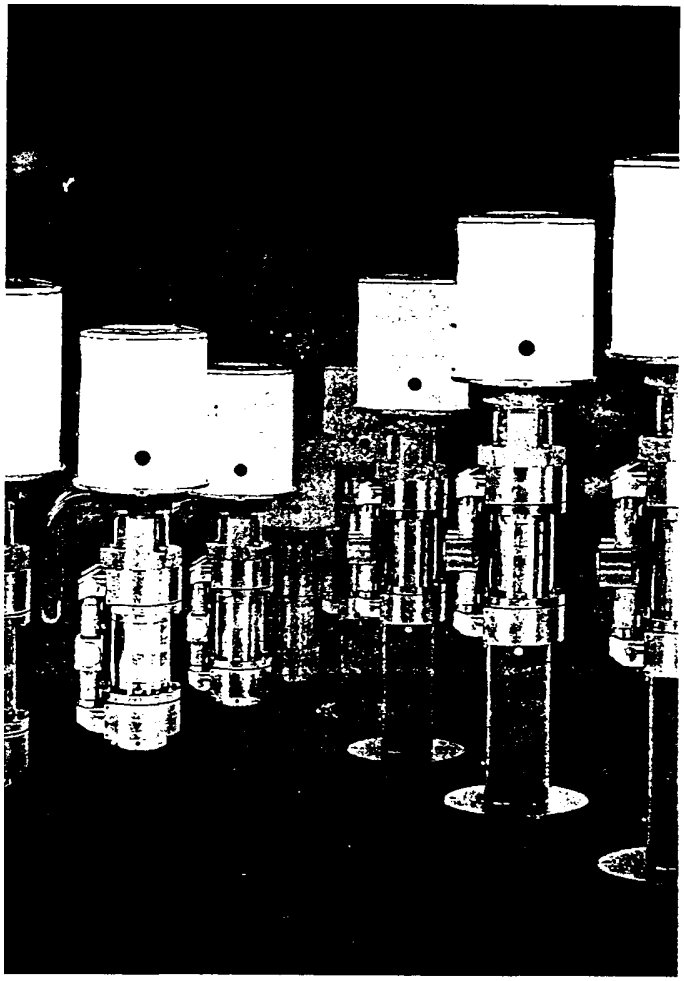
USER INFORMATION 6000327E

KEEP FOR FUTURE USE Rev. A

B.6.15.21



003.1450-DP

Piston pump

GRACO N.V.
Industrieterrein “Oude Bunders”
Loc. 2206 - Slakweidestraat 31
3630 Maasmechelen - Belgium
Tel.: 32 89 770 700 Fax: 32 89 770 777

GRACO

REGULAR TESTING OF THE APPLIANCES

Test certificate No.	Test date	Person responsible	
		Company	Name

This fluid spraying equipment is intended in particular for surface coating (e.g. airless paint spraying equipment, two-component coating equipment).

The operator must ensure that fluid spraying equipment is tested for proper operation after an operating pause of more than 6 months, and at least every 12 months by a competent person [1)].

The operator must ensure that the test results are properly recorded in writing for every liquid spray equipment [2)] and kept until the next test.

The operator must ensure that the test certificate is available at the place of use [3)] of the fluid spraying equipment.

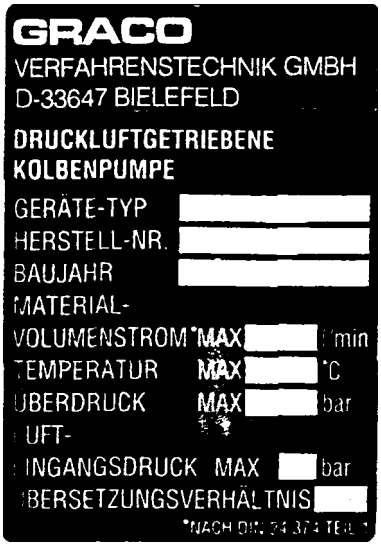
[1)] A competent person is somebody that has sufficient knowledge in the field of fluid spraying equipment based on professional training and experience, and is sufficiently conversant with the relevant national health and safety regulations, accident prevention regulations, recommendations and generally accepted rules and industrial norms to evaluate fluid spraying equipment.

[2)] Written records (test results) can, for example, be in the form of test certificates.

[3)] At the place of use, a copy of the test certificate or a test stamp on the appliance is considered as in compliance with the requirement.

-Extract from: Working with fluid spraying equipment (VBG 87)
Issued on: 10th October 1993
§ 23 (1), (3) and (4)
Implementation instructions VBG 87
to § 1 para. 1 and to § 23 para.1, para. 3, para. 4

PISTON PUMPS 003.1450-DP 4V
BASIC VERSION, BASIC APPLIANCES, COMPLETE APPLIANCES



The original manufacturer's nameplate can be found on the piston pump. Please compare all specifications and complete, if necessary.

Read and follow up the operator manual and the safety instructions before taking the pump into operation !

In this manual important information is marked with the following symbols:

Information affecting your safety

Important operational directions

Ensure that all other users know and understand all safety directions.

CONTENTS OF USER INFORMATION

Separate appendices include:
TEST CERTIFICATE (final inspection)
EU CONFORMITY DECLARATION (to be attached to the pump)
BRIEF OPERATING INSTRUCTIONS, WARNING SIGNS

CORRECT USE

The piston pump 003.1450-DP 4V is exclusively manufactured for common applications in surfacing technology (to convey coatings or auxiliary agents) or similar work.
Any other purpose above and beyond this is considered as incorrect use. We are not liable for any damage or injury resulting from this; the user will bear sole liability in such cases.

Use according to intended purpose implies adherence to the operating, maintenance and inspection conditions and regulations as laid down by us.

The piston pump 003.1450-DP 4V may only be operated, maintained and repaired by personnel familiar with, and trained to recognize the inherent dangers.

The relevant accident prevention regulations as well as safety and medical rules must be respected.

Unauthorized modifications to the appliances releases us from any liability for damages arising from this.

The user is responsible for the correct installation of the appliance.

FUNCTIONAL DIAGRAM

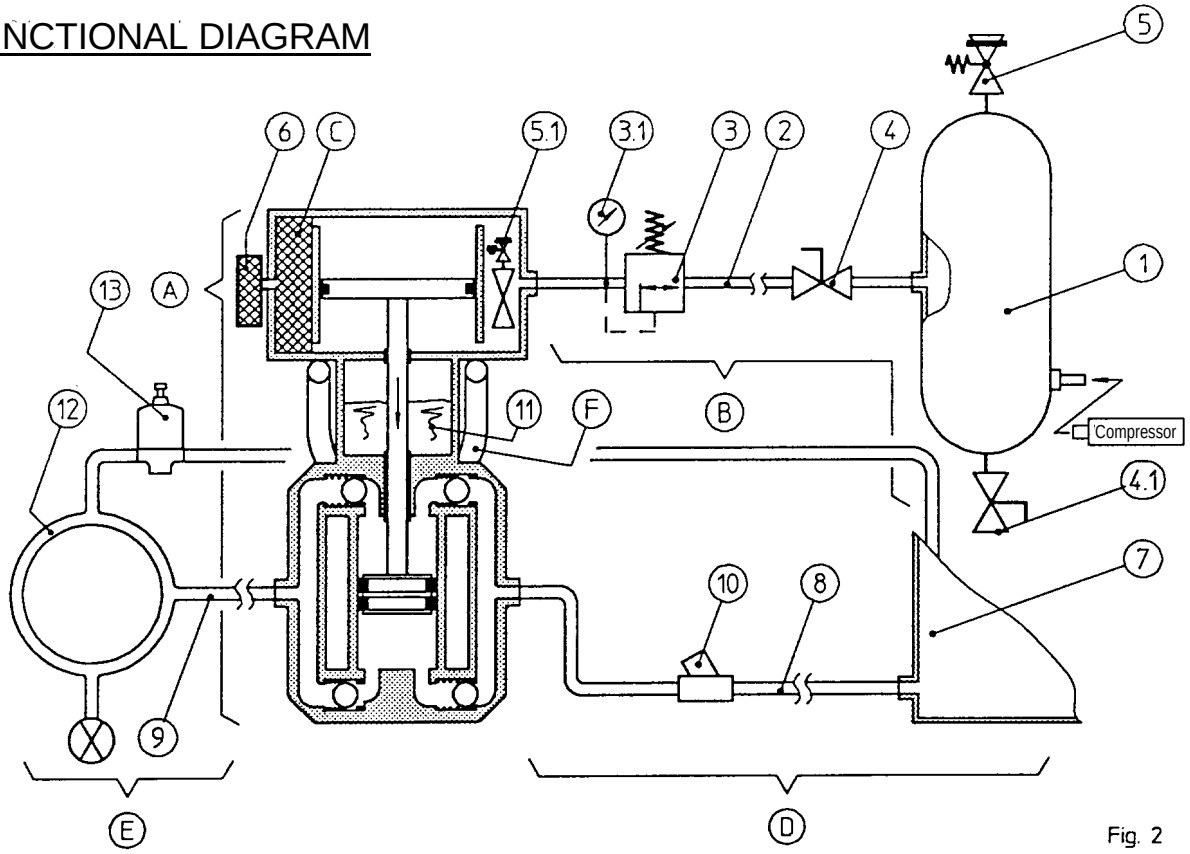


Fig. 2

A	PISTON PUMP	1	Compressed air container	7	Fluid container
B	COMPRESSED AIR SUPPLY	2	Pipeline or hose	8	Suction pipe
C	AIR EXHAUST SOUND SUPPRESSION	3	Pressure regulation valve	9	Pipeline/hose
D	FLUID SUCTION SYSTEM	3.1	Manometer	10	Strainer (dirt trap)
E	FLUID PRESSURE SYSTEM	4, 4.1	Ball valve	11	Wet cup
F	APPLIANCE SUPPORT	5, 5.1	Safety valve	12	Circulating circuit
		6	Additional silencer	13	Pressure regulation valve

DESCRIPTION OF FUNCTIONS

The compressed air Ⓐ is supplied to the piston pump from a pressure tank ① via a tube or hose line ② and a pressure regulation valve ③.

The air supply from the pressure tank to the piston pump can be interrupted by the ball valve ④.

The ball valve (4.1) is used to release condense water manually (an automatic moisture trap is recommended here).

The safety valve ⑤ protects the pressure tank against unacceptable air pressure increases (e.g. when heated).

As the compressed air supply Ⓑ is not only installed for the piston pump and because it is obligatory, the piston pump is also provided with a safety valve (5.1) (- integrated in the air motor).

During operation, the compressed air passes from the drive section (air motor) of the piston pump through the integrated air exhaust sound suppression Ⓒ and the additional silencer ⑥ (if present) into the atmosphere.

The fluid (coating or auxiliary agent) is sucked from a fluid container ⑦, through the suction line ⑧ into the piston pump and then delivered further via the pipe/hose ⑨.

A strainer (dirt trap) ⑩ protects the piston pump from foreign bodies that might have entered.

⚠ A wet cup ⑪ is essential in piston pumps of this design. The operating position (attachment position) of the piston pump will depend on it. Under certain conditions, the maximum permissible operating pressure may be exceeded when operating four-valve piston pumps (depending on the system). With closed pressure systems, e.g. circulating circuits ⑫, the rise in pressure can be prevented by appropriate measures such as the installation of a stop valve ⑬.

- Four valve piston pumps with an open pressure system are completely safe.

EQUIPMENT COMPONENTS – IMPORTANT INFORMATION

The following components are required in an operational system:

Ⓐ PISTON PUMP

See section “Technical Description of Product B.6.15.21-P“ for the functional description of the piston pump

Ⓑ THE COMPRESSED AIR SUPPLY

The compressed air supply consists of the compressor, the pressure tank with moisture trap, possibly a compressed air drier and pipeline. As a rule, the user provides the compressed air supply.

- If a compressed air supply needs to be installed, the relevant accident prevention regulations, safety rules and user information must be respected, in particular the information supplied by the compressor manufacturer. The connection between the piston pump and the compressed air line must be flexible (prevention of rupture due to vibration).

A hose line is most suitable

- Rated diameter DN16 or more
- Working pressure = max. mains pressure, preferably > 16 bar
- Air and ambient temperatures -20°C to +50°C

In areas with a danger of explosion, compressed air lines and hose lines must be electrically conductive (- to avoid electrostatic charging).

In most cases, the pressure regulation valve is mounted directly on the piston pump.

- Efficient flow rate at 6 bar and 25m/s > 210 m³/h
- Air inlet pressure 16 bar
- Air and ambient temperatures 0° to 50°C

The pressure regulation valve can be situated between the hose line and the compressed air line.

The manometer (3.1) in the functional diagram is adversely affected by the operation of the piston pump (air motor) (intensive pressure fluctuations).

- Therefore damped construction
- Display range 0 – 16 bar

A shut-off mechanism (e.g. a ball valve) should always be installed between the pressure regulation valve and the hose line, or between the hose line and the compressed air line.

- Quick and safe switch-off of the piston pump for operational breaks, maintenance work and in the event of faults.
- No change in the value set at the pressure regulation valve.
  - Rated pressure 25 to 50 bar
  - Material CuZn, nickel-plated

The rule for ball valves: wings (tap wrench) transverse to flow direction, line is closed off.

When sealing connection points do not use PTFE tape or hemp (- pressure regulation valve malfunction due to residues from the compressed air supply).

There are no special requirements for the quality of the compressed air supplied to the piston pump.

- Condense and residue oil from the compressor are separated mechanically (pressure tank, compressed air filter)
- Lubrication of compressed air not necessary
- Compressed air temperature < 50°C

In painting processes the compressed air must be free of substances that could lead to the formation of craters (oil, silicone).

- This also applies to component parts of the compressed air supply

Ⓒ AIR EXHAUST SOUND ABSORBER

The sound emission of a compressed air operated piston pump without a silencer can damage the hearing [> 115 dB (A)]. All piston pumps are therefore equipped with an integrated silencer. Since there is a relationship between “sound suppression and icing of the piston pump control system” the sound pressure level cannot be reduced indefinitely with a silencer [not to 70 db (A)].

Detailed information on the sound pressure level can be found in the corresponding section in the "Technical Product Description B.6.15.21-P".

⚠ Do not use the piston pump without the sound absorbing components.

- The decision whether or not to wear ear protection depends on the operating pressure and the resulting sound pressure level.

Special measures must be taken to reduce the sound level further.
The piston pump ① can be equipped with additional silencers.

Plate silencer
with exhaust air deflector ②

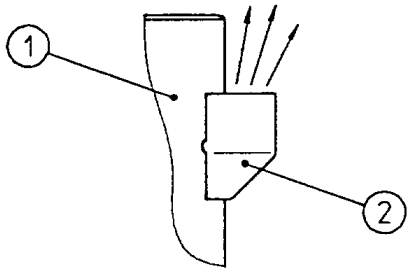


Fig. 3

Additional
silencer ③

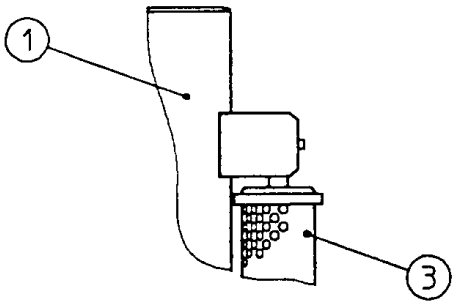
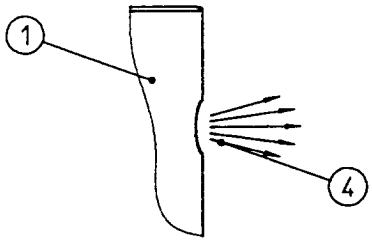


Fig. 4

When using the silencer according to Fig. 4 the stroke frequency of 8 DH/min (DH = double stroke) should not be exceeded.

- Icing of the control system

If the piston pump is operated without an additional silencer, the exhaust opening is not covered. The exhaust air ④ is pushed out into the room in a straight line.



⚠ When installing the piston pump, care should be taken to ensure that the exhaust thrust can not endanger personnel.

– e.g. install with the exhaust opening pointing to the wall.

An air exhaust deflector ⑤ should be used if this can not be guaranteed. In this case, the exhaust air thrust is (4.1) attenuated and diverted to a non-dangerous direction.

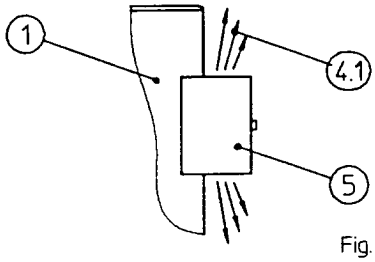


Fig. 5

Ⓓ THE FLUID SUCTION SYSTEM

The suction connection to the piston pump 003.1450-DP 4V is marked with “IN”.
The suction line ① can be screwed in directly.

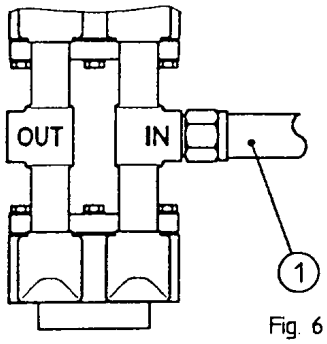


Fig. 6

All wetted metal parts of the suction area are made of austenitic stainless steel
(- suitable for water-based paints).

The connection piston pump > fluid circulating circuit or piston pump > pressure container must be flexible.
(Prevention of rupture due to vibration)

The suction connection of the piston pump can be swiveled (see product description, page 05). In this way the suction line can be moved in the direction of the fluid container.

The cross-section of the suction line is dimensioned to pump fluids with a kinematic viscosity up to 750mm²/s (cSt without any problem by the piston pump. If the viscosity is higher, the suction performance is reduced and can result in no suction. This can be recognized by an ever-increasing pressure drop during reversing the control (pressure pulsation).

- Measures for improvement are:
  keep the suction hose as short as possible or a short suction hose with a larger diameter.

Characteristics of the suction line :

- Electrically conductive, maximum permissible resistance 3 - 10^4Ohm/m (tested to ISO 8031) or, conducting resistance to earth > 10^6
  (suitable for use in locations with explosion hazard.)
- The individual parts of the suction assembly are designed to withstand an overpressure of 8 bar (suitable for suction heights of up to 7.8 m).
- Suction hose and parts in contact with the fluid are resistant to the usual solvents in the surface coating and are free of silicone
- Minimum rated width DN40
- Fluid temperature 10 to 85°C

⚠ The admission pressure (pressure in a supply system, e.g. in the circuit) acting on the piston pump and the suction line, must not exceed 8 bar.

⚠ The suction line supplied by us must not be used as a fluid pressure line. It is not designed for the fluid pressure generated by the piston pump.

When using a pipe screwed connection with suction pipe care should be taken that all parts in contact with the fluid are made of austenitic stainless steel (suitable for water-based paints).
The manufacturer’s assembly instructions should be followed.

Ⓔ FLUID PRESSURE SYSTEM

In most cases, the fluid pressure connector at the piston pump will be connected to a tube ①. The connection must be flexible (to avoid rupture caused by vibration).

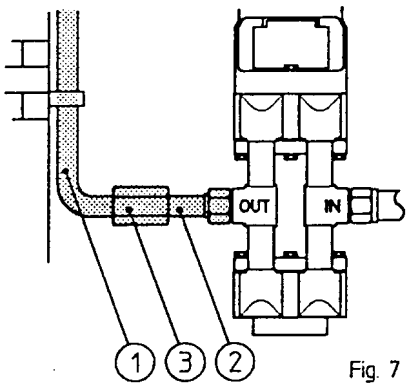


Fig. 7

The ratings for the flexible pressure line ②

- Working pressure ≥ max. permissible working overpressure (piston pump)
- Operating temperature 10 to 90°C
- For locations with possible explosion hazards :
  Electrically conductive (leakage resistance to earth < 10^6)
- The surface coating should be resistant to normal solvents and free from silicone when used for the surface coating application.

⚠ In a large fluid pressure system and in cases where the pressure system is influenced by heat (sunrays, heating systems, etc.) it is necessary to fit a suitable stop valve ③ between the tube and the flexible pressure line (to prevent damage caused by thermal expansion).

Ⓕ APPLIANCE SUPPORTS

The supports for the piston pump 003.1450-DP 4V are the pipe bracket and the column.

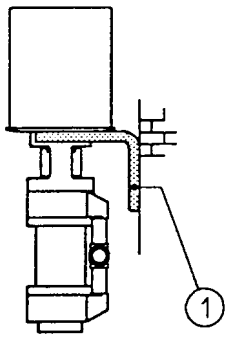


Fig. 8

The majority of piston pumps are secured to the wall of a building or a steel frame by a pipe bracket ①. When dowels are used to secure a pump to a wall, the length of the screws must be in accordance with the manufacturer's instructions. When we have supplied the dowels and screws, they meet the specifications of the Technical Product Description B.17.90.01-P.

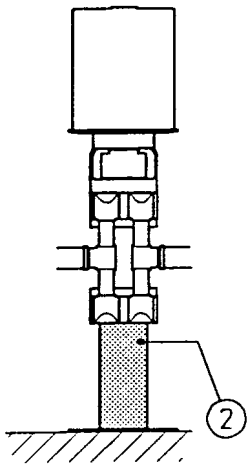


Fig. 9

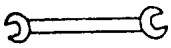
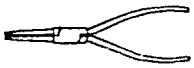
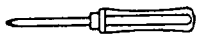
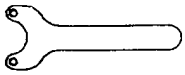
If a suitable load-bearing wall is not available for securing the piston pump, then it can be mounted on a column ②. It should be noted here that the standing area should be stable and as flat and level as possible.

⚠ Piston pumps on columns should not be installed standing free; they must be secured to the floor.

If the dowels and screws have been supplied by us, the following specifications apply:

– Drill diameter: 18 mm
– minimum hole depth 100 mm

LIST OF TOOLS

				
Allen Screw DIN 911	Open-ended spanner DIN 895	Pliers DIN 5256-D	Screwdriver for Phillips screws DIN 5262	Spanner DIN 3116
SW3, SW4, SW5, SW 7, SW 10, SW 17	SW 10, SW 17, SW 19, SW 30, SW 36	for retaining ring Ø 19 to Ø 60	Gr. 2 (for thread M4)	A 45

Open-ended spanner DIN 895
SW 55/60 Pipe screwed connection G 1 1/2 (fluid suction connections)

INSTALLATION

⚠ If a lifting appliance is used to install the piston pump, ensure that the load is at no time transported over people's heads.
A lifting lug ① (Part No. 77251 108001) can be used as a transportation device.
Standard eyebolts may not be used.

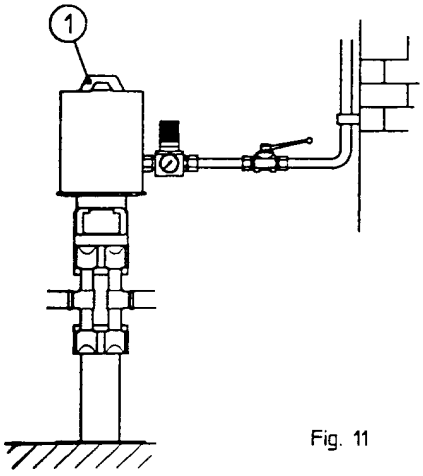


Fig. 11

INSTALLATION AND MOUNTING

Install or fit the piston pumps in a vertical position.

- The installation surface and wall should be level and be able to hold the weight.
- Plugs and mounting hardware must have correct dimensions.

Do not install in narrow, enclosed spaces like cabinets (- danger of malfunction due to icing of the air motor control).
When installing in hazardous locations, zone 1, you should follow up the guidelines for explosion prevention (EX-RL) ZH1/10 (chapter E2), as regards assembly materials.

VENTILATION OF THE WORK AREA

must be ensured

GROUNDING

The appliances must be grounded in locations with an explosion hazard. According to the guideline "Static electricity" ZH1/200 the following applies: The grounding connection must be so mechanically resistant and corrosion-resistant that it can meet all the stresses which arise during operation. The conductors that are used to make the connection to earth should be connected by soldering, welding or secure screwed connections to system parts or to the grounding points. Chains may not be used. When connecting, in particular to pipelines, care should be taken that the earth connection is not interrupted by incorporating non-conducting joining parts or as the result of repair work. A competent engineer in accordance with the operating requirements must check the ground connection.

- The grounding points on the appliances are appropriately marked.

Portable, conductive vessels or appliances that can be electrically charged must also be grounded. ⏚

This is usually achieved by means of a flexible connection secured, for example, by a clip.

– Chains may not be used.

COMPRESSED AIR SUPPLY

The compressor and compressed air container (pressure tank) must have adequate dimensions.

- Check

- see also page 4, "Quality of Compressed Air"

CONNECTIONS:

Compressed air pipeline ◄► Piston pump. Suction pipeline ◄► Piston pump.

Pressure line ◄► Piston pump

flexible and, in locations with an explosion hazard, electrically conductive

– See pages 3, 6 and 7

COMPRESSED AIR LINE

If a compressed air line has to be installed, it must have a gradient of 3 to 5 mm per meter in relation to the compressed air container or moisture trap. If a branch ① has to be made from an existing compressed air pipeline ②, then this must be done above the axis of the pipe.

When installing curved metal airlines, they should be selected with a bend radius on the tube axis not smaller than 2.5 x the outside diameter of the line.
Plastic lines in hazardous locations must have a conducting resistance to earth of $< 10^6$.

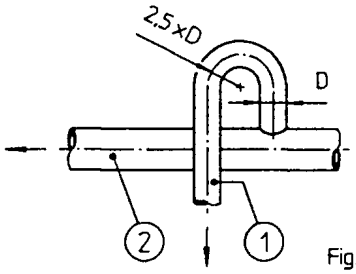


Fig. 12

COMPRESSED AIR CONTROL VALVE (PRESSURE REGULATION VALVE), MANOMETER AND BALL VALVE

See pages 3 and 4
If the pressure regulation valve ③ has been factory-fitted to the piston pump, it can be adjusted for easy reading of the pressure gauge.

– Loosen union nut ④
– Adjust pressure regulation valve
– Tighten union nut

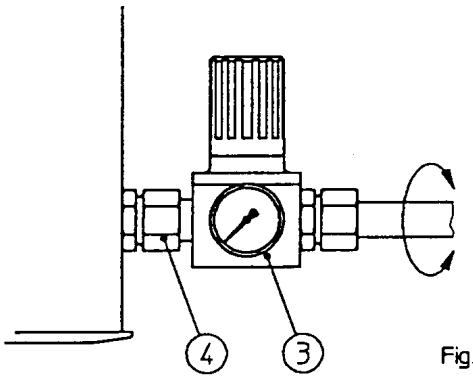


Fig. 13

SOUND ABSORBER

see page 5

- Check that the additional silencer is fixed properly.

FLUID SUCTION SYSTEM

see page 6.

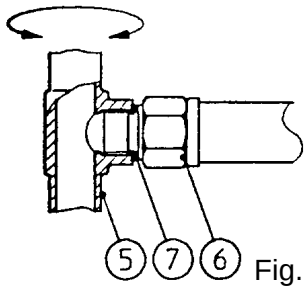


Fig. 14

The connector for the suction line can be swiveled ⑥ over 180° (see product description page 5).

– Screw in the suction line into the suction connection with a sealing ring ⑦ (SST) and align to the fluid container.

When using screwed pipe connections, Follow up the manufacturer's assembly instructions.

FLUID PRESSURE SYSTEM

see page 7

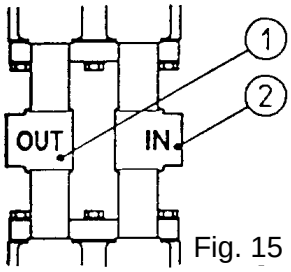


Fig. 15

The fluid pressure connection ① is marked with " OUT ".

The fluid suction connection ② with the same construction must not be used instead. The start up of the piston pump with the wrong fluid connections can lead to the destruction of vital components.

GENERAL ASSEMBLY INSTRUCTIONS

- Always use recommended torque
- Grease thread lightly.
- Do not use PTFE tape or hemp
- Components not supplied by us must have dimensions that correspond to the given dimensions of the piston pump
  - Follow the manufacturer's instructions
- Follow up manufacturer's assembly instructions when using cutting rings or double conical rings.
- When liquids are to be pumped that contain chlorinated hydrocarbons (halogenated hydrocarbons), e.g. trichloro-ethane or dichloromethane, the parts in contact with the fluid may not be zinc-plated or made of aluminum.
  - Reaction producing metal-organic compounds which are explosive and extremely caustic.

START-UP

FILLING THE WET CUP

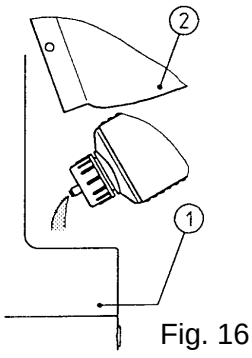


Fig. 16

Fill the wet cup ① with approx.150 cm3 of flushing agent; fill with oil when the piston pump requires oil. Remove the casing ② temporarily to facilitate access.

⚠ Do not operate the piston pump without the casing.

Any detergent used must be compatible with materials to be used later; we recommend consulting your material supplier.

FLUSH THE PISTON PUMP

All piston pumps are factory-tested with an anti-corrosion fluid after assembly. It is necessary to flush out the remainder of the fluid thoroughly with solvent (flushing agent), as well as other contaminants that might have entered during installation.
After flushing, the solvent must be removed thoroughly from the equipment (- though not from the wet cup). Air-drying does this.

- Air inlet pressure (manometer to the air motor) ≤ 1bar.

START-UP OF APPLIANCE / SYSTEM

Because the piston pump works automatically with back pressure, it can only be started (i.e. fluid delivered) when fluid is discharged from the pressure system, e.g. by using the spraying equipment.
Preparation

Ensure that the compressed air supply to the piston pump is interrupted.

- Close the compressed air regulation valve at the air motor. To do this, turn the regulating cap anti-clockwise as far as the stop.

Ensure free fluid flow in the pressure system.

- Open all shut-off units in the fluid pressure system.

Release the compressed air supply to the pressure regulation valve.

- Place the stop valve handle parallel to compressed air pipe.
- Open stop valve in compressed air line.

AERATING (BLEEDING) OF APPLIANCE/PLANT

Any air remaining in the piston pump or the system must be removed completely.
Ensure that the fluid supply (suction line) is connected.
Open the compressed air regulation valve so far until the piston pump slowly begins to run (about 0.5 bar air pressure).

- Operate the piston pump with low stroke frequency until no more air is pumped.

RETIGHTEN SCREWS

- After a week's operation, retighten the flanged screws with the specified torque. – See tightening torque Pos. 4, Page 18.

LOW AMBIENT TEMPERATURE

If start-up or operation is carried out at a local temperature around 10 °C the compressed air should be supplied with anti-freeze from a dosing apparatus (compressed air oilier). We recommend ethylene glycol, diluted, with high-pressure additives, 1000 ml , article no. 75682 114002).

IMPORTANT INFORMATION CONCERNING START-UP AND OPERATION

⚠ With regard to health, fire and explosion, only operate the equipment in sufficient ventilated areas.

Do not run the piston pump without load, unless under supervision and then only for a very short period of time and at a low air input pressure.

Dry operation after the material has passed through must be strictly avoided. It will damage or destroy important component parts.

Do not operate the piston pump without wet cup (flushing agent in wet cup).

– Leads to increased packing wear and to considerable reduction in the service life.

- Continuous operation with high stroke frequency leads to extensive icing of control system (see technical product description B. 6.15.21-P, page 03).
  – Increased pulsation until the piston pump comes to a standstill.
- During operation, do not take the suction unit out of the fluid and push it back in.
  – Air comes into the system. This leads for example to faulty painting.

⚠ Do not unscrew any parts of the piston pump during operation.
The removal of safety features (casing) can lead to injury during operation; therefore, ensure that all safety features are in place before starting up.

⚠ Wear personal health protection (respirator, eyewear, gloves, etc.) when working with hazardous fluids.

OPERATION

The piston pumps run automatically, i.e. during operational shutdown (no fluid drawn from fluid pressure system) no fluid is pumped.

If there is a slight leakage, however, pumping will start.

It is therefore recommended that the pump is disconnected from the air supply overnight or over the weekend, and bleeding (after the air is disconnected)lowers the fluid pressure.

It is also recommended that the flushing agent is drained before a prolonged shutdown and refilled when work recommences, provided it has not been contaminated.

In order to drain the flushing agent, unscrew the fixing screw ① from the valve housing ②. After removing the flushing agent, immediately screw back the fixing screw. Before commencing work again, fill again with flushing agent.

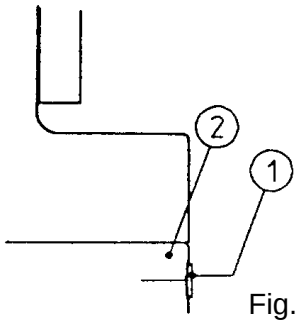


Fig. 17

Before long-term shutdown, e.g. company holidays, pumps carrying paint should be flushed.

In order to avoid the hardening of paint residue the detergent should remain in the pump during shutdown.

We recommend using an alkyl sulphone acidic ester, "ASE" phenol, as the flushing agent.

Please consult the fluid supplier about compatibility of the flushing agent.
Do not use nitro thinners or solvents as flushing agents.

MAINTENANCE AND INSPECTION, REPAIR

MAINTENANCE AND INSPECTION

The piston pump 003.1450-DP 4V requires little maintenance.

- A filter ③ has been integrated in the pressure line connector ④ of the piston pump to avoid increased wear of control components by contaminated air.
  This should be cleaned from time to time.
  – Screw out the compressed air connector for this reason.
- The flushing agent should be changed once a month or sooner if it is discolored. See Fig. 17
  – Drain using the fixing plug ①
  – Flush the wet cup ② with flushing agent
  – Fill up again with about 150m³ flushing agent.

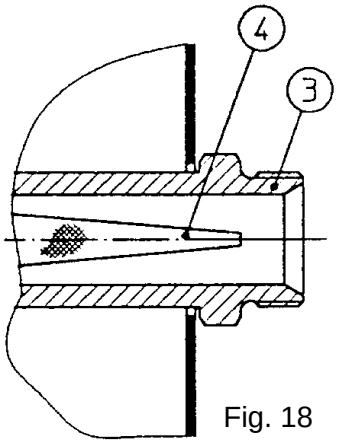


Fig. 18

- Condense water should be drained from the pressure tank, filter or filter regulator daily , if there is no automatic moisture drainage from the compressed air supply
- When using anti-freeze (when operating at around 10 °C), replenish it after use.
- Regularly check the strainer (open and inspect). The cleaning interval depends on the process fluid or solvent and must be determined by the user.
- Check the performance of the safety valves in the piston pump once a year. They have been installed in the air motor.
  For this, the max. permissible operating overpressure must be slightly exceeded(opening pressure up to 1.1 x max. permissible operating overpressure).
- The service life of the hose lines is adversely affected, and thus shortened, by surrounding influences (oxygen in air, temperature, light, etc.), even if correctly operated.
  It is recommended that they undergo regular visual checks and occasional checking of performance.
  As a precaution the hose lines should be replaced by new ones at intervals set by the operator (- after 2 to 3 years).

⚠ Never carry out any dismantling work on a pressurized piston pump.

The piston pump/system must be observed every day.

The lubricant in the wet cup should be checked every day.
If the flushing agent is noticeably discolored it should be changed (see above).

If the level of the flushing agent rises slowly while the piston pump is running, this is an indication that the packing is in an advanced state of wear.

If the flushing agent level rises rapidly, the packing is worn so badly that it must be replaced as quickly as possible.

- We recommend changing the lower piston packing at the same time.
If, during the daily inspection, a rise in pulsation or irregular running of the piston rod is observed the cause is likely to be wear of the valves.

- It is recommended to replace all four valves.
If, during daily inspection, the sound of escaping air is heard from the air exit aperture of the air motor while the piston pump is not operating, this may be an indication of advanced wear of control components.
If the sound level increases in the course of a few days, the flat slide(s) and the slide seat(s) should be changed.

REPAIR

⚠ Repairs must be carried out by qualified engineers (VBG 87).

Use only genuine replacement parts.
Our obligation to replace equipment is forfeited when non-genuine replacement parts are used (Product Liability Law of 15 December, 1989).

All parts that are to be re-used should be cleaned thoroughly after dismantling.

Do not damage sealing surfaces; do not throw parts around or hit them; do not use any cutting tools.

Renew all removed seals.

Lubricate all threads and fittings before assembly (grease lightly).

Before dismantling flush out the piston pump and then pump out the flushing agent (see shut down for a prolonged period of time).

⚠ Make sure that the compressed air supply to the piston pump is properly disconnected.

Replacement of the flat slides and slide seats

- Remove the casing ①
- Unscrew the countersunk screws ②
- Replace slide seat ③ and slide ④
  - Always replace together.

When assembling, tighten the countersunk screws ② before the screws (not shown in the figure) (centering)

- Unscrew the screws ⑤
- Replace the slide seat ⑥ and flat slide ⑦ together
  - If necessary, replace the O-Ring.

This opportunity should be used to check the drive rod ⑧ for wear.

For this

- Dismantle the retaining ring ⑨ and cover ⑩ on one side
- Press out the drive rod

Replace in the event of wear

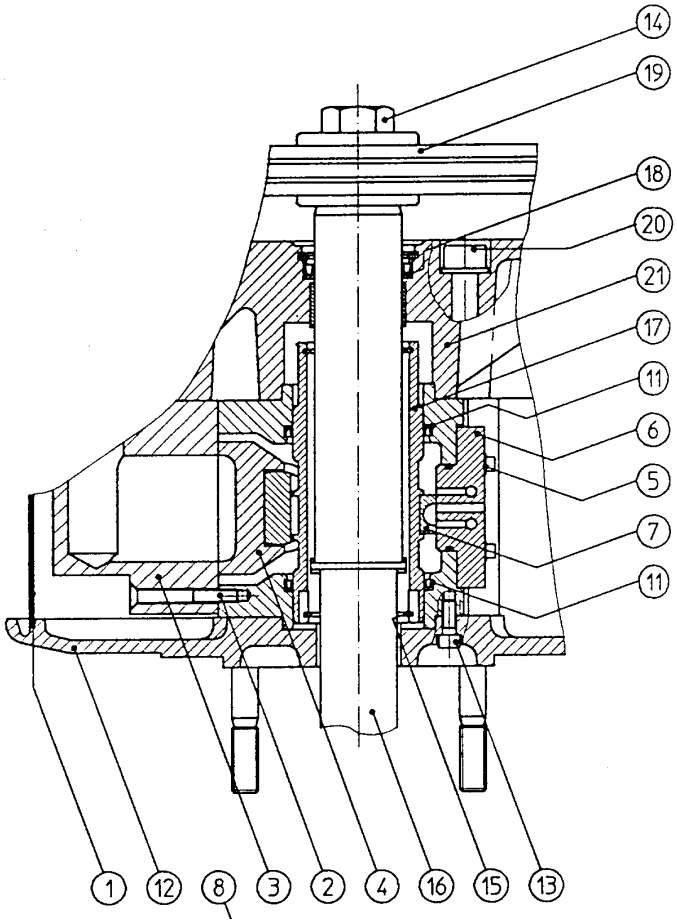


Fig. 19

Replacement of the grooved rings

If it is necessary to replace the grooved rings ⑪, the flat slides ④ ⑦, slide seats ③ ⑥ and drive rod ⑧ must be dismantled.

Then

- Remove the base ⑫, by loosening the screws ⑬
- Unscrew the hexagonal screw ⑭
- Remove retaining ring ⑮
- Pull out the piston rod ⑯ and sleeve ⑰
- Remove the worn out grooved rings
- Insert new grooved rings without using any objects with sharp edges

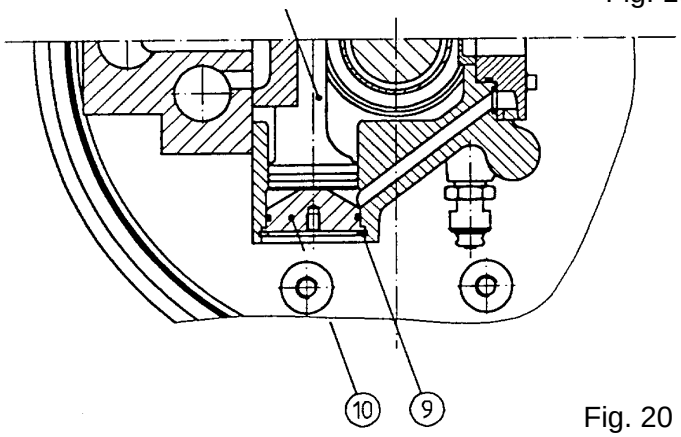


Fig. 20

If the sealing ring ⑱ has to be replaced, then

- Dismantle the ring piston ⑲
- Remove screws ⑳ and pull the cylinder bottom from the piston rod towards the top.

Before re-assembly, lightly grease all seals and running surfaces.

Replacing the packing

- Drain the flushing agent and remove casing ①
- Dismantle the split coupling ②
- Dismantle the hydraulic section below the wet cup ③.

In order to replace the top packing ④, pull the piston rod (with piston) ⑥ down out of the valve housing ⑦.
Remove threaded bush ⑧ with worn packing and rings (4.1) (4.2)
Grease the piston rod and put back.
Then push the threaded bush with inserted packing and rings over the piston rod into the valve housing.
Do not forget the sealing ring ⑪.
Firmly tighten the threaded bush.
The bottom packing is replaced outside the cylinder.
After assembling the new packing ⑤ tighten the screws ⑨ equally in the cross-over position with 10 Nm.
If the running surfaces of the piston rod and the cylinder show noticeable signs of wear (drag-lines, indentations), they must also be replaced.
Do not use the running surfaces of the piston rod as a counter support.

– Risk of damage

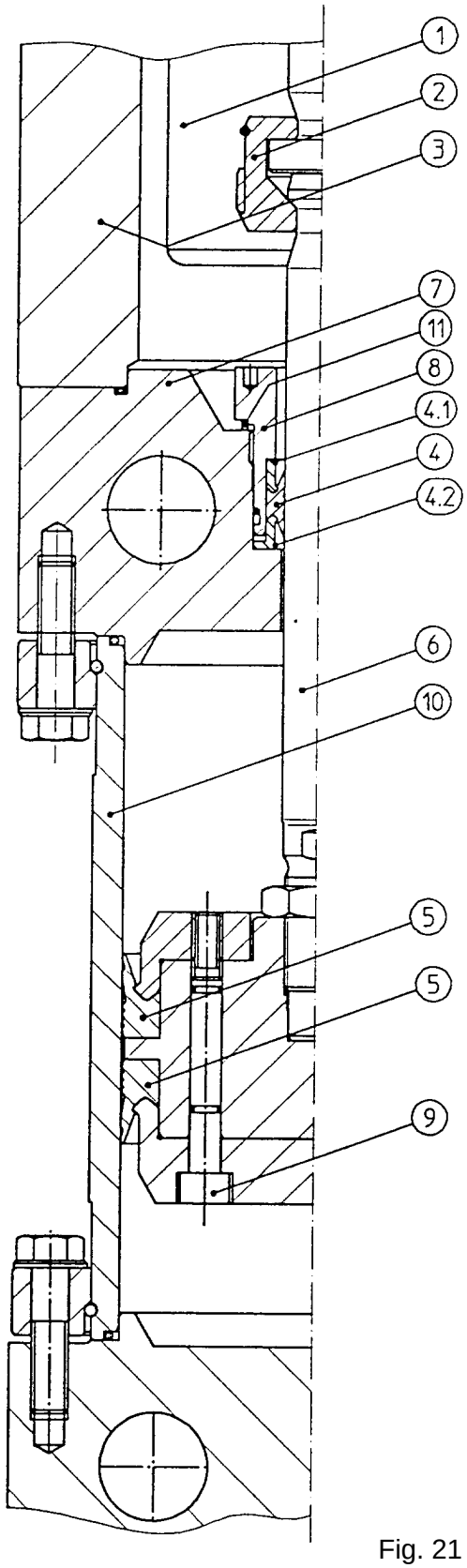


Fig. 21

Replacing the valves

It is recommended to replace the suction and pressure valves one after the other and not at the same time, in order to avoid confusing the connectors ① (fluid suction connection marked with “IN“) and ② (fluid pressure connection marked with “OUT“) during assembly.

Pressure valves

- Unscrew the set screws ③ top and bottom (4 screws)
- Pull out the connector ② with the two brackets ④ in front
- Replace valve seat ⑤ with O-Ring and valve ball ⑥.

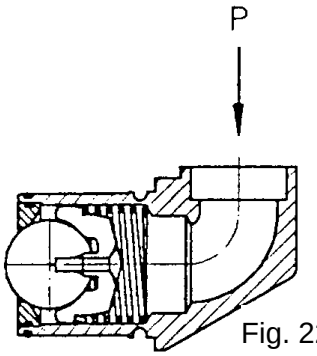


Fig. 22

Remove valve seats with a removing device or press out with compressed air.

⚠ Increase the air pressure P slowly while holding the valve seat and valve ball with the hand.

– Do not point in the direction of persons.

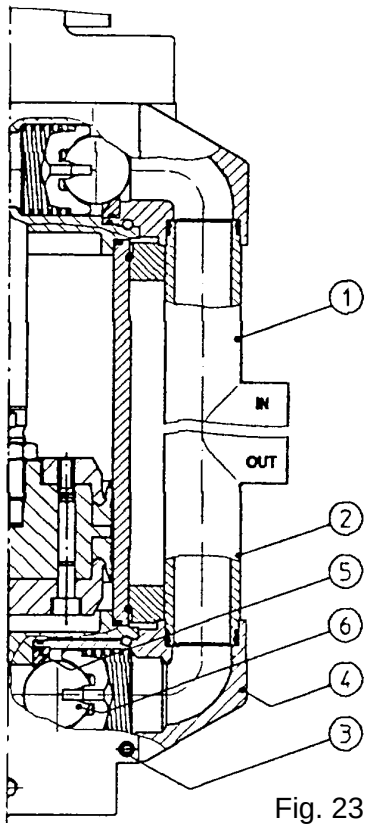


Fig. 23

- Insert the connector with brackets into the piston pump and screw in the set-screws.

The suction valves are replaced in the same way as the pressure valves.
The components (valve seat, O-Ring, valve ball, pressure spring) of all four valves are identical.
They are arranged differently in the pressure and suction valves.

– It is recommended to replace the valve seat together with the corresponding valve ball.

Dismantling the fluid lines

see page 10

If the screwed pipe connection of the type GE 42-ZLR-ED (see replacement accessories) is in use, it is recommended to acquire replacement sealing rings, product No. 75188 097004 before dismantling the fluid lines.

Threaded connections

Do not exceed the tightening torque below when tightening threaded connections.

TIGHTENING TORQUE

Pos.	Thread	Strength class	Tightening torque in Nm
1	M10	8.8	25
2	M20	8.8	180
3	M12	8.8	70
4	M12	10.9	50
5	M12	8	50
6	M20x 1.5	A4	100

The tightening torque in the following table apply to all screws and nuts not shown (not resetting the packing)

Thread	Strength class		
	8.8	10.9	12.9
	Tightening torque in Nm		
M4	3.1	4.6	5.3
M5	6.2	9.1	10.6
M6	10.5	15.1	18.0
M8	25.0	37.0	44.0
M10	50.0	73.0	86.0
M12	86.0	125.0	145.0

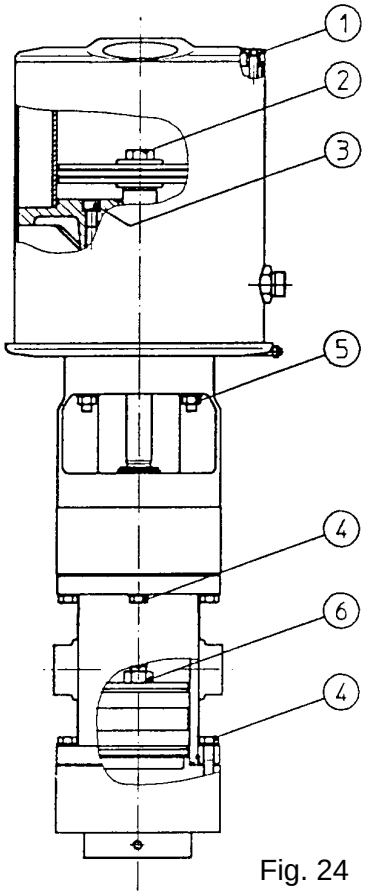


Fig. 24

SHUT-DOWN

⚠ If the air motor pressure is relieved while the fluid pressure system is still pressurized, fluid pressure can increase under certain system conditions. Therefore, relieve the pressure of the piston pump (air and fluid) only by discharging fluid when the compressed air feed is shut-off.

– FOR A SHORT PERIOD
- Cut off the compressed air supply
- Remove the pressure from the piston pump by discharging fluid

– FOR A LONGER PERIOD, FOR THE COMPANY HOLIDAY PERIOD
- Flush piston pump well
- Leave solvent in the piston pump
  – The wet cup must be filled
- Cut off the compressed air supply
- Relieve the pressure in the piston pump by removing the flushing agent

– FOR A LONG PERIOD
- Flush piston pump thoroughly
- Pump solvent out of the piston pump
- Briefly run the piston pump empty at the lowest air pressure level
- Interrupt (screw off) the compressed air connection to the piston pump
- Empty the wet cup (- page 12)


Care should be taken to ensure that on shut down, the piston is at its bottom point in order to avoid drying of fluid residues at the piston shaft.

ERROR ANALYSIS				
Component group	Nature of defect	Defect symptoms	Possible cause	Counter measure
Compressed air supply	Drop in fluid pressure	Heavy leakage	Defective fitting	Replace defective fitting
		Narrowing of cross section	Hose line pinched dirty fittings	Check lines clean fittings
Air motor, control	Works irregularly, stroke frequency falls, stops	Icing	Compressed air too moist, stroke frequency too high, local temperature too low	Remove ice, change operating conditions
	Air escapes continually from the air outlet of the air motor	Flat slide defective	Foreign body has gained access	Renew defective part, check compressed air filter
Hydraulic section	Pressure fluctuations Suction not in order, operates irregularly		Air bleeding not properly done	Aerate pump
		Leaks in suction system, loose connections	Rigid pipe line, vibrations	Flexible connections between pump and suction system
Suction valves	Pump does not stop during upwards stroke	Valve seat, - ball at top defective	Wear	Replace worn parts
	Pump does not stop in down stroke	Valve seat, - ball at bottom defective		
Pressure valves	Pump does not stop during upwards stroke	Valve seat, - ball at bottom defective		
	Pump does not stop in down stroke. Rise in pressure	Valve seat, - ball at top defective		Depressurize pump, immediately replace worn parts
Packing, top	Fluid escapes at the piston rod	Packing defective		Replace worn parts
Packing, bottom	Pump does not stop during upwards stroke	Packing defective		
Suction system	Pressure fluctuations	Suction strainer (dirt trap) is clogged	Fluid contaminated	Clean strainer

NOTES

AUTOMATIC SUPERVISION

If the piston pump 003.1450-DP 4V is operated unattended, danger should be avoided by automatic monitoring.

A stop valve is particularly suitable for this purpose as it interrupts (shuts off) the compressed air supply to the piston pump when the set limit is exceeded (e.g. due to excessive stroke frequency in case of a line breakage).

GUIDELINES AND DIRECTIVES TO COMPLY WITH

VBG 23	Verarbeiten von Beschichtungsstoffen*
VBF 23 DA	Durchführungsanweisungen zur Unfallverhütungsvorschrift Verarbeiten von "Beschichtungsstoffen“
VBG 87	Arbeiten mit Flüssigkeitsstrahlern*
VbF	Verordnung über brennbare Flüssigkeiten*
ZH1/10/EX-RL	Richtlinien für die Vermeidung der Gefahren durch explosionsfähige Atmosphäre mit Beispielsammlung Explosionsschutz-Richtlinien – (EX-RL)*
ZH1/200	Richtlinien für die Vermeidung von Zündgefahren infolge elektrostatischer Aufladungen*
DruckbehV	Druckbehälterverordnung*
Merkblätter	Gefährliche Arbeitsstoffe (Band 1 bis 5) Kühn ; Birett Druckerei Laub Gmbh, Elztal-Dallau

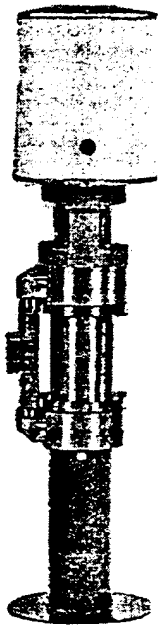
* Carl Heymanns Verlag KG, Luxemburger Str. 449, 50939 Cologne, Germany

USER INFORMATION

The user information (operating instructions) contains all necessary information about the piston pump 003.1450-DP.
The Technical Product Description B.6.15.21-P, and the Replacement Parts List are standard parts of every operating manual. For organizational reasons they are issued as separate documents.

PISTON PUMP 003.1450-DP 4V

Compressed air driven double action piston pumps are recommended for coating and process materials.



DESCRIPTION OF PISTON PUMP

The piston pumps consist of an oscillating air motor Ⓐ and a hydraulic section Ⓑ.

The piston ① of the air motor is connected to the piston ④ of the hydraulic section via the piston rod ② and the coupling ③.
Compressed air is applied alternately to the piston via the control ⑤ that leads to the upwards and downwards strokes.
The area ratio of the piston to the hydraulic section determines the pressure transmission ratio.
During the downwards stroke, the fluid to be delivered is sucked through the suction connection ⑥ via the suction valve ⑦ into the top part of the hydraulics cylinder ⑧, while the fluid leaves the pump under pressure in the bottom part of the cylinder through the pressure valve ⑨ at the pressure connection ⑩.
During the upwards stroke, this process is reversed.
When the pressure system is closed, there is an equilibrium of forces (air pressure/p_L) x area ring piston (A_D) = fluid pressure (p_M) x area hydraulics section (A_d) and the pump is stationary.
When fluid is removed from the pressure system, the pump starts automatically.
Even minor leakage will be replenished.
In a large pressure system, a stop valve ⑩ must be fitted to the pressure vent because of natural variations in temperature (pressure rise due to heat causes increase in volume).

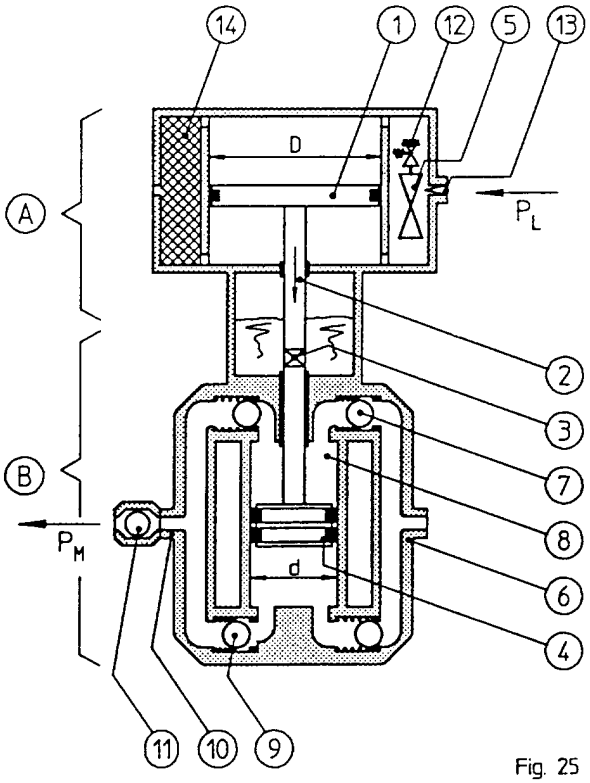


Fig. 25

Safety valves ⑫ protect the piston pump and the pressure system in cases where the air inlet pressure exceeds its maximum permissible value.
The filter ⑬ in the air inlet ensures that no contamination enters into the pump control system from the compressed air system.
The integrated silencer ⑭ ensures that a separate silencer is not necessary.

SUITABILITY, FLUID

TASK BEHAVIOR	SUITABILITY
Supply application	
Conveyance	++
Careful conveyance	+
Dosing	△
Suction behavior	
Automatic suction	++
Tendency to	
Adhere, stick	△
Deposit	–
Foam	+
Coagulate	–
Crystallizing	–
MATERIAL	
Solids content	
none	++
low to 1%	+△
medium 1 to 6 %	△
over 6%	△–
over 50%	–
Gas content	
Very low	++
Low	++
High	+
Kinematic viscosity in mm / s	
up to 500	++
500 up to 750	++
over 750	+ to ?
Behavior	
neutral	++
corrosive	++
abrasive	△
acidic	△
toxic	++
flammable, danger classes AI, AII, AIII	

[1] Open system, grounded, constantly monitored, air supply shut off when not in operation.

PROCESSING OF	SUITABILITY
Oil, Diesel fuel, fuel oil	++
Emulsions	++
Paint, containing solvents	++
Water laquers	++
Dispersions	++
Latex	++
Print colors	+△
Hardening agent	+–
Solvent	+
Alcohol	++
Water, waste water	+
Soap, cleaning agent	+?
Clay sludge, lime sludge	△?
Glazing	△
Water-based and solvent-based natural and synthetic resins	+
Wood preservatives	++
Fiber material, cellulose	–
Sludge, slurry, paste	–
Adhesive	?

++	very suitable	+	suitable
△	suitable under certain conditions	-	unsuitable
?	Application must be tested		

Please consult us when processing highly abrasive and aggressive (caustic) materials

TECHNICAL DATA

KEY TO DESIGNATION

PISTON PUMP 003. 1450 – D P 4V S

- Pressure rating 003 = 3 :1
- Fluid volume cm³/stroke 1450 = 1450 cm³/stroke
- Action: double-action oscillating
- Operating mode: pneumatic
- Four valves
- Additional detail : S = Column construction, W = wall construction

THE MODULES

Piston pump	Article No.	Air motor	Article No.	Coupling	Article No.	Hydraulic section	Article No.
003.1450-DP 4V	79034 095002	D230/S12 0	78015 026004	Support connection	77390 009002	000.1450-DO 4V	78003 067003

Detailed information about basic versions, basic devices, complete devices and article numbers can be found in the sales catalogue.

DATA

Piston pump	Stroke frequency in DH/min				Theoretical transmission ratio	Air		FLUID	
	Continuous operation full load	Continuous operation partial load	Intermittent operation full load	Intermittent operation full load		maximum permissible inlet overpressure	Stroke volume V_H	Max. permissible operating overpressure (Nominal pressure)	Volume
					l	in bar	in l	in bar	in cm³/DH
003. 1450-DP 4V	12 (9)	16	20	25	3	6 (7)	4,85	18 (21)	2900

When piston pumps are working in continuous operation (day and night operation) extra noise reduction measures are necessary.

Fluid – max. flow volume (pump delivery)

Piston pump	Volume flow rate max (at 25 DH/min) in t/min	v = 0.4 m/s		v = 0.7 m/s		v = 12 m/s	
		Stroke frequency in DH/min	Volume flow rate in t/min	Stroke frequency in DH/min	Volume flow rate in t/min	Stroke frequency in DH/min	Volume flow rate in t/min
003.1450-DP 4V	72,5	8	23,2	14	40,6	24	69,9

Air consumption

$V_L = V_H \bullet f \bullet p \bullet 2.6$ in l/min

Legend

V_H	= Stroke volume		V	= Flow rate
F	= actual stroke frequency	in DH/min	DH	= Double stroke
P	= actual air inlet overpressure	in bar	l	= Fluid operating overpressure / Air inlet overpressure

Max. suction height	7.8 m
Lowest operating temperature (no special measures)	10°C
Max. fluid temperature (operating temperature)	80 °C
Max. fluid admission pressure	8 bar

⚠ If the piston pump is operated with admission pressure, the max. permissible operating pressure (nominal pressure) of 21 bar may not be exceeded.

Use silicone-free process materials (compressed air) and accessories only when used for paint spraying.

SOUND EMISSION

As the working places cannot be anticipated the highest possible sound level is shown.

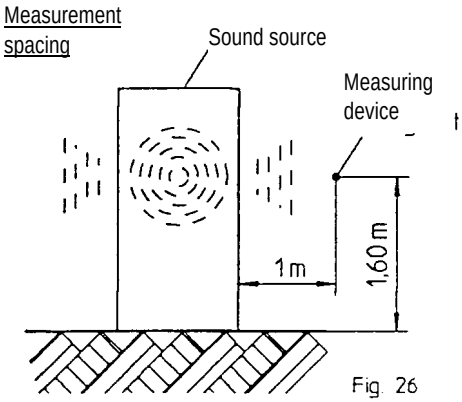


Fig. 26

Piston pump	Air inlet overpressure in bar			
	2	4	6	7
003.1450-DP 4V	81	87	91	93
	Sound level in dB (A)			

– without extra silencer

A danger warning sign is attached to the piston pump.

Fig. 27

MATERIALS
OF THE AREA IN CONTACT WITH THE FLUID

Pos.	Designation	Material/surface
1	Valve housing	SST 1.4571
2	Threaded bush	SST 1.4571
3	Packing	PE (1.4571)
4	O-ring	FPM/FEP
5	Cylinder	SST 1.4301/chrome-plated
6	Union nut	SST 1.4571
7	Thrust washer	SST 1.4571
8	Piston	SST 1.4571
9	Piston rod	ETG100/chrome-plated
10	Coupling housing	Al
11	Ball guide	POM
12	Valve ball	POM
13	Pressure spring	SST 1.4310
14	Valve seat	SST 1.4571
15	Connector	SST 1.4571
16	Ring	POM
17	Tee	SST 1.4571
18	Cheese head screw	A4-70
19	Seal ring	PE
	O-Rings	FPM

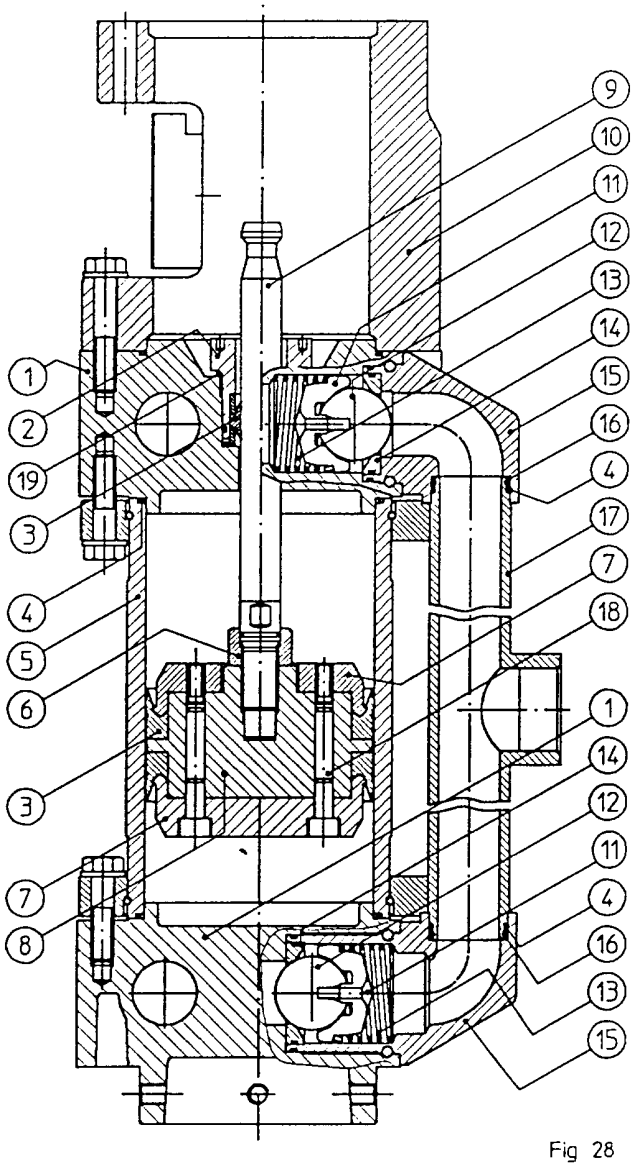


Fig. 28

DIMENSIONS, SCREW CONNECTION THREADS, RATED DIAMETER OF CONNECTIONS, MOUNTING POSITION

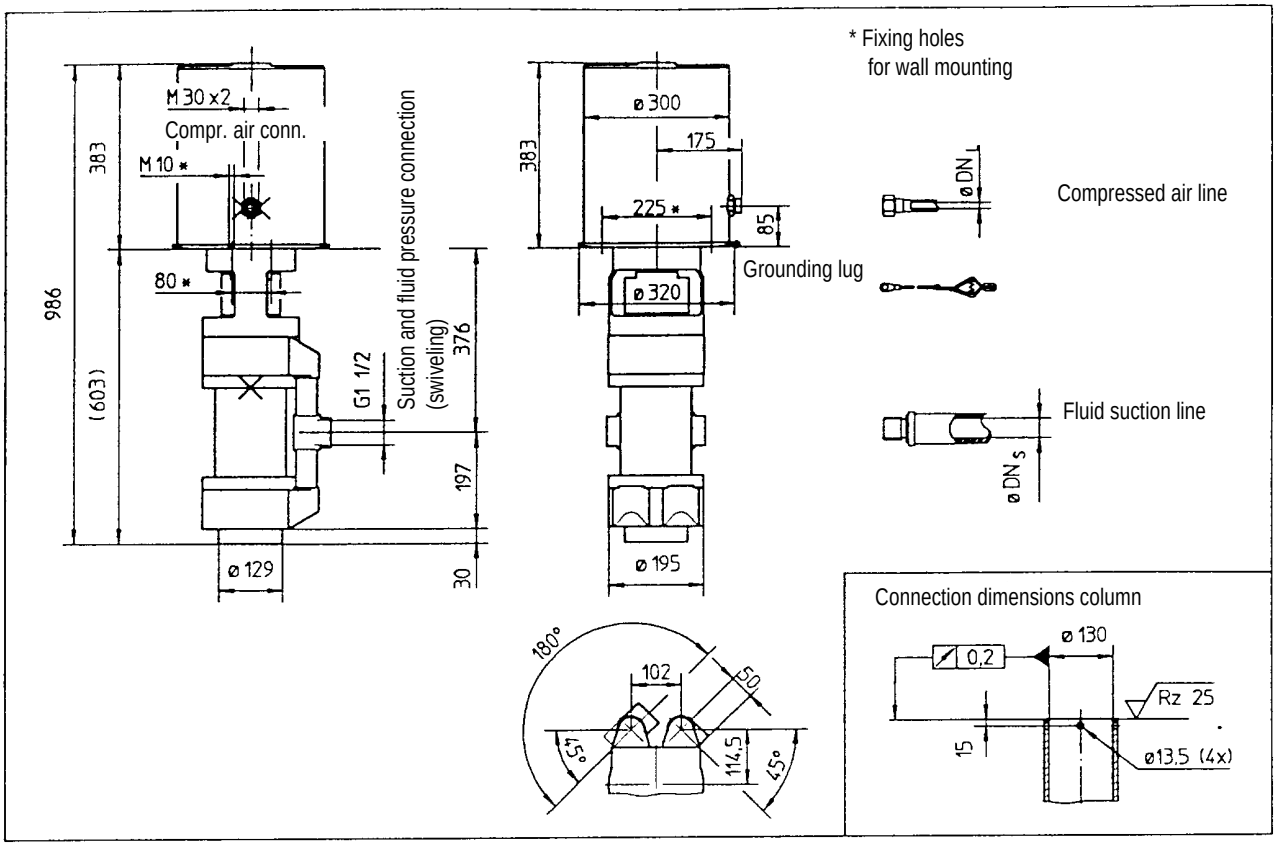


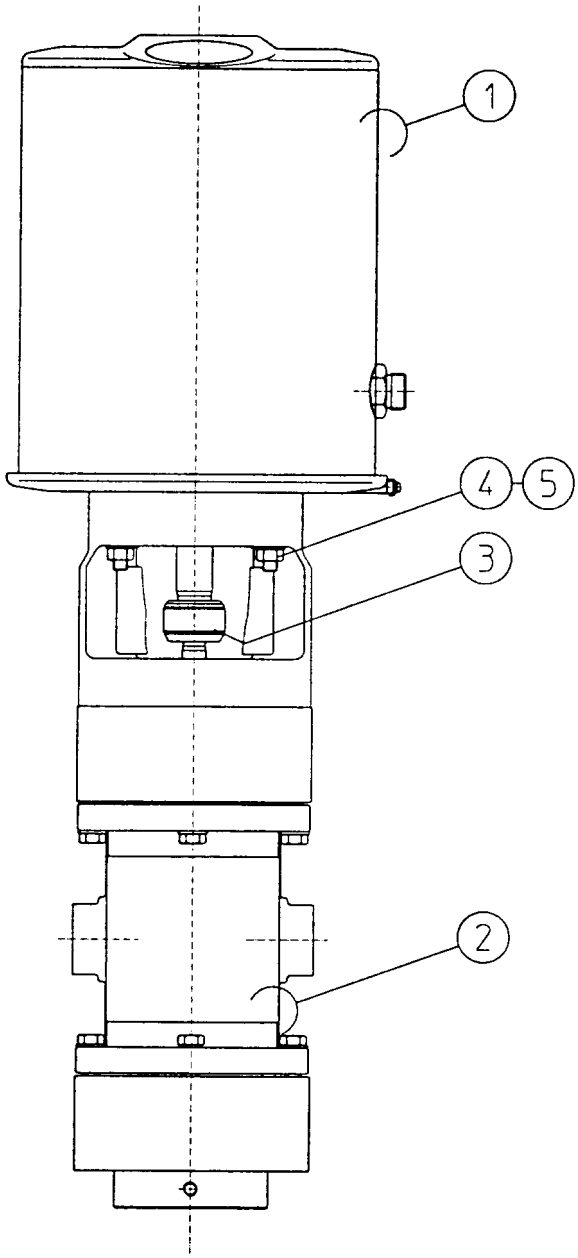
Fig. 29

Compressed air line	$DN_L \geq 16$	Elastic connections
Fluid suction line	$DN_S \geq 40$	Piston pump - compressed air supply, Piston pump - Fluid container / line required

The piston pumps should be operated in the vertical position.

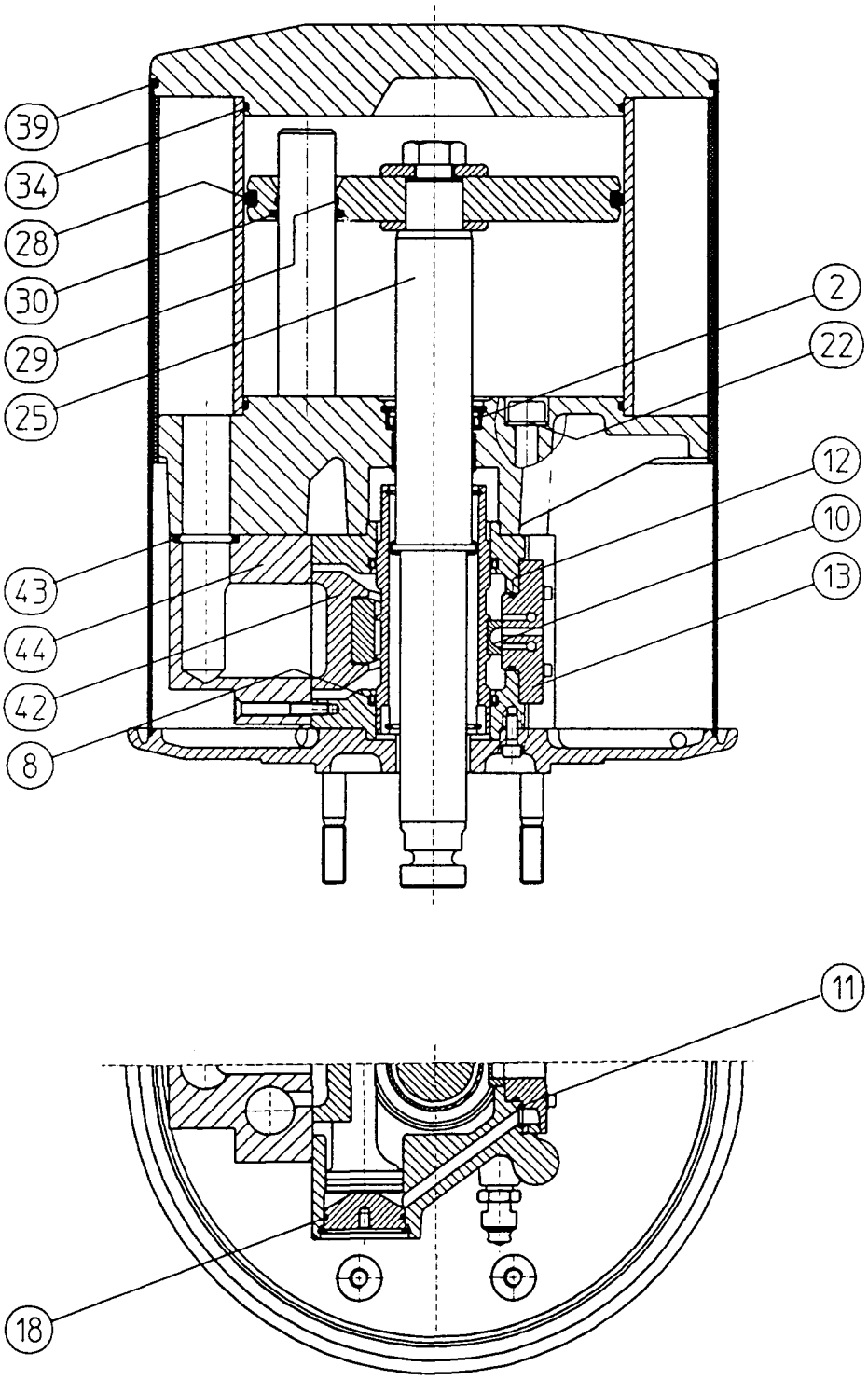
GRACO

PISTON PUMP 003.1450-DP 4V



Air motor Pos. 1	Hydraulic section Pos. 2	Support connection Pos. 3	Hexagonal nut Pos. 4	Washer Pos. 5
D230 S120 78015 026004	000.1450-DO 4V 78003 067003	 77390 009002	4 x M 12 74074 010023	4 x M 12 74094 014090

Pos. 1



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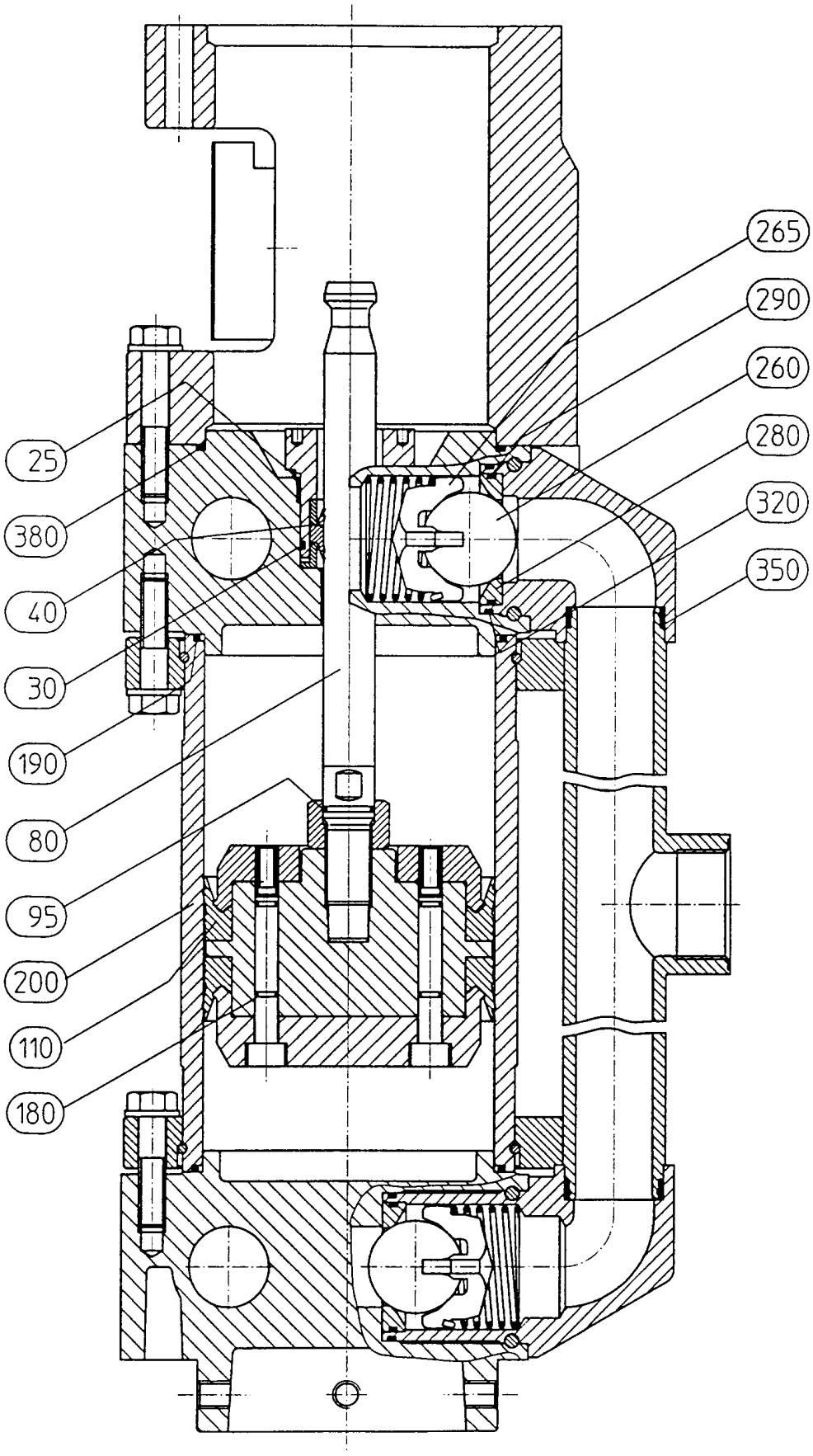
AIR MOTOR D230 S120

Replacement parts set, air motor control			Part No. 79978 904501	
Pos.	Number	Designation		
8	2	Packing	60 x 67.8 x 5	
10	1	Flat slide	24 x 19	
11	2	O-ring	9 x 2 B	
12	1	O-ring	35 x 2.5 B	
13	1	Valve seat	-	
18	2	O-ring	38 x 2 B	
42	1	Flat slide	62 x 45	
43	3	X-ring	26,58 x 23,53	
44	1	Valve seat	-	

Replacement parts set, air motor seals			Part No. 79978 904602	
Pos.	Number	Designation		
2	1	Axial radial seal ring	D 40	
22	4	Screw head seal	M 12	
28	1	O-ring	210 x 6 B	
29	1	Guide bushing	4 x 1.55 x 92	
30	1	Rod seal	D 30	
34	2	O-ring	220 x 3 B	
39	1	O-ring	290 x 3 B	

Replacement parts set, air motor piston rod			Part No. 76613 021002	
Pos.	Number	Designation		
25	1	Piston rod	D 40 L 367	

Pos. 2



F22.060.04, issued on 01.98

HYDRAULIC SECTION 000.1450-DO 4V

Replacement parts set, O-Rings hydraulic section			Part No. 79978 048001	
Pos.	Number	Designation		
30	1	O-ring	37	
190	2	O-ring	124	
290	4	O-ring	50	
320	4	O-ring	59	
350	4	O-ring	37,77	
380	1	O-ring	122	

Replacement parts set, packing hydraulic section			Part No. 79978 095001	
Pos.	Number	Designation		
25	1	Seal ring	46.5 x 48.5 x 3.5	
30	1	O-ring	37 x 2.5 B	
40	1	Packing	22 / 34 x 29,2	
110	2	Packing	DN 125 P21	
180	12	O-ring	7 x 1.5 B	
190	2	O-ring	125 x 3,55	

Replacement parts set, valve hydraulics section			Part No. 79978 050001	
Pos.	Number	Designation		
260	1	Valve ball	D 40	
265	1	Ball guide	-	
280	1	Valve seat	D 33,5	
290	1	O-ring	50 x 2.5 B	
350	1	O-ring	59 x 2.5 B	

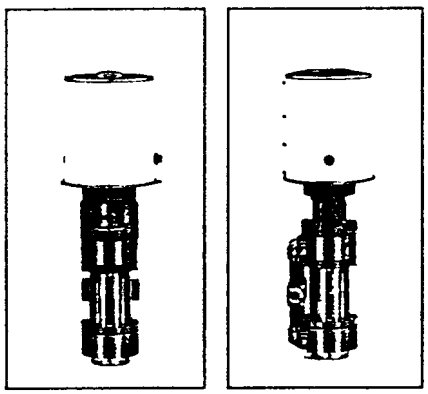
Replacement parts set, piston rod hydraulics section			Part No. 79978 051001	
Pos.	Number	Designation		
80	1	Piston rod	Hyd. D 22 L 282	
95	1	O-ring	18 x 2 B	
190	2	O-ring	125 x 3,55	
320	4	O-ring	59 x 2.5 B	

Replacement parts set, cylinder hydraulics section			Part No. 79978 906817	
Pos.	Number	Designation		
190	2	O-ring	D 40	
200	1	Cylinder	50 x 2.5 B	
320	4	O-ring	59 x 2.5 B	

a) When replacing all four valves, this set of parts is required four times.

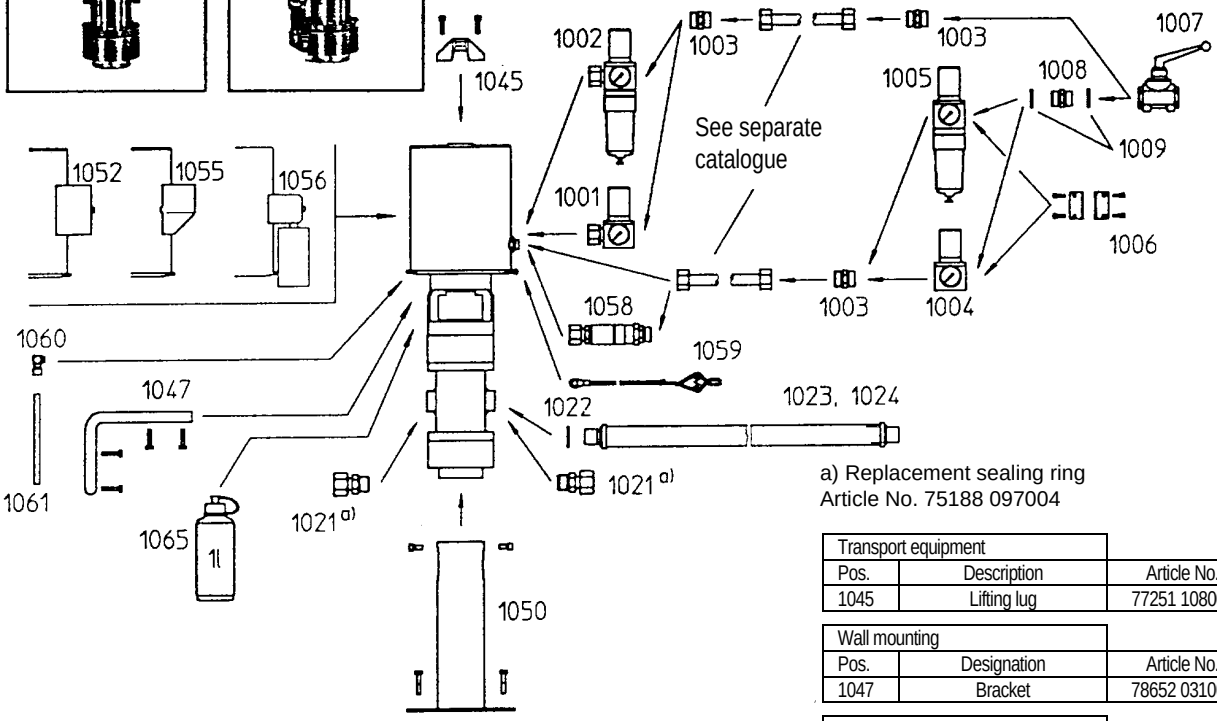
The piston pumps in their basic version

Pos.	Model	Weight (kg)	Article No.
002	003.1450-DP 4V	100	79034 095002



Piston pump ____
Model

- with safety valves
- with integrated silencer
- with air nipple with integrated filter



a) Replacement sealing ring
Article No. 75188 097004

Compr. air conn.				
Pos.	Designation	Material	Notes	Article No.
1001	Compr. air conn.	-	M30x2 – G 3/4	77522 032001
1002	Compr. air conn.	-	M30x2 – G 3/4	77522 034002
1003	Nipple	CrSt	M30x2-G3/4 tap.	76639 221001
1004	Compr. air conn.	-	G3/4	77522 028010
1005	Compr. air conn.	-	G3/4	77522 034003
1006	Elbow	St	Wall support	75650 009001
1007	Ball valve	-	PN 50 G3/4	75601 012005
1008	Nipple	CrSt	16-G3/4	76640 008001
1009	Seal ring	Al	27x32	74188 025070

Suction connection				
Pos.	Designation	Material	Notes	Article No.
1021	Screwed joint	SST	GE 42 – ZLR ED	75204 010007
1022	Seal ring	PA	48x55	74188 059050
1023	Suction hose	SST	R11/2-D42-L1475	77848 030012
1024	Suction hose	SST	R11/2-D42-L1875	77848 030013
1025	Suction hose	SST	D48-D42-L1470	77848 014012
1026	Suction hose	SST	D48-D42-L1870	77848 014013
1027	Suction hose	SST	D48 200l container	77848 013025

Pressure connection				
Pos.		Material	Notes	Article No.
1021	Screwed joint	SST	GE 42 – ZLR ED	75204 010007

Transport equipment		
Pos.	Description	Article No.
1045	Lifting lug	77251 108001

Wall mounting		
Pos.	Designation	Article No.
1047	Bracket	78652 031001

Base fastening		
Pos.	Designation	Article No.
1050	Column	77656 015007

Air diffuser		
Pos.	Designation	Article No.
1052	Pipe cut-out	77809 008005

Additional silencer		
Pos.	Designation	Article No.
1055 1056	Plate silencer Further information on request	77666 003001

Switching off unit		
Pos.	Designation	Article No.
1058	Stop valve	78594 001003

Grounding		
Pos.	Designation	Article No.
1059	Ground wire	73483 001011

Condense drain		
Pos.	Designation	Article No.
1060	Plug	75202 001004
1061	Hose	70350 030012

Detergent		
Pos.	Description	Article No.
1065	Bottle	77682 001010

Order Example

Please lay out each order as follows:

1. Designation _____ 2. Pos. No. ___ 3. Part No.

▼ ▼ ▼

Piston pump 003.1450 4V-DP 002 79034 095002

GRACO STANDARD WARRANTY

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco´s written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the repaid return of equipment claimed to be defective to an authorized Graco distributor for verification of claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco´s sole obligation and buyer´s sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

Graco does not extend its warranty to accessories, appliances, materials or components which are sold by Graco but are not manufactured by Graco and makes no guarantee, however implied, with regard to the brand capability and suitability for a certain purpose. These parts sold by Graco but not manufactured by Graco (such as electric motors, switches, hoses, etc.) are covered by the warranties of the respective manufacturers. Graco will support the buyer in enforcing any warranty claim with the proviso that in no event can Graco be made liable for indirect, incidental, special or consequential damages which arise from the supply of appliances by Graco under the conditions governed by these provisions, or the supply, performance or use of any products or other goods which are sold under the conditions governed by these provisions, whether as the result of breach of contract, breach of warranty, negligence on the part of Graco or for any other reason.

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