: Serial connection

Parallel connection

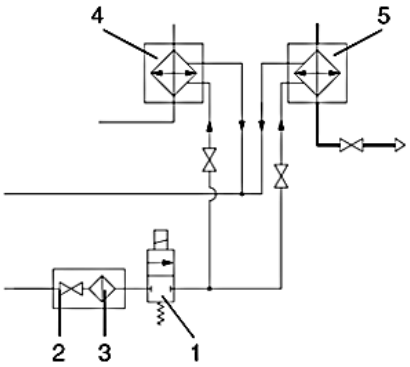


Fig. 2.6: Parallel connection

1 **Cooling water solenoid valve**
The cooling water solenoid valve closed the cooling water supply when the compressor switches off.

2 **Cooling water stop valve**
The compressor may be separated from the cooling water supply by means of the stop valve (e.g. for maintenance or repair work).

3 **Dirt trap (provided by customer)**
The dirt trap protects the cooling unit against sedimenting.
Pore size: max. 0.6 mm

4 **Oil cooling unit**

5 **Compressed air after-cooler**

The water cooling units are designed for specific standard cooling water quantities, temperatures and pressures (see „Technical data", page 11). For individually fluctuating values, they are designed according to the specified order data.

2.7 Cooling water

Water connection (for water cooling)

The cooling water must have the following properties:

Electrical conductivity	– > 50 µS/cm at pH value 7 – 9
Carbonate hardness ($CaCO_3$)	– < 16° dH
Cooling water pressure	– max. 10.0 bar
	– min. 2.0 bar
Cooling water inlet temperature	– min. + 5 °C
	– max. + 30 °C

Max. cooling water quantity see "Technical data".

Cooling water quality

The cooling units are fitted with nonferrous heat exchangers, as standard. To avoid damage to these components and to guarantee a long term function, ensure that the substances contained in the cooling water used do not exceed the following values.

Substances	Symbol	Max. admissible concentration [mg/l]
Ammonia	NH_3	2
Chloride < 70°C	Cl	100
Free chlorine	Cl	5
Iron	Fe	2
Free carbon dioxide	CO_2	20
Manganese	Mn	1
Nitrate	NO_3	100
Oxygen	O_2	2
Silicon oxide	SiO_2	8
Sulphate	SO_4	60
Totally diluted substances	TDS	600

Tab. 2.1: Maximum admissible concentration of the substances

Note!

If the specified limit values are exceeded, use cooling units made of other materials.

Please consult BOGE service.

Attention!

If the cooling water data changes, the cooling units may have to be redesigned. Incorrectly designed cooling units may cause malfunctions and the compressor to switch off!

Please consult BOGE.

3.1 Transport and storage

General

Please observe the generally accepted safety and accident prevention regulations when transporting the compressor. BOGE accepts no liability for damage caused by improper transport!

Attention!

The transport of the compressor may only be carried out by adequately instructed and authorized personnel!

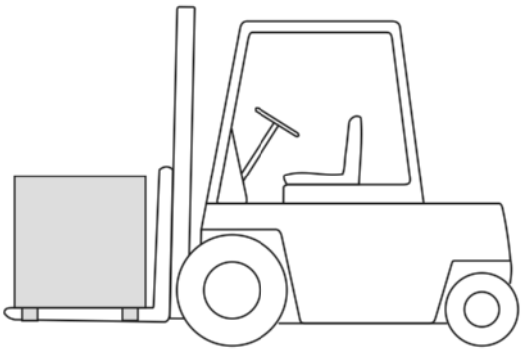
The capacity of the lifting gear (lifting cart or forklift truck) must correspond at least to that of the compressor (see Technical Data)!

Mind the position of the mass centre prior to lifting the compressor! The position of the mass centre is specified both in the attached dimensioned drawing and on the packing of the compressor.

The compressor is delivered filled with oil. Do not tilt during transport!

Transport possibilities

Forklift truck or lifting cart transport



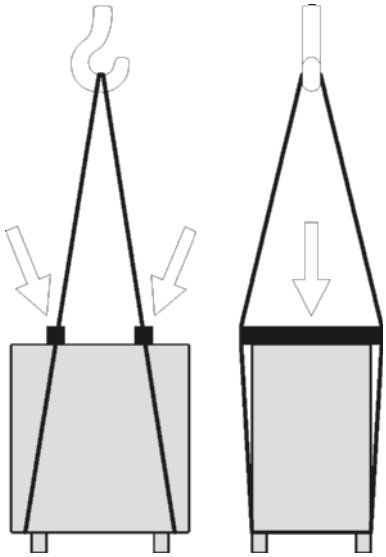
Ensure that the forks are underneath the base frame of the compressor (see illustration).

Fig. 3.1: Transport with forklift truck

Crane transport

Attention!

Do not subject the safety cladding to force during transport. Protect the compressor using wooden spacers (see arrows in the following illustration). Remove the transport timbers.



Only use suitable transport slings. Position the slings at the ends underneath the base frame of the compressor.

Fig. 3.2: Crane transport

Intermediate storage

In case the compressor is not installed immediately after delivery, it has to be stored at a sheltered location. It must be ensured that during the intermediate storage neither dust nor humidity can penetrate.

Note!

In case of an intermediate storage please observe the specifications and directions as to permissible environmental impacts (see chapter „3.2 Compressor room: Installation, maintenance conditions and application for compressed air receivers arranged below or separately“).

In case of a careless storage we assume no liability for consequent damages!

In the event of an extended intermediate storage you should consult BOGE-Service.

Please observe the directions for commissioning after an extended standstill (see chapter „3.5 Commissioning“) if the intermediate storage takes longer than two months.

3.2 Compressor room

Installation, maintenance conditions and application for compressed air receivers arranged below or separately

Caution!

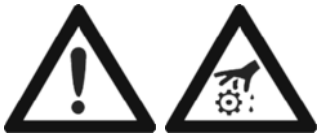
- Protect compressed air receivers against damage through mechanical effects (e.g. falling objects).
- Operate the compressed air receiver and its equipment from a safe location.
- Adhere to safety areas and safety clearances.
- Ensure that the compressed air receiver stands securely. It must not shift or tilt due to external forces. This also includes the additional weight during a pressure test!
- The compressed air receiver must **not** be bolted to the base.
- Ensure that the compressed air receiver is easily accessible from all sides (for recurring tests). For the necessary operating and maintenance areas have a look at the attached dimensioned drawings.
- Ensure that the factory label is clearly visible.
- Ensure that compressed air receivers are adequatly protected against corrosion.
- Only use the compressed air receiver for compressors operating with cut-in and cut-out mode if the pressure fluctuation range amounts to $\Delta p \leq 20\%$ of the maximum operating pressure.

Installation surface

A level industrial floor without foundation is adequate for the installation of the compressor. No special fastening elements are required.

Fire protection

The following applies to rooms in which compressors with oil injection cooling are to be installed:



Caution!

- For compressors with motor ratings **exceeding 40 kW**, ensure that the compressor room is equipped with special fire protection.
- Install compressors with motor ratings **exceeding 100 kW** in a separate fire protected room.

Requirements of fire protected compressor rooms:

- Walls, ceilings, floor and doors must be designed in **fire protection class F30** or higher.
- Flammable liquids must never be stored in the compressor room.
- The floor around the compressor must be made of non-flammable material.
- Leaking oil must not spread out over the floor.
- No inflammable materials must be located within a radius of at least 3 metres around the compressor.
- No inflammable machine parts, such as cable ducts, may run overhead of the compressor.

Sound protection

Only install compressors in workrooms if the sound pressure level of their measuring surfaces does not exceed 85 dB (A).

Caution: Risk of injury!

A sound pressure level above 80 dB (A) can cause permanent hearing damages to persons who constantly work in close proximity of the compressor!

These persons must wear ear protection when working in close proximity of the compressor.

Admissible environmental influences

The compressor room must be clean, dry, cool and free of dust.

Admissible ambient temperatures

Maximum ambient temperature (for air cooling):	+ 45°C
Minimum ambient temperature:	+ 5°C

Attention!

Nonobservance of the admissible ambient temperature may lead to the following problems:

- The compressor will switch off when the admissible final compression temperature is exceeded or gone below.
- Pipe lines and valves will freeze up at low temperatures.
- Damage due to reduced lubricating ability of the compressor oil.

Measures to be taken to ensure that admissible ambient temperatures are observed:

- Avoid any pipe lines or units radiating heat in the vicinity of the compressor, or insulate them well.
- Never install the compressor in the cooling air flow of other machines.
- Provide the supply air openings with adjustable louvres to ensure that the minimum temperature is not gone below in winter.
- Use of anti-freeze function (only in mode: Ready for operation)

Anti freeze protection

The compressor must be installed frost-protected. The BOGE anti-freeze device is a standard feature. It protects the safety devices from freezing up at ambient temperatures up to –10°C.

Ventilation

If the following instructions are not observed, the admissible final compression temperature may be exceeded. In this case, the compressor will switch off automatically.

Caution!

Arrange the compressor intake openings or ducts such, that dangerous admixtures (e.g. explosive or chemically unstable materials) cannot be drawn in.

Ventilation openings (free-standing installation)

– Arrange supply air openings close to the floor.
– Arrange exhaust air openings in the ceiling or at the top of the wall.
– The required cross sections for the supply openings (as well as for the flaps and weather protection grids) are indicated in the table.

Supply and exhaust air ducts

– Ensure that the flow rates in the ducts do not exceed 4 m/s.
– Never position cooling air ducts directly on the compressor. Always use a compensator to avoid distortion and the transfer of vibrations.

Ventilators

Ensure that the heated exhaust air is not taken in again.
If necessary, the heated air must be extracted by ventilators.

To ensure perfect cooling even at higher temperatures in the summer, the ventilators must be designed as follows:

– The ventilator capacity must be rated approx. 10...15% higher than the sum of the cooling air quantity required for all machines operated in the room (VDMA Code of Practice sheet 4363 „Ventilation of compressor rooms“).
– For free-standing installation, the cooling air requirement specified in the table corresponds to the required ventilator capacity.

Supply air filter

– Equip the compressor with supply air filter mats if the compressor room is contaminated with dust (option).

Cooling air requirement

Please refer to the following table for the cooling air requirement and size of the supply air openings for your compressor. Ensure that flaps and weather protection grids have the necessary free cross section. We generally recommend contacting a specialist company for performing the duct construction work and planning.

Type	Drive rating	**Air cooling**				**Water cooling** [1]	
		Cooling air requirement for free standing unit	Necessary inlet opening for free standing unit	Cooling air requirement for installation with ducting	Necessary free duct cross section	Cooling air requirement for free standing unit	Necessary inlet opening for free standing unit
	[kW]	[m³/h]	[m²]	[m³/h]	[m²]	[m³/h]	[m²]
SL 270	200	56.000	7	28.000	2.1	10.000	1.25
SL 340	250	66.000	8.3	33.000	2.4	10.000	1.25
SL 430	315	64.000	8.3	33.000	2.4	10.000	1.25
SL 341	250	66.000	8.3	33.000	2.4	10.000	1.25
SL 431	315	66.000	8.3	33.000	2.4	10.000	1.25
SL 481	355	66.000	8.3	33.000	2.4	10.000	1.25
SLF 221	160	48.800	6.1	24.400	1.8	9.000	0.37
SLF 271	200	56.000	7.1	28.000	2.06	10.000	0.37

[1] For the cooling air requirements the basis is a + 4°C temperature difference between room and outside temperature.

Tab. 3.1: Cooling air requirement, necessary aperture dimensions

Ventilation possibilities

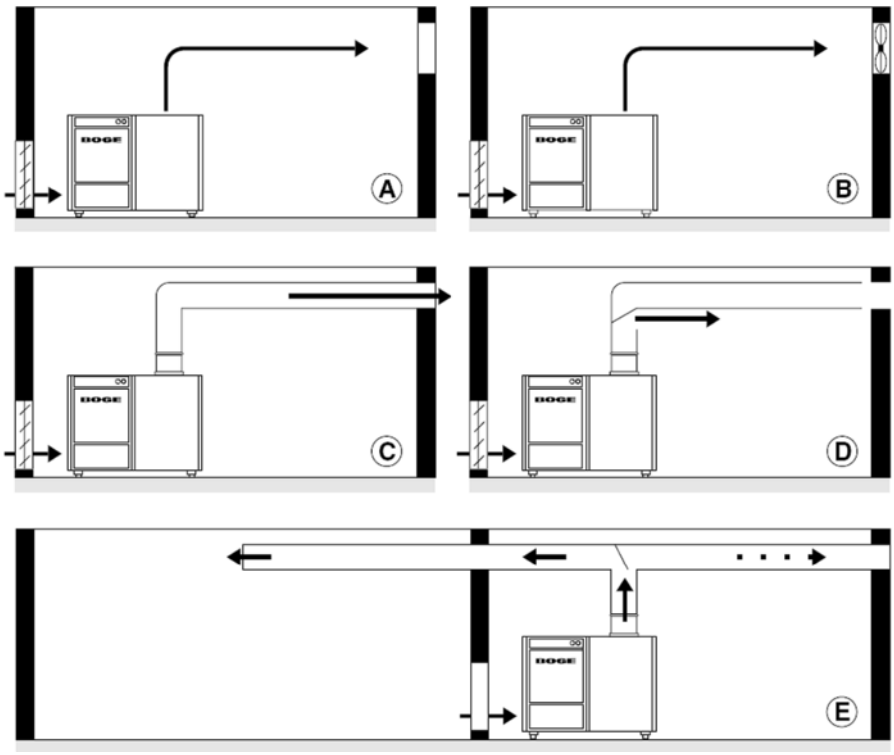


Fig. 3.3: Ventilation possibilities

A Supply and exhaust air openings in the outside walls (free-standing installation)

B Supported by exhaust air ventilator

C Exhaust air duct into the open

D Exhaust air duct with recirculation flap
Hot exhaust air is mixed with the cold ambient air, as required. Thus preventing the plant from freezing up at temperatures below freezing.

E Using the hot exhaust air for heating
In the winter, the hot exhaust air is used for room heating. In summer it is directed into the open.

Condensate disposal

The air taken in contains water in form of vapour, which turns into condensation during compression.

Attention!

The condensate contains oil. Never lead it into the public sewage system without prior treatment.
Pay attention to the pertaining rules and regulations of your local authorities.

Oil / water separator

The **BOGE oil / water separator** separates the oil from the condensate.
The cleaned water may be fed directly into the public sewage system.
The oil is collected in a separate container. Dispose of the oil according to environmental regulations.
If, due to special operating conditions, the oil should emulsify, use an emulsion cracking plant.

3.3 Assembly

General

BOGE compressor units are supplied ready for connection. Only the work described in the following paragraphs needs to be carried out during the assembly.

Caution!

Only have the installation work carried out by appropriately trained persons or specialists.

Lay out all energy supply lines in a trip-proof and barrier-free manner so that potential accidents can be avoided!

Prior to delivery, each compressor is subjected to a trail run at the factory. It is carefully tested and set. However, possible transport damage cannot be excluded.

– Please inspect the compressor immediately after delivery and direct damage claims to the last haulier – even when the packing is not damaged! To safeguard claims against the haulier we recommend leaving the machine, devices and packing material in the same condition as they were in when the damage was detected.
– Prior to commissioning, check the compressor for external damage.
– Observe the compressor very closely during commissioning and the following trial run.
– If malfunctions occur, switch off the compressor immediately and inform the BOGE-Service.

Checking the delivery scope

The delivery scope depends on your order.
Prior to commissioning, please check whether all required parts have been provided. Please check the order confirmation for any possible accessory equipment.

The delivery scope includes the following component parts:

- Operating instructions
- Keys
- Electric circuit diagram (in the compartment of the switch cabinet)
- List of electrical equipment (in the compartment of the switch cabinet)

Installing the compressor

- Remove the packing material on and in the compressor.
- Install compressor and align horizontally. The compressor must stand firmly on the ground on all feet.

Connecting the compressor to the compressed air network

- Connect the compressor to the compressed air network or a compressed air receiver.
  For this, use a BOGE high pressure hose.

Note!

Do not install a check valve in the pressure line.

The compressor is already equipped with a check valve.

Connecting the cooling water (option)

Caution: Risk of injury!

Risk of injury due to pressurized water when connecting the cooling water system!

Close external water mains prior to connection!

The connection may only be carried out by authorized qualified personnel!

The pipework for the cooling water circuit in the compressor is completely installed at the factory.

Only the following work must be performed during installation:

- Check, whether the water supply has the required data and whether the cooling water quality is adequate (see "Cooling water quality").
- Connect the cooling water supply and discharge line to the water supply.

The following component parts must be provided by the customer for cooling water installation:

– **Dirt traps**
  The dirt trap at the cooling water inlet protects the cooling units against sediment collecting. Pore width: max. 0.6 mm
– **Expansion vessel and safety valve**

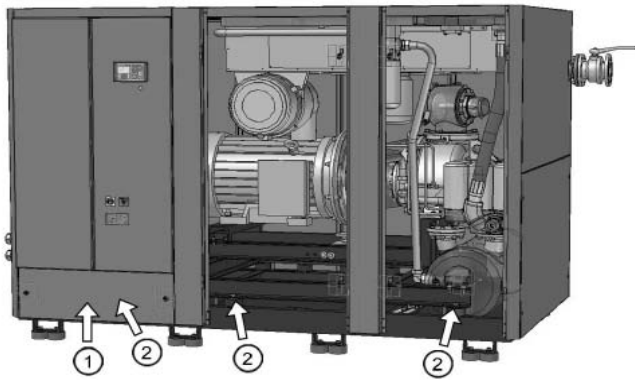
Attention!

If the stop valves in the supply and discharge lines are simultaneously closed in a closed cooling system, an enclosed room will result. If the water heats up in this room, it will expand and the pressure will increase.

Install an **expansion vessel** and a **safety valve** to prevent damage to the cooling units.

Removing the transport securing devices

The frame of the drive unit is bolted to the basic frame for transport.



Open flap (1).

Remove the four red marked screws (2) (two of each on the longitudinal side) together with the space collars.

Fig. 3.4: Removing the transport securing devices

Checking the oil level

BOGE compressors are supplied with a complete oil filling.

Prior to commissioning/start up, check the oil level as described in chapter "Maintenance".

3.4 Electrical connection

Caution: Voltage!

Ensure that work on the electrical equipment of the compressor is only carried out by authorized electricians.

When connecting to the power supply, observe the valid VDE, DIN and EVU regulations or the local safety regulations.

Also observe the regulations of your local power supply company regarding the load rating of your power supply.

Mains disconnecting device

According to accident prevention regulation VBG 5, § 12, the customer is responsible to provide the following safety measures:

Compressor plants having a drive motor larger than 3 kW and current intensities larger than 16 amperes have to be equipped with a mains disconnecting device according to DIN EN 60204-1:2007.

Please refer to the "Technical data" for the design and fuse rating.

Rated voltage

The data of your mains (operating voltage, control voltage, type of current, frequency, ...) must coincide with the data on the type plate on the switch cabinet.

In the event of deviations, please contact the BOGE service or your supplier.

Connecting the leads

– Check to ensure that all terminals in the switch cabinet are firmly tightened.
  If necessary, retighten the screw connections.
– Guide the lead cable through the PG screw connection.
– Connect the leads L1, L2, L3, N, Pe (PEN) firmly to the power supply terminal.
  A clockwise rotational field must be created.
– Retighten the electrical connections after the first 50 operating hours.

Drive with frequency converter

Caution: Voltage!

According to operational conditions electrical drive systems with frequency converter may have an earth leakage current above 10 mA.

Therefore the required precautions according to DIN EN 60204-1:2007 and DIN EN 50178:1998 have to be applied as soon as the compressor is electrically connected.

A permanently installed connection is required.

One or several of the following qualifications for the protective-conductor system have to be fulfilled:

1. The protective conductor must have a minimum cross section of 10 mm^2 Cu along its total length.
2. If the protective conductor has a minimum cross section of less than 10 mm^2 Cu, a second conductor with at least the same cross section has to be provided up to the point from where the protective conductor has a minimum cross section of more than 10 mm^2.
3. Automatic interruption of the supply if the continuity of the protective conductor is lost.

Please observe any additional national rules and regulations.

Caution: Risk of injury!

Prior to any work on the compressor:

– Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.
– Check to ensure that all conducting machine parts are voltage free.
– Depressurize all areas under pressure.

Never omit a single safety step! Otherwise, you will risk injuries due to restarting, electric shock or self-releasing parts.

Caution!

When the automatic restart (Auto-Restart) is activated, the compressor will start automatically following a voltage loss.

Prerequisite: The net pressure is lower than the set switch-on pressure.

3.5 Commissioning

Note!

We recommend the drawing up of a commissioning certificate in which the test results during the commissioning process can be listed up.

Caution: Risk of injury!

The commissioning may only be carried out by experienced and authorized qualified personnel!

Always wear protective gloves when working on the compressor to avoid bruising of fingers or hands while opening or closing components!

Check installation requirements

Attention!

Make sure that the compressor is installed according to the installation requirements!

Prior to starting the compressor for the first time, check if the transport securing device was duly removed (see chapter „3.3 Assembly“)!

List up the test results in the commissioning certificate.

Check rotational direction of drive and fan motor

Attention!

Always check the rotational direction of the drive and fan motor prior to commissioning/initial start up.

Even brief operation in the wrong direction of rotation (more than approx. 5 seconds) may cause total destruction of the air end!

List up the test results in the commissioning certificate.

Caution!

Ensure that the rotational direction coincides with the rotational direction arrow on the air end.

– Close mains disconnecting device.
– Switch the compressor on and immediately off again to check the rotational direction.

Changing the rotational direction

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

– Interchange two phases (L1, L2 or L3) in the power cable.

Check compressed air outlet for tightness

Caution: Risk of injury!

Work on the compressed air system may only be carried out by experienced and authorized qualified personnel!

Always wear protective clothing and goggles!

Immediately after having switched on the machine the connection of the compressed air outlet must be checked for tightness!

Make sure to observe an appropriate safety distance during the inspection!

– Close mains disconnecting device.
– To conduct the inspection switch on the compressor and check the compressed air outlet for tightness.
– Switch off compressor.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

– If necessary, have leakages repaired by skilled qualified pesonnel.

List up the test results in the commissioning certificate.

Opening the stop valve

Open ball valve on the compressor delivery.

In case of water cooling: Open stop valve at the water supply.

Checking for leaks

Caution: Risk of injury!

In case of leakages in the oil circuit there is a certain danger to slip and fall because of oil or water spills!

Have all connections of the oil or water cooling circuit checked for leakages by authorized qualified personnel!

During the inspection slip-resistant safety shoes and protective clothing are obligatory!

Undertake the following to prevent leaks:

– Check screw connection of the lines and retighten, if necessary.
– Check to ensure that the oil filter and oil separator are hand tight seated.

Conduct trial run

Close mains disconnecting device.

– Switch on the compressor using the ON key. The compressor starts.
– When the factory-set switch-off pressure is reached, the compressor cuts off automatically.
– Check network pressure on control display or netpressure manometer. If necessary, reset operating pressure (pressure target value).
– The compressor is ready for operation.
– For control function see control display.

Switch off the compressor after a trial run of several hours under maximum load.

List up the test results in the commissioning certificate.

Commissioning following extended stoppages

If an extended stoppage is scheduled, you should contact BOGE-Service beforehand.

Following an extended stoppage of more than 2 months, fill a small amount of oil in the suction controller prior to starting the compressor!

Attention!

Only fill the suction controller with the grade of oil used to operate the compressor.

Never mix different oil grades and brands.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

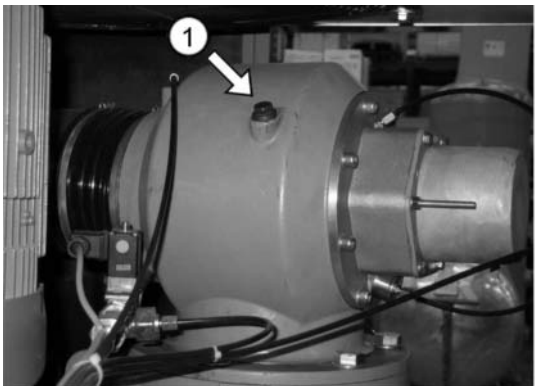


Fig. 3.5: Suction controller

– Unscrew plug from the suction controller (1).
– Fill approx. 10 l compressor oil into the suction controller.
– Screw in the plug again.
– **Turn compressor stage at the coupling by hand 5- to 10 times to spread the oil evenly.**

3.6 Dismantling

Note!

To avoid dangers when dismantling the compressor please consult your BOGE Service:

Telephone: +49 5206 601-0

Caution!

Dismantling of the compressor may only be carried out by experienced and authorized qualified personnel!

Make also sure to observe all information in the attached operation instructions as to a safe dismantling of the refrigeration compressed air dryer and a secure disposal of the refrigerant!

Caution: Voltage!

All work on the electrical installation may only be carried out by authorized and skilled electricians!

Prior to starting the work the power cable to the switch cabinet must be disconnected from the mains and secured against unintentional switching on!

4.1 General

The tables on the following pages give information on the possible causes of operating faults and measures for their rectification (please also refer to operating instructions of the compressor control).

Caution!

Ensure that any work required to rectify faults is only carried out by trained personnel or specialists.

Ensure that components which have a safety function are only set, repaired or exchanged by BOGE Service!

Please contact BOGE-Service at the following telephone number, if you have any questions.

Telephone: +49 5206 601-0

Caution: Voltage!

Prior to any work required to rectify faults:

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

Self-monitoring of controls

All programmed data are saved in a memory module (EEPROM) which can be electrically written on and erased again.

If an error occurs when the saved data in the EEPROM are read the control reacts as follows:

– The compressor is switched off.

– The corresponding fault message is displayed

In this connection we refer to the separate BOGE compressor control operating instructions.

4.2 General faults

Fault	Possible cause	Rectification
No quantity delivered, no pressure build-up, max. pressure 0.5 bar	System components in the compressor are leaking	Check oil and compressed air lines inside the compressor; tighten and/or reseal screw connections, if necessary
	Minimum pressure valve is defective	Close ball valve and check whether pressure builds up; if so, open ball valve again immediately; replace minimum pressure valve
	Electromagnetic venting valve does not close	Check solenoid valve and replace, if necessary
	Suction controller does not open	Suction controller or solenoid valve is defective; check and replace, if necessary

Fault	Possible cause	Rectification
Compressor system does not start up 	No electric power to compressor	Check electrical connection
	Fuses are defective	Check the mains and control fuses, replace if necessary
	Machine has not vented perfectly	Check venting valve and replace, if necessary
	Voltage fluctuations in the electrical mains power	Ensure constant voltage in accordance with IEC 38
	Compressor oil is very viscous due to low ambient temperature	Heat up the compressor system (additional heater available as an option)
Oil in suction filter 	Minimum pressure non-return valve is leaking	Check the minimum pressure check valve and replace, if necessary
	Suction controller is leaking	Check the suction controller and replace, if necessary
Excessive oil consumption 	Drain line is blocked	Dismantle and clean drain line
	Defective oil separator element	Check oil separator and replace, if necessary
	Excessive oil filling	Drain off oil
Safety valve blows 	Operating pressure target value maladjusted	Set operating pressure to maximum permissible pressure of the screw compressor
	Defective safety valve	Replace safety valve
System pressure does not decrease when switching off 	Venting valve does not open	Check venting valve and replace, if necessary
	Check valve is leaking	Examine check valve and replace, if necessary

5.1 BOGE-Duotherm BPT

Function

The heat recovery system **BOGE-Duotherm BPT** utilizes the heat energy released during compression to produce warm water free of charge (e.g. for production systems or to supply a heater).

The plate heat exchanger is connected in the main stream of the hot oil. It comprises of stainless steel plates which are soldered together. These form two separate duct systems. Compressor oil and water run through these ducts with opposing flow directions. The hot oil transfers its heat to the colder water via the plates.

Assembly

As a rule, the plate heat exchanger is installed into the compressor at the factory and comes equipped with all necessary pipework. Only the following work is required during assembly:

– Connect the supply and discharge water lines to the pipeline mains.
  Route the pipelines to prevent transmission of stresses / tension and vibrations to the heat exchanger.
– Provide venting and draining facilities.

The customer must provide the following components for assembly:

– Stop valves
  Stop valves in the water supply and discharge lines enable simple removal of the heat exchanger.
– Expansion vessel and safety valve.

Attention!

If the stop valves in the water supply and discharge lines are closed simultaneously, an enclosed space is created. If the water in this space is heated, it expands and the pressure increases.

Therefore, an expansion vessel and safety valve must be installed to avoid damage to the plate heat exchanger.

– Dirt trap (pore size: max. 0.6 mm)
  The dirt trap at the water inlet protects the plate heat exchanger against dirt deposits in the event of a high degree of water contamination.
– Flushing connections
  The flushing connections serve to clean the plate heat exchanger.

Separate installation

The plate heat exchanger may also be separately installed or retrofitted by the customer.

Normally, the plate heat exchanger is held in place by the pipelines. However, when installing larger types, the customer may have to provide a bracket.

Commissioning

Proceed as follows during commissioning:

– Check oil level in the oil circuit. If necessary, top up oil.
– Slowly open the stop valves in the water supply and discharge line.
– Avoid pressure hammers!
– Vent the pipelines.

Maintenance

Lime, oxides as well as grease or oil will deposit in the ducts of the plate heat exchanger during operation.
Regular cleaning will prevent thick deposits clogging individual ducts of the plate heat exchanger.

Cleaning intervals

Excessively soiled and limy water:	6 months
Moderately soiled water, surface water:	1 year
Lightly soiled water:	3 years

Recommended cleaning agents

Grease or oil deposits:	paraffin
Oxide or lime deposits:	formic acid, acetic acid or citric acid

Attention!
Always observe the instructions of the cleaning agent manufacturer!

Cleaning methods

Flushing:

– First close all stop valves in the supply lines.
– Close all stop valves in the discharge lines.
– Wait until the plate heat exchanger has cooled down.
– Open the flushing connections and drain the plate heat exchanger.
– Flush the plate heat exchangers.
  For this purpose, pump one of the above mentioned cleaning agents through the plate heat exchangers for an extended period of time.
– After flushing, rinse the plate heat exchanger thoroughly with water (e.g. using a high pressure hose).

Enhance the cleaning action by the following measures:

– Use a larger mass flow rate than for standard operation.
– Flush the cleaning agent through the plate heat exchanger in opposite direction to standard operation.

Allow to react (tenacious soiling):

– Dismantle plate heat exchanger.
– Fill plate heat exchanger with one of the above mentioned cleaning agents.

– Allow the cleaning agent to act for at least six hours.
  Point the connection upward to allow gases to escape.
– After cleaning, rinse the plate heat exchanger thoroughly with water (e.g. using a high pressure hose).

Note!

If the cleaning measures specified above are not sufficient, you should have the exchanger cleaned by a service company. Boge service will recommend contracting firms on request.

5.2 BOGE-Duotherm BSW

Function

The safety heat exchanger **BOGE-Duotherm-Plus BSW** is approved for drinking water. It is connected in the main stream of the hot compressor oil. The additional safety feature in comparison to the plate heat exchanger is provided through the following measures:

– **Separation of the circuits**
  For this heat exchanger, the oil and water circuits are completely separated by a barrier liquid.
  The barrier liquid transmits the heat. In the event of heat exchanger damage it prevents oil and water from mixing. Thus, contamination of the drinking water is excluded.
– **Pressure monitor**
  A pressure monitor responds immediately to a pipe rupture within the system, emitting a pulse which can be individually processed (e.g. alarm, switching off the system).

Note!

Set the pressure to a value at least 20% lower than the minimum pressure of the media used.

Operating conditions

Minimum water pressure:	0.5 bar
Maximum water pressure:	16 bar
Maximum oil pressure:	16 bar
Maximum pressure of the barrier liquid:	10 bar
Maximum temperature (oil and water):	100 °C

Note!

Exceeding the maximum temperature will lead to malfunctions.
A fault alarm is triggered.

Commissioning

– Check the oil level in the oil circuit.
– Slowly open the valves on the water side.
  Avoid pressure hammers!
– Vent the pipelines.
– Any residual air contained in the heat exchanger will be carried along by the respective medium and escapes via the system.

Maintenance

The safety circuit including pressure monitor and compensation vessel forms an enclosed, maintenance-free system.

Attention!

Do not open the system under any circumstances.
Opening the system will put the operation and safety of the heat exchanger at risk!

If barrier liquid escapes due to damage, send the heat exchanger to BOGE for repair.

6.1 Safety instructions

Caution!

Ensure that maintenance work is only carried out by specialists or appropriately trained person.

– Prior to starting any maintenance work, always stop the compressor as described in these operating instructions prior to removing any cladding or safety devices. Refit the cladding or safety devices immediately upon completion of the maintenance work.
– Heavy components may only be lifted up by various persons in due consideration of the local industrial safety regulations.
– Only use original spare parts, compressor oils and operating materials released by BOGE for the maintenance work.
– With an activated automatic restart (Auto-Restart) the compressor may restart automatically after a voltage failure.
  Prerequisite: The net pressure is lower than the set switch-on pressure.

Caution: Risk of injury!

Always adhere to the prescribed operating method described below for all maintenance work. Never omit a single safety step!

Otherwise you will risk injury from restarting, electric shock or parts which may fly off.

Prior to all maintenance work:

1. Switch off the compressor using the OFF button.
2. Press Emergency Stop button.
3. Open mains disconnection device and secure against unintentional switch on by means of a padlock.
4. Fix a warning label to the control and fill in the name of the person responsible who is authorized to switch on the machine again.
5. Check to ensure that all machine elements are definitely currentless.
6. Prior to starting work let cool down all hot components of the compressor to 50°C.
7. Separate the compressor from the compressed air network by closing the ball valve at the compressed air outlet.
8. Vent the compressor.
   To this effect open the safety valve on the combined compressed air-oil receiver as follows:
   – Turn the knurled nut counterclockwise until you can feel a resilient resistance.
   – Turn the knurled nut a little further.
     Any possibly existing air will escape.
     The system pressure gauge will indicate a pressure of 0 bar.
   – Once the residual air has completely escaped from the system, firmly retighten the knurled nut.
9. Remove all safety cladding necessary to perform the maintenance work.

Once the maintenance work has been concluded:

10. Reattach all removed safety cladding.
11. Open the ball valve at the compressed air outlet.
12. Prior to switching on again, check whether anyone else is working on the compressor.
13. Remove warning sign not until then and release power disconnecting device.
14. Unlock Emergency Stop button.

6.2 General

Maintenance through BOGE service

Have BOGE service check your compressor every 3,000 operating hours or annually.

Note!

Maintenance agreement!

Enter into a maintenance agreement with BOGE.

BOGE service will carry out the proper maintenance on your compressor at regular intervals. This guarantees maximum safety and realiability of your compressed air supply.

Review of regular maintenance work

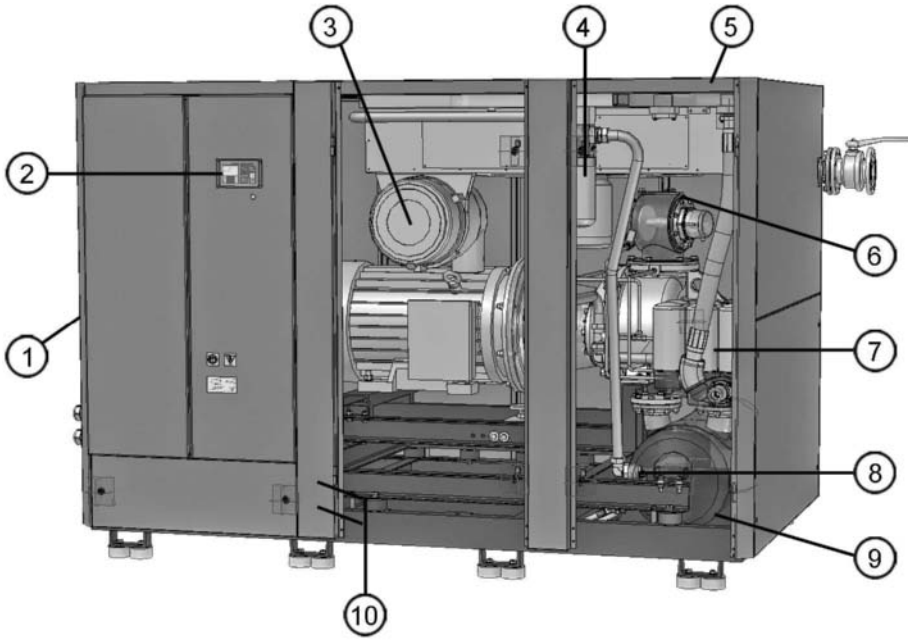


Fig. 6.1: Review of regular maintenance work

1 Change supply air filter (on the front side, option)
2 Check / set pressure sensor
3 Check suction filter
  – Clean filter and cartridge
  – Change filter cartridge
4 Change oil filter
5 Clean compressed air/oil cooler externally
6 Top up oil in the suction controller after an extended down time
7 Change oil separator
8 – Check oil level
  – Top up oil
9 Oil change
10 (Lubricate motor bearings, A and B side)

Maintenance intervals

The maintenance intervals specified in the table are based on average operating and ambient conditions.

Extreme conditions may require shorter maintenance intervals.

Note!

Note down any maintenance work in the table on the last page. This will facilitate trouble shooting for BOGE service.

Attention!

Check monthly if all screw connections on the compressor are fully tightened.

Oil change:

Please change oil and replace oil filter and nozzle with dirt catch after the first 500 operating hours!

Maintenance work	Maintenance intervals in operating hours [1]					Page
	weekly, monthly	1,000 annually	1,500 annually	3,000 annually	9,000 every 2 years	
General maintenance work						
Check final compression temperature (set point value: 70...100°C)	w					Control
Check compressor for leaks				X		–
Check system relief on system pressure gauge (22) (set point value 0...1.5 bar)	w					Control
Check function of Emergency-Stop button	m					Control
Check and if necess. change supply air filter (option)	w					51
Clean oil cooler			X			63
Check if electrical connections are tightened			X			–
Air circuit						
Check and if necessary change suction filter	m					50
Change suction filter cartridge				X		51
Check / reset operating pressure sensor				X		Control
Check safety valve				X		65
Replace minimum pressure valve (wearing parts set)				X		–
Replace suction controller (wearing parts set)					X	–
Replace solenoid valve					X	–
Oil circuit						
Check oil level and top up as required [2]		X				54
Change oil separator [2]				X		58
Change oil filter [2]				X		56
Change oil [2]					X	59
Replace oil regulator (wearing parts set)				X		–
Replace nozzle with dirt catch				X		–
Drive						
Lubricate drive motor bearings	See data on type plate of drive motor!					
Replace grease in motor bearings	Depending on mains frequency: 50 Hz 10,000 operating hours 60 Hz 8,000 operating hours					

[1] If the compressor is not often used, undertake the maintenance according to the specified intervals (weekly/monthly/annually) irrespective the number of operating hours.

[2] The specified intervals only apply when BOGE compressor oil Syprem 8000 S is used! The service life may differ depending on the ambient temperature. In this case have the oil analyzed by your BOGE service!

Tab. 6.1: Maintenance intervals

General information concerning the lubricants used

Caution: Risk of injury!

Oil presents a potential danger to health and environment due to their additives.

- Avoid contact with skin and eyes.
  Wear protective gloves made of resistant synthetic material.
  Wash yourself thoroughly after contact with oils.
- Do not inhale the fumes or mist.
- Protect your environment.
  Ensure that no oil is spilt.
- Do not eat or drink when working with oil!
- Fire, naked flames and smoking is strictly prohibited when handling oil.

Please take notice of the directions in the corresponding safety data sheet!

We recommend using only oil according to following specification:

- Viscosity range of 55 mm²/s at 40°C.
- Minimum viscosity at 100°C of 8 mm²/s.
- Maximum viscosity at 0°C of 1,000 mm²/s.
- Comply to FZG test acc. to DIN 51 354 with failure load stage 10.
- (Test Method A/8,3/90 min 10).
- Excellent oxidation stability: Meets requirements of Pneurop oxidation test.
- Antifoam – additives.
- Additives to prevent residue formation.
- Compatibility with all used sealing materials like Neoprene, FPM, PTFE, FKM (Viton) and acrylic and epoxy resin paints.
- Flash point > 230°C.
- Additives for excellent demulsifying properties.
- Additives for corrosion protection of metallic surfaces.
- Excellent oxidation stability: Rotating bomb oxidation Test (ASTM D 2272) higher than 2,400 minutes.
- Meets VDL requirements DIN 51 506 for lube oils (including Pneurop test).
- Or you use BOGE compressor oil **Syprem 8000 S.** The stated maintenance intervals refer to the use of **Syprem 8000 S** only.
- **Syprem 8000 S** can be purchased from BOGE retailers.
- Never mix different oil types and brands.
  The additives may be incompatible. It may lead to foam formation, premature aging or loss of lubricating ability.

Disposal of used operating material

Attention!

The handling and disposal of mineral oils is subject to legal regulations. It is an offense not to ensure correct and safe disposal of old oil!

Please instruct one of the known service companies to dispose of used operating materials or deliver them to an authorized disposal point.

Observe the following points when disposing of old oil:

– Never mix the oil with other material or liquids.
– Used oil filters and oil separator cartridges require special waste treatment and must be kept separate from normal waste!

Pressure hoses

Caution!

Risk of injury and damage to compressor due to obsolete pressure hoses!

Never use pressure hoses beyond the prescribed service life!

Check hoses and connections regularly for leakages!
Check the service life of the hoses and replace them in due time!

As replacement only use original spare parts released by BOGE!

Used pressure hoses are not permitted as a replacement!

Spare and wearing parts

Caution!

Only use original spare parts, compressor oils and operating materials released by BOGE for repair and maintenance work.

BOGE is not liable for any damage resulting from the use of other spare parts or operating materials.

Attention!

If the nozzle with dirt catch is soiled the oil consumption may increase significantly!

6.3 Regular maintenance work

Clean or change suction filter

Cleaning:

– 1x monthly, however, at least every 500 operating hours.
– Correspondingly earlier if the air taken in is heavily soiled.

Change:

– In the event of damage.
– After the second cleaning.

Switch off the compressor with the OFF button.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

Removing the filter cartridge

– Remove cladding on the maintenance side.
– Remove lid (1) of the filter housing.
– Loosen nut (3) and remove filter cartridge (2).

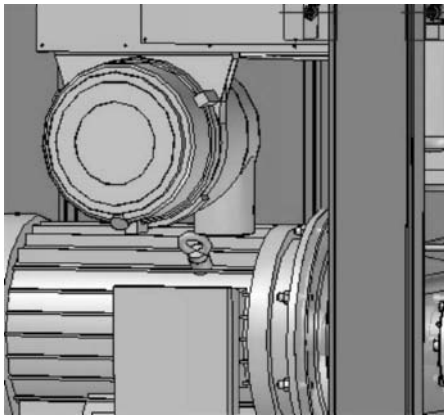


Fig. 6.2: Changing the suction filter

Cleaning the filter cartridge

Attention!

Do not clean filter cartridges in liquids.

Do not use any hard objects when cleaning to avoid damaging the filter paper.

Refit a new filter cartridge in the event of damage or when it has been cleaned twice.

– Hit on the filter cartridge using the palm of your hand to knock out coarse dust.
– Blow out fine dust **from the inside to the outside** using dry compressed air (maximum pressure 5 bar).
– Clean the sealing surface of the filter cartridge.

Fitting a filter cartridge

– Insert filter cartridge into the filter housing.
– Tighten nut.
– Attach lid of the filter housing.
– Attach cladding on the maintenance side.

Changing the supply air filter mats (option)

Check:

– 1x weekly,
however, at least every 500 operating hours.
– Correspondingly earlier if the air taken in is heavily soiled.

Change:

– When a crust of dirt has accumulated on the filter mat.
– When the final compression temperature has exceeded its set point value by 4 to 5°C.
The crust of dirt on the filter mat prevents an adequate cooling air supply.

– Switch off the compressor using the OFF button.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

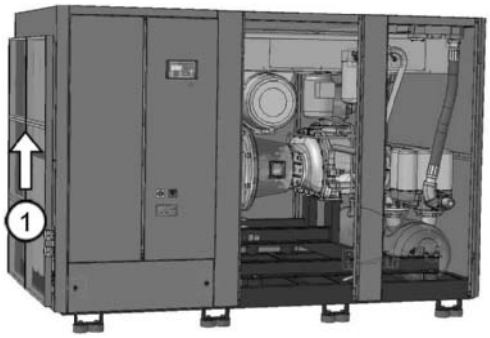


Fig. 6.3: Changing the supply air filter

– Pull filter mat (1) out of its holder from above.
– Insert new filter mat into the holder.

Lubricate drive motor bearings

As a rule, the bearings of the drive motors are provided with a maintenance free **permanent lubrication**. Drive motors of some compressor series are equipped with a **relubrication device**.

These motors are easily recognised by the two grease nipples on the top of the cover. Additionally signs on the compressor draw attention to the kind of motor lubrication.

Drive motors with permanent lubrication

Under normal operating conditions (refrigerant temperature max. 40°C, continous operation) the bearings are maintenance free for the service life.

Mains frequency	Operating hours (Oh)
50 Hz	10,000
60 Hz	8,000

Tab. 6.2: Service life of bearings

The service lives specified above are extended or shortened in the event of higher or lower thermal stress (due to the higher or lower temperature of the refrigerant).

Attention!

The bearings must be replaced by BOGE-service after their service life has expired.

Drive motors with lubrication device

Motors with lubricating devices are easily recognised by the two grease nipples on the top of the cover. Additionally stickers on the compressor refer to the lubricating device. Please check which motor is installed in your compressor and service it according to the respective instructions. Lubricate the bearings of the drive motor at the prescribed intervals so as not to sustain damage due to lack of lubricant.

Caution: Risk of injury!

Always exercise great caution when lubricating the bearings with the compressor running and observe all safety precautions! Never put your hand in the area of the fan wheel. Fitted safety devices and cladding may not be removed.

Attention!

Always use the same type of grease for lubrication. The lubricating ability can be sharply reduced if different types of greases are mixed.

If you intend to use a different type of grease:

– Have the bearings removed and thoroughly cleaned prior to filling with new grease.

Please always observe the specified lubrication intervals and quantities of grease.

Over-greasing and an excess of lubricant can also destroy the bearings.

On motors with lubrication devices, regular greasing forms part of the scope of maintenance. The lubrication intervals, quantity and type of grease are given on the type plate or a separate plate. For lubrication, the required quantity is pressed through the nipple into the bearing with a grease gun while the compressor is running.

Fig. 6.4: Grease nipples of the lubrication device

Checking the oil level, topping up oil

Check:

– Prior to commissioning / start-up of the compressor.
– Then every 1,000 operating hours, however at least once a year.

Topping up:

– When the oil level has dropped below the "min." mark (see sketch).

Attention!

Always use the same oil type when topping up. Never mix different oil types and brands.

– Switch off the compressor using the OFF button.

Series SL 270 / SL 340 / SL 430 / SLF 221

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

– Close ball valve at the compressed air outlet.
– Vent the compressor (as described in the beginning of the chapter). The system pressure gauge must indicate a pressure of 0 bar.
– Wait approx. 3 minutes to permit the oil to settle.
– Remove cladding on the maintenance side.

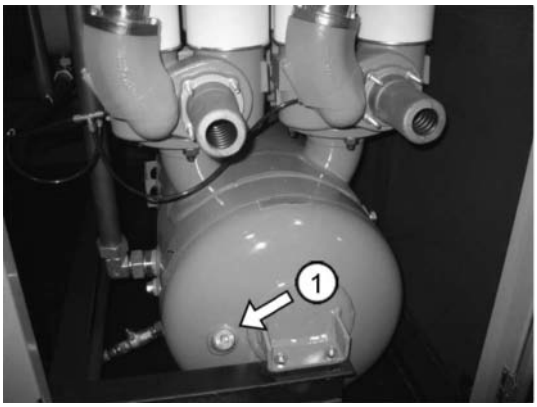
Caution: Risk of injury!

Danger of burning due to hot oil!

Always wear protective gloves when working on the compressor!

– Open sound insulation hood.

– Remove plug of oil filling socket (1).



– Check oil level.
  The oil level must not drop below the "min." mark.
– If necessary, top up with oil to the lower edge of the thread ("max." mark) on the oil filling socket.
– Screw plug back in.

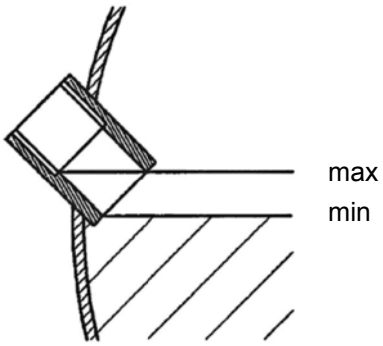


Fig. 6.5: Checking the oil level, topping up with oil

– Close sound insulation hood.
– Reattach cladding on the maintenance side.
– Open ball valve at the compressed air outlet.

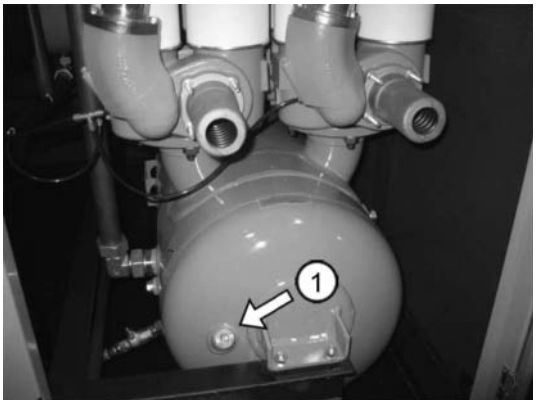
Series SL 341 / SL 431 / SL 481 / SLF 271

Caution: Risk of injury!

Danger of burning due to hot oil!

Always wear protective gloves when working on the compressor!

– Open sound insulation hood.
– Remove plug (1) with sealing shim (4) from the plug (2).
– The oil dipstick (3) is inside the document case fixed to the bunch of keys (on delivery).
– Insert oil dipstick (3) and check oil level. The oil level must not drop below the "min" mark nor rise above the "max" mark (see sketch).



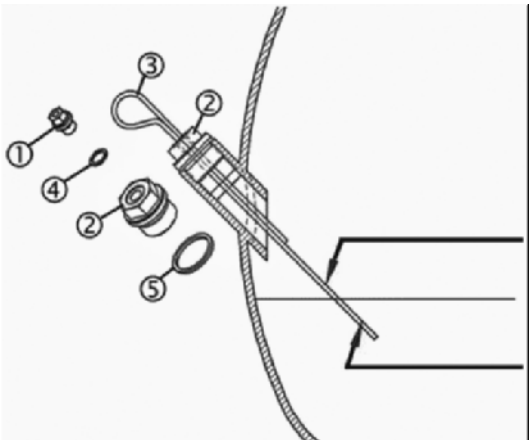


Fig. 6.6: Checking the oil level, topping up with oil

– Remove plug (2) with sealing shim (5) and refill oil, if necessary.
– Screw plug (2) with sealing shim (5) and plug (1) with sealing shim (4) back in.

– Close sound insulation hood.
– Reattach cladding on the maintenance side.
– Open ball valve at the compressed air outlet.

Changing the oil filter

Change:

– After 3,000 operating hours, however, no later than after one year.
– With each oil change!

– Switch off the compressor using the OFF button.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

– Close ball valve at the compressed air outlet.
– Vent the compressor (as described in the beginning of the chapter). The system pressure gauge must indicate a pressure of 0 bar.
– Wait approx. 3 minutes to permit the oil to settle.
– Remove cladding on the maintenance side.

Caution: Risk of injury!

Danger of burning due to hot oil!

Always wear protective gloves when working on the compressor!

– Unscrew soiled oil filter (3) by hand or use a strap wrench, turning counterclockwise (see fig. 6.7).
– Catch the draining oil and dispose of properly according to environmental regulations.
– Fill the new oil filter (3) with compressor oil.
– Lightly oil the sealing ring of the new oil filter.
– Screw in new oil filter by hand, turning clockwise.

Attention!

Do not use tools to screw in the new oil filter!

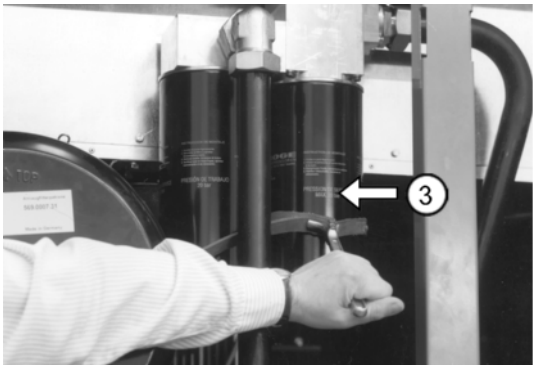
You might damage the oil filter or its sealing ring.

A hand tight seating of the oil filter is sufficient.

– Reattach cladding on the maintenance side.
– Open ball valve at the compressed air outlet.
– Switch on the compressor and heat up to operating temperature.
– Subsequently, check the oil filter for leaks once again and tighten by hand, if necessary (proceed as described before).

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.



– Check the oil filter for leaks and tighten by hand, if necessary.
– Check oil level. Top up oil losses, if any.

Fig. 6.7: Changing the oil filter (the photo shows the SL 340, air-cooled)

Changing the oil separator

Change:

- When the difference between network and system pressure exceeds 0.8 bar.
- When warning message "8" appears on the control system display (if option is installed).
- After 3,000 operating hours, however, not later than after one year.

Caution: Risk of injury!

If the prescribed maintenance intervals are not observed, the oil separators might become blocked. In this case, the differential pressure will increase until the safety valve blows.

- Switch off the compressor using the OFF button.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

- Vent the compressor (as described in the beginning of the chapter). The system pressure gauge must indicate a pressure of **0 bar**.
- Wait approx. 3 minutes to permit the oil to settle.

Caution: Risk of injury!

Danger of burning due to hot oil!

Always wear protective gloves when working on the compressor!

- Remove cladding on the maintenance side.
- Unscrew soiled oil separators (4) by hand or use a strap wrench, turning counterclockwise (see fig. 6.8).
- Catch the draining oil and dispose of properly according to environmental regulations.
- Lightly oil the sealing rings of the new oil separator.
- Screw in new oil separators (4) by hand, turning clockwise.

Attention!

Do not use tools to screw in the new oil separators!
You might damage the oil separators or their sealing rings.
A hand tight seating of the oil separators is sufficient.

- Reattach cladding on the maintenance side.
- Open ball valve at the compressed air outlet.
- Switch on the compressor and heat up to operating temperature.
- Check the oil filter for leaks once again.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

– Check the oil separators for leaks and tighten by hand, if necessary.

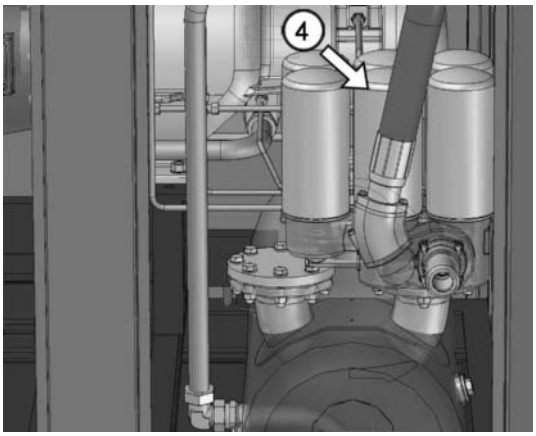


Fig. 6.8: Changing the oil separators

Oil change

Change:

– After 9,000 operating hours when using BOGE Syprem 8000 S, however, at the latest after two years.
– For other types of oil the appropriate oil change intervals must be complied with.

Note!

The service life of the oil, the oil filter and oil separators is reduced under the following conditions:

– When the compressor is operated at extreme ambient temperatures.
– When the intake air is extremely soiled.

Building up a pressure cushion

The combined compressed air / oil receiver is located at the lowest point of the system. Therefore, a light pressure cushion (approx. 1.5 bar system pressure) must be applied to drain the oil. This pressure cushion forces the oil through the drain hose into a suitable collecting vessel.

– Use emergency stop button to switch of the compressor once the system pressure has been reached.

Caution: Risk of injury!

Open mains disconnection device and secure against unintentional switch on by means of a padlock.

Attention!

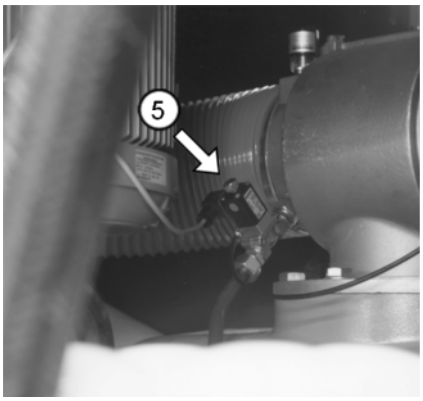
Never use any tools to screw on the cap nut!

They might damage the solenoid valve.

The cap nut (M8) is located in the storage compartment of the switch cabinet.

Caution: Risk of injury!

Open mains disconnection device and secure against unintentional switch on by means of a padlock.



- Screw cap nut (5)onto the vent hole of the solenoid valve on the suction controller by hand.
- Slowly loosen cap nut (5) until compressed air escapes.
- Let off compressed air until the system pressure gauge shows a residual pressure of approx. 2 bar.
- Tighten cap nut (5) by hand.

Fig. 6.9: Solenoid valve on the suction controller with the cap nut screwed on

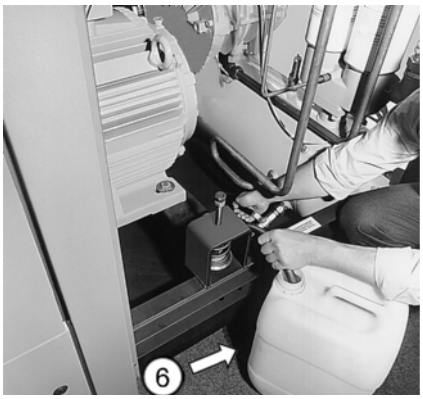
Draining old oil

Caution: Risk of injury!

Danger of burning due to hot oil!

Always wear protective gloves when working on the compressor!

- Place the oil drain hose into a suitable container (6) (see fig. 6.10).
- Slowly open the stop valve.
  The pressure cushion forces the oil into the container.
- Once the compressed air / oil receiver has been completely drained, close the stop valve.
- Remove the cap nut from the solenoid valve.



– Remove oil filler screw (7) on the compressed air / oil cooler and drain the residual oil (max. 5 litres) into a suitable container (see fig. 6.11).
– Reinsert the oil filler screw together with a new copper sealing ring.
– Change oil filter (procedure as described above).
– Change oil separators (procedure as described above).

Fig. 6.10: Drain off old oil from oil/compressed air receiver

Filling with new oil:

– Fill up to the edge of the thread of the filling socket (max.) (procedure as described above).

Attention!

After each oil change you have to fill a small quantity of oil into the suction controller before starting the compressor.

For oil quantity and procedure see chapter „Commissioning: Commissioning following extended stoppages“.

Attention!

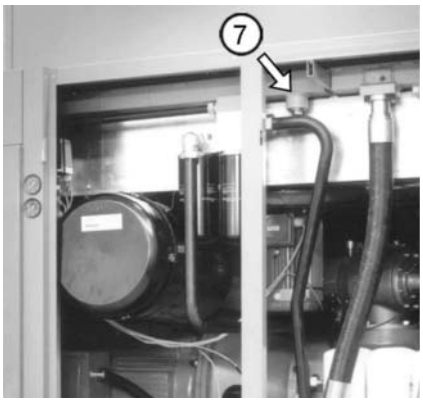
Always fill with the same oil type as previously used. Never mix different oil types and brands.

The oil circuit must be flushed prior to changing the oil type (procedure as described above).

– Reattach cladding on the maintenance side.
– Conduct trial run.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.



- Check the oil filters and oil separators for leaks and tighten by hand, if necessary.
- Check oil level (procedure as described above).
  Top up oil losses, if any.

Fig. 6.11: Drain off residual oil from compressed air/oil cooler

Flushing the oil circuit

Flushing the oil circuit with clean oil becomes necessary:

- When the oil is excessively soiled.
- Prior to changing the oil type.

Attention!

When flushing the oil circuit only use oil of the same brand you want to fill in afterwards.

- Drain used oil completely (procedure as described above).
- Leave used oil filters and separators inside the compressor.
- Fill oil compressed air receiver with clean oil up to approx. one third of the complete oil quantity.
- Close oil filling socket.
- Let compressor run for approx. 10 minutes.
- Drain flushing oil and dispose of properly.
- Change oil filter and oil separator cartridges (procedure as described above).
- Fill in new oil up to required oil level (procedure as described above).

Cleaning the compressed air/oil cooling unit (air cooling)

Cleaning:

– After 1,500 operating hours, however, not later than after one year.

Note!

The service life of the compressed air/oil cooling unit depends on the degree of soiling (dust, oil vapour) of the suctioned cooling air. Extreme external soiling of the cooling unit leads to an increased temperature in the oil circuit.

– Switch off the compressor using the OFF button.

Caution: Risk of injury!

Press Emergency Stop button, open mains disconnection device and secure against unintentional switch on by means of a padlock.

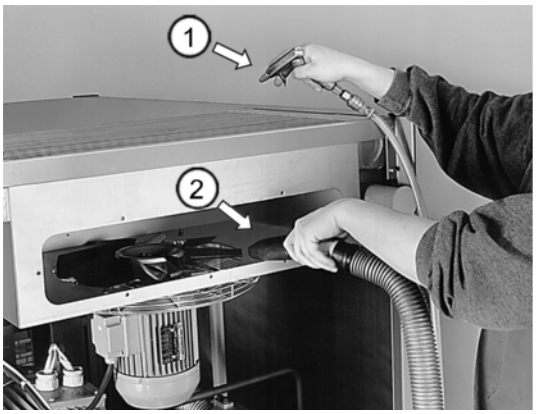
– Remove cladding on the maintenance side.
– Unscrew the maintenance flap on the air guidance box.
– Remove accumulated soiling with a fibre brush.

Attention!

Do not use any sharp objects for cleaning!

These could damage the cooling unit.

If the cooling unit is excessively soiled (cleaning is no longer possible with compressed air), have it disassembled and cleaned by BOGE service.



Blow down the dirt with compressed air (1) in the opposite direction to the normal cooling air flow. Vacuum out the dirt using an industrial vacuum cleaner (2).

Fig. 6.12: Cleaning the compressed air/oil cooling unit

Cleaning the oil cooling unit (water cooling)

Cleaning:

– After 1,500 operating hours, however, not later than after one year.
– In the event of excessive lime deposits and dirt.

Note!
The service life of the cooling unit depends on the degree of soiling and lime deposits in the cooling water. In the event of excessive soiling, check the cooling unit correspondingly earlier.

Carry out the cleaning as described for plate heat exchangers.

Proportional controller (option)

Check:

– After approx. 3,000 operating hours, however, at least once a year.

1. Set operating pressure sensor

Switch-on pressure: p_{min} = final compression pressure – 1 bar.
Switch-off pressure: p_{max} = final compression pressure.

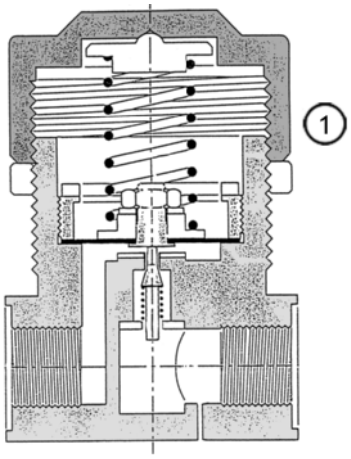


Fig. 6.13: Set proportional controller

2. Set proportional controller

The control range of the proportional controller can be moved by turning the cap (1).

– Increase pressure level:
  Turn cap clockwise.
– Decrease pressure level:
  Turn cap anti-clockwise.

Note!
Always set proportional controller higher than operating pressure value (p_{min})!

3. Pressure switch for infinitely variable power control

The vacuum switch for the infinitely variable power control limits the reduction of the air delivery and switches the compressor to idling or off if the air delivery falls below 50%.

Checking the safety valve

Check:

– After approx. 3,000 operating hours, but at least 1x yearly.

Check the safety valve by turning open the lock screw (1).

Caution: Risk of injury!

Take extreme care when checking the safety valve with the compressor running, and observe all safety measures.

A hot air-oil mixture escapes when opening!

Always wear protective goggles and gloves!

– Open the lock screw (1) by turning it anti-clockwise. The compressed air escapes.
– Tighten the lock screw by turning it clockwise.

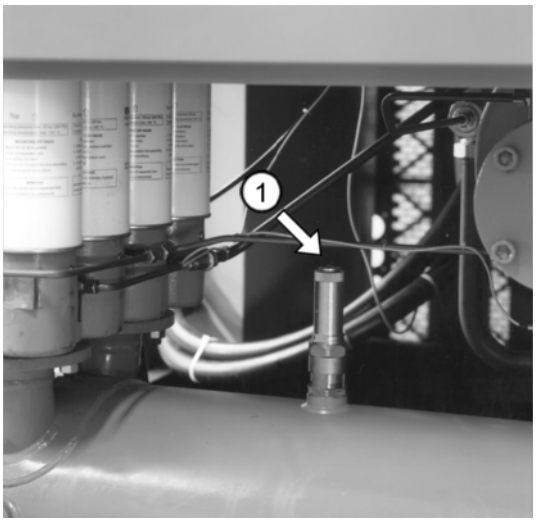


Fig. 6.14: Checking the safety valve

6.4 Spare parts and optional equipment

List of spare and wearing parts (for maintenance)

Designation
Filter mat for supply air filter (option)
BOGE Syprem 8000 S special lubricant for screw compressors
Lubrication for drive motor bearings
Maintenace package: oil filter, oil separator, suction filter cartridge, gaskets, nozzle with dirt catch
Wearing part kit: oil regulator, intake regulator, minimum pressure valve
Solenoid valve

List of available optional equipment

Designation
Optional equipment for compressed air treatment
Oil/water separator
Frost protection device
Proportional controller
Automatic condensate draining unit Bekomat
BOGE-DUOTHERM BPT Plate heat exchanger
BOGE-DUOTHERM-PLUS BSW Safety heat exchanger

Attention!

When ordering, please specify the data on the type plate:

– Type
– Year of manufacture
– Machine number

7.1 Guidelines and standards complied with

The compressor conforms to the following guidelines and standards:

Guidelines and directives

– Machinery Directive 2006/42/EC
– Pressure Equipment Directive 97/23/EC
– EMC Directive 2004/108/EC
– Low Voltage Directive 2006/95/EC
– Simple Pressure Vessels Directive 2009/105/EC

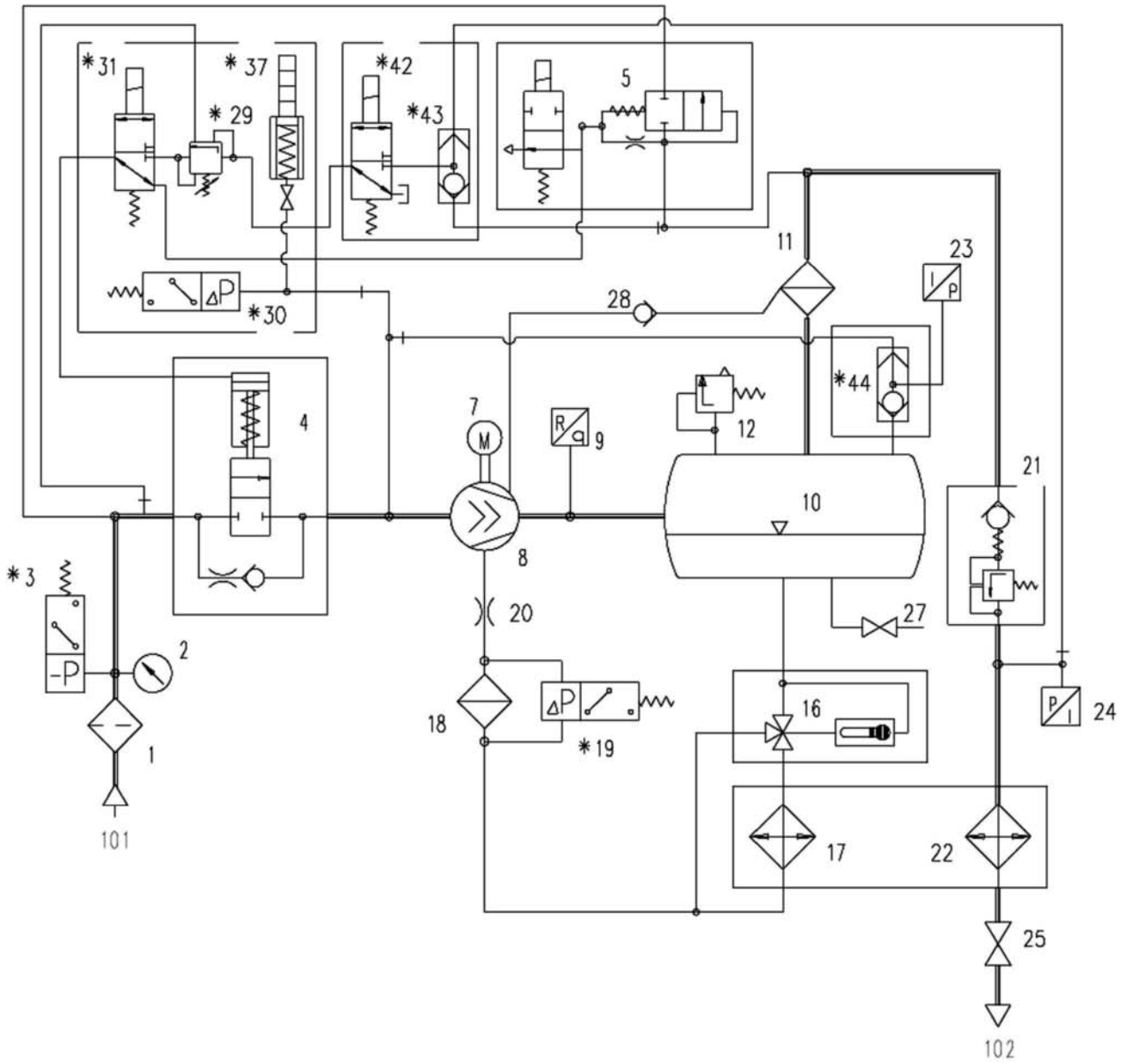
Applied harmonized standards

– DIN EN 1012-1:2011
– DIN EN ISO 12100:2011
– DIN EN 60204-1 / VDE 0113-1:2007
– DIN EN 61000-6-2 / VDE 0839-6-2:2006
– DIN EN 61000-6-4 / VDE 0839-6-4:2007

7.2 Flow chart

On the following pages you will find the individual flow charts for the different machine types and components.

Air cooled version, standard

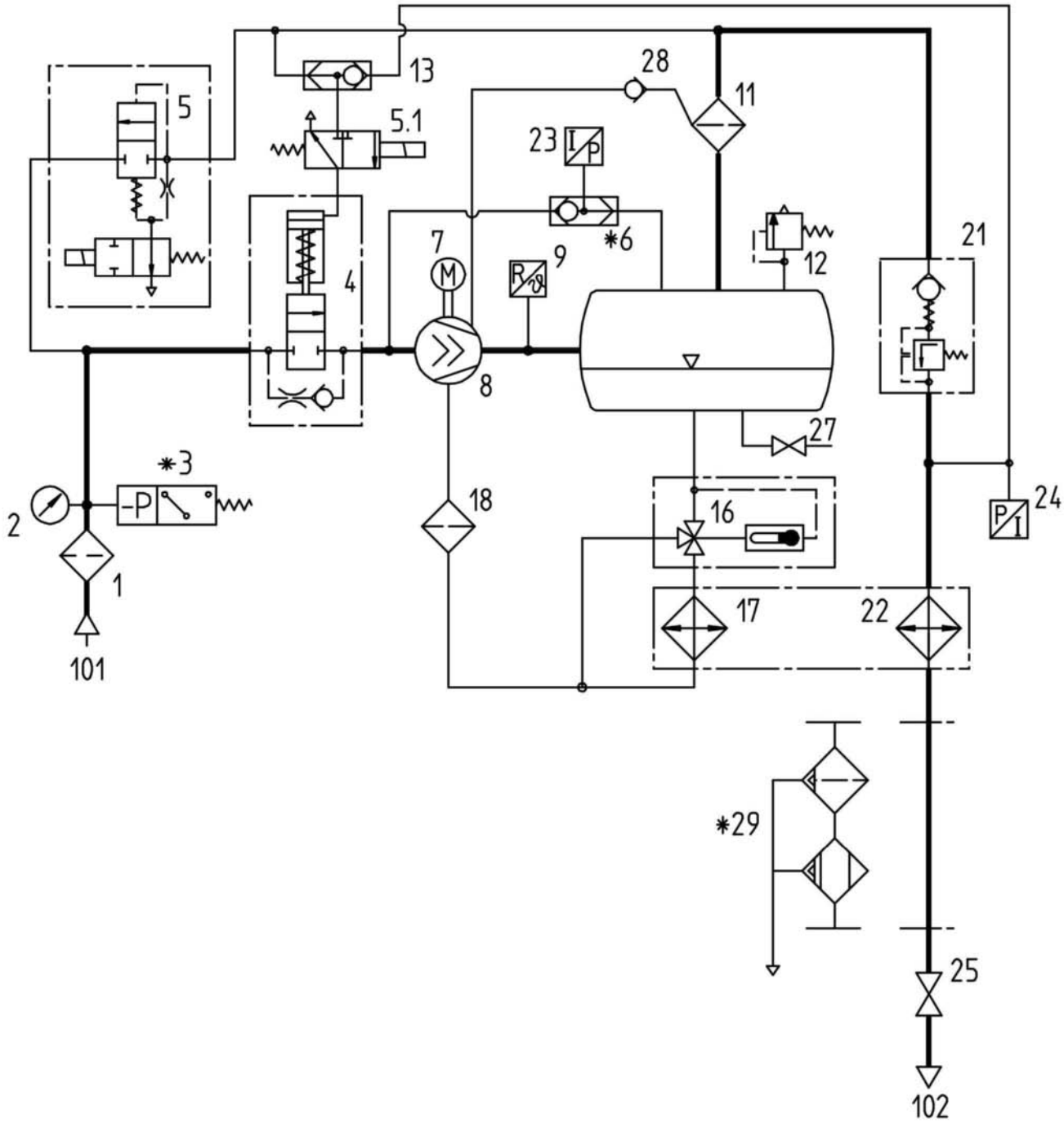


101 Intake air INLET
102 Compressed air OUTLET

1 Suction filter
2 Maintenance display (from 30 kW)
3 Vacuum switch (for suction filter monitoring) *
4 Suction controller
5 Ventilation and regulation control valve
7 Drive motor
8 Compressor air end
9 Sensor for final compression temperature
10 Combined compressed air/oil receiver
11 Oil separator
12 Safety valve
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
19 Differential pressure switch (for oil filter monitoring) *
20 Oil throttle
21 Minimum pressure check valve
22 Compressed air after-cooler
23 Pressure sensor system pressure
24 Pressure sensor network pressure
25 Stop valve, compressed air outlet
27 Stop valve, oil drainage
28 Check valve drainage line (up to 75 kW)
29 Proportional controller *
30 Differential pressure switch for proportional controller *
31 3/2-way solenoid valve for prop. controller (passage here in case of standard control) *
37 Air delivery indicator for proportional controller *
42 3/2-way solenoid valve for suction controller *
43 Double check valve (Pos. 42 + 43 = rapid start valve) *
44 Double check valve (rotational direction monitoring) *

* option

Air cooled version, frequency controlled

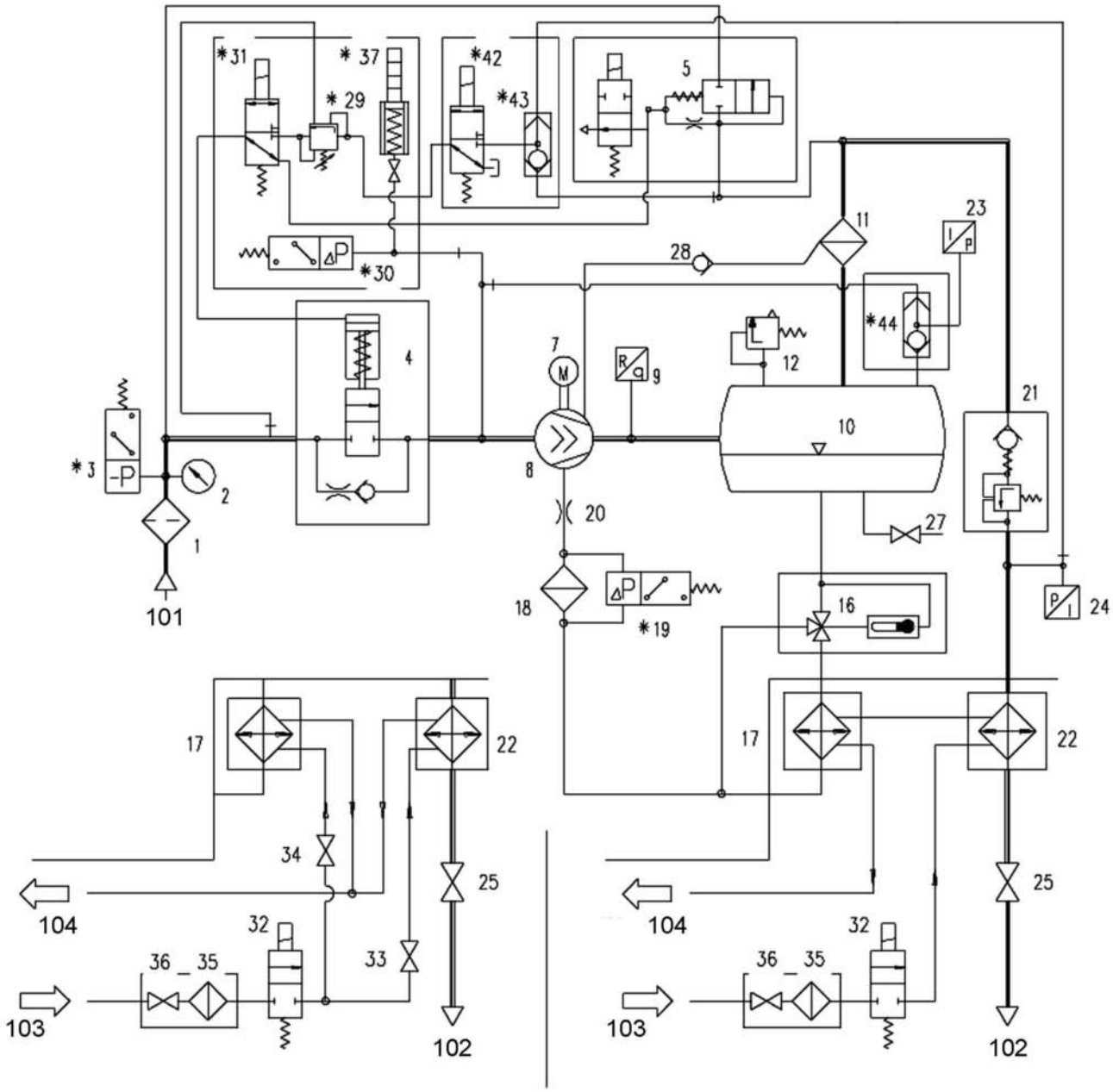


101 Intake air INLET
102 Compressed air OUTLET

1 Suction filter
2 Maintenance display
3 Suction filter monitoring *
4 Suction controller
5 Air relief valve
5.1 Suction control valve
6 Direction of rotation monitoring with double check valve *
7 Drive motor
8 Compressor air end
9 Sensor for final compression temperature
10 Combined compressed air/oil vessel
11 Oil separator
12 Safety valve
13 Rapid start valve
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
21 Minimum pressure non-return valve
22 Compressed air after-cooler
23 Pressure transmitter system pressure
24 Pressure transmitter net pressure
25 Stop valve, compressed air outlet
27 Oil drainage
28 Check valve drainage line
29 Cyclone separator with condensate drain and compressed air refrigeration dryer with condensate drain *

* option

Water cooled version, serial connection – parallel connection



Parallel connection

Serial connection

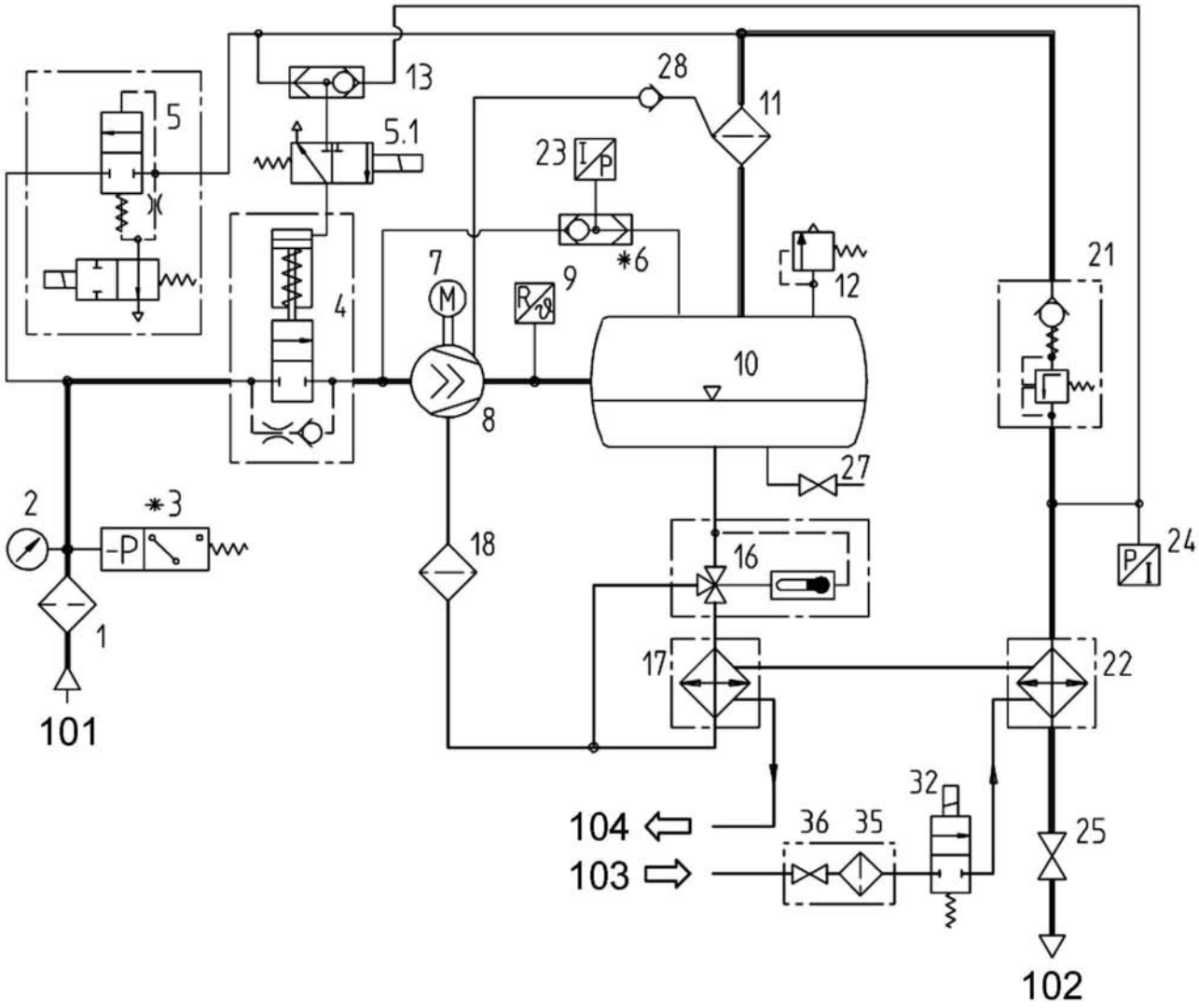
101 Intake air INLET
102 Compressed air OUTLET
103 Water INLET
104 Water OUTLET

1 Suction filter
2 Maintenance display (from 30 kW)
3 Vacuum switch (for suction filter monitoring) *
4 Intake regulator
5 Ventilation and regulation control valve
7 Drive motor
8 Compressor air end
9 Sensor for final compression temperature
10 Combined compressed air/oil receiver
11 Oil separator
12 Safety valve
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
19 Differential pressure switch (for oil filter monitoring) *
20 Oil throttle
21 Minimum pressure non-return valve
22 Compressed air after-cooler
23 Pressure sensor system pressure
24 Pressure sensor net pressure
25 Stop valve, compressed air outlet
27 Stop valve, oil drainage
28 Check valve drainage line (up to 75 kW)
29 Proportional regulator *
30 Differential pressure switch for proportional controller *
31 3/2-way solenoid valve for prop. controller (passage here in case of standard control) *
32 2/2-way solenoid valve
33 Control valve water inlet (preset)
34 Control valve water inlet (preset)
37 Air delivery indicator for proportional controller *
42 3/2-way solenoid valve forsuction controller *
43 Double check valve (Pos. 42 + 43 = rapid start valve) *
44 Double check valve (rotational direction monitoring) *

* option

To be supplied by customer:
35 Dirt trap
36 Stop valve

Water cooled version, serial connection – frequency controlled



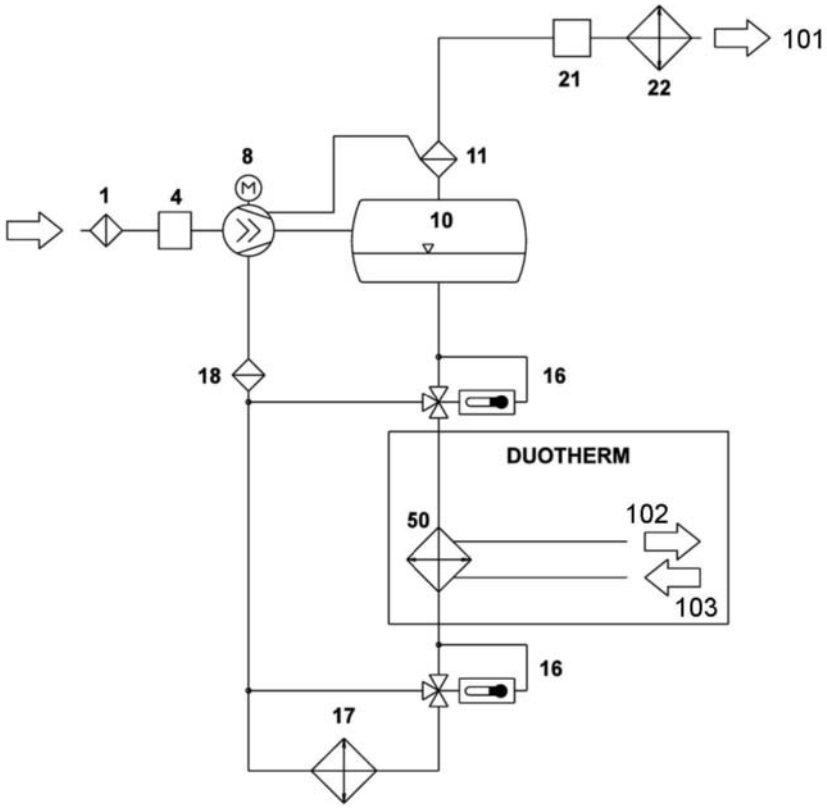
101 Intake air INLET
102 Compressed air OUTLET
103 Water INLET
104 Water OUTLET

1 Suction filter
2 Maintenance display
3 Suction filter monitoring *
4 Suction controller
5 Vent valve
5.1 Suction control valve
6 Direction of rotation monitoring with double check valve *
7 Drive motor
8 Compressor air end
9 Sensor for final compression temperature
10 Combined compressed air/oil vessel
11 Oil separator
12 Safety valve
13 Rapid start valve
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
21 Minimum pressure non-return valve
22 Compressed air after-cooler
23 Pressure transmitter system pressure
24 Pressure transmitter net pressure
25 Stop valve, compressed air outlet
27 Oil drainage
28 Check valve drainage line
32 2/2-way solenoid valve (water valve) *

* option

To be supplied by customer:
35 Dirt trap
36 Stop valve

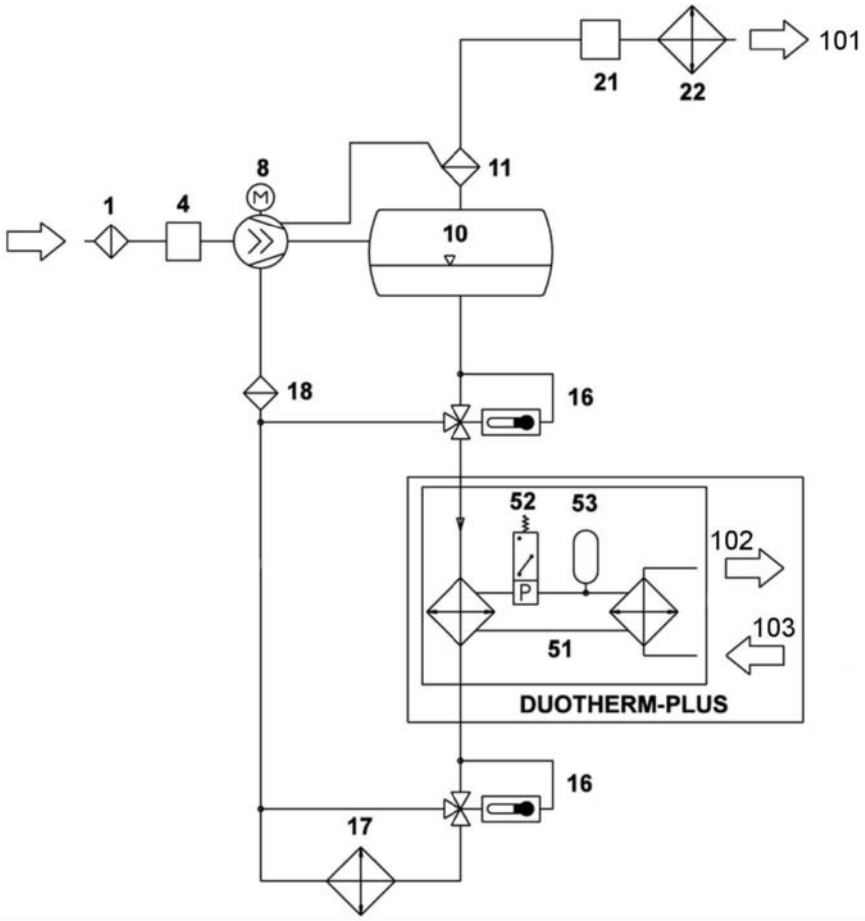
BOGE-Duotherm BPT plate heat exchanger



101 Compressed air OUTLET
102 Return
103 Flow

1 Suction filter
4 Intake regulator
8 Compressor air end
10 Combined compressed air/oil vessel
11 Oil separator
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
21 Minimum pressure check valve
22 Compressed air after-cooler
50 Heat exchanger

BOGE-Duotherm-Plus BSW safety heat exchanger



101 Compressed air OUTLET
102 Return
103 Flow

1 Suction filter
4 Suction controller
8 Compressor air end
10 Combined compressed air/oil vessel
11 Oil separator
16 Thermostatic oil control valve
17 Oil cooler
18 Oil filter
21 Minimum pressure check valve
22 Compressed air after-cooler
51 Safety heat exchanger
52 Pressure monitor in case of pipe rupture
53 Compensation vessel

7.3 List of maintenance and service work

Please note the completed maintenance work in the respective columns.

Date	*Operating hours*	*Net pressure*	*System pressure*	*Tempera-ture*	*Suction filter* *	*Oil filter*	*Oil level* **	*Oil separator*	*Cooling unit cleaning*	*Motor mainte-nance*	*Remarks*

** Cl = Cleaning*
Ch = Change

*** Co = Control*
Ch = Change

Please note the completed maintenance work in the respective columns.											
Date	*Operating hours*	*Net pressure*	*System pressure*	*Temperature*	*Suction filter* *	*Oil filter*	*Oil level* **	*Oil separator*	*Cooling unit cleaning*	*Motor maintenance*	*Remarks*

* *Cl = Cleaning*
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Please note the completed maintenance work in the respective columns.

Date	*Operating hours*	*Net pressure*	*System pressure*	*Temperature*	*Suction filter* *	*Oil filter*	*Oil level* **	*Oil separator*	*Cooling unit cleaning*	*Motor maintenance*	*Remarks*

** Cl = Cleaning*
Ch = Change

*** Co = Control*
Ch = Change