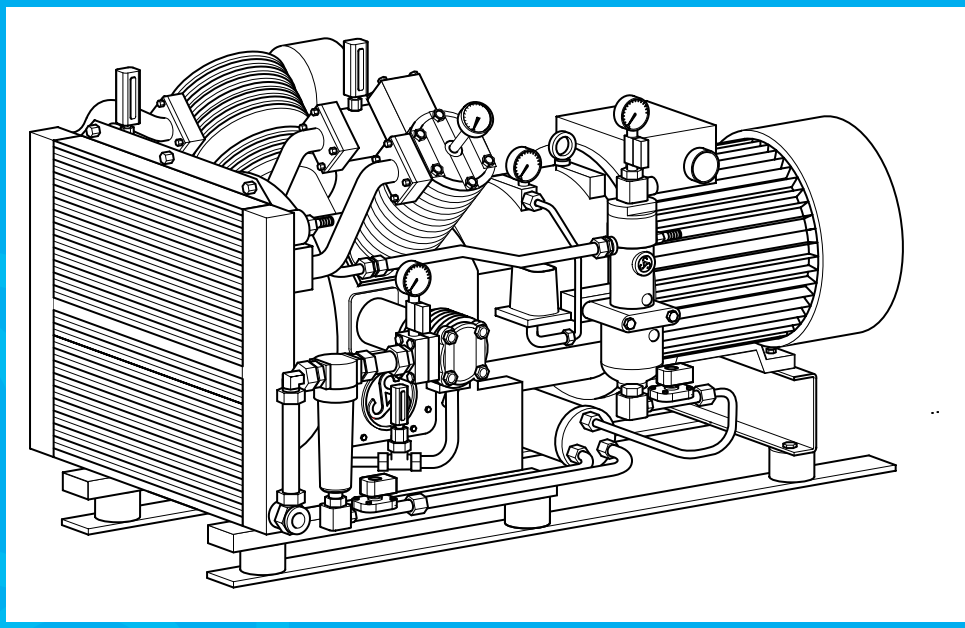
J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

Type: WP 311 L

Operating Manual

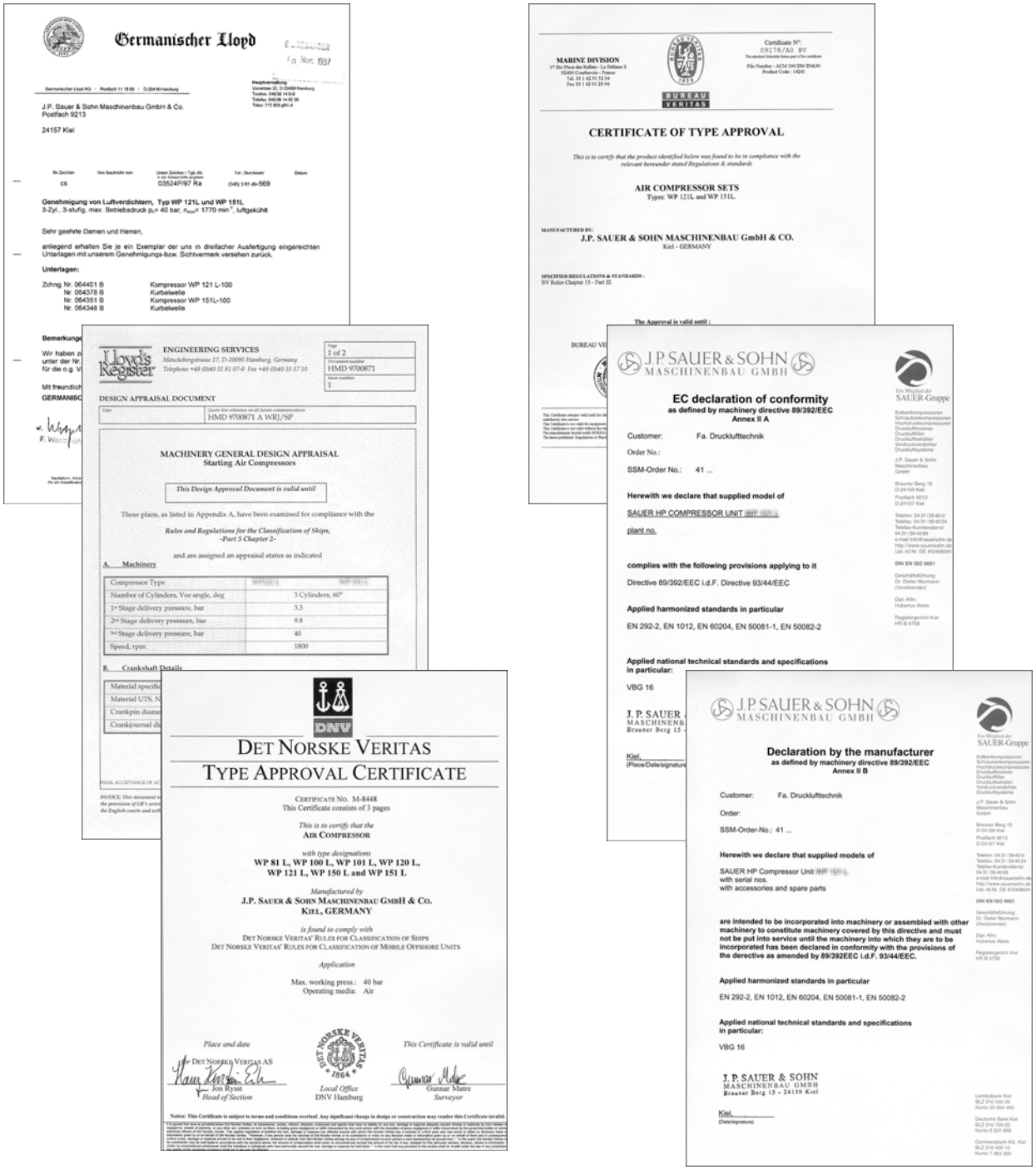
- High pressure compressor
- 3 stages
- Air-cooled

Ein Mitglied der
SAUER-Gruppe

Edition: 12 / 2007
Edited by: J.P. Sauer & Sohn Maschinenbau – Technical Documentation

WP311L_BA_Titel_en_07.fm

Sauer compressor Type Approvals



Germanischer Lloyd

J.P. Sauer & Sohn Maschinenbau GmbH & Co.
Postfach 9213
24157 Kiel

Genehmigung von Luftverdichtern, Typ WP 121L und WP 151L
3-Zyl., 3-stufig, max. Betriebsdruck p_e= 40 bar, n_{max}= 1770 min^{-1}, luftgekühlt

Sehr geehrte Damen und Herren,

anliegend erhalten Sie je ein Exemplar der uns in dreifacher Ausfertigung eingereichten Unterlagen mit unserem Genehmigungs-bzw. Sichtvermerk versehen zurück.

Unterlagen:

Zchng. Nr. 064401 B Kompressor WP 121 L-100
Nr. 064378 B Kurbelwelle
Nr. 064351 B Kompressor WP 151L-100
Nr. 064348 B Kurbelwelle

Lloyd's Register

ENGINEERING SERVICES

DESIGN APPRAISAL DOCUMENT

HMD 9700871 A WRI/SP

MACHINERY GENERAL DESIGN APPRAISAL
Starting Air Compressors

This Design Approval Document is valid until

These plans, as listed in Appendix A, have been examined for compliance with the

Rules and Regulations for the Classification of Ships,
-Part 5 Chapter 2-

and are assigned an appraisal status as indicated

A. Machinery

Compressor Type	
Number of Cylinders, Vee angle, deg	3 Cylinders, 60°
1st Stage delivery pressure, bar	3.3
2nd Stage delivery pressure, bar	9.8
3rd Stage delivery pressure, bar	40
Speed, rpm	1800

B. Crankshaft Details

DNV

DET NORSKE VERITAS
TYPE APPROVAL CERTIFICATE

CERTIFICATE NO. M-8448
This Certificate consists of 3 pages

This is to certify that the
AIR COMPRESSOR

with type designations
WP 81 L, WP 100 L, WP 101 L, WP 120 L,
WP 121 L, WP 150 L and WP 151 L

Manufactured by
J.P. SAUER & SOHN MASCHINENBAU GMBH & CO.
KIEL, GERMANY

is found to comply with
DET NORSKE VERITAS' RULES FOR CLASSIFICATION OF SHIPS
DET NORSKE VERITAS' RULES FOR CLASSIFICATION OF MOBILE OFFSHORE UNITS

Application

Max. working press.: 40 bar
Operating media: Air

Place and date
for DET NORSKE VERITAS AS
Jon Rysst
Head of Section

Local Office
DNV Hamburg

This Certificate is valid until
Gunnar Matre
Surveyor

Notice: This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.

MARINE DIVISION

BUREAU VERITAS

CERTIFICATE OF TYPE APPROVAL

This is to certify that the product identified below was found to be in compliance with the relevant hereunder stated Regulations & standards

AIR COMPRESSOR SETS
Types: WP 121L and WP 151L

MANUFACTURED BY:
J.P. SAUER & SOHN MASCHINENBAU GmbH & CO.
Kiel - GERMANY

SPECIFIED REGULATIONS & STANDARDS :
BV Rules Chapter 15 - Part II.

The Approval is valid until :

J.P. SAUER & SOHN
MASCHINENBAU GMBH

EC declaration of conformity
as defined by machinery directive 89/392/EEC
Annex II A

Customer: Fa. Druckluftechnik

Order No.:

SSM-Order No.: 41 ...

Herewith we declare that supplied model of

SAUER HP COMPRESSOR UNIT

plant no.

complies with the following provisions applying to it

Directive 89/392/EEC i.d.F. Directive 93/44/EEC

Applied harmonized standards in particular

EN 292-2, EN 1012, EN 60204, EN 50081-1, EN 50082-2

Applied national technical standards and specifications in particular:

VBG 16

J. P. SAUER & SOHN MASCHINENBAU GMBH
Brauner Berg 13 - 24139 Kiel

Kiel,
(Place/Date/signature)

Ein Mitglied der SAUER-Gruppe

J.P. SAUER & SOHN
MASCHINENBAU GMBH

Declaration by the manufacturer
as defined by machinery directive 89/392/EEC
Annex II B

Customer: Fa. Druckluftechnik

Order:

SSM-Order-No.: 41 ...

Herewith we declare that supplied models of

SAUER HP Compressor Unit
with serial nos.
with accessories and spare parts

are intended to be incorporated into machinery or assembled with other machinery to constitute machinery covered by this directive and must not be put into service until the machinery into which they are to be incorporated has been declared in conformity with the provisions of the derective as amended by 89/392EEC i.d.F. 93/44/EEC.

Applied harmonized standards in particular

EN 292-2, EN 1012, EN 60204, EN 50081-1, EN 50082-2

Applied national technical standards and specifications in particular:

VBG 16

J. P. SAUER & SOHN
MASCHINENBAU GMBH
Brauner Berg 13 - 24139 Kiel

Kiel,
(Date/signature)

Ein Mitglied der SAUER-Gruppe

Note!

On this page only a few examples are shown. FurtherType Approvals are available on request.

Genuine Sauer spare parts – certified safety

Konformitäts- und Echtheitszertifikat

Seriennummer: 104000 *

Mit diesem Konformitäts- und Echtheitszertifikat bestätigt die

J.P. SAUER & SOHN
MASCHINENBAU GMBH
D-24157 Kiel,

daß die, und nur die, mit dem anliegenden Lieferschein
Nr. _____ gelieferten insgesamt _____ Positionen

Original Sauer Ersatzteile

mit kontrollierter, garantierter und nachvollziehbarer Qualität sind. Durch jede handschriftliche oder anderweitig nachträglich angebrachte Änderung auf dem anliegenden Lieferschein oder dem Zertifikat selbst wird dieses Zertifikat ungültig. Es liegen dann begründete Anzeichen vor, daß Graumarktteile minderer Qualität geliefert wurden.

SPECIMEN

In Zweifelsfällen, oder falls Sie über Ihre Vorteile durch den Einsatz von Original Sauer Ersatzteilen informiert werden möchten, wenden Sie sich bitte an unseren Kundendienst:
Durchwahl 04 31/39 40-86/87 (Fax -89),
e-mail: service@sauersohn.de
oder besuchen Sie unsere Webseite http//www.sauersohn.de.

Kiel, den _____ _____

Table of Contents

1 General

1.1 Foreword

This Operator Manual provides installation guidance, safe operation, maintenance and repair instructions with illustrated parts breakdown.

The following unique specification for the Sauer Compressor can be found on the nameplate affixed to the compressor:

– compressor type
– serial number
– year of construction

We recommend you record this information in Chapter 11, “Spare Parts and Accessories”, and always provide this data when requesting parts and any repair instructions.

1.2 Precautions

Specific precautions

We recommend that only authorised and trained personnel Operate and Service the Sauer Compressor. Such responsible personnel should be thoroughly familar with, and frequently review, the Operator Manual.
These instructions should always be readily available at the compressor installation.

Copyright

1.3 Warranty and Liability

Sauer can no longer cover warranty, be liable for any claims, if a failure is attributed to any of the following:

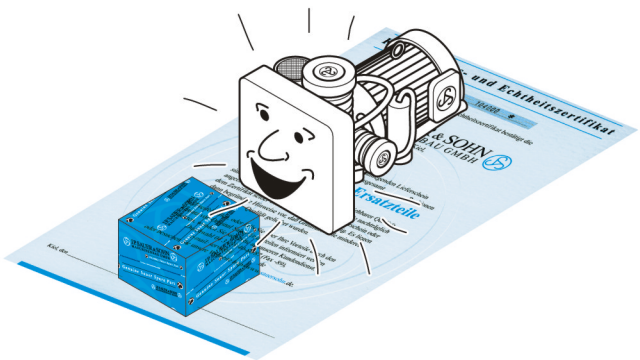
- use of the machine not as specified;
- substitution of parts not manufactured or approved by Sauer;
- use of spare parts that are not genuine Sauer spare parts;
- operation of the machine with faulty or improperly installed safety and/or protection devices;
- disregard of the operating instructions;
- unauthorised modification to the machine or its control system;
- inadequate monitoring of machine parts subject to wear;
- failure to maintain/repair in accordance with Sauer instructions;
- force majeure.

1.4 Type Approval and genuine Sauer spare parts

- The Type Approval for the Sauer Compressor is valid under the condition that parts and components specified and qualified by J.P. SAUER & SOHN are used. The Type Approval is provided by the Classification Society and the EC Declaration of Conformity or EC Manufacturer's Declaration. Disregard for the “specifications“ may cause the Type Approval to expire.
- Only the use of genuine Sauer spare parts will ensure compliance with these ’specfications’ and, therefore, reliable and safe operation of the Sauer Compressors.
- If non-genuine Sauer spare parts are used, we reserve the right of exclusion from liability for personal injury and material damage.
- Genuine Sauer spare parts are supplied with a Certificate of Conformity and a Certificate of Authenticity. An example of this document is shown just before the Table of Contents in these instructions. If spare parts are received without this certificate, there is a risk that these are not genuine Sauer spare parts. In such an istance please contact our Customer Service.

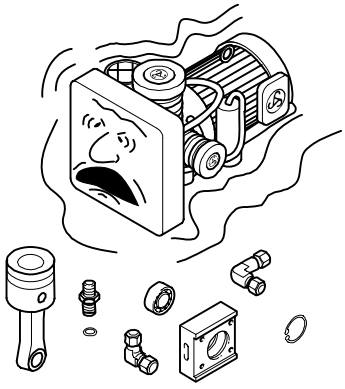
Note!
Be aware this is a high-pressure compressor, for your own safety and for reliable compressor operation, only unse genuine Sauer parts.

Correct



Only use genuine Sauer spare parts supplied with a Certificate!

Incorrect



Do not use parts from the "grey market"!

1.5 J.P. SAUER & SOHN customer service

Should you have any technical questions relating to maintenance or repair, please contact our Customer Service:

J.P. SAUER & SOHN Maschinenbau GmbH
Customer Service
P.O. Box 92 13
24157 Kiel

Telephone (international):	
Technical information	+49 431 39 40 -87
Spare parts orders	+49 431 39 40 -86/886
Telefax (international):	+49 431 39 40 -89
Emergency service (international):	+49 172 4 14 63 94
E-Mail:	service@sauersohn.de
Web:	www.sauersohn.de

Note!

If you have questions regarding your Sauer Compressor, please state Compressor model and serial number (see chapter 11 “Spare Parts and Accessories” or nameplate on the compressor).

1.6 Specific instructions

Part Lists

General lists are hyphenated.

e. g.:

Compressor cooling consists of

– fan wheel,
– fan wheel cage, and
– cooler assembly.

Instructions

Individual instructions or multiple instructions requiring action but where the sequence is of no importance are normally denoted by a bullet-point.

e. g.:

• Check oil level.

Instructions to be carried out in a certain sequence are numbered.

e. g.:

1. Turn the main switch ON.
2. Choose the Operating mode.
3. Turn the control ON.

Results of actions carried out are denoted by a tick mark.

Example:

✓ The control light is on.

Safety instructions

Safety and warning instructions are presented pictorially with clear instructions. The safety instructions are described in detail in Chapter 2 “Safety”.

2 Safety

2.1 Conditions of use

This Sauer Compressor must be used for the compression of helium. The Sauer Compressor must not be used at ambient temperatures below +5 °C. Any other use not as specified, requires the explicit consent in writing from J.P. SAUER & SOHN.

Observing operating instructions, the installation requirements detailed in the instructions, and keeping maintenance records, are all part of the specified conditions of use.

Most accidents which occur during operation and maintenance of machinery result from failure to observe basic safety rules or precautions.
When handling, operating or carrying out maintenance, personnel must observe safe engineering working practices and local regulations.

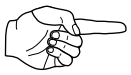
2.2 Unauthorised modification

Unauthorised modification of the Sauer Compressor is not permitted. Modifications may lead to an accident that can be life-threatening, cause personal injury or result in damage to the equipment.
Contact J.P. SAUER & SOHN when planning any modification to obtain written approval.

2.3 Safety information - Warning & Caution

The safety information in these instructions is presented as ’high’ risk and ’lower’ risk, as follows:

Warning - Danger!
High risk.
Ignoring this safety information can cause personal injury, or death, and significant equipment damage.



Caution - Note!
Less risk.
Disregarding this safety note may cause damage to the equipment.

2.4 Safety warnings on the machine

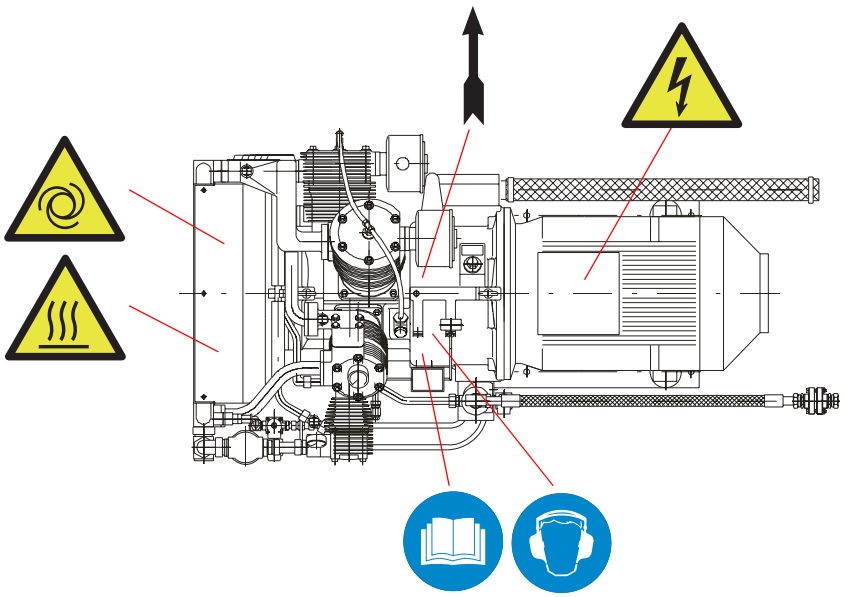
Danger!
Safety labeling affixed to the machine must not be altered or removed. Replace damaged or lost safety labels immediately with an approved replacement.

Sauer compressor models with an EC Manufacturer's Declaration or EC Declaration of Conformity are marked with the following safety labels:

Safety label	Meaning
	Danger! High voltage!
	Compressor starts auto-matically without warning!
	Hot surface!

Safety label	Meaning
	Read Operator Manual!
	Wear hearing protection!
	Rotational direction of crankshaft

Location of safety markings:



2.5 Safety and protection devices

Danger!

Safety devices must not be adjusted, tampered with or removed.

The safety devices must be periodically tested and checked.

Safety valves must be

– installed with a lock-seal

should be replaced, adjusted and re-sealed only by authorised personnel.

Safety valves

Each compression stage of the Sauer compressor is equipped with a safety valve, which will fully discharge the gas when the set pressure of the valve is reached.

Safety valves are installed at the following locations:

– 1st compression stage: in the honeycomb cooler of the 1st stage;
– 2nd compression stage: in the honeycomb cooler of the 2nd stage;
– 3rd compression stage: at the final separator after the 3rd stage.

Safety fuse / temperature monitor

The Sauer compressor is fitted with a safety fuse in the final separator to protect against a compressor cooling failure. The safety fuse blows at 121 °C and releases an opening for the compressed air if the temperature limit is exceeded.

The safety fuse works only once. If it has blown, it must be replaced with a new one.

As an alternative to the safety fuse, the Sauer compressor can be equipped with a temperature monitor. The temperature monitor switches off the compressor if the compressed air temperature exceeds the preset limit value.

Oil pressure sensor

The Sauer compressor is fitted with an oil pressure sensor, which activates to shutdown the compressor if the oil pressure falls below 1 bar.

Final pressure sensor

The Sauer compressor is fitted with a final pressure sensor which is activated as soon as the final pressure is reached. This sensor is factory set to the respective final pressure.

2.6 Noise protection

Sound pressure level details are found in the Technical Specification (see Chapter 4).

The Sauer compressor can be arranged with a sound-dampening enclosure to reduce the noise. This sound-dampening enclosure is available as optional accessory from J.P. SAUER & SOHN.

Danger!

When the compressor is operated without sound-dampening enclosure, hearing protection should be worn when working near to the compressor.

2.7 Waste disposal

Note!

While recyclable materials are used as far as possible, local environmental regulations, or laws, dictate that the following are disposed of to avoid polluting the environment.

- condensate (oil and water saturated mixture) arising from intercooling in the compression process;
- used oil and grease, and soiled materials;
- cleaning material and soiled rags.

2.8 Personal safety

Only personnel authorised by J.P. SAUER & SOHN are permitted to Service the Sauer Compressor! Before commencing work they must have read and understood the instructions in the Manual, and must be familiar with all safety devices and safety regulations.

In addition to the instructions in this Manual, and manufacturer documentation, accepted engineering standards must be observed as well as local regulations and standards e.g.

– Equipment and Product Safety Act,
– Industrial Health and Safety,
– Regulations for accident prevention pertaining to compressors,
– Regulations on environmental protection.

Additionally, where appropriate Classification Society and operational regulations must be observed.

Only those trained and thoroughly familar with the compressor operation, should be authorised to operate the compressor.

Personnel authorised to service the compressor must be trained ’specialists’.

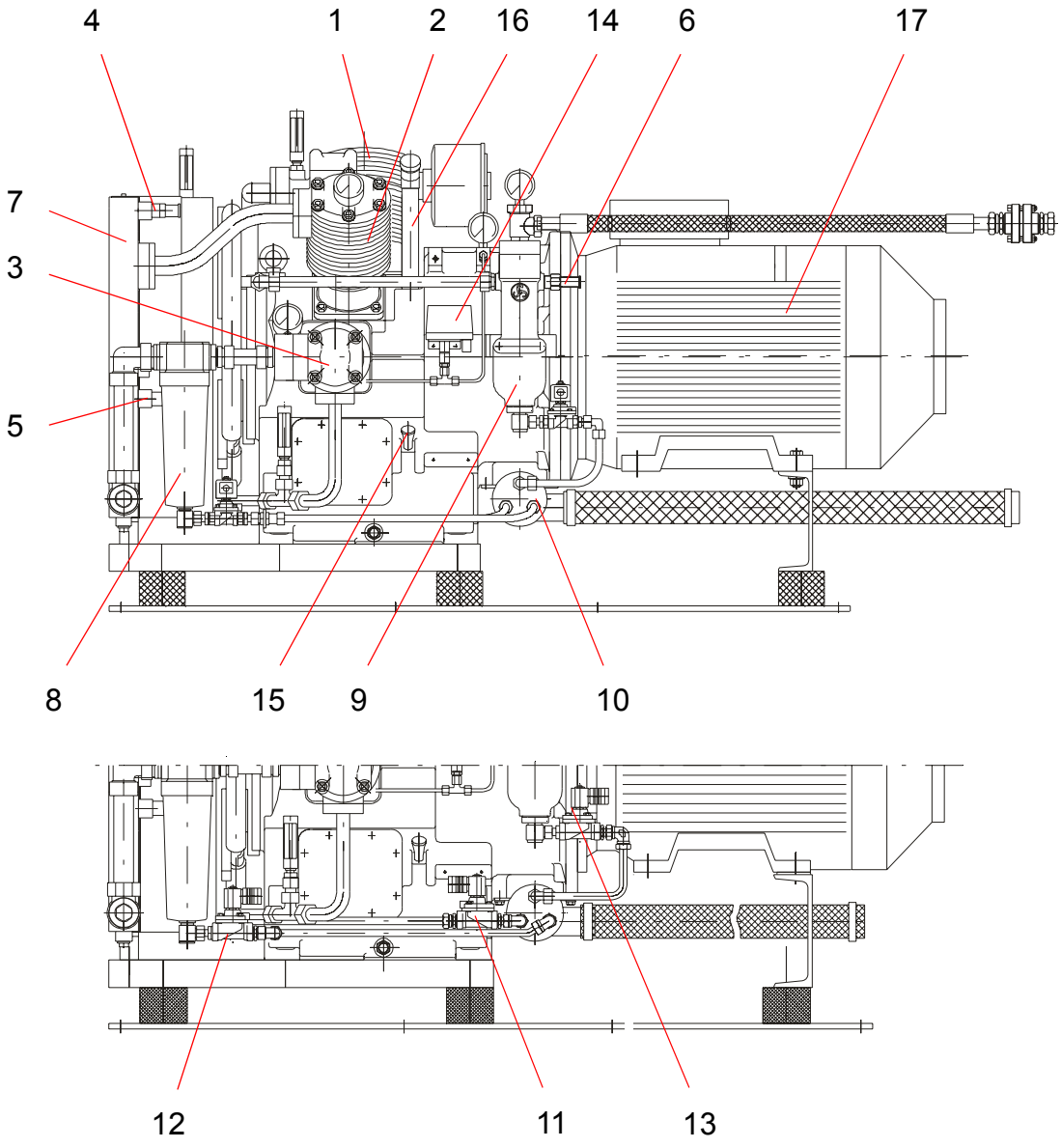
2.9 Personal protection

The user should provide personal protection (e.g. hearing protection, safety boots, etc.) for the operator, or Service engineer carrying out any work on the Sauer compressor.

3 Design and Function

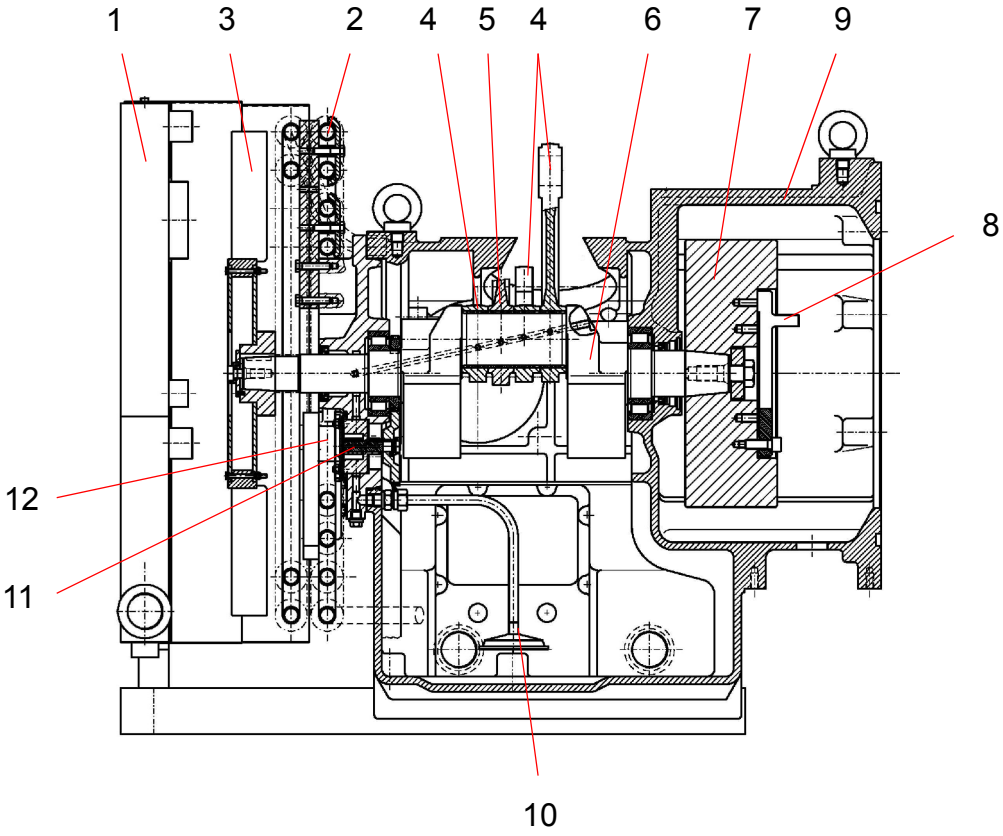
3.1 Overview

Note!
Details of parts and spare parts can be found in the spare parts catalogue.



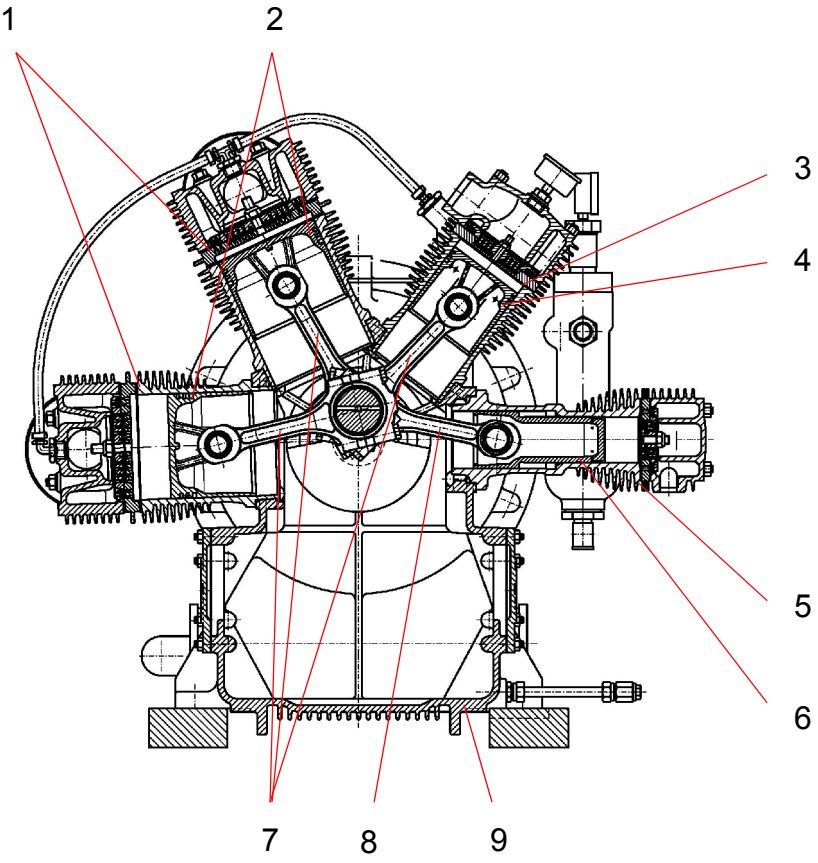
Item	Description
1	Cylinder 1st stage
2	Cylinder 2nd stage
3	Cylinder 3rd stage
4	Safety valve 1st stage
5	Safety valve 2nd stage
6	Safety valve 3rd stage
7	Cooler
8	Condensate separator 2nd stage
9	Condensate separator 3rd stage
10	Condensate collection pot
11	Drain valve 1st stage
12	Drain valve 2nd stage
13	Drain valve 3rd stage
14	Oil pressure monitor
15	Oil dip stick
16	Crankcase vent with insulating hose
15	Electric motor

Vertical sectional view



Item	Description
1	Cooler 1st and 2nd stage
2	Cooler 3rd stage
3	Fan wheel
4	Connecting rod 1st and 2nd stage
5	Connecting rod 3rd stage
6	Crankshaft
7	Flywheel
8	Compressor half coupling
9	Bell housing
10	Oil filter / strainer
11	Lubricating oil pump
12	Bearing housing

Horizontal sectional view



Item	Description
1	1st stage: Cylinder with head and valve
2	Piston 1st stage
3	2nd stage: Cylinder with head and valve
4	Piston 2nd stage
5	3rd stage: Cylinder with head and valve
6	Piston 3rd stage
7	Connecting rod 1st and 2nd stage
8	Connecting rod 3rd stage
9	Crankcase

3.2 Functional description

Drive

The Sauer compressor is driven by an electric motor that is screwed to the coupling housing with a flange and an intermediate housing. Torque is transmitted by means of a flexible coupling.
Alternatively a diesel motor can be used, which is mounted with a special flange and transmits torque by means of a centrifugal coupling.

Compressor control

The electric motor driven Sauer compressor is electrically controlled and monitored by a compressor control system. This control system must comply with the legal regulations. Optionally, J.P. SAUER & SOHN supplies a suitable compressor control system.

Compression

The compressor takes in the ambient air through a layered filter with damping pipe and compresses it in three single-stage cylinders to the final pressure. Each cylinder is a compression stage after which the air is recooled.
Dividing the entire pressure ratio into three stages results in particularly low compression temperatures.
The cylinders arranged in a W-configuration are equipped with concentric valves or lamellar valves, which have a long life and are easy to service. Due to the low compression temperatures, coking of the valves is practically ruled out.

Cooling

An axial fan mounted on the crankshaft sucks in cooling air from the surrounding area and blasts it across the cylinders, coolers, valves and oil sump. Low noise and low compressed air recooling values are achieved by arranging the fan in an aerodynamic housing.
Recooling takes place

– after the 1st and 2nd stage in an aluminium honeycomb cooler;
– after the 3rd stage in a steel tube cooler;

Condensate separation

Oil and water condensate produced during compression and recooling in the 1st stage is collected in the collection vessel of the 1st stage recooler. The 2nd and 3rd stages have a separate condensate separator each.

Condensate draining / pressure relief

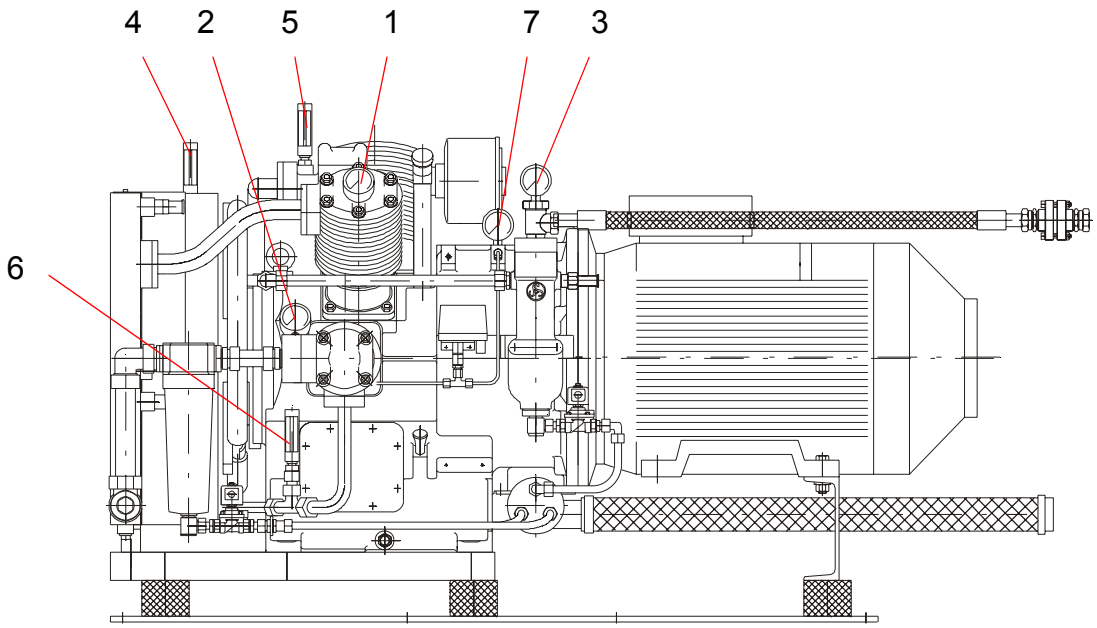
The condensate is drained via drainage pipes. Solenoid valves are built in the drainage pipes. The drain valves must be open when the Sauer compressor is stopped. The drain valves should close a few seconds after the compressor starts, and the compressor should run up against pressure. When the compressor is running, the drain valves should drain the machine

at fixed intervals. The drain valves (solenoid valves) are controlled by the compressor control.

Lubrication / oil pressure

A gear oil pump, driven by the crankshaft, draws the lubricating oil from the crankcase and then pumps it to the connecting rod bearings. Crankshaft bearings, gudgeon pin bearings and pistons are lubricated by the oil splash in the crankcase. The oil pressure is monitored by an oil pressure monitor.
The compressor is immediately stopped by the control if the oil pressure falls to the lower limit.

3.3 Indicators



Item	Description	Indicator
1	Pressure gauge 1st stage	Compressed air pressure after the 1st stage
2	Pressure gauge 2nd stage	Compressed air pressure after the 2nd stage
3	Pressure gauge 3rd stage	Final pressure
4	Thermometer 1st stage	Compressed air temperature after the 1st stage
5	Thermometer 2nd stage	Compressed air temperature after the 2nd stage
6	Thermometer 3rd stage	Compressed air temperature after the 3rd stage
7	Oil pressure gauge	Oil pressure of the oil pump

3.4 Compressor Control System - Indicators and Control

Note!
If the compressor control system is supplied by J.P. SAUER & SOHN, read the documentation supplied.

On the front of the compressor control, the following indicators and control elements can be found:

Indicator/ Control feature	Description
Signal lamp “Operation”	Illuminates when the compressor is running.
Fault indicator lamp “Oil pressure”	Illuminates if the compressor has shutdown because of low oil pressure.
Fault indicator lamp “Gas temperature”	Illuminates if the compressor has shutdown because of high outlet gas temperature.
Fault indicator lamp “Overcurrent”	Illuminates if the compressor has shutdown because of excess motor current.
Operating hours counter	Indicates the operating hours of the compressor.
Operating mode selector	• “Manual” Mode: Starts the compressor manually. The compressor starts up and continues to run until it is manually turned off. • Selector position “0“: Turn the commpressor manually off. Any pending fault messages are reset. • “Auto” Mode: The compressor starts and stops by the opening and closing of a remote contact (e.g. pressure switch at a compressed gas receiver).
Isolator - Main switch	Disconnects the power supply to the Compressor Control. A main Isolator should be installed if required by local law and regulations.

4 Technical Specification

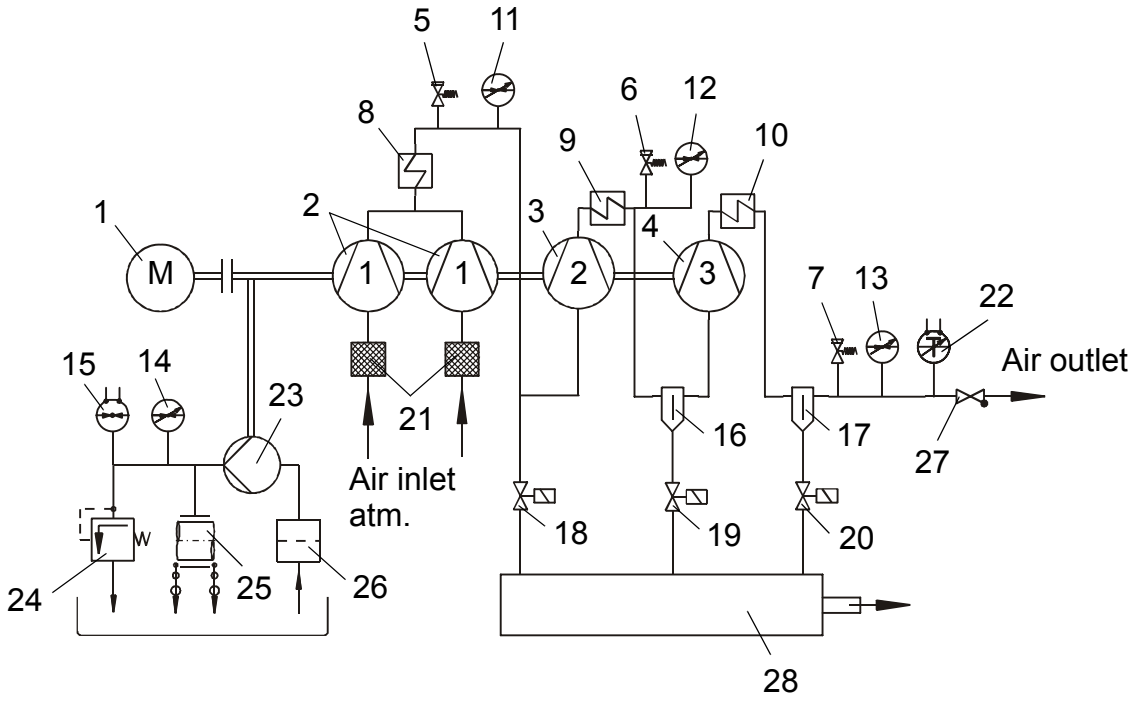
4.1 Specification data

Description	Data
Compressor type	WP 311 L
Number of cylinders	4
Number of compression stages	3
Cylinder diameter 1st stage	2 x 160 mm
Cylinder diameter 2nd stage	120 mm
Cylinder diameter 3rd stage	70 mm
Piston stroke	100 mm
Maximum speed	1800 rpm
Direction of rotation (when viewed from flywheel)	clockwise
Maximum working pressure	40 bar
Set pressures for safety valves:	
1st stage	4 bar
2nd stage	12 bar
3rd stage	5 % above final pressure
Oil sump quantity	21.5 l
Oil quantity between the dip stick marks (MAX./MIN.)	4.5 l
Oil type	See Chapter 10 "Lubricant table"
Oil pressure monitor:	
Maximum switching current	6 A / 220 V

Description	Data
Setting	opens at 1 bar falling closes at 2 bar rising approx. 15 s delay on start instruction
Switch function	change-over contact
Drain valves	
Power	30 VA / 8 W
Setting	currentless open relief starting: approx. 5 s periodic drainage: every 15 minutes for 15 s
Final pressure switch (option):	
Maximum switching current	6 A / 220 V
Setting	as per customer's specification
Switch function	change-over contact
Temperature monitor (option):	
Maximum switching current	6 A / 220 V
Setting	opens at 80 °C rising
Switch function	change-over contact
Sound pressure level (free field at a distance of 1 m)	max. 93 dB(A)
Weight and dimensions	See installation drawing

Note!
Please refer to the order-specific documentation of your compressor for data such as final pressure, speed, power requirements, etc.

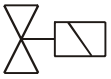
4.2 P&I Diagram




Drive motor

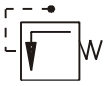

Compressor stage


Oil pump


Solenoid valve


Safety valve


Non-return valve


Relief valve


Oil pressure switch


Temperature switch

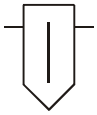

Pressure gauge


Drive lubrication


Oil filter


Oil filter / strainer


Intermediate cooler and aftercooler


Separator

Item	Description
1	Drive motor
2	1st compressor stage
3	2nd compressor stage
4	3rd compressor stage
5	Safety valve 1st stage
6	Safety valve 2nd stage
7	Safety valve 3rd stage
8	Cooler 1st stage
9	Cooler 2nd stage
10	Cooler 3rd stage
11	Pressure gauge 1st stage
12	Pressure gauge 2nd stage
13	Pressure gauge 3rd stage
14	Oil pressure gauge
15	Oil pressure switch
16	Condensate separator 2nd stage
17	Condensate separator 3rd stage
18	Solenoid valve (drainage) 1st stage
19	Solenoid valve (drainage) 2nd stage
20	Solenoid valve (drainage) 3rd stage
21	Oil filter / strainer
22	Temperature switch (option)
23	Oil pump
24	Relief valve
25	Drive lubrication
26	Oil filter
27	Non-return valve
28	Condensate collection vessel

5 Transport and Installation

5.1 Transport

Shipping

The machine is suitably packed for shipping.

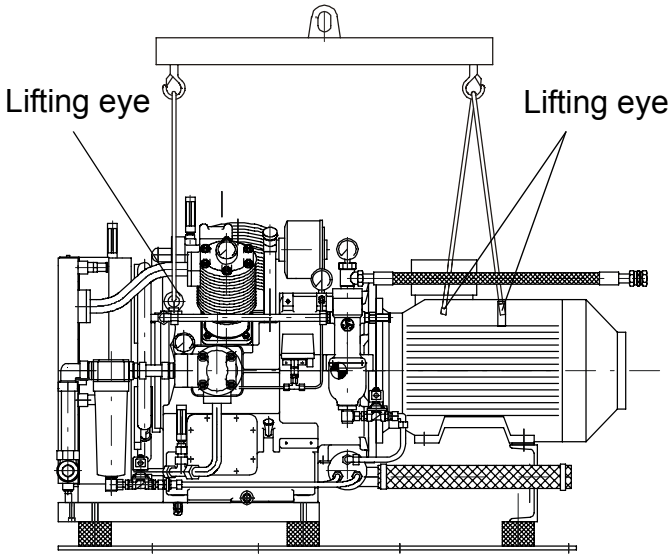
- Immediately on receipt of the Sauer compressor, it should be checked for completeness and any damage.
- The transport company and J.P. SAUER & SOHN must be notified immediately of any damage to the packing or the machine.

Transport

The Sauer compressor must be transported by a forklift truck or hoisted by a crane.l

Danger!
Suspended load when transported.
The forklift truck/crane must have sufficient load bearing capacity.

- Ensure that no personnel are within the danger area of the suspended load and the forklift truck/crane.
- Sling the unpacked compressor at the three lifting eyes (see illustration).
- Lift, move, and set down carefully.



5.2 Storage before installation

If the Sauer compressor has to be stored before installation, do not unpack it, and store it in the following conditions:

– Temperature: +5 to +40 °C;
– relative humidity 30 … 95 %, non-condensing;
– dry area, under a roof and protected against the weather;
– protected against soiling;
– protected against vibration and shock;

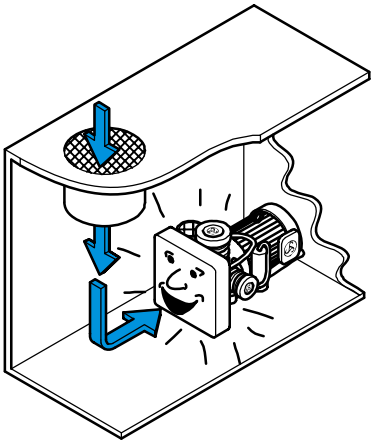
Note!
The standard factory preservation from Sauer is sufficient for a maximum storage period of 12 months.

5.3 Installation

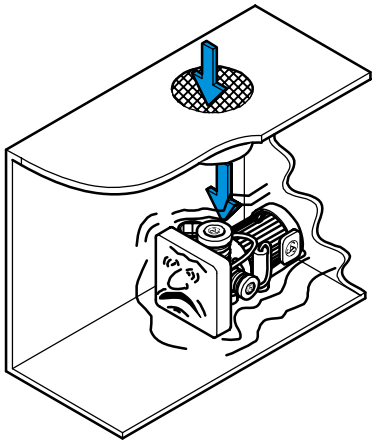
Note!
If in doubt regarding the suitability of the intended place of installation, please contact J.P. SAUER & SOHN. Sauer can provide help with the design of a ventilation, system if required.

For proper installation observe the installation instructions and the following.

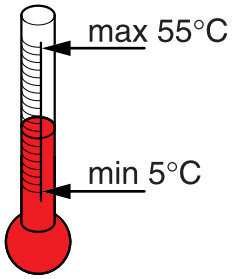
Correct ventilation



Incorrect ventilation



Installation conditions



- The installation area must be dry and free from dust.
- Ensure that the installation is ventilated in such way that the heat generated during operation is removed.
- Operational:+5°C … +55°C
  (If it is intended to operate the compressor outside this temperature range, please contact J.P. SAUER & SOHN for written approval.)
- For proper installation observe the installation instructions and the following.

Note!
The air temperature at the cooling air intake to the compressor must not exceed +55 °C when the compressor is running. Room conditions and the heat generated by the compressor and other machines installed in the room must be taken into consideration.
If necessary, install a ventilation and/or exhaust system at the place of installation.
Install the fresh air feed of the ventilation system in such way that the cooling air stream is never directed at the compressor. This helps to avoid any risk of condensation inside the machine and subsequent damage.

- At a room temperature below +5 °C the room needs to be heated or the Sauer compressor must be equipped with a heating system.
- Choose the installation location such that the Sauer compressor is accessible and has sufficient clearance all round for maintenance (see installation documents).
- Install in such a way that the motor end is not in a recess of the installation area so that the compressor does not take in the warm cooling air again.
- The installation must ensure that the fan cannot recirculate the warm cooling air.
- Do not install several compressors one after the other in order to prevent one compressor from taking in the warmed-up cooling air of another compressor.

Note!
J.P. SAUER & SOHN would be pleased to provide advice on the installation of the compressors.

Foundation

Note!
The resilient-mounts delivered as standard have a resonance frequency of approx. 10 Hz.
Therefore, vibratory excitation of the compressor-foundation from other machinery sources installed in the vicinity, must not be in the 10 Hz range. This helps to avoid any risk that the standard resilient-mount being excited by a resonant frequency.

1. Check that there are no excitation ’foundation’ vibrations in the 10 Hz range.
2. If in doubt, contact J.P. SAUER & SOHN for advice on a possible alternative resilient-mount.

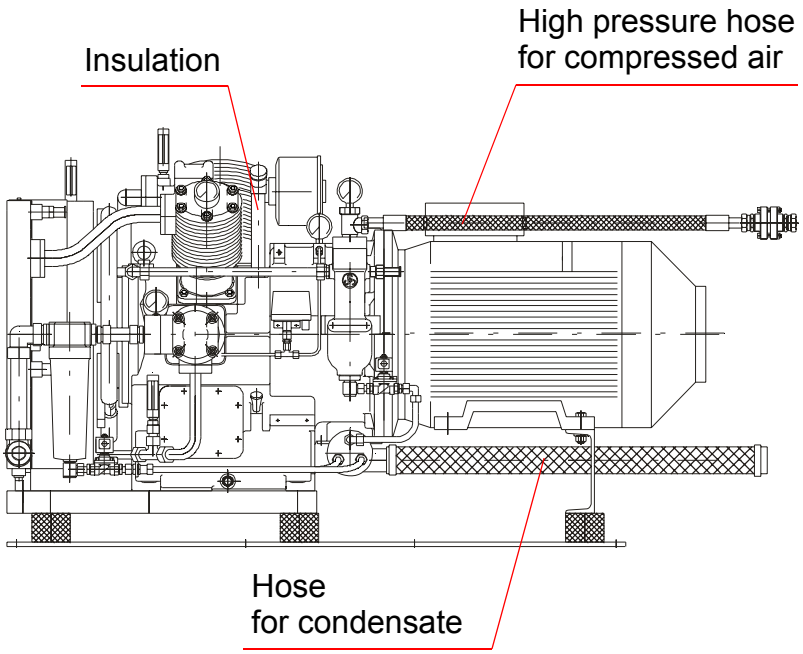
5.4 Connecting the compressor

Danger!
The compressor should only be connected by a qualified technician. Any work on the electrical installation must only be carried out by a qualified electrician.

Note!
The oil filling pipe is protected with an insulating hose. Do not take away this insulating material.

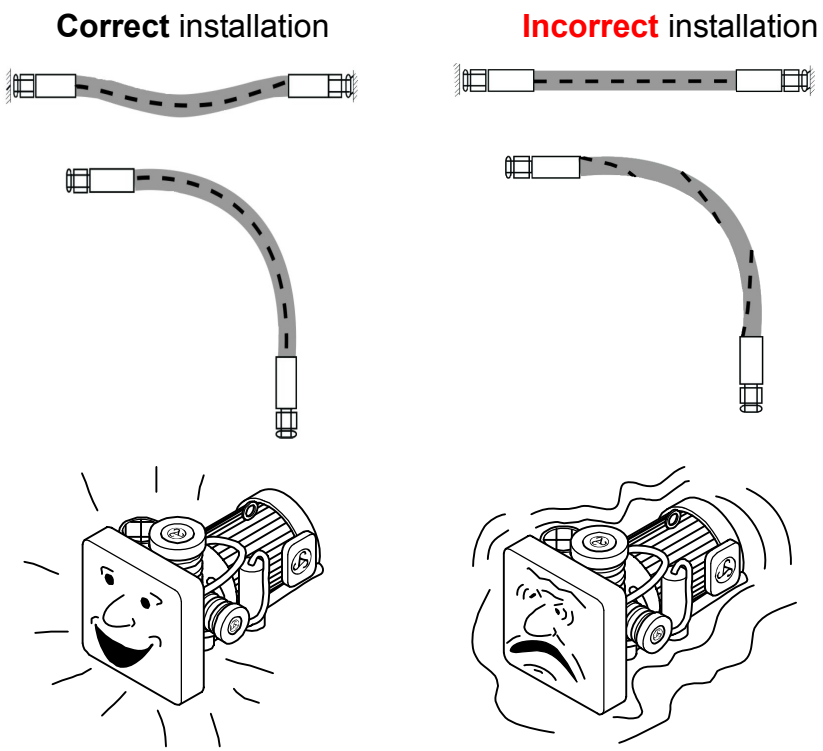
Pipelines

The compressed air outlet and the drainage connections of the Sauer Kompressors must be connected with hoses to the fixed pipelines of the system operator.



Danger!
Compressed air escapes from the drainage connections when the compressor is started and during drainage. Therefore, do not operate the compressor without connecting the hoses.

The hose lines have to be installed free of tension and not twisted.

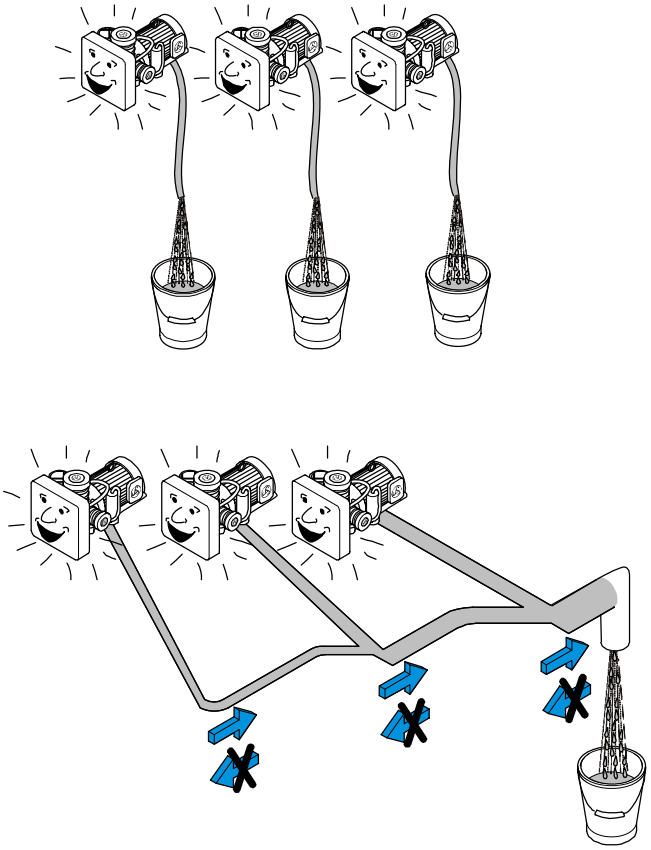


Drainage

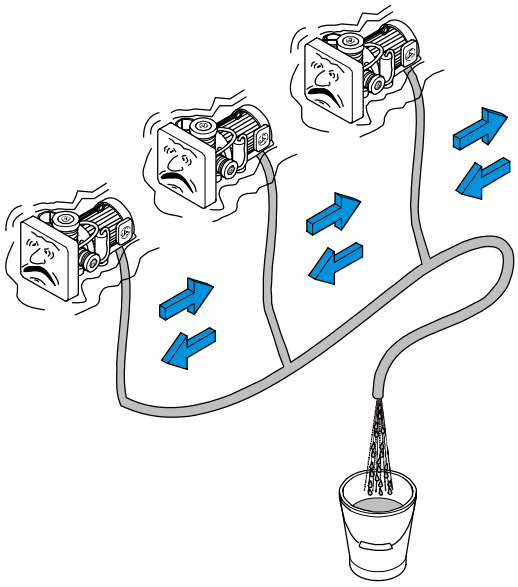
Note!
Accumulated 'condensate' contains oil. It may only be disposed of in compliance with applicable legal regulations.
J.P. SAUER & SOHN offers condensate collecting vessels for separating the air from the condensate and condensate treatment systems for separating the oil from the condensate.

Note!
We recommend to connect the compressor's drainage separately.
If the drain lines of **several compressors** are to be connected to a common pipe, observe the following:
Choose a sufficient nominal diameter for the common drain line;
Connect drain lines of the individual compressors at a sharp angle to the common drain line, so no pressure can build up in the drain line of a stopped compressor.

Correct connection

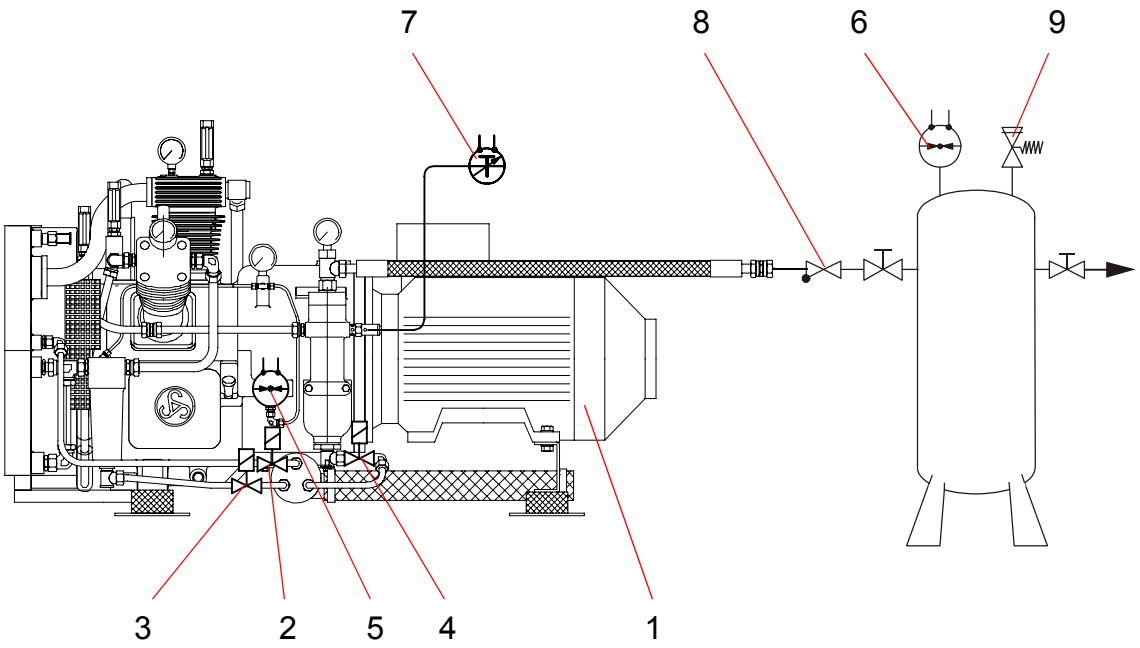


Incorrect connection



Connections

The illustration below shows the connections and fittings for the operation of a typical Sauer compressor.



Item	Description	Type	Function
1	Drive motor	AC motor	Driving the compressor
2	Drain valve 1st stage	Solenoid valve	Start relief and drainage
3	Drain valve 2nd stage	Solenoid valve	Start relief and drainage
4	Drain valve 3rd stage	Solenoid valve	Start relief and drainage
5	Oil pressure switch	Toggle switch	Switching off the compressor if the oil pressure is too low
6	Final pressure switch	Toggle switch	Start/stop the compressor
7	Temperature monitor (optional)	Toggle switch	Switching off the compressor if the temperature is too high
8	Non-return valve	Plug valve	Prevent air back-flow
9	Safety valve	Spring-operated safety valve	Prevent overpressure of parts under pressure

Note!
For technical specifications of the individual items please refer to Chapter 4.
All optional toggle switches are set at the factory.
Optionally the components are already prewired on a terminal box.

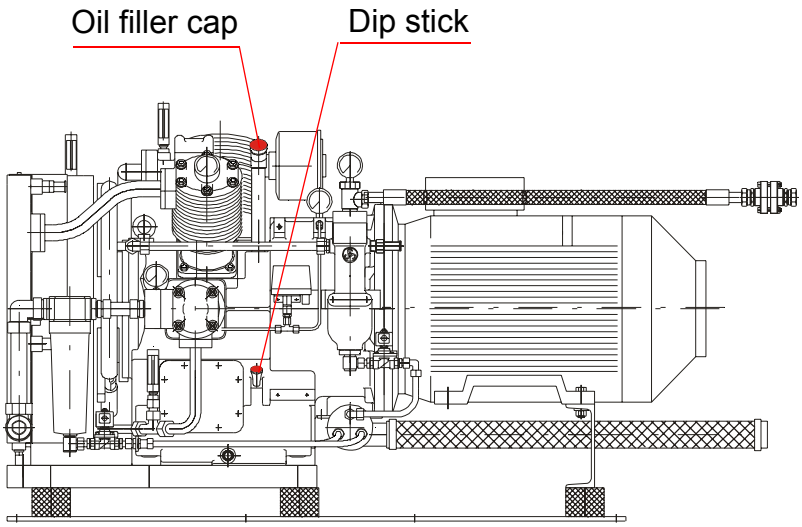
5.5 Stop/Start pressure switch setting(s)

Note!
Any final pressure switch should be connected directly to the compressed gas storage vessel to ensure a proper compressor operation.

Keep in mind the pressure drop between the compressor and the compressed gas storage for setting the maximum pressure. The safety valve of the final stage will blow if the set value of pressure is too high.

5.6 Filling with oil

Sauer compressors are delivered without oil.



Danger!
The compressor's crankcase oil sump must be filled with oil before initial operation!
Use lubricating oil (see Chapter 10 "Lubricant Table").
Note the amount of oil needed (see Chapter 4 "Technical Specification").

1. Unscrew the oil filler cap (red).
2. Fill oil and check the oil level with the dip stick (red).

Note!
Only fill to the upper mark on the oil level indicator. If overfilled the oil consumption of the compressor will increase.

3. Remove the dip stick and screw in the oil filler cap.

5.7 Installation checks before the initial start

- Check whether the electrical connection corresponds with the data on the nameplate.
- Check if all compressor connections to the compressed air system are properly installed. Pay special attention to the compressed air connection.
- Are drain lines properly connected? See section "Drainage".
- Has the crankcase been filled with oil?
- Have all tools and foreign objects been removed from the compressor?
- Check whether the cooling air inlet is not obstructed or clogged.
- Has the air filter been turned from the transport position to the operating position?
- Is the entire unit clean?

6 Operation

6.1 Safe operation

Danger!
Only authorised persons are permitted put into operation and operate the Sauer compressor!

Danger!
Turn on and start the compressor only if
it has been checked for proper working condition;
all tools and foreign objects have been removed from the machine.

Danger!
Immediately turn the compressor off if personnel and objects are endangered. Start compressor only when there is no danger or possible damage.

Danger!
In automatic mode the compressor starts automatically without warning.

Danger!
Risk of burns from touching hot surfaces of the compressor during operation. Wear protective gloves.

Danger!
Risk of hearing damage due to the sound pressure level when the compressor is running! Wear ear protection near the compressor.

Note!
Turn the compressor off if there are any faults, irregularities or if the operating values are not normal. Refer to Chapter 7 "Troubleshooting" to correct any fault.

6.2 Operation modes

When the power supply to the Sauer compressor is turned on, it can be started with the operation mode selector switch in one of the following two operation modes:

– Operation mode "**Manual**":
  The compressor starts and keeps running until it is stopped or turned off with either the operation mode selector switch or the main switch.
– Operation mode "**Automatic**":
  Starting and stopping of the compressor are controlled by external devices (e.g. by the pressure switch of the pressure vessel).

When the Sauer compressor starts, it starts without load with the drain valves open. After a few seconds the valves close and the compressor runs up against pressure.

6.3 Initial operation

Check the direction of rotation

Allow the Sauer compressor to run only for a few seconds to check the direction of rotation.

1. Turn the power supply on.
2. Set the operation mode selector to “Manual“ to start the compressor in manual mode.
3. Immediately check the compressor's direction of rotation. It must rotate in the direction indicated by the arrow on the crankcase.
4. Set the operation mode selector to “0“ to stop the compressor.
5. Turn the power supply off.
6. If the direction of rotation is incorrect, the polarity of the electric motor should be changed by a qualified electrician.

Danger!
If the direction of rotation is incorrect, there is no oil pressure. Risk of subsequent damage.

Test run

1. Turn the power supply on.
2. Set the operation mode to “Manual” to start the compressor in manual mode.

√ If the setting is correct, the drain valves will close after approx. 15 seconds and the compressor will run up against pressure.

3. Check the gas pressure for each stage and the oil pressure, and compare with the nominal values (for nominal values see Chapter 6.4 “Routine operation”).
4. Check the function of the automatic periodic drainage.

√ Drainage must occur for approx. 15 seconds every 15 minutes. This is shown as pressure drop on the pressure gauges.

5. Set the operation mode selector to "0" to stop the compressor.
6. Turn the power supply off.
7. If necessary, correct any faults and deviations from the desired values. See also Chapter 7 "Troubleshooting".
8. Complete the start up journal and send it to J.P. SAUER & SOHN service department. The start up journal can be found in the appendix to this manual.

6.4 Routine operation

Cleaning

- Keep compressor area clean.
- Keep indicators and control elements clean.

Checks

- Inspect connections, pipes and electric cables for damage.
- Check the oil level once a week before starting and top up if necessary. Do not overfill with oil beyond the maximum mark.

Operation

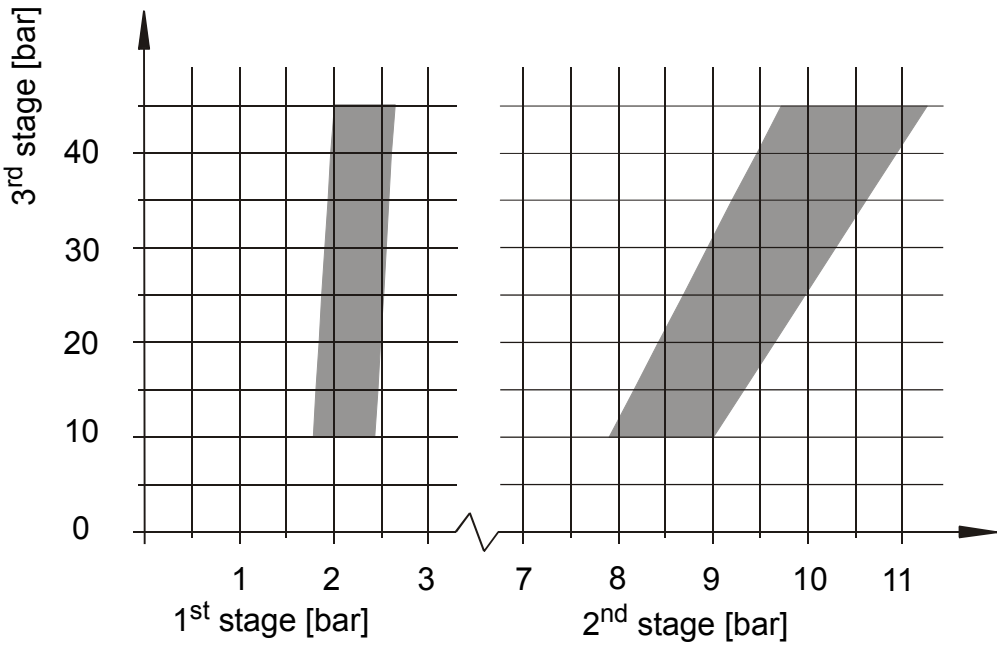
1. Turn the power supply on.
2. Set the operation mode selector switch to "Auto" to operate the compressor in automatic mode.

Observation

- Pay attention to abnormal operating noise.
- Pay attention to leaks (compressed air, oil, condensate).
- During operation the pressure indicated at the optional pressure gauge should be within the shaded region of the stage pressure chart (see stage pressure chart, 1st and 2nd stage).
- The oil pressure should be between 1.8 bar and 4 bar.

For any deviation see Chapter 7 "Troubleshooting".

Stage pressure diagram - 1st and 2nd stage



Note!
Depending on the desired final pressure in the 3rd stage, the allowable pressure for the 1st and 2nd stage can be read from the above diagram.

7 Troubleshooting guide

Note!
Should a malfunction occur, first check the 'User Interface' display status on the compressor Control Panel.
The following information tabulated below, provides help to correct any fault.
If the fault cannot be corrected, please contact J.P. SAUER & SOHN customer service. The fault description journal is in the appendix of this manual.

Fault	Probable cause	Remedy
The compressor does not start or shuts down.	No supply voltage / no control voltage.	Check fuses. Replace blown fuses.
Compressor shut down, oil pressure monitor has responded.	The oil level is too low.	Check the oil level and refill with oil if necessary. Check for leaks.
	Oil too viscous.	Fill oil in accordance with the recommendations. Check if the ambient temperature is > + 5 °C.
	Oil filter blocked.	Clean the oil filter.
	Oil pipe blocked.	Clean the oil pipe.
	Oil pump is faulty or leaking.	Check the oil pump. If necessary, fix the leak or replace the oil pump.
Compressor was switched off by the overcurrent relay.	Excessive current drawn.	Check the supply voltage and the electrical connections. The compressor can be started again after a cooling down period.
		Check if the crankshaft can be easily rotated by hand. If not, decouple it and check if the fault lies in the motor or the compressor.
	Piston seizure	Check cylinders and pistons for any score marks and replace as necessary.
Safety valve of 1st stage blows:		

Fault	Probable cause	Remedy
Pressure exceeds set pressure (4 bar)	2nd stage valve malfunction.	Check the 2nd stage valve and replace if necessary.
	Gasket between suction and pressure end of the 2nd stage is defective.	Replace gasket.
Pressure below set pressure (4 bar)	Safety valve is faulty.	Replace the safety valve.
Safety valve of 2nd stage blows:		
Pressure exceeds set pressure (12 bar)	3rd stage valve malfunction.	Check the 3rd stage valve and replace if necessary.
	Gasket between suction and pressure end of the 3rd stage is defective.	Replace gasket.
Pressure below set pressure (12 bar)	Safety valve is faulty.	Replace the safety valve.
Safety valve of 3rd stage blows:		
Pressure exceeds set pressure (final pressure + 5%)	Valve in the air line to the compressed air vessel is closed.	Open the valve.
	Pressure switch set too high.	Reduce set pressure.
Pressure below set pressure (final pressure + 5%)	Safety valve set too low or defective.	Replace the safety valve.
	Too much pressure loss in the air line to the compressed air vessel.	Correct pressure losses.
Pressure gauge of the 1st stage indicates too high pressure.	2nd stage valve is leaky.	Check the 2nd stage valve and replace if necessary.
Pressure gauge of the 2nd stage indicates too high pressure.	3rd stage valve is leaky.	Check the 3rd stage valve and replace if necessary.
Pressure gauges of all stages indicate too low pressure.	1st stage valve is leaky.	Check the 1st stage valve and replace if necessary.
	Air filter heavily soiled.	Clean or replace the air filter insert.
Pressure gauges of all stages indicate no pressure.	No power at the solenoid valve of the drainage.	Check solenoid valve power supply.
	Solenoid valve of the drainage is faulty.	Check the solenoid valve and replace if necessary.

Fault	Probable cause	Remedy
Air escaping from compressed air lines.	Gaskets of the connections are leaking.	Replace the faulty gasket.
	Cutting ring connections leaky.	Switch off the compressor. Wait until all parts are relived of pressure and check the pressure gauges. Then tighten the connections.
Air escaping from the overflow opening of the final separator safety fuse.	Compressed air temperature at the outlet is too high; insufficient cooling due to faulty fan.	Replace the fan. Replace the safety fuse.
	Cooler is heavily soiled; insufficient ventilation.	Clean the cooler. Check the room ventilation. Replace the safety fuse.
Compressor was shut down, temperature monitor has responded.	Compressed air temperature at the outlet is too high; insufficient cooling due to faulty fan.	Check if the fan wheel can be rotated, check the fan wheel and replace if necessary. Check if the ambient temperature is < 55°C. Check whether the cooling air inlet is not blocked.
	Cooler is dirty or feed line is blocked; insufficient ventilation.	Clean the cooler. Check the room ventilation.
Solenoid valve (drainage) does not close.	No supply voltage.	Check fuses, replace blown fuses.
	Solenoid faulty.	Replace the solenoid.
	Foreign matter in the solenoid valve.	Clean the solenoid valve.
Abnormal compressor noise.	Connecting rod bearing (big-end bearing) faulty.	Check the connecting rod bearing and replace if necessary. Check the oil supply.
	Gudgeon pin bearing faulty.	Check the gudgeon pin bearing and replace if necessary.
	Crankshaft bearing faulty.	Check the crankshaft bearing and replace if necessary.
	Motor bearing faulty.	Check the motor bearing and replace if necessary.
Oil leaking to the outside.	Gasket or shaft sealing ring faulty. Screws not tight.	Tighten the screws. If there is **significant leakage**, check to see which gasket is faulty and then replace it. **Minor traces of oil** on the crankcase or oil drops below the compressor are harmless. Wipe off with a lint-free rag.
Air escaping between cylinder and valve cover.	Gasket or O-ring of the liner above the relief groove is faulty.	Replace gasket or O-ring.

Fault	Probable cause	Remedy
Oil leaking at the relief groove of the cylinder flange surface.	O-ring of the liner below the relief groove is faulty.	Replace the O-ring.
Water in the oil	Incorrect ventilation (excessive cooling of the compressor)	Correct the room ventilation.
	Poor drainage.	Check drain lines and drain intervals..
	No insulating hose at crankcase ventilation or insulating hose is damaged.	Replace the insulating hose.
	Very short compressor running time.	Prolong the compressor running time.

8 Maintenance

8.1 J.P. SAUER & SOHN maintenance service

J.P. SAUER & SOHN customer service offers various maintenance services: inspections, maintenance, major overhauls, reconditioned compressors and service contracts.

8.2 Safety during maintenance

Before maintenance work

1. Interrupt power supply to the compressor.
2. Fit 'Warning: maintenance work' warning sign to power supply.
3. Shut off the compressor and secure to prevent restarting.

Danger!
Risk of injury due to incorrect operation!
Only authorised personnel are permitted to service and adjust the Sauer compressor!

Danger!
Risk of injury from hot surfaces!
Let compressor cool down after turning OFF.

Danger!
Risk of injury due to pressurised components!
Before undertaking any maintenance work, use pressure gauge to ensure that there is no more pressure in the compressor.

Danger!
Danger! High voltage!

- Never assume that a circuit is de-energised – always check for your own safety!
- The mains isolator remains energised, even when it is turned OFF.
- Components being worked on should only be energised if this is explicitly specified.

Danger!
Danger of death if there are no safety devices or no isolating protection devices!
After undertaking servicing work, always refit all safety devices and isolating protection devices. This also applies to electrical protection devices.

8.3 Maintenance schedule

Danger!
Whenever undertaking maintenance work, observe section 8.4, 'Table of tightening torques', for particular bolts.

Note!
The maintenance intervals specified in the maintenance schedule must be observed. Shortening the maintenance intervals is of no advantage with regard to the operating performance or service life of the Sauer compressor.

Note!
After the final maintenance routine, the maintenance schedule starts from the beginning.

Use of the maintenance schedule

- Use the maintenance schedule as a master template or copy the relevant page from the digital document and save it as a separate file under a suitable name. Use the maintenance schedule as a guide and for verification.
- Regularly check the maintenance schedule to see which maintenance intervals are due depending upon the number of operating hours. The intervals are shown in the table's column headers.
- Check the column for each maintenance interval to see which maintenance work is to be carried out at the end of the maintenance interval. The required tasks are indicated by checkboxes. A description and the section number of the tasks are shown in the first column.
- **Carry out** all maintenance tasks for a maintenance interval and **tick** the appropriate check boxes of the maintenance schedule. Then **enter** hours of operation, date and signature.
- When beginning a new maintenance schedule:
  - **enter**: maintenance schedule number, date and hours of operation, main specifications and date of commissioning;
  - **mark with a cross**: beginning of this maintenance schedule following commissioning or following the last maintenance routine.

Maintenance Schedule No.	
Beginning of this maintenance schedule	
❑ after commissioning ❑ after last maintenance routine	
Date:	
Hours of operation:	

Compressor type	WP311L
Type series	3L
Compressor number:	
Factory no.:	
Year of construction:	
Date of initial operation:	

Interval [hours of operation] / Maintenance work	50 h after initial commissioning	50 h after last maintenance routine or repair	At least annually at < 1000 h	1000 h	2000 h	3000 h	4000 h
Maintenance set item No.				069266	069200	069266	069201
Check screwed connections, chapter 8.5	❑	❑					
Replace air filter cartridge, chapter 8.6			❑	❑	❑	❑	❑
Carry out oil change, chapter 8.7	❑	❑	❑	❑	❑	❑	❑
Clean oil strainer, chapter 8.8							❑
Check 1st stage valves, chapter 8.9					❑		
Check 2nd stage valves, chapter 8.9					❑		
Replace 1st stage valves, chapter 8.10							❑
Replace 2nd stage valves, chapter 8.10							❑
Replace 3rd stage valves, chapter 8.10					❑		❑
Replace 1st stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Replace 2nd stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Replace 3rd stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Check piston and cylinder, chapter 8.12							❑
Renew flexible gear rim, chapter 8.15							❑
Check condensate separator, chapter 8.16							❑
Overhaul drain valves (as per order), chapter 8.17							❑
Hours of operation							
Date							
Signature (initials)							

8.4 Table of torques

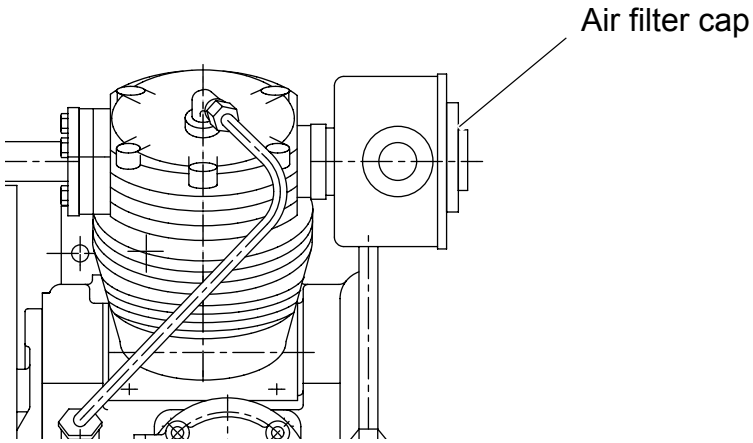
Bolt(s)	Torque
Connecting rod bolts	70 Nm
Flywheel bolt	350 Nm
Cylinder head nuts	75 Nm

8.5 Checking screwed connections

Check all unions and screwed connections for tightness and re-tighten if necessary. This relates to:

– cooler and air lines;
– unions on pipe and hose lines;
– cylinder heads;
– cylinders;
– electric motor;
– measuring and switching devices;
– bearing; and
– accessories and equipment parts.

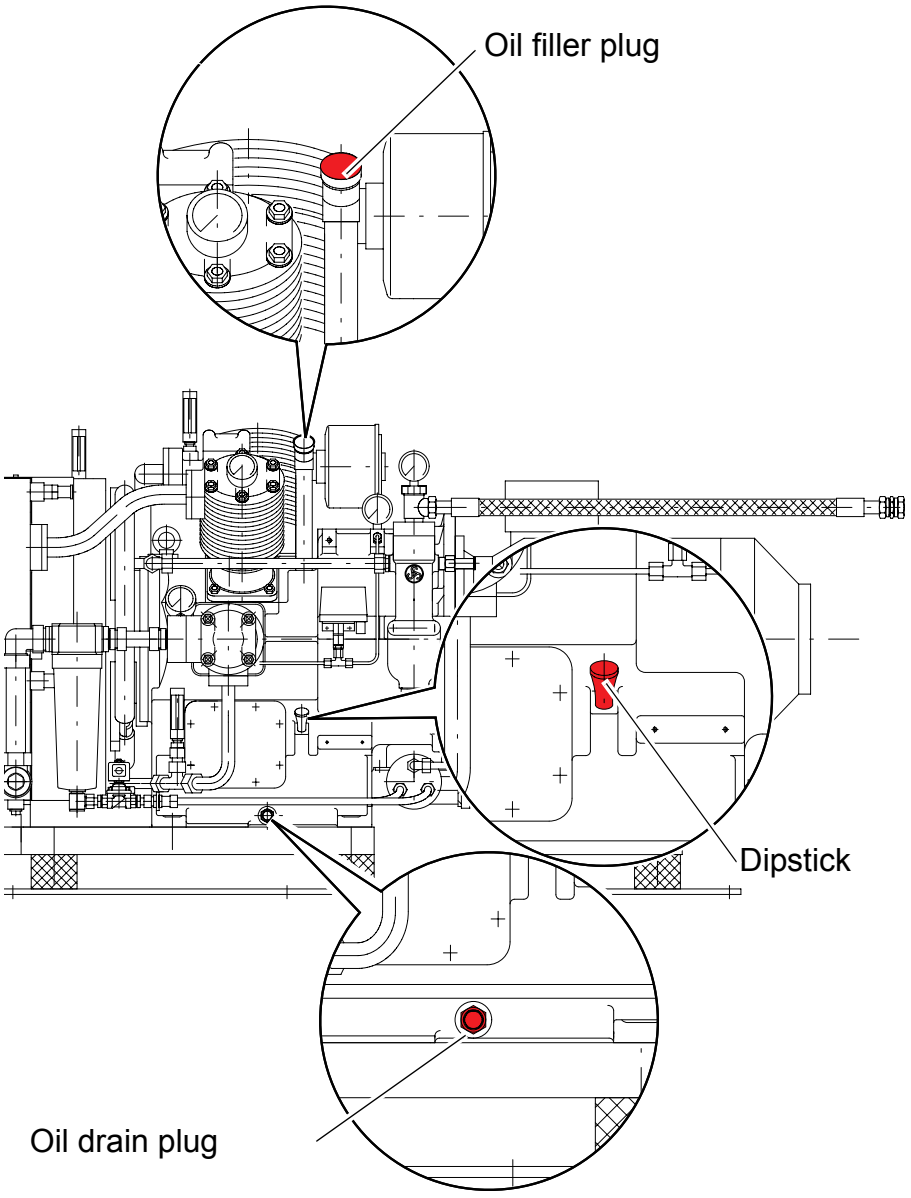
8.6 Replacing air filter cartridge



1. Open clips and take air filter cap off.
2. Remove used cartridge.
3. Clean filter housing with a suitable solvent and wipe out with a lint-free cloth.
4. Insert new cartridge into air filter.
5. Put on cap and close clips.

8.7 Carry out oil change

Note!
Use oil according to the lubricant table (see chapter 10).



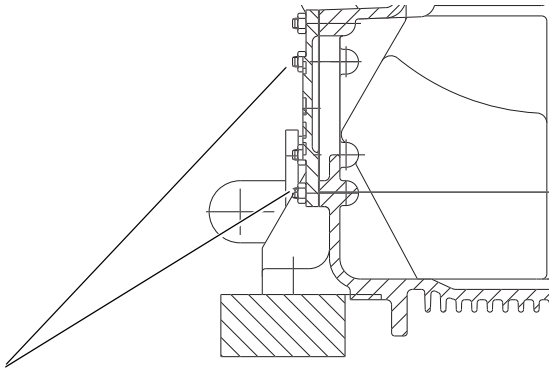
1. Run compressor for approx. 5 minutes until operating temperature is reached.
2. Place oil pan (of a capacity sufficient to hold the complete oil filling, 21.5 l) below the oil drain plug.
3. Unscrew oil filler plug (red), unscrew oil drain plug and pull out dipstick.
4. Wait until all oil is drained.
5. Screw on oil drain plug with a new ring.

6. Top up oil and check level with the dipstick.

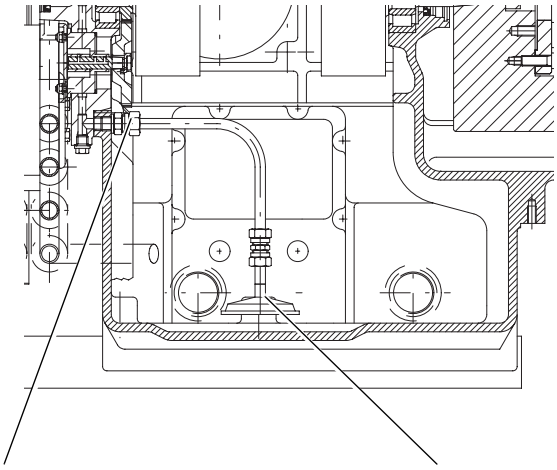
3 The level should be between the upper and lower mark on the dipstick.

7. Put dipstick back in and screw the oil filler plug back on.

8.8 Clean oil strainer



Nuts for inspection hole cover



Screwed connection Oil strainer

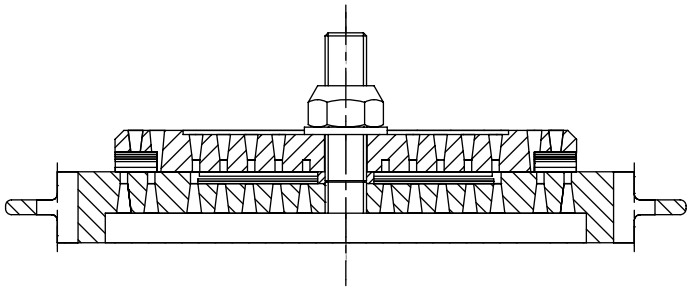
1. Unscrew nuts for inspection hole cover.
2. Take off inspection hole cover.
3. Unscrew union on oil strainer.
4. Take out oil strainer.
5. Wash out oil strainer in suitable solvent.
6. Carefully clean sealing surface for inspection hole cover gasket.
7. Position inspection hole cover with new original Sauer gasket.
8. Tightly refasten oil strainer.
9. Tighten nuts for inspection hole cover.

8.9 Checking the valves

Remove valves

1. Loosen unions and hose line at the cylinder heads.
2. Remove cylinder head nuts and remove the cylinder heads.
3. Remove the valves with care.

Note!
When removing and installing a valve, take care that no valve parts are damaged. This particularly applies to the sealing surfaces.



Check valves

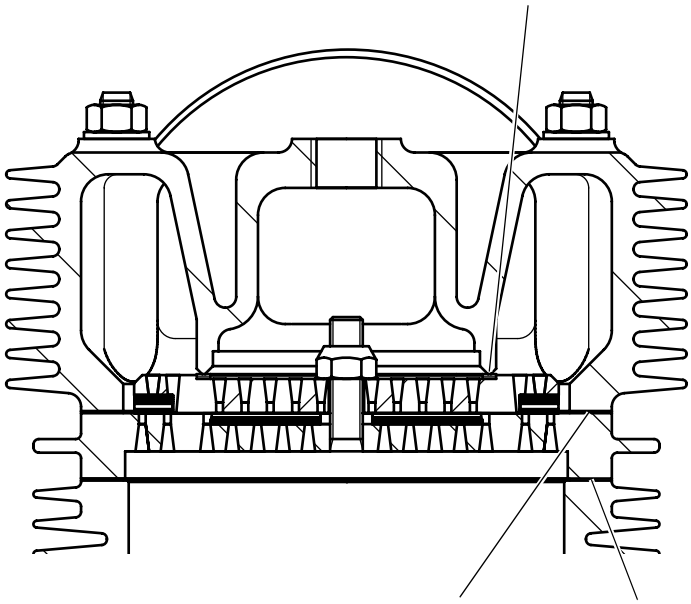
4. Check valves externally for:
   Damage,
   Carbonisation,
   Oiling,
   Corrosion and
   Moisture.
   Replace damaged, severely carbonised or corroded valves. Determine cause (see operating manual chapter 7 "Trouble-shooting").
5. Clean all sealing surfaces.

Remove valves

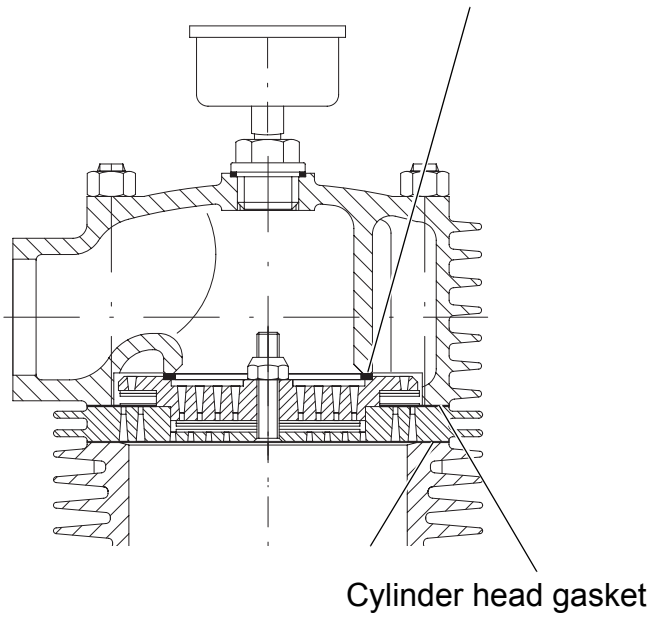
Note!
Refit all valves with new gaskets and rings only. Only use original Sauer spare parts. Installing other gaskets may lead to compressor leaks and damage.

6. Install valves and cylinder heads. Insert new cylinder head gaskets and new low tolerance gaskets (see Illustrations).

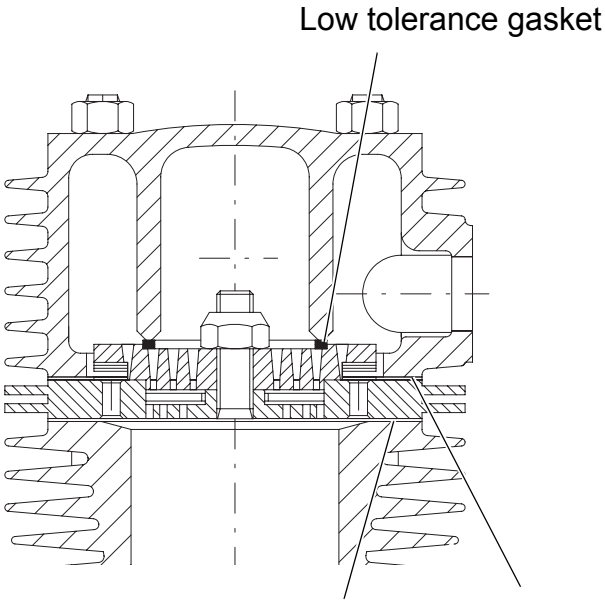
1st stage



2nd stage



3rd stage



Note!
Never reuse or turn over and reuse the old low tolerance gasket. This may lead to leaks.

7. Attach unions and hose line to the cylinder heads.

Note!
Valves are those parts of a reciprocating compressor that are subject to the most stress. In order to achieve the guaranteed maintenance routines, these valves are high-quality precision parts which have been co-ordinated especially to the individual compression stages and checked carefully for proper functioning before delivery.

8.10 Replacing valves

Remove and install valves as described in section 8.8, 'Checking valves'. Replace complete valve.

Note!
Valves whose service life has expired must be replaced and disposed of.
Due to material fatigue, we recommend that used valves not be repaired.

8.11 Replacing piston rings, gudgeon pins and gudgeon pin bearings

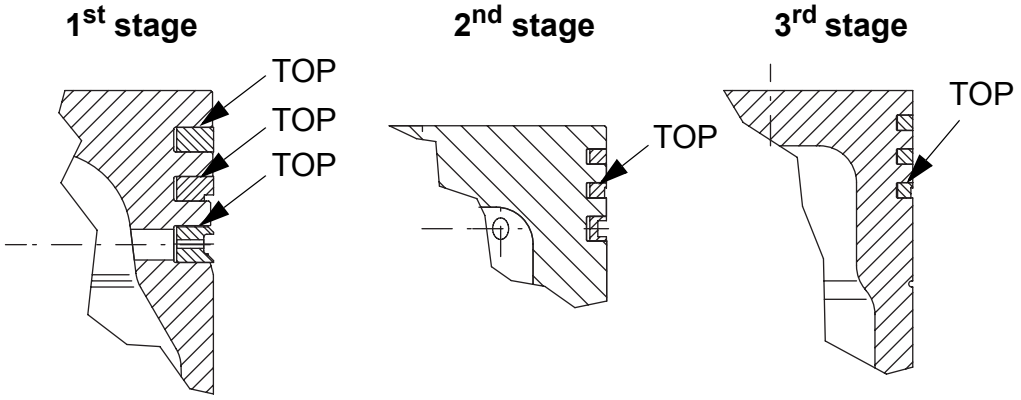
1. Remove cylinder heads and valves as described in section 8.9, 'Checking valves'.
2. Remove cylinder base nuts.
3. Remove cylinders. Grab and hold the piston before you have completely removed the cylinder.

Note!
If you do not hold the piston while you remove the cylinder, it will collide with the crankcase.

4. Remove the safety rings of the piston pins, press the piston pins out and remove the pistons.
5. Remove all piston rings from the pistons and clean pistons.
6. Install new piston rings in the respective pistons. Make sure they are in the correct positions: piston rings with asymmetrical cross sections are marked on one of the surfaces with 'TOP'. During installation this face must face upwards (see illustration).

Note!
Replace all piston rings with new ones! The following damage may occur on removal of the piston rings:

- the edges of the piston rings may be damaged on the wearing edges in the cylinder;
- fine cracks which can lead to material fracture may appear if the piston rings are bent up repeatedly.



Note!
Stagger the piston ring gaps.

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7. Press the gudgeon pin bearing out from the connecting rod eye using suitable tools and renew.
8. Install piston with the new, halfway-inserted gudgeon pin in the cylinder.
9. Insert new Sauer cylinder base gasket.
10. Assemble piston together with cylinder by pressing the gudgeon pin in at the connecting rod. Observe tightening torque (see section 8.4).
11. Insert circlips precisely into grooves.
12. Screw on cylinder base nuts.
13. Install cylinder heads and valves as described in section 8.9, 'Checking valves'.

8.12 Checking pistons and cylinders

1. Remove cylinder heads and valves as described in section 8.9, 'Checking valves'.
2. Remove cylinders and pistons as described in section 8.11, 'Replacing piston rings'.
3. Check cylinders and pistons for scoring and heavy wear and tear marks. Replace relevant parts.

Note!
If the piston running surface in the cylinder reveals perceptible wearing edges, the edges must be broken up with a honing brush or *Scotch-Brite* abrasive cloth.
Otherwise the edges will damage the new piston rings on installation of the pistons.

4. Check wear limits as described in section 8.13, 'Wear limits for cylinder diameters'.
5. Install cylinders and pistons as described in section 8.11, 'Replacing piston rings, gudgeon pins and gudgeon pin bearings'.
6. Install valves and cylinder heads as described in section 8.9, 'Checking valves'.

8.13 Wear limits for cylinder diameters

1. Measure cylinder and replace if the following wear limits are exceeded:

Cylinders	Wear limit of diameter
1st stage	160.15 mm
2nd stage	120.15 mm
3rd stage	Top part: 70.10 mm Guide part: 88.10 mm

8.14 Checking coupling

Note!
This applies to Sauer compressors with electric motors.

Visual inspection

1. Remove the electric motor from the copmressor as described in section 8.15, 'Renewing flexible gear rim'.
2. Check the coupling parts for damage.

3 The teeth of the coupling parts must not be deformed.

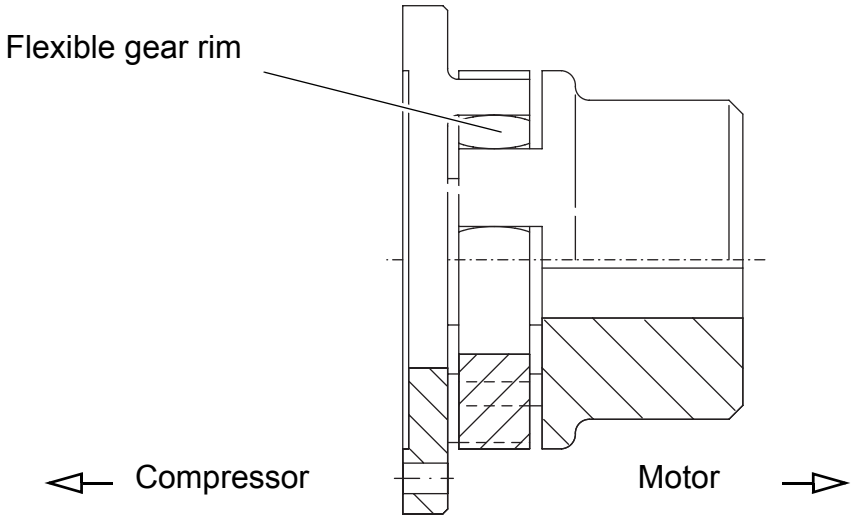
3. Replace flexible gear rim as described in section 8.15, 'Renewing flexible gear rim'.

8.15 Renewing flexible gear rim

Note!
This applies to Sauer compressors with electric motors.

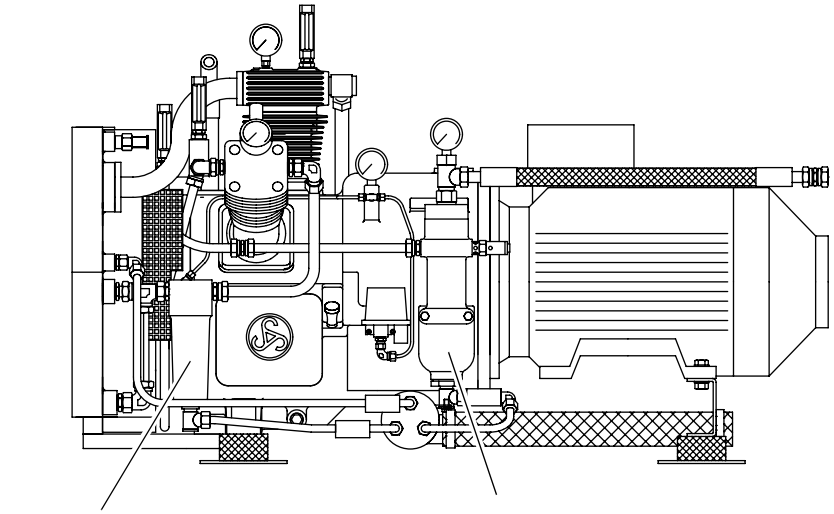
Renewing flexible gear rim

1. Support compressor under the coupling bell housing.
2. Remove the electric motor mounting screws.
3. Carefully lift the electric motor using the lifting eyes (see section 5.1, 'Transport').
4. Carefully pull the electric motor away from the compressor.
5. Replace flexible gear rim.
6. Carefully slide electric motor against the compressor and tighten the motor mounting screws.
7. Remove support from under the coupling bell housing.



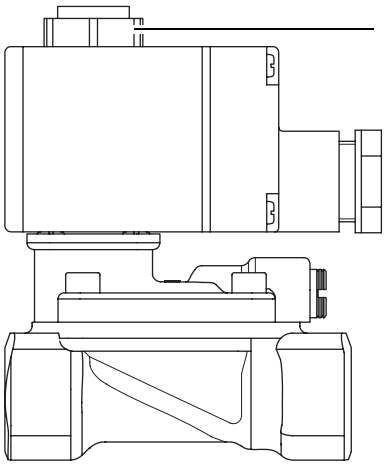
8. Reinstall separated connecting lines and pipes.

8.16 Check and clean condensate separator



1. Remove attached air lines and hoses.
2. Disassemble separator.
3. Check separator for internal and external damage and soiling.
4. Remove soiling with a suitable solvent.
5. Blow out solvent with air.
6. Assemble in reverse sequence.

8.17 Overhauling water drain valves



1. Unscrew hexagon nut.
2. Carefully lift up plastic threaded part with the screwdriver.
3. Remove coil from armature.
4. Unscrew the four Allen screws.
5. Remove upper section of valve.
6. Replace following parts:
   conical spring, diaphragm and two O-rings.
7. In case of severe soiling: clean nozzle.
8. Position upper section of valve.
9. Tighten the four Allen screws.
10. Place the coil on the armature.

Note!
The coil and the armature must always be dry.

11. Correctly position the plastic threaded part and press onto the armature.
12. Carefully position hexagon nut by hand and screw on.
13. Lightly tighten hexagon nut using a spanner.

9 Storage, Preservation - “lay-up“ procedure

9.1 Safety when storing and removing

Danger!

The compressor shall only be removed and ’layed-up’ by trained Operators and specialists. These specialists must be familar with the protection devices and regulations before starting the work. Any work on the electrical installation must be carried out by qualified electricians only.
In addition, information contained in the documentation of outside vendors must be observed.

9.2 Temporary preservation & storage

If idle, every 4 weeks perform a test run for at least 30 minutes. Additional corrosion prevention measures are not required.
When the Sauer compressor is to be layed-up **for more than 12 weeks**, preservation with a flushing or preservation oil is recommended. When this preservation is completed, periodic test runs are not needed.

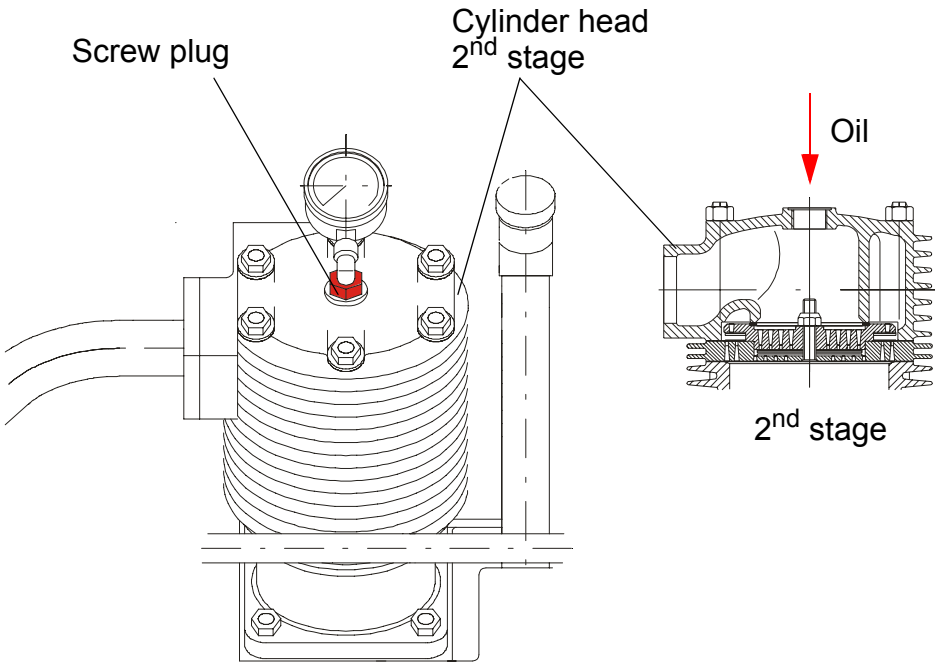
Note!

Use one of the preservation oils recommended in Chapter 10 "Lubricant Table" for corrosion protection.
The preservation oil has satisfactory running properties. In an emergency the machine can be started for a short duration when filled with preservation oil.

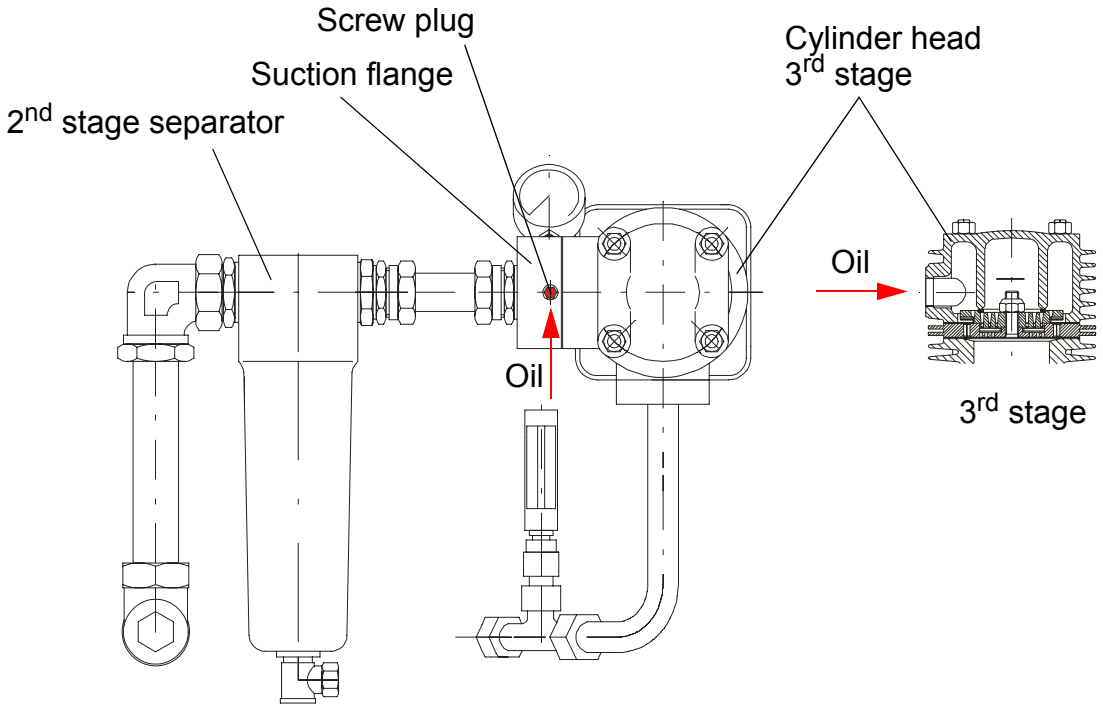
1. Run compressor for approx. 5 minutes with drain valves and pressure line open.

✓ Any existing oil / water is removed.

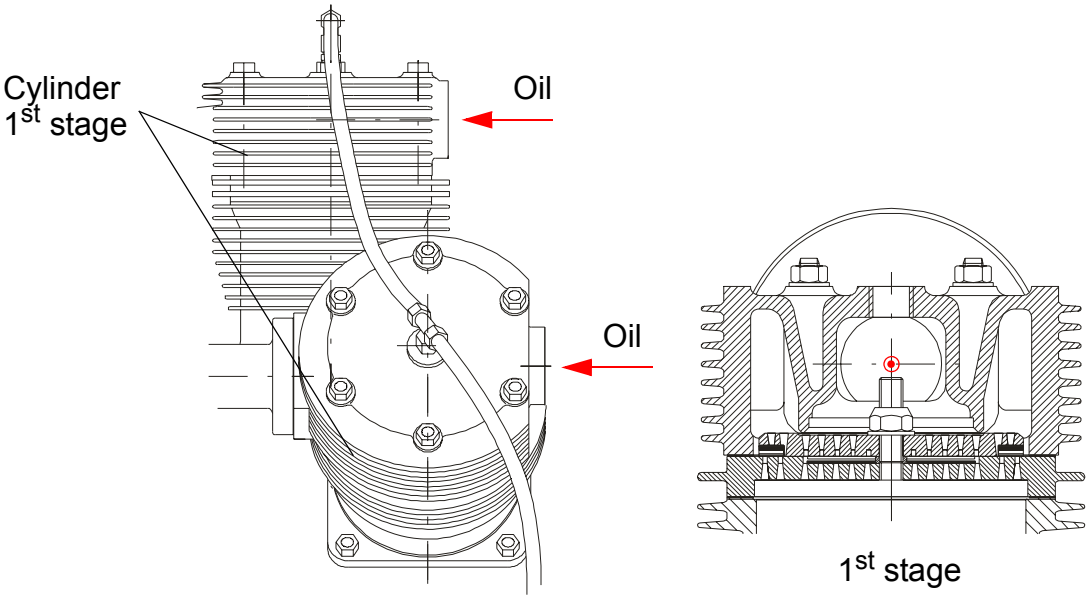
2. Drain compressor oil and dispose of it in an environmentally compatible manner.
3. Fill with about 15 litres of anti-corrosive oil.
4. Start compressor and run for approx. 5 minutes with drain valves and pressure line open.
5. Stop the compressor.
6. Remove the air filter on the cylinder heads of the 1st stage.
7. Remove the screw plug with pressure gauge on the cylinder head of the 2nd stage.



8. Inject approx. 10 cm^3 anti-corrosive oil in the opening of the 2nd stage cylinder head.
9. Tighten the screw plug on the cylinder head of the 2nd stage.
10. Remove the screw plug on the suction flange of the 3rd stage.



11. Inject approx. 10 cm^3 anti-corrosive oil in the suction opening of the flange of the 3rd stage cylinder head.
12. Tightly screw the screw plug again.
13. Start the compressor and inject approx. 15 cm^3 anti-corrosive oil in the intake fittings of the 1st stage.



14. Wait until oil mist escapes from the pressure line.
15. Stop the compressor.
16. Mount the air filter again on the cylinders of the 1st stage.
17. If necessary put up a sign that the compressor has been treated with anti-corrosion agents and is shut down.
18. If necessary disconnect the main supply.

Restarting

1. As necessary connect the mains supply.
2. Fill compressor oil as described in Chapter 5.6 "Filling with oil".
3. Proceed as described in Chapter 6.3 "Initial operation".

9.3 Removing

Removing

1. Switch off the compressor and disconnect from power supply.
2. Make sure by reading the pressure gauges or the pressure display that the compressor is completely relieved of pressure.
3. Disconnect the mains supply cables.
4. Remove oil and lubricants for safe disposal.
5. Drain any remaining condensate, again for safe disposal.

Disposal

Material / Component	Safe disposal
Lubricants	Hazardous waste
Steel / iron	Metal scrap
Electric cables	Hazardous waste
Electronic components	Electronic waste
Plastics	Hazardous waste

10 Lubricant table

Scope

The lubricant table applies to all Sauer compressors intended for air compression.
The lubricant table does **not** apply

– to Sauer compressors used for compressing neutral gases;
– to temperature ranges outside 5 … 55 °C.

General recommendation

For the temperature range of 5 … 55 °C, we recommend **mineral oils** of a viscosity class according to **ISO VG 100**. The lubricating oils should at least correspond to the **VCL group as per DIN 51506** .
We do not allow the use of synthetic lubricating oils for 3-stage air-cooled compressors due to the following reasons:

– The good water separation properties of synthetic lubricating oils result in condensation of moisture in the crankcase, and there is a risk of corrosion and drive damage.
– Depending on their type of construction, 3-stage air-cooled compressors have low final compression temperatures. Therefore, the high temperature stability of synthetic oils is of no use.

Note!
The recommended oil types reduce coking in the compressor valves and in the pipelines and fittings to a minimum.
Lubricants not listed in the lubricant table may only be used with the permission of J.P. SAUER & SOHN. Otherwise the warranty will be void.
Please contact our Customer Service when selecting oils not listed or if the operating conditions differ from those recommended.

Note!
Unless explicitly requested, Sauer compressors are supplied without first oil fill.

10.1 Lubricating oils

The mineral oils listed below may be used in Sauer compressors; Sauer standard is to use the mineral oil Shell Corena P 100 for filling and operation.

Brand	Product name	Group
Agip	Diesel Gamma 30	VCL-100
	Dicrea 100	VDL-100
	Acer 100	VCL-100
	Motor Oil HD 30	SAE 30
	Cladium 50	SAE 30
ARAL	Kowal M30	VCL-100
AVIA	Avilub Verdichteröl VDL-100	VDL-100
BP	Energol RC 100	VDL-100
	Energol IC-DG 30	VCL-100
	Vanellus C3 SAE 30	SAE 30
	Aircol PD 100	VDL-100
CHEVRON	HD Compressor Oil 100	VDL-100
	Delo 1000 Marine 30	SAE 30
	Veritas 800 Marine 30	SAE 30
ESSO	Rarus 426	VDL-100
	Rarus 427	VDL-100
	Mobilgard 300	SAE 30
	Mobilgard 312	SAE 30
	Delvac 1230	SAE 30
Shell	Corena P 100	VDL-100
	Rimula X 30	SAE 30
	Melina S Oil 30	SAE 30
	Melina Oil 30	SAE 30
	Gadinia Oil 30	SAE 30
TEXACO	Compressor Oil EP VDL 100	VDL-100
	Regal EP 100	VCL-100
	Ursatex 30	SAE 30
	Veritas 800 Marine 30	SAE 30
TOTAL	Dacnis P 100	VDL-100
	Disola M 3015	SAE 30

For marine applications the following mineral oils can be alternatively used without any restrictions:

Brand	Product name	Group
NATO classified	O - 278	VDL-120
NATO classified	OMD 113	VDL-100

10.2 Preservation oils

Sauer standard is to use Mobilarma 524.
Alternatively, the following preservation or, flushing, oils can be used:

Brand	Product name
Agip	Rustica C SAE 30
ARAL	Konit Motoröl SAE 30
AVIA	MK 1540 S
BP	MEK 20 W-20
DEA	Deamot EKM 642 SAE 30
Esso	MZK Motorenöl HD 30
	Rostschutz MZ 110
Mobil	Mobilarma 524
Shell	Ensis Motor Oil 30

Note!
The product names may vary by country.

11 Spare Parts and Accessories

Note!
Please note the information in Chapter 1 "General" regarding our genuine Sauer spare parts.

.P. SAUER & SOHN guarantee the complete spare parts supply over the entire service life of the Sauer Compressors.

Our genuine Sauer spare parts are subject to constant quality control and further development. They conform to the latest technical developments.
In addition to the genuine Sauer spare parts, our delivery program comprises a large number of accessories for your Sauer Compressor and special components to complete your gas system, such as:

- fully automatic control systems;
- adsorption dryers;
- refrigerant type dryers;
- filters;
- silencing cabinets;
- compressed air vessels;
- fittings.

We supply instructions and a maintenance manual for each accessory.

Spare parts catalogue

The spare parts catalogue can be found in the annex to this operating manual.

– With the help of overviews, illustrations and lists, the required parts can be quickly found.
– The spare parts catalogue, including the operating instructions, is also available on CD-ROM. This allows you to fill out, print out and immediately send an order form.
To do so, you need the **main specification data** of your Sauer Kompressors from the table below. If the data has not yet been entered, it can be found on the nameplate affixed to the crankcase.

Compressor type:					
Factory no.:					
Year of manufacture:					

Furthermore, please state the **number of operating hours**, if possible.

12 Annex

This annex to the operating instructions contains

– the blank for the start-up journal;
– the blank for notification of claim and return of goods;
– documentation supplied by component suppliers;
– data sheets.

Start-up log sheet for compressors			J.P. SAUER & SOHN Maschinenbau GmbH Brauner Berg 15 - 24159 Kiel Tel.: +49 - 431- 39 40 - 0 Fax: +49 - 431- 39 40 - 89 E-mail: service@sauersohn.de
Purchaser		Operating company	Place of installation
Company		Company	
Street		Street	
Postcode		Postcode	
Contact person		Contact person	
Telephone number		Telephone number	
Customer number			
Order number			
Compressor type		Serial number	
Delivery date		Operating hours	
Start-up date			
Sauer service engineer	Company/Name		
	Company/Name		
	Company/Name		
	Company/Name		
Installation of compressor / complete system ☐ good ☐ fault		Rotational direction check	
		Compression temperature	°C
Ventilation ☐ good ☐ fault		Suction temperature	°C
		Start/stop pressure	
Ambient conditions ☐ good ☐ fault		Oil level check	
		Control function check	
Voltage? ☐ good ☐ fault		Test run	
Vibration behaviour of the compressor ☐ good ☐ fault			
Accessories		Installation of complete system carried out by: ☐ good ☐ fault	
Compressed air vessel			
Refrigerant type dryer			
Adsorption dryer			
Filter			
Condensate removal			
Operating personnel have received instruction and are familiar with safety and maintenance required. The operating company has the maintenance instructions. The operating company has been advised to use only genuine SAUER & SOHN spare parts.			
Remarks / Faults:			

The system has been accepted by the operating company. Place: Date:

Purchaser Operating company Authorised Sauer Service Partner

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1 Return of goods
1 Notification of claim

Date:

J.P. SAUER & SOHN
Maschinenbau GmbH
Brauner Berg 15 - 24159 Kiel
Tel.: +49 - 431- 39 40 - 0
Fax: +49 - 431- 39 40 - 89
E-mail: service@sauersohn.de

To be completed by applicant

Applicant:
Company
Street
Postcode / Place
Customer no.
Location

Please always complete!
Compressor type:

Serial number:

End customer:
Company
Street
Postcode / Place
Customer no.
Location

Operating hours:

Date of fault:

Ambient temperature:

Spare parts

Description	Quantity	Part no.

Reason for return

Report on fault	1
Repair	1
Checking on goodwill basis	1
Goods returned against credit note	1

Short description of fault:

To be completed by the manufacturer

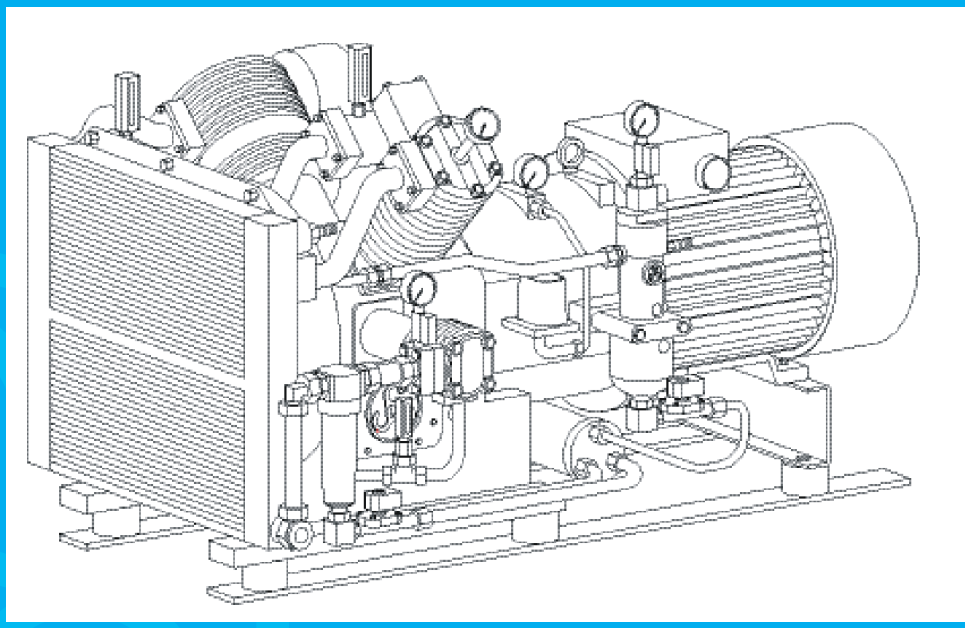
Report

Maintenance Schedule No.	
Beginning of this maintenance schedule	
❑ **after commissioning** ❑ **after last maintenance routine**	
Date:	
Hours of operation:	

Compressor type	WP311L
Type series	3L
Compressor number:	
Factory no.:	
Year of construction:	
Date of initial operation:	

Interval [hours of operation] **Maintenance work**	50 h after initial commissioning	50 h after last maintenance routine or repair	At least annually at < 1000 h	1000 h	2000 h	3000 h	4000 h
Maintenance set item No.				069266	069200	069266	069201
Check screwed connections, chapter 8.5	❑	❑					
Replace air filter cartridge, chapter 8.6			❑	❑	❑	❑	❑
Carry out oil change, chapter 8.7	❑	❑	❑	❑	❑	❑	❑
Clean oil strainer, chapter 8.8							❑
Check 1st stage valves, chapter 8.9					❑		
Check 2nd stage valves, chapter 8.9					❑		
Replace 1st stage valves, chapter 8.10							❑
Replace 2nd stage valves, chapter 8.10							❑
Replace 3rd stage valves, chapter 8.10					❑		❑
Replace 1st stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Replace 2nd stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Replace 3rd stage piston rings, gudgeon pins and gudgeon pin bearings, chapter 8.11							❑
Check piston and cylinder, chapter 8.12							❑
Renew flexible gear rim, chapter 8.15							❑
Check condensate separator, chapter 8.16							❑
Overhaul drain valves (as per order), chapter 8.17							❑
Hours of operation							
Date							
Signature (initials)							

J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

Type: WP 311 L

Spare Parts List

Ein Mitglied der
SAUER-Gruppe

Edition: 10 / 2007
Edited by: J.P. Sauer & Sohn Maschinenbau – Technical Documentation

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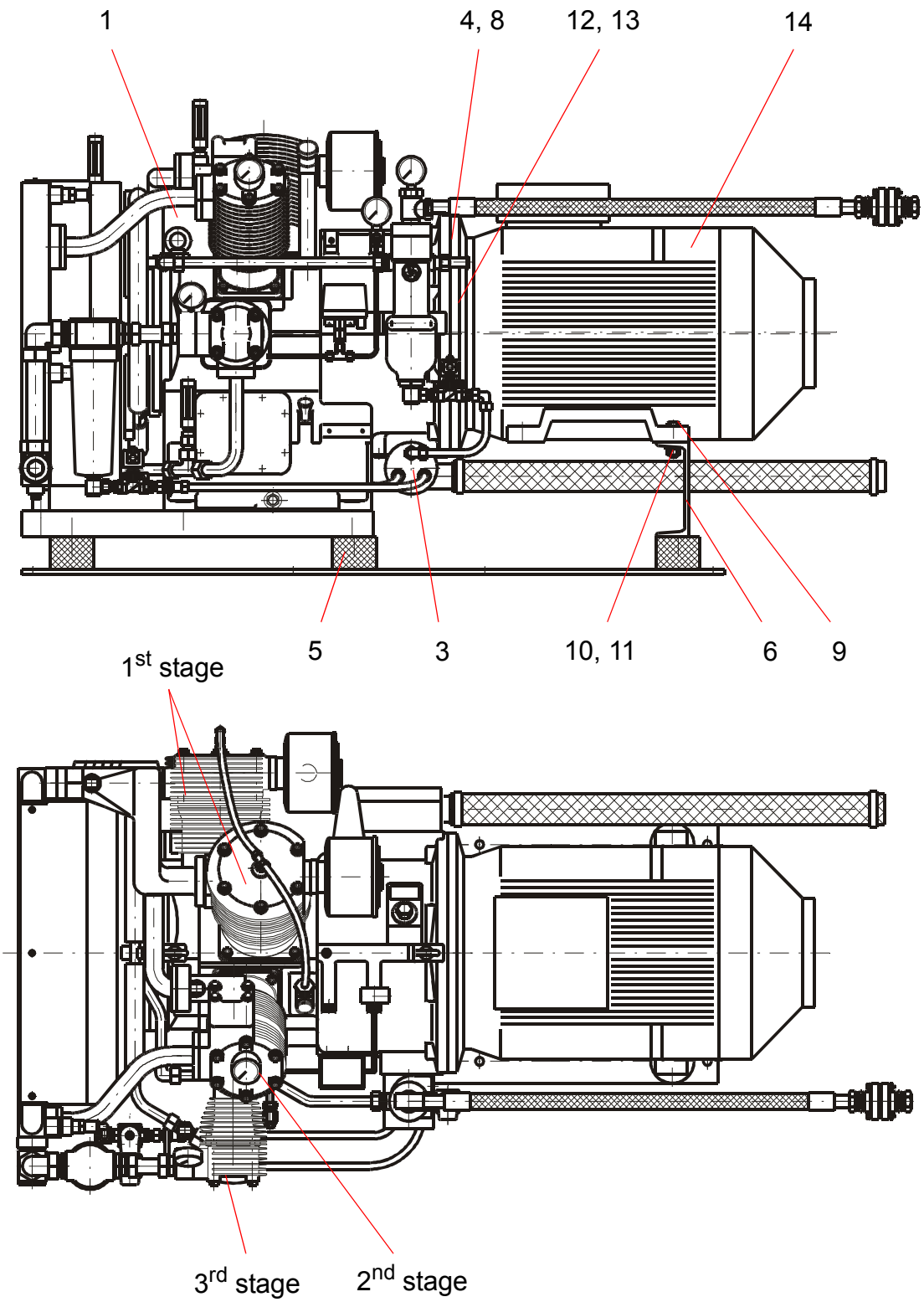
065 183 Sauer Compressor WP 311 L

Note:

Explanation of the assemblies can be found in Chapter 3 "Design and Function" of the operating manual.

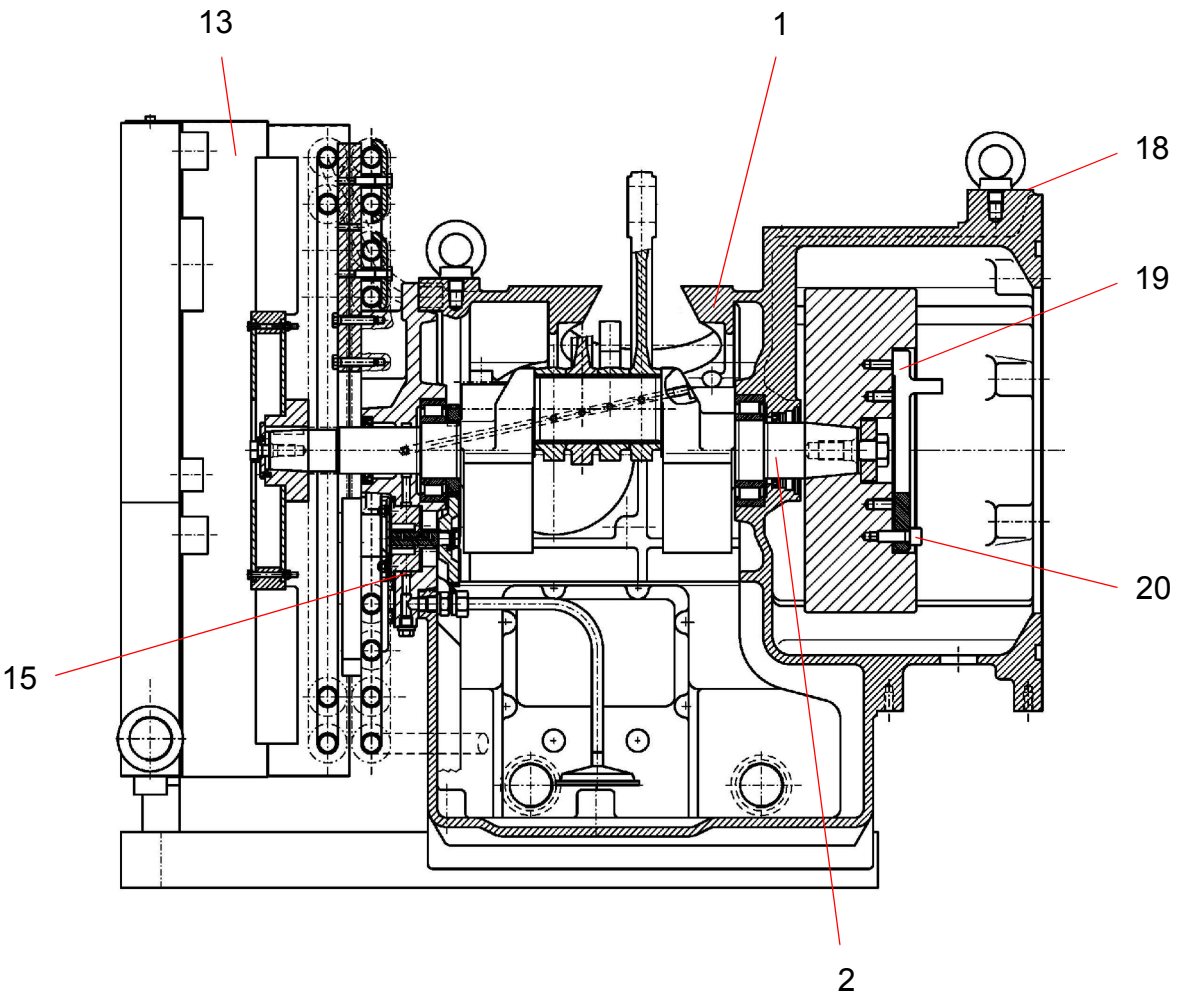
065 183 Sauer Compressor WP 311 L



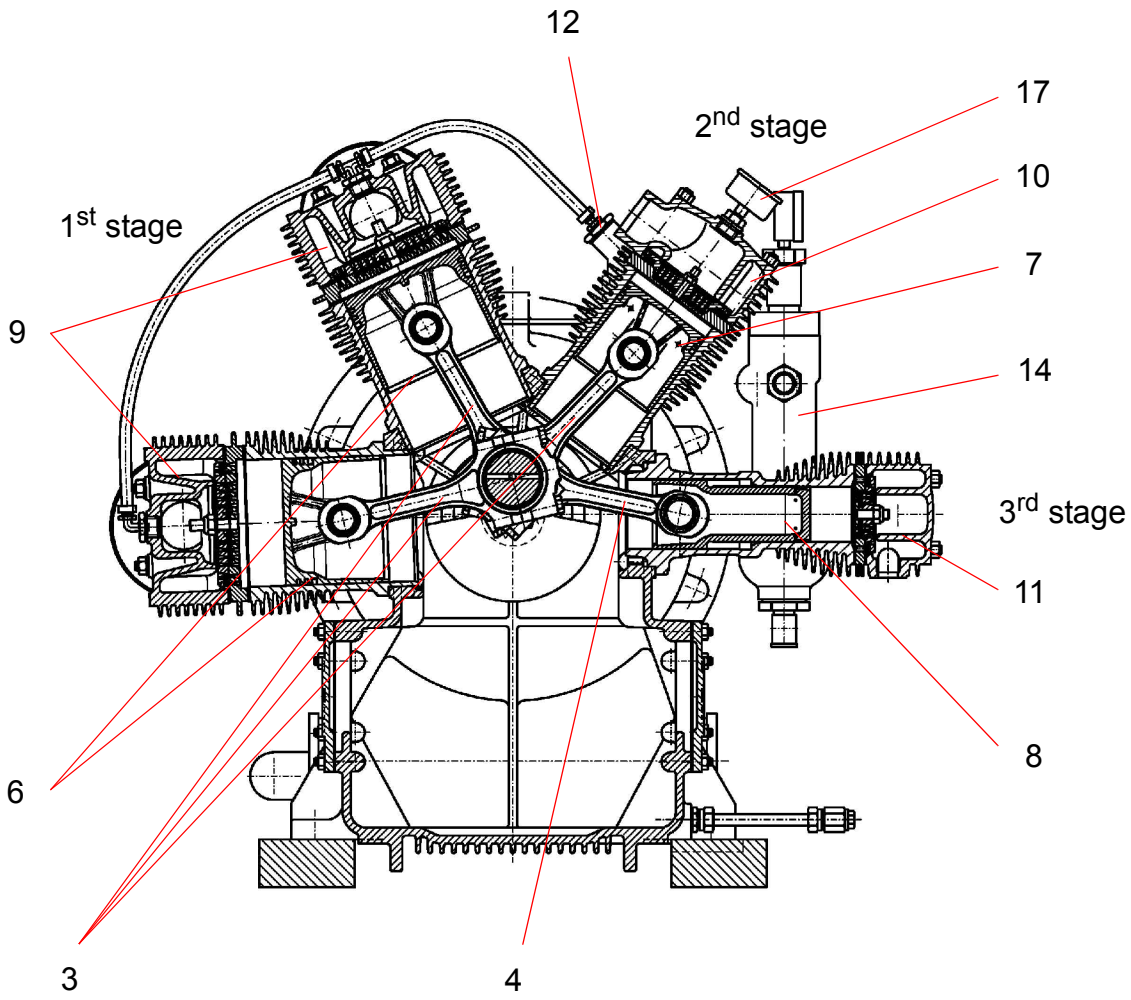
065 183 Sauer Compressor WP311 L

Item no.	Part no.	Description	Quantity
1	065 184	Compressor WP 311 L	1
3	065 181	Automatic drainage system	1
4	064 501	Spacer ring	1
5	065 169	Resilient mounts	1
6	065 185	Motor support	1
8	000 187	Hexagon head screw	6
9	000 220	Hexagon head screw	2
10	002 063	Hexagon nut	2
11	001 638	Washer	2
12	036 438	Motor half coupling	1
13	033 423	Flexible coupling insert	1
14		Three phase AC motor 250 M	1

065 184 Compressor WP 311 L



065 184 Compressor WP 311 L

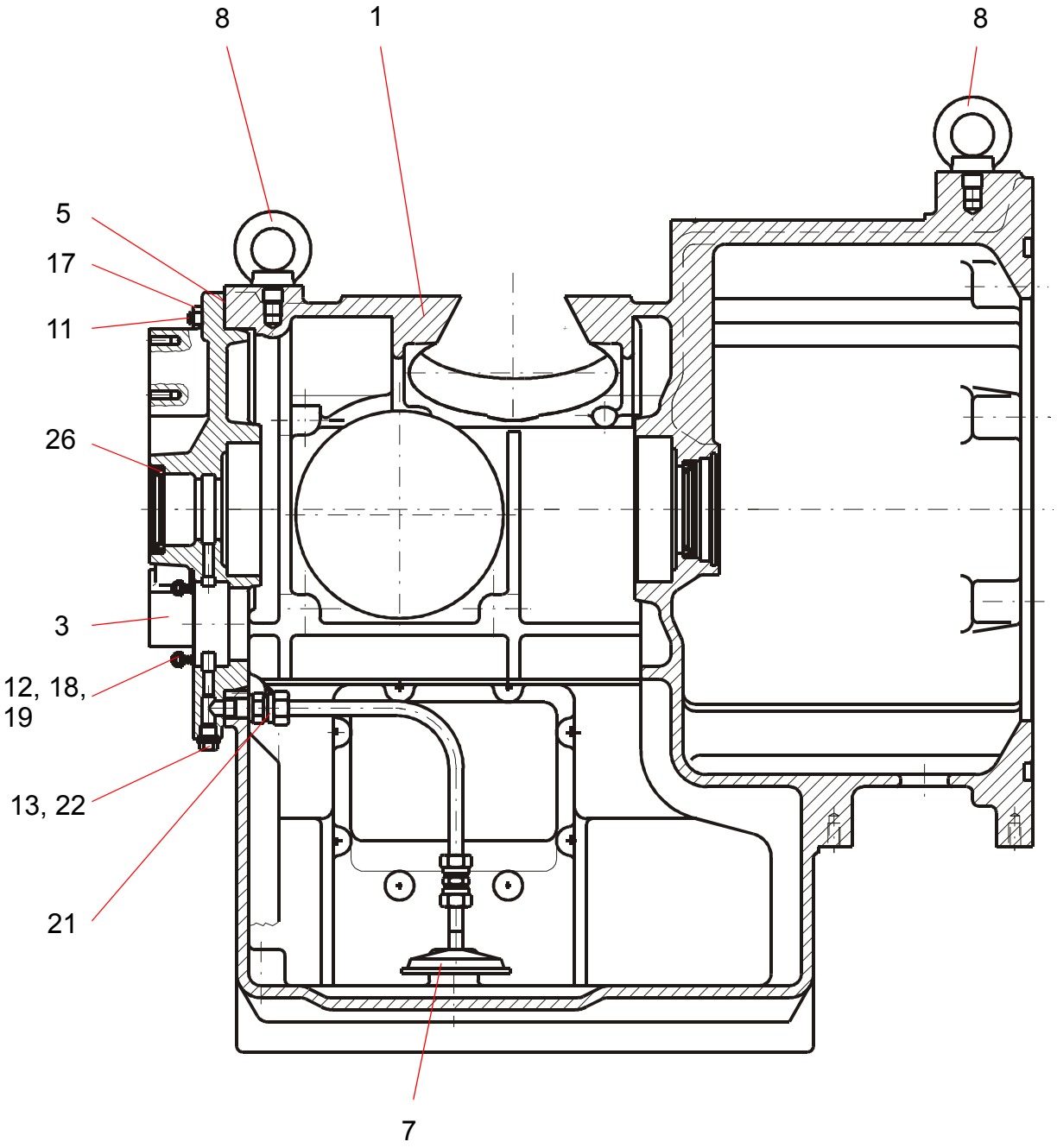


065 184 Compressor WP 311 L

065 184 Compressor WP 311 L

Item no.	Part no.	Description	Quantity
1	065 173	Crankcase	1
2	065 187	Crankshaft	1
3	064 568	Connecting rod 1st and 2nd stage	3
4	064 848	Connecting rod 3rd stage	1
6	033 185	Piston 1st stage	2
7	037 049	Piston 2nd stage	1
8	063 305	Piston 3rd stage	1
9	064 408	Cylinder with head and valve 1st stage	2
10	065 175	Cylinder with head and valve 2nd stage	1
11	065 176	Cylinder with head and valve 3rd stage	1
12	065 177	Crankcase vent	1
13	065 178	Cooler and air lines	1
14	063 121	Complete separator 3rd stage	1
15	064 119	Lubricating oil pump drive	1
17	065 180	Measuring device	1
18	004 408	Name plate rivet	4
19	036 333	Compressor half coupling	1
20	000 543	Cap screw	10

065 173 Crankcase



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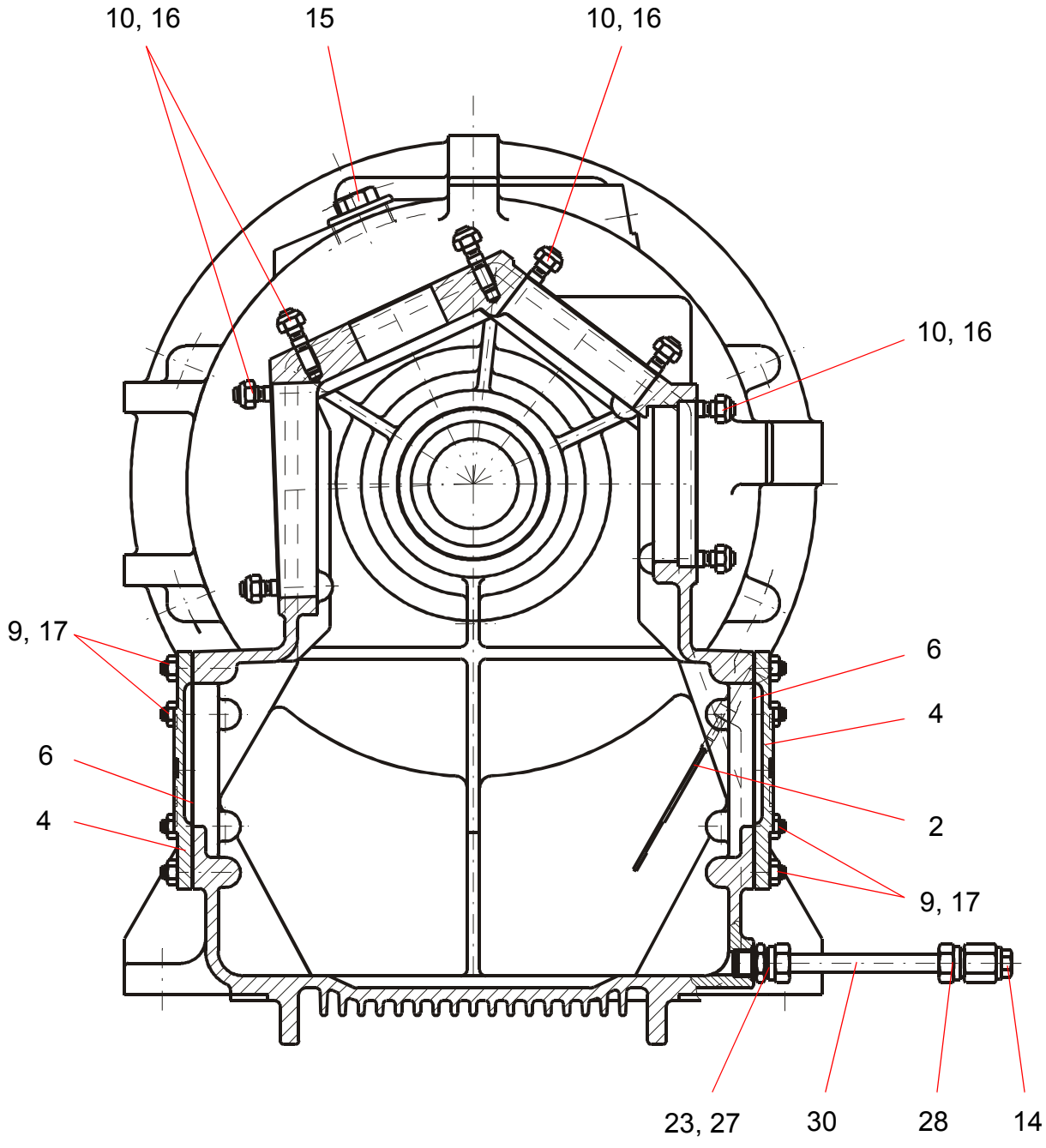
065 173 Crankcase

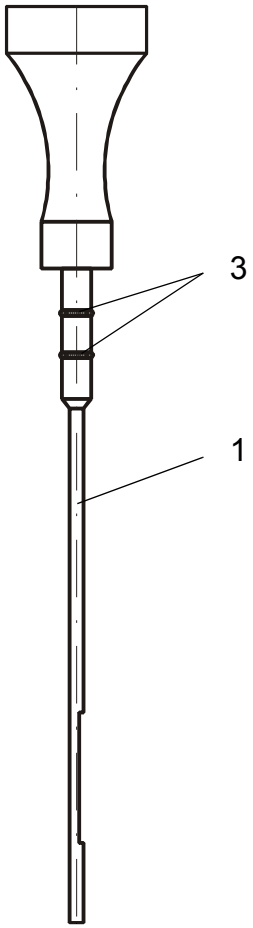


065 173 Crankcase

065 173 Crankcase

Item no.	Part no.	Description	Quantity
1	065 117	Crankcase	1
2	064 064	Dip stick	1
3	064 079	Bearing housing	1
4	051 883	Crankcase inspection cover	2
5	064 095	Gasket	1
6	063 748	Gasket	2
7	065 348	Oil filter / strainer	1
8	000 270	Lifting eye bolt	2
9	001 411	Stud screw	16
10	033 717	Stud screw	16
11	001 410	Stud screw	8
12	001 459	Stud screw	4
13	001 009	Screw plug	1
14	030 744	Screw plug	1
15	001 021	Screw plug	1
16	002 098	Hexagon nut	16
17	002 031	Hexagon nut	24
18	002 094	Hexagon nut	4
19	002 146	Washer	4
21	004 635	Fitting	1
22	005 001	Sealing ring	1
23	005 009	Sealing ring	1
25	007 123	Shaft seal	1
26	030 831	Shaft seal	1
27	004 641	Fitting	1
28	035 310	Fitting	1
30	008 663	Pipe	1

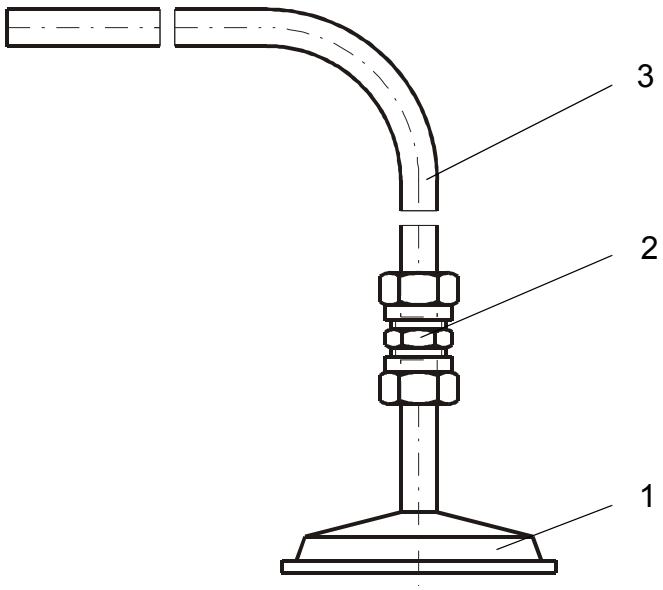
064 064 Dip stick



064 064 Dip stick

Item no.	Part no.	Description	Quantity
1	037 076	Dip stick	1
3	035 520	O-ring	2

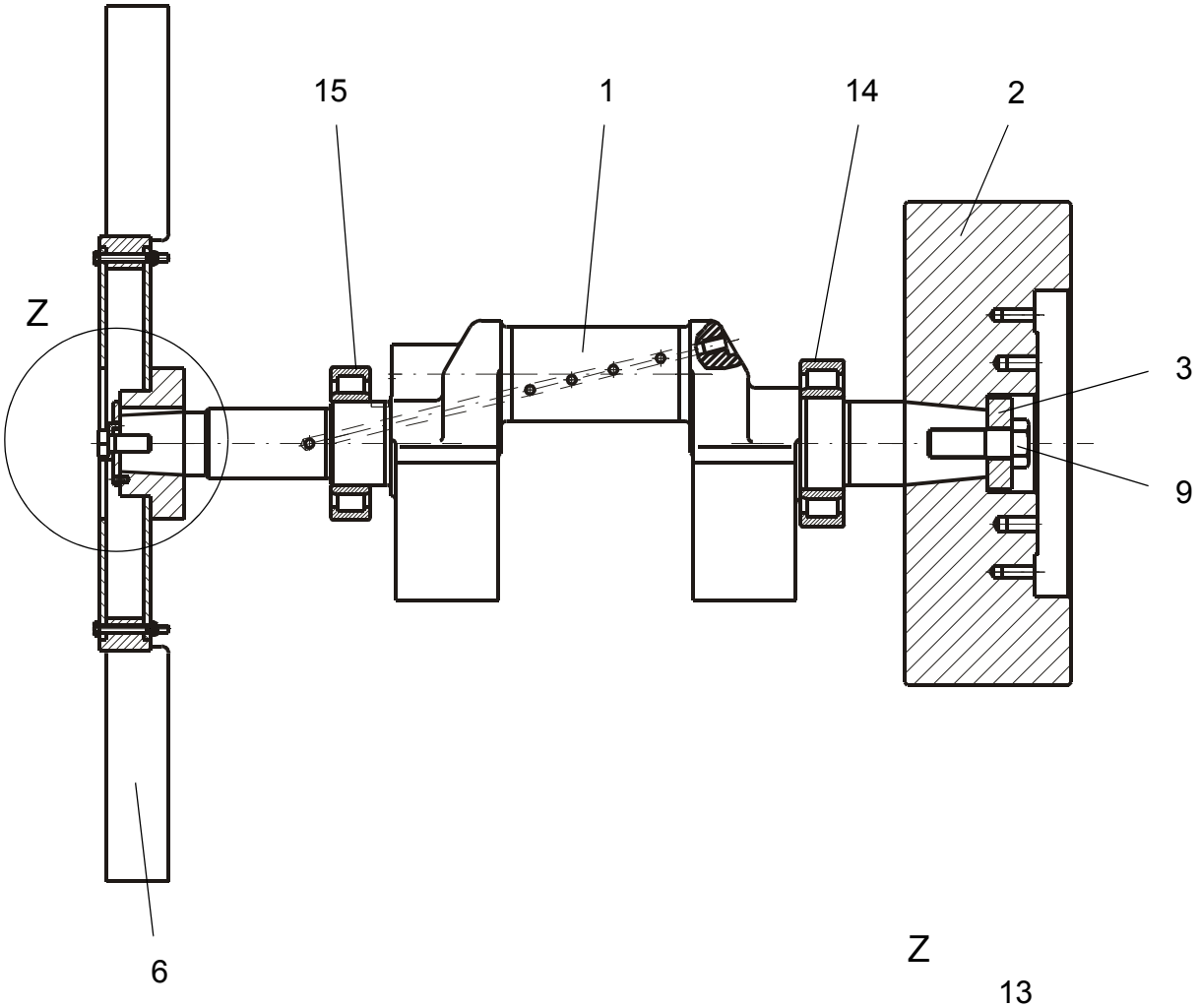
065 348 Oil filter / strainer

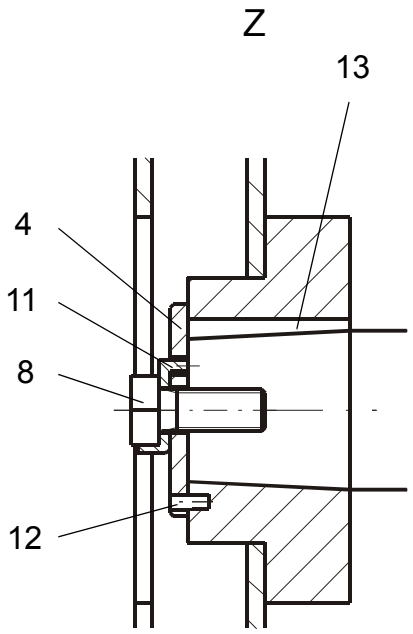


065 348 Oil filter / strainer

Item no.	Part no.	Description	Quantity
1	036 897	Oil filter / strainer	1
2	004 694	Fitting	1
3	008 651	Pipe	1

065 187 Crankshaft





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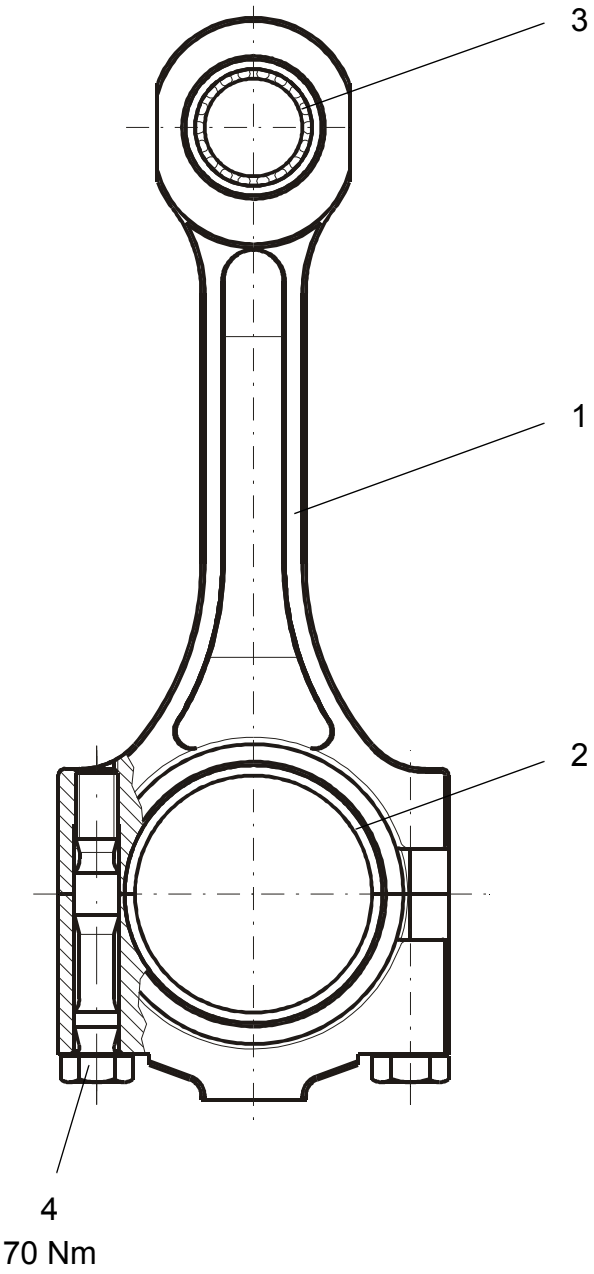
065 187 Crankshaft

Item no.	Part no.	Description	Quantity
1	065 190	Crankshaft	1
2	064 345	Flywheel	1
3	064 420	Washer	1
4	056 264	Washer	1
6	037 790	Fan wheel	1
8	000 057	Hexagon head screw	1
9	000 216	Hexagon head screw	1
11	001 675	Lock plate	1
12	004 472	Locking pin	1
13	032 430	Key	1
14	034 575	Cylindrical roller bearing	1
15	033 215	Cylindrical roller bearing	1

064 568 Connecting rod 1st and 2nd stage



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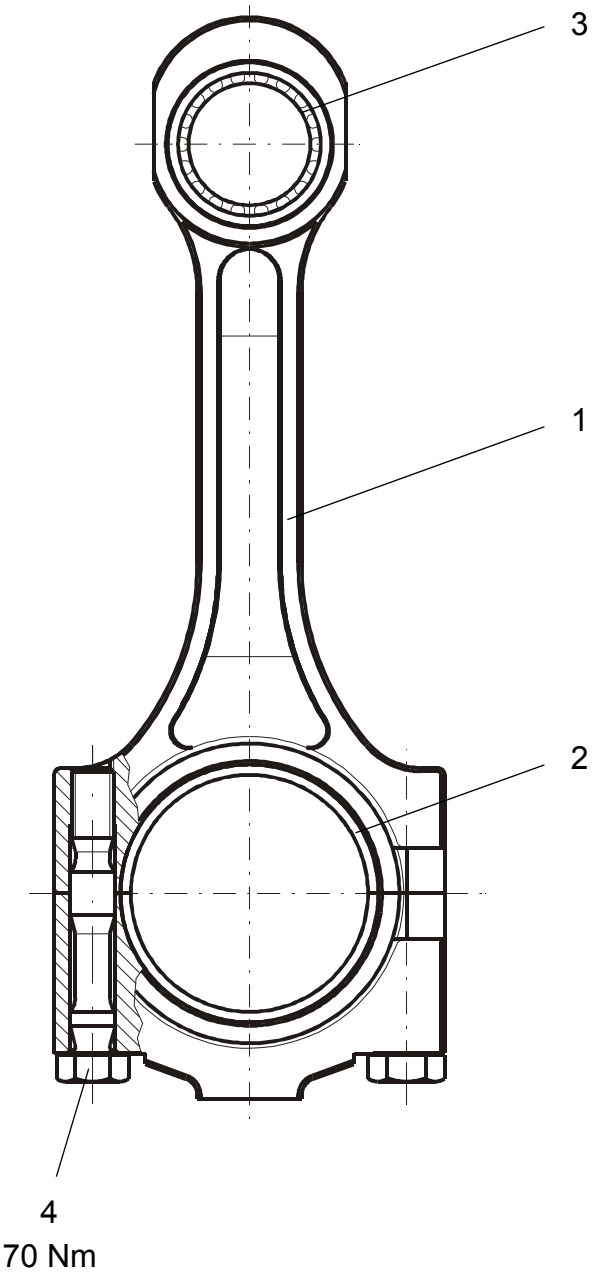
064 568 Connecting rod 1st and 2nd stage

Item no.	Part no.	Description	Quantity
1	064 352	Connecting rod	1
2	056 272	Big-end bearing	1
3	033 213	Small-end bearing	1
4[1)]	056 316	Connecting rod bolt	2

[1)] Item 4, 056 316 connecting rod bolt, is part of assembly 064 352.

064 848 Connecting rod 3rd stage

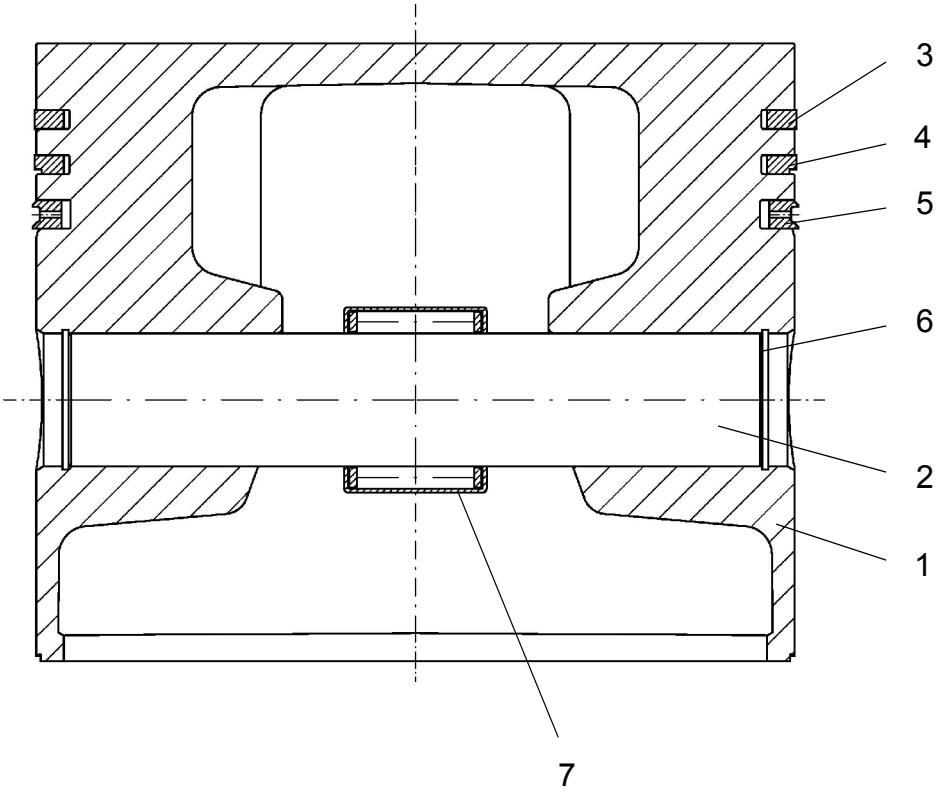


064 848 Connecting rod 3rd stage

Item no.	Part no.	Description	Quantity
1	064 849	Connecting rod	1
2	056 272	Big-end bearing	1
3	034 552	Small-end bearing	1
4[1)]	056 316	Connecting rod bolt	2

[1)] Item 4, 056 316 connecting rod bolt, is part of assembly 064 849.

033 185 Piston 1st stage

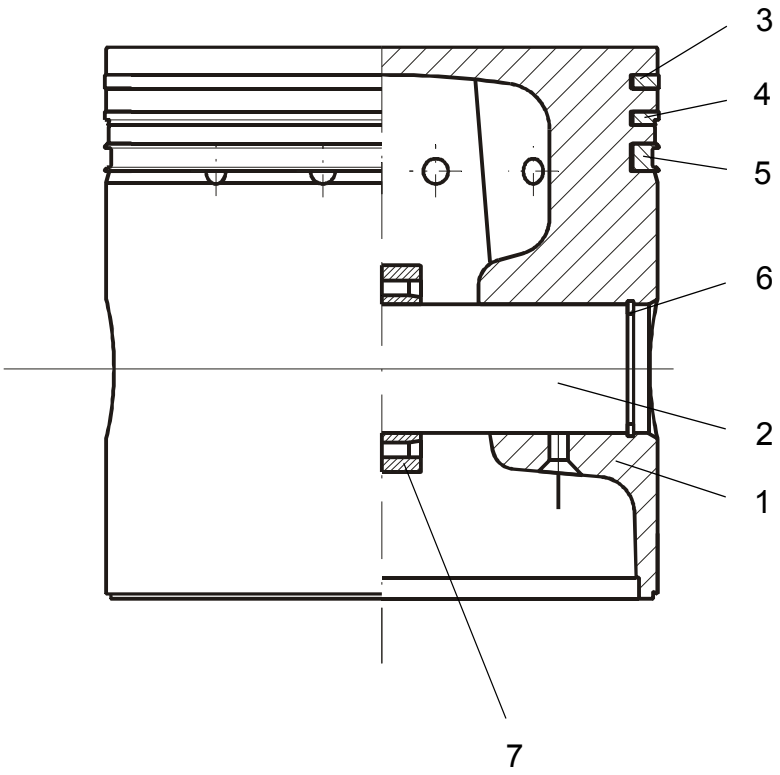


033 185 Piston 1st stage

Item no.	Part no.	Description	Quantity
1	033 186	Piston	1
2	033 187	Gudgeon pin	1
3	035 199	Plain ring	1
4	033 188	Nose ring	1
5	035 200	Oil scraper ring	1
6	002 984	Circlip	2
7[1)]	033 213	Small-end bearing	1

[1)] Item 7, small-end bearing 033 213, is part of assembly 064 568.

037 049 Piston 2nd stage

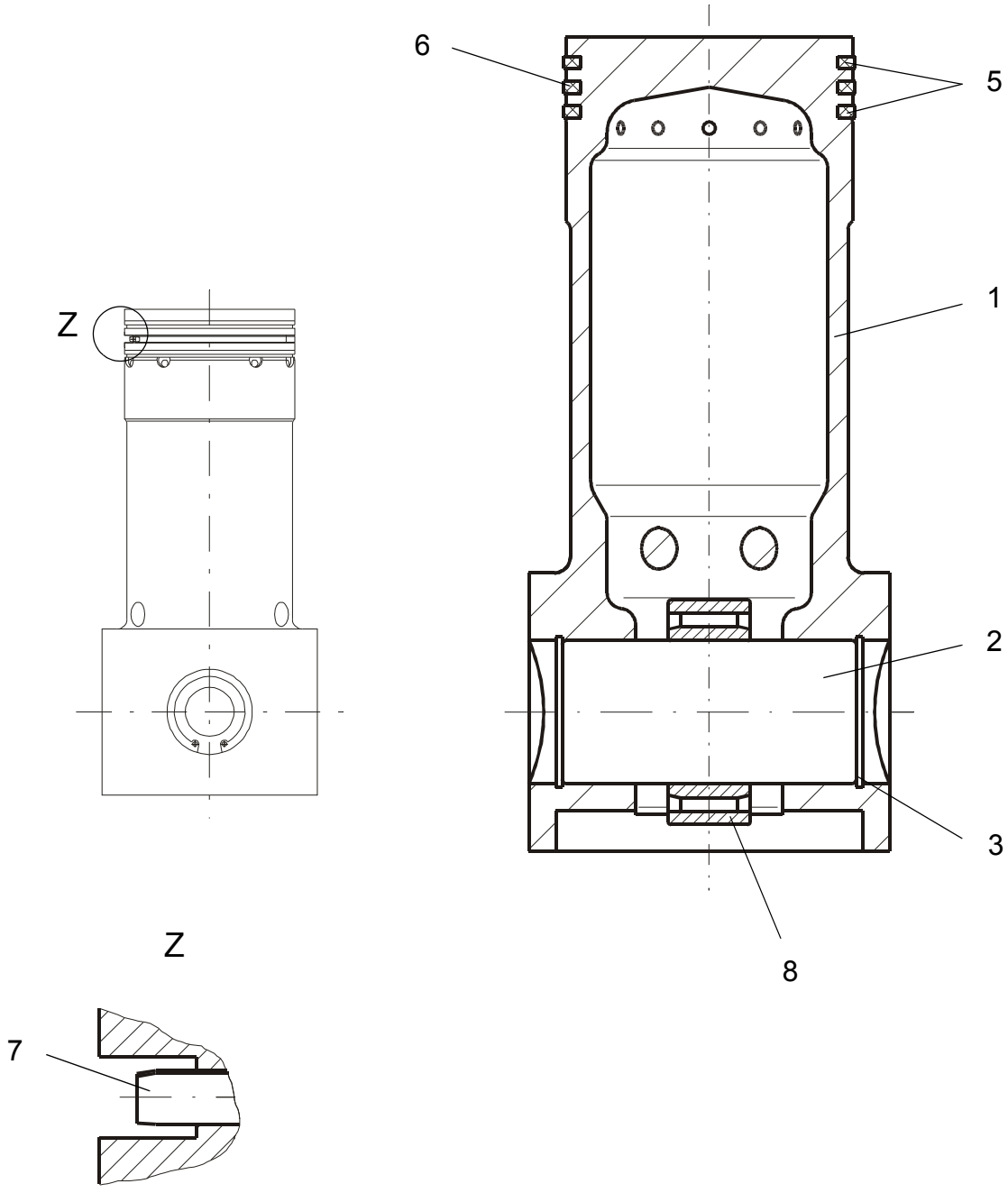


037 049 Piston 2nd stage

Item no.	Part no.	Description	Quantity
1		Piston	1
2	032 289	Gudgeon pin	1
3	037 050	Plain ring	1
4	002 566	Nose ring	1
5	037 051	Oil scraper ring	1
6	002 984	Circlip	2
7[1)]	033 213	Small-end bearing	1

[1)] Item 7, small-end bearing 033 213, is part of assembly 064 568.

063 305 Piston 3rd stage

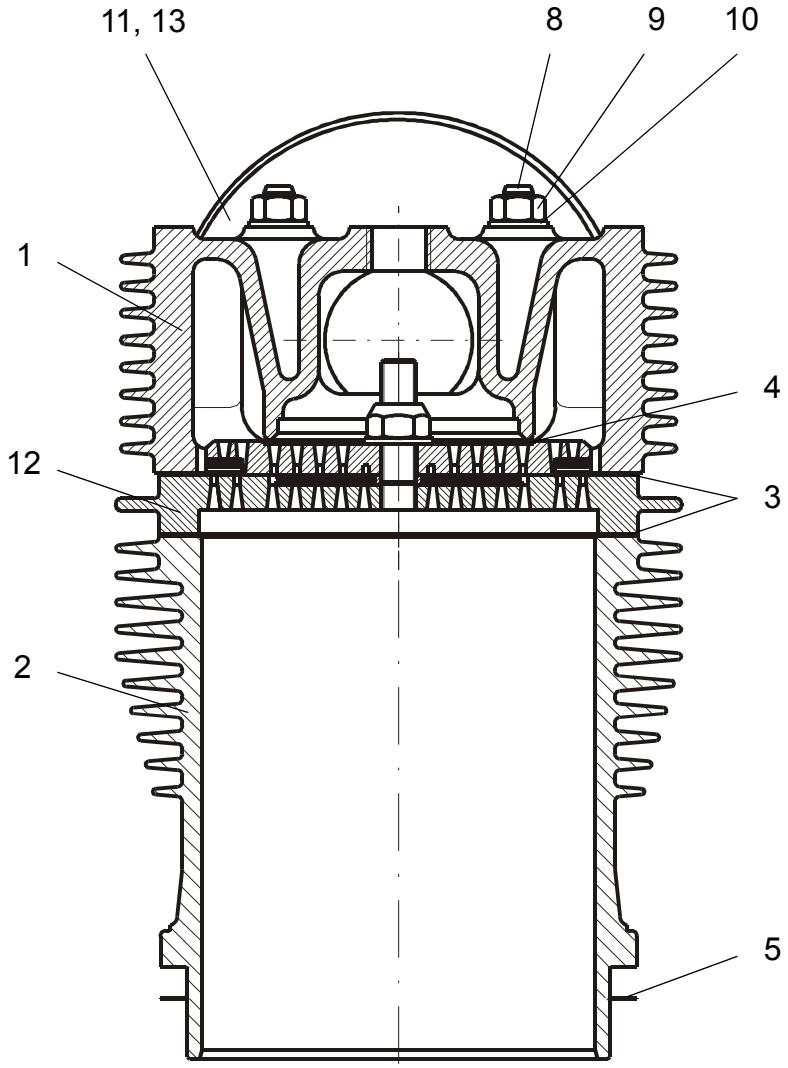


063 305 Piston 3rd stage

Item no.	Part no.	Description	Quantity
1	063 304	Piston	1
2	065 526	Gudgeon pin	1
3	002 988	Circlip	2
5	002 552	Nose ring	2
6	037 656	Plain ring	1
7	004 442	Dowel pin	1
8[1)]	034 552	Small-end bearing	1

[1)] Item 8, small-end bearing 034 552, is part of assembly 064 848.

064 408 Cylinder with head and valve 1st stage

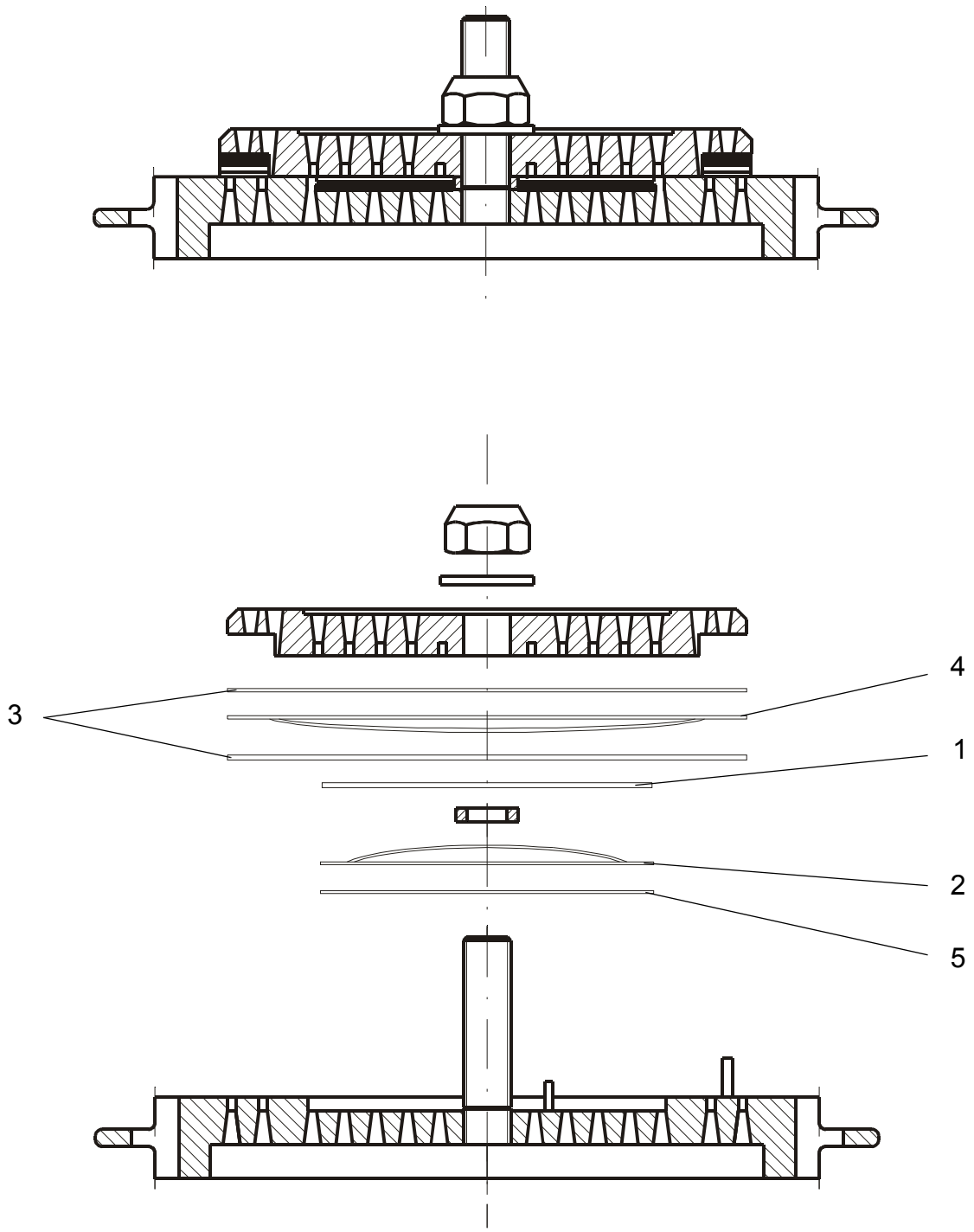


064 408 Cylinder with head and valve 1st stage

Item no.	Part no.	Description	Quantity
1	064 481	Cylinder head	1
2	056 216	Cylinder	1
3	056 237	Gasket	2
4	056 239	Sealing ring	1
5	062 375	Gasket	1
8	037 477	Stud screw	6
9	001 620	Hexagon nut	6
10	002 161	Washer	6
11	036 394	Dry air filter	1
12	037 460	Concentric valve 1st stage	1
13[1)]	036 395	Filter insert	1

[1)] Item 13, 036 395 filter insert, is part of assembly 036 394.

037 460 Concentric valve 1st stage



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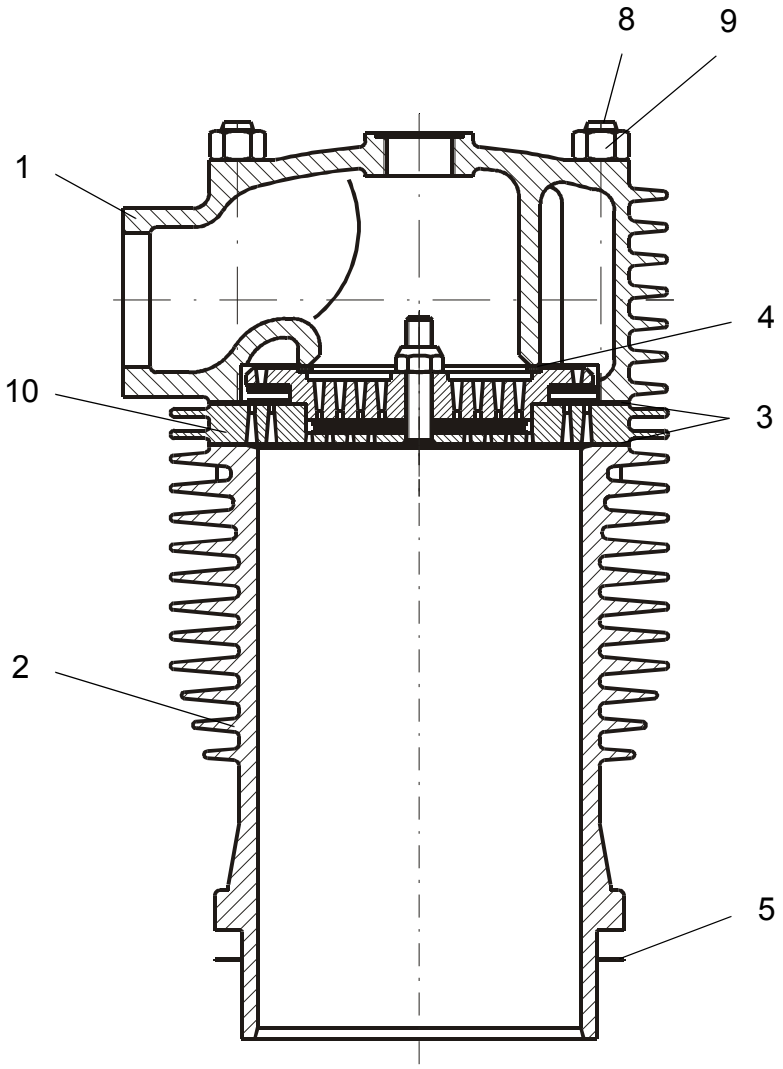
037 460 Concentric valve 1st stage

Item no.	Part no.	Description	Quantity
1	037 468	Suction valve plate	1
2	037 469	Suction valve spring	1
3	037 470	Delivery valve plate	2
4	037 471	Delivery valve spring	1
5	037 472	Suction valve plate	1

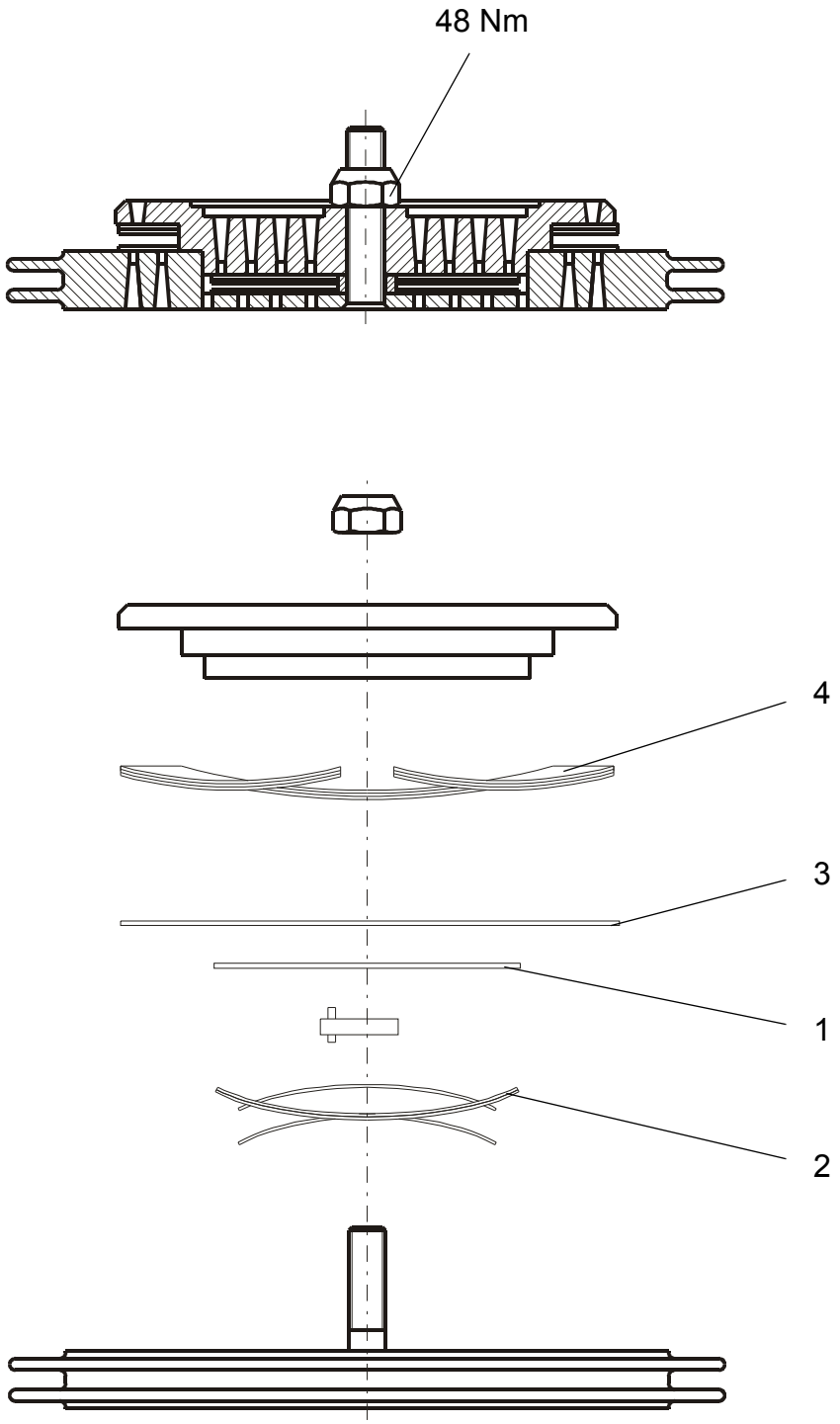
065 175 Cylinder with head and valve 2nd stage



065 175 Cylinder with head and valve 2nd stage

Item no.	Part no.	Description	Quantity
1	056 222	Cylinder head	1
2	059 286	Cylinder	1
3	059 393	Gasket	2
4	056 235	Sealing ring	1
5	062 376	Gasket	1
8	001 520	Stud screw	6
9	001 620	Hexagon nut	6
10	034 591	Concentric valve 2nd stage	1

034 591 Concentric valve 2nd stage



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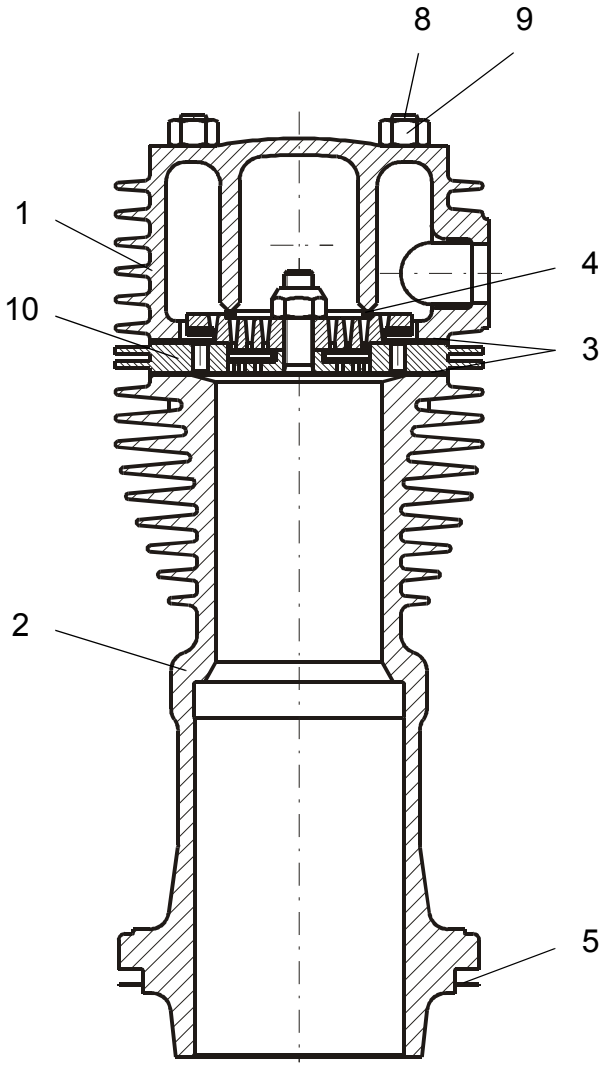
034 591 Concentric valve 2nd stage

Item no.	Part no.	Description	Quantity
1	034 592	Suction valve plate	1
2	034 593	Suction valve spring	1
3	034 594	Delivery valve plate	1
4	034 595	Delivery valve spring	3

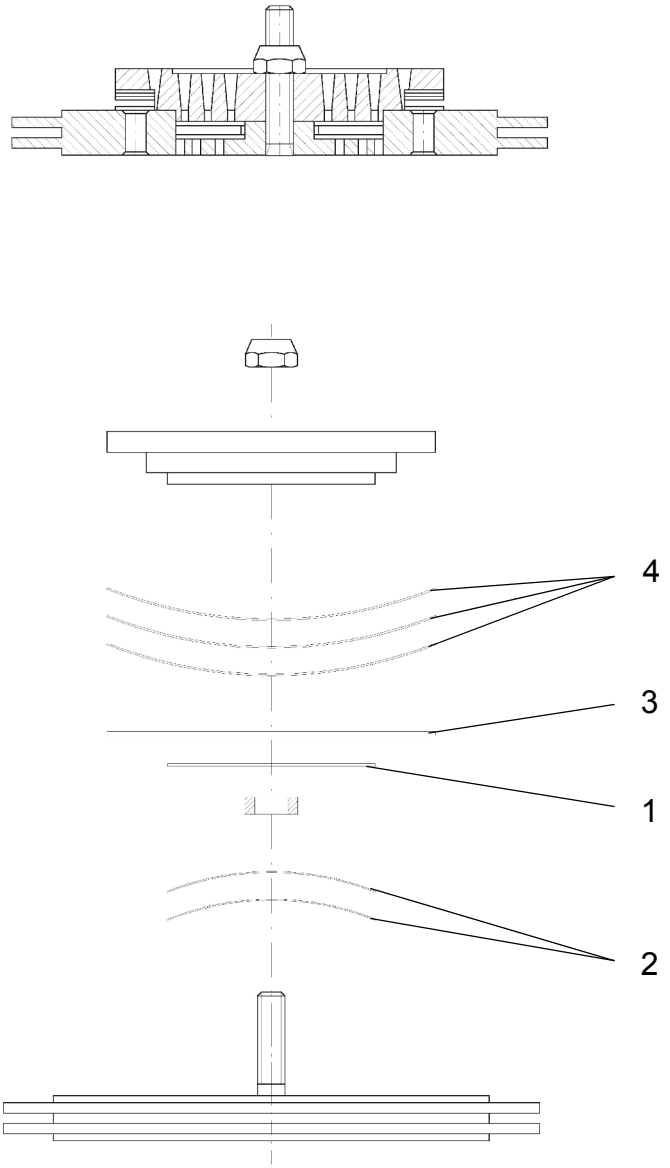
065 175 Cylinder with head and valve 3rd stage



065 175 Cylinder with head and valve 3rd stage

Item no.	Part no.	Description	Quantity
1	056 278	Cylinder head	1
2	063 303	Cylinder	1
3	056 282	Gasket	2
4	063 079	Sealing ring	1
5	062 376	Gasket	1
8	001 519	Stud screw	4
9	001 620	Hexagon nut	4
10	033 893	Concentric valve 3rd stage	1

033 893 Concentric valve 3rd stage



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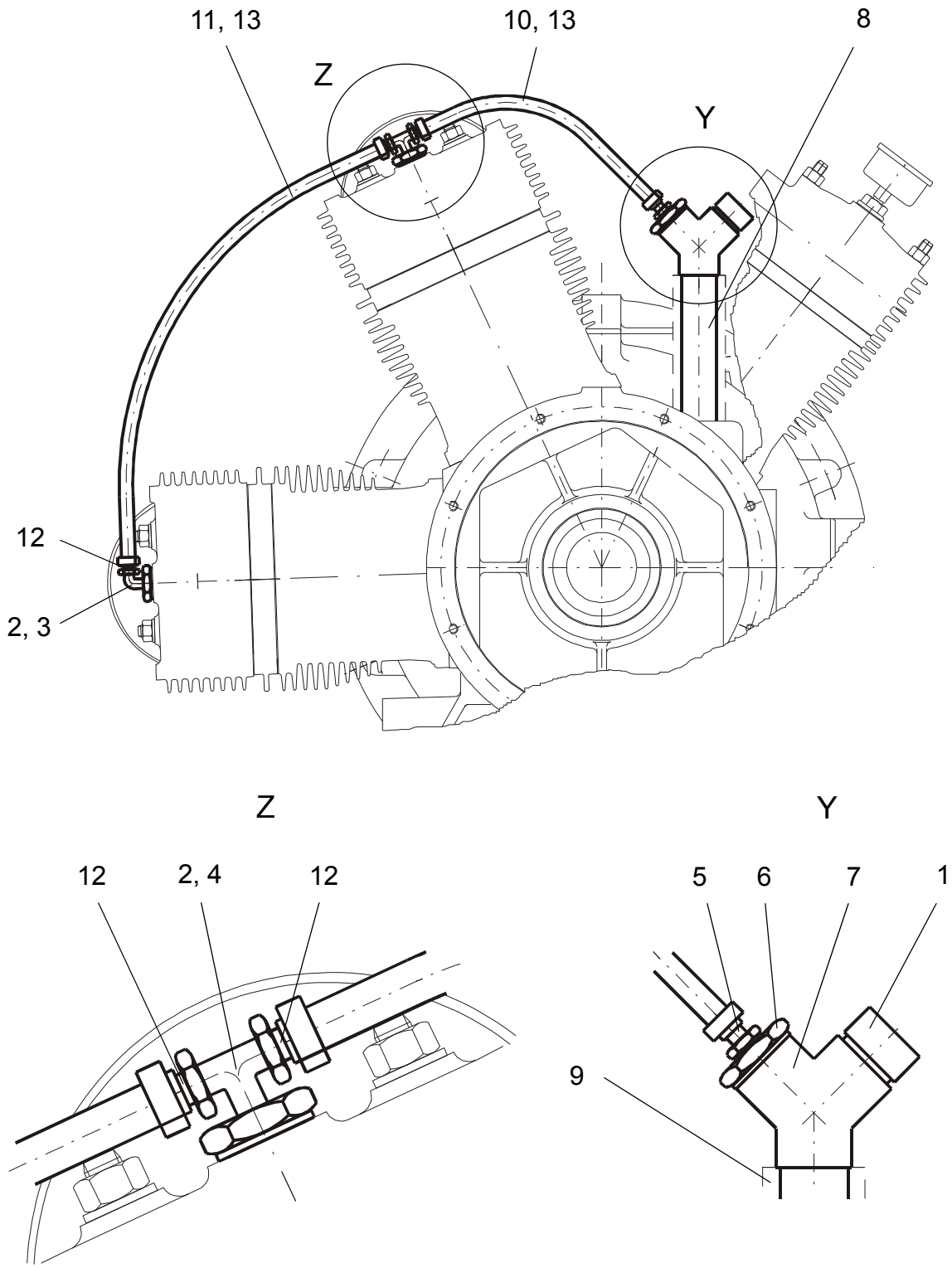
033 893 Concentric valve 3rd stage

Item no.	Part no.	Description	Quantity
1	033 903	Suction valve plate	1
2	033 904	Suction valve spring	2
3	033 905	Delivery valve plate	1
4	033 906	Delivery valve spring	3

065 177 Crankcase vent



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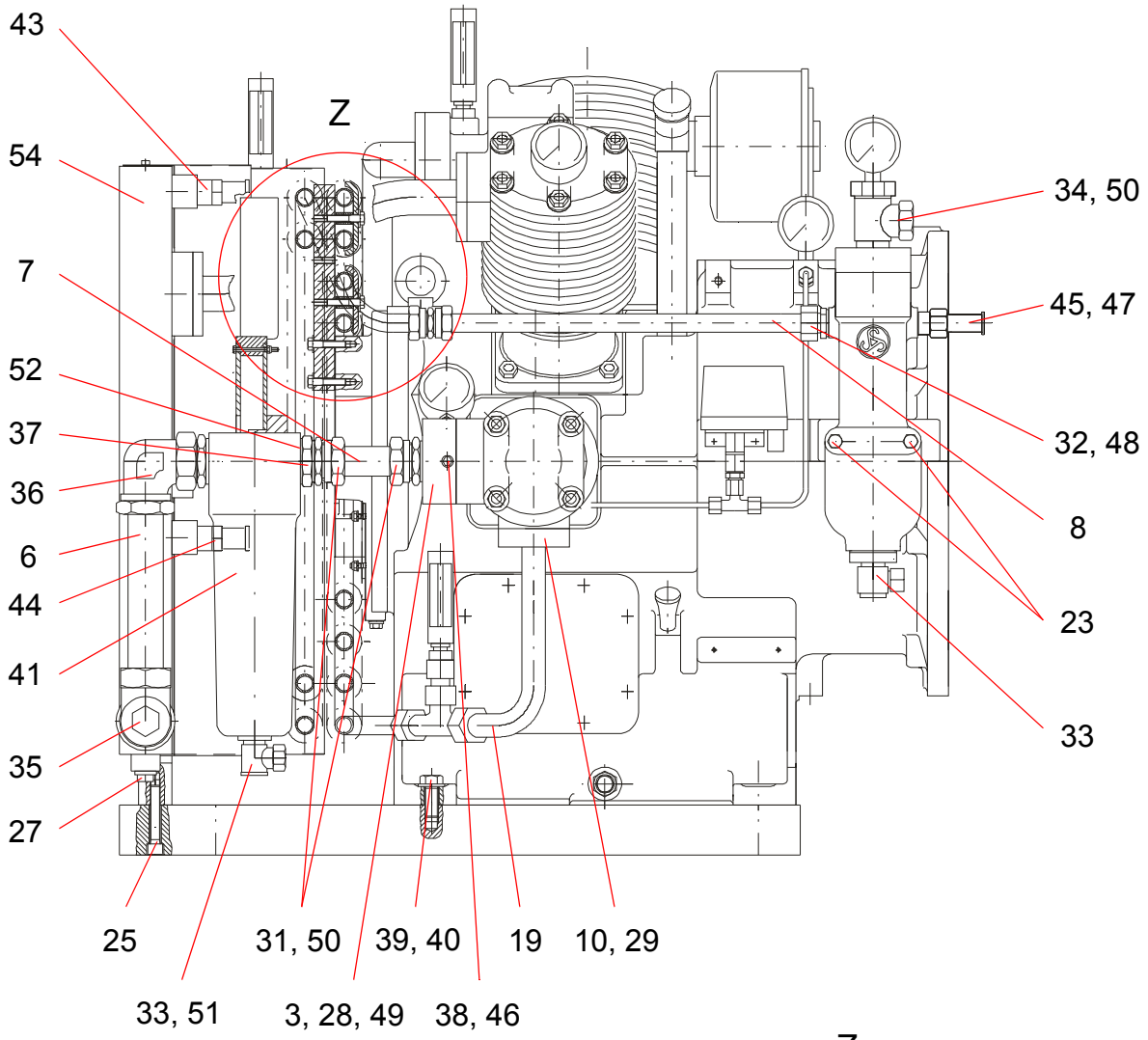
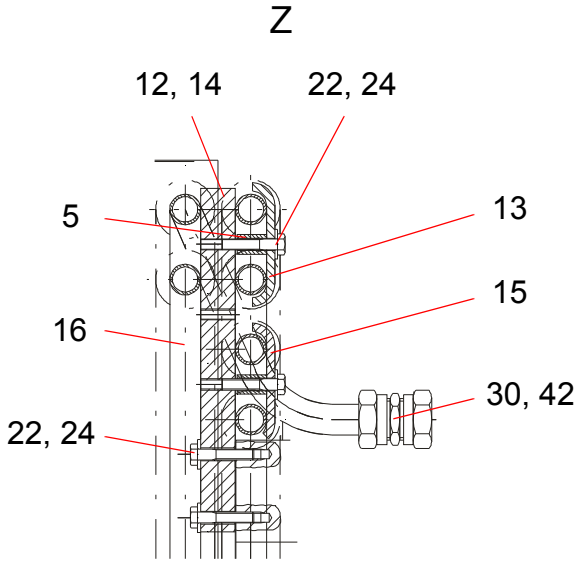
065 177 Crankcase vent

Item no.	Part no.	Description	Quantity
1	035 824	Filler cover	1
2	006 383	Reducing union	2
3	006 205	Fitting	1
4	033 614	Fitting	1
5	033 487	Stub	1
6	037 138	Reducing piece	1
7	037 137	Y-piece	1
8	064 523	Double nipple	1
9	036 546	Insulation hose	1
10	034 612	Low pressure hose	1
11	037 264	Low pressure hose	1
12	012 766	Pipe	1
13	035 254	Worm thread clamp	4

065 178 Cooler and air lines





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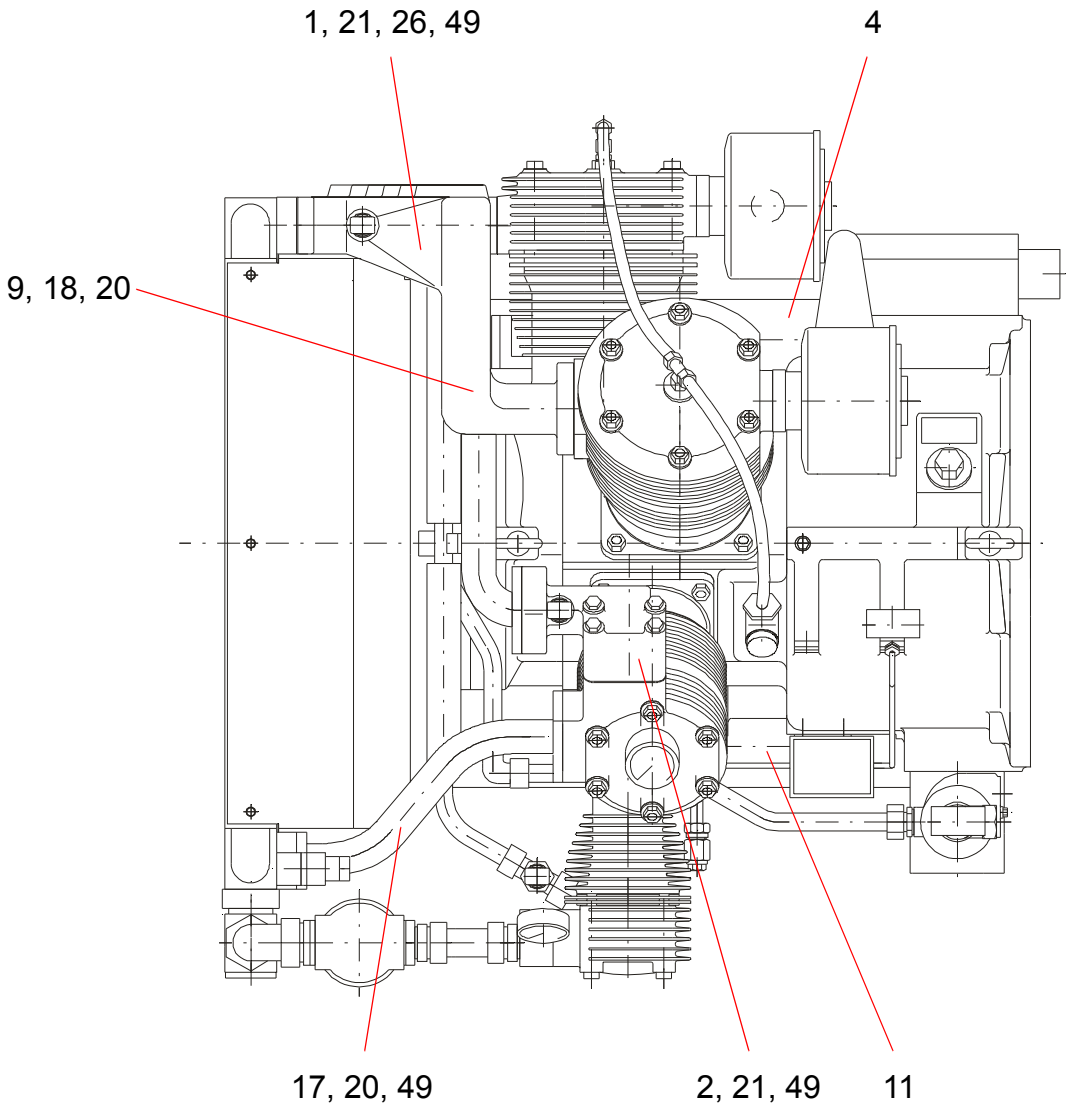
065 178 Cooler and air lines



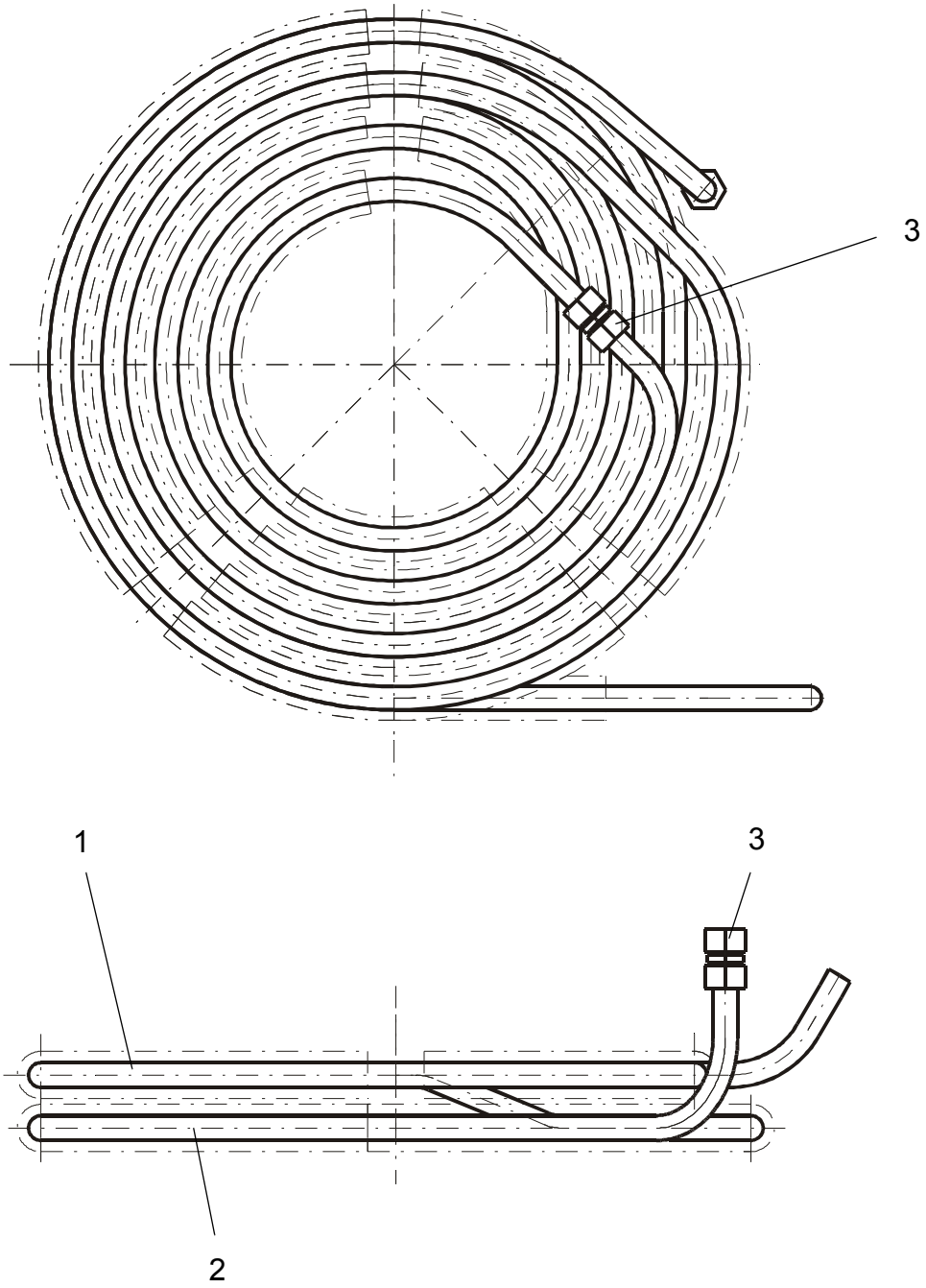
065 178 Cooler and air lines

Item no.	Part no.	Description	Quantity
1	065 120	Compressed air channel	1
2	065 122	Angle flange	1
3	064 581	Flange	1
4	065 389	Attachment rail	1
5	065 195	Spacer sleeve	9
6	065 197	Pipe	1
7	065 198	Pipe	1
8	065 200	Pipe	1
9	056 335	Gasket	4
10	056 369	Gasket	1
11	065 376	Attachment rail	1
12	065 194	Pipe bracket	3
13	064 075	Clamp	5
14	065 235	Clamp	1
15	065 234	Clamp	2
16	065 229	Cooler 3rd stage	1
17	065 159	Suction line	1
18	065 160	Pressure line	1
19	065 310	Pressure line	1
20	000 054	Hexagon head screw	16
21	000 162	Hexagon head screw	8
22	003 114	Schnorr lock washer	15
23	000 147	Hexagon head screw	2
24 1)	000 123	Hexagon head screw	15
25	000 558	Cap screw	2
26	000 540	Cap screw	8
27	030 744	Screw plug	2
28	000 059	Hexagon head screw	4

Item no.	Part no.	Description	Quantity
29	012 851	Hexagon head screw	2
30	004 707	Fitting	1
31	037 851	Fitting	2
32	036 157	Fitting	1
33	006 186	Fitting	2
34	006 193	Fitting	1
35	006 197	Fitting	1
36	006 231	Fitting	1
37	006 391	Reducing union	1
38	001 007	Screw plug	1
39[2)]	000 184	Hexagon head screw	2
40	002 166	Washer	2
41	036 555	2nd stage separator	1
42	036 081	Fitting	1
43	033 224	Safety valve 1st stage	1
44	033 714	Safety valve 2nd stage	1
45	030 752	Safety valve 3rd stage	1
46	003 496	Sealing ring	1
47	005 009	Sealing ring	3
48	005 016	Sealing ring	3
49	056 334	Gasket	5
50	005 023	Sealing ring	2
51	030 340	O-ring	1
52	032 401	O-ring	1
54	037 776	Cooler	1

[1)] Use item 24, 000 123 hexagon head screw, with Loctite 542.
[2)] Use item 39, 000 184 hexagon head screw, with adhesive 033 636.

065 229 Cooler 3rd stage



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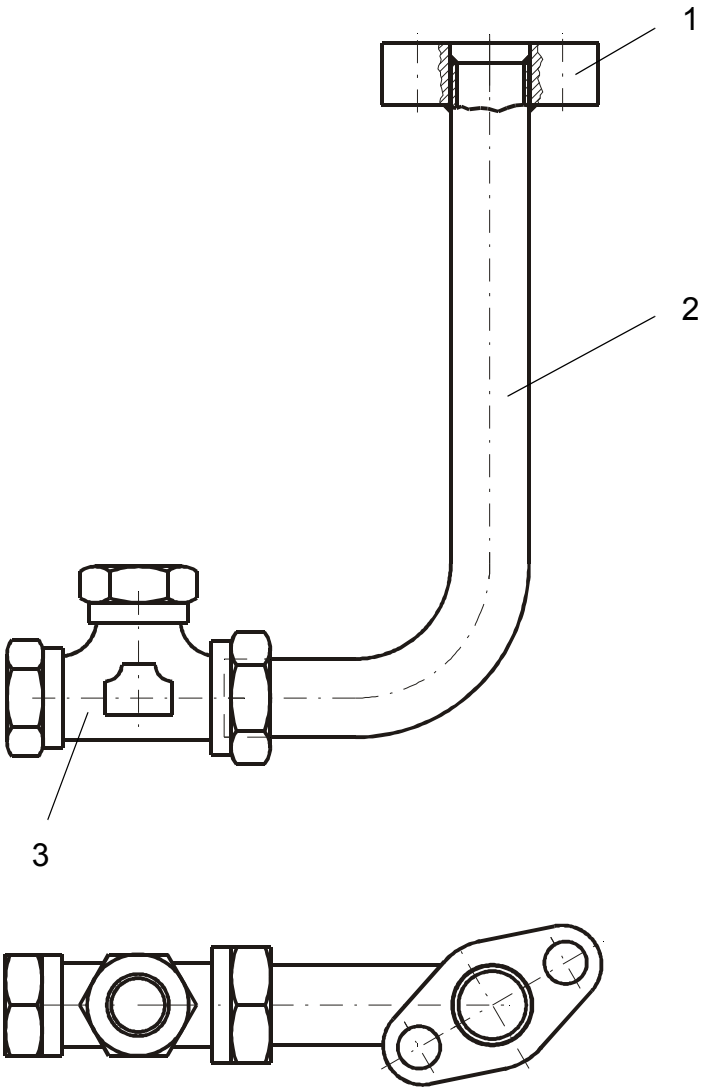
065 229 Cooler 3rd stage

Item no.	Part no.	Description	Quantity
1	065 196	Cooler 3rd stage	1
2	065 230	Cooler 3rd stage	1
3	004 705	Fitting	2

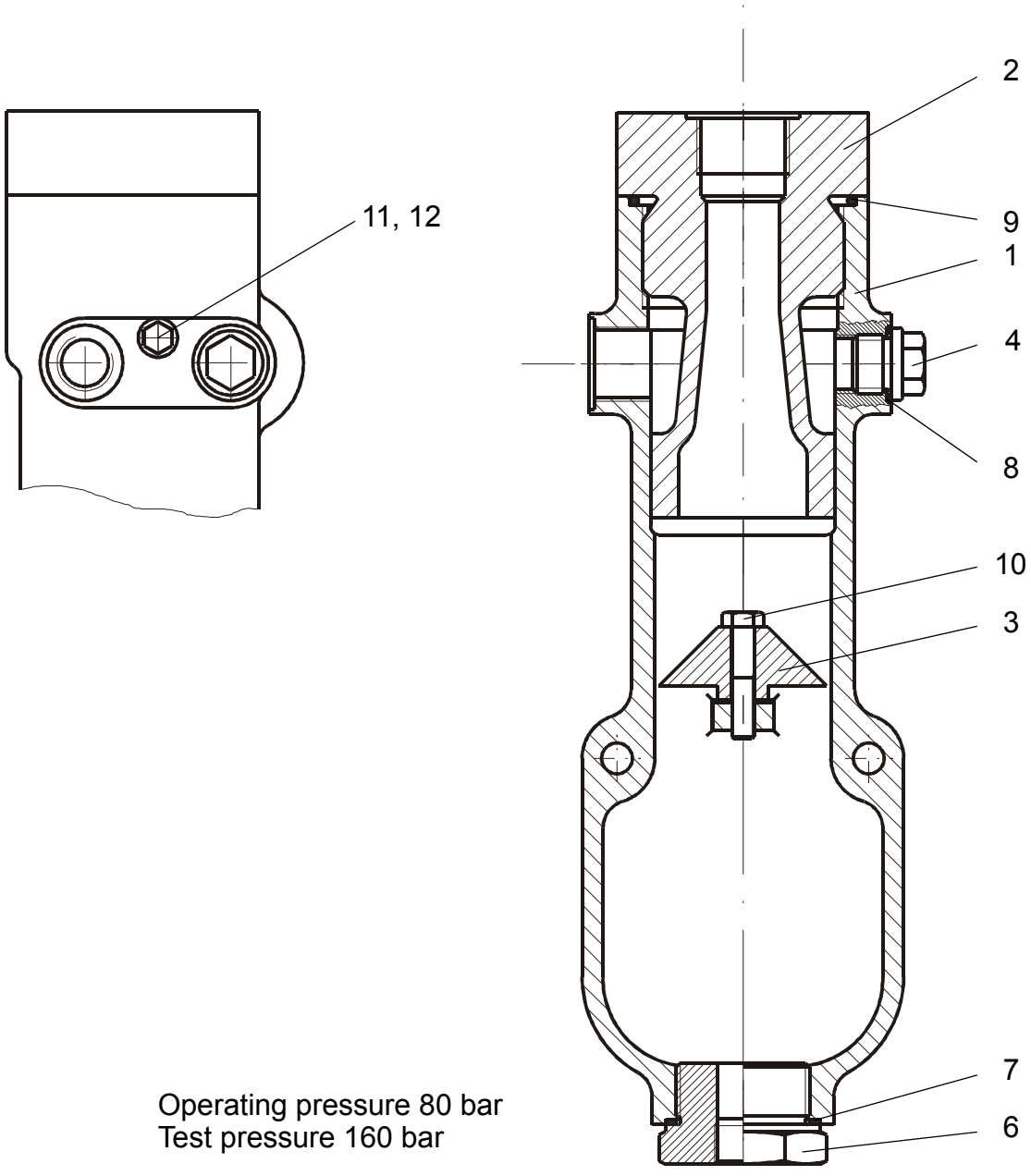
065 310 Pressure line



065 310 Pressure line

Item no.	Part no.	Description	Quantity
1	059 453	Flange	1
2	037 863	Elbow pipe	1
3	006 071	Fitting	1

063 121 Complete separator 3rd stage



Operating pressure 80 bar
Test pressure 160 bar

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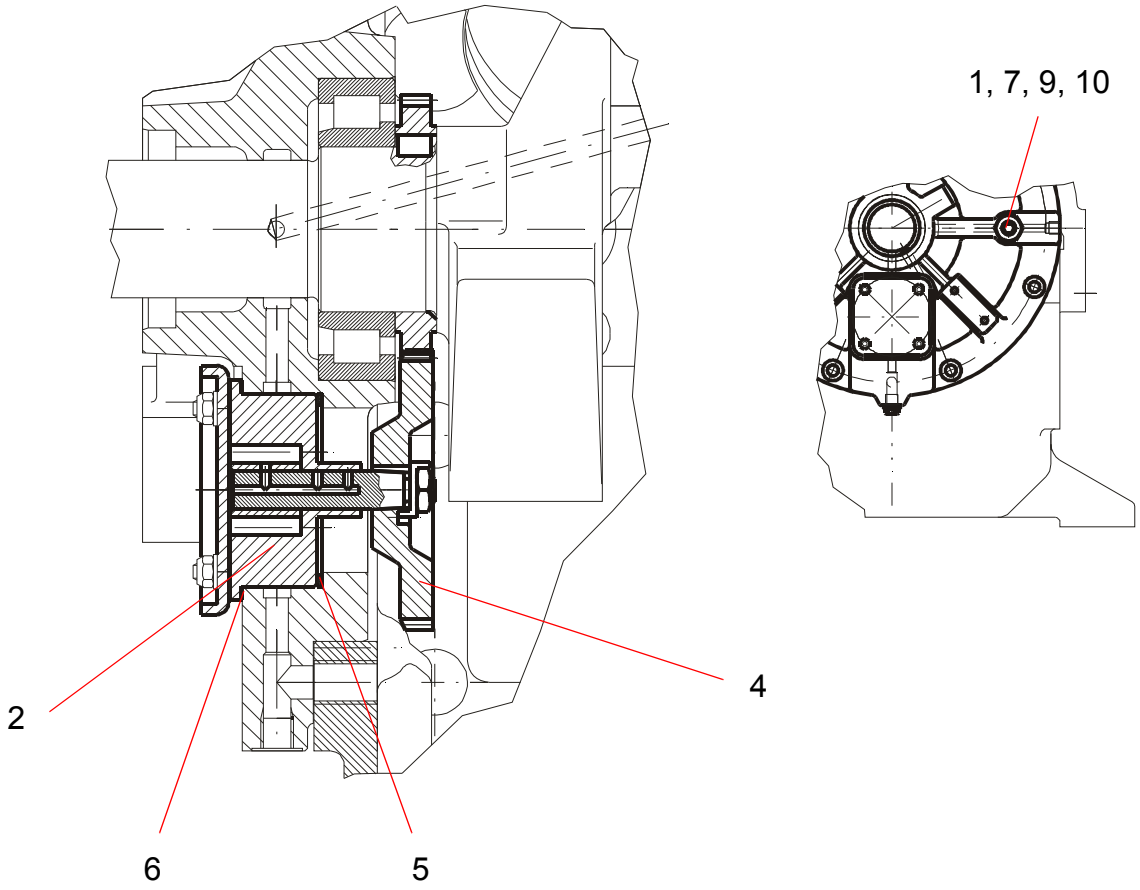
063 121 Complete separator 3rd stage

Item no.	Part no.	Description	Quantity
1	063 228	Separator housing	1
2	063 229	Separator head	1
3	062 328	Baffle cone	1
4[1)]	060 342	Fusible plug	1
6	006 390	Bottom plug	1
7	005 029	Sealing ring	1
8	005 009	Sealing ring	1
9	036 171	O-ring	1
10	036 041	Hexagon head screw	1
11	001 007	Screw plug	1
12	003 496	Sealing ring	1

[1)] 121 °C / 250 °F

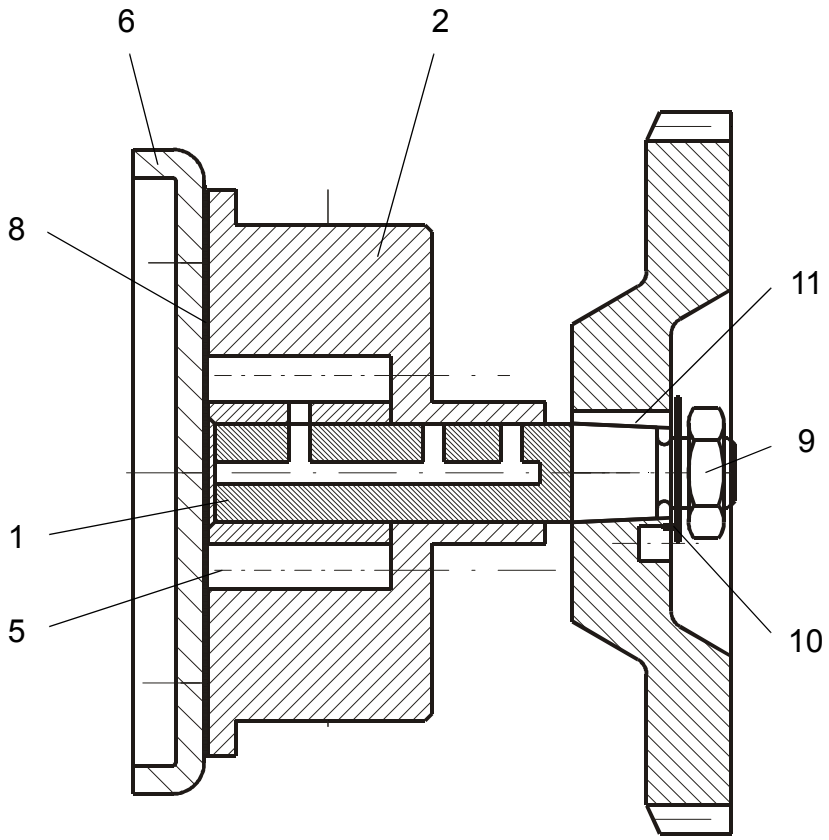
064 119 Lubricating oil pump drive



064 119 Lubricating oil pump drive

Item no.	Part no.	Description	Quantity
1	057 916	Relief valve	1
2	062 909	Gear oil pump	1
3	064 098	Gear wheel	1
4	056 730	Gear wheel	1
5	056 318	Gasket	1
6	030 545	Gasket	1
7	000 970	Screw plug	1
8	001 942	Key	1
9	003 496	Sealing ring	1
10	003 438	Sealing ring	1

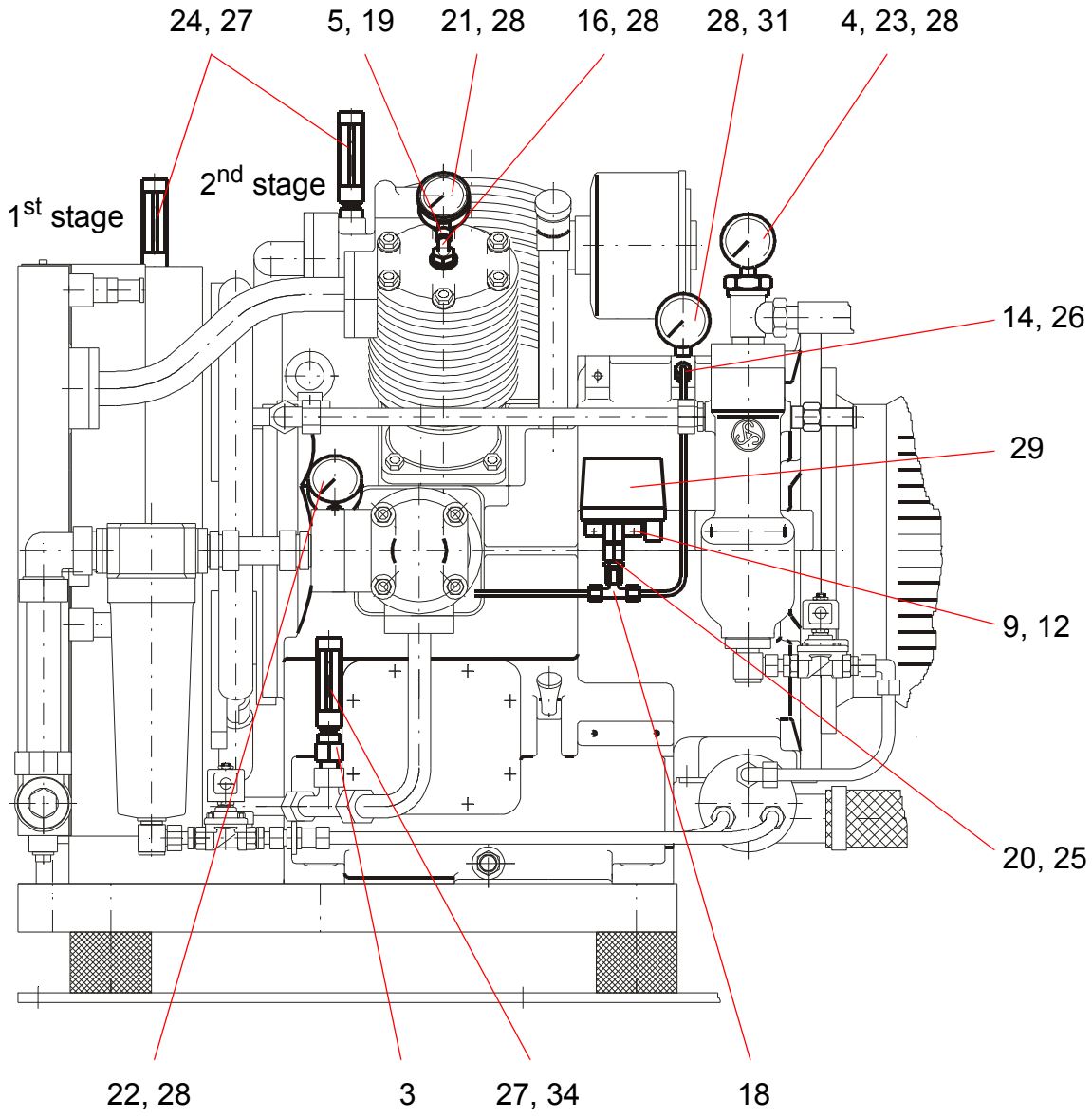
062 909 Gear oil pump



062 909 Gear oil pump

Item no.	Part no.	Description	Quantity
1	062 908	Oil pump gear wheel	1
2	036 360	Oil pump housing	1
5	036 359	Gear wheel	1
6	033 212	Oil pump cover	1
8	063 824	Gasket	1
9	001 064	Hexagon nut	1
10	001 672	Lock plate	1
11	001 925	Key	1

065 180 Measuring device



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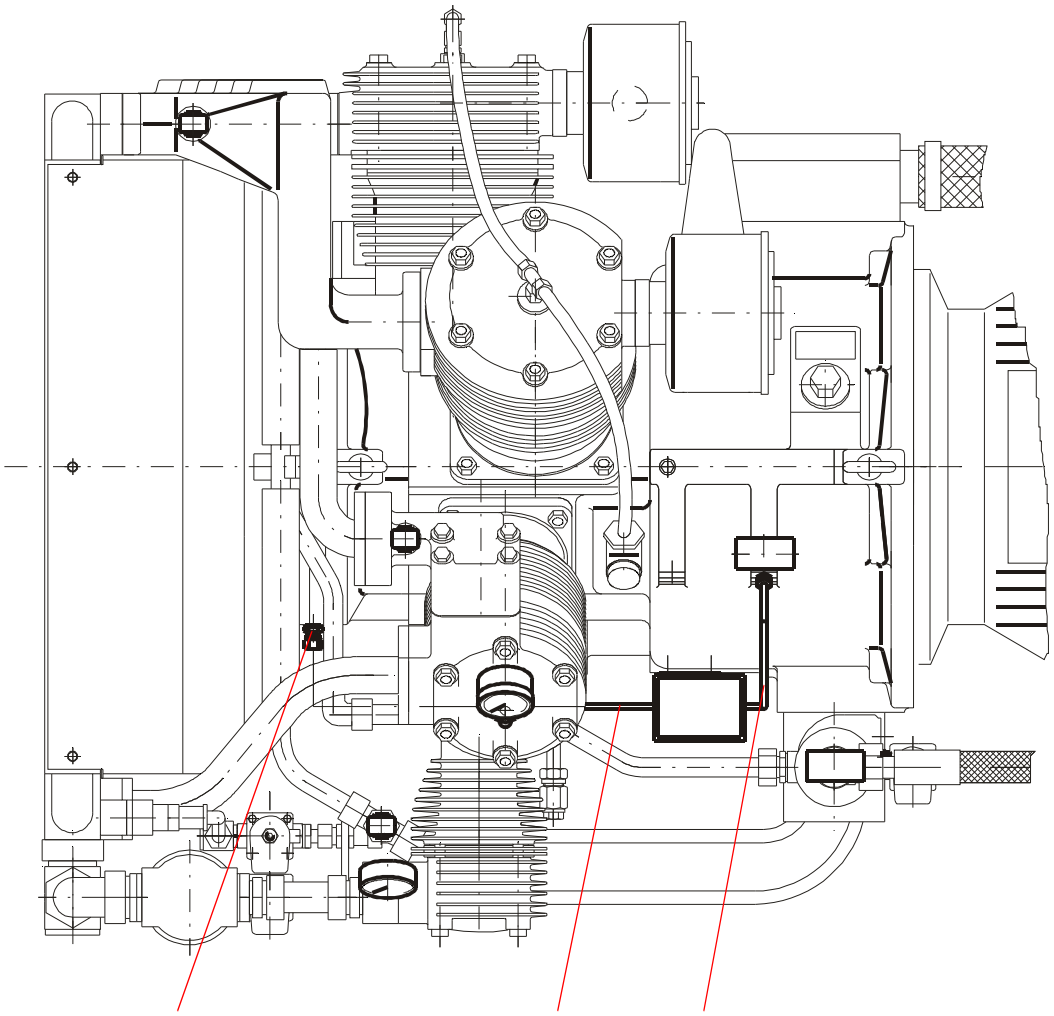
065 180 Compressor monitoring and protection

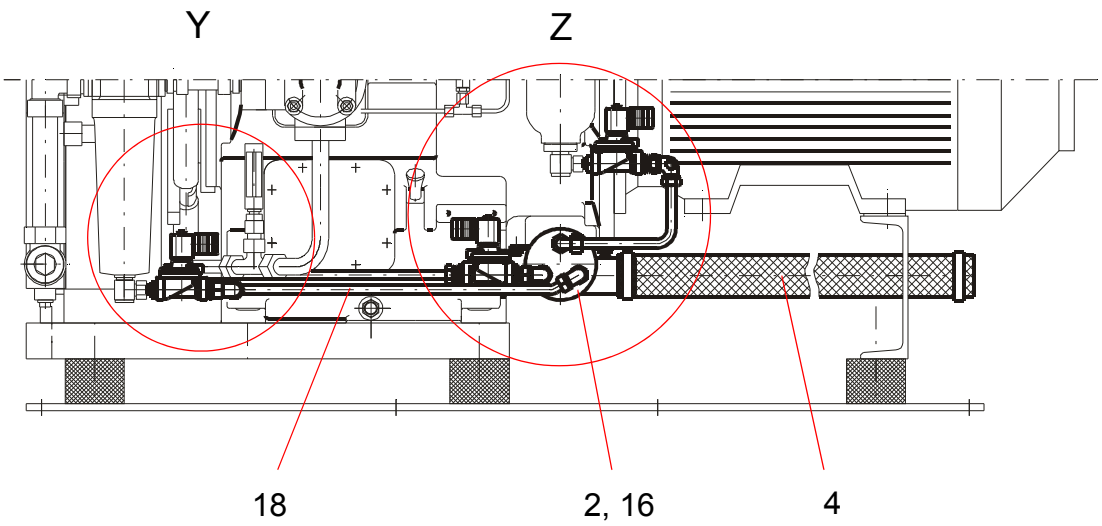


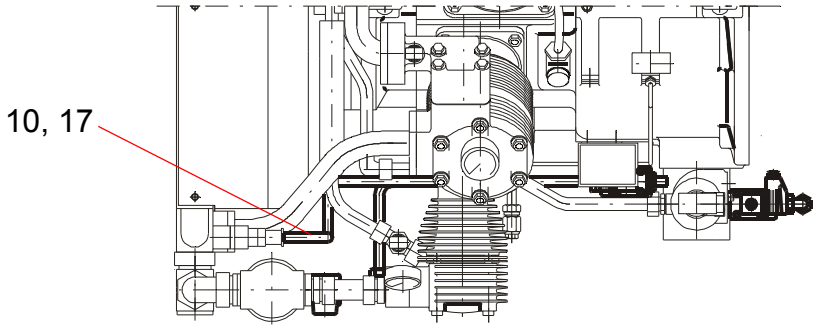
065 180 Compressor monitoring and protection

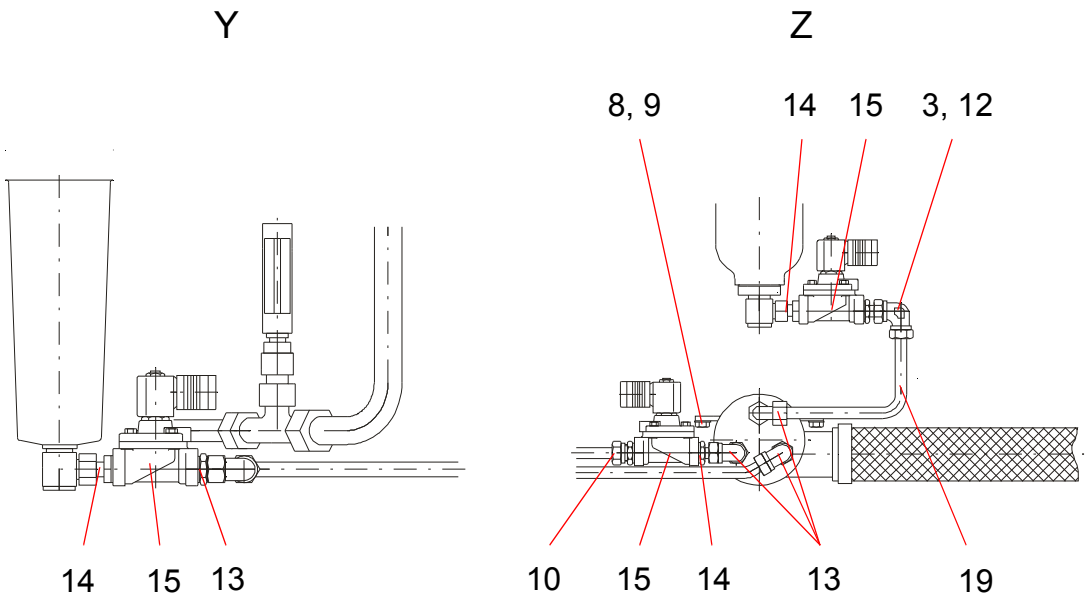
065 180 Compressor monitoring and protection

Item no.	Part no.	Description	Quantity
3	064 365	Stub	1
4	065 352	Screw-in fitting	1
5	065 353	Screw-in fitting	1
9	000 010	Hexagon head screw	2
12	002 144	Washer	2
14	004 598	Fitting	1
16	038 264	Pressure gauge angle	1
17	030 510	Fitting	1
18	033 912	Fitting	1
19	005 016	Sealing ring	1
20	033 017	Bottom plug	1
21	038 280	Pressure gauge 1st stage	1
22	033 281	Pressure gauge 2nd stage	1
23	033 282	Pressure gauge 3rd stage	1
24	033 223	Thermometer 1st / 2nd stage	2
25	005 006	Sealing ring	1
26	005 001	Sealing ring	2
27	005 009	Sealing ring	3
28	035 061	Sealing ring	5
29	030 082	Low oil pressure switch	1
31	033 279	Pressure gauge oil	1
32	008 633	Pipe	1
33	008 633	Pipe	1
34	037 839	Thermometer 3rd stage	1

065 181 Automatic drainage system







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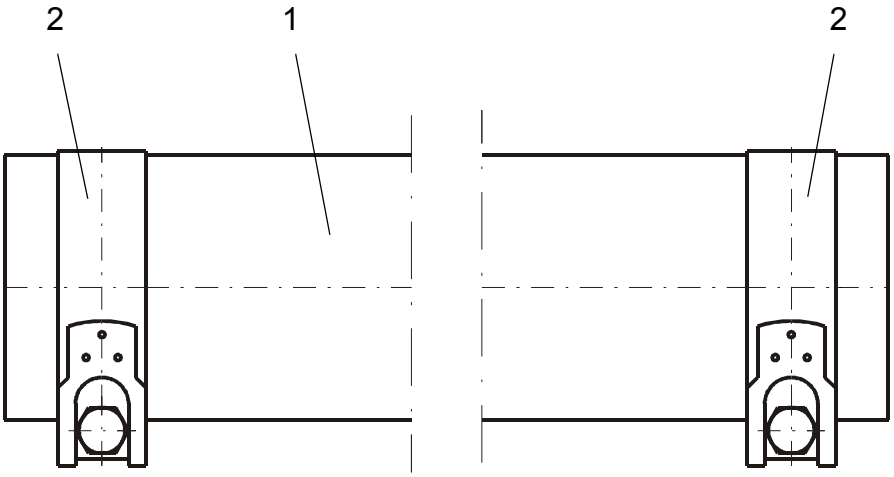
065 181 Automatic drainage system

Item no.	Part no.	Description	Quantity
2	063 120	Expansion tank	1
3	066 885	Orifice	1
4	065 478	Drain hose	1
8	000 036	Hexagon head screw	4
9	003 115	Schnorr lock washer	4
10	004 641	Fitting	2
12	006 215	Fitting	1
13	006 216	Fitting	4
14	033 961	Stub	3
15[1)]	037 681[2)]	Solenoid valve	3
16	030 744	Screw plug	1
17	008 663	Pipe	1
18	008 663	Pipe	1
19	008 663	Pipe	1

[1)] Specify voltage and frequency when ordering!
[2)] The part no. of the solenoid valve depends on the order.

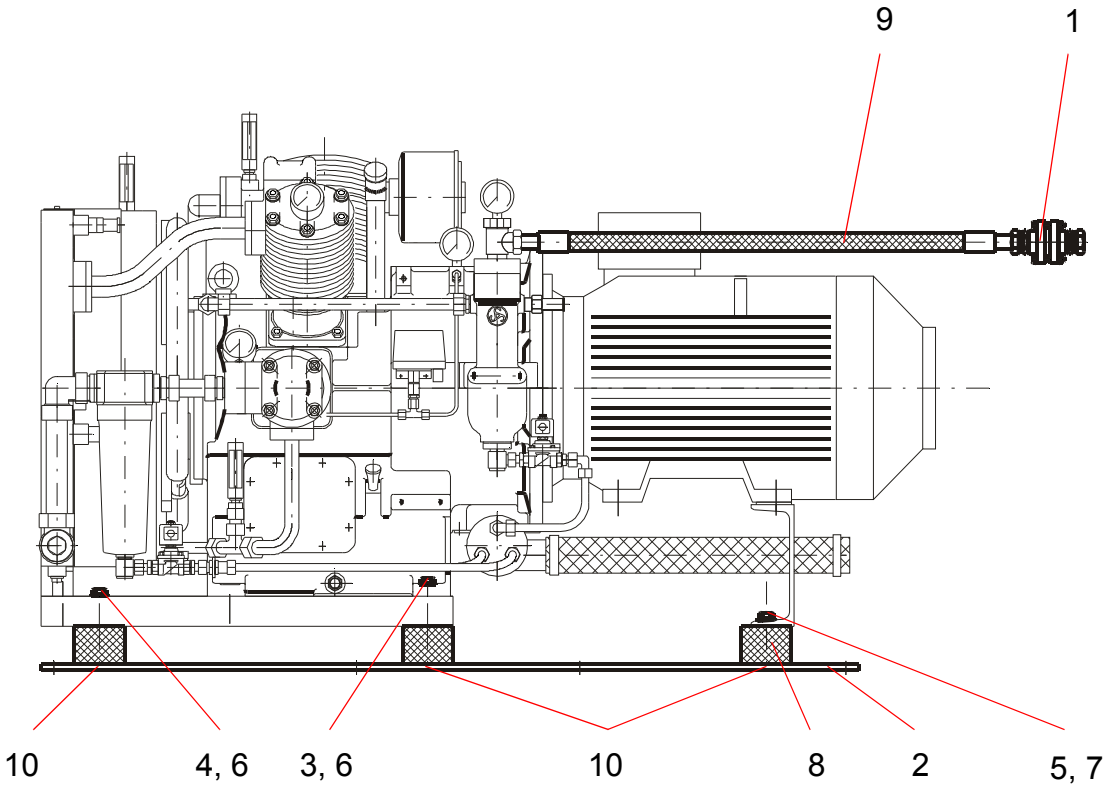
065 478 Drain hose



065 478 Drain hose

Item no.	Part no.	Description	Quantity
1	037 941	Compressed air hose	1
2	037 942	Joint bolt clamp	2

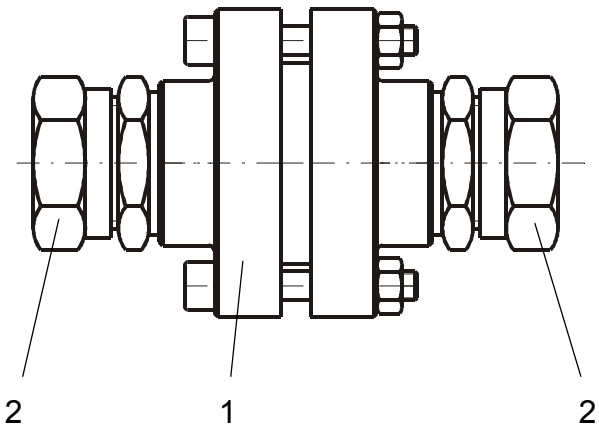
065 169 Resilient mounts



065 169 Resilient mounts

Item no.	Part no.	Description	Quantity
1	065 388	Non-return valve	1
2	065 216	Rail	2
3	000 197	Hexagon head screw	2
4	005 269	Hexagon head screw	2
5	000 068	Hexagon head screw	2
6	002 166	Washer	4
7	001 637	Washer	2
8	031 149	Anti-vibration resilient mount	6
9	034 763	High pressure hose	1
10	033 531	Countersunk screw	6

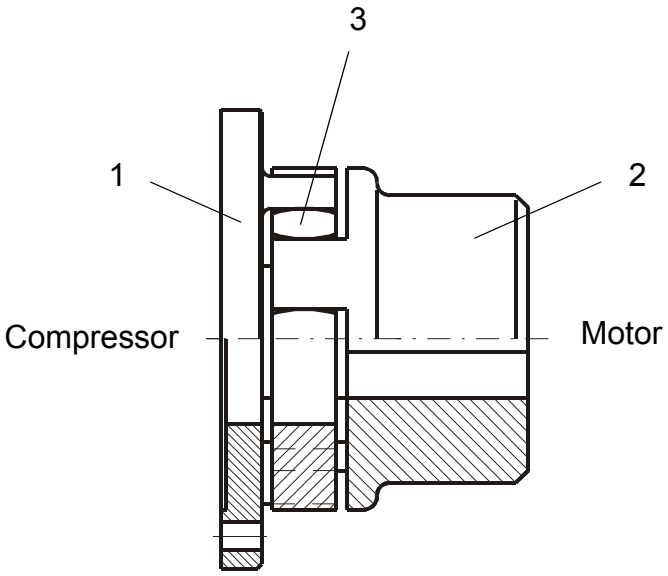
065 388 Non-return valve



065 388 Non-return valve

Item no.	Part no.	Description	Quantity
1	037 883	Non-return valve	1
2	004 661	Fitting	2

Flexible coupling



Flexible coupling

Item no.	Part no.	Description	Quantity
1[1)]	036 333	Compressor half coupling	1
2[2)]	036 438	Motor half coupling	1
3[3)]	033 423	Flexible coupling insert	1

[1)] Item 1, 036 333 compressor half coupling, is part of assembly 065 184.
[2)] Item 2, 036 438 motor half coupling, is part of assembly 065 183.
[3)] Item 3, 033 423 flexible coupling insert, is part of assembly 065 183.

Parts List by Part No.

Part no.	Description	Assembly	Page E -	Item
001 459	Stud screw	065 173	12	12
001 519	Stud screw	065 176	40	8
001 520	Stud screw	065 175	36	8
001 620	Hexagon nut	064 408	32	9
001 620	Hexagon nut	065 175	36	9
001 620	Hexagon nut	065 176	40	9
001 637	Washer	065 169	68	7
001 638	Washer	065 183	6	11
001 672	Lock plate	062 909	58	10
001 675	Lock plate	065 187	20	11
001 925	Key	062 909	58	11
001 942	Key	064 119	56	8
002 031	Hexagon nut	065 173	12, 13	17
002 063	Hexagon nut	065 183	6	10
002 094	Hexagon nut	065 173	12	18
002 098	Hexagon nut	065 173	13	16
002 144	Washer	065 180	60	12
002 146	Washer	065 173	12	19
002 161	Washer	064 408	32	10
002 166	Washer	065 169	68	6
002 166	Washer	065 178	46	40
002 552	Nose ring	063 305	30	5
002 566	Nose ring	037 049	28	4
002 984	Circlip	033 185	26	6
002 984	Circlip	037 049	28	6
002 988	Circlip	063 305	30	3
003 114	Schnorr lock washer	065 178	46	22
003 115	Schnorr lock washer	065 181	64	9
003 438	Sealing ring	064 119	56	10

Part no.	Description	Assembly	Page E -	Item
038 264	Pressure gauge angle	065 180	60	16
038 288	Pressure gauge 1st stage	065 180	60	21
051 883	Crankcase inspection cover	065 173	13	4
056 216	Cylinder	064 408	32	2
056 222	Cylinder head	065 175	36	1
056 235	Sealing ring	065 175	36	4
056 237	Gasket	064 408	32	3
056 239	Sealing ring	064 408	32	4
056 264	Washer	065 187	20	4
056 272	Big-end bearing	064 568	22	2
056 272	Big-end bearing	064 848	24	2
056 278	Cylinder head	065 176	40	1
056 282	Gasket	065 176	40	3
056 316	Connecting rod bolt	064 352	22	4
056 316	Connecting rod bolt	064 849	24	4
056 318	Gasket	064 119	56	5
056 334	Gasket	065 178	46, 47	49
056 335	Gasket	065 178	47	9
056 369	Gasket	065 178	46	10
056 730	Gear wheel	064 119	56	4
057 916	Relief valve	064 119	56	1
059 286	Cylinder	065 175	36	2
059 393	Gasket	065 175	36	3
059 453	Flange	065 310	52	1
060 342	Fusible plug	063 121	54	4
062 328	Baffle cone	063 121	54	3
062 375	Gasket	064 408	32	5
062 376	Gasket	065 175	36	5
062 376	Gasket	065 176	40	5

Parts List by Description

Part no.	Description	Assembly	Page E -	Item
001 021	Screw plug	065 173	13	15
030 744	Screw plug	065 173	13	14
030 744	Screw plug	065 178	46	27
030 744	Screw plug	065 181	64	16
065 352	Screw-in fitting	065 180	60	4
065 353	Screw-in fitting	065 180	60	5
003 438	Sealing ring	064 119	56	10
003 496	Sealing ring	063 121	54	12
003 496	Sealing ring	064 119	56	9
003 496	Sealing ring	065 178	46	46
005 001	Sealing ring	065 173	12	22
005 001	Sealing ring	065 180	60, 61	26
005 006	Sealing ring	065 180	60	25
005 009	Sealing ring	063 121	54	8
005 009	Sealing ring	065 173	13	23
005 009	Sealing ring	065 178	46	47
005 009	Sealing ring	065 180	60	27
005 016	Sealing ring	065 178	46	48
005 016	Sealing ring	065 180	60	19
005 023	Sealing ring	065 178	46	50
005 029	Sealing ring	063 121	54	7
035 061	Sealing ring	065 180	60	28
056 235	Sealing ring	065 175	36	4
056 239	Sealing ring	064 408	32	4
063 079	Sealing ring	065 176	40	4
063 229	Separator head	063 121	54	2
063 228	Separator housing	063 121	54	1
007 123	Shaft seal	065 173	12	25
030 831	Shaft seal	065 173	12	26

Part no.	Description	Assembly	Page E -	Item
001 638	Washer	065 183	6	11
002 144	Washer	065 180	60	12
002 146	Washer	065 173	12	19
002 161	Washer	064 408	32	10
002 166	Washer	065 169	68	6
002 166	Washer	065 178	46	40
056 264	Washer	065 187	20	4
064 420	Washer	065 187	20	3
035 254	Worm thread clamp	065 177	44	13
037 137	Y-piece	065 177	44	7