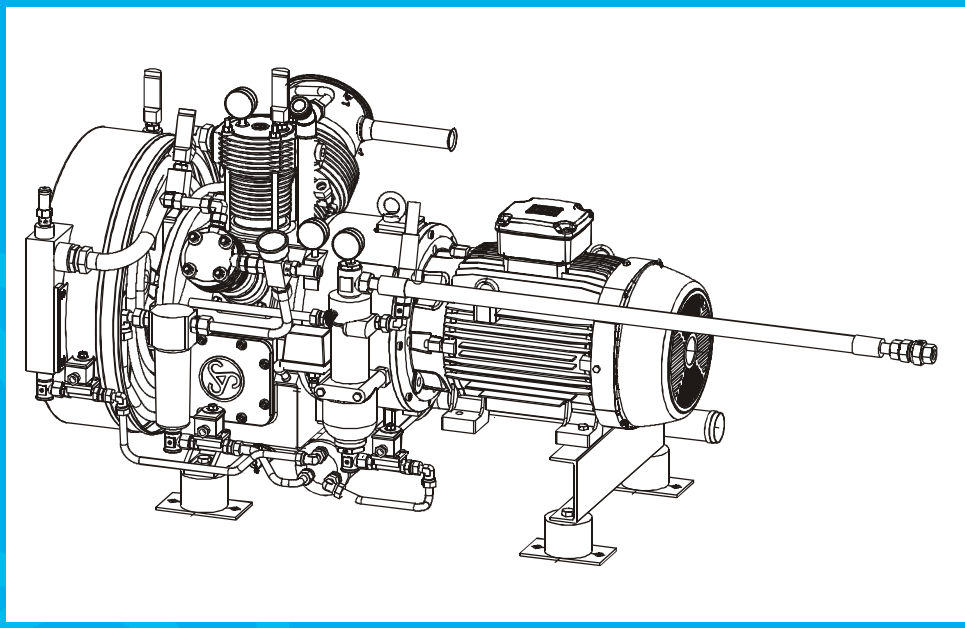
J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

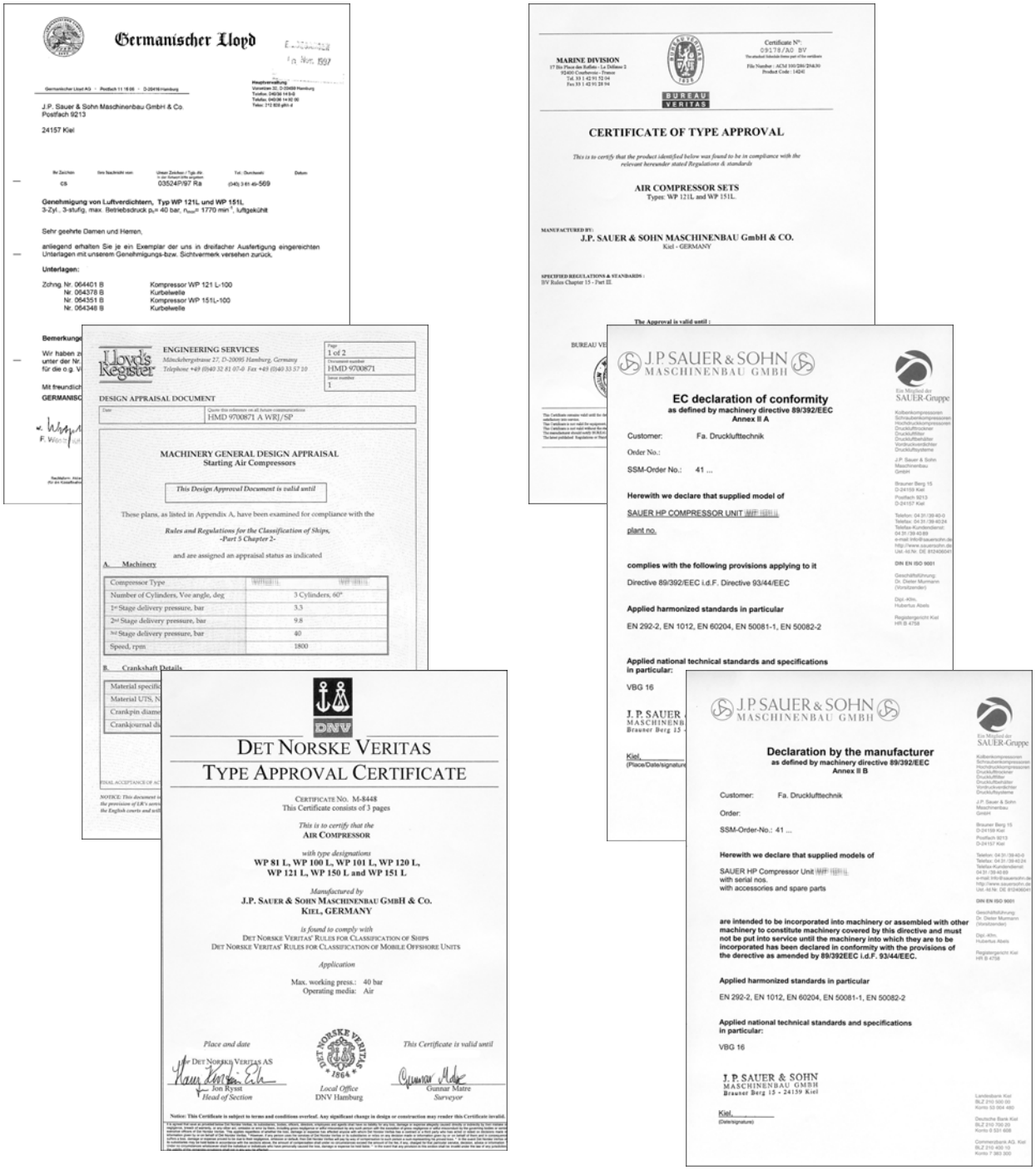
Type: WP 66 L

Operating Manual

- High-Pressure Compressor
- 3 Stages
- Air Cooled

Ein Mitglied der
SAUER-Gruppe

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
Münckebergstrasse 27, D-20095 Hamburg, Germany
Telephone +49 (0)40 32 81 05-0 Fax +49 (0)40 33 57 10

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	[illegible]
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

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

BUREAU VERITAS

Certificate N°: 09178/A0 BV

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 [illegible]

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 - 24159 Kiel

Kiel,
(Place/Date/signature)

Ein Mitglied der SAUER-Gruppe

Kolbenkompressoren
Schraubenkompressoren
Turbokompressoren
Druckluftmischer
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 69
e-mail: info@sauersohn.de
http://www.sauersohn.de
Ust.-Id.Nr. DE 815406047

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. Druckluftechnik

Order:

SSM-Order-No.: 41 ...

Herewith we declare that supplied models of

SAUER HP Compressor Unit [illegible]
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

Kolbenkompressoren
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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 69
e-mail: info@sauersohn.de
http://www.sauersohn.de
Ust.-Id.Nr. DE 815406047

DIN EN ISO 9001

Geschäftsführung:
Dr. Dieter Murmann
(Vorsitzender)
Dipl.-Kfm.
Hubertus Abels

Registergericht Kiel
HR B 4758

Landesbank Kiel
BLZ 210 500 00
Konto 53 004 480

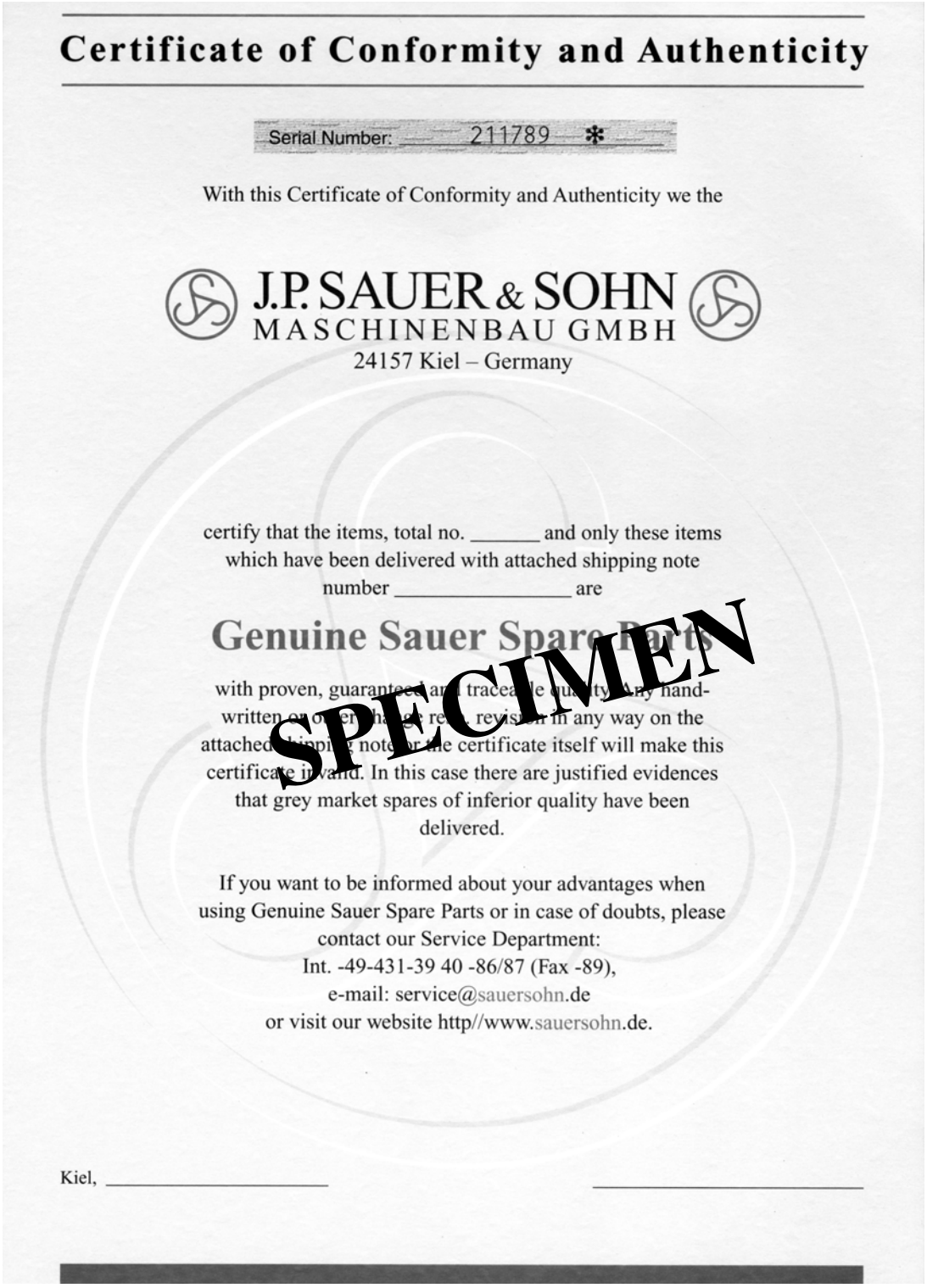
Deutsche Bank Kiel
BLZ 210 700 20
Konto 0 531 608

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

Note!

On this page only a few examples are shown. Further TypeApprovals 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 change re. 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. Preliminary note

1.1 Important information

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”.

Conditions

We presuppose that only authorised 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

1.2 Warranty and Liability

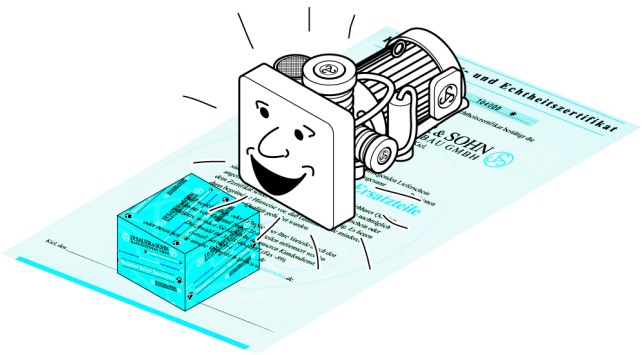
We exonerate the contractually agreed warranty claims and liability claims, if they can be attributed to at least one of the following:

- 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 improperly installed safety devices and protection devices;
- disregard of the operating instructions;
- unauthorised modifications of the machine or its control system;
- inadequate monitoring of machine parts subject to wear;
- inexpert repairs;
- force majeure.

1.3 Type approval and genuine Sauer spare parts

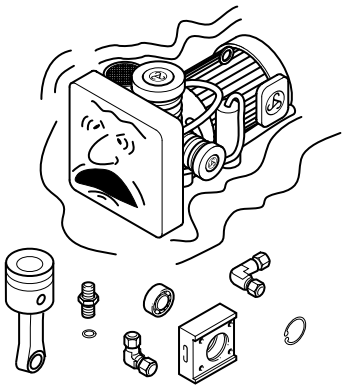
- The type approval for the Sauer compressor is valid under the condition that parts and components specified and qualified by J.P. SAUER & SOHN are used. The type approval is made by the Classification Society and the EC Declaration of Conformity or EC Manufacturer's Declaration. Please note that if non-genuine parts are used, in the event of damage the insurance cover will cease to apply.
- 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 Tontents 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 case please contact our customer service.

Correct



Only use genuine Sauer spare parts with certificate!

Incorrect



Do not use parts from the „grey market“!

1.4 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 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 type and factory number (see chapter 11. “Spare Parts and Accessories” or type label on the crankcase).

1.5 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 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.

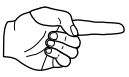
Contact J.P. SAUER & SOHN when planning conversions or modifications to obtain a written permission.

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

Danger!

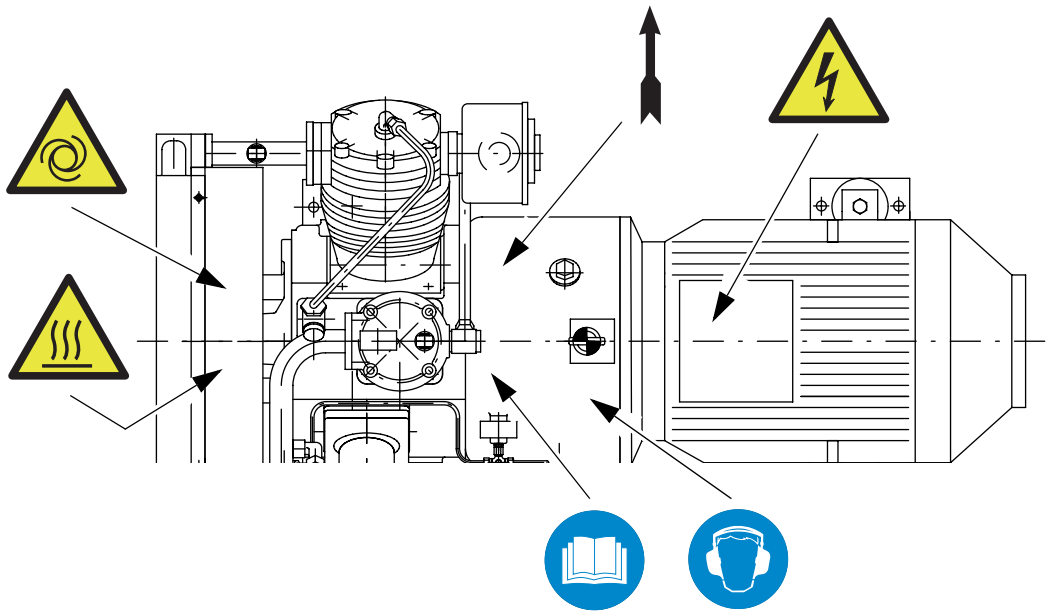
Safety markings affixed to the machine must not be altered or removed. Replace damaged or lost safety markings immediately, true to the original.

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)



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: on the honeycomb radiator;
– 2nd Compression stage: on the cylinder head of the 3rd stage's cylinder;
– 3rd Compression stage: on the final separator behind the stage;

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.

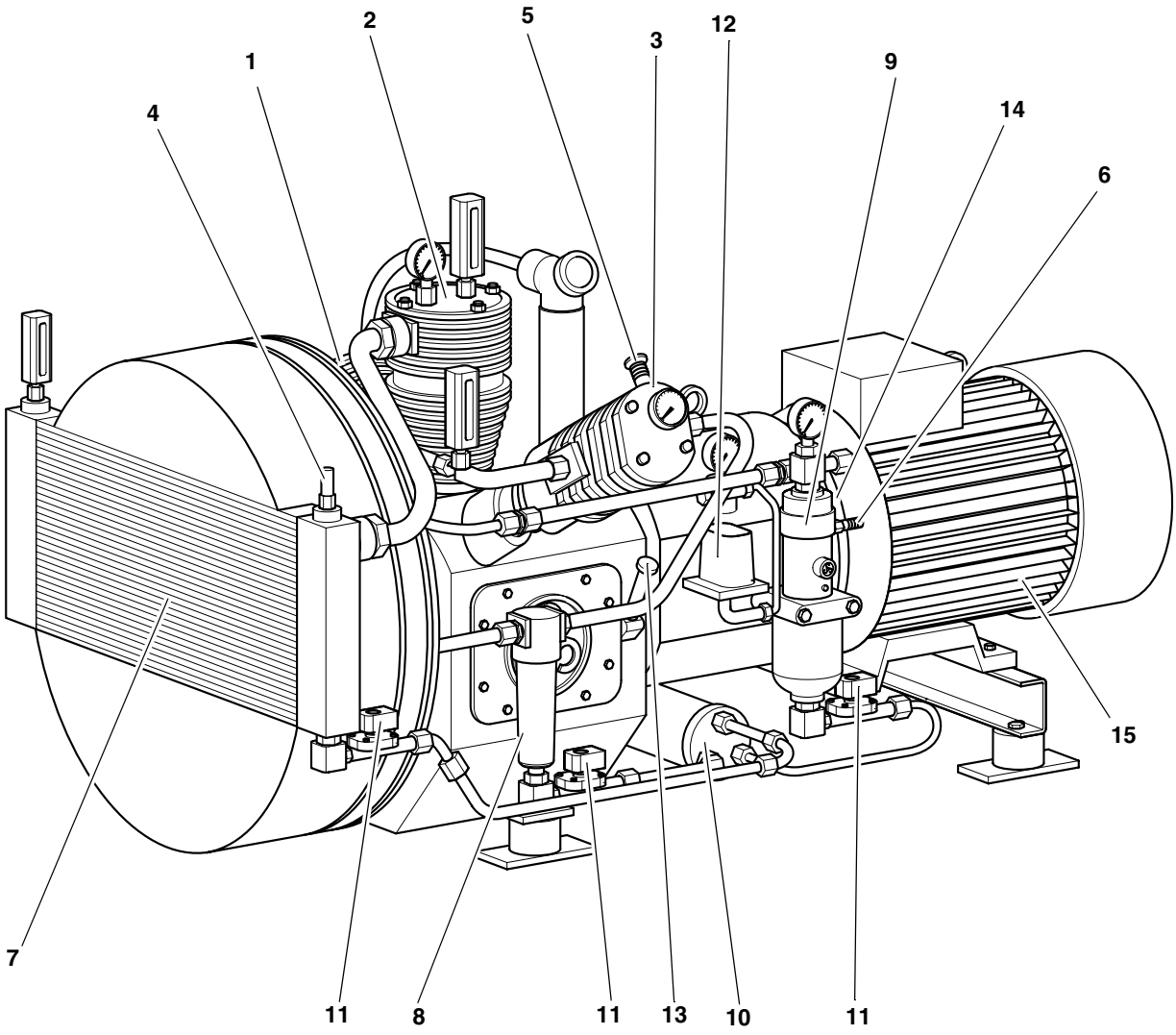
Persons authorised to service the compressor are the trained specialists of the operator and of the manufacturer.

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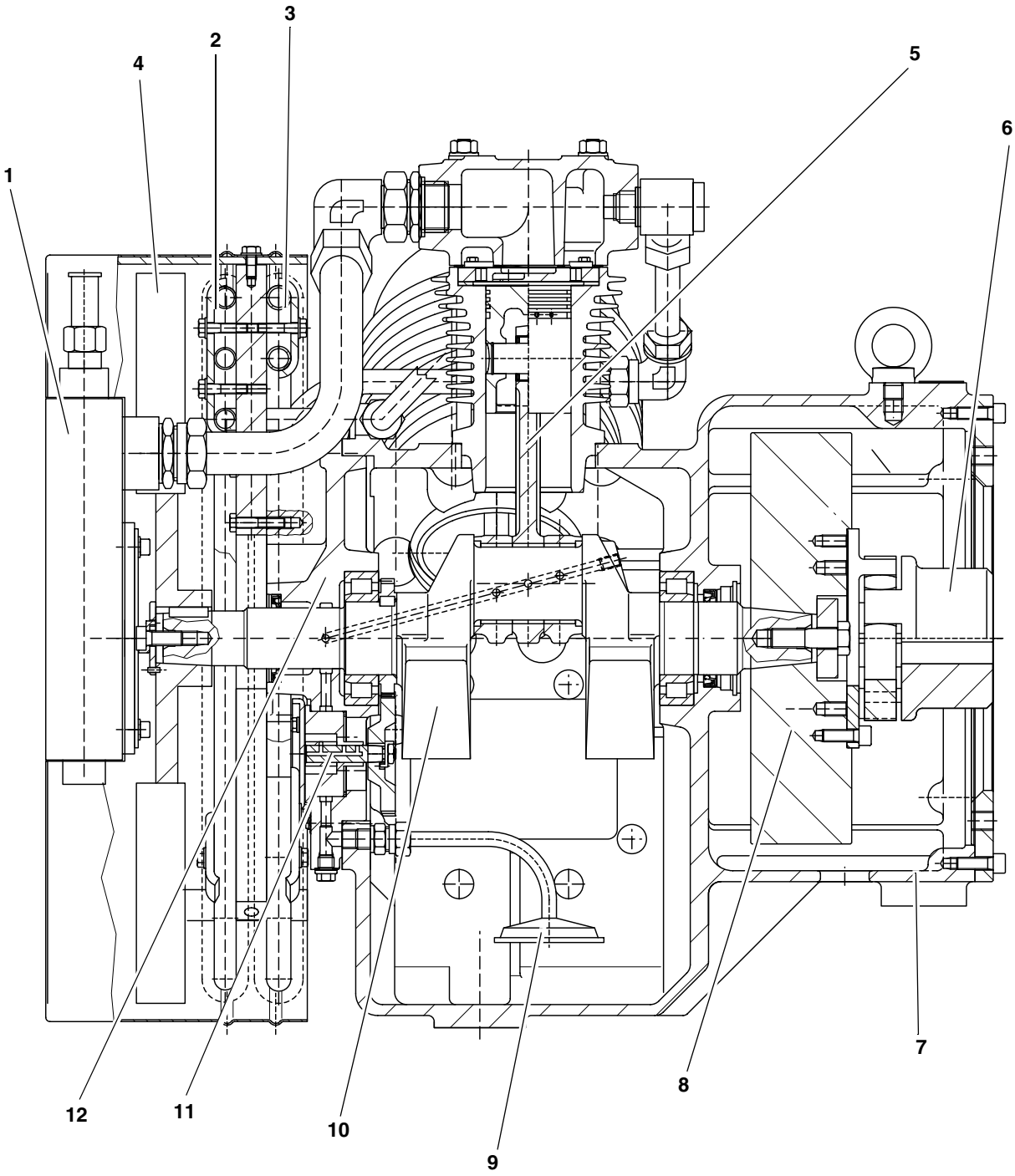
Item	Designation
1	Cylinder 1st stage
2	Cylinder 2nd stage
3	Cylinder 3rd stage
4	Safety valve 1st stage
5	Safety valve 2nd stage
6	Safety valve 3rd stage
7	Cooler 1st stage
8	Condensate separator 2nd stage
9	Condensate separator 3rd stage (final separator)
10	Condensate collecting pot
11	Drain valves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

Longitudinal section



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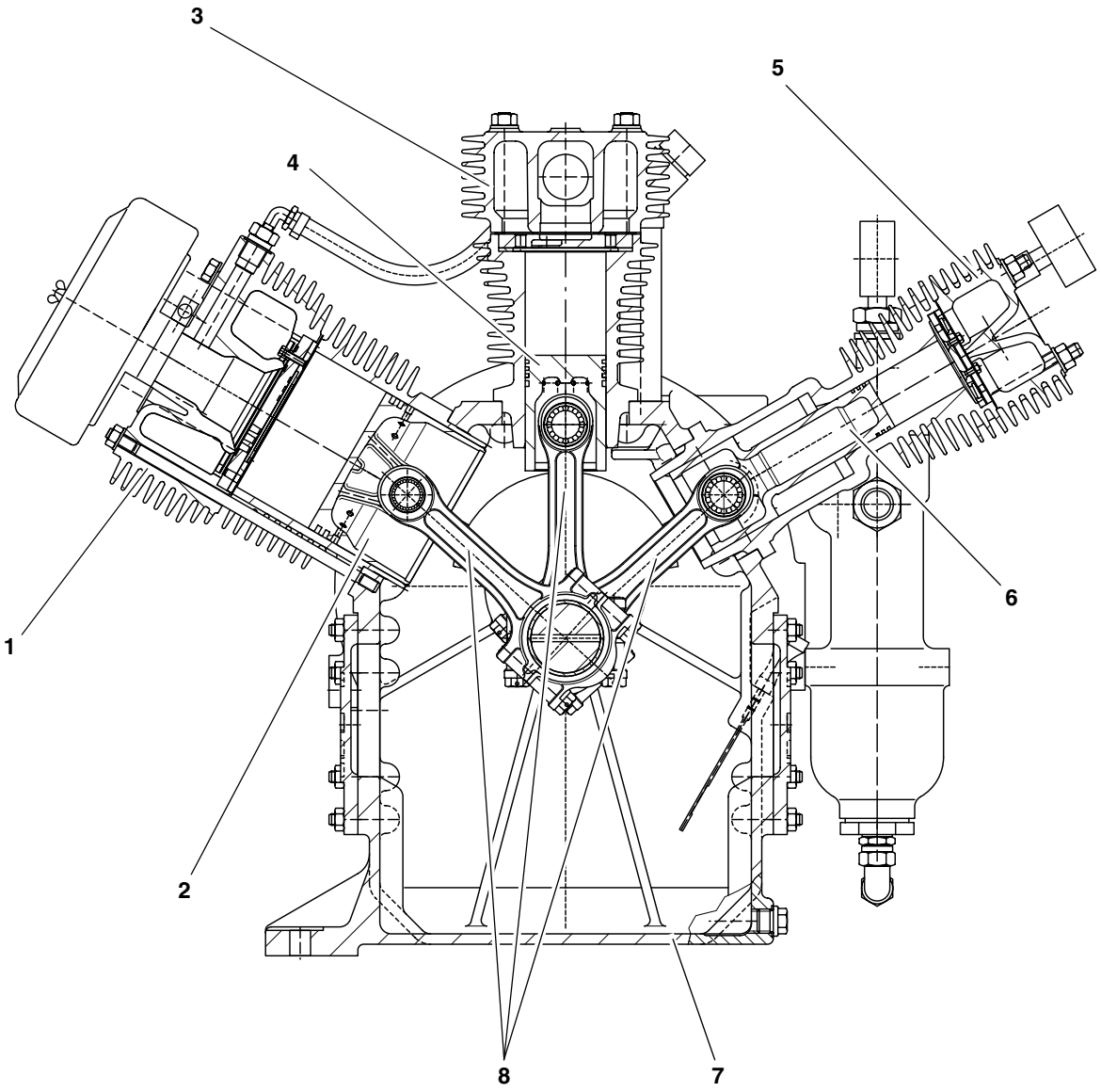
Item	Designation
1	Cooler 1st stage
2	Cooler 2nd stage
3	Cooler 3rd stage
4	Fan wheel
5	Connecting rod
6	Flexible coupling
7	Transmission bell housing
8	Flywheel
9	Oil suction filter
10	Crankshaft
11	Lubricating oil pump
12	Bearing bracket

Cross section



Note!

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

I_FK003_1A.fm

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 compressor 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 compressor 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, past 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 easy to service lamellar valves, which have a long service life. 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 stage in an aluminium honeycomb radiator;
– after the 2nd and 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 3rd stage each have a separate condensate separator for the oil- and water-saturated condensate arising from compressing and recooling.

Condensate draining/pressure relief

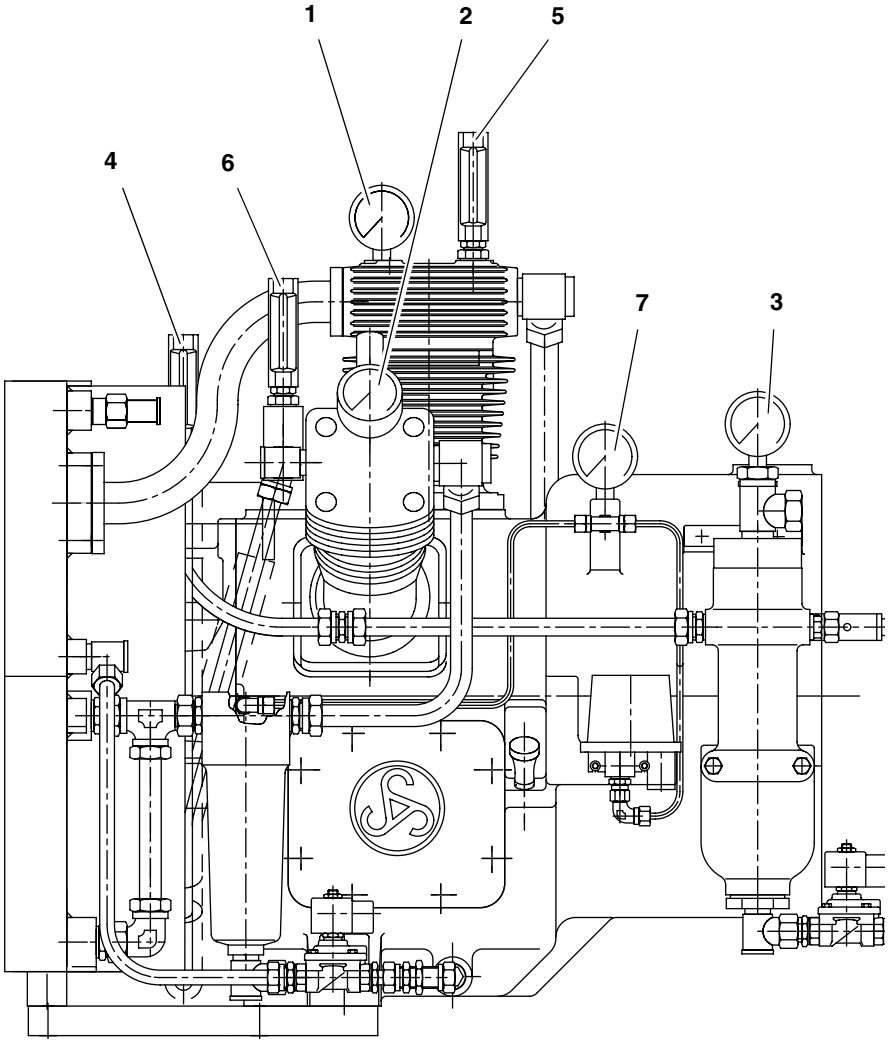
The condensate is drained through drain lines. The drain lines have solenoid valves built-in. These must be open when the Sauer compressor is unpressurized. The drain valves should close several seconds after starting and the Sauer compressor run up against pressure. During operation the solenoid valves 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 3rd 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 3rd stage	Compressed air temperature after the 3rd stage
7	Oil pressure gauge	Oil pressure of oil pump

I_FK003_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.

1. Technical Specifications

1.1 Specification data

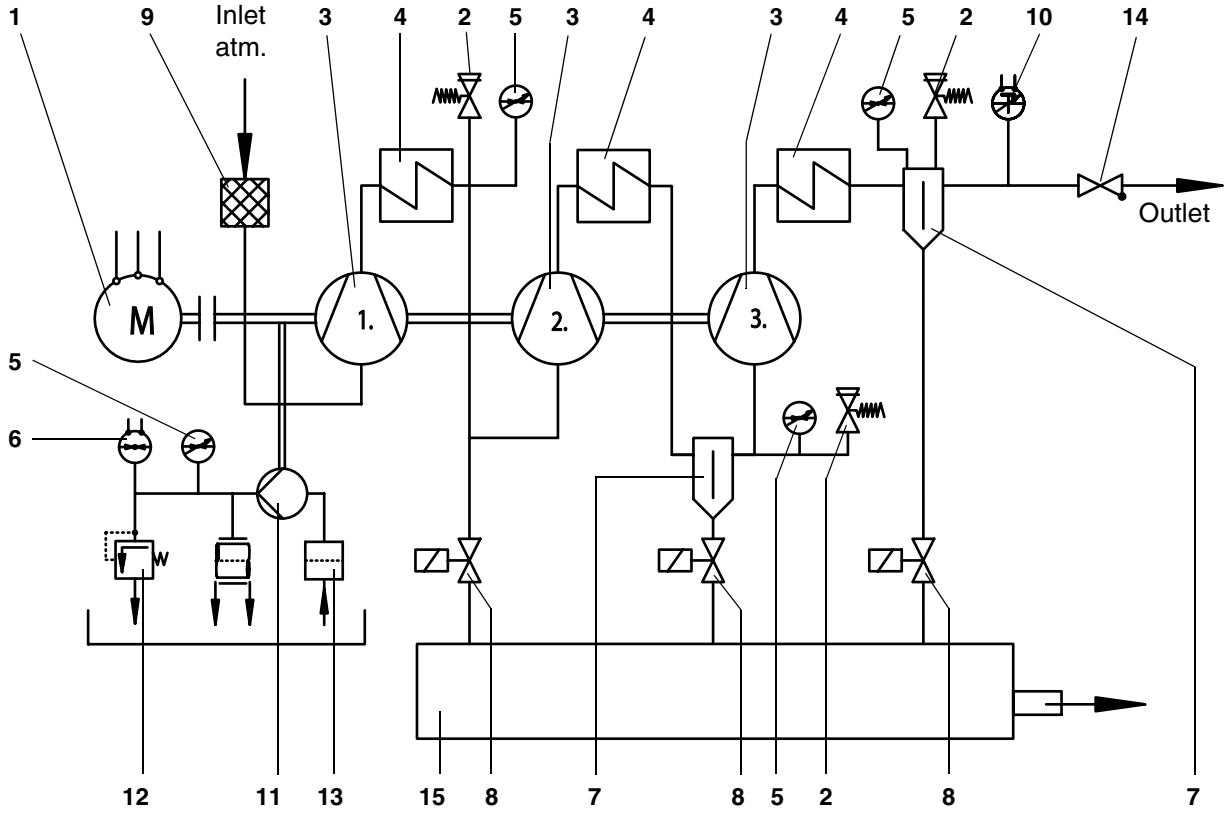
Name	Data
Compressor type	WP 66 L
Number of cylinders	3
Number of compression stages	3
Cylinder diameter 1st stage	136 mm
Cylinder diameter 2nd stage	70 mm
Cylinder diameter 3rd stage	32 mm
Piston stroke	81 mm
Maximum speed	1770 rpm
Direction of rotation (as seen on flywheel)	clockwise
Maximum working pressure	80 bar
Set pressures of safety valves:	
1st stage	4 bar
2nd stage	23 bar
3rd stage	5 % above final pressure
Oil sump quantity	10.5 l
Oil refill quantity - MAX / MIN	2.0 l
Oil type	see chapter 10 “Lubricant table”

Name	Data
Oil pressure switch:	
Maximum switching current	6A / 220 V
Setting	as customer‘s specification
Switch function	change-over contact
Drain valves (solenoid valves):	
Power	18 VA / 14 W
Setting	currentless open; starting relief: approx. 15 seconds; periodic drainage: every 15 min for 15 s
Ultimate pressure switch (option):	
Maximum switching current	6A / 220 V
Setting	to customer's specifications
Switch function	change-over contact
Compressed air-contact thermometer (option):	
Maximum switching current	16A / 440 V
Setting	closes at 80 °C rising
Switch function	change-over contact
Sound pressure level (in free sound field at 1 m distance)	maximum 80 dB(A)
Weight and dimensions	see plan of installations

Note!

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

4.2 P&I-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

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.

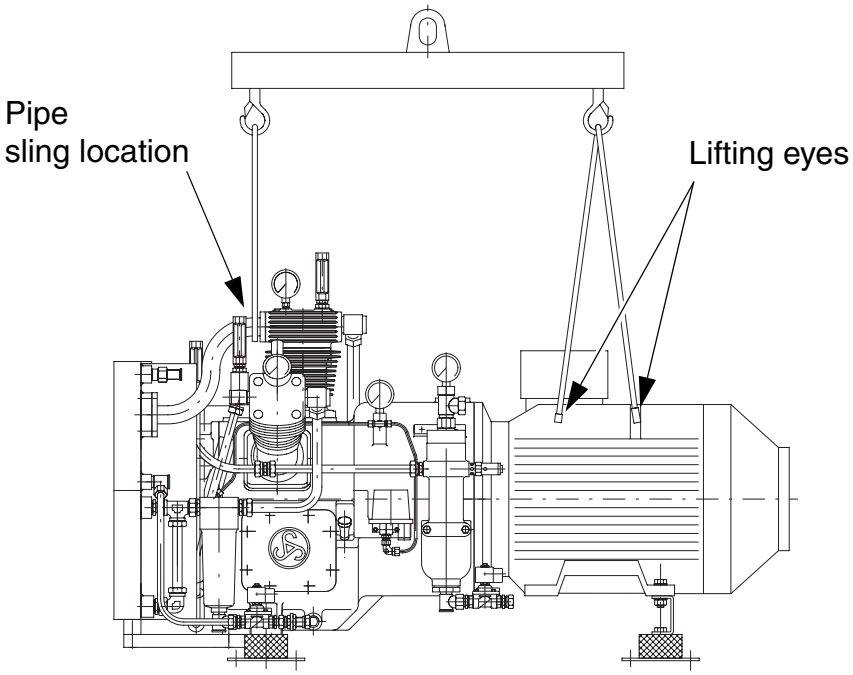
Transportation

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 two lifting eyes and at the pipe (see illustration). Protect pipe sling location against scratching.
- 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

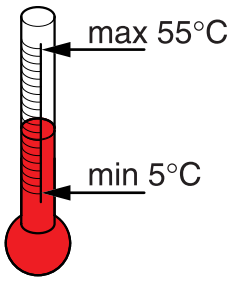
Note!

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

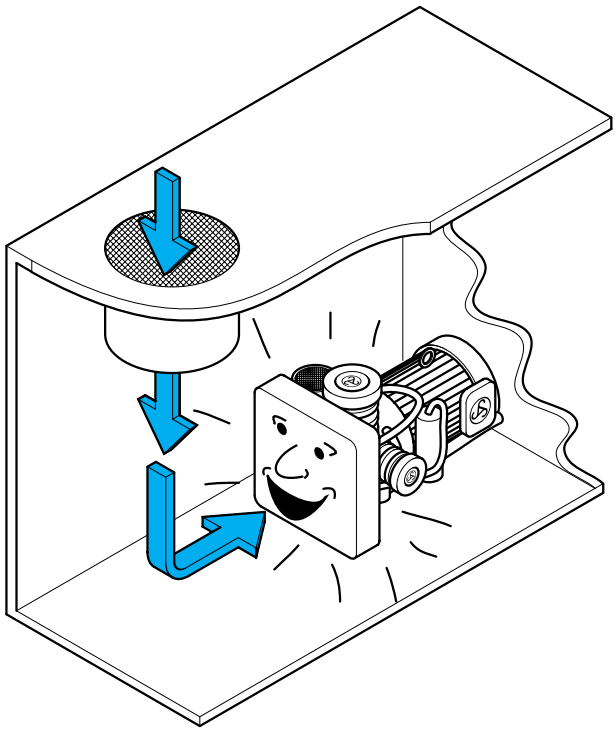
– The place of installation must be dry and free of dust.
– The place of installation must be vented in such way that the heat generated during operation is dissipated.
– Room temperature while the Sauer compressor is running: +5 … +55 °C
(deviating temperatures only if confirmed in writing by J.P. SAUER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



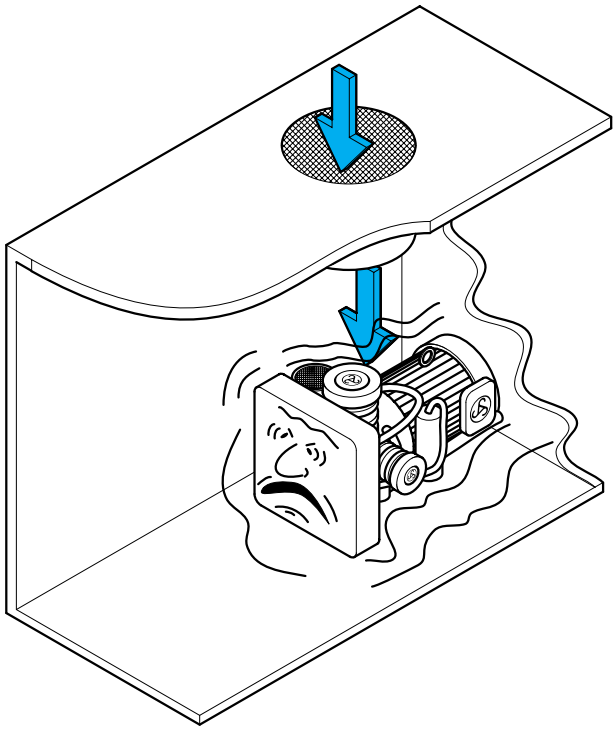
Note!

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.



This way is correct!



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!

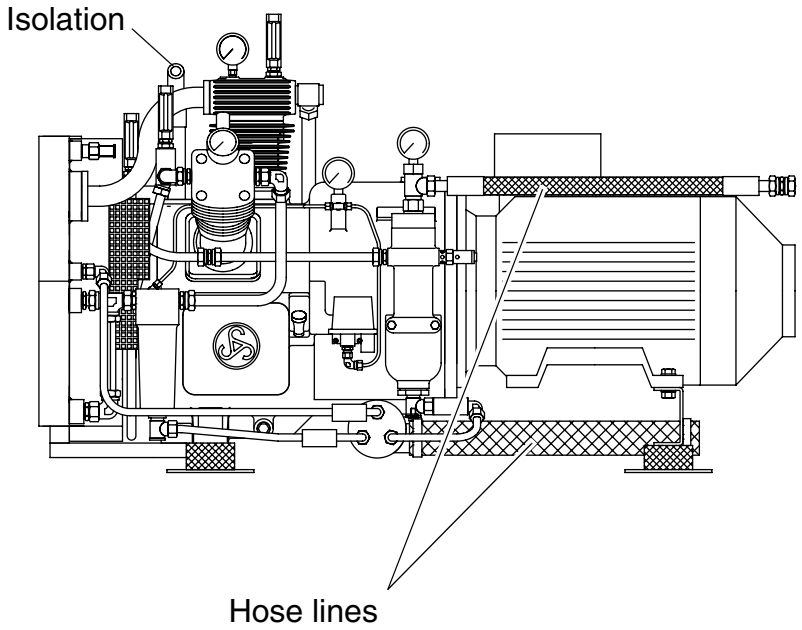
The compressor should only be connected by qualified technicians. Any work on the electrical installation must be carried out by qualified electricians only.

Note!

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

Pipelines

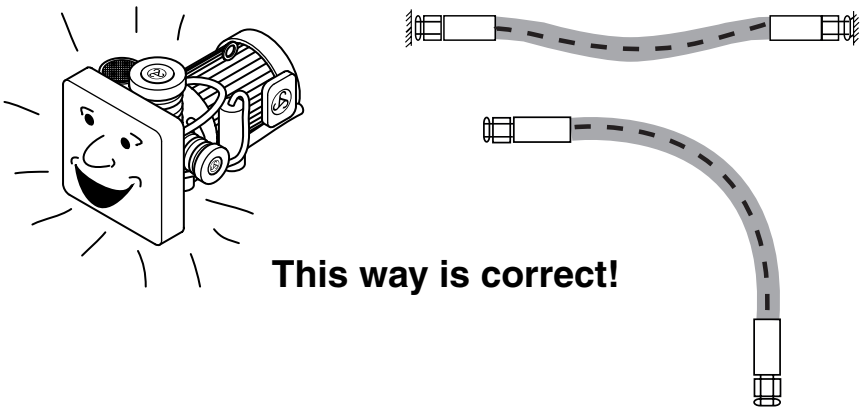
The compressed air outlet and the drain outlets of the Sauer compressor must be connected to the stationary pipelines by hose lines.



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.



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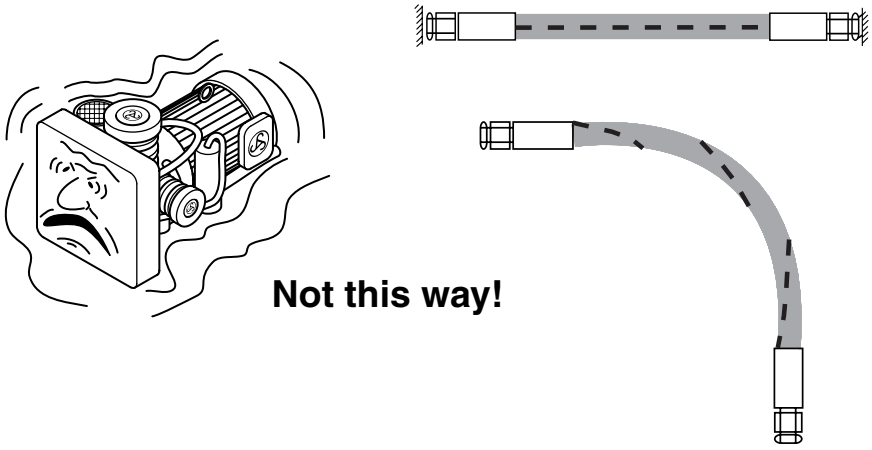


Not this way!

Drainage

Note!

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

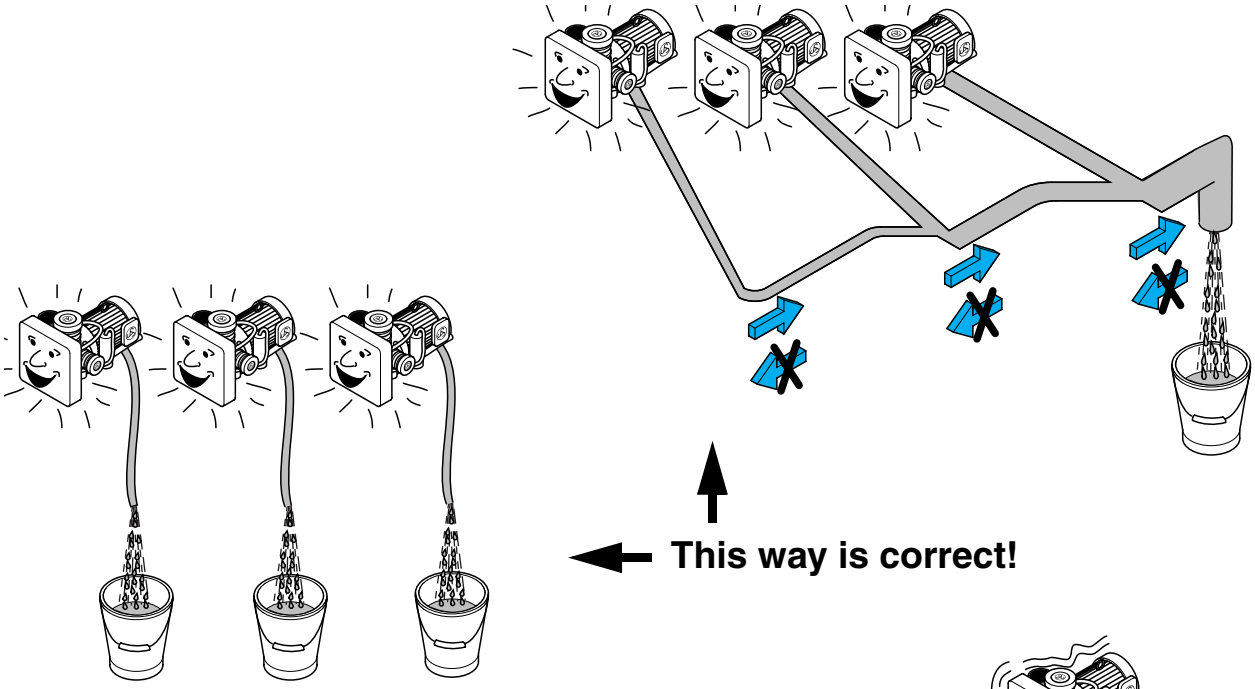
J.P. SAUER & SOHN can supply condensate collecting pots for separating condensate, as well as condensate treatment units for separating the oil from the condensate.

Note!

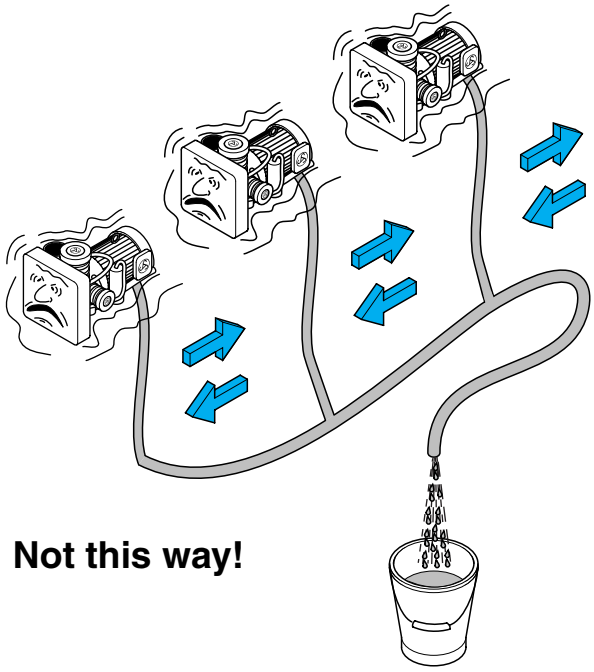
We recommend connecting the compressor's drainage separately.

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.



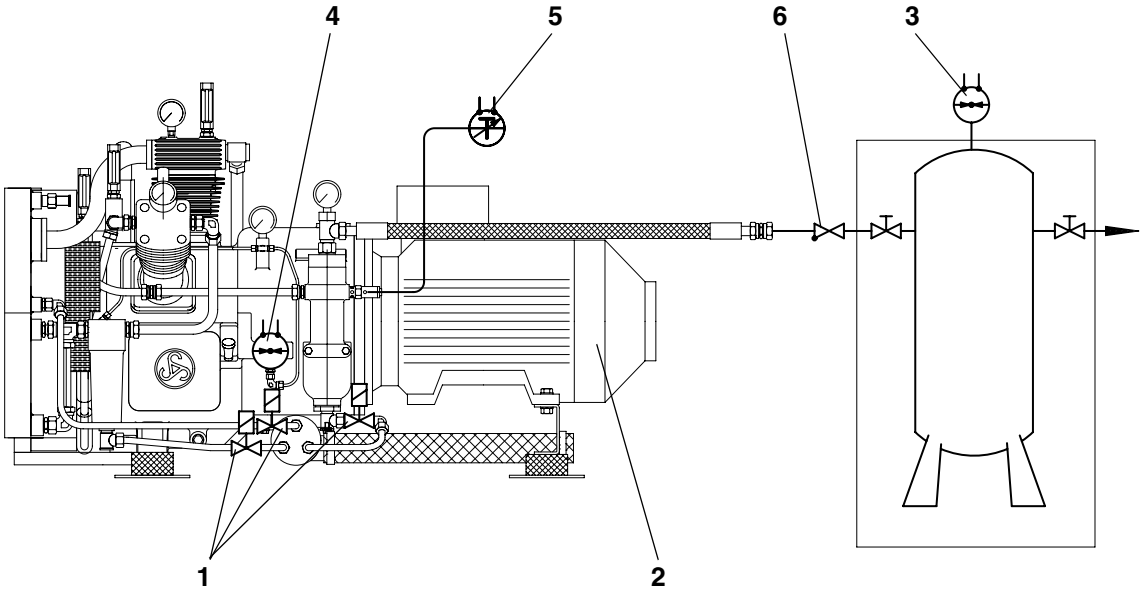
This way is correct!



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	Drive motor	3-phase motor	Drive of the compressor
3	Ultimate pressure switch	Selective switch	Stops/starts the compressor
4	Oil pressure switch	Selective switch	Stops compressor when oil level is low
5	Temperature control (optional)	Selective switch	Stops compressor in case of excess temperature
6	Non-return valve	Plate valve	Prevent air backflow

5.5 Setting the ultimate pressure switch

Note!

The ultimate pressure switch must be connected directly to the compressed air receiver to ensure a quiet and uniform compressor operation.

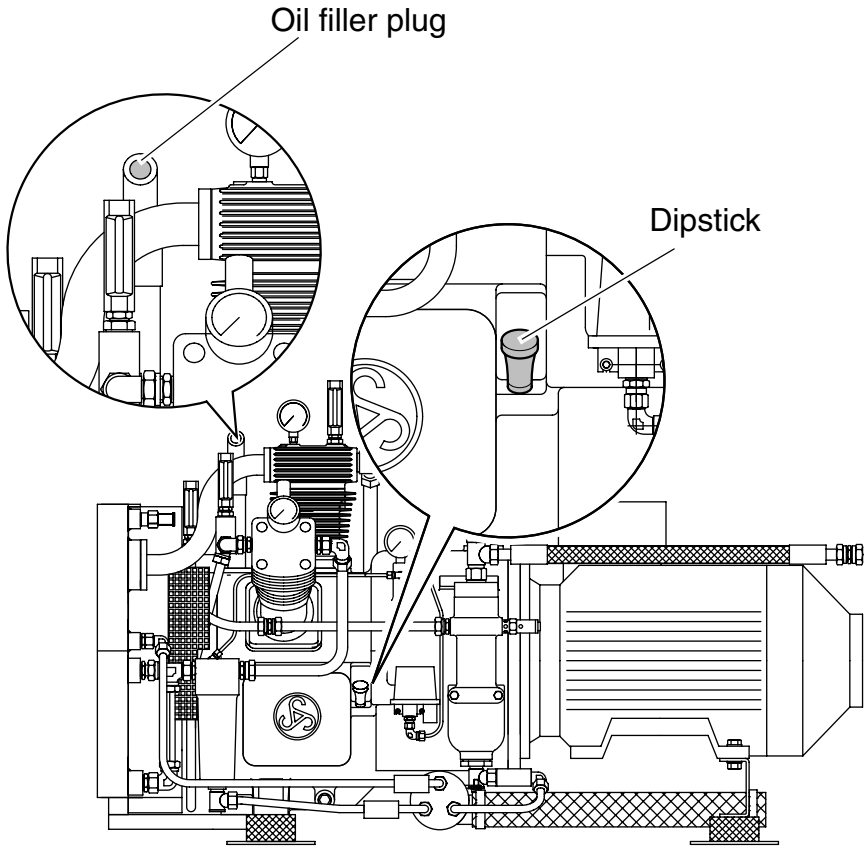
The pressure loss between the compressor and compressed air receiver must be taken into account for selecting the maximum set pressure. Too high a set pressure can cause the safety valve of the final stage to blow off.

5.6 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 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.

5.7 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.

Danger!

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 drain 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.

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 chapter 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.
- Check the oil level once a week before starting, top up if necessary. Do not fill oil beyond the maximum mark.

Operation

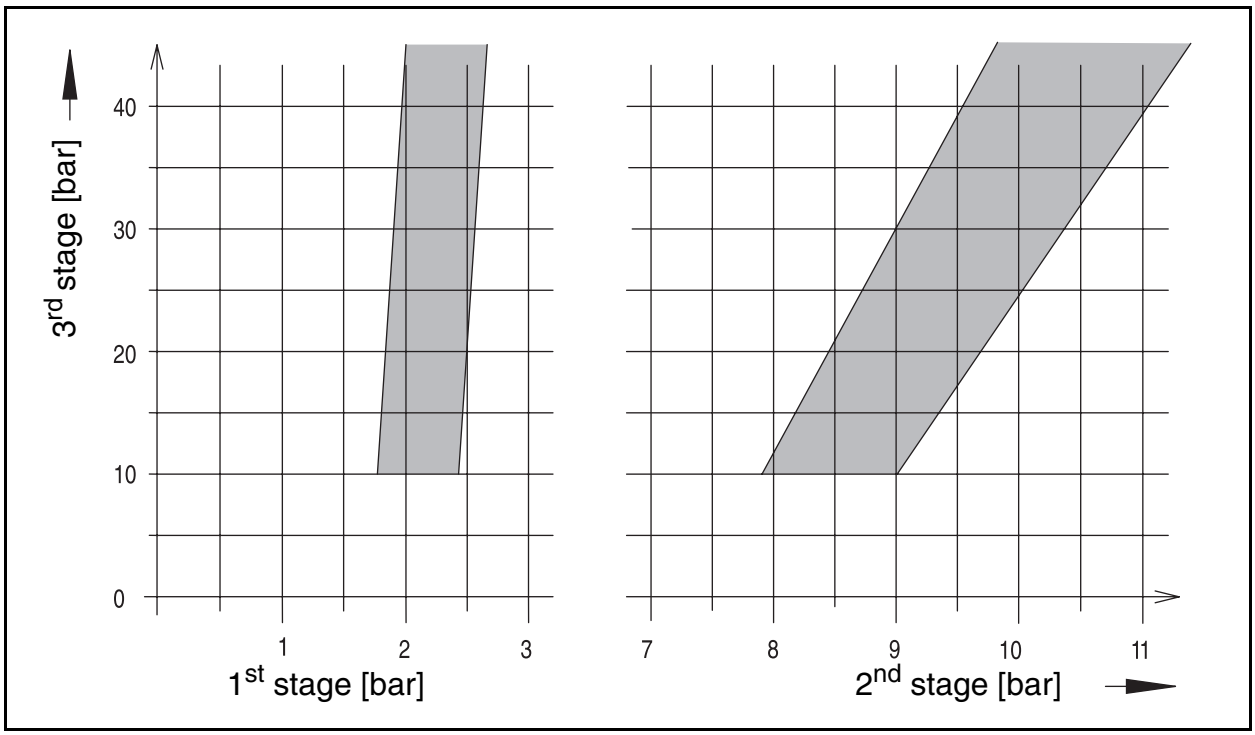
1. Turn power supply ON.
2. Set operating mode selector to “Auto” to operate the compressor in Automatic mode.

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.

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.
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.
	Very short compressor run time.	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 chapter 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									❑						❑
Replace shaft seals 8.13															❑
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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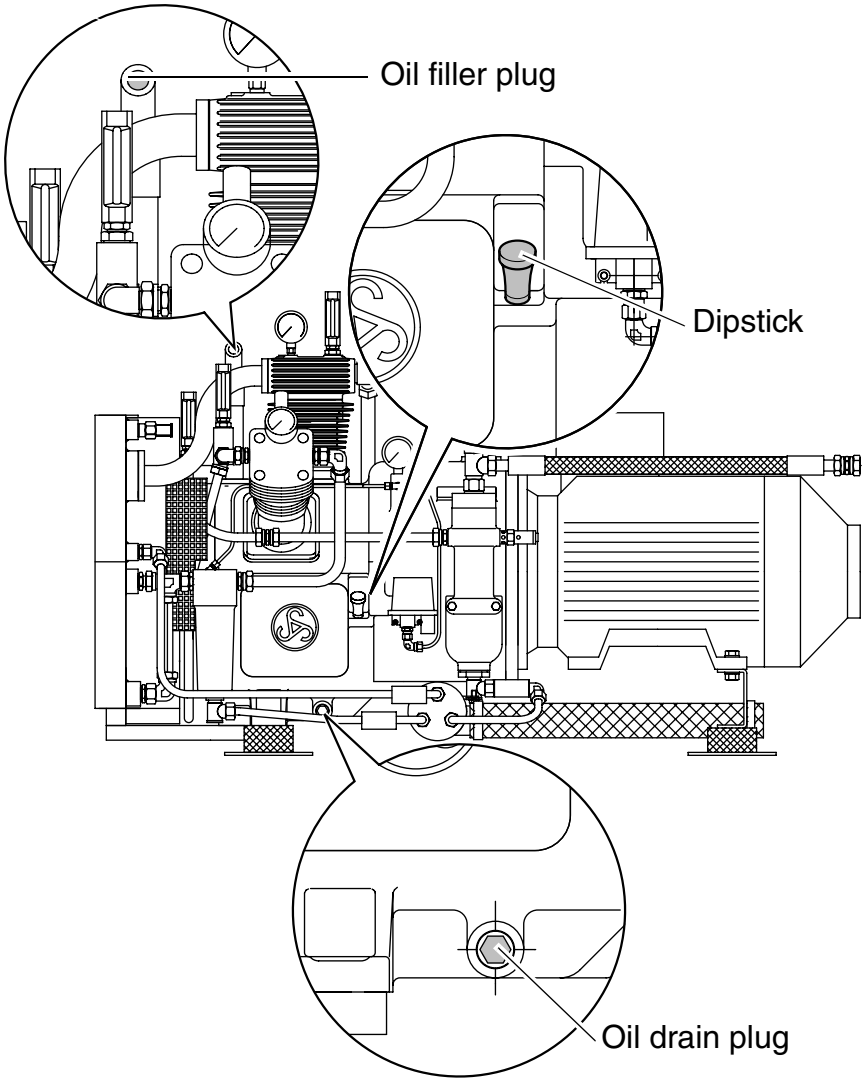
8.4 Table of tightening torques

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 chapter 10).



1. Place oilpan (of a capacity sufficient to hold the complete oil filling, see chapter 4 “Technical Specifications”) below the oil drain plug.
2. Remove the oil drain plug.

3. Wait until all oil is 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.

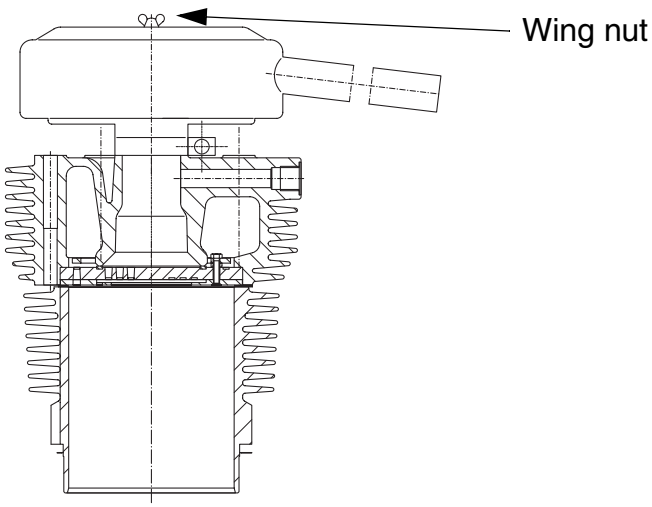
7. Put dipstick back in and screw the oil filler plug back on.

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. Unscrew wing nut and take the air filter cap off.
2. Remove the used air filter cartridge.
3. Put new air filter cartridge in.
4. Refit cap and tighten the wing nut.

8.8 Checking 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.

Checking the lamellar valves (1st, 2nd, 3rd stage)

4. Check valves. If lamellar valve is heavily coked or damaged, replace complete valve.

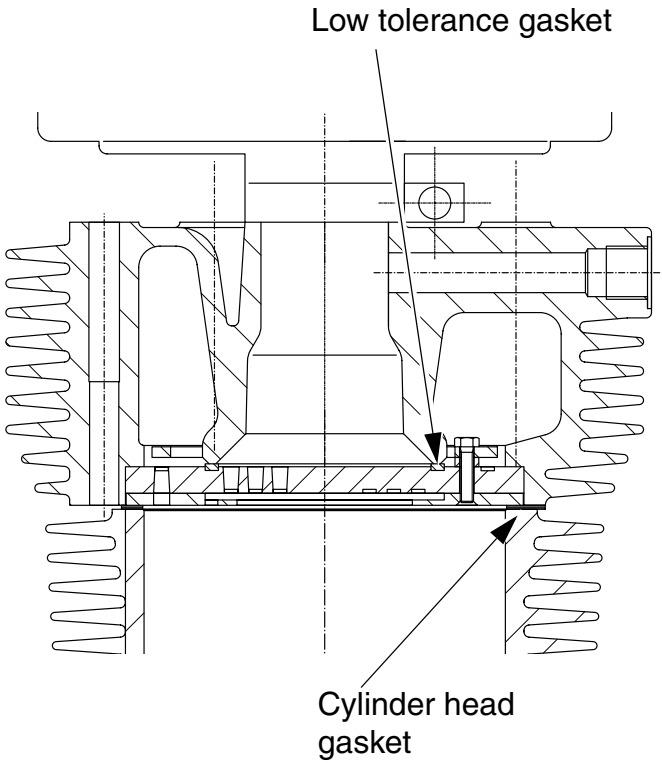
Note!

The 1st, 2nd, and 3rd stage lamellar valves are of the low-maintenance type and, contrary to plate valves, are operative even when slightly soiled. Normally the plates have the same service life as the valve body which, due to its geometry can not be refaced or lapped. Therefore a replacement of individual plates is not recommended.

Should a plate be broken prematurely nevertheless (e.g. through the influence of foreign objects), contact our service.

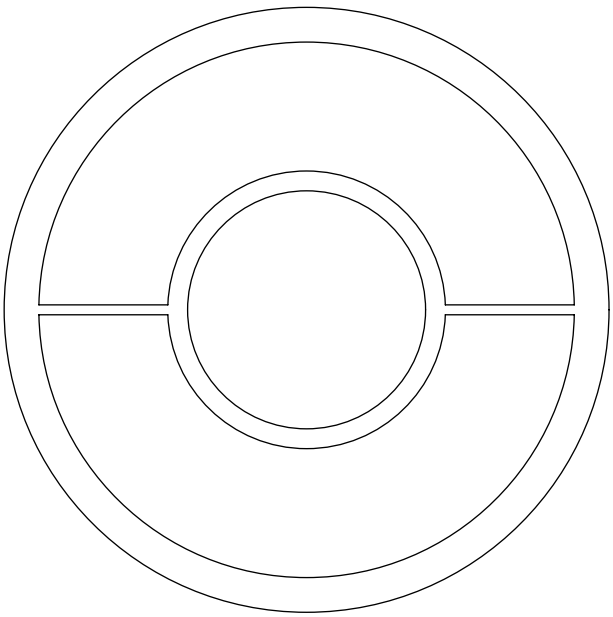
Valve installation

5. Install lamellar valve and cylinder head of the 1st stage, using new cylinder head gaskets and a new low tolerance gasket (see illustration).

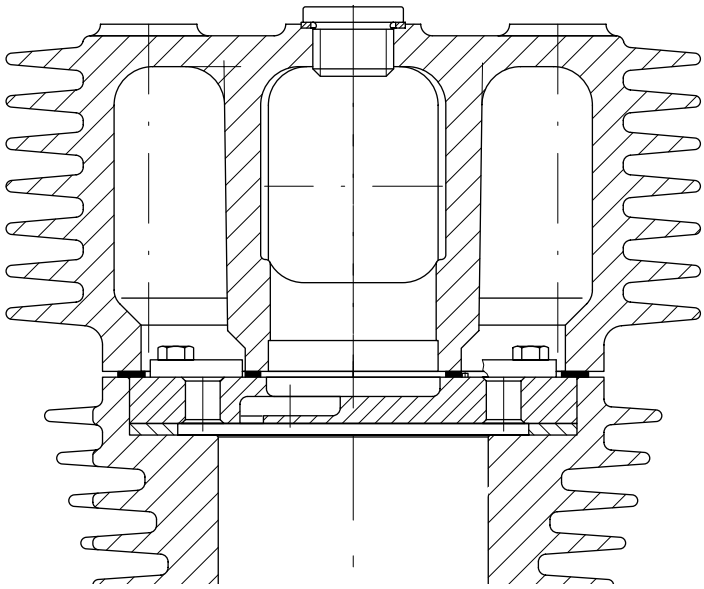


Note!

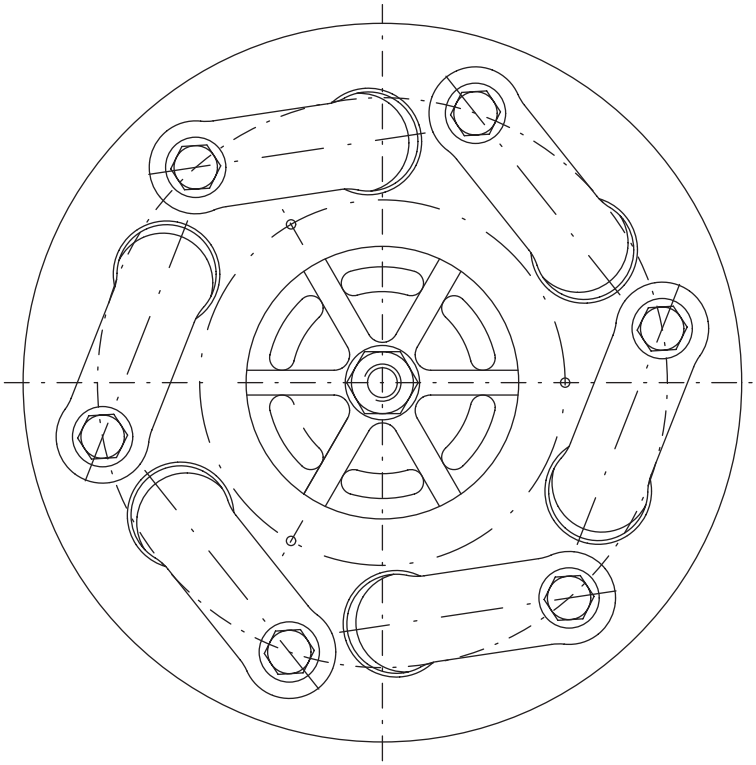
Never turn the old low tolerance gasket upside down. Doing so leads to leakage within a short time.



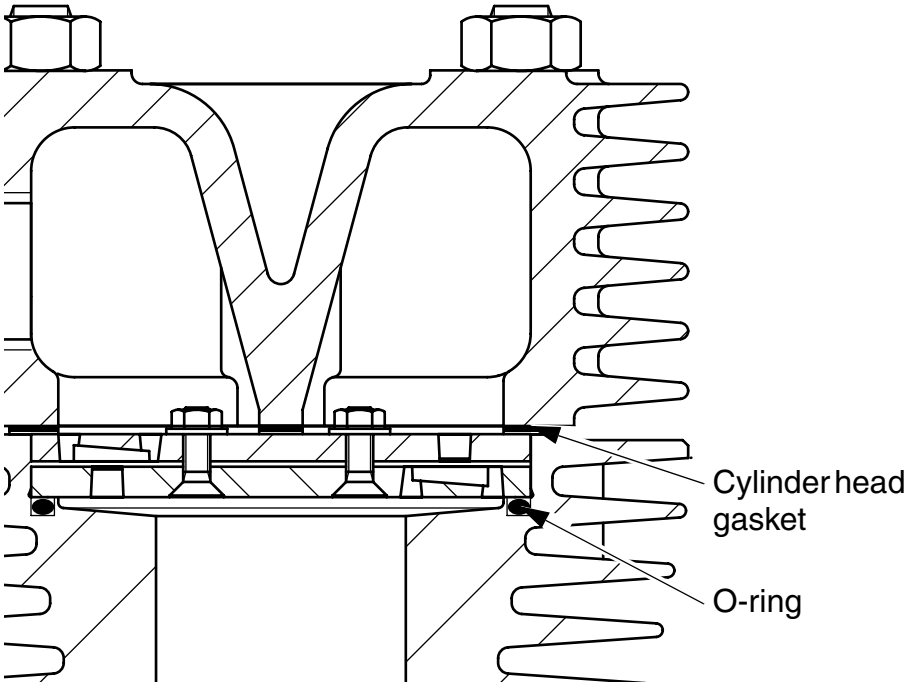
6. Remove bars to separate inner and outer rings of cylinder head gasket.
7. Install lamellar valve and cylinder head of the 2nd stage, fitting a new cylinder head gasket between valve and cylinder head.



8. Insert inner ring between pins



9. Install lamellar valve and cylinder head of the 3rd stage, fitting a new O-ring in the cylinder below the valve and a new cylinder head gasket between valve and cylinder head.



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

Note!

Lamellar valves in particular are the parts in a compressor pump that are subject to the 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 chapter 8.8 “Checking the valves”.
2. Unscrew the cylinder base screws of the 3rd stage.
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.

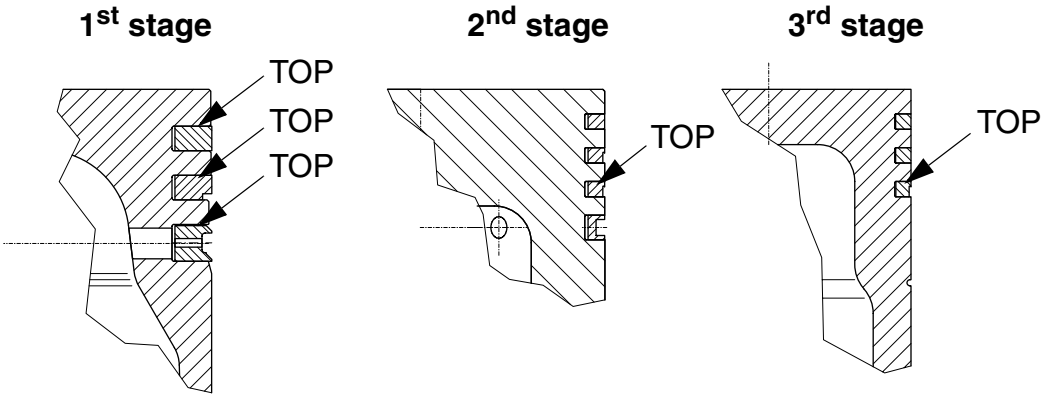
4. Remove circlips of gudgeon pins, push gudgeon pin out and take piston off.
5. Remove all piston rings from the pistons.
6. Place piston rings in their respective cylinders and measure the gap clearance with a feeler gauge.
7. Replace piston rings if the gap clearance exceeds the following limits.

1st stage	1.40 mm
2nd stage	0.80 mm
3rd stage	0.60 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 the cylinder base screws of the 3rd stage.
13. Install cylinder heads and valves as described in chapter 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 section 3.1 “Overview”.) Observe tightening torque.
8. Install inspection hole cover.
9. Install cylinder and pistons as detailed in section 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. 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. 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 for diameter
1st stage	136.15 mm
2nd stage	70.10 mm
3rd stage	Top part: 46.10 mm Guide part: 80.10 mm

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

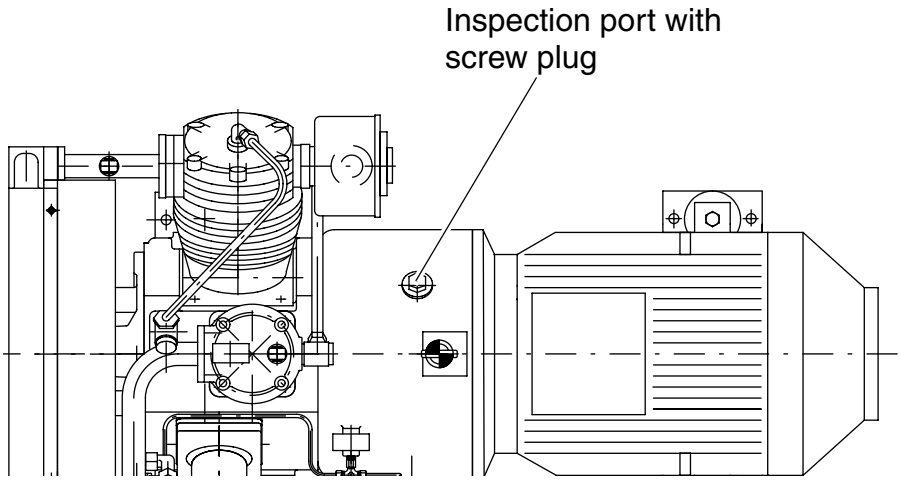
Only replace shaft seals of crankshaft bearing when the bearing bracket is removed, not when fitted!

9. Check crankshaft bearings, replace if substantially worn.
10. Install crankshaft.
11. Install bearing bracket.Use new gasket.
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

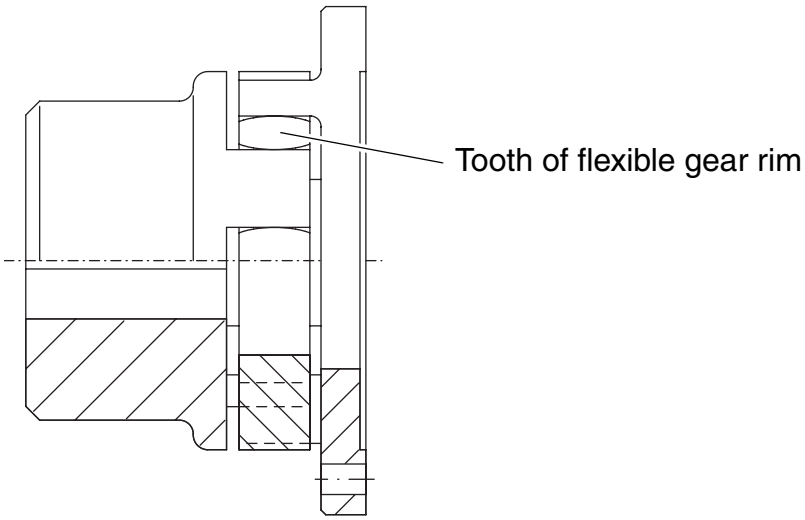
Visual check

- 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.



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

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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!

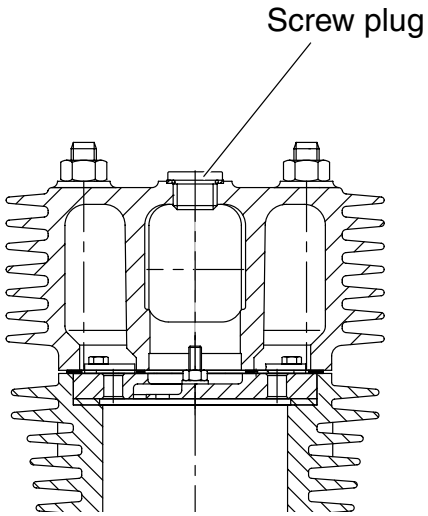
Use one of the slushing oils recommended in chapter 10. “Lubricant Table”.

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

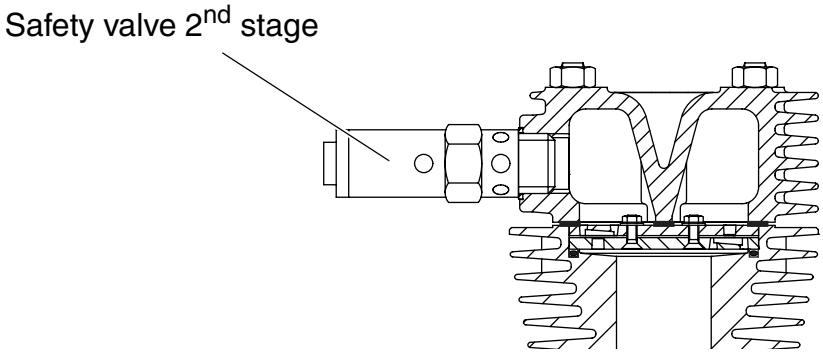
1. Run compressor for approx. 5 minutes with open drain valves and opened pressure line.

✓ Any existing condensate is blown off.

2. Drain compressor oil and dispose of in an environmentally friendly manner.
3. Fill in approx. 6 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.
7. Remove screw plug 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 the safety valve of the 2nd stage from the 3rd stage's cylinder head.



11. Inject approx. 10 cc of slushing oil into the cylinder head opening.
12. Replace safety valve and tighten.
13. Start compressor and slowly inject approx. 15 cc slushing oil into the intake port.
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 power lines from the mains 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 chapter 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

Scope

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 inert, noble or hazardous gases;

– temperature ranges outside of +5 … +55°C.

General recommendation

We recommend mineral oils of the viscosity class in accordance with **ISO VG 100** for the temperature range 5 … 55°C. The lubricating oils should at least conform to the group **VCL** in accordance with **DIN 51506**.

We do **not** permit the use of synthetic lubrication oils with 2-stage air-cooled compressors the following reasons:

– The good hydrolytic properties of synthetic oils causes moisture to condense in the crankcase, risk of corrosion and drive damage.

– Because of their design, 2-stage air-cooled compressors have low final compression temperatures, rendering the hight temperature stability of synthetic oils useless.

Note!

The recommended oil types reduce carbonisation in the compressor valves and the connected pipes and fittings to a minimum.
Lubricants not referred to in the lubricant table may only be used after approval by J.P. SAUER & SOHN. Otherwise the warranty is void.
Please contact our customer service when selecting oils not listed or if operating conditions differ from those recommended.

Note!

Unless otherwise ordered, Sauer Compressors are delivered without oil..

10.1 Lubricating oils

The approved list of mineral oils can be used in Sauer compressors; as a standard for industrial applications, the mineral oil **Shell Corena P 100** is used in Sauer compressors.

Brand	Product name	Class
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 Compressor Oil 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 navy applications the NATO classified synthetic oil **NATO OY 1230** can be used as an alternative without restriction:

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

10.2 Preservation oils

Mobilarma 524 is recommended to be used as preservation oil for Sauer compressors.
Alternatively, the following preservation oils can be recommended:

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

Note!
The product name may vary by country.

11 Spare Parts and Accessories

Note!

Please note the information in Chapter 1 “General” regarding our genuine Sauer spare parts.

J.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 air system, such as:

– fully automatic control systems;
– adsorption dryers;
– refrigerant type dryer;
– filters;
– silencing cabinets;
– pressure 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 these instructions.

– With the help of illustrations and lists the required parts can be quickly found.
– The spare parts catalogue, including the operating instructions is also available on CD-ROM. An order form can be completed, printed out and sent immediately.
  To do so, you need the **main specification** 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 construction:					

Furthermore, the **number of operating hours** should be stated, 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 outside vendors.

Start-up log sheet for compressors

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

Purchaser		**Operating company**	**Installation**
Company		Company	
Street		Street	
Postcode		Postcode	
Contact person		Contact person	
Telefone number		Telefone number	
Customer number			
Order number			
Compressor type		Serial number	
Delivery date		Operational hours	
Start-up date			
Sauer service engineer	Company/Name		
	Company/Name		
	Company/Name		
	Company/Name		

Installation of compressor / Complete system ☐ good ☐ fault		Rotation check	
		Compression temperature	°C
Ventilation ☐ good ☐ fault		Suction temperature	°C
		Start/stop pressure	
Environment 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:	
Compressed air vessel		
Refrigerant type dryer		
Adsorption dryer	☐ good	☐ fault
Filter		
Condensate removal		

Operatiors have received instruction and are familar with safety and maintenance required.
The maintenance instructions are ready available.
The operating company has been advised to only genuine SAUER & SOHN spare parts.

Notes / Faults:

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

Purchaser Operating company Authorised SAUER service partner

☐ **Return of goods**
☐ **Notification of claim**

Date:

J.P. SAUER & SOHN
Maschinenbau GmbH
Brauner Berg 15 - 24159 Kiel
Phone: +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.
Station

End customer:
Company
Street
Postcode / Place
Customer-No.
Station

Please always complete:
Compressor type:

Serial No.:

Running hours:

Date of fault:

Ambient temperature:

Spare parts

Description	Quantity	Part-No.

Reason for return

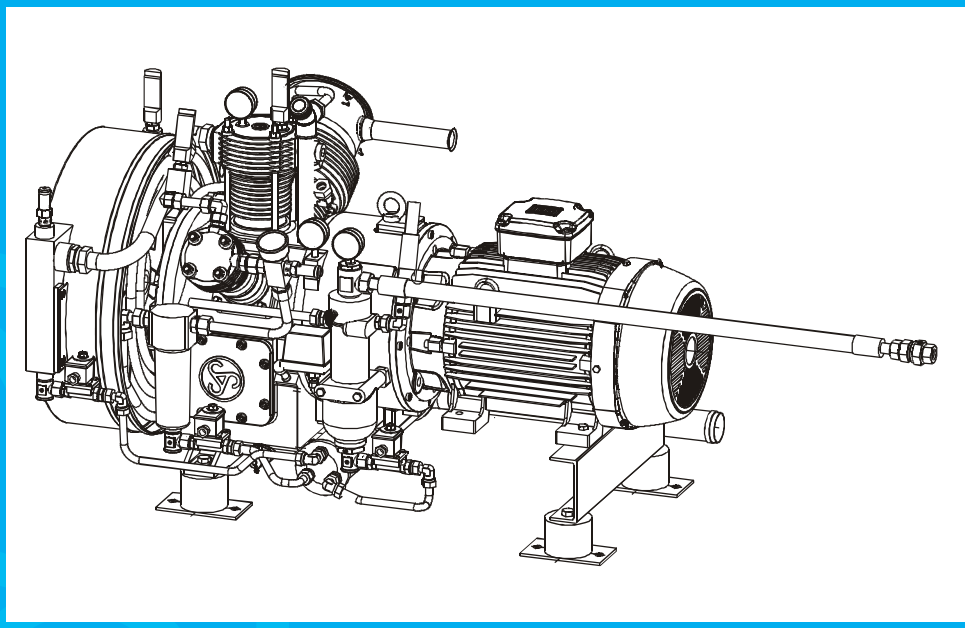
Report on fault ☐
Repair ☐
Checking by matter of goodwill ☐
☐
Goods returned against credit note ☐

Short description of fault

To be completed by manufacturer

Report

J.P. SAUER & SOHN
MASCHINENBAU GMBH



Sauer Compressor

Type: WP 66 L

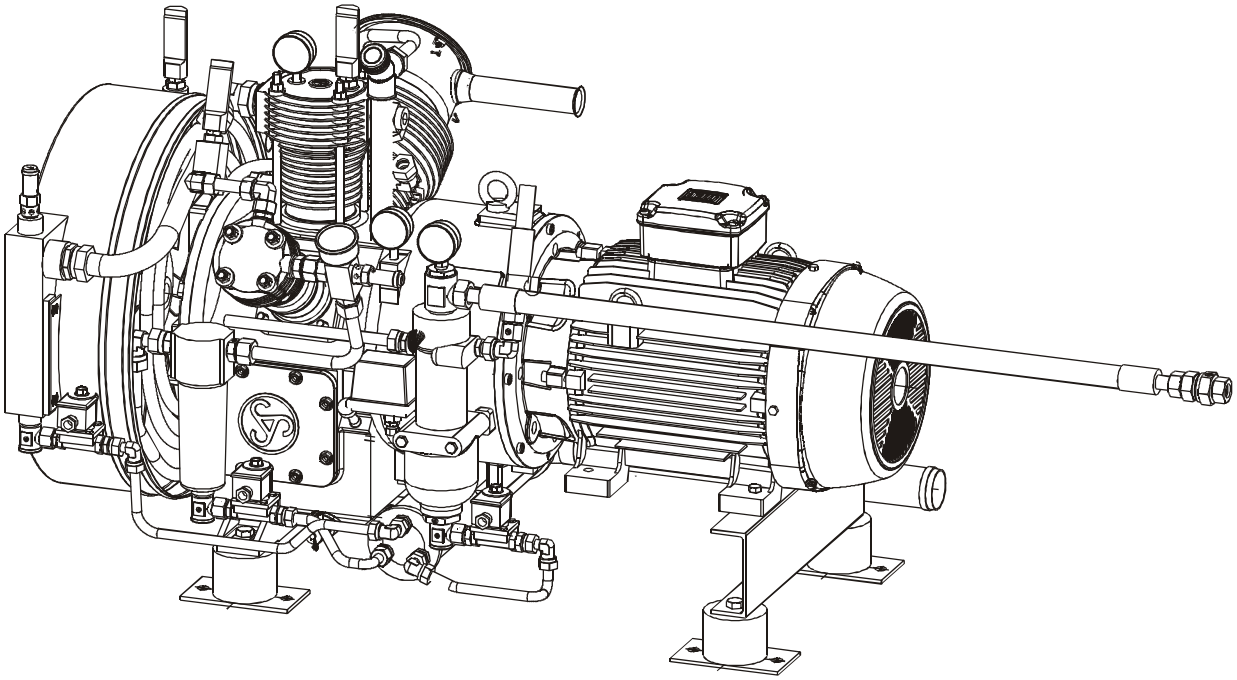
Spare Parts List

Ein Mitglied der
SAUER-Gruppe

Sauer Compressor WP 66 L

Note:
Explainations of the assemblies in Chapter 3 “Design and Function“ of the operator manual.

Sauer Compressor WP66L

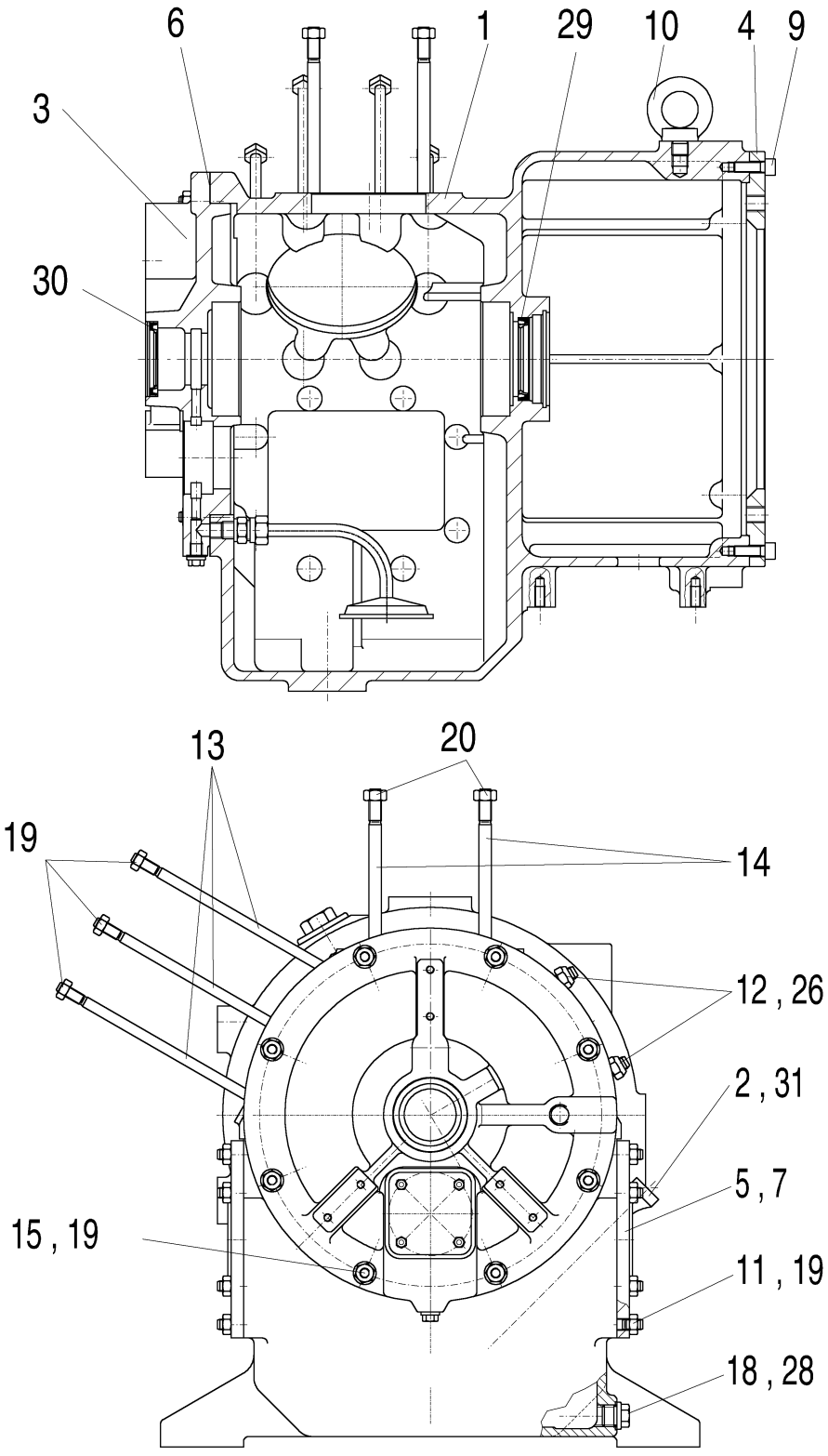


Sauer Compressor WP66L

Item	Ref. No.	Description	Qty.
1	064 106	Crankcase	1
2	064 284	Crankshaft	1
3	063 102	Connecting rod 1st stage	1
4	063 103	Connecting rod 2nd stage	1
5	062 981	Connecting rod 3rd stage	1
6	031 881	Piston 1st stage	1
7	062 525	Piston 2nd stage	1
8	064 108	Piston 3rd stage	1
9	064 109	Cylinder with head and valve 1st stage	1
10	064 110	Cylinder with head and valve 2nd stage	1
11	064 111	Cylinder with head and valve 3rd stage	1
12	064 112	Cooler complete	1
13	064 302	Crankcase vent	1
14	064 105	Final separator complete	1
15	064 118	Measuring device	1
16	064 119	Lubricating oil pump and drive	1
17	037 320	Flexible coupling	1
18	1)	AC drive motor	1
19	065 248	Resilient mounts	1
20	064 458	Automatic drainage	1
21	064 773	Manual drainage	1

1) AC drive motor ref. No. as customer's specification.

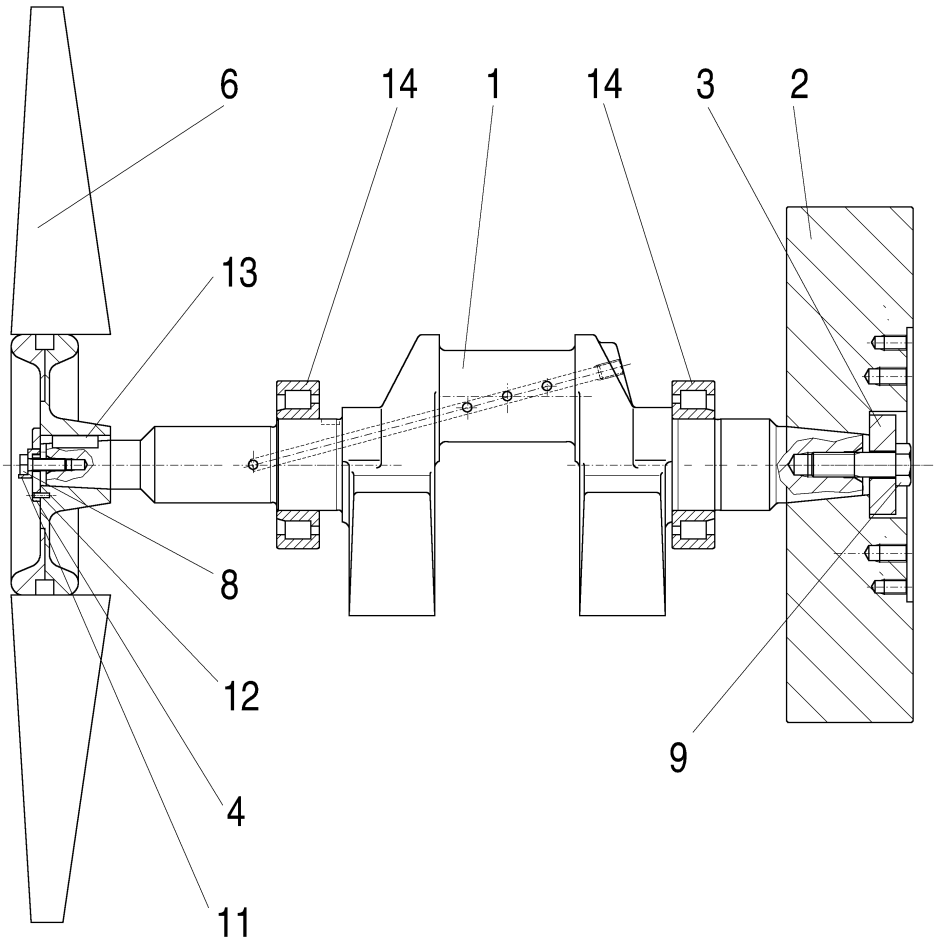
064 106 crankcase



064 106 crankcase

Item	Reference No.	Designation	Qty.
1	064 303	crankcase	1
2	064 064	dipstick	1
3	064 079	bearing bracket	1
4	064 137	flange at E-motor drive	1
4	064 386	flange at diesel engine drive	1
5	051 883	inspection hole cover	2
6	064 095	packing for bearing bracket	1
7	063 748	packing for cover	2
9	000 499	screw at E-motor drive	8
10	000 270	eye bolt	1
11	001 411	stud	16
12	033 717	stud	4
13	037 217	cylinder head stud 1st stage	6
14	037 218	cylinder head stud 2nd stage	4
15	005 930	stud	8
18	030 744	plug	1
19	002 031	hexagon nut	30
20	001 620	hexagon nut	4
26	002 098	hexagon nut	4
28	005 009	gasket	1
29	007 123	shaft seal	1
30	030 831	shaft seal	1
31	035 520	o-ring	2

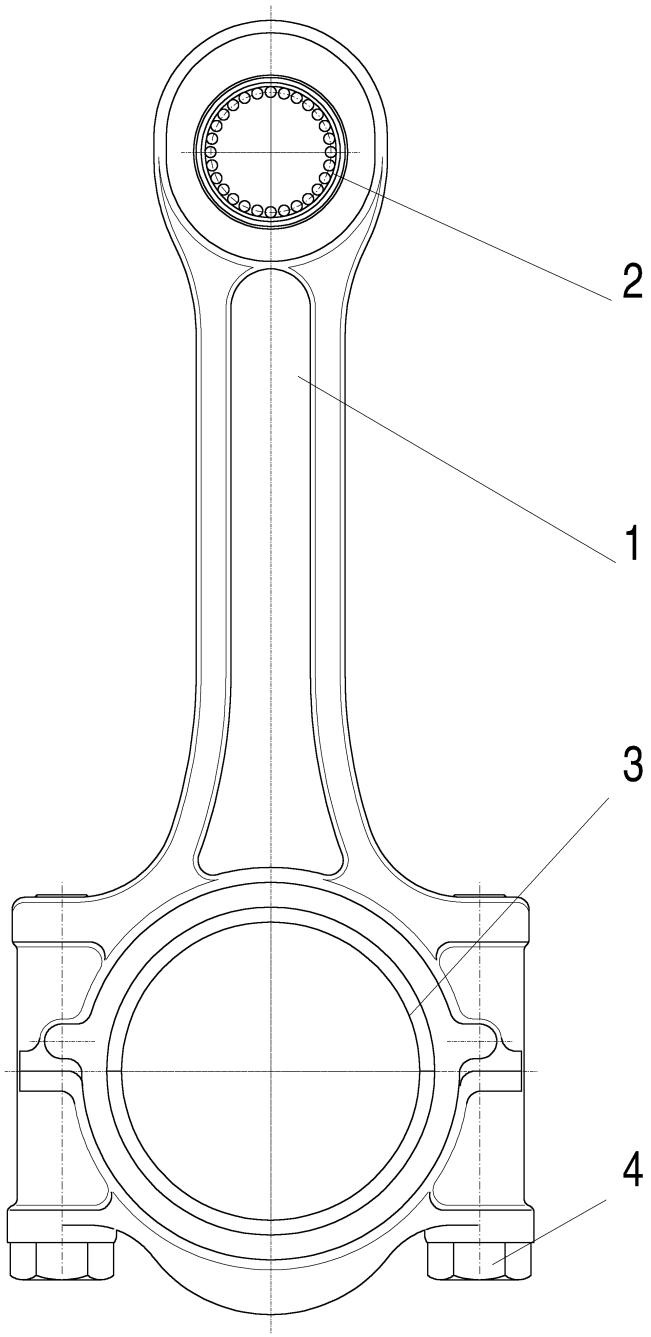
064 284 crankshaft



064 284 crankshaft

Item	Reference No.	Designation	Qty.
1	064 323	crankshaft	1
2	064 138	flywheel at E-motor drive	1
2	064 389	flywheel at diesel engine drive	1
3	064 054	pressure washer flywheel	1
4	056 887	pressue washer fan wheel	1
6	033 502	fan wheel	1
8	000 032	hexagon head screw	1
9	000 188	hexagon head screw	1
11	001 667	locking plate	1
12	004 458	tension bushing	1
13	001 982	fitting key	1
14	033 215	cylinder roller bearing	2

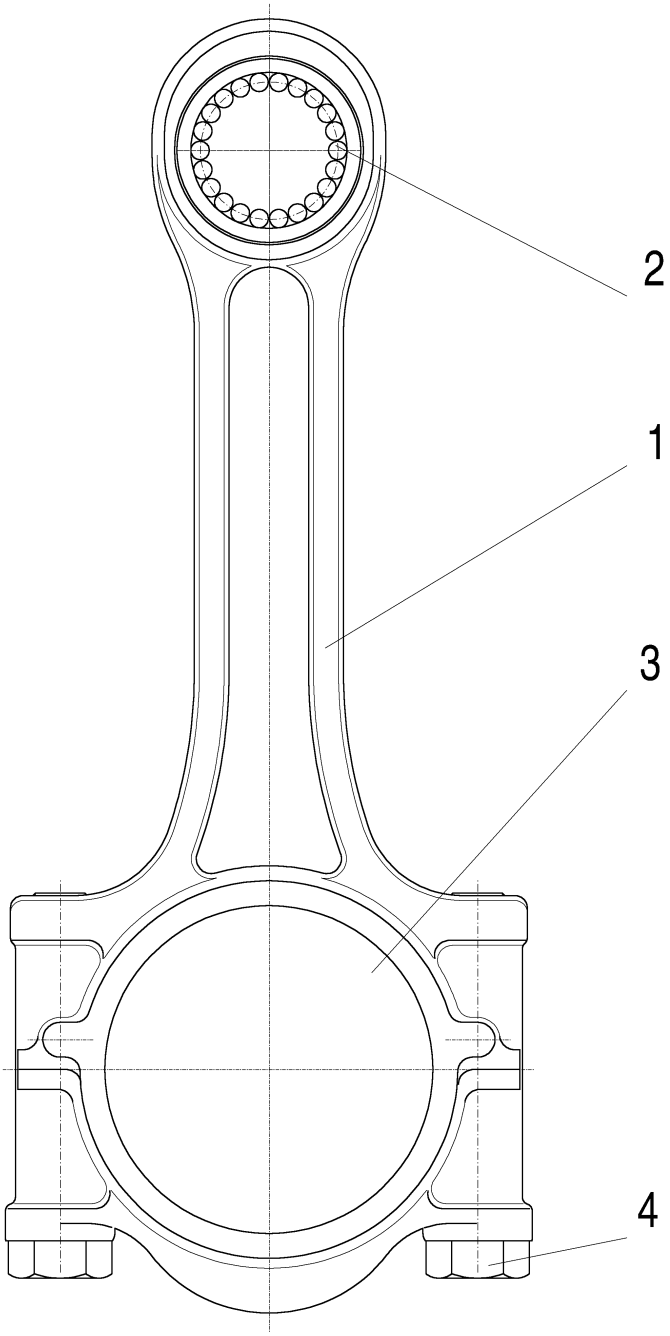
063 102 connecting rod 1st stage



063 102 connecting rod 1st stage

Item	Reference No.	Designation	Qty.
1	063 100	connecting rod 1st stage	1
2	036 107	piston pin bearing	2
3	056 590	connecting rod bearing	1
4	053 713	connecting rod screw	2

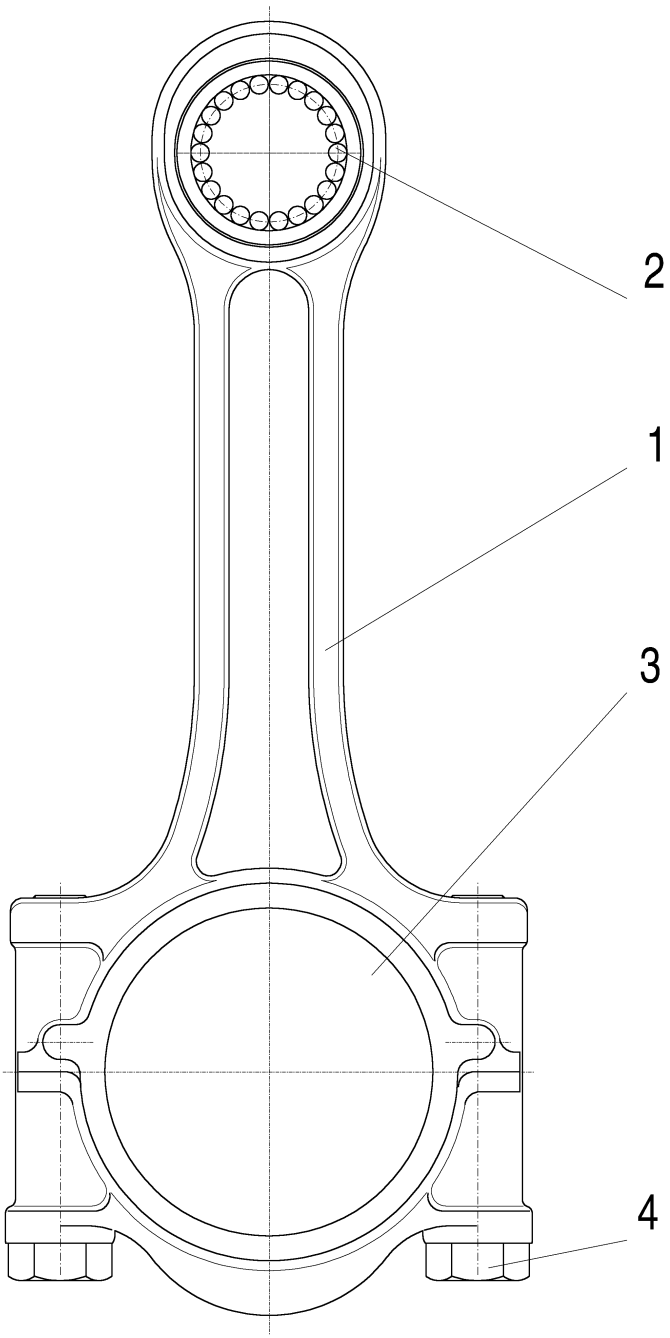
063 103 connecting rod 2nd stage



063 103 connecting rod 2nd stage

Item	Reference No.	Designation	Qty.
1	063 101	connecting rod 2nd stage	1
2	036 108	piston pin bearing	1
3	056 590	connecting rod bearing	1
4	053 713	connecting rod screw	2

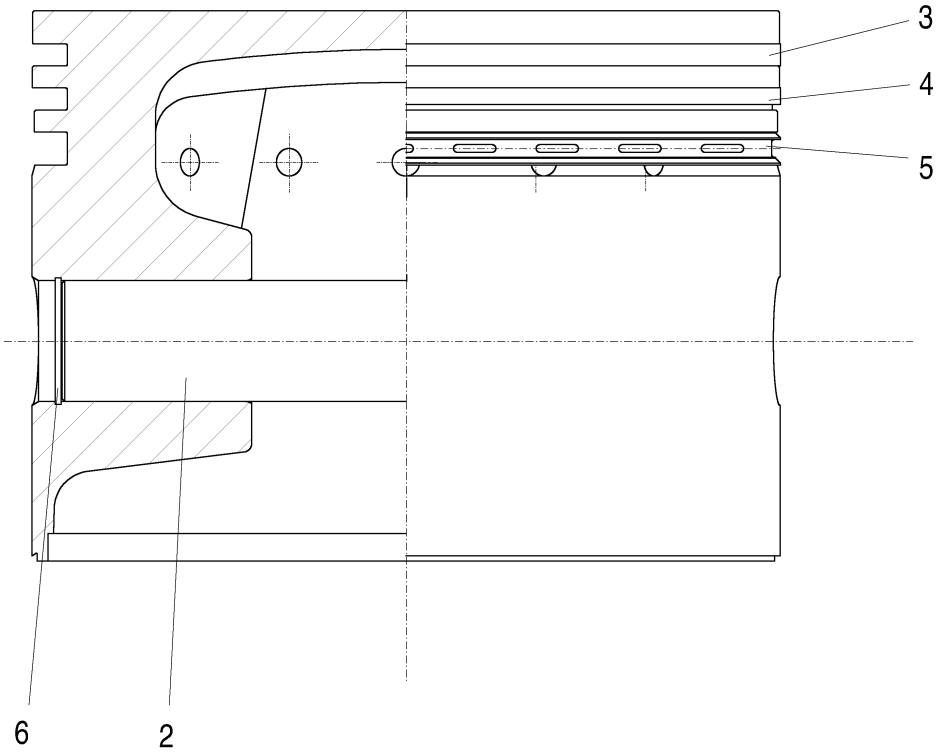
062 981 connecting rod 3rd stage



062 981 connecting rod 3rd stage

Item	Reference No.	Designation	Qty.
1	062 982	connecting rod 3rd stage	1
2	036 108	piston pin bearing	1
3	056 590	connecting rod bearing	1
4	053 713	connecting rod screw	2

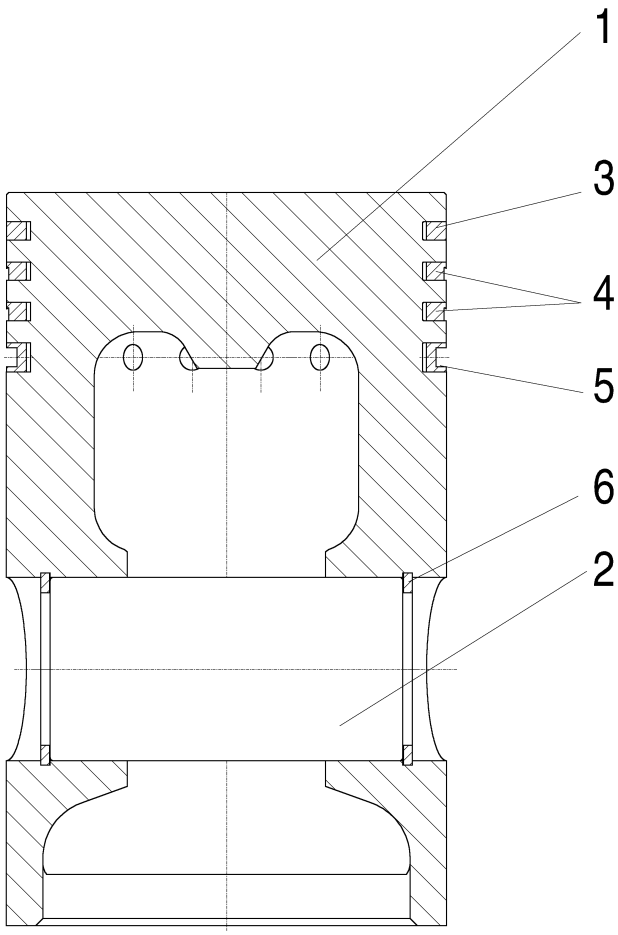
031 881 piston 1st stage



031 881 piston 1st stage

Item	Reference No.	Designation	Qty.
2	031 883	piston pin 1st stage	1
3	012 512	M-ring	1
4	031 901	N-ring	1
5	031 902	G-ring	1
6	002 976	circlip	2

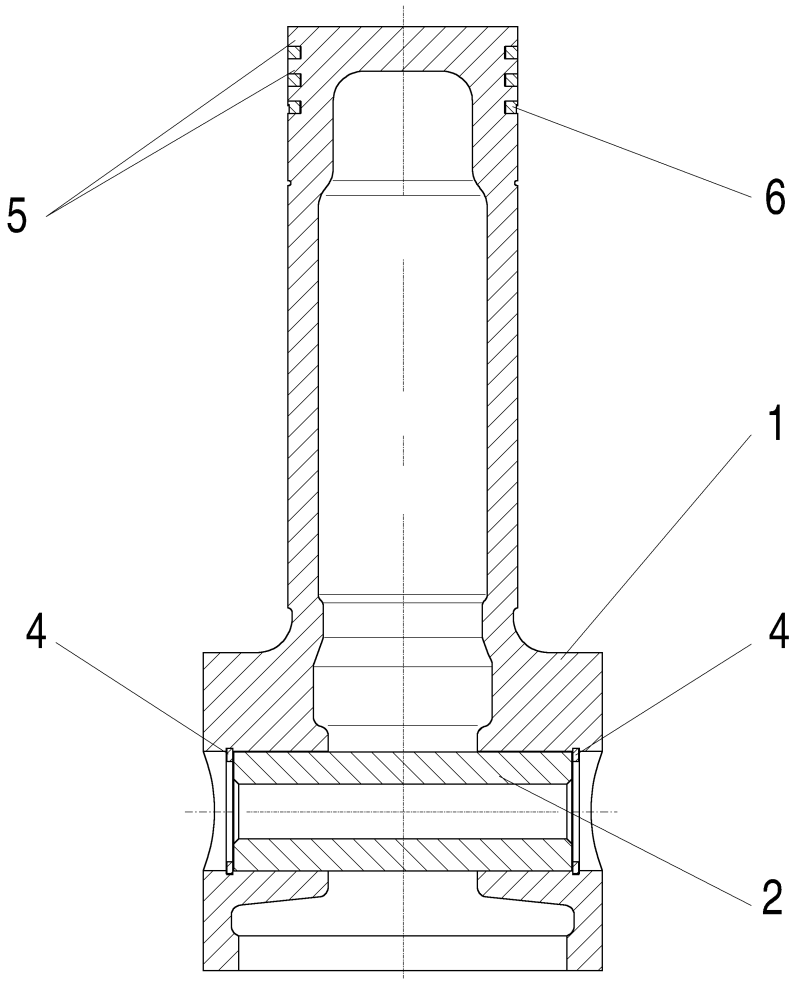
062 525 piston 2nd stage



062 525 piston 2nd stage

Item	Reference No.	Designation	Qty.
1	062 404	piston 2nd stage	1
2	062 524	piston pin 2nd stage	1
3	002 748	R-ring	1
4	002 552	N-ring	2
5	002 585	S-ring	1
6	036 112	circlip	2

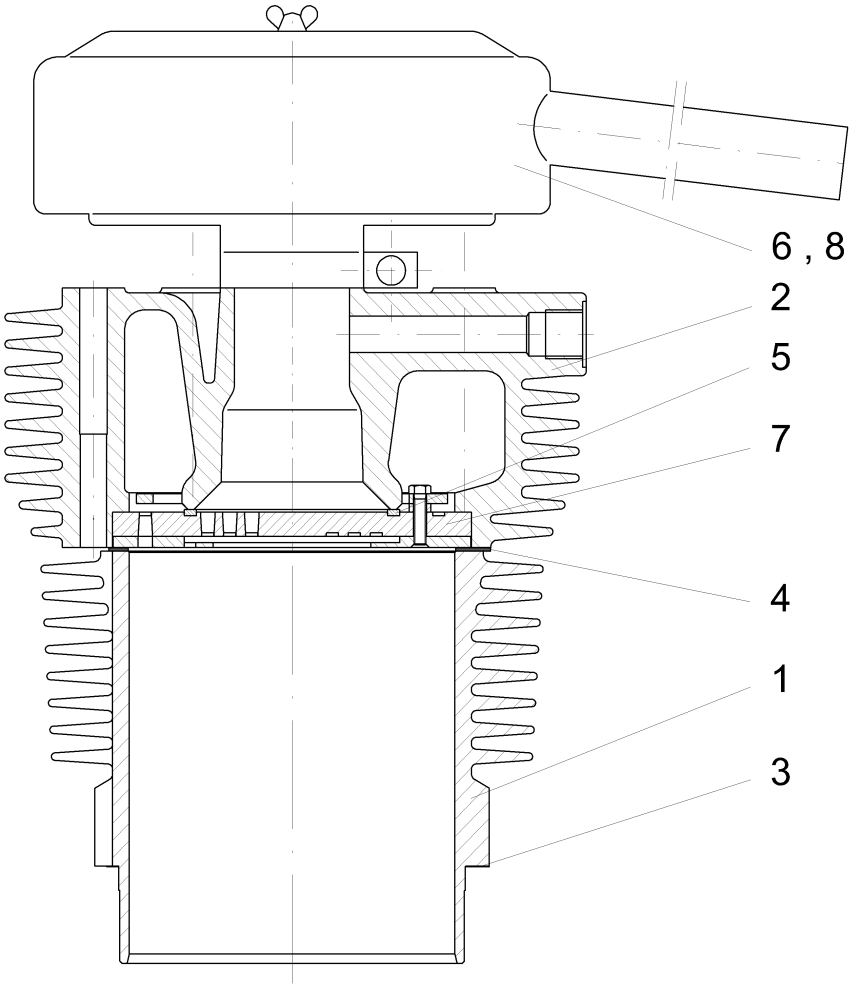
064 108 piston 3rd stage



064 108 piston 3rd stage

Item	Reference No.	Designation	Qty.
1	064 093	piston 3rd stage	1
2	062 469	piston pin 3rd stage	1
4	036 112	circlip	2
5	002 662	R-ring	2
6	002 543	N-ring	1

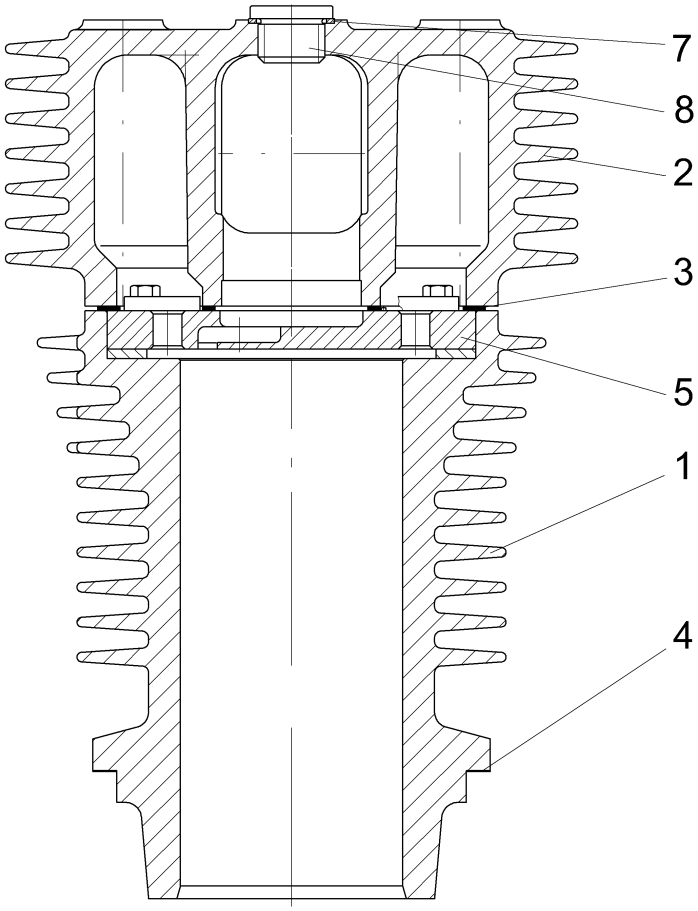
064 109 cylinder with head and valve 1st stage



064 109 cylinder with head and valve 1st stage

Item	Reference No.	Designation	Qty.
1	064 087	cylinder 1st stage	1
2	064 134	cylinder head 1st stage	1
3	064 048	cylinder foot packing 1st stage	1
4	063 059	cylinder head packing 1st stage	1
5	056 235	low tolerance gasket	1
6	030 911	air filter	1
7	037 157	lamellar valve 1st stage	1
8	033 291	filter insert for air filter	1

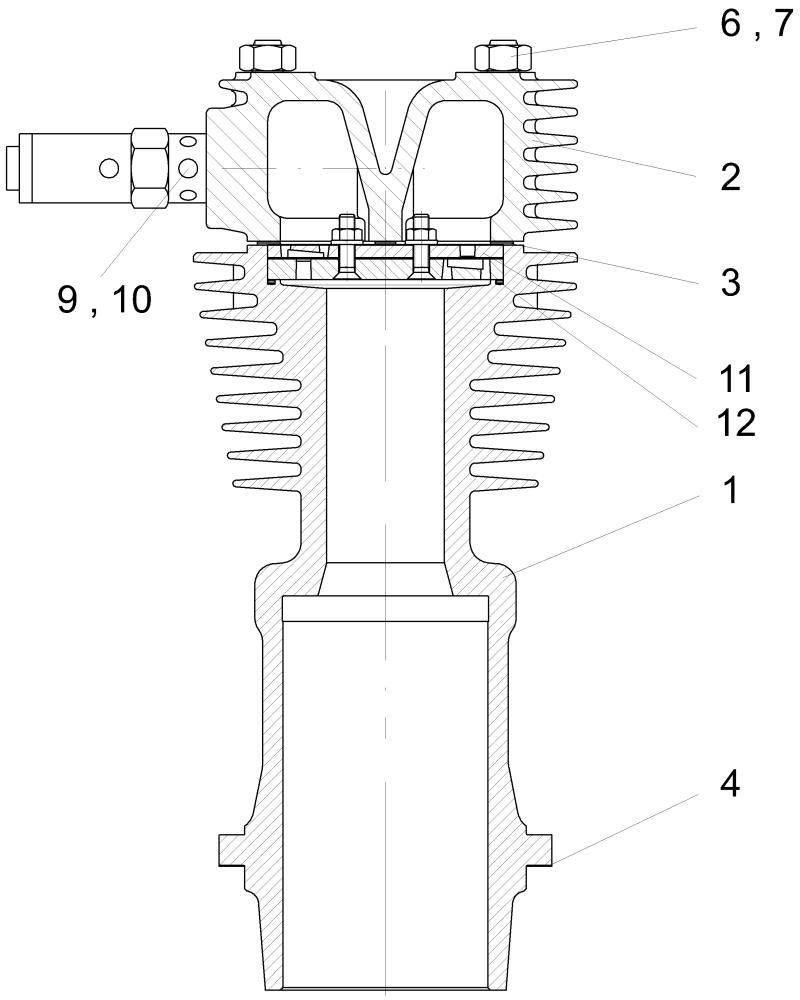
064 110 cylinder with head and valve 2nd stage



064 110 cylinder with head and valve 2nd stage

Item	Reference No.	Designation	Qty.
1	064 082	cylinder 2nd stage	1
2	064 085	cylinder head 2nd stage	1
3	060 266	cylinder foot packing 2nd stage	1
4	064 094	cylinder head packing 2nd stage	1
5	034 983	lamellar valve 2nd stage	1
7	005 009	gasket	1
8	000 972	plug	1

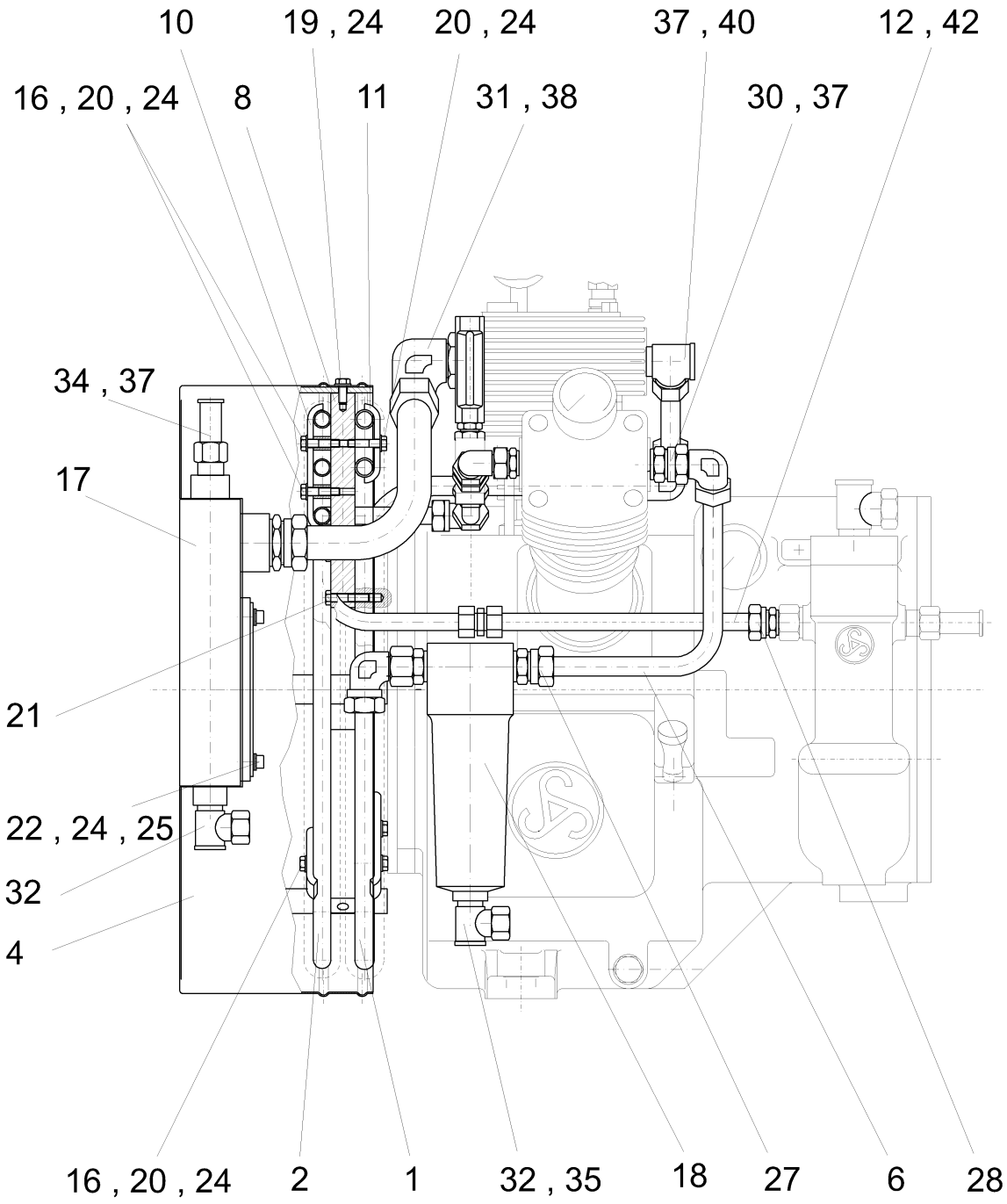
064 111 cylinder with head and valve 3rd stage



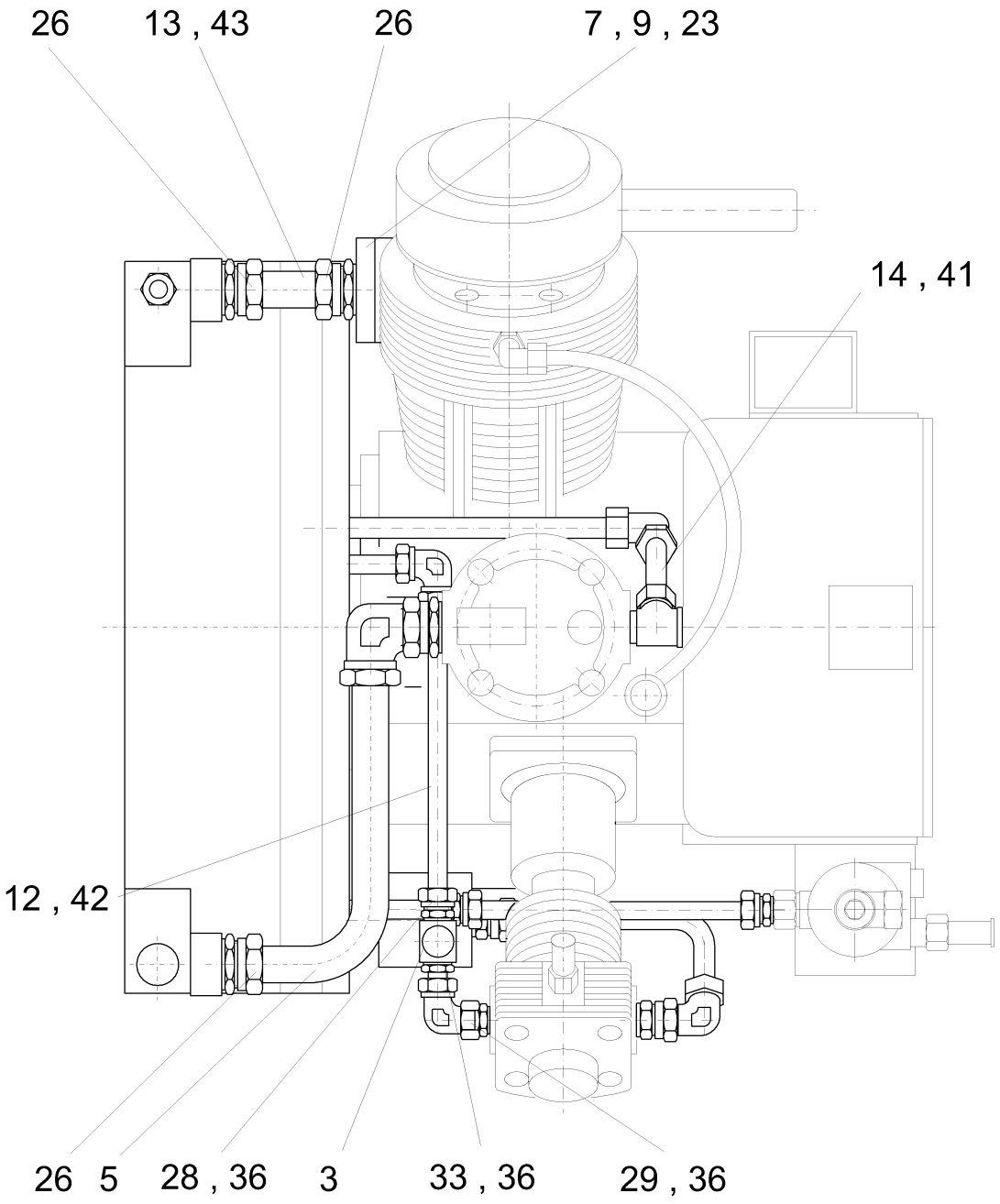
064 111 cylinder with head and valve 3rd stage

Item	Reference No.	Designation	Qty.
1	064 084	cylinder 3rd stage	1
2	064 135	cylinder head 3rd stage	1
3	064 051	cylinder head packing 3rd stage	1
4	062 936	cylinder foot packing 3rd stage	1
6	001 517	cylinder head stud	4
7	001 620	hexagon nut	4
9	033 714	savety valve 2nd stage	1
10	005 016	gasket	1
11	037 158	lamelar valve 3rd stage	1
12	037 526	O-ring	1

064 112 cooler, compl.



064 112 cooler, compl.



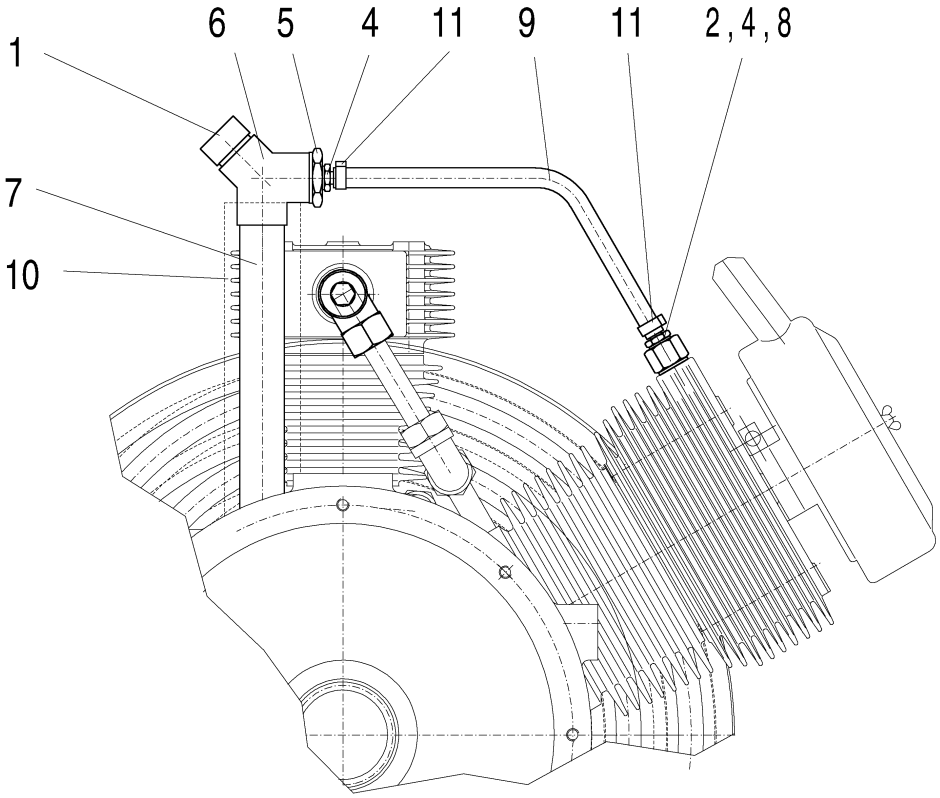
064 112 cooler, compl.

Item	Reference No.	Designation	Qty.
1	064 113	cooler 2nd stage	1
2	064 114	cooler 3rd stage	1
3	064 524	distribution piece	1
4	064 102	fan cover, compl.	1
5	064 115	pipe	1
6	064 116	pipe	1
7	064 091	cooler flange	1
8	064 092	cooler ledge	3
9	064 050	packing	1
10	064 042	clamp	3
11	064 075	clamp	3
12	064 117	pipe	2
13	064 618	pipe 105mm long	1
14	064 619	pipe 125mm long	1
16	064 342	pipe	4
17	037 211	block cooler 1st stage	1
18	037 221	separator 2nd stage	1
19	005 247	hexagon head screw	3
20	033 532	hexagon head screw	9
21	000 123	hexagon head screw	6
22	000 450	cylinder head screw	4
23	000 497	cylinder head screw	4
24	003 114	locking washer	16
25	002 156	washer	4
26	004 666	union	3
27	004 652	union	1
28	004 647	union	2
29	006 219	union	1
30	006 221	union	1
31	006 228	union	1
32	006 187	union	2
33	006 452	stud adaptor	1
34	033 224	safety valve 1st stage	1

064 112 cooler, compl.

Item	Reference No.	Designation	Qty.
35	030 340	O-ring	1
36	005 009	gasket	3
37	005 016	gasket	2
38	005 027	gasket	1
40	006 190	union	1
41	038 096	cutting ring	2
42	037 966	cutting ring	4
43	038 401	cutting ring	2

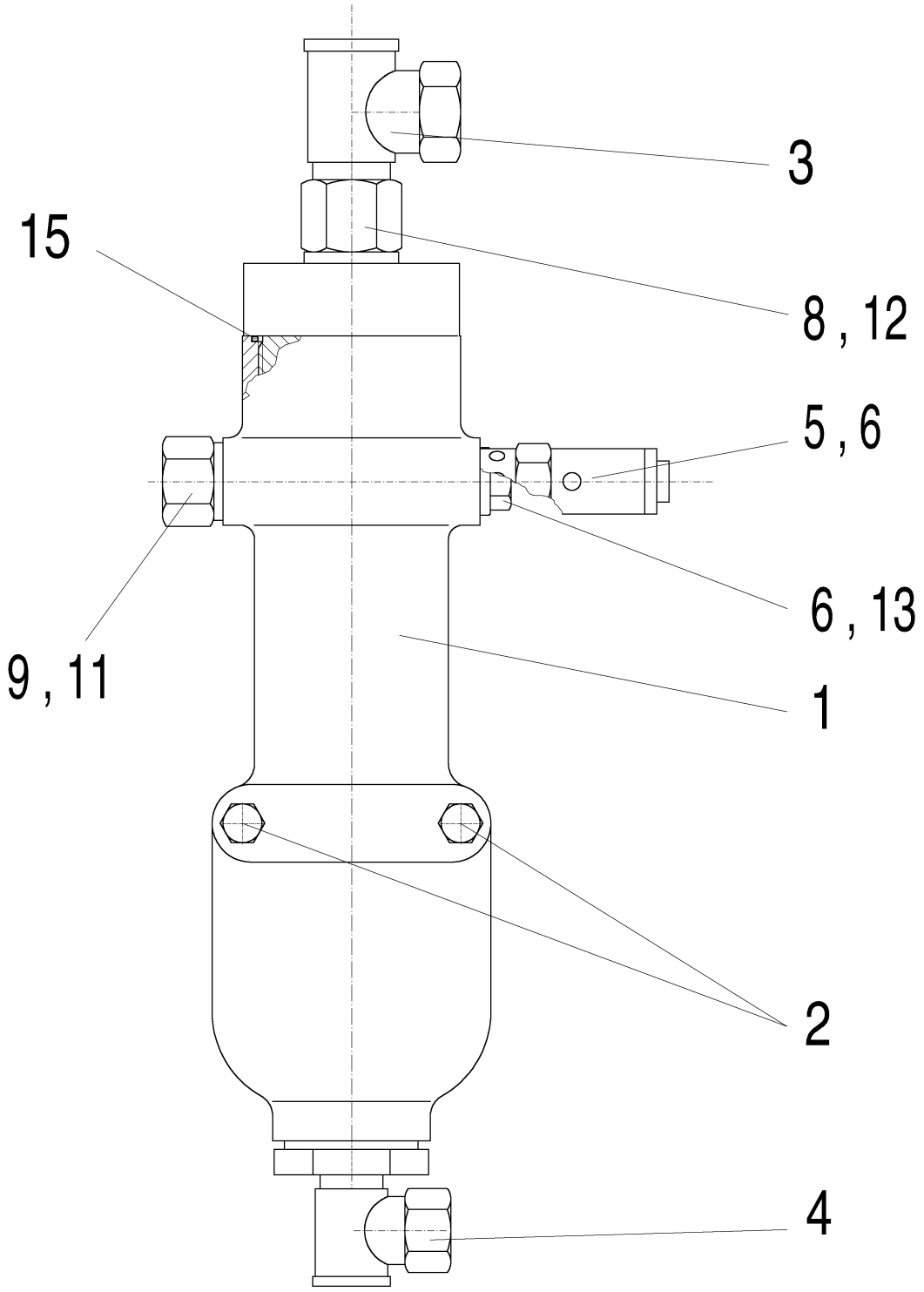
064 302 crankcase venting



064 302 crankcase venting

Item	Reference No.	Designation	Qty.
1	035 824	filling cover	1
2	006 380	reducer	1
4	033 487	bend	2
5	037 138	reducer	1
6	037 137	distribution piece	1
7	064 523	pipe adaptor	1
8	005 009	gasket	1
9	034 612	LP-hose	1
10	033 952	Armaflex-hose 280 mm long	1
11	035 254	hose clamp	2

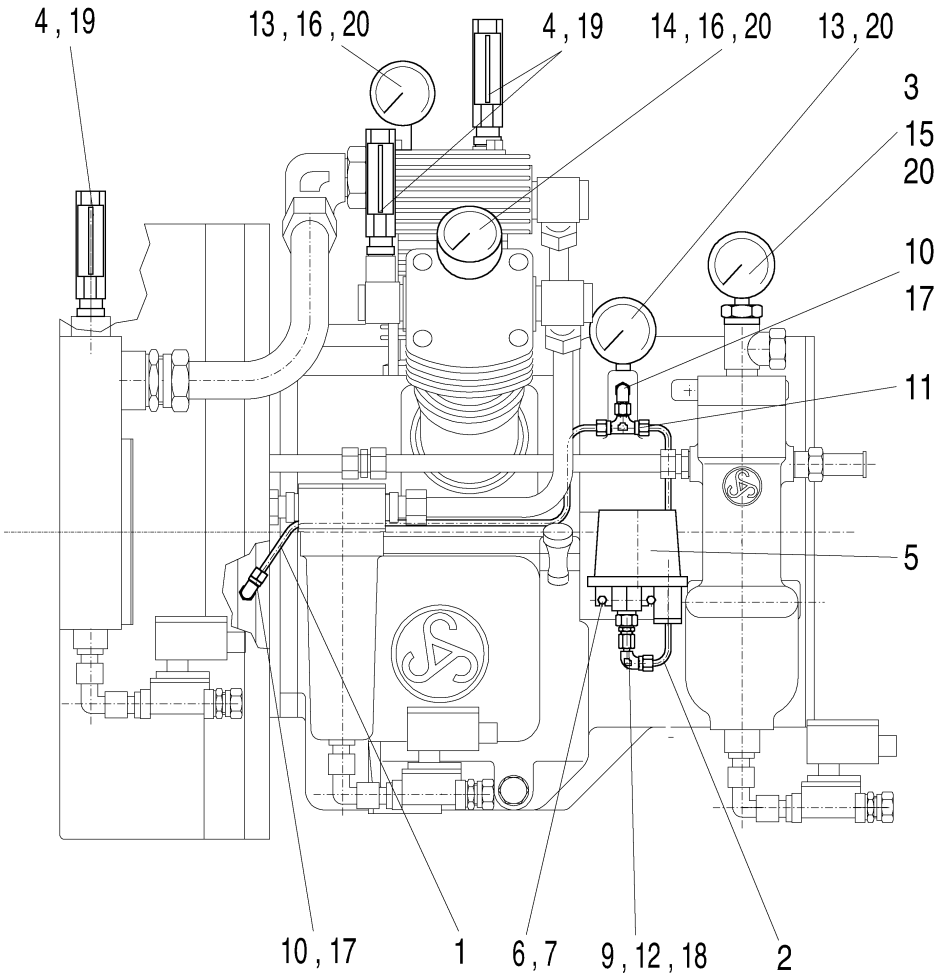
064 105 final separator, compl.



064 105 final separator, compl.

Item	Reference No.	Designation	Qty.
1	063 121	separator	1
2	000 147	hexagon head screw	2
3	031 905	union	1
4	006 187	union	1
5	030 752	safety valve 3rd stage	1
6	005 009	gasket	2
8	006 387	reducer tube	1
9	006 385	reducer tube	1
11	005 016	gasket	1
12	005 023	gasket	1
13	060 342	fusible plug	1
15	036 171	O-ring	1

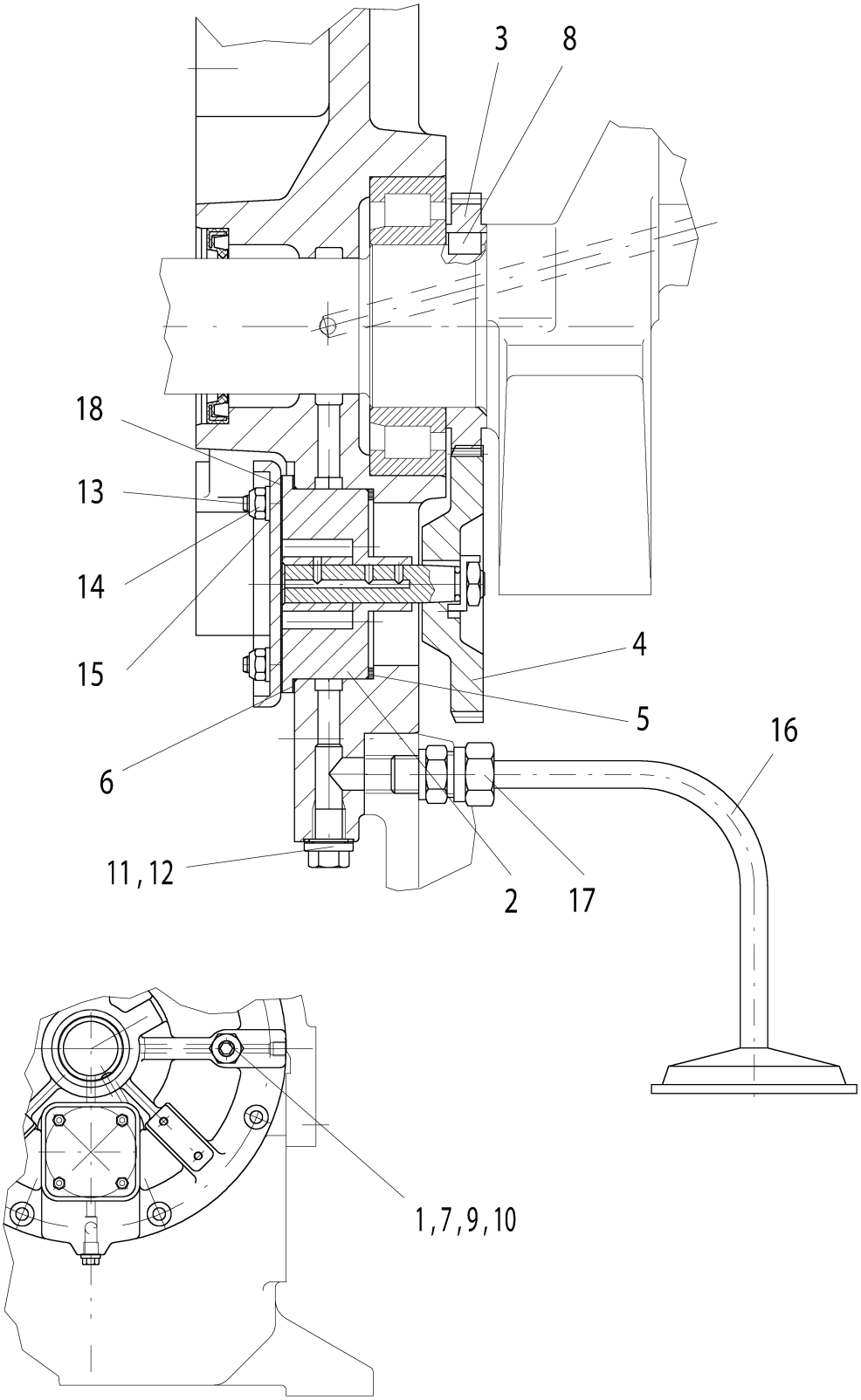
064 118 measuring device



064 118 measuring device

Item	Reference No.	Designation	Qty.
1	008 633	pipe 400mm long	1
2	008 633	pipe 400mm long	1
3	064 326	connector	1
4	033 223	thermometer	3
5	030 082	control switch	1
6	000 010	screw	2
7	002 144	washer	2
9	033 704	union	1
10	030 510	union	2
11	034 132	union	1
12	033 017	union	1
13	033 261	pressure gauge	2
14	037 815	pressure gauge	1
15	030 664	pressure gauge	1
16	037 160	adaptor	2
17	005 001	gasket	2
18	005 006	gasket	1
19	005 009	gasket	3
20	035 061	gasket	4

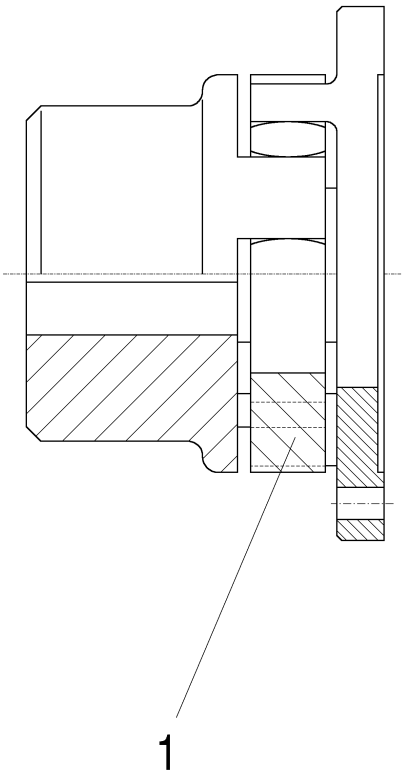
064 119 lubricating oil pump and drive



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
11	001 009	plug	1
12	005 001	gasket	1
13	001 459	stud	4
14	002 094	hexagon nut	4
15	002 146	washer	4
16	036 897	oil sieve	1
17	004 635	union	1
18	063 824	packing	1

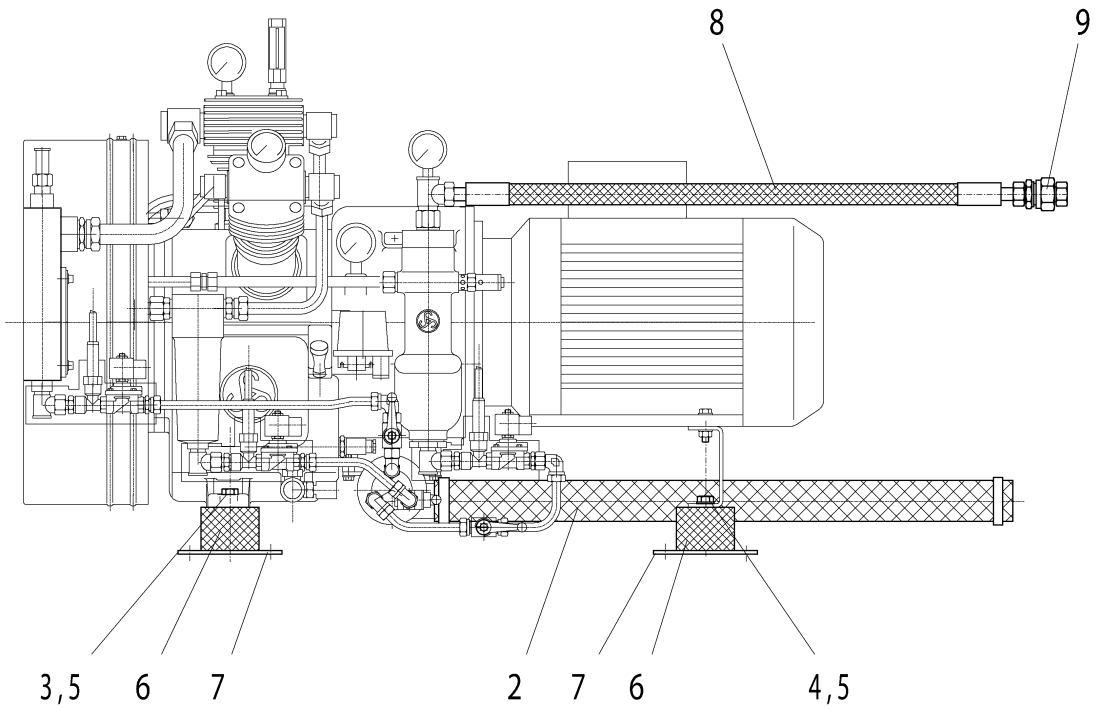
037 320 flexible coupling



037 320 flexible coupling

Item	Reference No.	Designation	Qty.
1	033 494	flexible gear rim	1

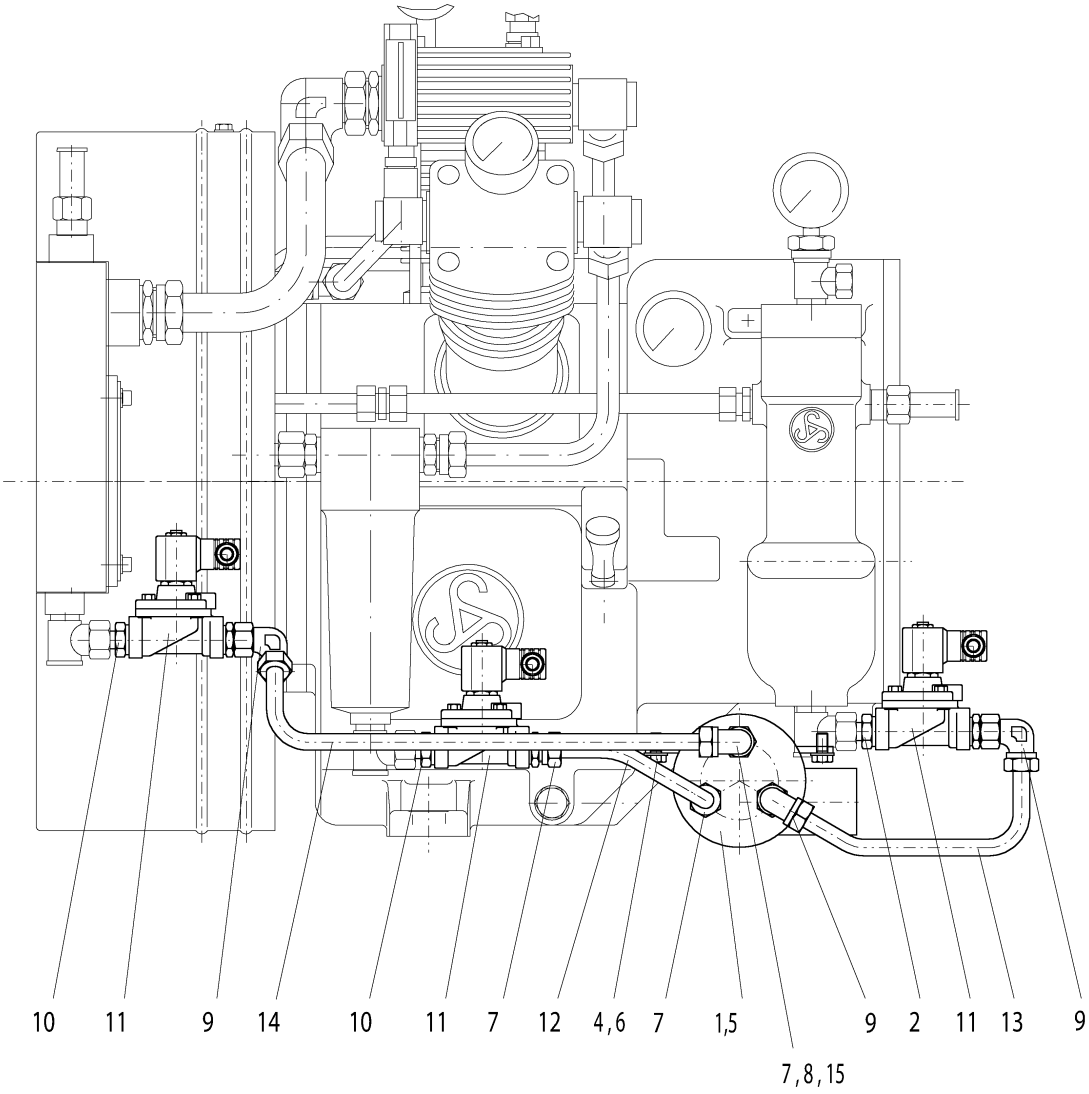
065 248 resilient mounts



065 248 resilient mounts

Item	Reference No.	Designation	Qty.
2	065 478	drain hose	1
3	000 069	hexagon head screw	2
4	000 066	hexagon head screw	2
5	002 166	washer	4
6	031 149	resilient mount	4
7	037 172	fixing rail	4
8	033 222	HP-hose	1
9	033 489	non-return valve	1

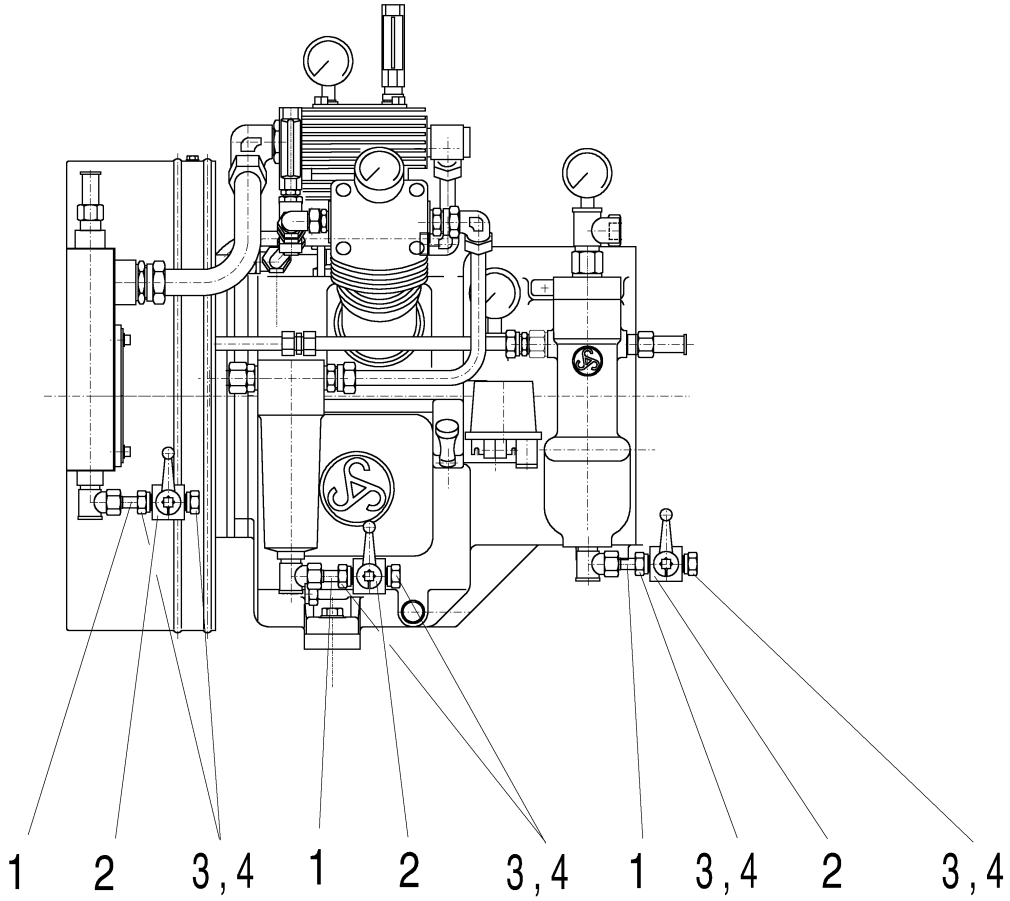
064 458 automatic drainage



064 458 automatic drainage

Item	Reference No.	Designation	Qty.
1	063 120	expansions receiver	1
2	065 109	flow restrictor	1
4	000 036	hexagon head cap screw	4
5	030 744	plug	1
6	003 115	locking washer "Schnorr"	4
7	004 641	union	3
8	004 998	union	1
9	006 216	union	3
10	006 455	stud adaptor	2
11	037 680	solenoid valve	3
12	008 663	pipe 100mm long	1
13	008 663	pipe 100mm long	1
14	008 663	pipe 100mm long	1
15	008 663	pipe 100mm long	1

064 773 manual drainage



064 773 manual drainage

Item	Reference No.	Designation	Qty.
1	064 772	adaptor	3
2	031 623	ball valve	3
3	037 334	nut	6
4	006 473	progessivring	6

Reference No.	Designation	Page	Pos.
005 009	gasket	25	7
005 009	gasket	32	36
005 009	gasket	35	8
005 009	gasket	37	6
005 009	gasket	39	19
005 016	gasket	27	10
005 016	gasket	32	37
005 016	gasket	37	11
005 023	gasket	37	12
005 027	gasket	32	38
005 247	hexagon head screw	31	19
005 930	stud	7	15
006 187	union	31	32
006 187	union	37	4
006 190	union	32	40
006 216	union	47	9
006 219	union	31	29
006 221	union	31	30
006 228	union	31	31
006 380	reducer	35	2
006 385	reducer tube	37	9
006 387	reducer tube	37	8
006 452	stud adaptor	31	33
006 455	stud adaptor	47	10
006 473	progessivring	49	4
007 123	shaft seal	7	29
008 633	pipe 400mm long	39	1
008 633	pipe 400mm long	39	2
008 663	pipe 100mm long	47	12
008 663	pipe 100mm long	47	13
008 663	pipe 100mm long	47	14
008 663	pipe 100mm long	47	15
012 512	M-ring	17	3
030 082	control switch	39	5
030 340	O-ring	32	35
030 510	union	39	10
030 545	packing	41	6
030 664	pressure gauge	39	15
030 744	plug	7	18
030 744	plug	47	5
030 752	safety valve 3rd stage	37	5
030 831	shaft seal	7	30
030 911	air filter	23	6
031 149	resilient mount	45	6
031 623	ball valve	49	2
031 881	piston 1st stage	5	6
031 883	piston pin 1st stage	17	2
031 901	N-ring	17	4
031 902	G-ring	17	5
031 905	union	37	3
033 017	union	39	12

Reference No.	Designation	Page	Pos.
056 235	low tolerance gasket	23	5
056 318	packing	41	5
056 590	connecting rod bearing	11	3
056 590	connecting rod bearing	13	3
056 590	connecting rod bearing	15	3
056 730	gearwheel	41	4
056 887	pressue washer fan wheel	9	4
057 916	overpressure valve	41	1
060 266	cylinder foot packing 2nd stage	25	3
060 342	fusible plug	37	13
062 404	piston 2nd stage	19	1
062 469	piston pin 3rd stage	21	2
062 524	piston pin 2nd stage	19	2
062 525	piston 2nd stage	5	7
062 909	gearwheel oil pump	41	2
062 936	cylinder foot packing 3rd stage	27	4
062 981	connecting rod 3rd stage	5	5
062 982	connecting rod 3rd stage	15	1
063 059	cylinder head packing 1st stage	23	4
063 100	connecting rod 1st stage	11	1
063 101	connecting rod 2nd stage	13	1
063 102	connecting rod 1st stage	5	3
063 103	connecting rod 2nd stage	5	4
063 120	expansions receiver	47	1
063 121	separator	37	1
063 748	packing for cover	7	7
063 824	packing	41	18
064 042	clamp	31	10
064 048	cylinder foot packing 1st stage	23	3
064 050	packing	31	9
064 051	cylinder head packing 3rd stage	27	3
064 054	pressure washer flywheel	9	3
064 064	dipstick	7	2
064 075	clamp	31	11
064 079	bearing bracket	7	3
064 082	cylinder 2nd stage	25	1
064 084	cylinder 3rd stage	27	1
064 085	cylinder head 2nd stage	25	2
064 087	cylinder 1st stage	23	1
064 091	cooler flange	31	7
064 092	cooler ledge	31	8
064 093	piston 3rd stage	21	1
064 094	cylinder head packing 2nd stage	25	4
064 095	packing for bearing bracket	7	6
064 098	gearwheel	41	3
064 102	fan cover, compl.	31	4
064 105	final separator, compl.	5	14
064 106	crankcase	5	1
064 108	piston 3rd stage	5	8
064 109	cylinder with head and valve 1st stage	5	9
064 110	cylinder with head and valve 2nd stage	5	10