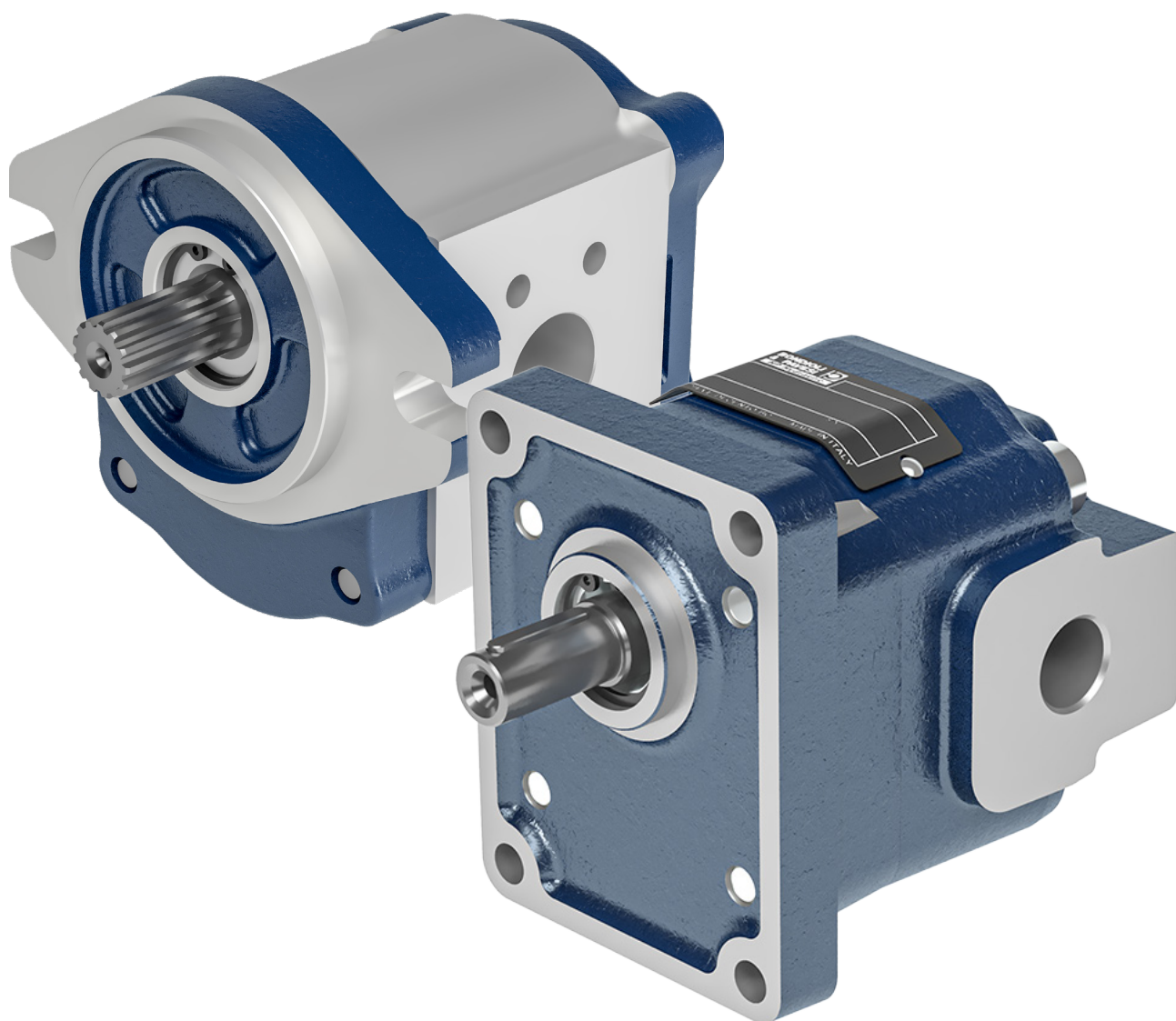
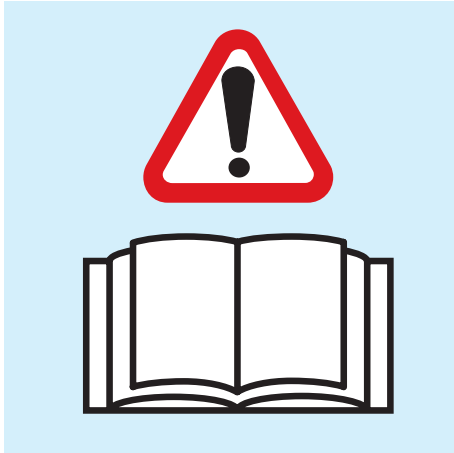


General instructions for use





This manual contains instructions for the installation and operation of gear units which include external gear pumps and motors. The following instructions apply to standard products.

Due to the constant technological research that aims to improve the technical characteristics of our products, Bondioli & Pavesi reserves the right to modify its products and internal calibration and testing procedures without prior notice and/or official changes being made. For this reason, this material shall not constitute a base for legal proceedings.

Bondioli & Pavesi shall not be held liable for faults, incidents or modifications caused by a failure to comply with the instructions in this manual and a failure to comply with the safety standards in force, even if not included in this manual.

Bondioli & Pavesi shall not be held liable for any errors in this manual; if in doubt, please contact our central office for more information.

Failure to observe these instructions will result in the manufacturer's warranty being automatically voided.

This catalogue may not be reproduced, even partially, without specific authorisation in writing from Bondioli & Pavesi. This catalogue replaces all previous versions.

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Description of product

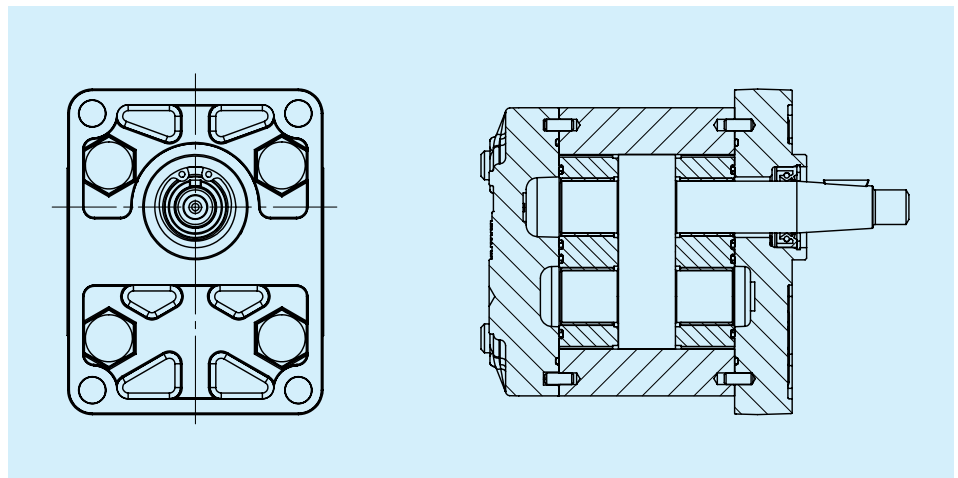
The Bondioli & Pavesi range of external gear units includes hydraulic pumps and motors.

The series feature a special type of material used for the pump/motor body and the type of external teeth used.

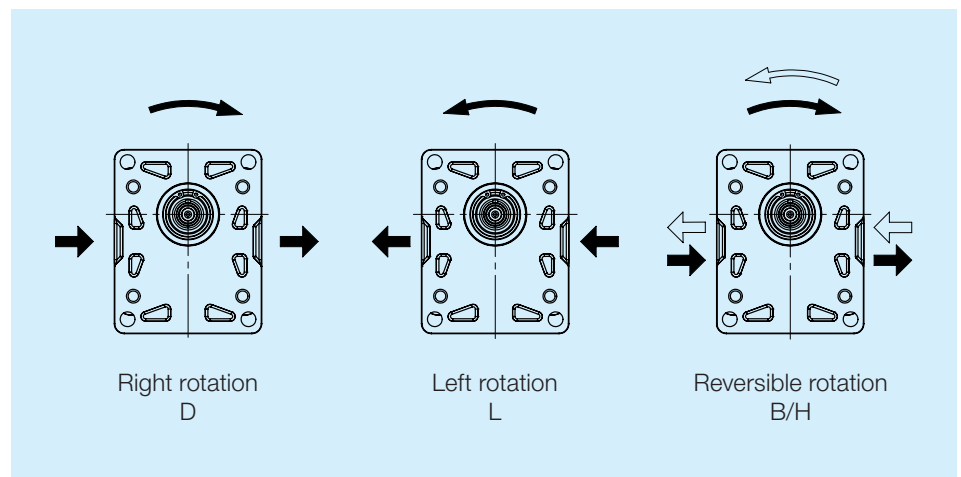
The range includes HPL series aluminium and HPG series cast iron pumps with straight tooth gears and HPZ series aluminium and HPX cast iron pumps with helical tooth gears.

Each series is available in several groups and can be used to supply multiple pumps and pumps and motors with valves.

Refer to the relevant technical files to make a choice and our sales department, if necessary.

**Definition of direction of rotation**

The direction of rotation is the direction viewed from the drive shaft.



General formulas Here are the formulas used to calculate the flow rate, torque and power.

Pump:

$$Q = c \cdot \eta_v \cdot n \cdot 10^{-3}$$

$$M = \frac{\Delta p \cdot c}{62,83 \cdot \eta_m}$$

$$P = \frac{\Delta p \cdot c \cdot \eta}{600 \cdot 1000 \cdot \eta_t}$$

Motor:

$$Q = \frac{c \cdot n \cdot 10^{-3}}{\eta_v}$$

$$M = \frac{\Delta p \cdot c \cdot \eta_m}{62,83}$$

$$P = \frac{\Delta p \cdot c \cdot \eta \cdot \eta_t}{600 \cdot 1000}$$

where:

Q = Flowrate [l/min]

M = Torque [Nm]

P = Power [kW]

c = Displacement [cm³/rev]

n = rpm [min⁻¹]

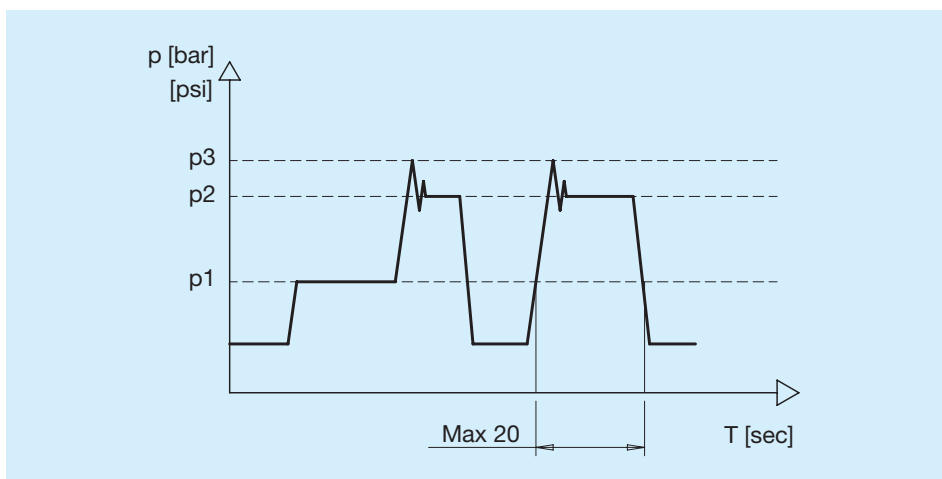
Δp = Pressure [bar]

η_v = Volumetric efficiency

η_m = Mechanical efficiency

η_t = η_v · η_m Overall efficiency

Definition of pressures



p1	Continuous pressure
p2	Intermittent pressure Maximum pressure allowed for short periods (relief valve setting)
p3	Peak pressure

Peak pressure is the maximum allowable pressure and corresponds to the maximum relief valve pressure setting. If the relief valve setting is compliant, but the overpressure is above the limit, reduce the relief valve setting so that the overpressure value drops to within the limit.

Tightening torques

Series	Screw	Min. torque [Nm]	Max. torque [Nm]
HPL..1	M8	20	25
HPL..2 HPZ..2	M10	43	45
HPL..2 HPZ..2 SG version	M10	60	65
HPL..3	M12	125	140
HPL..4 SG version	M10	48	50
HPG..2 HPX..2	M10	70	75
HPG..3	M12	125	140
HPG..4	M16	275	290

General instructions

To ensure that Bondioli & Pavesi components operate correctly, the following recommendations must be observed during design and installation.

Transport

Depending on the weight and duration of transport (dimensions and weights can be found in the product specifications sheet or technical drawing), the following transport options are available:

Manual transport

Bondioli & Pavesi pumps weighing up to 15 kg can be manually transported for a short period of time if necessary.

Warning!



Manual transport may be harmful to health. Use personal protective equipment (e.g., safety glasses, gloves, suitable work clothing, safety footwear).

Avoid the manual handling of pumps with sensitive accessories (e.g., sensors or valves).

Transport with lifting strap

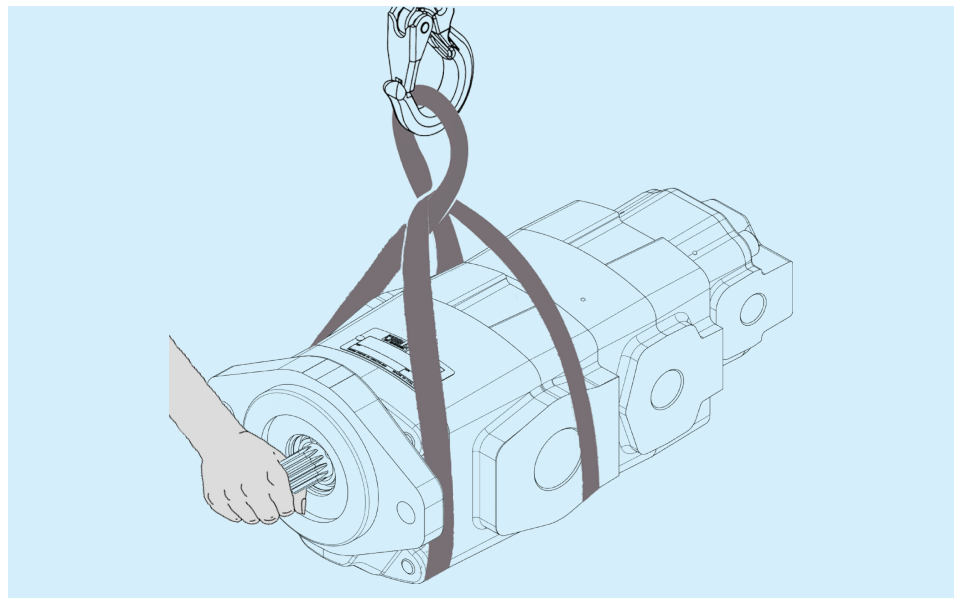
Gear **units** can be transported by connecting them to a lifting device and using **suitable transport** (lifting strap).

Warning!



Suspended loads. When being transported with a lifting device, the gear unit may slip out of the lifting strap and cause injury.

Make sure the gear unit is securely attached with the lifting belt and guide it to prevent abnormal rocking. Use the widest possible lifting strap. Only manually guide the gear unit for fine positioning or to prevent rocking. Do not stand or place your hands under suspended loads. Position the support belt around the gear unit so that it does not pass over components (e.g. valves) or other accessories.



Storage The storage areas must be free of corrosive materials and gases. To avoid damaging the seals, do not use ozone-releasing equipment (e.g., mercury vapour lamps, high voltage equipment, electric motors, sources of electrical sparks or discharges) in the storage areas.

The storage areas must be completely dry.

The ideal storage temperature must be between +5 °C and +20 °C (minimum storage temperature -40 °C, except for units that have electronic components; maximum storage temperature +50 °C).

Avoid exposing the gear units to high light irradiation (e.g. bright windows or direct fluorescent lighting).

Do not stack the gear units and protect them from knocks.

Do not store the gear units on the shaft or accessories (e.g. sensors or valves).

Check the gear units once a month to ensure they are stored correctly.

The gear units are supplied by the manufacturer with anti-corrosion packaging.

A unit can be stored for a maximum of 12 months with standard protection or a maximum of 24 months with corrosion protection.

The warranty will no longer be valid if the storage requirements and conditions are not complied with or the maximum period of storage has expired.

Procedure when maximum storage period has expired

- Check the entire gear unit for damage and corroded areas before installation.
- Perform a test run to check that the gear unit operates correctly.
- If stored for over 24 months, the shaft seal must be replaced.

Bondioli & Pavesi recommends this procedure

When the maximum storage period expires or if you have questions regarding repair work or spare parts, contact the Bondioli & Pavesi customer service. The instructions below refer to gear units that use mineral oil-based hydraulic fluid. Other hydraulic fluids require specific methods of storage.

- Empty and clean the gear unit.
- For storage periods of up to 12 months, coat the inside of the gear unit with mineral oil and fill with approximately 100 ml of mineral oil.
- For storage periods of up to 24 months, fill the unit with a VCI 329 corrosion inhibitor (20 ml).
- Seal all the oil ports.
- Wet the unpainted surfaces of the gear unit with mineral oil, or with a suitable anti-corrosion product that can be easily removed.
- Wrap the gear unit in protective anti-corrosion film and store it where it is protected from knocks.

Installation position When assembling the component and the drain pipes, make sure they are in a position in which the internal parts remain lubricated by the oil during long periods of machine shutdown.
Make sure that the inlet, delivery and drainage pipes flow into the tank below the minimum fluid level under all operating conditions; this is to prevent the formation of air or foam.
Before connecting the pipes, remove any end caps and make sure they are perfectly clean.
Check the direction of rotation of the gear unit and make sure it corresponds to that of the drive motor and/or dissipator power take-off (right pump on the left motor or vice versa).

Pipes and fittings The pipes that connect the gear unit to the hydraulic circuit must be able to withstand the required operating pressure.
Always make sure the system is protected by pressure relief valves.
Avoid overtight bends, make the path of the pipes as short as possible and reduce the number of hydraulic resistances (elbows, throttling, etc.) to a minimum. The pipe cross section must also be sufficiently large to keep the fluid velocity within the following limits:

DELIVERY PIPES: 5 m/sec MAX

RETURN, DRAIN PIPES: 3 m/sec MAX

SUCTION PIPES: 1.5 m/sec MAX

The following simplified formula can be used to calculate the fluid velocity:

$$v = \frac{Q \times 21,2}{d^2}$$

where:

v = fluid velocity (m/sec)

Q = fluid flow rate (l/min)

d = inner diameter of pipe (mm)

Suction Gear suction must use a pipe that can withstand vacuums and sharp bends, blockages and excessive lengths (over two metres) should be avoided. It must also be placed so that it is 5 cm above the bottom of the tank and the same distance apart if the outlet is lateral. A pipe that is too close to the bottom of the tank could cause air to be sucked in.

Gear pumps The suction pressure p must be between 0.7 bar and 3 absolute bars where if $p > 1.5$ bar, special shaft seal versions are needed.

One-way gear motors The maximum pressure on the motor drain is $p = 5$ bar.

Drain line The drainage pipes must be positioned so that the gear unit is always filled with hydraulic fluid and long periods of downtime must be avoided to prevent air infiltration.
The maximum pressure on the drain port is $p = 5$ bar.

Check If the p pressure values are exceeded, special shaft seals are required; for more information, contact our technical sales department.

Filters Filter the filling oil to ensure the ISO or NAS class required in the "Type of oil" section.
We recommend fitting a filter on the suction line to prevent cavitation. The filter on the return duct must not exceed 60 microns at operating pressures up to 150 bar; for higher pressures, it can reach 30 absolute microns.

Filters should normally be replaced:

- After the first 50 hours of operation
- When the indicator shows that the filter is clogged
- Every 500 hours of operation

Temperature The temperature of the fluid in the reservoir must not exceed 80°C **for any reason whatsoever**; higher values may damage the components and lead to a rapid deterioration in performance.

To keep the temperature low:

- Do not install the components near heat emitters (heat engines, mufflers, radiators, etc.).
- Use oil reservoirs with a capacity of over 50 litres at least.
- Use adequately sized pipes
- Adequately size the system heat exchanger.

Keep the radiating surfaces clean.

Suitable detectors should be installed that warn the operator when high temperatures are reached or stop machine operating to prevent overheating.

Cleaning Correct cleaning of all the system parts is essential and should be done before start-up.

The main connection operations should be performed in a clean, dust-free environment and debris of all types must be removed immediately before it enters the circuit.

Bondioli & Pavesi gear units are delivered with the ports closed by protective plugs which should only be removed when the unit is connected.

When the component has been installed, it is good practice to add a small amount of hydraulic oil to protect the internal parts until the hydraulic system is filled.

Pickle the pipes and wash them with suitable solvents.

Dry thoroughly with compressed air to remove all traces of solvent.

Type of oil Use pre-filtered ISO/DIN compliant mineral hydraulic oil containing anti-wear and anti-foam additives.

Check that the fluid viscosity required for correct operating corresponds: minimum 10 mm²/s (for short periods), maximum 1000 mm²/s (cold start), recommended viscosity range 15-90 mm²/s.

Cold start refers to short periods of time at low speeds, respecting the recommended viscosity and minimum suction pressure values.

If the ambient temperature is below -20°C, the speed and pressure of the system should be limited until the hydraulic fluid temperature reaches -20°C.

The required contamination class is ISO 4406 20/18/15 (NAS 1638-9).

Operating limit temperatures

For NBR seals temperature range -20°C... +85°C

For FKM seals temperature range -20°C... +110°C

Operating at temperatures above the indicated maximum will lead to premature deterioration of the functional characteristics of the seals used.

Couplings

Bear in mind that no axial or radial load should be directly applied to the Bondioli & Pavesi gear unit shaft.

In any case, provide adequate coupling joints that do not transmit loads to the shaft.

Precautions to be taken before start-up

Thoroughly clean all the parts of the system that will come into contact with the circuit hydraulic fluid (reservoir, pipes, heat exchangers, filters, etc.) Make sure that nothing prevents normal suction of the gear units (taps closed on the suction line, loose connections which could cause water to enter the pipes, etc.).

Pressure gauges must also be installed to check the system operating pressures.

Filling

For correct operation of the gear unit, fill and vent it adequately.

When filling use hydraulic fluid filtered at 10 micron to prevent foreign bodies entering the system. Even new hydraulic fluids may contain impurities.

System start-up

When the system starts up, all the air in the hydraulic circuit must be eliminated before the circuit is subjected to high stresses.

Warning!

Do not operate the gear unit if the gear unit has not first been filled. The components may be seriously damaged.

The gear unit must always be supplied with an adequate amount of hydraulic fluid. A correct supply must be guaranteed when the gear unit is started up. During the various start-up stages, check the hydraulic fluid level in the reservoir and top up if necessary.

Constantly check for any noise (possible cavitation) and/or if the hydraulic fluid has bubbles, an indication that the fluid supply is insufficient.

To check the correct fluid supply, the gear unit must be operated for a few minutes without load and pressure, paying attention to any leaks, noises and the presence of bubbles in the fluid (if this is the case, recheck the system). When the operating values are reached, check the pipe seal and the operating temperature.

Flushing of system

"Flushing of the system" means eliminating, as far as possible, all the contaminating particles in the hydraulic fluid and system components from the hydraulic circuit.

Do this when the machine is new, when the system has been heavily overhauled, important parts have been replaced or faults have occurred when may introduce metal particles into the circuit.

Flush the gear unit without load.

Use additional 3-10 micron filters which should be temporarily placed on the pipes which run back to the reservoir and the suction ones, sized according to the required flow rates and pressures.

Operate the transmission so that the manoeuvres cause the particulate pollutants to come off the pipes and the parts of the hydraulic system.

Flushing must last long enough for all the hydraulic fluid to pass through the filters at least 15-20 times.

Flushing should be considered satisfactory when the level of oil contamination, according to the ISO 4406 Standard, is 20/18/15 or lower.

Notes If there are several parallel-connected motors in the circuit, flushing must be performed on each "branch" of the circuit, i.e. the pipes that connect each motor to the point where the flow is divided. To do this, we recommend series connecting a high pressure ball shut-off valve to the bypass pipe of each motor. The corresponding circuit branch with the valve open will be flushed whereas the others will be closed. By repeating the same procedure for each branch, the circuit will be completely flushed.

After flushing, the filter and any pipes and auxiliary valves used must be removed, the hydraulic fluid replaced and the system returned to a normal operating configuration.

Introduction The components listed in this troubleshooting procedure can be inspected, repaired or replaced according to the procedures outlined in this manual. The information found in this section serves as a guide for identifying the causes of faults or malfunctioning in the hydraulic components. It is therefore a useful tool for eliminating problems that are easy to solve.

Experience has shown that we can divide the types of problem into a number of general cases.

These cases are listed in the tables below, with possible causes and solutions. However, the list does not include all the faults which, in practice, may occur.

Fault	Possible cause	Solution
Insufficient or no flow	rotation speed too low	check the gear unit plate data
	undersized suction line	correctly size the suction line
	fluid viscosity out of optimum range	use suitable hydraulic fluid
	suction pressure too low	check the length and position of the suction line
	insufficient venting of the hydraulic system	fill the gear unit and the suction line, eliminating the air present
	wear or mechanical failure	replace the gear unit
	if the problem persists	contact Bondioli & Pavesi
Reduced operating pressure	connection with faulty coupling	check that the coupling is correct
	wear or mechanical failure	replace the gear unit
	rotation speed too low	check the gear unit plate data
	insufficient venting of the hydraulic system	fill the gear unit and the suction line, eliminating the air present
	if the problem persists	contact Bondioli & Pavesi

Fault	Possible cause	Solution
External oil leakage	broken seals	replace seals
	reversed direction of rotation	check assembly is correct
	slight seeping of oil between gear unit covers	clean the gear unit
	if the problem persists	contact Bondioli & Pavesi
Hydraulic fluid temperature too high	oil level in reservoir too low	top up oil level
	blocked or faulty heat exchanger	clean or repair heat exchanger
	rotation speed too high	check the gear unit plate data
	wear of gear unit	replace the gear unit
	if the problem persists	contact Bondioli & Pavesi
Abnormal noise	undersized suction line	correctly size the suction line
	suction pressure too low	check the length and position of the suction line
	rotation speed too high	check the gear unit plate data
	Incorrect fastening of the gear unit	check assembly is correct
	mechanical damage to the gear unit (e.g. damaged bearings)	replace the gear unit
	insufficient venting of the hydraulic system	fill the gear unit and the suction line, eliminating the air present
	if the problem persists	contact Bondioli & Pavesi

Routine maintenance

Routine maintenance work on a hydraulic system is usually carried out at regular intervals and involves:

- Checking the fluid level and topping up if necessary.
- Cleaning and maintenance of the radiating surfaces.
- Replacing the filters.
- Replacing the oil.

Warning!

Perform all maintenance work and controls when the system is not in service and has cooled down, without pressure and disconnected from the power supply.

We recommend

- Perform all the operations in a clean, dust-free environment so that foreign particles are not introduced into the components.
- Plug all the pressure ports with plastic caps as soon as the hydraulic pipes have been disconnected.
- Replace the seals each time the components are opened.

Procuring seal kits before working on the components.

Therefore, the recommended intervals are:

Before every machine start-up:

- Check the oil level in the reservoir
- Clean the heat exchanger.
- Check that the reservoir breather is clean.

After the first 50 hours of operation:

- Replace the oil filter

Every 500 hours or at least once a year:

- Replace the oil filter

Every 1000 hours or at least once every two years:

- Change the oil in the hydraulic system (do this when the oil is hot).
- Replace the reservoir breather filter

After repair work and/or overhauling of the system components:

- Change the oil in the hydraulic system (do this when the oil is hot).

Cleaning and care

The reliability and durability of the gear unit depends on constant cleaning and care of the unit:

- Check that all the seals and fitting closures are installed correctly to prevent moisture entering during cleaning.
- Remove impurities and keep sensitive components, such as valves, sensors, etc., clean.
- Periodically check for leaks
- Check there is no abnormal noise
- All fastening elements must be properly tightened

Special maintenance

Special maintenance work involves:

- All work that requires the disassembly and replacement of the gear unit or parts of it.
- Checking parts of the gear unit.

To disassemble the gear unit, proceed as follows:

- Turn off the machine
- Drain the hydraulic system and make sure there is no pressure
- Wait for the gear unit to cool down
- Procure a liquid collection tank for any fluid spills
- Unscrew the gear unit with proper tools from the pipes so that the fluid is collected in the designated collection tank
- Empty the gear unit completely
- Close all ports
- Store the gear unit as described on page 8 (storage)

Warning!

Transformations of the gear unit are not allowed.



The Bondioli & Pavesi warranty applies exclusively to the delivered configuration.

Any changes will render the warranty null and void

Labelling

An identification plate is attached to all the Bondioli & Pavesi components that leave the factory, both new and overhauled, which lists in full the product type and code, the job number and a progressive number.

If a request for spare parts is made, it is very important that all the information on this identification plate is provided.

If a product is overhauled, the plate is replaced with updated information; every modification to the pump that involves the issue of a new code must be indelibly marked on the plate.

Protection of oil ports

All Bondioli & Pavesi components are shipped with the oil ports protected with plugs.

Metal plugs are used for unused ports and plastic ones for all the others.

The plugs should be left in position until the components are installed in the system to prevent the entry of humidity and pollutants that may damage them.

If a component has to be dismantled for repair and/or overhauling, **we recommend closing the oil ports with plugs to protect them from pollution and dirt.**

Protection of components

Bondioli & Pavesi components are usually shipped in plastic bags to protect them from humidity and oxidation.

This packaging protects the component for a normal shipping and storage period which does not exceed 20 days.

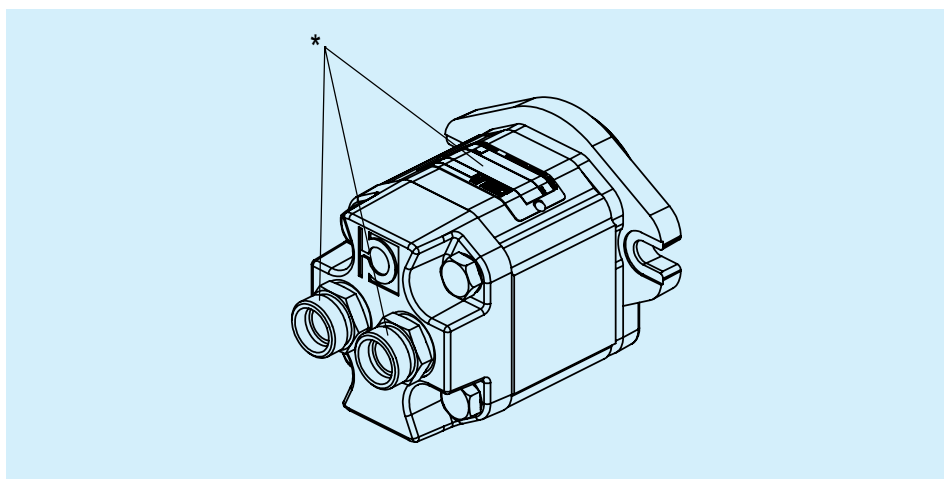
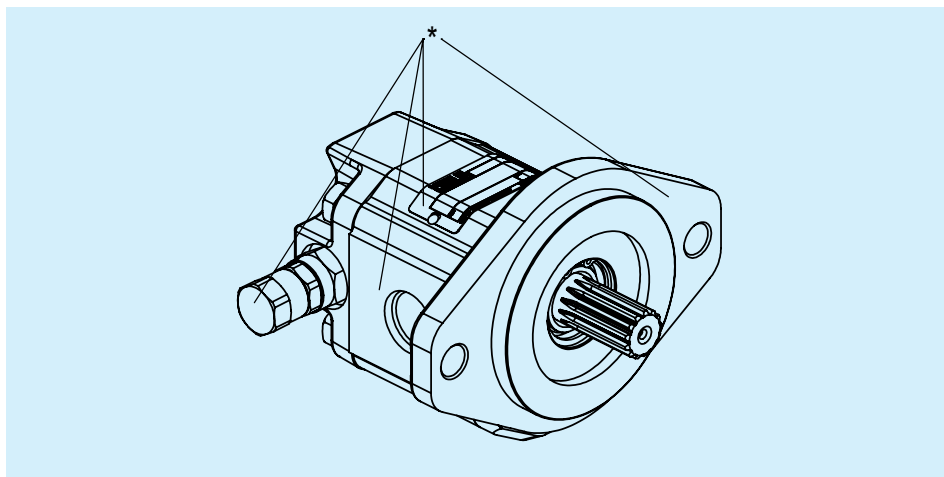
For longer periods of storage, we recommend unpacking the component and applying protective oil to the exterior to prevent oxidation.

Store the component in an enclosed area with low humidity.

Painting

If Bondioli & Pavesi components require painting, it is very important to protect the mating surfaces, i.e.:

- Flanges
- Versions
- Connection ports
- Identification plate



The following components, if present, should also be protected:

- Solenoid valves and valves
- ECUs
- Speed sensors

Warning!

If electrostatically painted, the electrical/electronic components and speed sensors on the Bondioli & Pavesi pumps and motors must be adequately protected.

