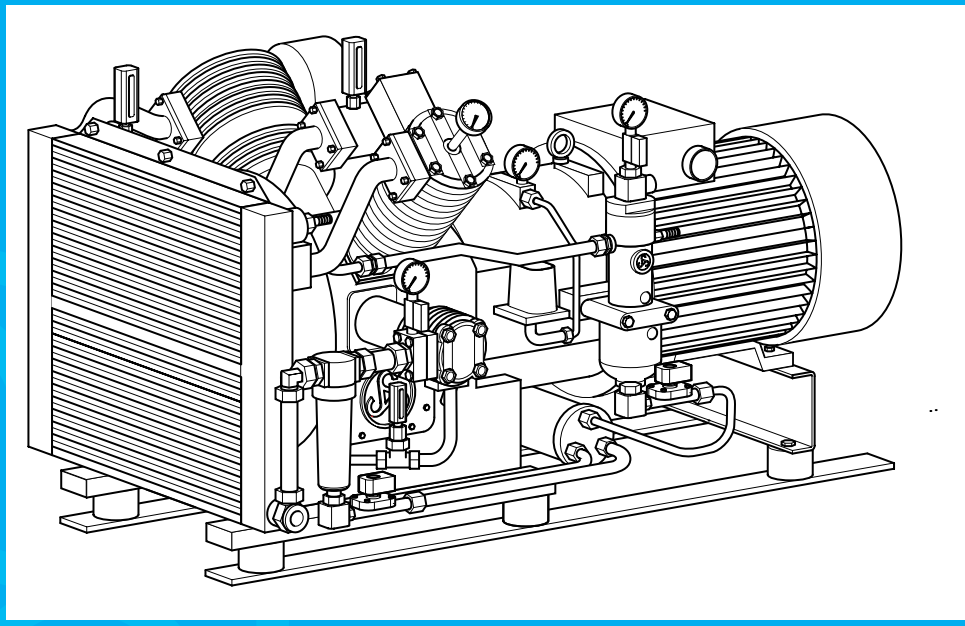
J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

Type: WP 311 L

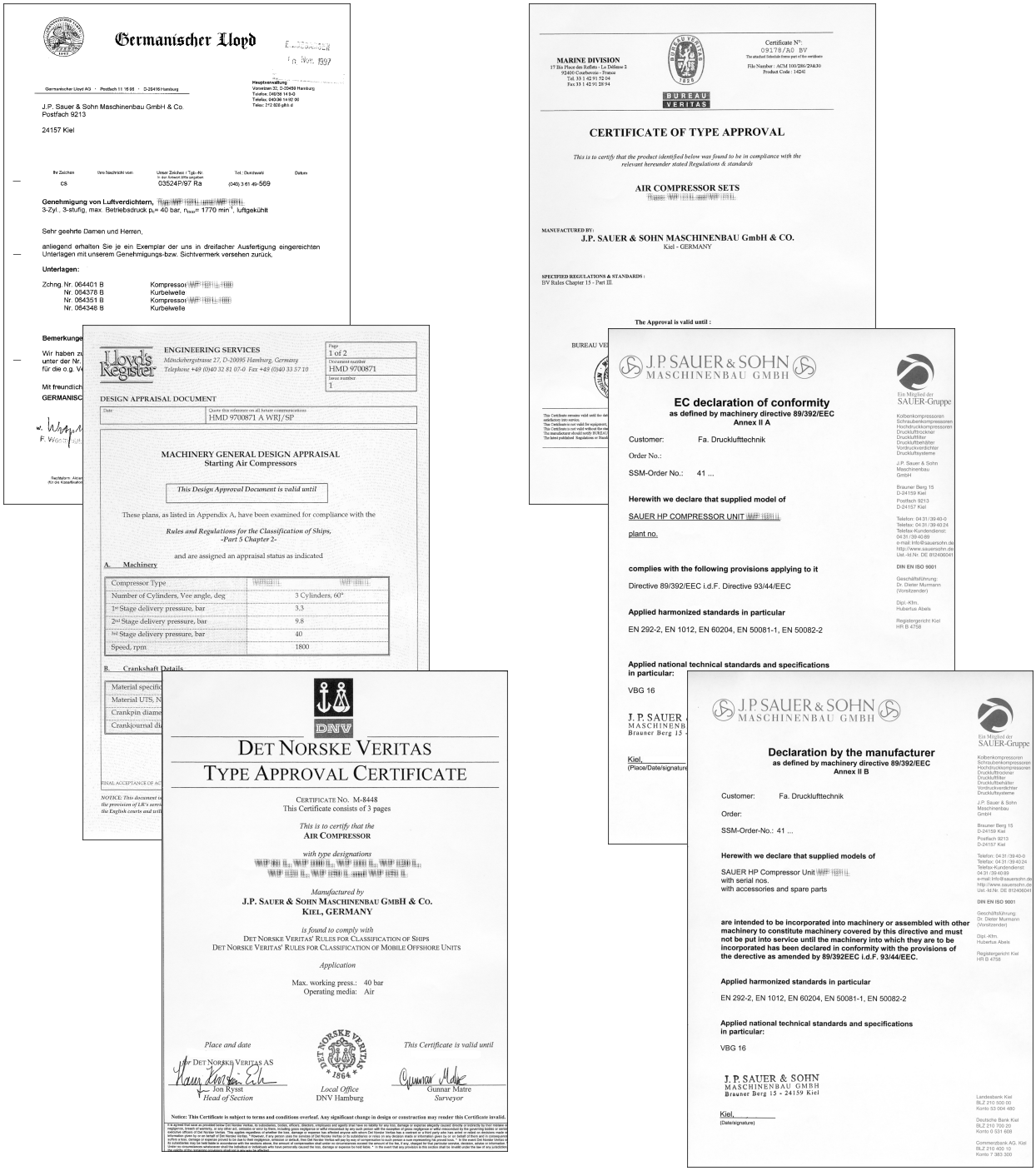
Operating Manual

- High-Pressure Compressor
- 3 Stages
- Air Cooled

Ein Mitglied der
SAUER-Gruppe

Version 2 - 2

Sauer compressor type approvals



Germanischer Lloyd

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

24157 Kiel

Genehmigung von Luftverdichtern,
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
Nr. 064378 B Kurbelwelle
Nr. 064351 B Kompressor
Nr. 064348 B Kurbelwelle

Lloyd's Register

ENGINEERING SERVICES
Möncheborgstrasse 27, D-20095 Hamburg, Germany
Telephone +49 (0)40 32 81 07-0 Fax +49 (0)40 33 57 10

DESIGN APPRAISAL DOCUMENT

HMD 9700871 A WRJ/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

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 Ryst
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
17 Bis Place des Reflets - La Défense 2
92400 Courbevoie - France
Tel. 33 1 42 91 52 04
Fax 33 1 42 91 28 94

BUREAU VERITAS

Certificate N°:
09178/A0 BV

File Number : ACM 100/286/294430
Product Code : 14241

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

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

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

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. Drucklufttechnik

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

Kiel,
(Place/Date/signature)

Ein Mitglied der SAUER-Gruppe

Kolbenkompressoren
Schraubenkompressoren
Hochdruckkompressoren
Druckluftrockner
Druckluftfilter
Druckluftbehälter
Vordruckverdichter
Druckluftsysteme

J.P. Sauer & Sohn Maschinenbau GmbH

Brauner Berg 15
D-24159 Kiel

Postfach 9213
D-24157 Kiel

Telefon: 04 31 / 39 40-0
Telefax: 04 31 / 39 40 24
Telefax-Kundendienst: 04 31 / 39 40 89
e-mail: Info@Sauersohn.de
http://www.sauersohn.de
Ust.-Id.Nr. DE 810490041

DIN EN ISO 9001

Geschäftsführung:
Dr. Dieter Murmann
(Vorsitzender)

Dipl.-Kfm.
Hubertus Abels

Registergericht Kiel
HR B 4758

J.P. SAUER & SOHN MASCHINENBAU GMBH

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

Customer: Fa. Drucklufttechnik

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 15 - 24159 Kiel

Kiel,
(Date/signature)

Landesbank Kiel
BLZ 210 500 00
Konto 53 004 480

Deutsche Bank Kiel
BLZ 210 700 20
Konto 0 531 609

Commerzbank AG, Kiel
BLZ 210 400 10
Konto 7 383 300

Note!

On this page only a few examples are shown. Further type approvals are available on request.

Genuine Sauer spare parts – certified safety

Certificate of Conformity and Authenticity

Serial Number: 211789 *

With this Certificate of Conformity and Authenticity we the

J.P. SAUER & SOHN
MASCHINENBAU GMBH
24157 Kiel – Germany

certify that the items, total no. _____ and only these items which have been delivered with attached shipping note number _____ are

Genuine Sauer Spare Parts

with proven, guaranteed and traceable quality. Any hand-written or other alternate resp. revision in any way on the attached shipping note or the certificate itself will make this certificate invalid. In this case there are justified evidences that grey market spares of inferior quality have been delivered.

SPECIMEN

If you want to be informed about your advantages when using Genuine Sauer Spare Parts or in case of doubts, please contact our Service Department:
Int. -49-431-39 40 -86/87 (Fax -89),
e-mail: service@sauersohn.de
or visit our website http//www.sauersohn.de.

Kiel, _____ _____

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Contents

1. General

1.1 At the outset

The following main specifications of your Sauer compressor are found on the type label affixed to the crankcase:

– compressor type
– factory number
– year of construction

We recommend you write down this information in chapter 11. “Spare Parts and Accessories”.

1.2 General information

Conditions

We presuppose that only authorized persons will operate and service the Sauer compressor. These persons must have read and understood the operating instructions.

Availability

These instructions shall always be kept available at the site of operation.

Copyright

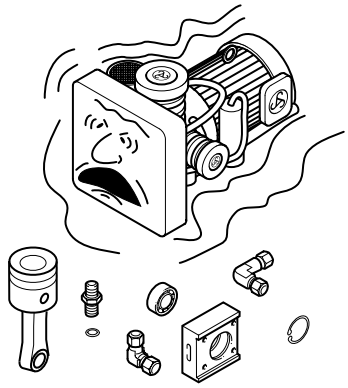
1.3 Warranty and Liability

We exonerate the contractually agreed warranty claims and liability claims, if they can be attributed to at least one of the following:

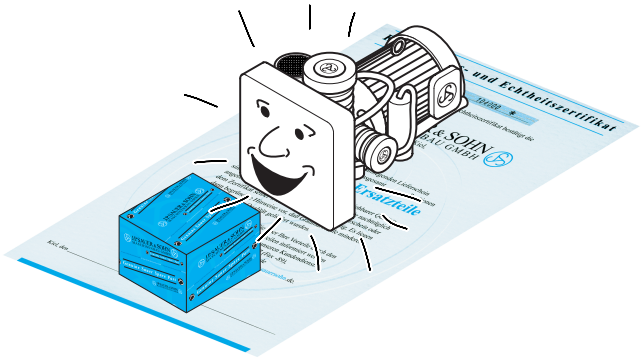
– use of the machine not as specified;
– use of spare parts that are not genuine Sauer spare parts;
– operation of the machine with faulty or not properly installed safety devices and protection devices;
– disregard of the operating instructions;
– unauthorized modifications of the machine or its control system;
– inadequate monitoring of machine parts subject to wear;
– inexpert repairs;
– 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 made by the Classification Society and the EC Declaration of Conformity or EC Manufacturer's Declaration. Disregard of the specifications may cause the type approval to expire.
- Only the use of genuine Sauer spare parts ensures compliance with these specfications and thus the perfect and safe operation of the Sauer compressor.
- If genuine Sauer spare parts are not used we reserve the right of exclusion of liability for personal injury and material damage.
- genuine Sauer spare parts are supplied with a Certificate of Conformity and a Certificate of Authenticity. A specimen of this document is shown before the table of contents of these instructions. If spare parts are received without this certificate, there is a risk that these are not genuine Sauer spare parts. In such case please contact our customer service.



Do not use parts from the „grey market“…



… but only genuine Sauer spare parts with certificate!

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1.5 J.P. SAUER & SOHN customer service

In case of technical questions pertaining to maintenance or repair please contact our customer service:

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

Telephone (international):	
Technical information	+49 431 39 40 -87
Spare parts ordering	+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 type and factory number (see chapter 11. “Spare Parts and Accessories” or type label on the crankcase).

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1.6 How these instructions are organized

Listings

General listings are denoted by horizontal bars.

Example:

The cooling consists of

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

Action

Individual instructions or multiple instructions, where the sequence is of no importance are normally denoted by bullets.

Example:

• Check oil level.

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

Example:

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

Results

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

Example:

✓ The control light is on.

Safety instructions

Safety instructions are emphasized by pictographs and signal words. The safety instructions are described in detail in chapter 2. “Safety”.

2. Safety

2.1 Specified conditions of use

This Sauer compressor must be used for the compressing of air only. The Sauer compressor must not be used at ambient temperatures of below +5 °C. Any other use is not as specified and requires the explicit consent in writing by J.P. SAUER & SOHN.

Observance of these operating instructions, the installation requirements detailed in the instructions, and the keeping of maintenance rates are part of the specified conditions of use as well.

2.2 Prohibition of unauthorized conversion

Unauthorized conversion and modification of the Sauer compressor is not permitted, since they could endanger humans and may lead to machine damage.

Contact J.P. SAUER & SOHN when planning conversions or modifications to obtain a written permission.

2.3 Safety information

The safety information in these instructions is divided in two classes. The following pictographs and signal words are used:

Danger!

High risk.
Disregard of this safety information may cause personal injury and substantial material damage.

Note!

Average risk.
Disregard of this safety information may cause damage to the machine.

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2.4 Safety markings on the machine

Caution!

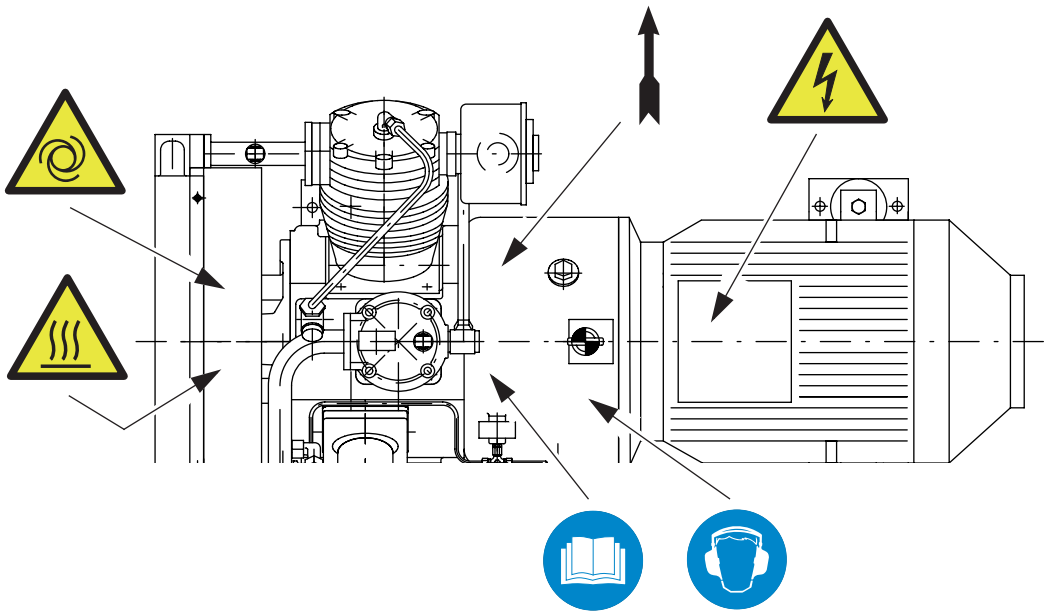
Safety markings affixed to the machine must not be altered or removed. Replace damaged or lost safety markings immediately, true to the original.

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

Safety marking	Meaning
	Danger! High voltage!
	Compressor starts automatically without warning!
	Hot surface!

Safety marking	Meaning
	Read instructions!
	Wear hearing protection!
	Rotational direction of crankshaft

Location of safety markings (top view)



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2.5 Safety devices

Danger!

Safety devices must not be adjusted, disabled or removed.

The safety devices shall be periodically tested and checked.

Safety valves must be

– installed sealed and
– shall be replaced, adjusted and sealed by authorized personnel only.

Safety valves

Every pressure compartment of a stage of the Sauer compressor is equipped with a safety valve, which will blow off when the blowing-off pressure is reached.

Safety valves are installed at these locations:

– 1st compression stage: in the 1st stage's honeycomb radiator;
– 2nd compression stage: in the 2nd stage's honeycomb radiator;
– 3rd compression stage: in the final separator.

Fusible plug/ temperature control

To monitor the cooling, a fusible plug is installed in the final separator. It will melt at 121 °C, opening an exhaust port for the compressed air when it has exceeded the temperature limit. This protects the compressor from overheating.

The fusible plug works only once. Once it has responded it must be replaced by a new fusible plug.

As an alternative to the fusible plug the Sauer compressor can be equipped with a temperature control. This will turn the compressor off if the temperature of the compressed air exceeds the limit.

2.6 Noise protection

Sound pressure level details are found in the Technical Specifications (see chapter 4).

If necessary the Sauer compressor can be equipped with a noise protection hood, which is available as optional accessory from J.P. SAUER & SOHN.

Danger!

When the compressor is operated without noise protection hood, hearing protection should be worn near the compressor.

2.7 Waste disposal

Note!

Under the laws and regulations in force, the following materials arising from the operation of the compressor need to be disposed of ecologically safe:

- condensate (oil and water saturated) arising from recooling in the compression process;
- used oil and grease and rags soiled by it;
- cleaning material and rags soiled by it.

2.8 Staff requirements

Only authorised persons are permitted to service the Sauer Compressor! Before commencing work they must have read and understand the operating manual and must be familiar with the safety devices and safety regulations.

In addition to the instructions in this operating manual and manufacturer documentation, accepted technical standards must be observed as well as all regional laws, standards and regulations such as the

- Equipment and Product Safety Act (Geräte- und Produktsicherheitsgesetz),
- Ordinance on Industrial Safety and Health (Betriebssicherheitsverordnung),
- Regulations for accident prevention pertaining to compressors,
- VDE regulations and
- Regulations on environmental protection.

In addition, where appropriate, regulations of the responsible classification society as well as operational regulations must be observed.

Persons authorised to operate the compressor are the attending specialists introduced to the job and trained by the operator.

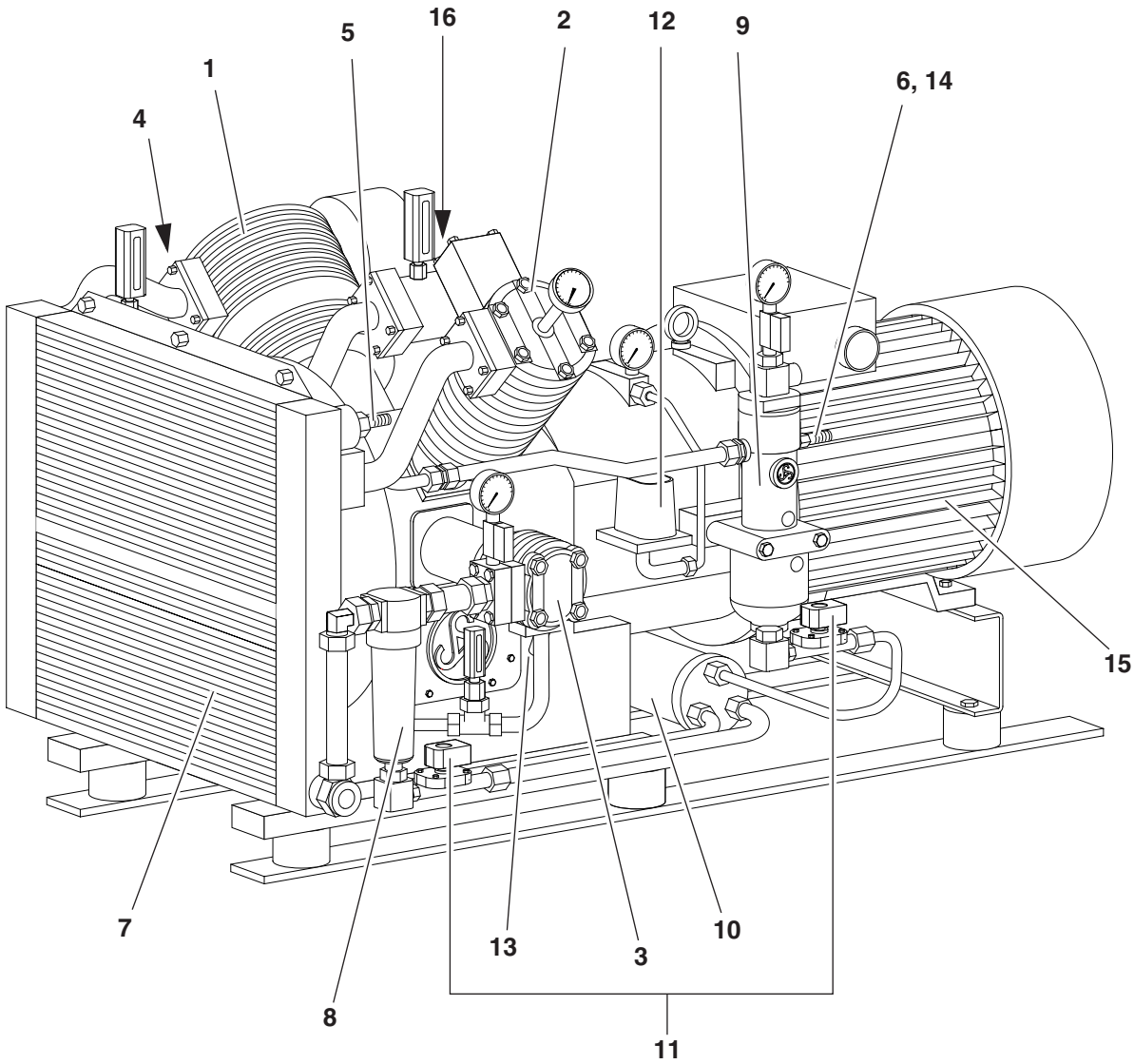
Persons authorised to service the compressor are the trained specialists of the operator and of the manufacturer.

2.9 Personal protection gear

The operator has to provide the personal protection gear (hearing protection, safety boots, etc.) for the personnel carrying out any work on the Sauer compressor.

3. Design and Function

3.1 Overview



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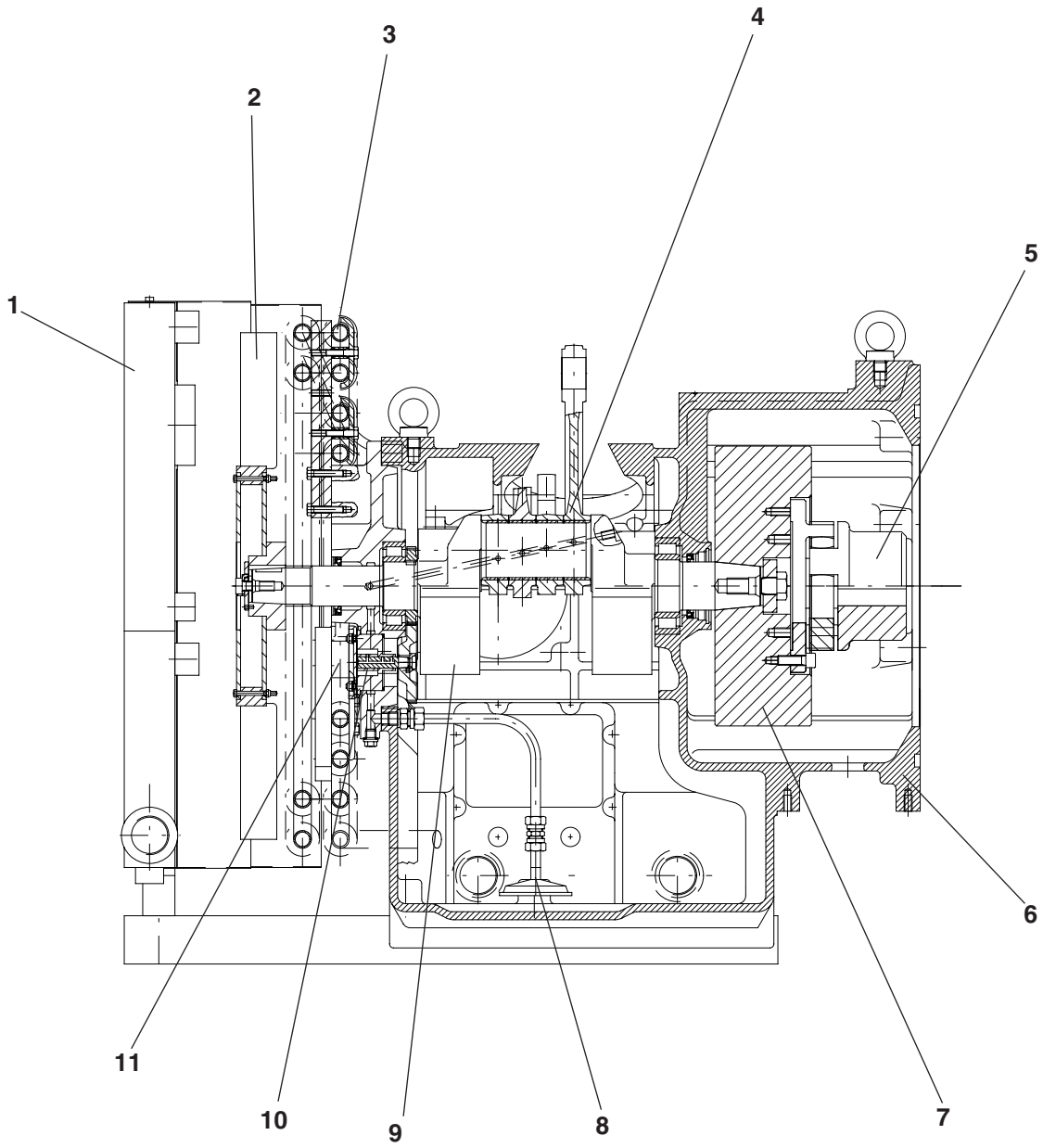
Item	Designation
1	Cylinder 1st stage
2	Cylinder 2nd stage
3	Cylinder 3rd stage
4	Safety valve 1st stage (not visible)
5	Safety valve 2nd stage
6	Safety valve 3rd stage
7	Cooler 1st and 2nd stage
8	Condensate separator 2nd stage
9	Condensate separator 3rd stage (final separator)
10	Condensate collecting pot
11	Drain valves 1st, 2nd, 3rd stage
12	Oil pressure monitor
13	Oil dip stick
14	Fusible plug (not visible)
15	Electric motor
16	Crankcase vent with insulating sleeve (not visible)

Longitudinal section



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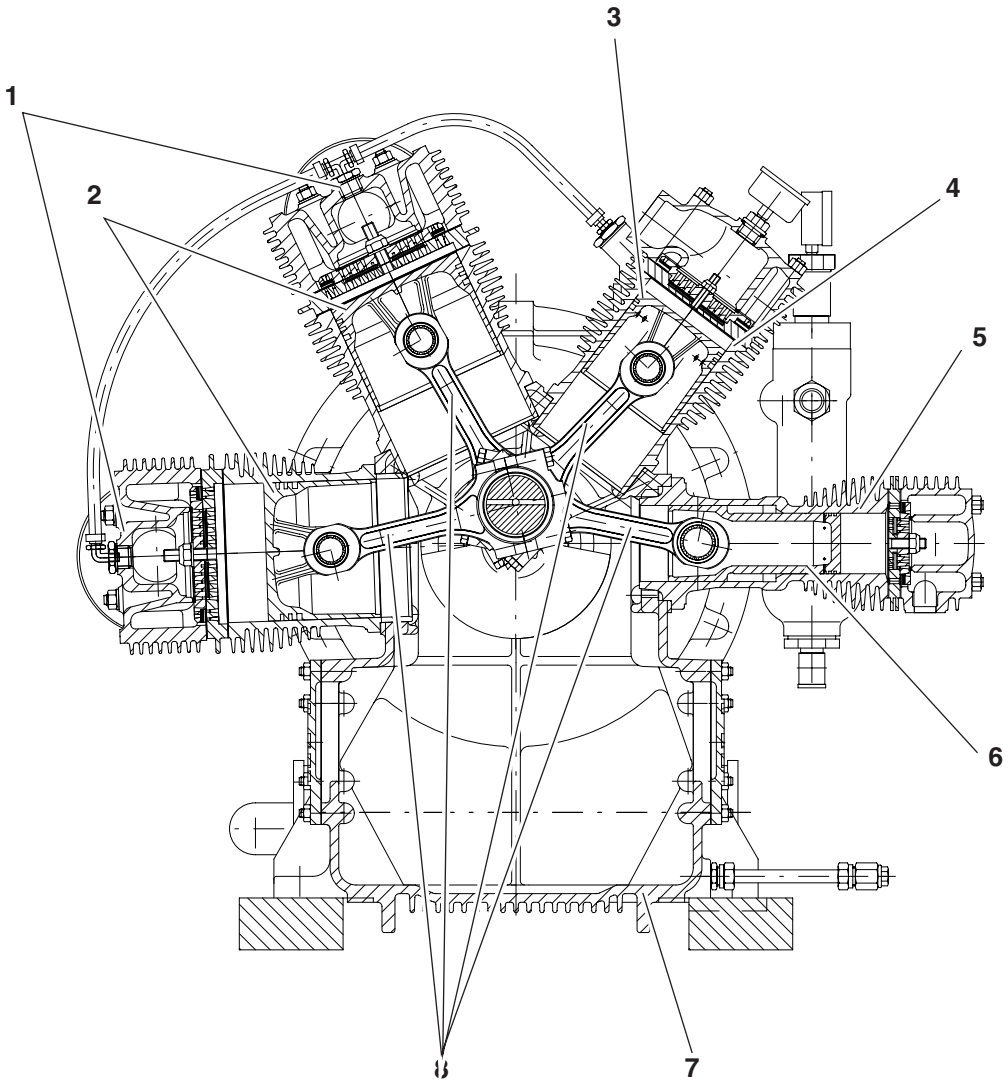
Item	Designation
1	Cooler 1st and 2nd stage
2	Fan wheel
3	Cooler 3rd stage
4	Connecting rod
5	Flexible coupling
6	Transmission bell housing
7	Flywheel
8	Oil suction filter
9	Crankshaft
10	Lubricating oil pump
11	Bearing bracket

Cross section



Note!

Details of parts and spare parts are found in the spare parts catalogue.

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Item	Designation
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	Crankcase
8	Connecting rod

3.2 Functional description

Drive

The Sauer Kompressors is driven by an electric motor directly flanged to the transmission bell housing of the crankcase, where the force is transferred by means of a flexible coupling.

Alternatively a diesel engine can be used to drive the compressor. This is installed by means of a special flange. It transfers the power by means of a centrifugal clutch.

Compressor control

The Sauer Kompressor with electric drive is controlled and monitored by an electric 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 ambient air through a sheet filter with tube silencer and compresses it in three single-stage cylinders to the ultimate pressure. Each cylinder is a compression stage, behind which the air is recooled.

Splitting the entire pressure ratio into three stages results in especially low compression end temperatures. The final temperatures are below the flash point of standard motor oils (mineral oils).

The cylinders in W-shape configuration are equipped with plate-type valves or lamellar valves, which have a long service life and are easy to service. Due to the low compression end temperatures the susceptibility of the valves to coking is extremely low.

Cooling

An axial fan on the crankshaft takes in ambient air and blows it on cylinders, intercoolers, valves and oil sump.

Recooling takes place

– after the 1st and 2nd stage in an aluminium honeycomb radiator;
– after the 3rd stage in a steel gilled pipe radiator.

Condensate separation

Condensate arising from the 1st stage is collected in the 1st stage intercooler's collecting tank. Both 2nd and 3nd stage each have a separate condensate separator for the oil- and water-saturated condensate arising from compressing and recooling.

Condensate draining/pressure relief

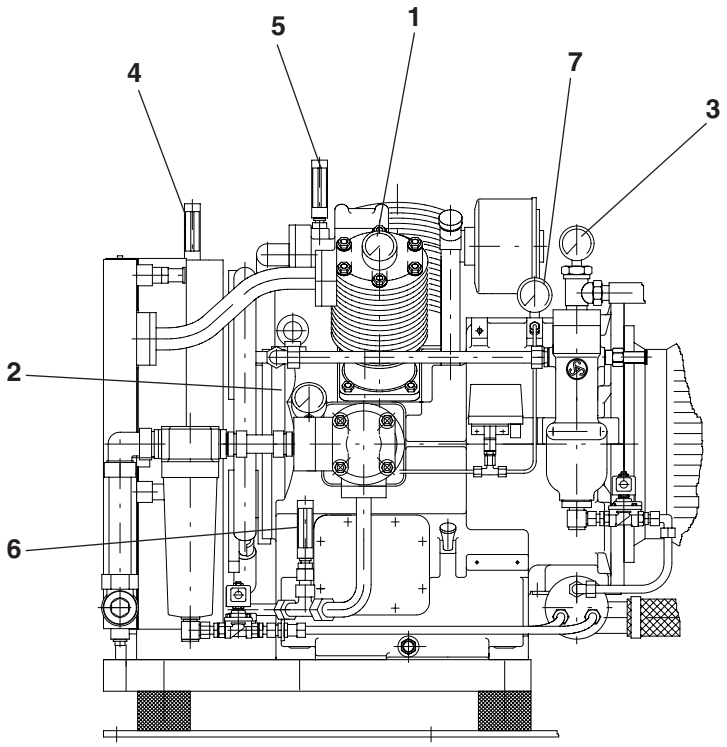
The condensate is drained through drain lines. The drain lines have solenoid valves built-in. These must be open when the Sauer Kompressor is unpressurized. The drain valves should close several seconds after starting and the Sauer Kompressor run up against pressure. During operation the solenoid valves shall drain the machine at predetermined intervals. The solenoids valves are controlled by the compressor control system.

Lubrication/oil pressure

An oil gear pump driven by the crankshaft primes the lubrication oil from the crankcase and supplies it to the friction bearings of the connecting rods. Crankshaft bearings, gudgeon pin bearings and pistons are lubricated by the splash oil in the crankcase. The oil pressure is monitored by an oil pressure monitor.

The compressor control system will stop the compressor immediately if the oil pressure falls to the lower limit.

3.3 Indicators on the Sauer compressor



Item	Designation	Display
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 3st stage	Ultimate 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 3st stage	Compressed air temperature after the 3st stage
7	Oil pressure gauge	Oil pressure of oil pump

I_FK002_1A.fm

3.4 Indicators and controls of the compressor control system

Note!

If the compressor control system is supplied by J.P. SAUER & SOHN take notice of the documentation supplied.

At the front of the compressor control the following indicators and control elements are found:

Indicator/ Control element	Description
Signal lamp “Operation”	Lights when the compressor is running.
Fault indicator lamp “Oil pressure”	Lights if the compressor has been shut off because of low oil pressure.
Fault indicator lamp “Air temperature”	Lights if the compressor has been shut off because of excessive outlet air temperature.
Fault indicator lamp “Overcurrent”	Lights if the compressor has been shut off because of excess motor current.
Working hour meter	Indicates the working hours of the compressor.
Operating mode selector	• Selector position “Manual”: Starting the compressor manually. The compressor starts up and continues to run until it is manually turned off. • Selector position “0”: Turns compressor manually OFF. Any pending fault messages are reset. • Selector position “Auto”: The compressor is started and stopped by the opening and closing of an external switching contact (e.g. pressure switch of the compressed air receiver).
Main switch	Interrupts the power supply from the compressor control to the compressor. A main switch should be installed if required by local laws and regulations.

4. Technical Specifications

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 2st stage	120 mm
Cylinder diameter 3rd stage	70 mm
Piston stroke	100 mm
Maximum pump speed	1800 rpm
Direction of rotation (when looking at flywheel)	right hand
Maximum working pressure	40 bar
Set pressures of safety valves:	
1st stage	4 bar
2nd stage	12 bar
3rd stage	5 % higher than the ultimate pressure
Oil filling quantity	21.5L
Oil quantity between dip stick markings	4.5L
Oil type	see chapter 10. “Lubricant table”
Oil pressure monitor	
Maximum switching current	6A / 220 V
Setting	opens at 1 bar falling closes at 2 bar rising approx. 15 sec. starting bypass
Switch function	change-over contact

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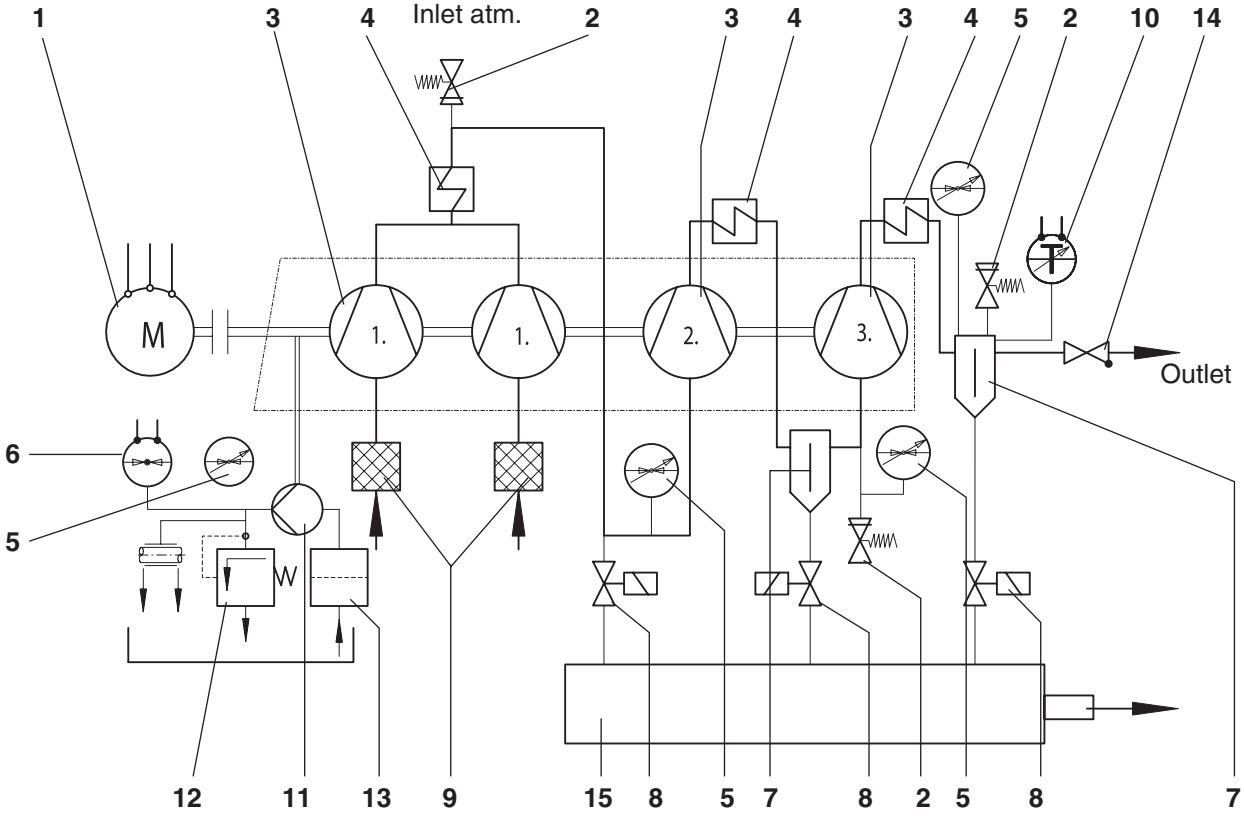
Description	Data
Drain valves:	
Pick-up and holding power	30 VA / 8 W
Setting	normally open; starting relief: approx. 15 seconds; intermediate draining: 15 seconds every 15 minutes.
Ultimate pressure switch (optional):	
Maximum switching current	6A / 220 V
Setting	to customer's specifications
Switch function	change-over contact
Temperature control (optional):	
Maximum switching current	6A / 220 V
Setting	opens at 80 °C rising
Switch function	change-over contact
Sound pressure level (in free sound field at 1 m distance)	maximum 93 dB(A)
Weight and dimensions	see plan of installations

Note!

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

4.2 Compressed air wiring diagram



Item	Designation
1	Drive motor
2	Safety valve
3	Compressor stage
4	Intercooler and aftercooler
5	Pressure gauge
6	Oil pressure switch
7	Separator
8	Solenoid valve
9	Intake filter
10	Temperature switch (optional):
11	Oil pump
12	Overpressure valve
13	Oil filter
14	Non-return valve
15	Condensate collecting pot

I_TD003_1A.fm

5. Transport and Installation

5.1 Transport

Shipping

The machine is packed suitable for shipping.

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

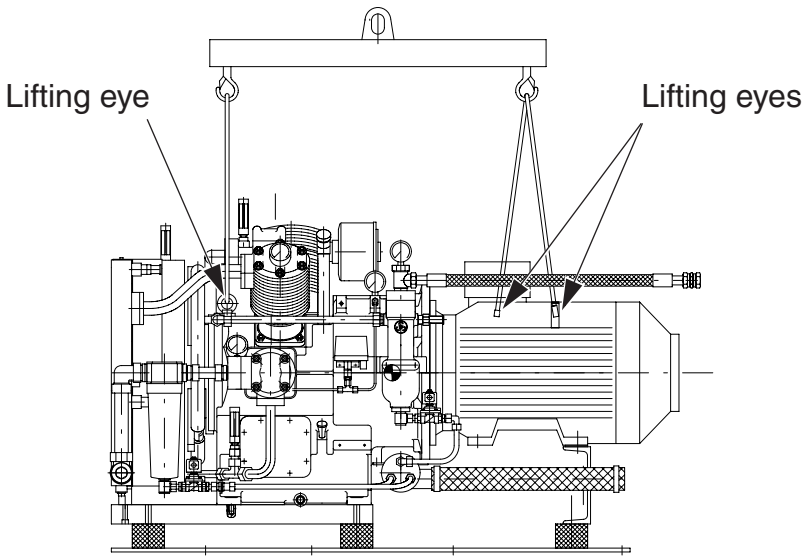
Transportation

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

Danger!

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

- Ensure that no persons stay 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 and store at the following conditions:

– temperature: +5 to +40 °C;
– relative humidity 30 … 95%, not condensating;
– dry, under a roof and protected against dew;
– protected against soiling;
– protected against vibrations and shocks.

Note!

The standard factory conservation is sufficient for a maximum storage period of 12 months.

5.3 Installation

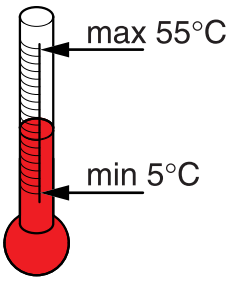
Note!

When in doubt if the intended place of installation and room are suitable, contact J.P. SAUER & SOHN in time before the installation. There you will also get help with the design of a ventilating system, if required at the place of installation.

For installation observe the installation instructions and the following conditions.

Installation conditions

– The place of installation must be dry and free of dust.
– The place of installation must be vented in such way that the heat generated during operation is dissipated.
– Room temperature while the Sauer compressor is running: +5 … +55 °C
(deviating temperatures only if confirmed in writing by J.P. SAUER & SOHN)



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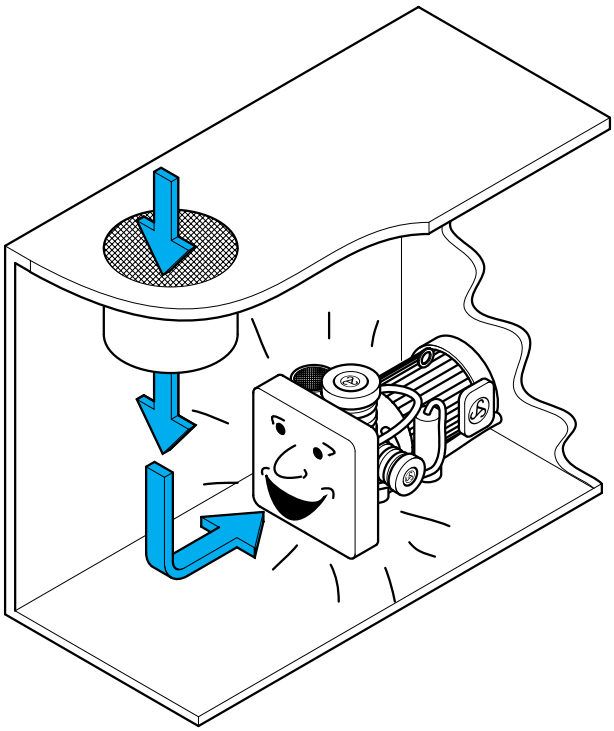
Note!

The air temperature at the cooling air intake of 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 or exhaust system at the place of installation.
- Install any ventilation system in such way that the fresh air stream is not directly directed against the compressor. Otherwise there is a risk of condensation of water inside the machine and subsequent damage.



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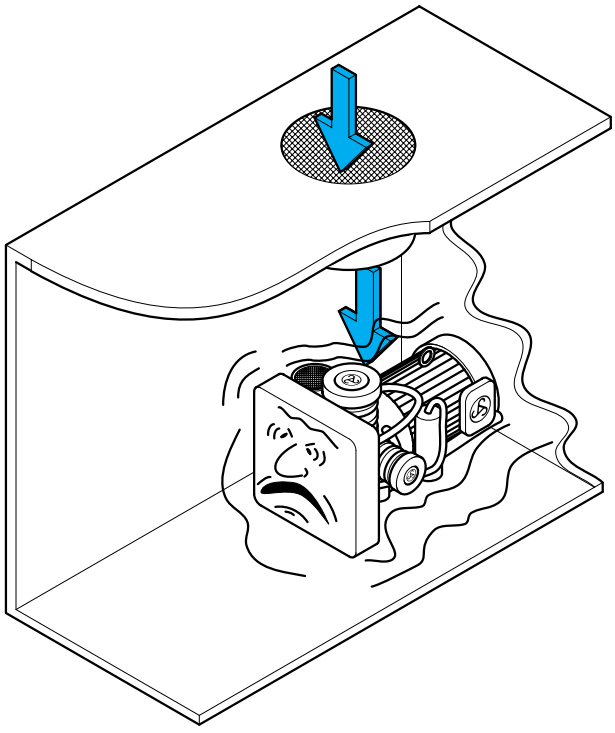


Do not install fresh air feed this way!

Installation conditions (cont'd)

– At a room temperature of below +5 °C the room needs to be heated or the Sauer compressor must be equipped with a heating system.
– Choose the location so that the Sauer compressor is accessible and has sufficient clearance to walls and other machinery (see installation documents).
– Do not position the motor side in a room niche, so the Sauer compressor will not take in the warmed-up cooling air again.
– Do not position several compressors one after the other, to prevent one compressor from taking in the warmed-up cooling air of another compressor.

Note!

J.P. SAUER & SOHN is glad to advise you on the installation of the compressors.

Foundation

Note!

The standard delivery resilient-mount bedding has a resonant frequency of approx. 10 Hz.
Generation of oscillations of the intended foundation by other nearby machinery must not be at 10 Hz. Otherwise there is a risk that the standard delivery resilient-mount bedding is destroyed by sympathetic vibration.

1. Check early enough if there are foundation vibrations in the 10 Hz range.
2. If in doubt, check with J.P. SAUER & SOHN to see if a modified resilient-mount bedding can be used.

5.4 Connecting the compressor

Danger!

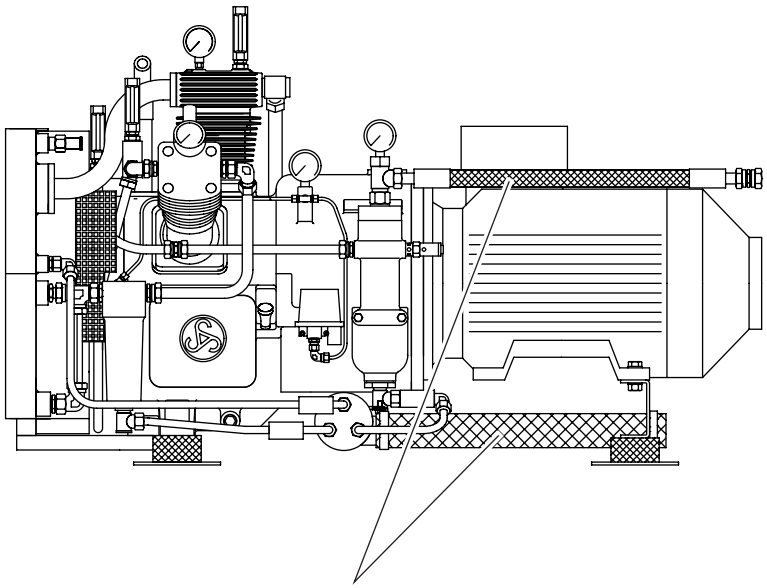
The compressor should only be connected by qualified technicians. Any work on the electrical installation must be carried out by qualified electricians only.

Note!

The oil filler tube is insulated using a section of hose. Do not remove the insulating material.

Pipelines

The compressed air outlet and the drain outlets of the Sauer compressor must be connected to the stationary pipelines by hose lines.

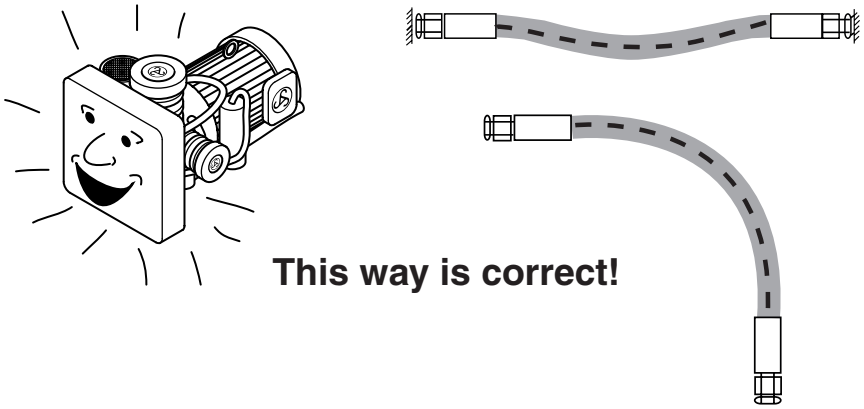


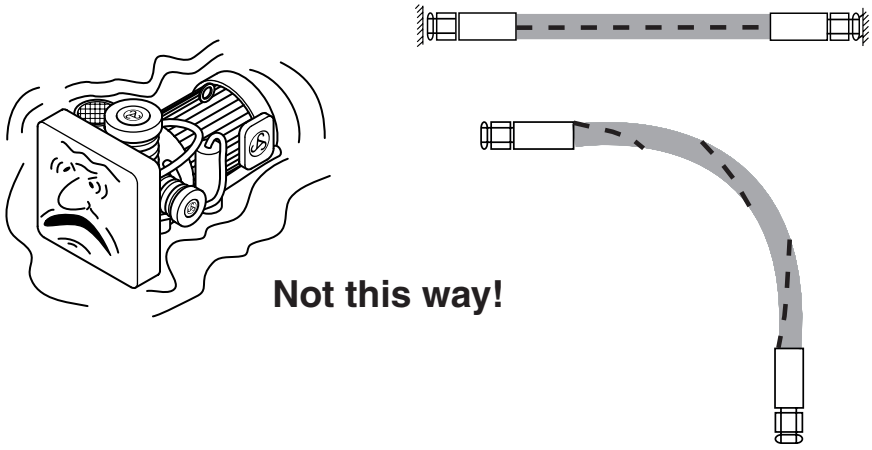
Hose lines

Danger!

Compressed air escapes from the drain outlets when the compressor starts and when the condensate is drained. Do not operate compressor without the hose lines connected.

Hose lines have to be installed free of tension and untwisted.





Drainage

Note!

Condensate build-up is oil-saturated. It may only be disposed of in compliance with applicable legal regulations.

J.P. SAUER & SOHN can supply condensate collecting pots for separating condensate, as well as condensate treatment units for separating the oil from the condensate.

Note!

We recommend connecting the compressor's drainage separately.

When 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.

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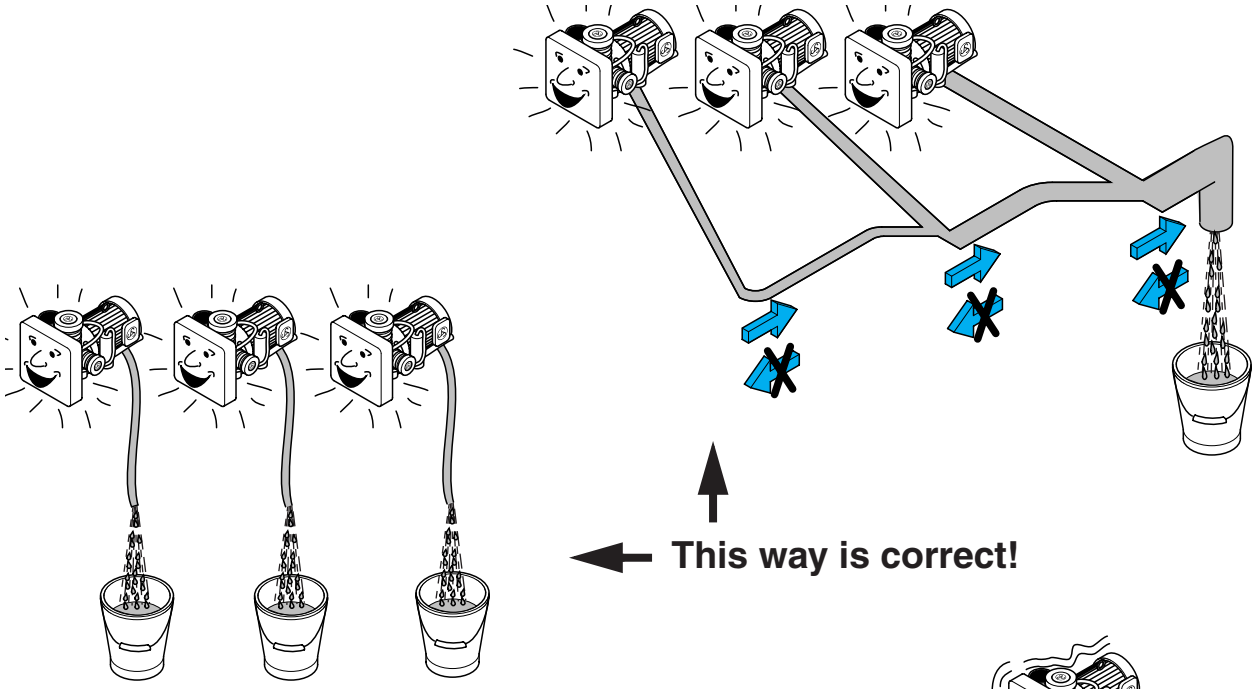
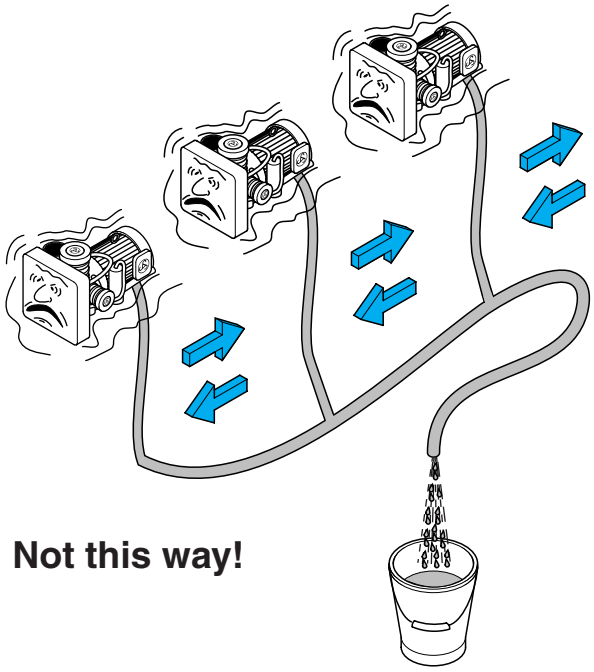
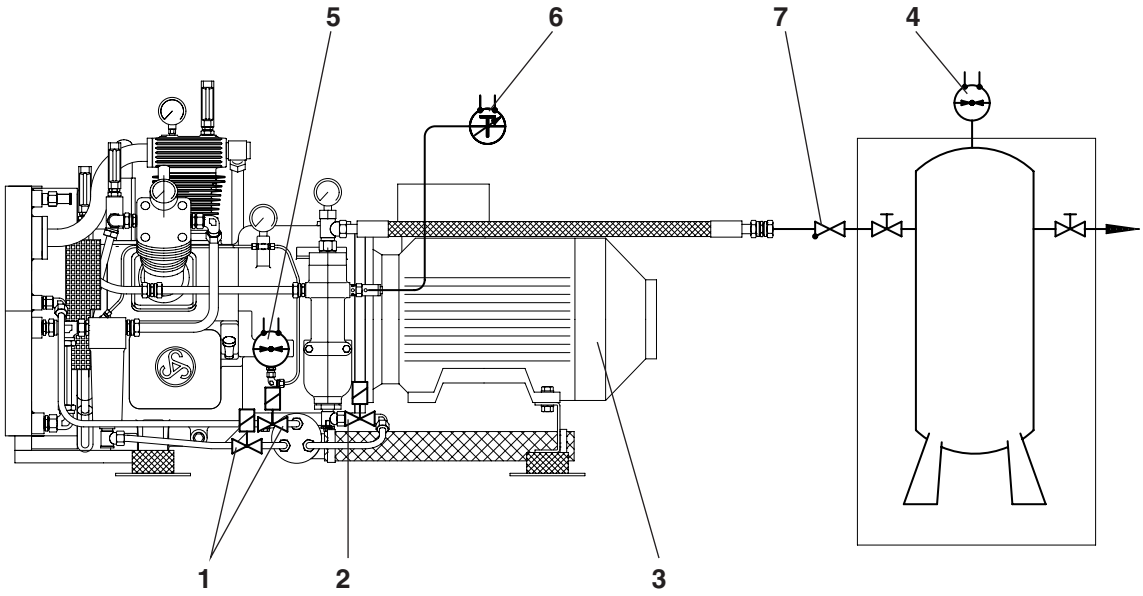

This way is correct!


Not this way!

Connections

The illustration below shows the connections and armatures for the operation of the standard versionSauer compressor.



Note!

For technical specifications of the individual items please refer to Chapter 4

All selective switches are factory set.

As an option, the subsystems can be prewired in a terminal box.

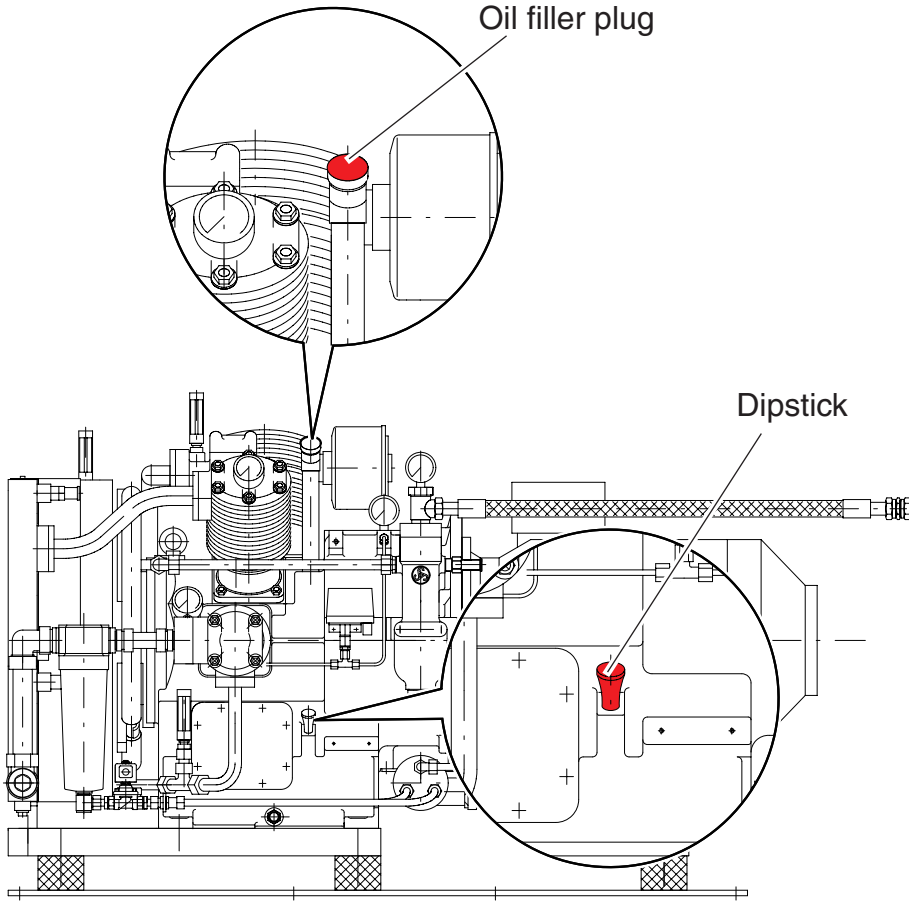
Item	Designation	Type	Function
1	Drain valve	Solenoid valve	Starting relief and drainage
2	Drain valve	Solenoid valve	Starting relief and drainage
3	Drive motor	3-phase motor	Drive of the compressor
4	Ultimate pressure switch	Selective switch	Stops/starts the compressor
5	Oil pressure switch	Selective switch	Stops compressor when oil level is low
6	Temperature control (optional)	Selective switch	Stops compressor in case of excess temperature
7	Non-return valve	Plate valve	Prevent air backflow

5.5 Filling in oil

The Sauer compressor is supplied without oil.

Danger!

Oil must be filled into the compressor's crankcase before initial operation!Use lubricating oil (see chapter 10. “Lubricant table”). Observe filling amount (see chapter 4. “Technical Specifications”).



1. Unscrew oil filler plug (red).
2. Fill in oil and check level with the dipstick.

Note!

Fill only to the upper marking on the dipstick.Otherwise the oil consumption of the compressor will increase.

3. Put dipstick back in and replace the oil filler plug.

5.6 Checks after installation and before the first start

- Electrical connection corresponds with the type label data?
- Are all connections between compressor and the pressurized air unit supplied correctly installed? Pay special attention to the compressed air outlet.
- Are drain lines properly connected? See section “Drainage”
- Oil filled into crankcase?
- Have all tools and foreign objects been removed from the compressor?
- Air filter turned from transport position to operating position?
- Entire unit clean?

6. Operation

6.1 Safe operation

Danger!

Only authorized persons are permitted to commission 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 are removed from the machine.

Caution!

Turn compressor immediately OFF when persons or objects are endangered. Start compressor only when the danger is over.

Danger!

In Automatic mode the compressor starts automatically without warning!

Danger!

Risk of burns by hot surfaces of the compressor when it is running. Wear gloves.

Danger!

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

Note!

Turn compressor OFF in the case of faults, abnormal ratings or irregularities. Refer to chapter 7. “Trouble Shooting” to remove cause.

6.2 Operating modes

After the power supply to the Sauer compressor is turned ON, it can be started with the operating mode selector in one of the following two operating modes:

– Operating mode “**Manual**”:
  The compressor starts and continues to run until it is stopped or turned OFF with either the operating mode selector or the main switch.
– Operating mode “**Automatic**”:
  Starting and stopping of the compressor is controlled by external devices (e.g. by the pressure switch of the compressed air receiver).

When the Sauer compressor starts, it starts loadless with opened relief valves. Several seconds after starting the valves close and the compressor runs up against pressure.

6.3 Initial operation

Checking the direction of rotation

At first, let the Sauer compressor run only briefly for a few seconds to check the direction of rotation.

1. Turn the power supply ON.
2. Set the operating 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 operating mode selector to “0” to stop the compressor.
5. Turn the power supply OFF.
6. If the direction of rotation is incorrect, have polarity of the electric motor changed by a qualified electrician.

Danger!

No oil pressure at incorrect direction of rotation. Risk of subsequent damage.

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Test run

1. Turn the power supply ON.
2. Set the operating mode selector to “Manual” to start the compressor in Manual mode.

✓ If correctly set the drain valves will close after approx. 15 seconds and the compressor runs up against pressure.

3. Check the pressure gauges of the stages and the oil pressure gauge and compare with the nominal values (for nominal values see section 6.4 “Routine operation”).
4. Check the functioning of the automatic intermediate draining.

✓ It must drain every 15 minutes for approx. 15 seconds. This is recognizable by the pressure drop at the pressure gauges.

5. Set the operating mode selector to “0” to stop the compressor.
6. Turn the power supply OFF.
7. If necessary, remove causes for deviations and faults. See also chapter 7. “Trouble Shooting”.

6.4 Routine operation

Cleaning

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

Checks

- Inspect connections, pipelines and electric cables for damage.
- Once a week check the oil level before starting, top up if necessary.

Operation

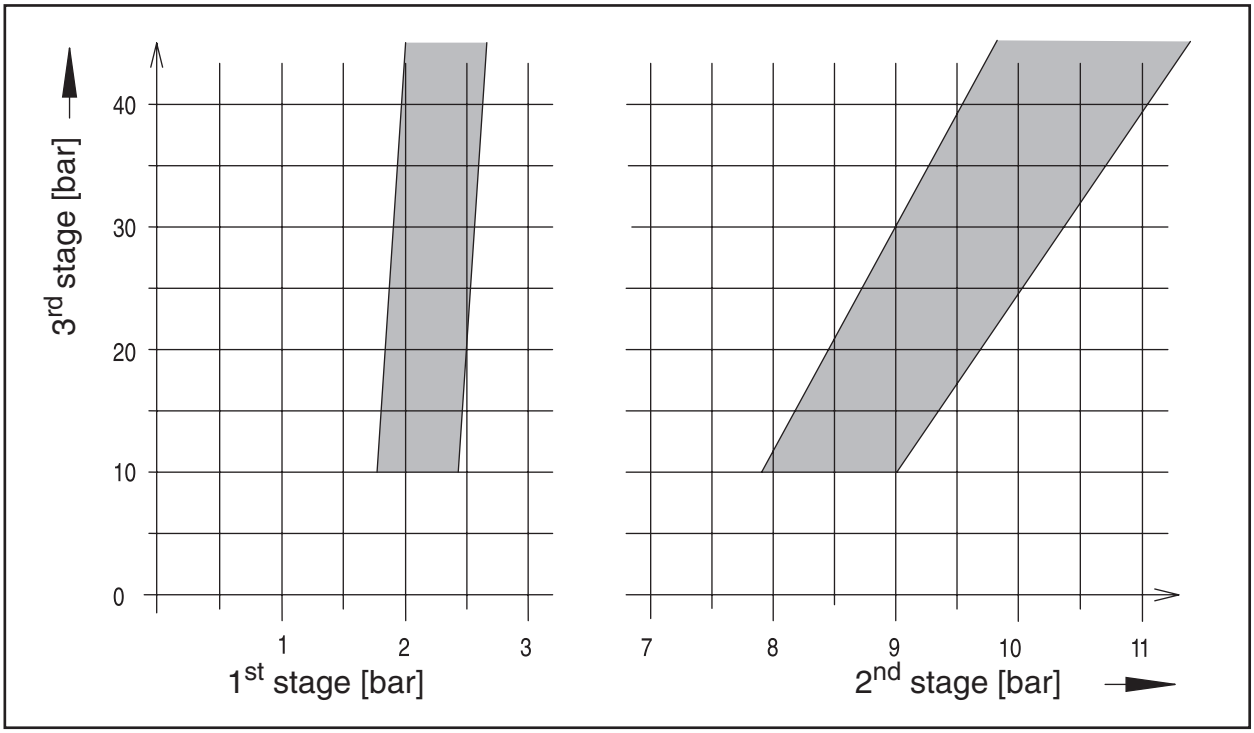
1. Turn power supply ON.
2. Set operating mode selector to “Auto” to operate the compressor in Automatic mode.

Observation

- Pay attention to abnormal operating sounds.
- Pay attention to leakages (compressed air, oil, condensate).
- During operation the pressure indicated by the pressure gauges shall be within the shaded range of the stage pressure chart (see below).
- The oil pressure shall be between 1.8 bar and 4 bar.

In case of deviation see chapter 7. “Trouble Shooting”.

Stage pressure chart 1st and 2nd stage



Note!

Dependent on the desired ultimate pressure of the 3rd stage the permissible pressure for the 1st and 2nd stage can be taken from the chart.

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7. Troubleshooting

Note!

- In case of malfunctions, first check the compressor control and compressor displays.
- Try to remedy the fault by following the information given in the table below.
- If the cause for the fault cannot be eliminated, contact J.P. SAUER & SOHN customer service.

Fault	Likely cause	Remedy
The compressor does not start or does not switch OFF.	No supply voltage / no control voltage.	Check fuses. Replace blown fuses.
The oil pressure monitor has responded.	The oil level is too low.	Check the oil level, add oil as required.
	The oil pump is faulty or leaking.	Check the oil pump. Fix the leak or replace the oil pump, as required.
The compressor has been shut down by the overcurrent relay of the control system.	The motor is overheated. Excessive current draw.	Determine the cause of the fault and remedy. The compressor can be started again after being allowed to cool off.
	Piston seizure	Check cylinder and piston for striation, replace if necessary.
Safety valve of 1st stage blows off:		
Pressure exceeds blowing-off pressure (4 bar)	2nd stage valve is not working properly.	Check 2nd stage valve, replace if necessary.
	Sealing between inlet and outlet side of the 2nd stage is faulty.	Replace gasket.
Pressure below blowing-off pressure (4 bar)	Safety valve is faulty.	Replace the safety valve.
2nd stage safety valve blows off:		
Pressure exceeds blowing-off pressure (12 bar)	3rd stage valve is not working properly.	Check 3rd stage valve, replace if necessary.
	Sealing between inlet and outlet side of the 3rd stage is faulty.	Replace gasket.
Pressure below blowing-off pressure (12 bar)	Safety valve is faulty.	Replace the safety valve.

Fault	Likely cause	Remedy
3rd stage safety valve blows off:		
Pressure exceeds blowing-off pressure (ultimate pressure + 5%)	Valve in air line to compressed air receiver closed.	Open the valve.
	Pressure switch set too high.	Reduce set pressure.
Pressure below blowing-off pressure (ultimate pressure + 5%)	Safety valve set too low or faulty.	Replace safety valve.
	Too much pressure loss in the compressed air lines to the receivers.	Reduce pressure losses.
Maximum pressure is exceed in the 1st stage.	2nd stage valve leaking.	Check valve for damage, replace if necessary.
Maximum pressure is exceeded in the 2nd stage.	3rd stage valve leaking.	Check valve for damage, replace if necessary.
Pressure gauges of 1st, 2nd, and 3rd stage displaying insufficient pressure.	1st stage valve leaking.	Check 1st stage valve, replace if necessary.
	Air filter very dirty.	Replace air filter cartridge.
No pressure indicated in 1st, 2nd and 3rd stage pressure gauges.	No power at solenoid valve.	Check solenoid valve power supply.
	Solenoid valve faulty.	Check solenoid valve, replace if necessary.
Air escaping from compressed air lines	Gaskets of connections leaking.	Replace relevant gasket.
	Compression fittings leaking.	Turn compressor OFF. Wait until all parts are relieved of pressure (check pressure gauges). Then tighten unions.
Air escaping from the overflow opening of the final separator's fusible plug.	Temperature of compressed air too high at outlet; insufficient cooling by faulty fan.	Replace fan. Replace fusible plug.
	Very dirty cooler; insufficient ventilation.	Clean cooler. Check room ventilation. Replace fusible plug.
Temperature control has responded.	Temperature of compressed air too high at outlet; insufficient cooling by faulty fan.	Replace fan.
	Very dirty cooler; insufficient ventilation.	Clean the cooler. Check the room ventilation.
Drain valve does not close.	No supply voltage.	Check fuses, replace blown fuses.
	Solenoid faulty.	Replace solenoid.
	Foreign matter in solenoid valve.	Clean solenoid valve.

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Fault	Likely cause	Remedy
Compressor makes loud noises.	Connecting rod bearing faulty.	Check connecting rod bearing, replace if necessary. Check oil supply.
	Gudgeon pin bearing faulty.	Check gudgeon pin bearing, replace if necessary.
	Crankshaft bearing faulty.	Check crank shaft bearing, replace if necessary.
Oil leaking from crankcase.	Gasket or shaft seal faulty. Screws not tight.	Tighten screws. **If there is heavy leaking**, check to see which gasket is faulty, then replace it. **Minor traces of oil** on the crankcase or oil drops below the compressor are harmless. Wipe off with a rag.
Water is leaking at the relief groove of the cylinder flange surface.	Liner o-ring above the relief groove is faulty.	Replace the o-ring.
Oil is leaking at the relief groove of the cylinder flange surface.	Liner o-ring below the relief groove is faulty.	Replace the o-ring.
Water in oil	Incorrect ventilation (compressor is undercooled).	Change the room ventilation.
	Insufficient drainage.	Check drain lines and drain intervals.
	Insulating sleeve of crankcase vent missing or damaged.	Replace insulating sleeve. Extend compressor operating time.
Premature breaking of valve plates, valve springs or valve disks.	Insufficient drainage.	Check drain lines and drain intervals. **Note:** Indentation marks appearing on the valve plate due to valve impact are normal.

8. Maintenance

8.1 Maintenance service by J.P. SAUER & SOHN

The J.P. SAUER & SOHN customer service offers different maintenance services – e.g. full maintenance or valve replacement service.

8.2 Maintenance safety

Before servicing

1. Disconnect the power supply to the compressor.
2. Post danger sign “Caution Maintenance Work!” at the power supply.

Danger!
Only authorised persons are permitted to service and make adjustments to the Sauer compressor!

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

Danger!
Risk of injury from pressurised compressor components!
Check the pressure gauges before servicing to ensure the compressor is completely relieved of pressure.

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

Danger!
Danger of death from missing safety devices and missing isolating protection devices!
Reinstall all safety devices and isolating protection devices after servicing. This also applies to electrical protection devices (e.g. earth wires).

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8.3 Maintenance schedule

Danger!

For all maintenance work section 8.4 “Table of tightening torques” must be observed for specific screws.

Note!

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

Note!

After a major overhaul (=12,000 operating hours) the maintenance schedule begins all over again.

Instructions for the maintenance schedule

- Use the maintenance schedule as master template for copying or copy the respective page from the digital document and save it as a separate file under a suitable name. Use the maintenance schedule as guide and for documentation.
- Regularly check the maintenance schedule to see which maintenance rates, subject to the number of operating hours, are due.The intervals are shown in the table's column headers.
- Check the column of each maintenance rate to see which maintenance work is to be carried out at the end of each maintenance rate.The required tasks are indicated by check boxes.Description and chapter number of the tasks are shown in the first column.
- **Carry out** all maintenance work of a maintenance rate and **tick** the appropriate check boxes of the maintenance schedule.Then **enter** operating hours meter count, date and your signature.
- When beginning a new maintenance schedule
  - **enter**: main specifications, date of initial operation, number of maintenance schedule, current date and operating hours meter count
  - **tick**: begins with initial operation/after major overhaul

Maintenance Schedule No.	
Beginning of this maintenance schedule	
❑ after initial operation ❑ after major overhaul	
Date:	
Operating hours count:	

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

Interval (operating hours) / Maintenance work	50 after initial operation	50 after major overhaul	At least yearly if < 1.000/year	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000 = major overhaul
Check screwed connections 8.6	❑	❑													
Oil change 8.5	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Air filter cartridge replacement 8.7			❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Checking valves 8.8					❑		❑		❑		❑		❑		
Checking the piston rings 8.9									❑						❑
Replacing gudgeon pins/ gudgeon pin bearings 8.10									❑						❑
Replacing valves 8.11															❑
Checking pistons and cylinders 8.12															❑
Check drive bearings 8.13															❑
Check coupling 8.14									❑						❑
Operating hours meter count:															
Date															
Signature (abbrev.)															

Note!

Check compressor **50 hours after every maintenance work** has been carried out.Check all screws affected by the maintenance work to see if they are tight.

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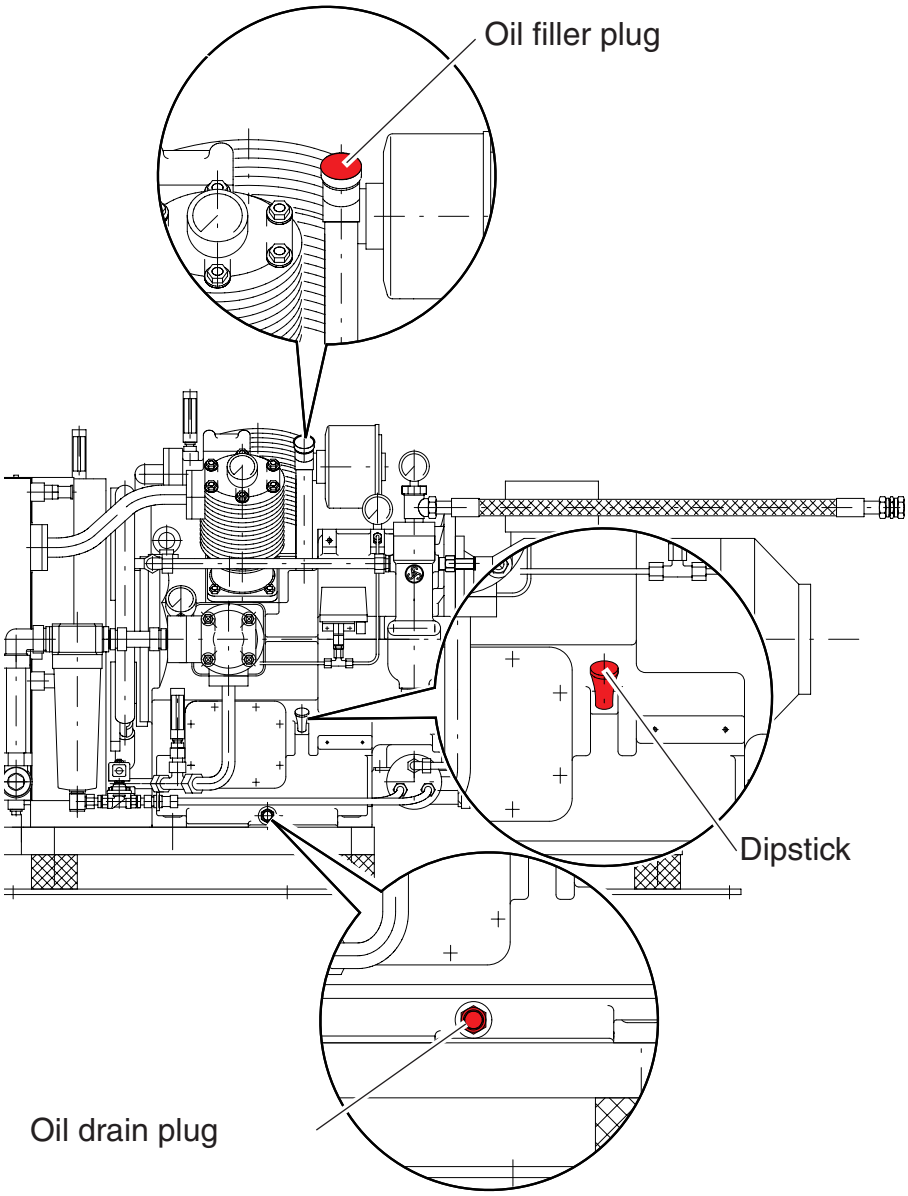
8.4 Table of tightening torques

Screw(s)	Tightening torque
Connecting rod screws	70 Nm
Flywheel fastening screw	350 Nm
Cylinder head screws	75 Nm

8.5 Oil change

Note!
Use oil as per Lubricant Table (see chapter10).



1. Place oilpan (of sufficent capacity to hold the complete oil filling, see chapter 4) under the oil drain plug.
2. Remove the oil drain plug.
3. Wait until all oil has drained.
4. Replace the oil drain plug.
5. Unscrew oil filler plug (red).
6. Fill in oil and check level with the dipstick.

✓ The level shall be between the upper and lower mark on the dipstick.

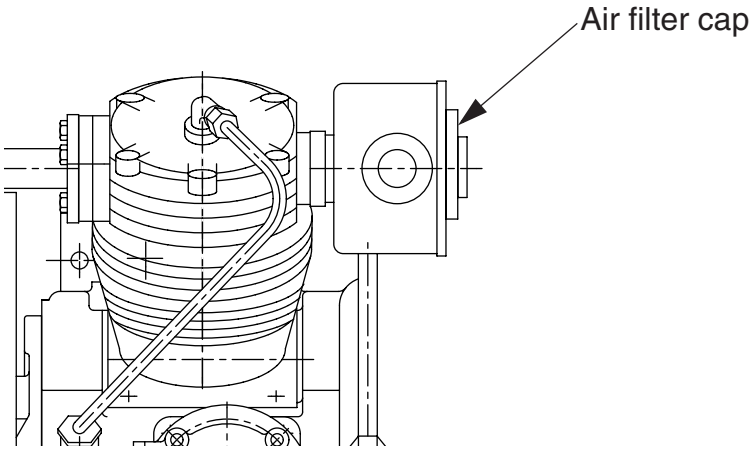
7. Put dipstick back in and screw the oil filler plug back on.

8.6 Checking screwed connections

Check all unions and screwed connections for tightness, retighten if necessary. This concerns

– cooler and air lines;
– unions of pipe lines and hose lines;
– cylinder heads;
– cylinders;
– electric motor and intermediate flange;
– measuring and switching devices;
– bedding;
– accessories and equipment parts.

8.7 Air filter cartridge replacement



1. Open clips and take the air filter cap off.
2. Take the used air filter cartridge out.
3. Put new air filter cartridge in.
4. Put cap back on and close the clips.

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8.8 Checking the valves

Note!

Install all valves with new gaskets and rings only. Use only genuine Sauer spare parts.They are precision parts with defined and tested dimensions and material characteristics, specially designed for use in Sauer compressors.Installation of other gaskets may lead to leakage and could cause substancial damage to the compressor.

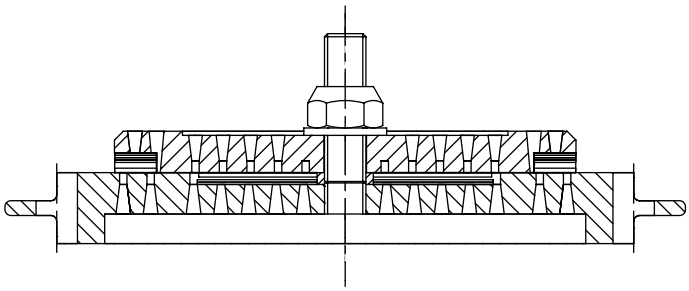
Valve removal

1. Loosen unions and hose line at the cylinder heads.
2. Remove cylinder head bolts and remove the cylinder heads.
3. Carefully take the valves out.

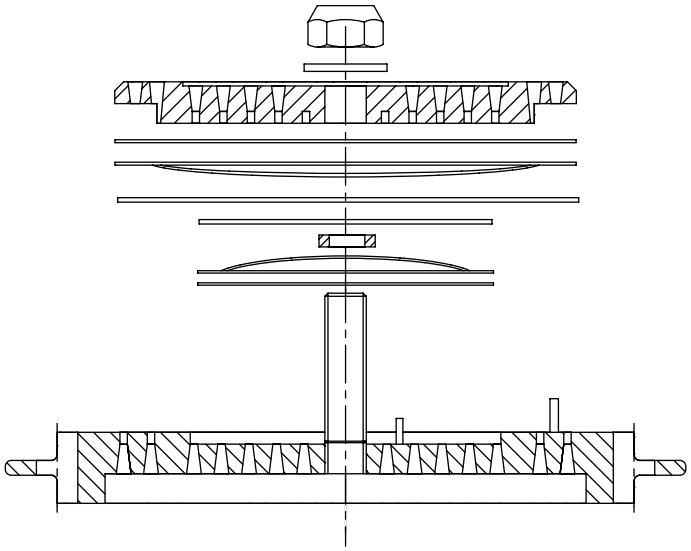
Check plate valve

Note!

When removing, cleaning and installing the plate valve, take care that no valve parts are damaged.This applies particularly to the seat faces and the valve springs.Slight damage to the packing strips of the valve seats can be removed by refacing on a lapping plate.



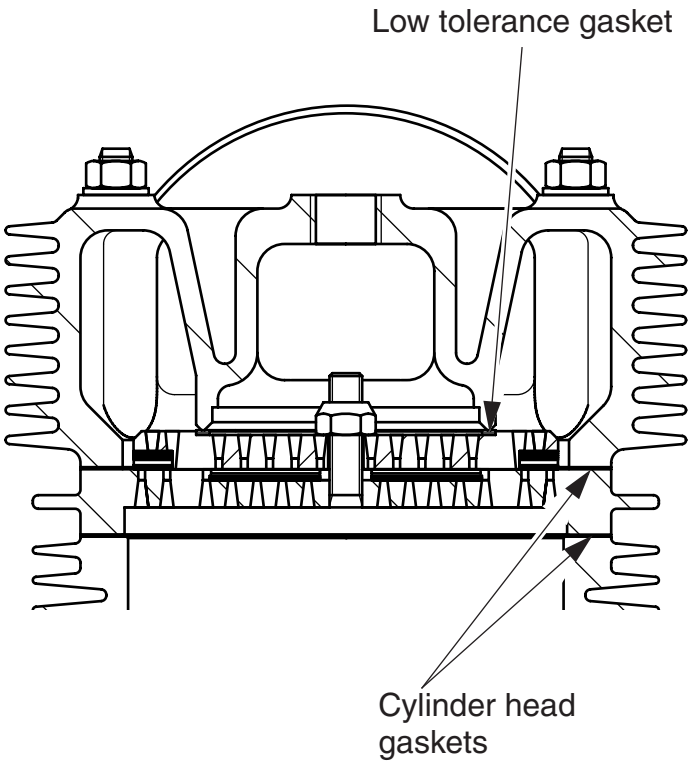
4. Unscrew nut.Do to so, hold valve in vice fitted with fibre grips in order to prevent damage to the valve's faces.
5. Dissamble valve.
6. Clean all valve parts.
7. Check valve parts for damage.Replace damaged valve parts.



8. Carefully reassemble valve (see illustration), tighten nut.
9. Use a pin with round tip to check the valve plate's smoothness of action against the spring pressure.

Valve installation

10. Install concentric valve and cylinder head of 1st, 2nd and 3rd stage, using new cylinder head gaskets and a new low tolerance gasket (see illustration).



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Note!

Never turn the old low tolerance gasket upside down.Doing so leads to leakage within a short time.

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

Note!

Concentric plate valves are the parts of a piston compressor subject to highest stress. In order to achieve the guaranteed maintenance rates, these valve are high-quality precision parts, specially matched to the individual compression stages and their functioning carefully checked before delivery.Repair by the maintenance and operating personnel requires special knowledge, not in any case given.For such cases J.P. SAUER & SOHN offer a valve replacement service.In case it should be necessary please contact the Sauer service department.

8.9 Checking the piston rings

1. Remove cylinder heads and valves as described in section 8.8 “Checking the valves”.
2. Remove cylinder base nuts.
3. Pull cylinder off. Hold the piston before the cylinder comes off.

Note!

If the piston is not held when pulling the cylinder off, it will fall against the crankcase.

4. Remove circlips of gudgeon pins, push gudgeon pin out and take piston off.
5. Remove all piston rings from the pistons.
6. Place piston rings in their respective cylinders and measure the gap clearance with a feeler gauge.
7. Replace piston rings if the gap clearance exceeds the following limits.

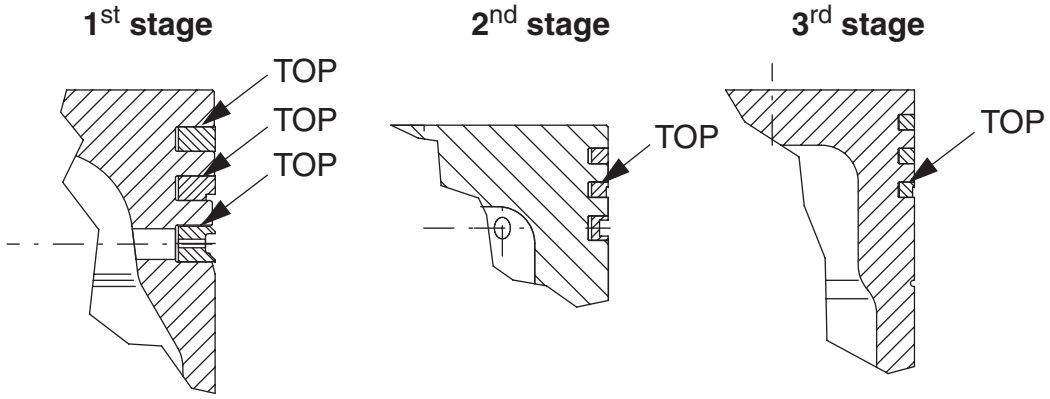
1st stage	1.50 mm
2nd stage	1.10 mm
3rd stage	0.70 mm

Note!

Always replace all pistons rings of a piston when one of the piston rings exceeds the limit.

8. Install piston rings on the respective piston. Make sure they

are in the correct position: piston rings having an asymmetric cross section are marked on one of the surfaces with “TOP”. The marked face must be at the top when the piston ring is installed. See illustration.



9. Install pistons on the connecting rods. To do so, push gudgeon pin in and install the circlips of the gudgeon pins.
10. Fit a new cylinder base gasket for each cylinder.
11. Push cylinder onto the pistons.
12. Tighten cylinder base nuts.
13. Install cylinder heads and valves as described in section 8.8 “Checking the valves”.

8.10 Replacing gudgeon pins/gudgeon pin bearings

1. Uninstall cylinder heads and valves as detailed in section 8.8 “Checking valves”.
2. Uninstall cylinder and pistons as detailed in section 8.9 “Checking the piston rings”.
3. Take inspection hole cover off and remove connecting rods.
4. Press gudgeon pin bearing out of the connecting rod's small end.
5. Replace gudgeon pin and gudgeon pin bearing.
6. Press gudgeon pin bearing into the connecting rod's small end.
7. Install connecting rods. Make sure the connecting rods are in their correct position on the crankshaft. (See cross-sectional drawing in 3.1 “Overview”.) Observe tightening torque.
8. Install inspection hole cover.
9. Install cylinder and pistons as detailed in 8.9 “Checking the piston rings”.
10. Install cylinder heads and valves as detailed in section 8.8 “Checking valves”.

8.11 Replacing valves

Remove and install valves as detailed in section 8.8 “Checking valves”. Replace complete valve.

8.12 Checking pistons and cylinders

1. Remove cylinder heads and valves as described in section 8.8 “Checking the valves”.
2. Remove cylinders and pistons as described in section 8.9 “**Checking the piston rings**”.
3. Check cylinders and pistons for scoring and excessive wearing marks. Replace relevant parts.
4. Measure cylinders and replace if the following wear limits are exceeded:

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

5. Install cylinders and pistons as described in section 8.9 “**Checking the piston rings**”.
6. Install cylinder heads and valves as described in section 8.8 “Checking the valves”.

8.13 Checking the drive bearings

1. Remove cylinder heads and valves as described in section 8.8, “Checking the valves”.
2. Remove cylinders and pistons as described in section 8.9, “Checking the piston rings”.
3. Uninstall fan cover, fan wheel and the entire cooler unit.
4. Uninstall intermediate flange, coupling and flywheel.
5. Take inspection hole cover off and remove connecting rods.
6. Remove bearing bracket.
7. Pull crankshaft out.
8. Check connecting rod bearings, replace if substantially worn.

Note!

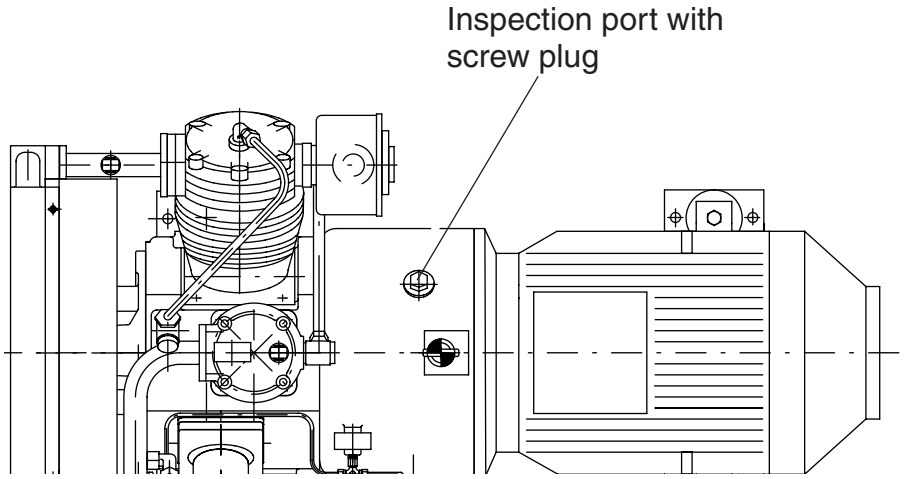
The shaft seals of the crank shaft bearing should only be replaced after the bearing brackets have been removed!

9. Check crankshaft bearings, replace if substantially worn.
10. Install crankshaft.
11. Install bearing bracket.
12. Install connecting rods, making sure they are in the correct position. Observe the tightening torque (see section 8.4).
13. Install inspection hole cover.
14. Install electric motor with intermediate flange, coupling and flywheel. Observe the tightening torque (see section 8.4).
15. Install cooler unit, fan wheel and fan cover.
16. Install cylinders and pistons as described in section 8.9, “Checking the piston rings”.
17. Install cylinder heads and valves as described in section 8.8, “Checking the valves”.

8.14 Checking the coupling

Visual check

- Remove screw plug from crankcase. Through the inspection port check the coupling's flexible gear rim for damage. The teeth of the flexible gear rim must not be deformed.
- Replace screw plug.
- If necessary, replace the flexible gear rim as detailed below.



Removing the gear rim

1. Support compressor under the transmission bell housing.
2. Remove the motor mounting screws.
3. Lift electric motor carefully at the lifting eyes (see section 5.1 “Transport”).
4. Pull electric motor carefully away from the intermediate flange.

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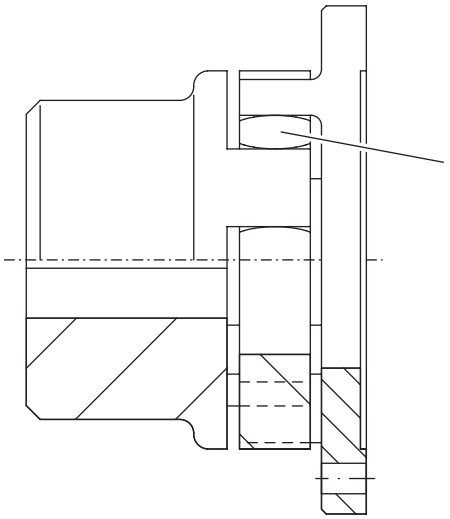

5. Slide electric motor gently against the intermediate flange and tighten the motor mounting screws.
6. Remove support from under the transmission bell housing.

9. Placing out of Service

9.1 Safety when placing out of service and dismounting

Danger!

The compressor shall only be placed out of service and dismounted by instructed and trained specialists of the operator. The 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 is to be observed.

9.2 Placing the compressor out of service for a limited time

Every 4 weeks perform a test run for at least 30 minutes. Then additional corrosion prevention measures are not required.

When the Sauer compressor is to be placed out of service **for more than 12 weeks**, conservation with slushing oil is recommended. In this case periodic test runs are not necessary.

Note!

Use one of the slushing oils recommended in the Chapter 10. “Lubricant Table”.

The slushing oil has sufficient running properties. In case of emergency the machine can be started on short notice with a slushing oil filling.

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

✓ Any existing condensate is blown off.

2. Drain compressor oil and dispose of in an environmentally friendly manner.
3. Fill in approx. 15 litres of slushing oil.
4. Start compressor and run for approx. 5 minutes with open drain valves and opened pressure line.
5. Stop compressor.
6. Remove air filter.

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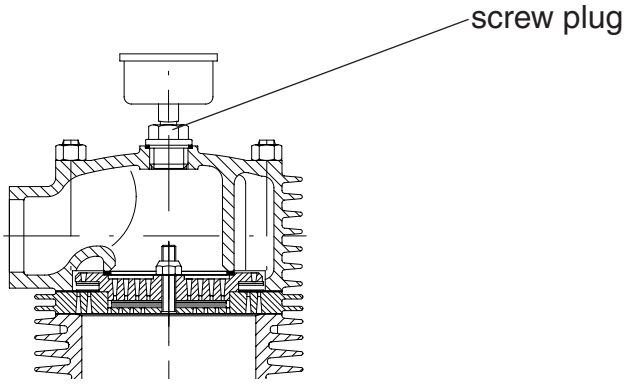
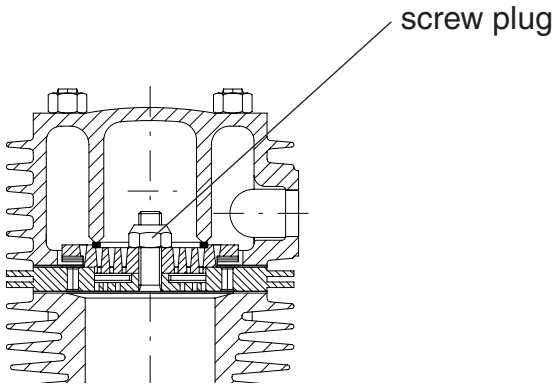
7. Remove screw plug with pressure gauge from the cylinder head of the 2nd stage.



8. Inject approx. 10 cc of slushing oil into the cylinder head opening.
9. Replace screw plug of the 2nd stage's cylinder head.
10. Remove screw plug from the intake flange of the 3rd stage.



11. Inject approx. 10 cc of slushing oil into the cylinder head opening.
12. Replace screw plug.
13. Start compressor and slowly inject approx. 15 cc slushing oil into the intake ports.
14. Wait until oil mist comes out of the pressure line.
15. Stop compressor.
16. Replace the air filter.
17. If necessary, post a sign that the compressor has been treated with anti-corrosion measures and is placed out of service.
18. Disconnect from power supply, if necessary.

Placing back into service

1. Connect to power supply, if necessary.
2. Drain slushing oil and fill with compressor oil.
3. Proceed as detailed in Section 6.3 “Initial operation”.

9.3 Dismantling

Dismantling

1. Turn compressor OFF and disconnect from power supply.
2. Make sure by reading the pressure gauges before servicing that the compressor is completely relieved of pressure.
3. Disconnect power lines from the mains supply.
4. Remove oil and lubricants and dispose of in an environmentally friendly manner.
5. Drain any remaining condensate and dispose of in an environmentally friendly manner.

Disposal

Material/component	How to dispose
Lubricants	as hazardous waste
Steel/iron	as metal scrap
Electric cables	as hazardous waste
Electronic components	as electronic waste
Plastics	as hazardous waste

10. Lubricant Table

Note!

Lubricants not mentioned in the lubricant table may only be used after approval by J.P. SAUER & SOHN. Otherwise the warranty will expire. Contact our service in case of need.

Take note of all information about the lubricants given in this section.

Area of validity

The lubricant table applies to all Sauer compressors intended for the compression of air.

The lubricant table does **not** apply to

- Sauer compressors for the compression of neutral gases;
- temperature ranges outside of 5 … 55 °C.

General recommendation

The following recommendations apply to the 5 … 55 °C temperature range:

- Use **mineral oils** of viscosity class **ISO VG 100** or **SAE 30**.
- Lubricating oils should conform to group **VCL** according to **DIN 51506**.

Note!

Only for **2-stage 30 bar compressors** the use of **synthetic lubricating oils** may be of advantage. In case of need we will name the synthetic lubricating oils approved by us.

In general we do **not** permit the use of synthetic lubricating oils for the following reasons:

- The good water separation ability of these oils causes condensation of moisture in the crankcase. Risk of corrosion damage and drive damage.
- Because of their design, 3-stage air-cooled compressors have low compression end temperatures, rendering the high temperature stability of these oils useless.

10.1 Lubricating oils

Brand	Description	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	Motanol HE 100	VDL-100
	Kowal M 30	VCL-100
	Disola M 30	SAE 30
AVIA	Avilub Compressor Oil VDL-100	VDL-100
	Avilub Compressor Oil VDL-100	VCL-100
	Motor oil HDC 30	SAE 30
	Motor oil HD 30	SAE 30
BP	Energol RC 100	VDL-100
	Energol IC-DG 30	VCL-100
	Energol DL-MP 30	SAE 30
	Energol OE-HT 30	SAE 30
	Vanellus C3 SAE 30	SAE 30
Castrol	Aircol PD 100	VDL-100
	Marine CDX 30	SAE 30
Chevron	HD Compressor Oil 100	VDL-100
	Delo 1000 Marine 30	SAE 30
	Veritas 800 Marine 30	SAE 30
	RPM Heavy Duty Motor 30	SAE 30
DEA	Actro EP VDL-100	VDL-100
	Trion EP VDL-100	VDL-100
	Regis SAE 30	SAE 30
Esso	Exxcolub 77	VDL
	Exxcolub 100	VDL-100
	Compressor Oil 3021 N	VDL-100
	Exxmar 12 TP 30	SAE 30
	Exxmar XA	SAE 30
	Essolube HDX Plus +30	SAE 30
Mobil	Rarus 427	VDL-100
	DTE Oil Heavy	VDL
	Mobilgard 300	SAE 30
Shell	Corena Oil 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

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Brand	Description	Group
TEXACO	Compressor Oil EP VDL 100	VDL-100
	Regal R&O 100	VCL-100
	Ursatex 30	SAE 30
	DORO AR 30	SAE 30
TOTAL	Dacnis P 100	VDL-100
	Carprano TD 30	SAE 30
	Milcano TC 30	SAE 30
	Disola M 3015	SAE 30

10.2 Preservation oils

Brand	Description
Agip	Rustica C SAE 30
ARAL	Konit Motor Oil SAE 30
AVIA	MK 1540 S
	Avilub MK 3000
BP	MEK 20 W-20
Castrol	Running-in and Preservation Oil
DEA	Deamot EKM 642 SAE 30
ELF	Stockage 30
Esso	MZK Motor Oil HD 30
	Antirust MZ 110
FINA	Rusan NF Motor Oil SAE 30
Mobil	Mobilarma 524
Shell	Ensis Motor Oil 30
TEXACO	Engine Oil EKM 146 SAE 30

11. Spare Parts and Accessories

Note!

Please note the information in chapter 1. “General” regading our genuine Sauer spare parts.

J.P. SAUER & SOHN garantee the complete spare parts supply over the entire service life of the Sauer compressor.

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 air system, such as:

- fully automatic controls;
- adsorption dryers;
- refrigerated air dryers;
- filters;
- silencing cabinets;
- compressed air receivers;
- fittings.

We supply instructions and a maintenance manual for each accessory.

Spare parts catalogue

The spare parts catalogue is found in the annex to these instructions.

- With the help of overviews, illustrations and lists the required parts is quickly found.
- The spare parts catalogue, including the operating instructions is also available on CD-ROM. Here, an order form can be filled in, printed out and send immediately.
  For doing so, you need the **main specifications** of your Sauer compressor from the table below. If they have not yet been entered there, they can be found on the type label affixed to the crankcase.

Compressor type					
Factory no.:					
Year of construction:					

Furthermore, the **number of operating hours** should be stated, if possible.

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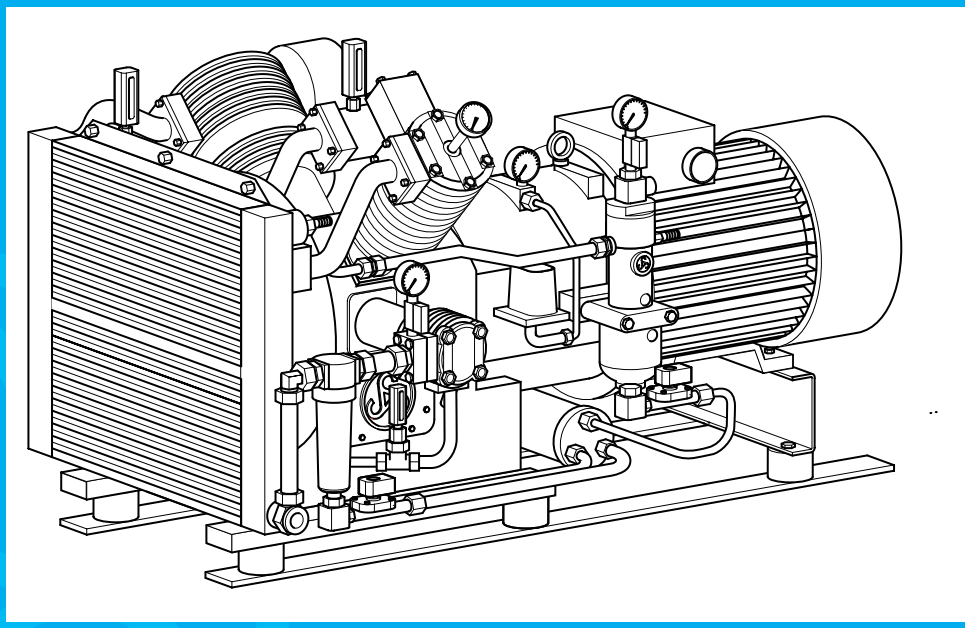
12. Annex

This Annex to the operating instructions contains
– documentation supplied by outside vendors;
– data sheets.

J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

Type: WP 311 L

Spare Part List

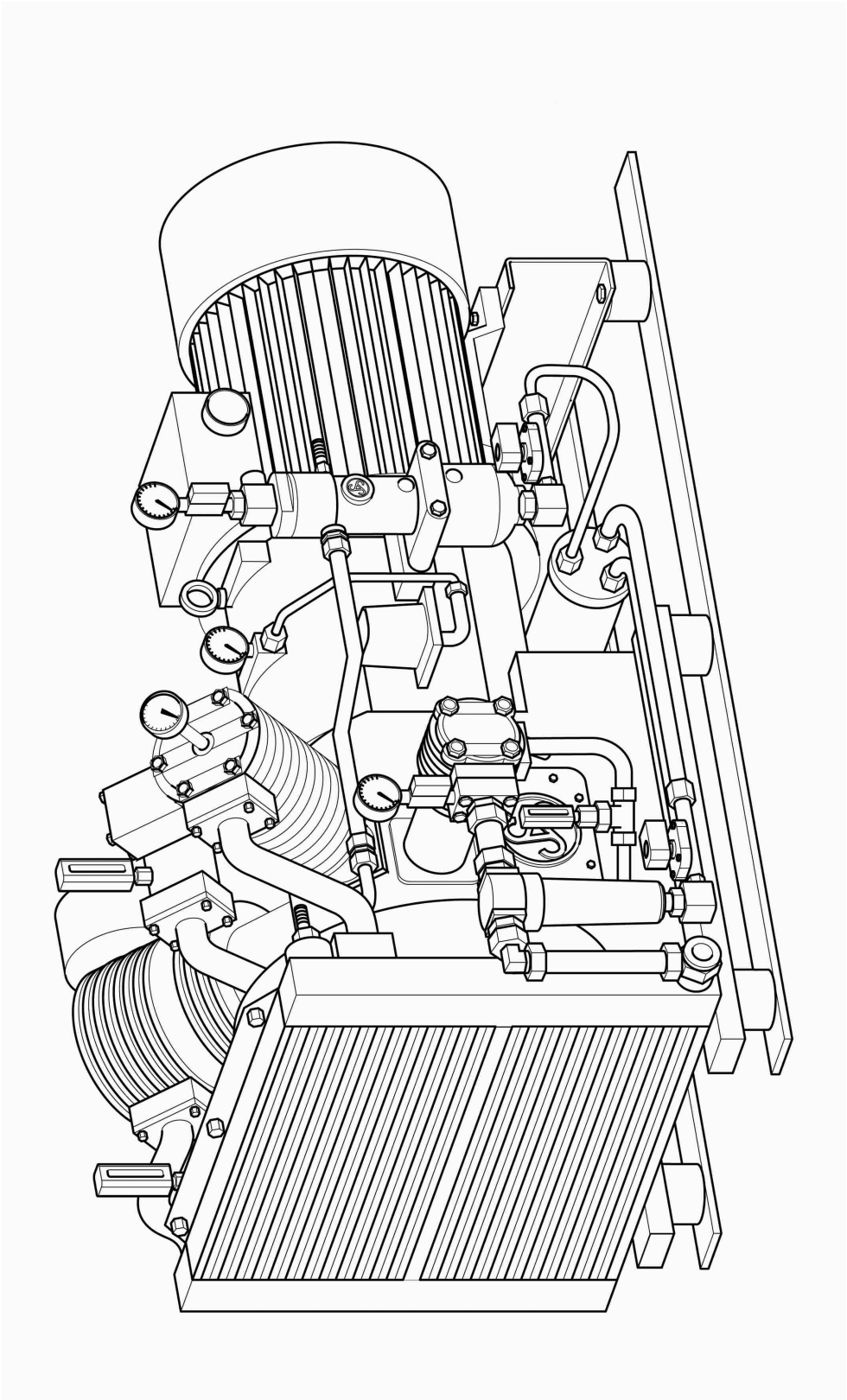
Ein Mitglied der
SAUER-Gruppe

Version 2 - 2

WP 311 L Sauer compressor

Note: Explanation of the subassemblies in chapter 3 "Design and Function" of the operating instructions

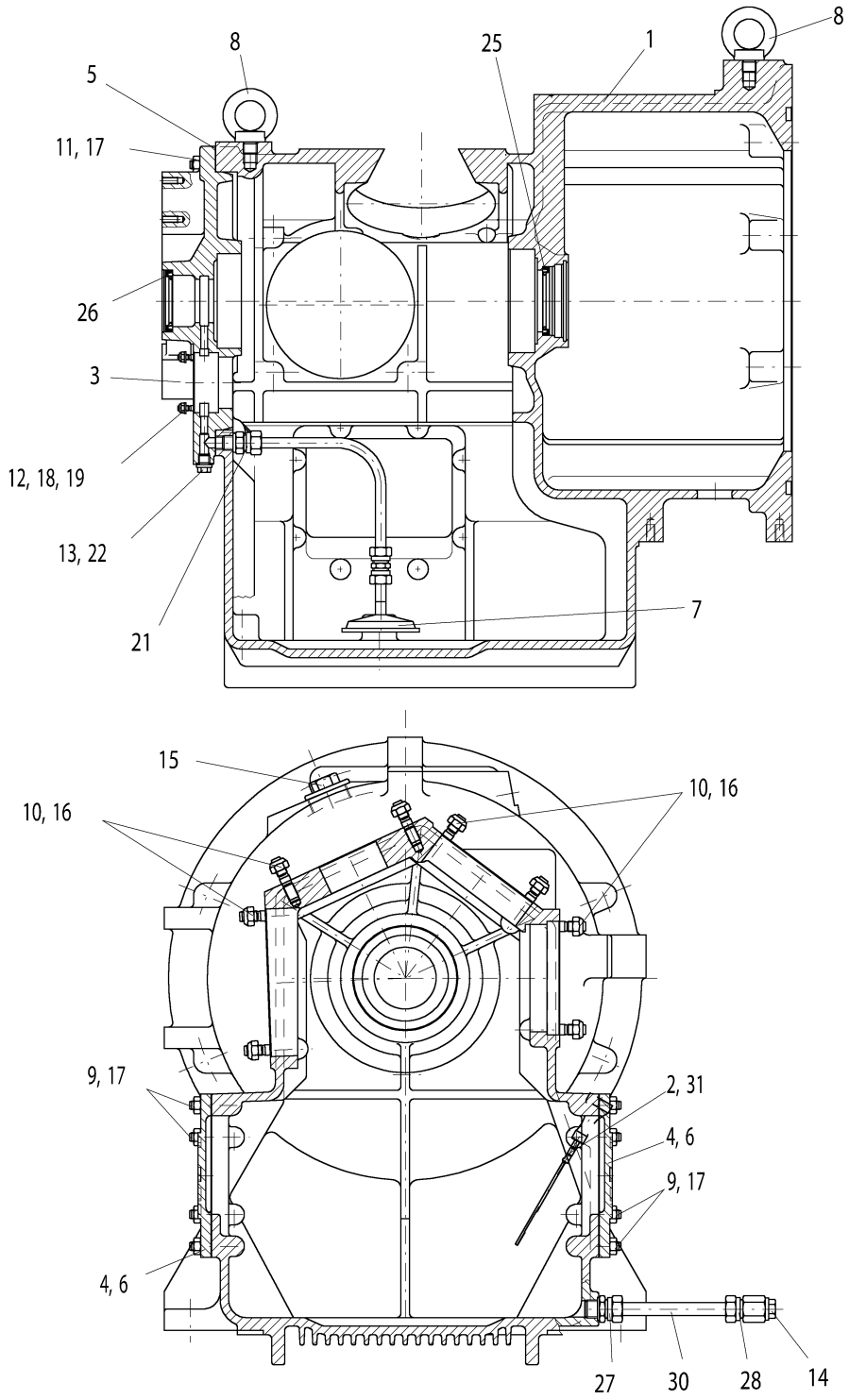
WP 311 L Sauer compressor



WP 311 L Sauer compressor

Item	Reference No.	Designation	Qty.
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
5	033 185	piston 1st stage	2
6	037 049	piston 2nd stage	1
7	063 305	piston 3rd stage	1
8	064 408	cylinder with head and valve 1st stage	2
9	065 175	cylinder with head and valve 2nd stage	1
10	065 176	cylinder with head and valve 3rd stage	1
11	037 460	concentric valve 1st stage	1
12	034 591	concentric valve 2nd stage	1
13	033 893	concentric valve 3rd stage	1
14	065 177	crankcase venting	1
15	065 178	cooler and air lines	1
16	064 119	lubricating oil pump and drive	1
17	065 180	measuring device	1
18	063 121	final separator, compl.	1
19	034 129	flexible coupling	1
20	065 169	resilient mounts	1
21	065 181	automatic drainage	1

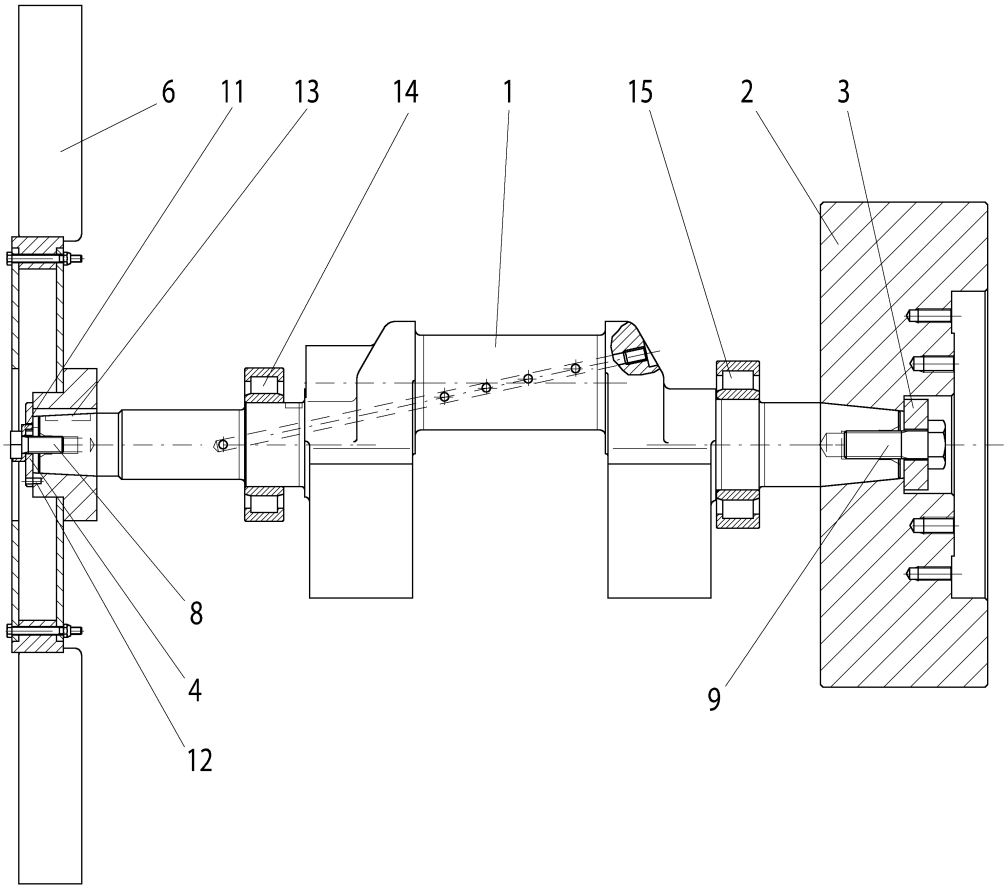
065 173 crankcase



065 173 crankcase

Item	Reference No.	Designation	Qty.
1	065 117	crankcase	1
2	064 064	dipstick	1
3	064 079	bearing bracket	1
4	051 883	inspection hole cover	2
5	064 095	packing	1
6	063 748	packing	2
7	065 348	oil sieve	1
8	000 270	eye bolt	2
9	001 411	stud	16
10	033 717	stud	16
11	005 930	stud	8
12	001 459	stud	4
13	001 009	plug	1
14	030 744	plug	1
15	001 021	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	union	1
22	005 001	gasket	1
25	007 123	shaft seal	1
26	030 831	shaft seal	1
27	004 641	union	1
28	035 310	union	1
30	008 663	pipe 300mm long	1
31	035 520	o-ring	2

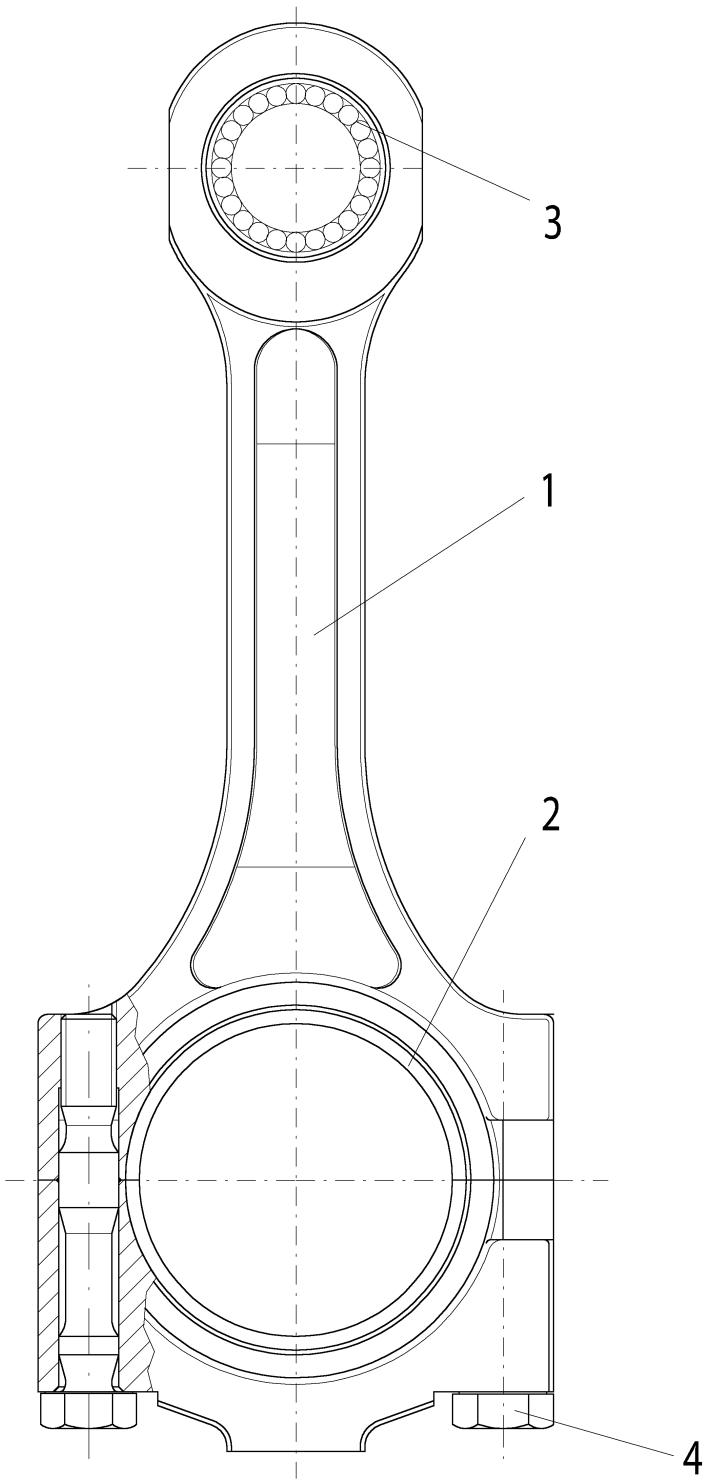
065 187 crankshaft



065 187 crankshaft

Item	Reference No.	Designation	Qty.
1	065 190	crankshaft	1
2	064 345	flywheel	1
3	064 420	pressure washer flywheel	1
4	056 264	pressure washer fan wheel	1
6	037 790	fan wheel	1
8	000 057	hexagon head screw	1
9	000 216	hexagon head screw	1
11	001 675	locking plate	1
12	004 472	tension bushing	1
13	032 430	fitting key	1
14	034 575	cylinder roller bearing	1
15	033 215	cylinder roller bearing	1

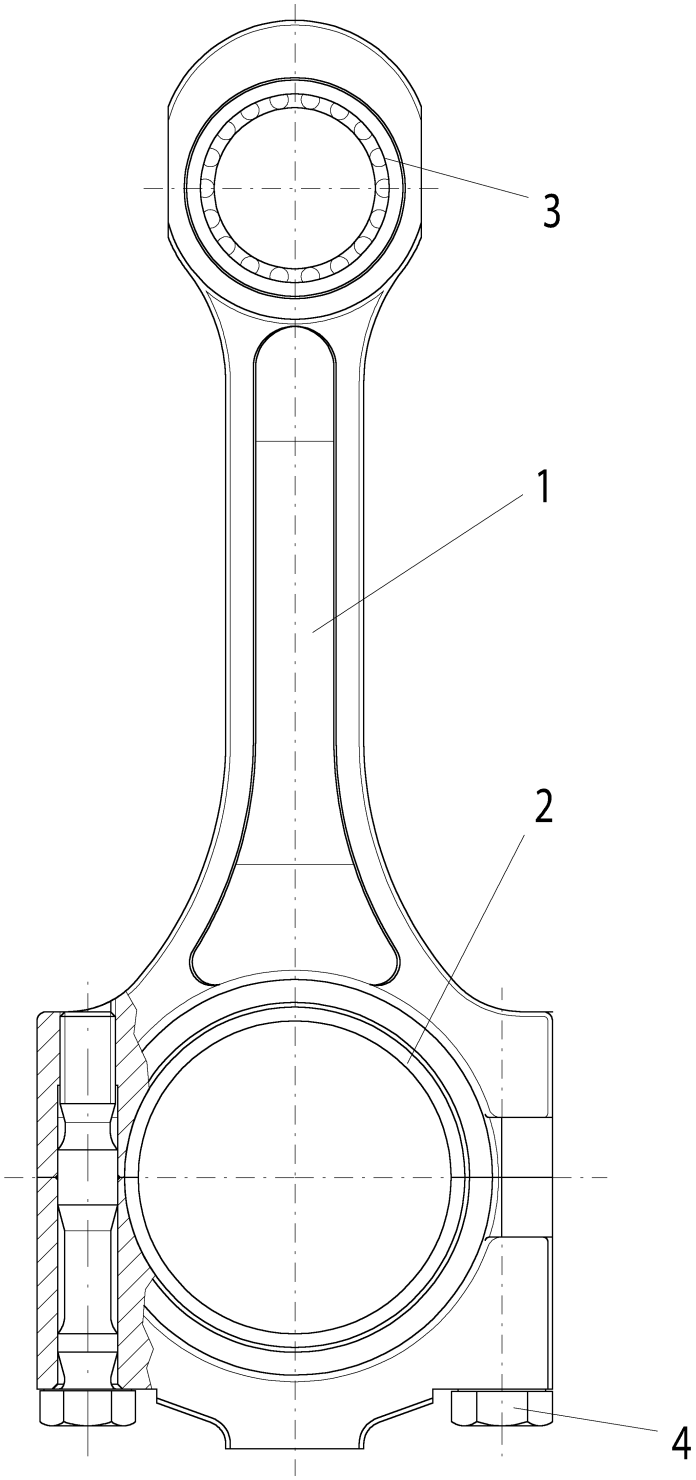
064 568 connecting rod 1st and 2nd stage



064 568 connecting rod 1st and 2nd stage

Item	Reference No.	Designation	Qty.
1	064 352	connecting rod	1
2	056 272	connecting rod bearing	1
3	033 213	piston pin bearing	1
4	056 316	connecting rod screw	2

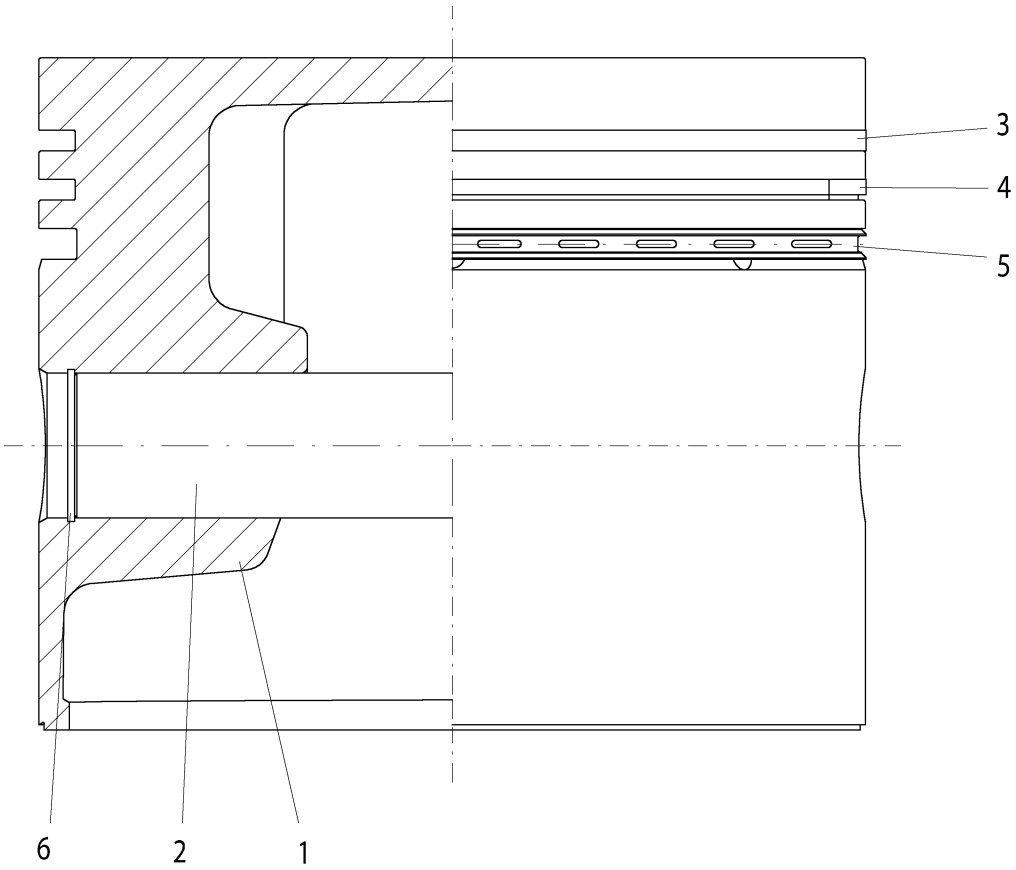
064 848 connecting rod 3rd stage



064 848 connecting rod 3rd stage

Item	Reference No.	Designation	Qty.
1	064 849	connecting rod	1
2	056 272	connecting rod bearing	1
3	034 552	piston pin bearing	1
4	056 316	connecting rod screw	2

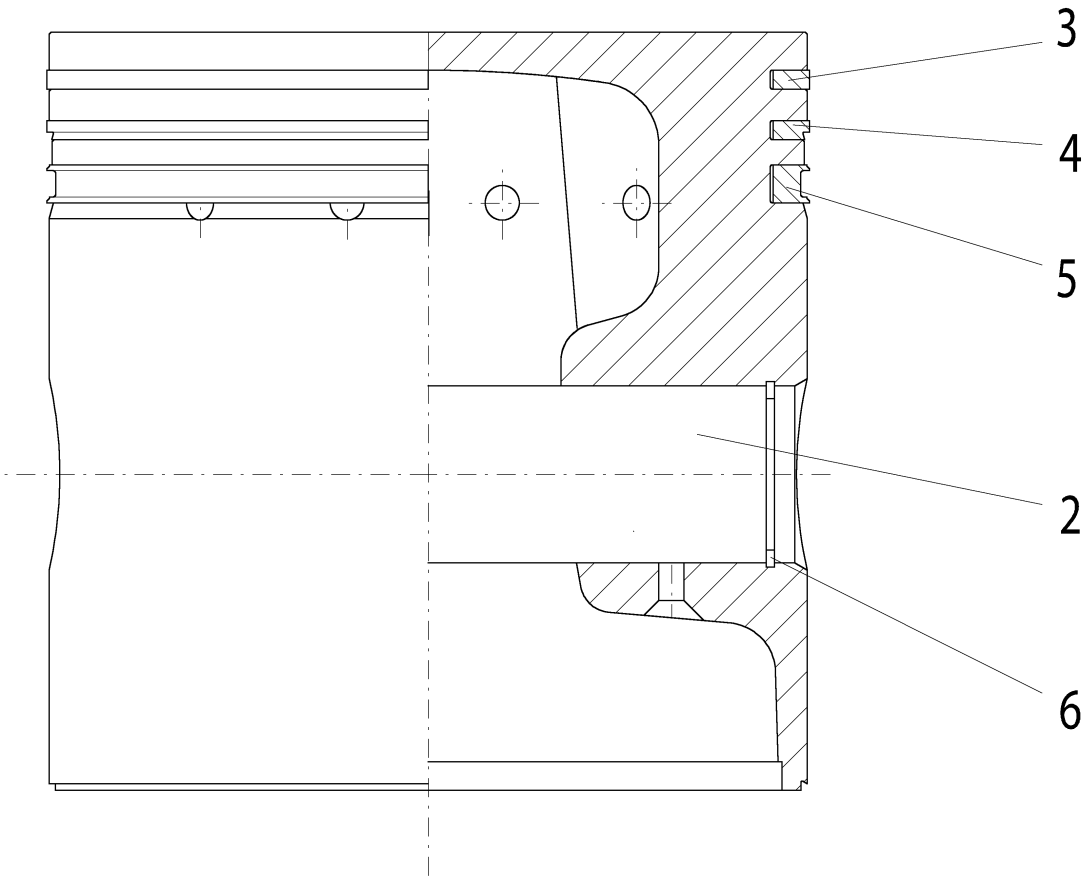
033 185 piston 1st stage



033 185 piston 1st stage

Item	Reference No.	Designation	Qty.
1	033 186	piston 1st stage	1
2	033 187	piston pin	1
3	035 199	M-ring	1
4	033 188	N-ring	1
5	035 200	G-ring	1
6	002 984	circlip	2

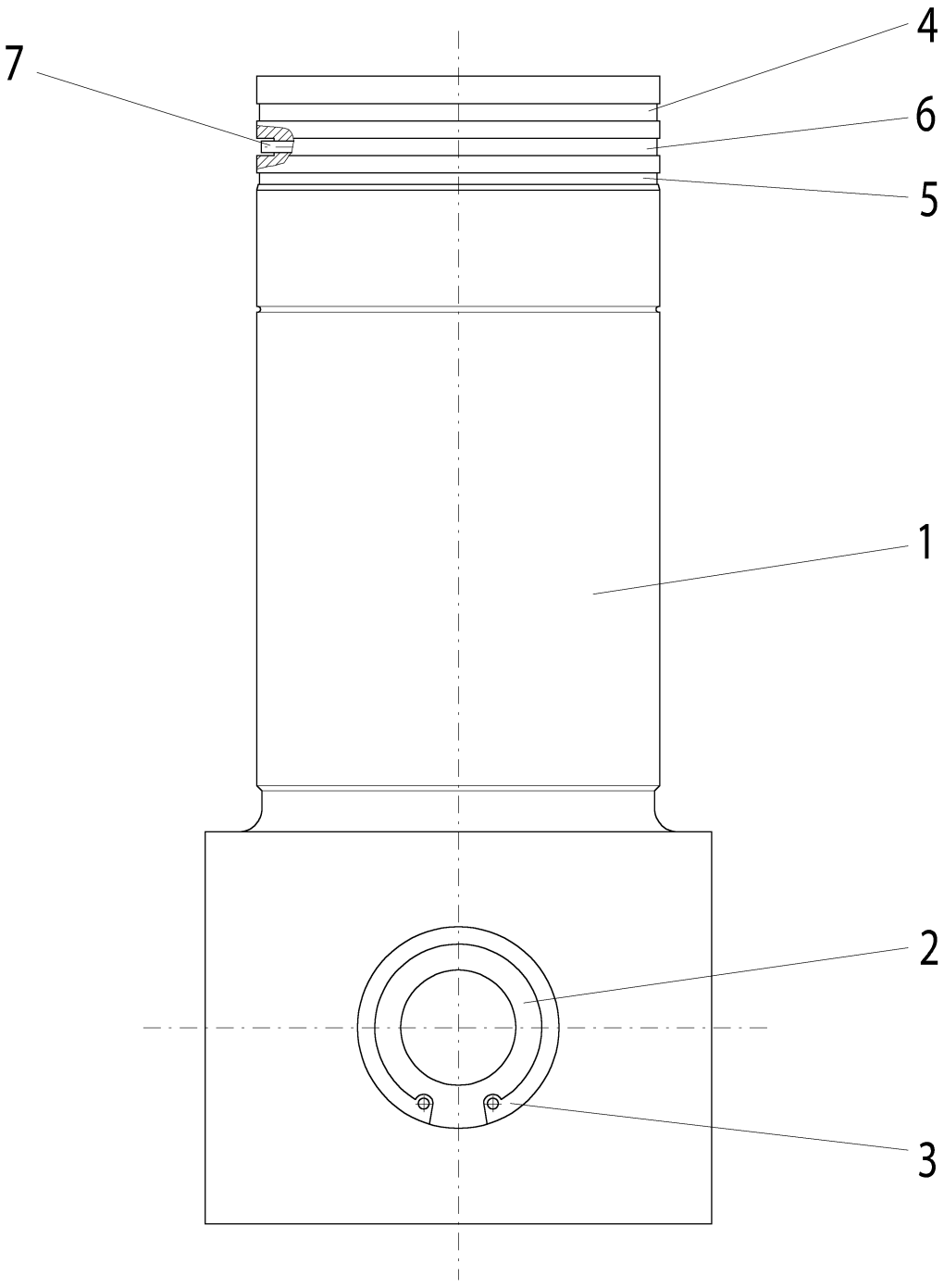
037 049 piston 2nd stage



037 049 piston 2nd stage

Item	Reference No.	Designation	Qty.
2	032 289	piston pin	1
3	037 050	M-ring	1
4	002 566	N-ring	1
5	037 051	G-ring	1
6	002 984	circlip	2

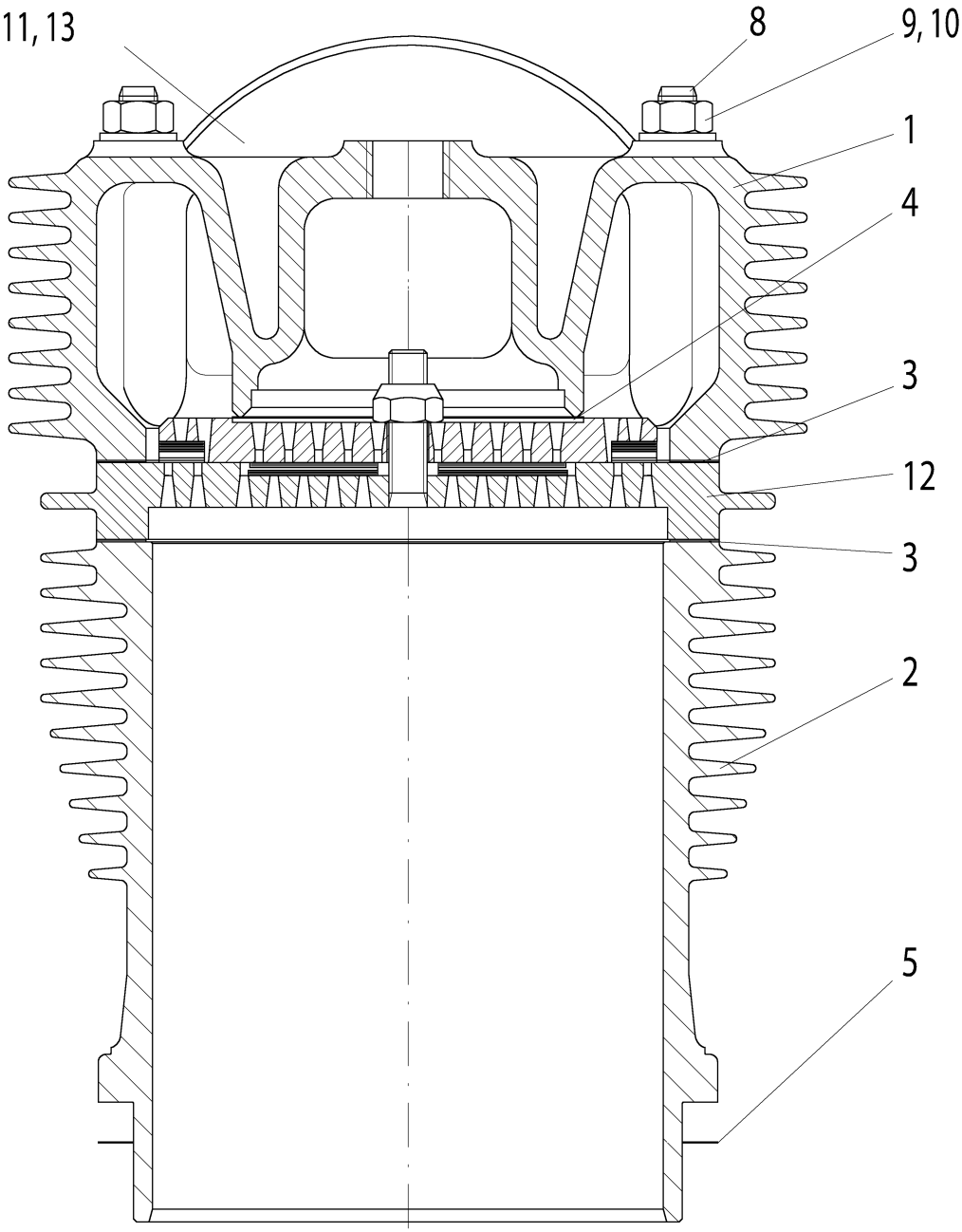
063 305 piston 3rd stage



063 305 piston 3rd stage

Item	Reference No.	Designation	Qty.
1	063 304	piston 3rd stage	1
2	059 298	piston pin	1
3	002 988	circlip	2
4	002 748	R-ring	1
5	002 552	N-ring	1
6	037 656	R-ring	1
7	004 442	pin	1

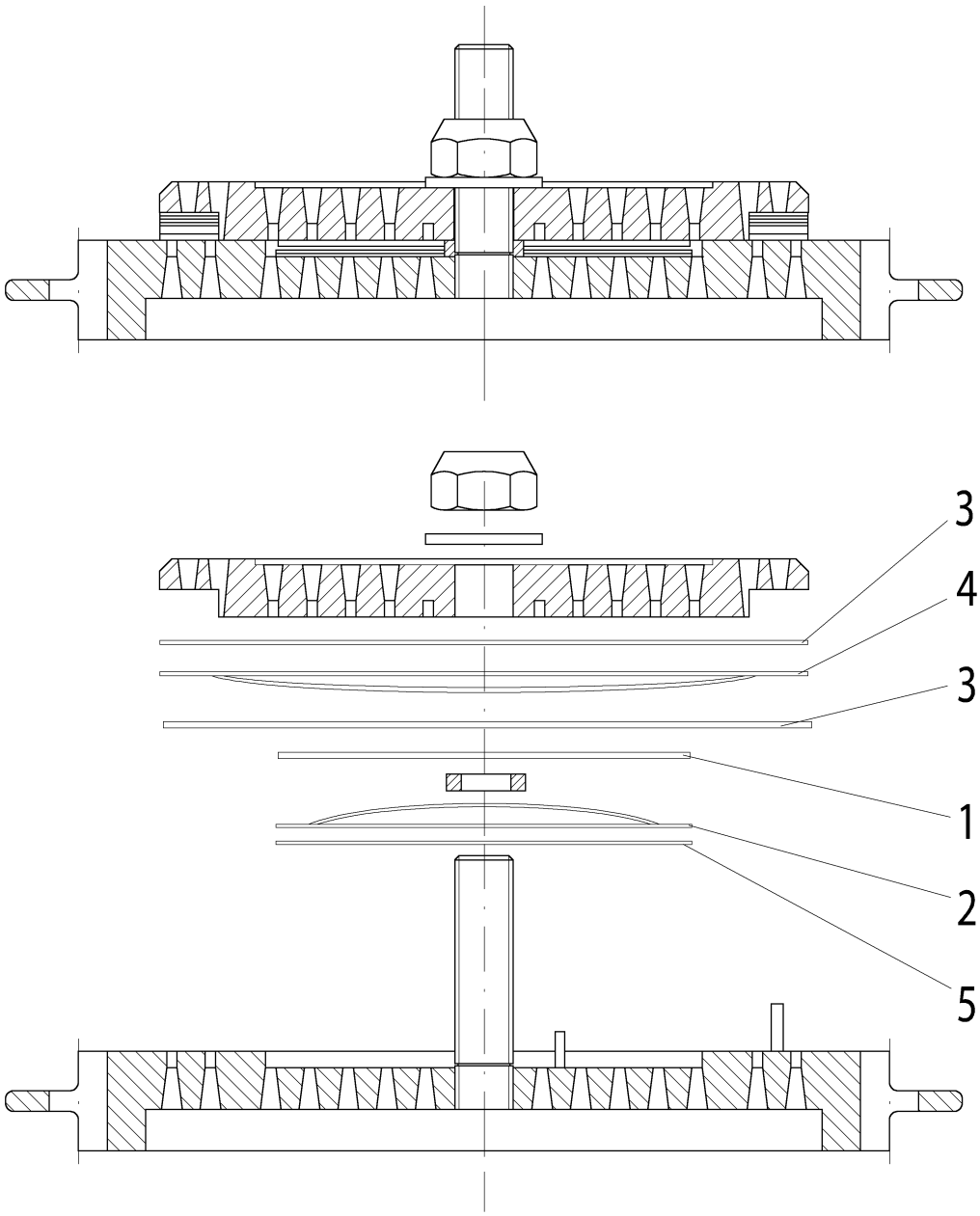
064 408 cylinder with head and valve 1st stage



064 408 cylinder with head and valve 1st stage

Item	Reference No.	Designation	Qty.
1	064 481	cylinder head 1st stage	1
2	056 216	cylinder 1st stage	1
3	056 237	cylinder head packing 1st stage	2
4	056 239	low tolerance gasket	1
5	062 375	cylinder foot packing 1st stage	1
8	037 477	stud	6
9	001 620	hexagon nut	6
10	002 161	washer	6
11	036 394	air filter	1
12	037 460	concentric valve 1st stage	1
13	036 395	filter insert for air filter	1

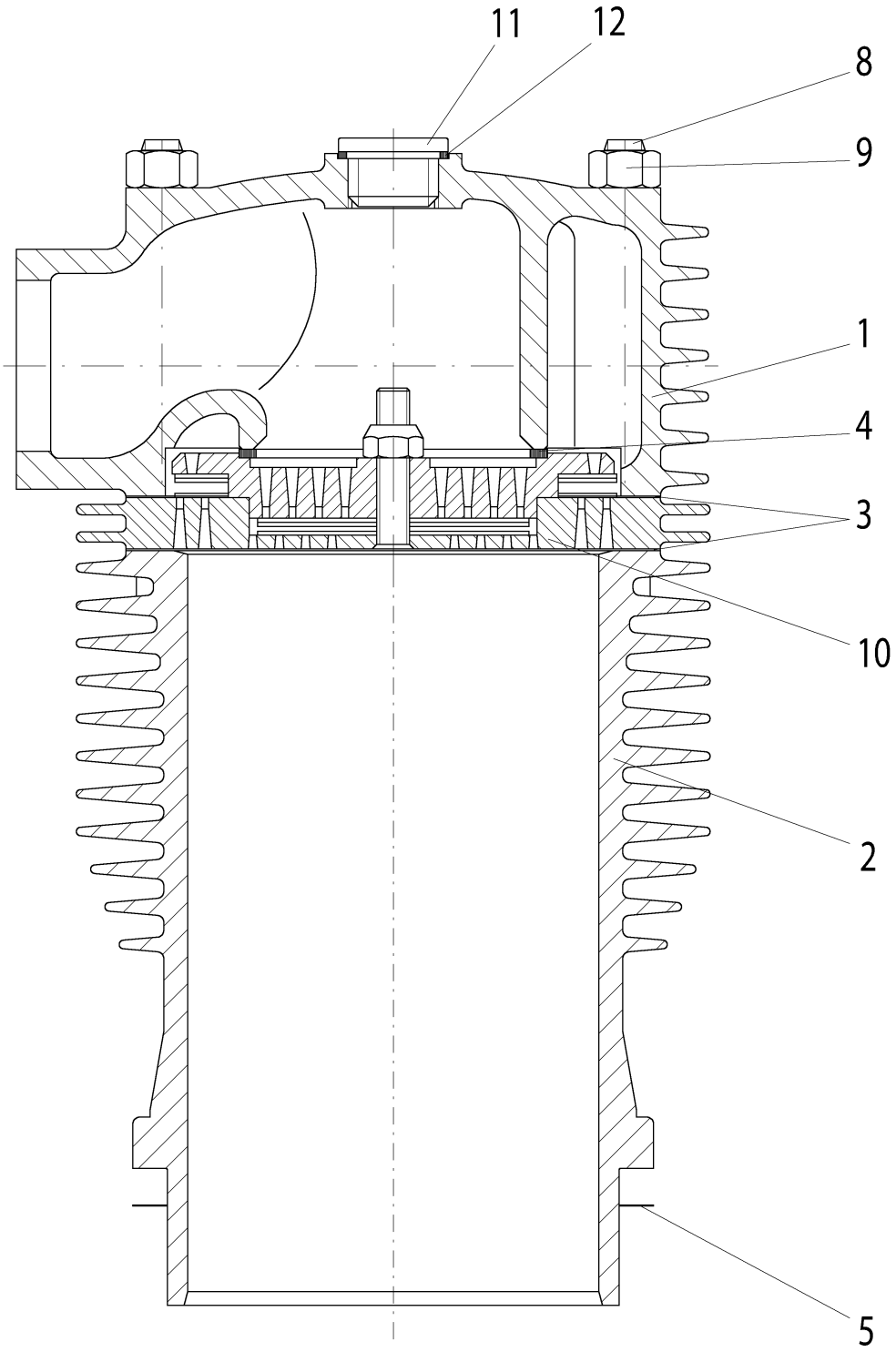
037 460 concentric valve 1st stage



037 460 concentric valve 1st stage

Item	Reference No.	Designation	Qty.
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

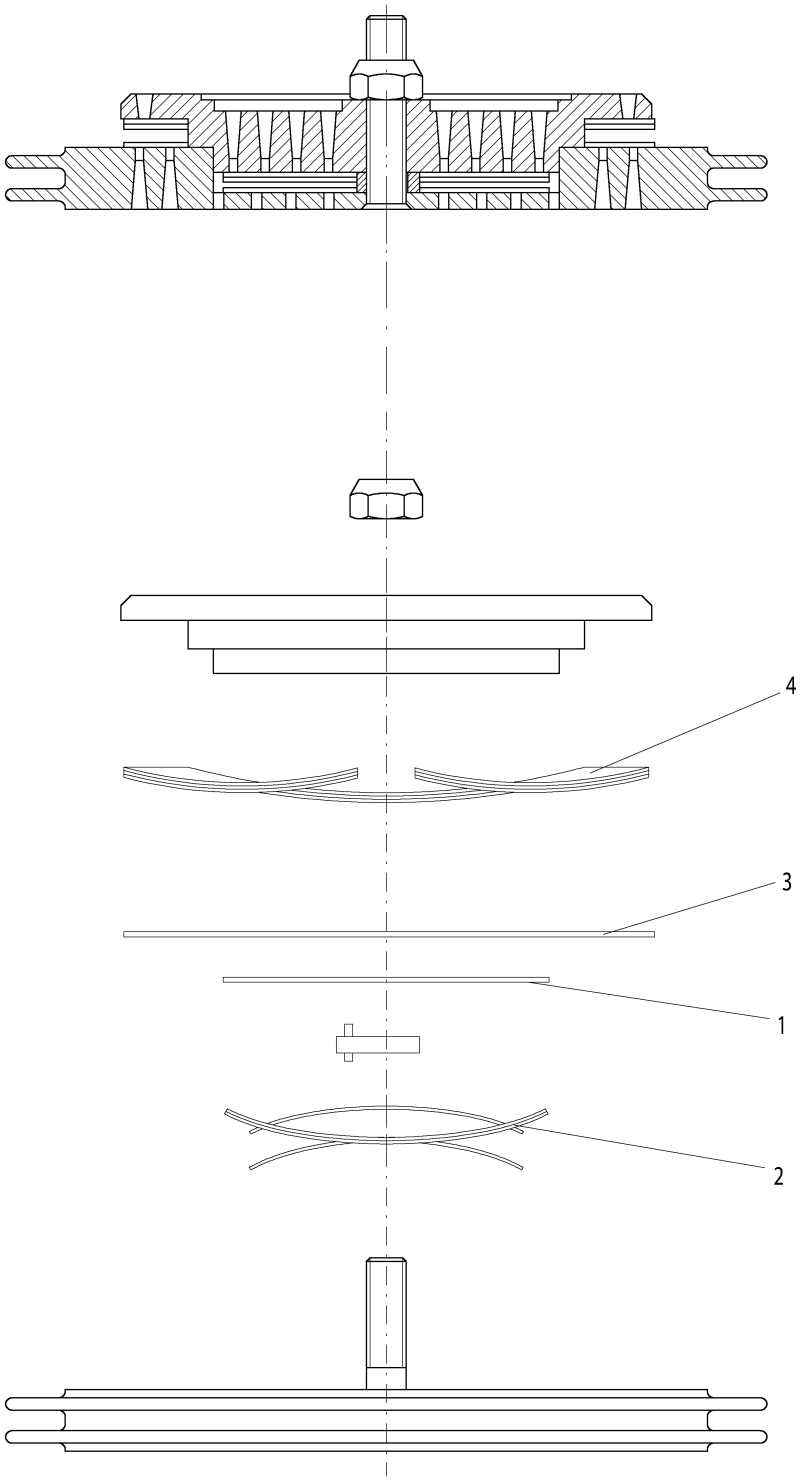
065 175 cylinder with head and valve 2nd stage



065 175 cylinder with head and valve 2nd stage

Item	Reference No.	Designation	Qty.
1	056 222	cylinder head 2nd stage	1
2	059 286	cylinder 2nd stage	1
3	059 393	cylinder head packing 2nd stage	2
4	056 235	low tolerance gasket	1
5	062 376	cylinder foot packing 3rd stage	1
8	001 520	stud	6
9	001 620	hexagon nut	6
10	034 591	concentric valve 2nd stage	1
11	000 976	plug	1
12	005 016	gasket	1

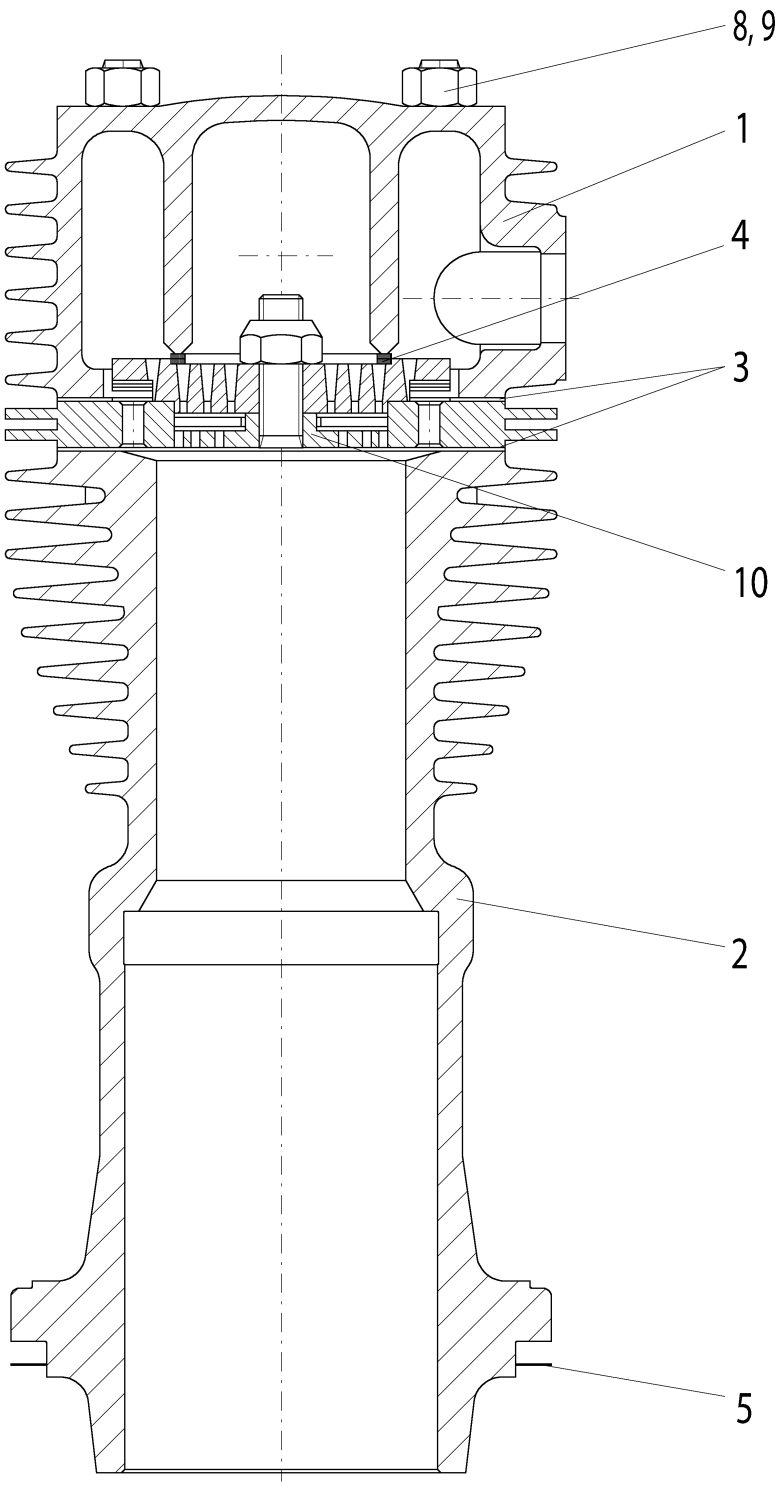
034 591 concentric valve 2nd stage



034 591 concentric valve 2nd stage

Item	Reference No.	Designation	Qty.
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

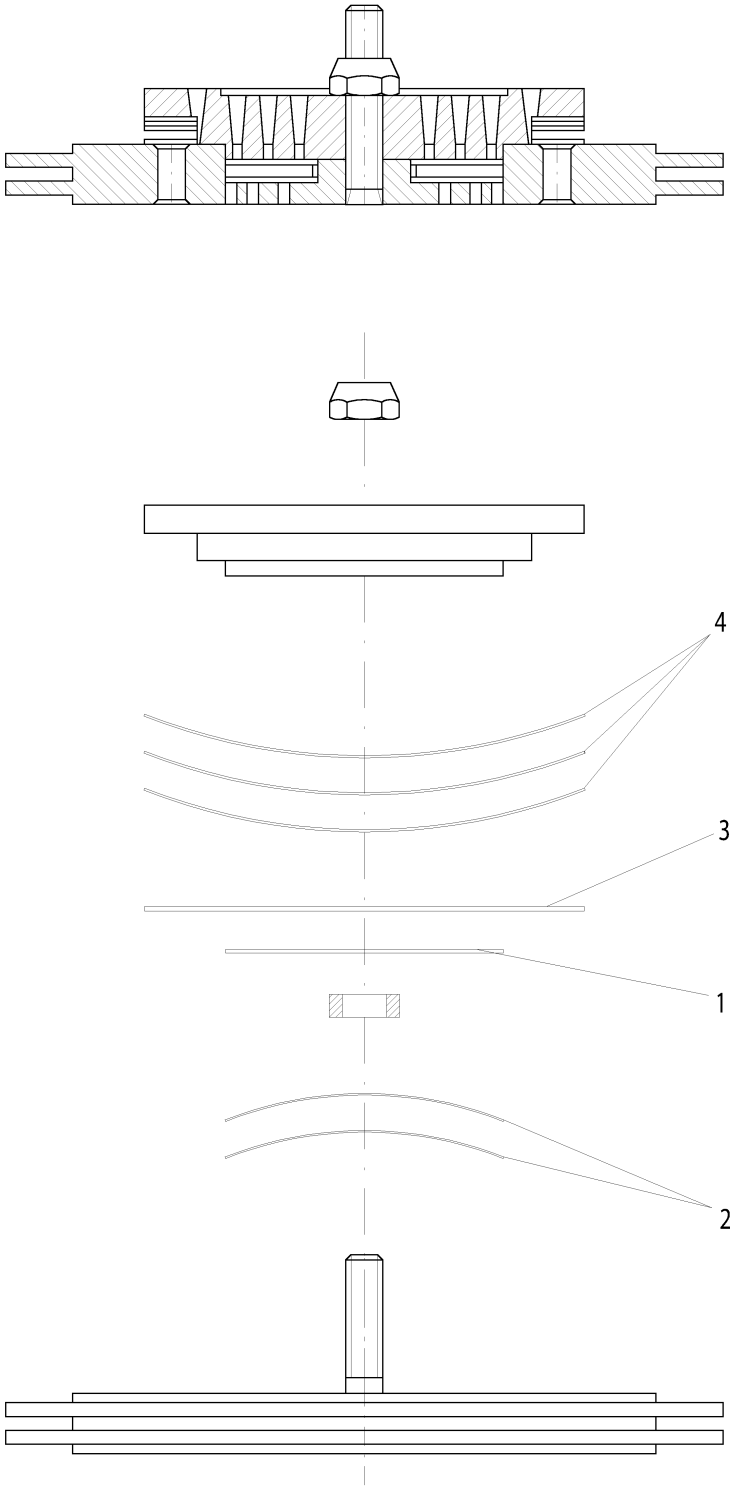
065 176 cylinder with head and valve 3rd stage



065 176 cylinder with head and valve 3rd stage

Item	Reference No.	Designation	Qty.
1	056 278	cylinder head 3rd stage	1
2	063 303	cylinder 3rd stage	1
3	056 282	cylinder head packing 3rd stage	2
4	063 079	low tolerance gasket	1
5	062 376	cylinder foot packing 3rd stage	1
8	001 519	stud	4
9	001 620	hexagon nut	4
10	033 893	concentric valve 3rd stage	1

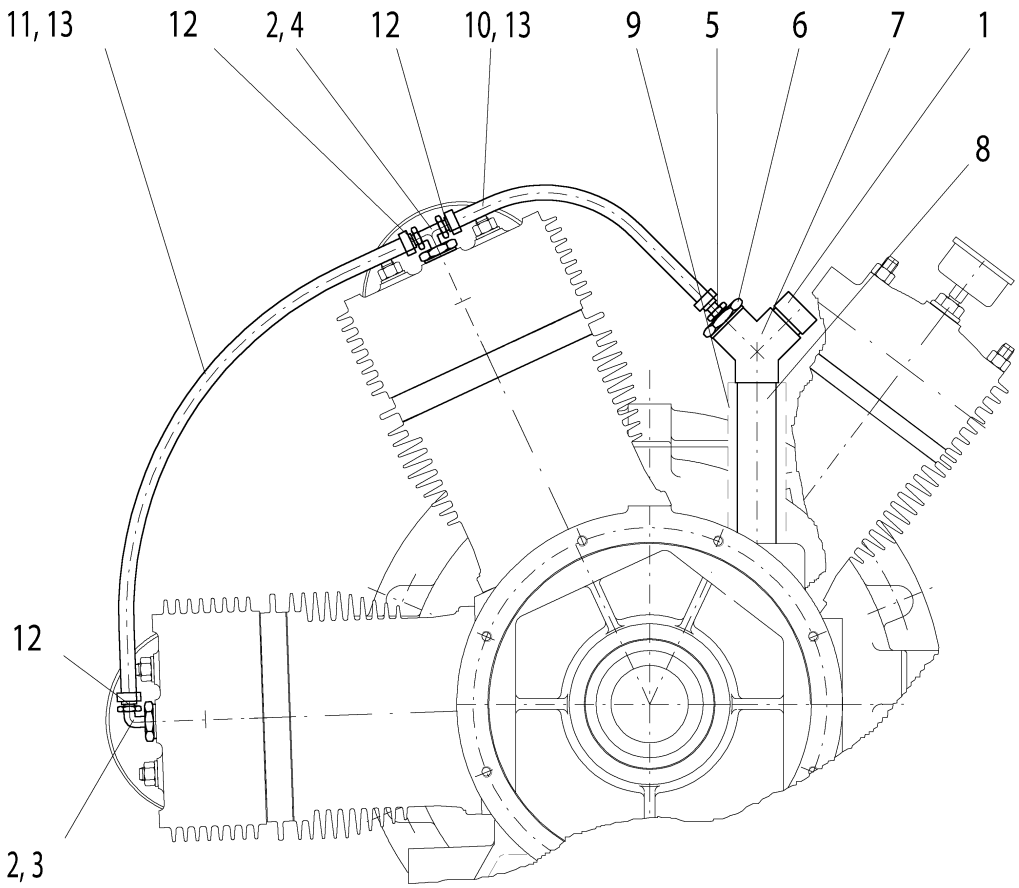
033 893 concentric valve 3rd stage



033 893 concentric valve 3rd stage

Item	Reference No.	Designation	Qty.
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

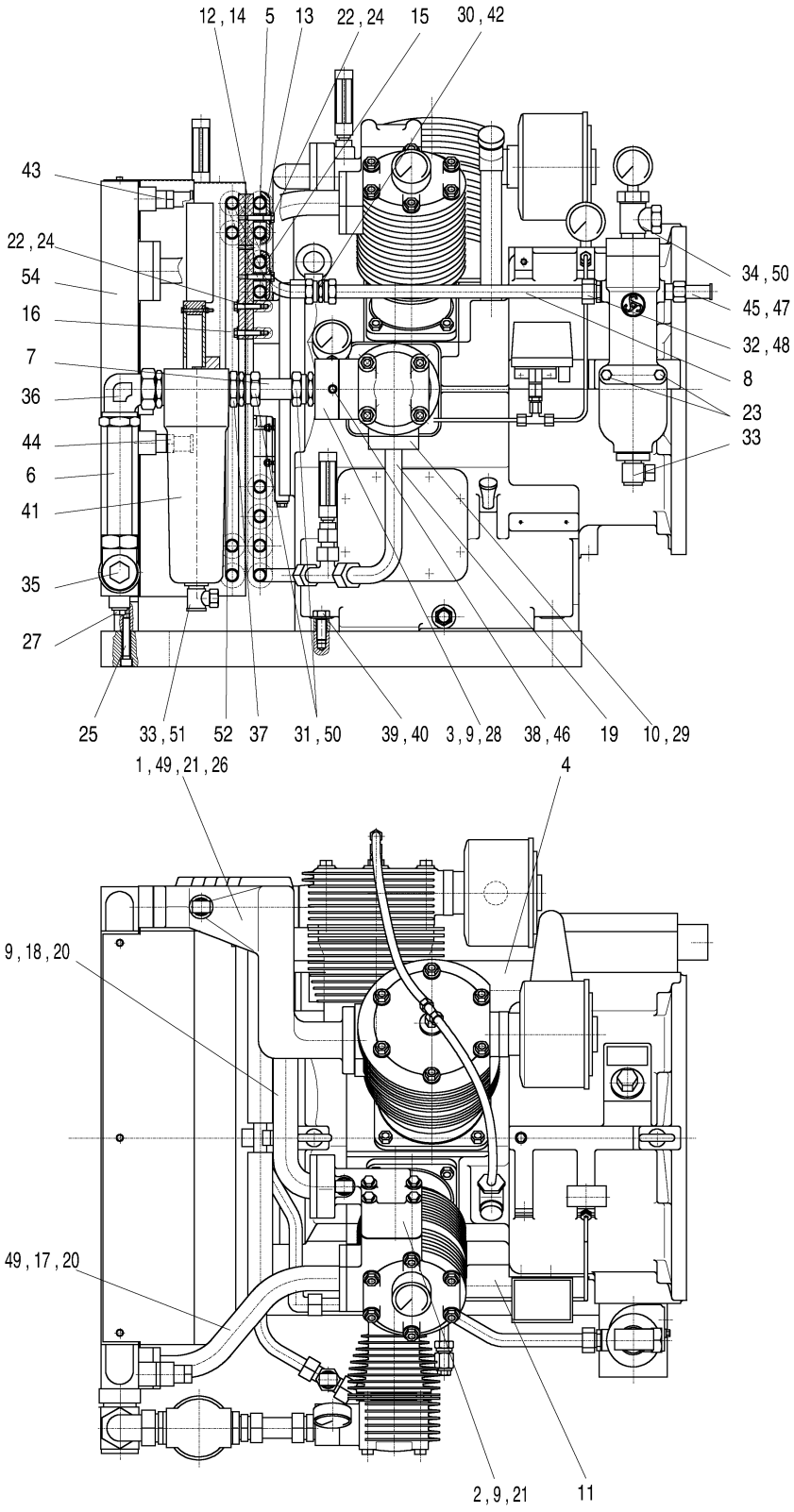
065 177 crankcase venting



065 177 crankcase venting

Item	Reference No.	Designation	Qty.
1	035 824	filling cover	1
2	006 380	reducer	2
3	006 205	union	1
4	033 614	union	1
5	033 487	stud adaptor	1
6	037 138	reducer	1
7	037 137	distribution piece	1
8	064 523	pipe adaptor	1
9	033 952	hose 220mm long	1
10	034 612	LP-hose	1
11	034 225	LP-hose	1
12	012 766	pipe 70mm long	3
13	035 254	hose clamp	4

065 178 cooler and air lines



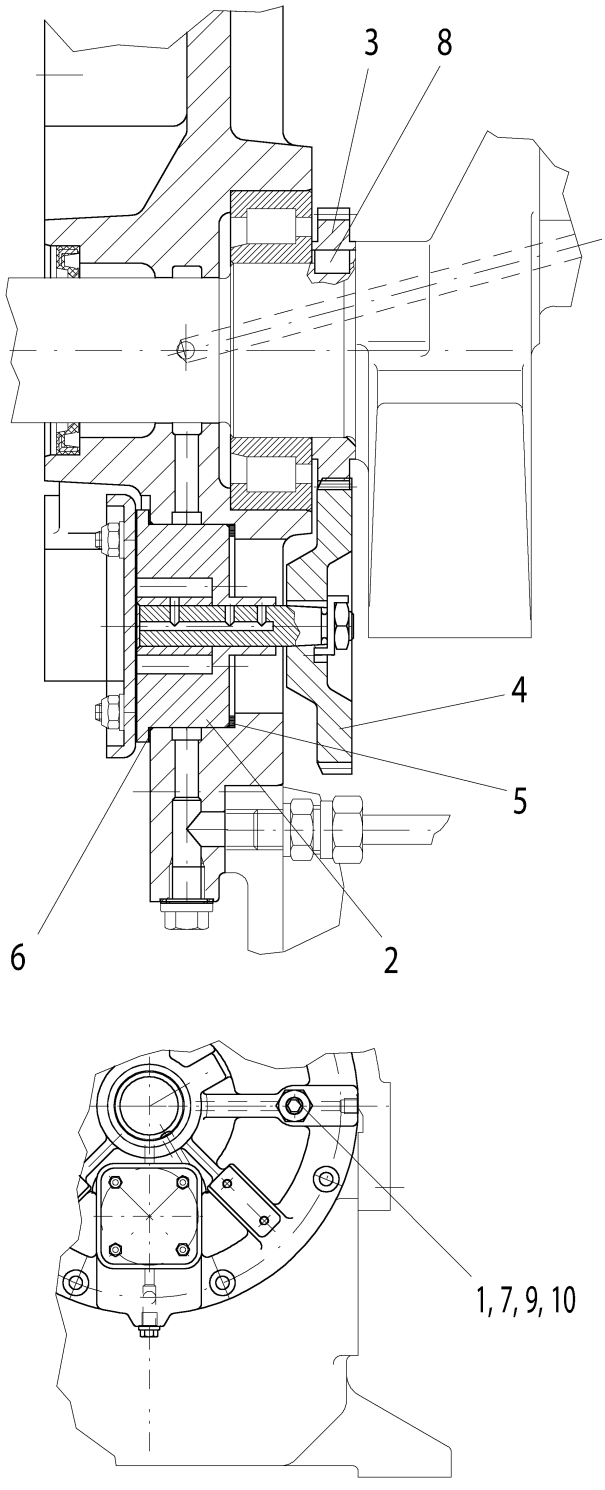
065 178 cooler and air lines

Item	Reference No.	Designation	Qty.
1	065 120	pressure air channel	1
2	065 122	bend flange	1
3	064 581	flange	1
4	065 389	ledge	1
5	065 195	distance bush	9
6	065 197	pipe	1
7	065 198	pipe	1
8	065 200	pipe	1
9	056 335	packing	4
10	056 369	packing	1
11	065 376	ledge	1
12	065 194	pipe holder	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 lines	1
18	065 160	pressure air lines	1
19	065 310	pressure air lines	1
20	000 054	hexagon head screw	16
21	000 162	hexagon head screw	8
22	033 532	hexagon head screw	9
23	000 147	hexagon head screw	2
24	000 123	hexagon head screw	6
25	000 558	cylinder head screw	2
26	000 540	cylinder head screw	8
27	030 744	plug	2
28	000 059	hexagon head screw	4
29	012 851	hexagon head screw	2
30	004 707	union	1
31	037 851	union	2
32	036 157	union	1
33	006 186	union	2

065 178 cooler and air lines

Item	Reference No.	Designation	Qty.
34	006 193	union	1
35	006 197	union	1
36	006 231	union	1
37	006 391	reducer	1
38	001 007	union	1
39	000 184	hexagon head screw	2
40	002 166	washer	2
41	036 555	condensat separator	1
42	036 081	union	1
43	033 224	safety valve	1
44	033 714	safety valve	1
45	030 752	safety valve	1
46	003 496	gasket	1
47	005 009	gasket	3
48	005 016	gasket	3
49	056 334	packing	5
50	005 023	gasket	2
51	030 340	o-ring	1
52	032 401	o-ring	1
54	037 776	cooler	1

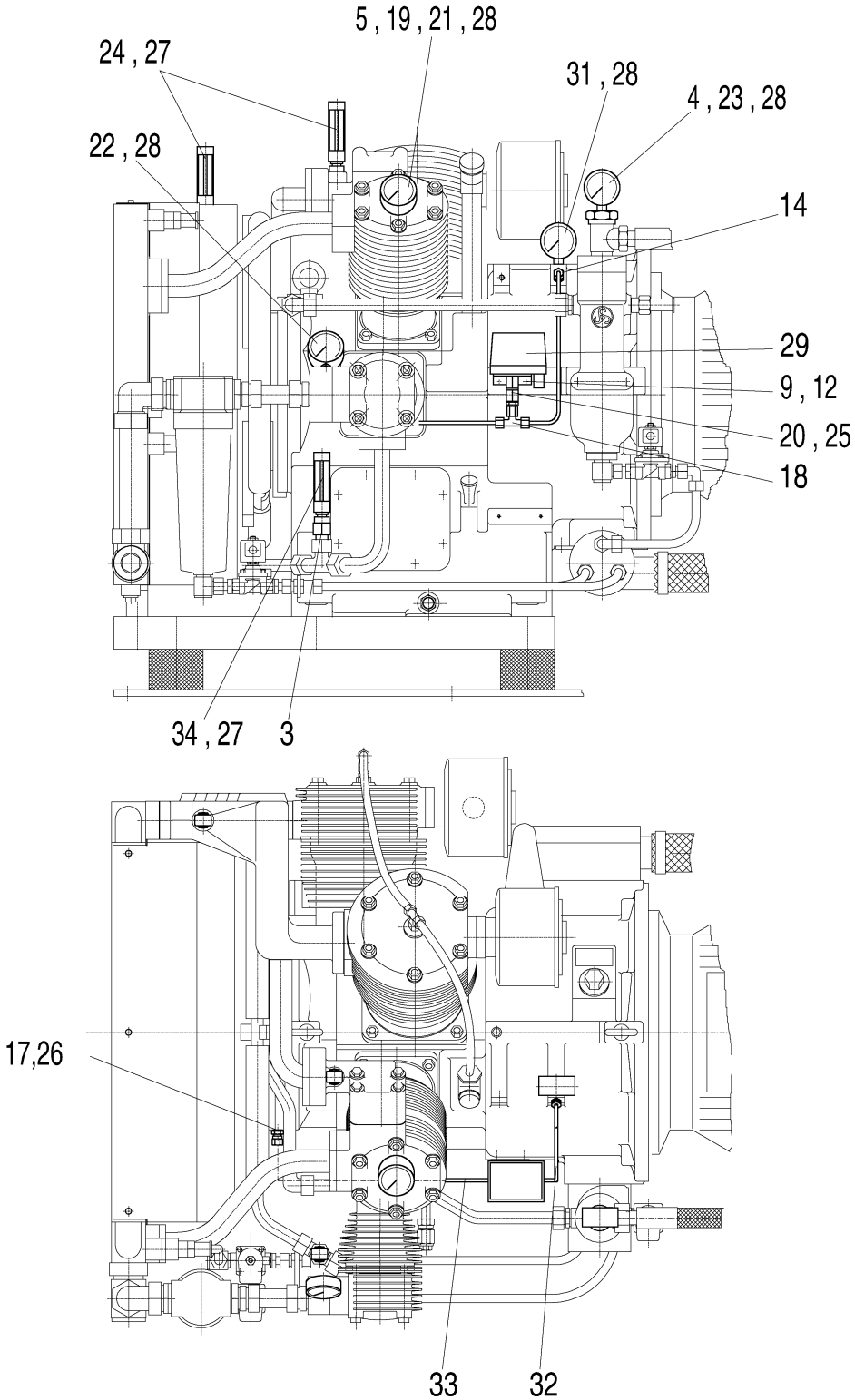
064 119 lubricating oil pump and drive



064 119 lubricating oil pump and drive

Item	Reference No.	Designation	Qty.
1	057 916	overpressure valve	1
2	062 909	gearwheel oil pump	1
3	064 098	gearwheel	1
4	056 730	gearwheel	1
5	056 318	packing	1
6	030 545	packing	1
7	000 970	plug	1
8	001 942	fitting key	1
9	003 496	gasket	1
10	003 438	gasket	1

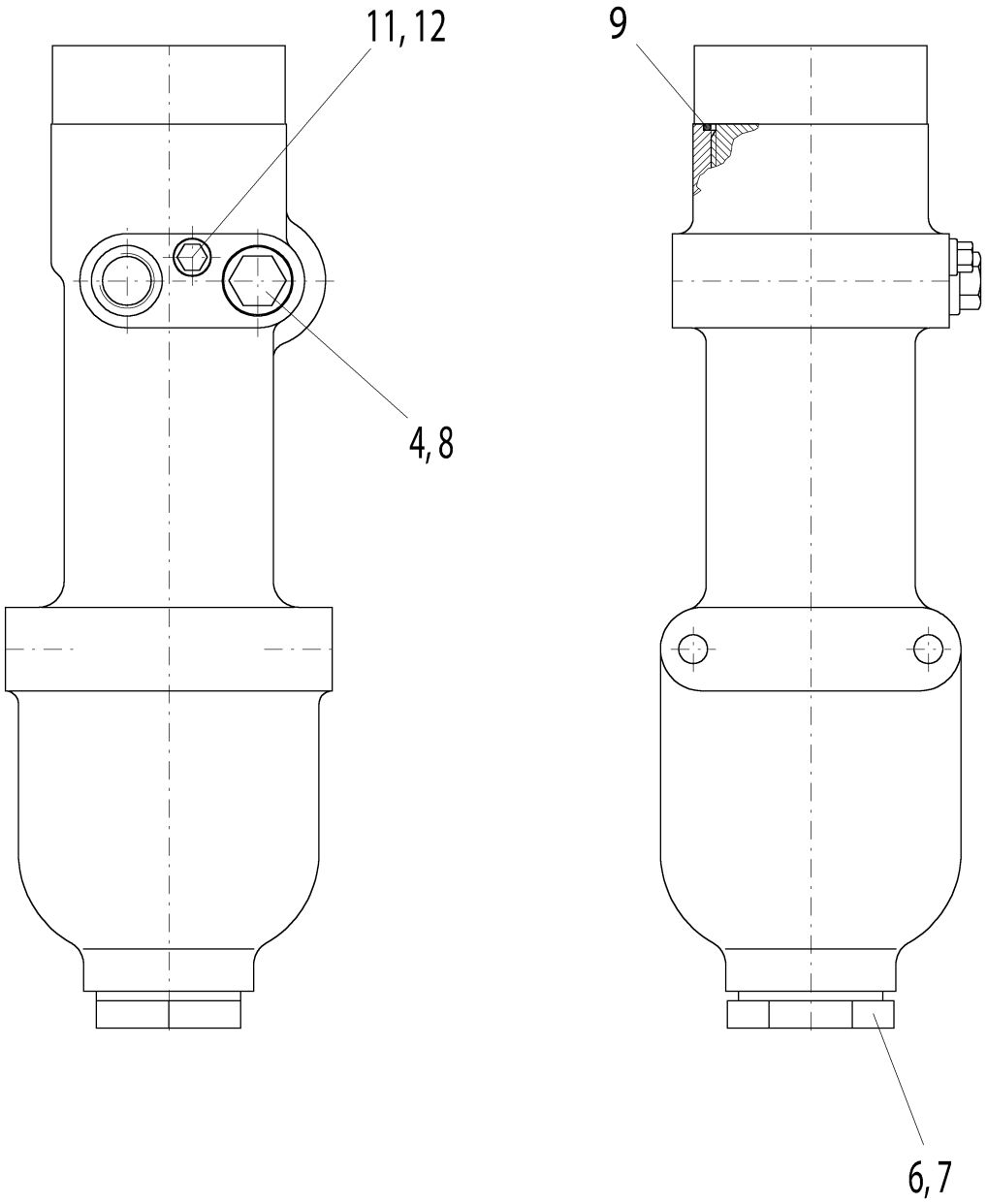
065 180 measuring device



065 180 measuring device

Item	Reference No.	Designation	Qty.
3	064 365	tube	1
4	065 352	tube	1
5	065 353	tube	1
9	000 010	hexagon head screw	2
12	002 144	washer	2
14	004 598	union	1
17	030 510	union	1
18	033 912	union	1
19	005 016	gasket	1
20	033 017	reducer	1
21	035 009	pressure gauge 1st stage	1
22	033 262	pressure gauge 2nd stage	1
23	030 664	pressure gauge 3rd stage	1
24	033 223	thermometer	2
25	005 006	gasket	1
26	005 001	gasket	1
27	005 009	gasket	3
28	035 061	gasket	4
29	030 082	oil pressure switch	1
31	033 261	pressure gauge , oil	1
32	008 633	pressure gauge pipe 750mm long	1
33	008 633	pressure gauge pipe 750mm long	1
34	037 839	thermometer	1

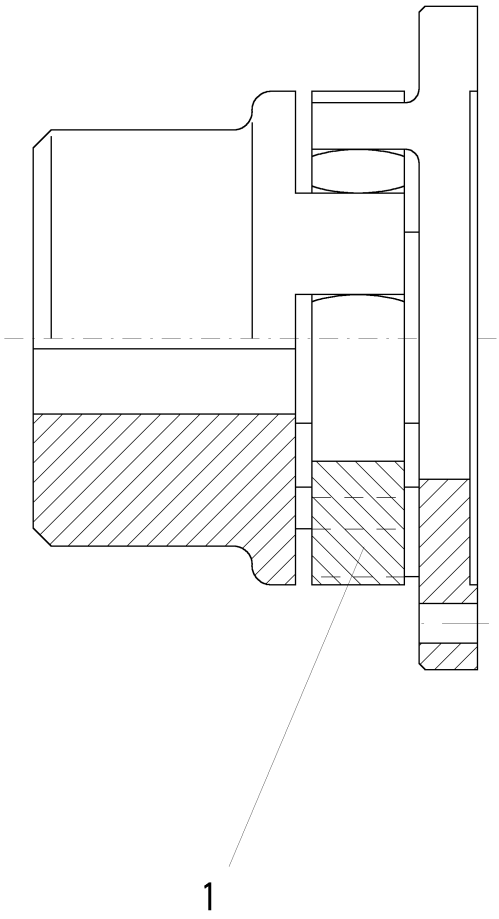
063 121 final separator, compl.



063 121 final separator, compl.

Item	Reference No.	Designation	Qty.
4	060 342	fusible plug	1
6	006 390	reducer	1
7	005 029	gasket	1
8	005 009	gasket	1
9	004 181	o-ring	1
11	001 007	union	1
12	003 496	gasket	1

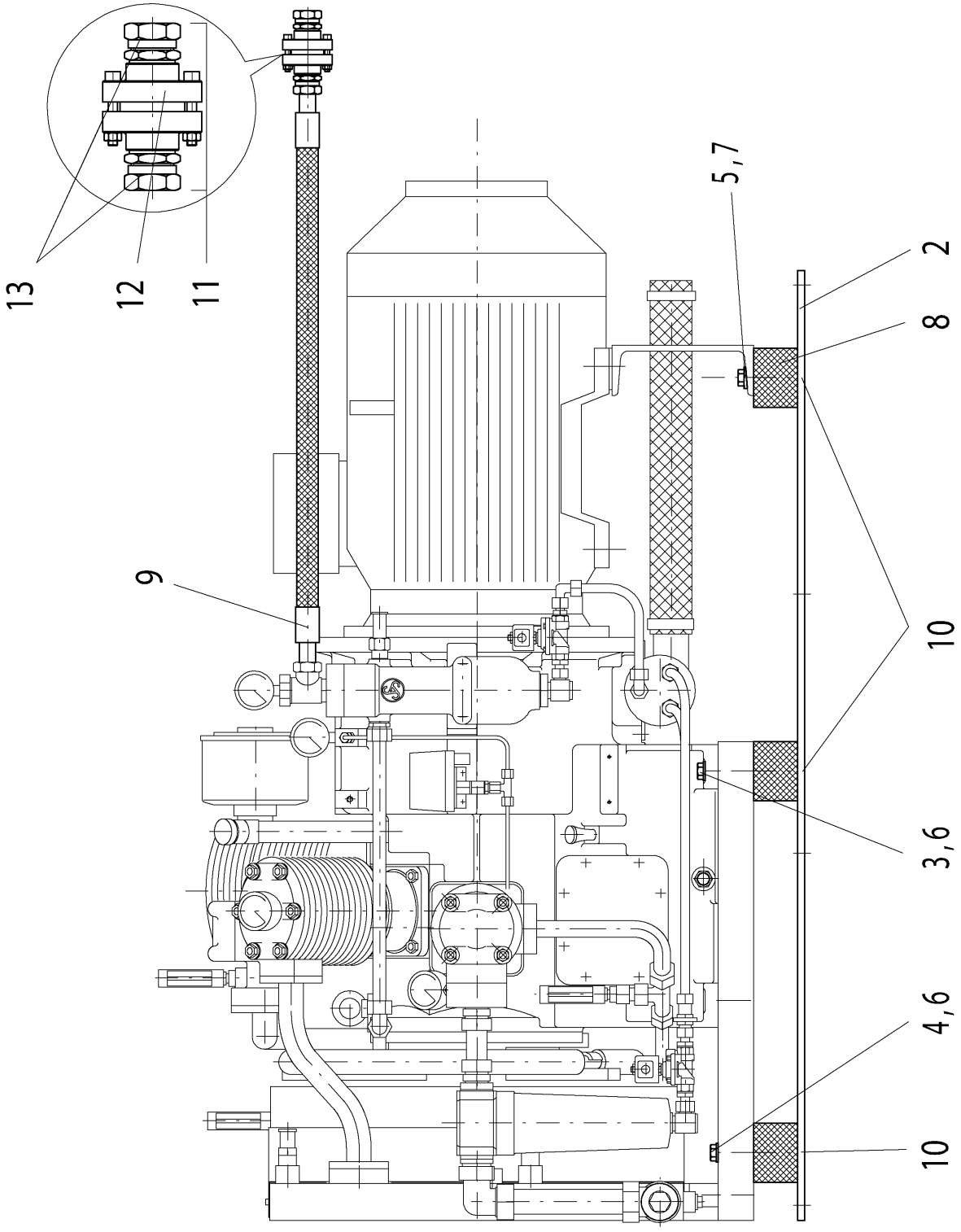
034 129 flexible coupling



034 129 flexible coupling

Item	Reference No.	Designation	Qty.
1	034 423	flexible gear rim	1

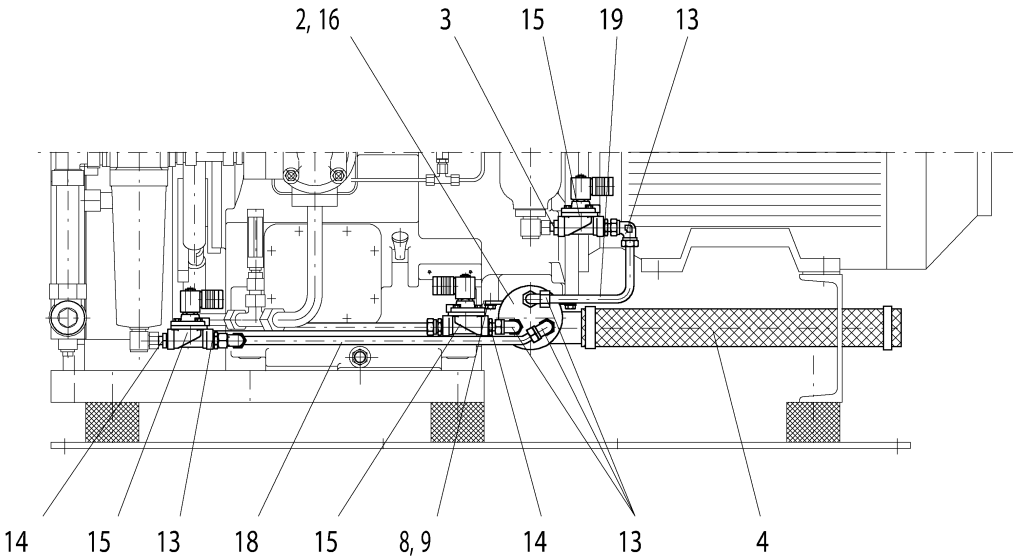
065 169 resilient mounts

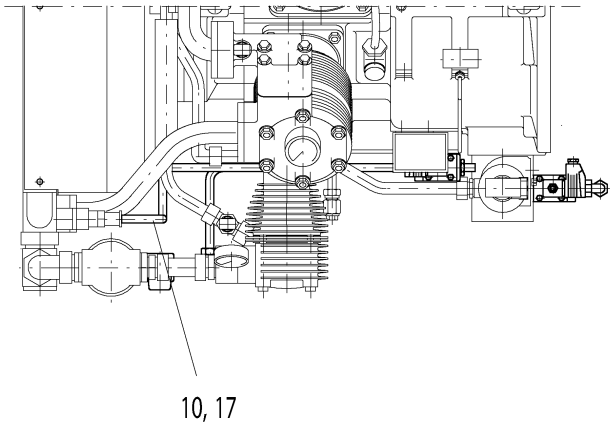


065 169 resilient mounts

Item	Reference No.	Designation	Qty.
2	065 216	rail	2
3	000 197	hexagon head screw	2
4	005 269	hexagon head screw	2
5	000 066	hexagon head screw	2
6	002 166	washer	4
7	001 637	washer	2
8	031 149	resilient mount	6
9	034 763	pressure air hose	1
10	033 531	countersunk screw	6
11	065 388	non-return valve, connection 28	-
12	037 883	non-return valve, RV1-25	1
13	004 661	union	2

065 181 automatic drainage





065 181 automatic drainage

Item	Reference No.	Designation	Qty.
2	063 120	expansion receiver	1
3	062 481	flow control	1
4	062 478	drainage hose	1
8	000 036	hexagon head screw	4
9	003 115	locking washer "Schnorr"	4
10	004 641	union	1
13	006 216	union	5
14	033 961	stud adaptor	2
15	037 680	solenoid valve	3
16	030 744	plug	1
17	008 663	pipe 300mm long	1
18	008 663	pipe 300mm long	1
19	008 663	pipe 300mm long	1

Reference No.	Designation	Page	Pos.
004 472	tension bushing	9	12
004 598	union	41	14
004 635	union	7	21
004 641	union	7	27
004 641	union	49	10
004 661	union	47	13
004 707	union	35	30
005 001	gasket	7	22
005 001	gasket	41	26
005 006	gasket	41	25
005 009	gasket	36	47
005 009	gasket	41	27
005 009	gasket	43	8
005 016	gasket	25	12
005 016	gasket	36	48
005 016	gasket	41	19
005 023	gasket	36	50
005 029	gasket	43	7
005 269	hexagon head screw	47	4
005 930	stud	7	11
006 186	union	35	33
006 193	union	36	34
006 197	union	36	35
006 205	union	33	3
006 216	union	49	13
006 231	union	36	36
006 380	reducer	33	2
006 390	reducer	43	6
006 391	reducer	36	37
007 123	shaft seal	7	25
008 633	pressure gauge pipe 750mm long	41	32
008 633	pressure gauge pipe 750mm long	41	33
008 663	pipe 300mm long	7	30
008 663	pipe 300mm long	49	17
008 663	pipe 300mm long	49	18
008 663	pipe 300mm long	49	19
012 766	pipe 70mm long	33	12
012 851	hexagon head screw	35	29
030 082	oil pressure switch	41	29
030 340	o-ring	36	51
030 510	union	41	17
030 545	packing	39	6
030 664	pressure gauge 3rd stage	41	23
030 744	plug	7	14
030 744	plug	35	27
030 744	plug	49	16
030 752	safety valve	36	45
030 831	shaft seal	7	26
031 149	resilient mount	47	8
032 289	piston pin	17	2
032 401	o-ring	36	52
032 430	fitting key	9	13

Reference No.	Designation	Page	Pos.
037 049	piston 2nd stage	5	6
037 050	M-ring	17	3
037 051	G-ring	17	5
037 137	distribution piece	33	7
037 138	reducer	33	6
037 460	concentric valve 1st stage	5	11
037 460	concentric valve 1st stage	21	12
037 468	suction valve plate	23	1
037 469	suction valve spring	23	2
037 470	delivery valve plate	23	3
037 471	delivery valve spring	23	4
037 472	suction valve plate	23	5
037 477	stud	21	8
037 656	R-ring	19	6
037 680	solenoid valve	49	15
037 776	cooler	36	54
037 790	fan wheel	9	6
037 839	thermometer	41	34
037 851	union	35	31
037 883	non-return valve, RV1-25	47	12
051 883	inspection hole cover	7	4
056 216	cylinder 1st stage	21	2
056 222	cylinder head 2nd stage	25	1
056 235	low tolerance gasket	25	4
056 237	cylinder head packing 1st stage	21	3
056 239	low tolerance gasket	21	4
056 264	pressure washer fan wheel	9	4
056 272	connecting rod bearing	11	2
056 272	connecting rod bearing	13	2
056 278	cylinder head 3rd stage	29	1
056 282	cylinder head packing 3rd stage	29	3
056 316	connecting rod screw	11	4
056 316	connecting rod screw	13	4
056 318	packing	39	5
056 334	packing	36	49
056 335	packing	35	9
056 369	packing	35	10
056 730	gearwheel	39	4
057 916	overpressure valve	39	1
059 286	cylinder 2nd stage	25	2
059 298	piston pin	19	2
059 393	cylinder head packing 2nd stage	25	3
060 342	fusible plug	43	4
062 375	cylinder foot packing 1st stage	21	5
062 376	cylinder foot packing 3rd stage	25	5
062 376	cylinder foot packing 3rd stage	29	5
062 478	drainage hose	49	4
062 481	flow control	49	3
062 909	gearwheel oil pump	39	2
063 079	low tolerance gasket	29	4
063 120	expansion receiver	49	2
063 121	final separator, compl.	5	18