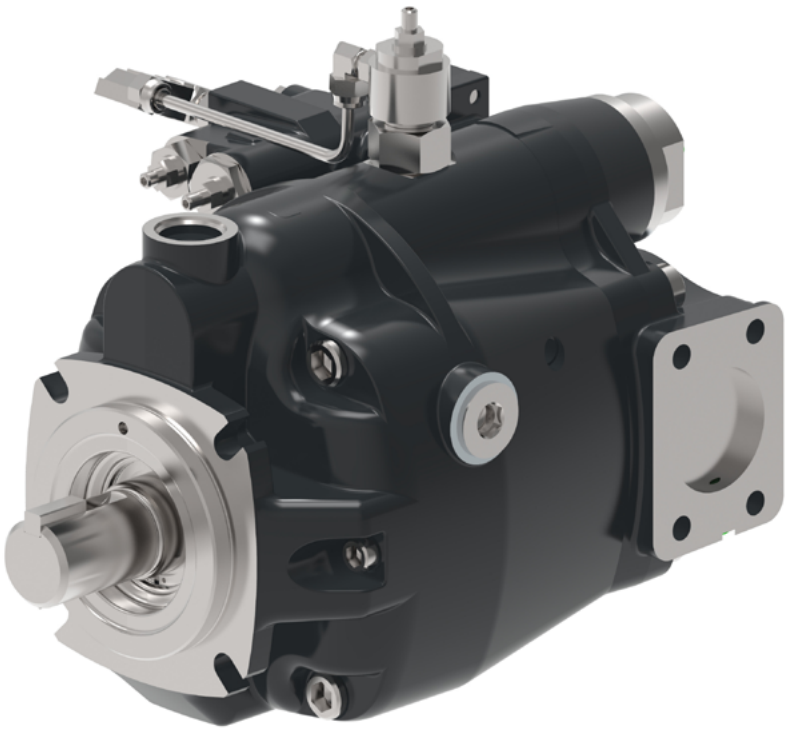
ENGINEERING
TOMORROW

Service Guide

PVM Piston Pump Service Guide



VICKERS
by Danfoss

Industrial pumps

Contents

1. Overview

This manual contains information about the installation, maintenance, and simple repair of the PVM series open-type axial piston pumps. It covers the instructions for the pump and its various sub-assemblies, troubleshooting information, and simple repair procedures. Please follow the procedures in this manual for the installation, maintenance, and simple repair of the PVM series open-type axial piston pumps to avoid affecting the product warranty.

Simple maintenance can only be carried out after the pump has been removed from the machine. Before any maintenance or repair work, thoroughly clean the pump. Since dust and contamination are the most detrimental factors for any hydraulic equipment, please strictly comply with the cleanliness requirements.

Especially when replacing the system filters or disassembling and assembling the hydraulic pipes, make sure that the cleanliness meets the standards!

2. Safety Precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Unintended machine movement

WARNING

Unintended movement of the machine or mechanism may cause injury to the technician or by standers. To protect against unintended movement, secure the machine or disable / disconnect the mechanism while servicing.

Flammable cleaning solvents

WARNING

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Fluid under pressure

WARNING

Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.

Personal safety

WARNING

Protect yourself from injury. Use proper safety equipment, including safety glasses, at all times.

3. Installation

Before installation, check to ensure that all shipped components are complete, free from any damage, and not externally contaminated. Protect them properly to prevent the intrusion of contaminants. It is recommended to thoroughly clean the equipment with hydraulic oil before installation to remove any possible corrosive substances that may be present.

3.1. Installation of Pump - Motor Unit

To ensure the normal operation of the oil pump and extend its service life, the input shaft of the hydraulic pump is strictly prohibited from bearing additional radial and axial loads. The Danfoss hydraulic pump should be connected to the output shaft of the prime mover by means of a bell housing and an elastic coupling, and the two shafts need to be accurately aligned. The coaxial error of the axes should not exceed 0.08mm, and the angular error should not exceed 0.5°.

Before assembly, it is necessary to check the relevant dimensions of the bell housing and coupling to ensure that the design and manufacturing meet the assembly requirements of the pump-motor unit.

3.1.1. Hoisting Of the Hydraulic Pump

When hoisting the hydraulic pump, the lifting device should be hooked on the base or the lifting rings of the pump body. It is strictly prohibited to hoist the main shaft of the oil pump! Knocking or hitting the main shaft and the sealing surfaces of the oil inlet and outlet is strictly prohibited.

3.1.2. Installation Of the Bell Housing Coupling

Install the key block on the pump shaft and loosen the set screws inside the coupling. Use a copper rod to gently and evenly tap the coupling on the pump to install the coupling in the proper position. (Note to control the tapping force. Heavy blows are strictly prohibited!).

Install the key block on the motor shaft. Use a copper rod to gently and evenly tap the coupling to install the coupling in the appropriate position. (Pay attention to controlling the tapping force. Heavy tapping is strictly prohibited!)
When installing the motor, bell housing and pump, make selections according to the actual situation to ensure the reliability and convenience of the connection.
After the installation, check the coaxiality and perpendicularity between the main shaft of the motor and the positioning boss of the bell housing. Check the clearance of the coupling to ensure that it is between 3 and 5 millimetres.

3.1.3. Pump Installation

The pump can be installed horizontally or vertically (with the shaft end facing upwards). Rigid connections between the pump and the oil tank cover or tank body, as well as between the pump and the oil suction steel pipe and the oil discharge steel pipe should be avoided, to prevent the entire system from being excited by the vibration of the pump.

Vertical installation (with the shaft end facing upwards). The following installation scenarios can be referred to.

3.1.3.1 Installation inside the oil tank

When the lowest liquid level of the oil tank is equal to or higher than the installation, please refer to Figure 1 for connecting the pipeline.

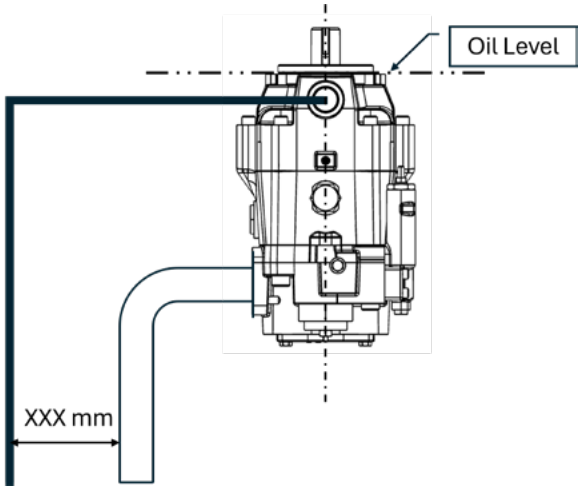


Figure 1

3.1.3.2 Installation outside the oil tank

Under both static and dynamic conditions, the pressure at the lowest oil suction port of the pump shall not be lower than 0.8 bar, and the allowable oil suction height shall not be higher than 800 mm. For the pipe connection, please refer to Figure 2.

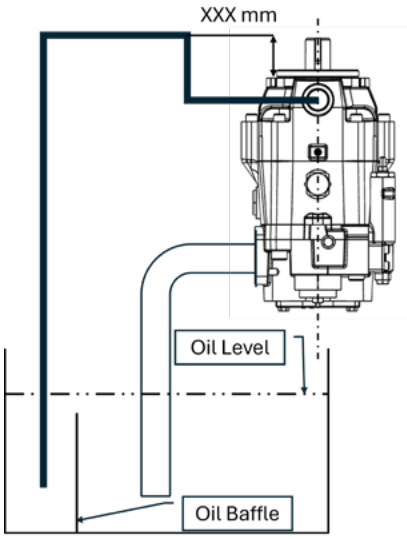


Figure 2

3.1.4 Horizontal Installation

3.1.4.1 Installed inside the oil tank

When the lowest liquid level of the oil tank is above the top of the pump, please refer to Figure 3 to connect the pipeline. When the lowest liquid level of the oil tank is lower than the upper end of the pump, please refer to Figure 4 to connect the pipeline.

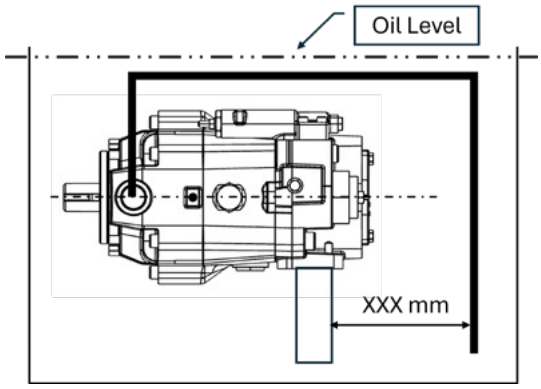


Figure 3

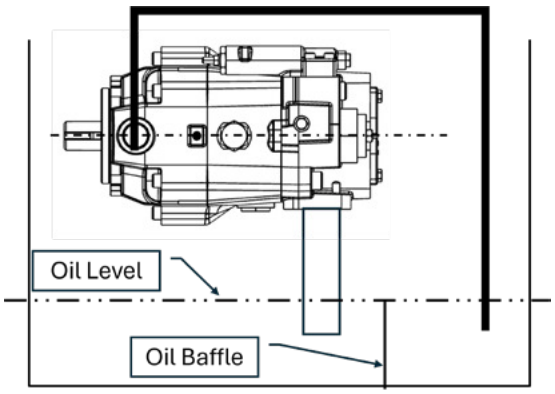


Figure 4

3.1.4.2 Install outside the oil tank

If it is installed above the oil tank, please refer to Figure 5 to connect the pipeline.

If it is installed below the oil tank, please refer to Figure 6 to connect the pipeline.

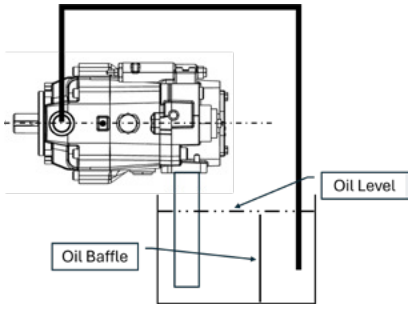


Figure 5

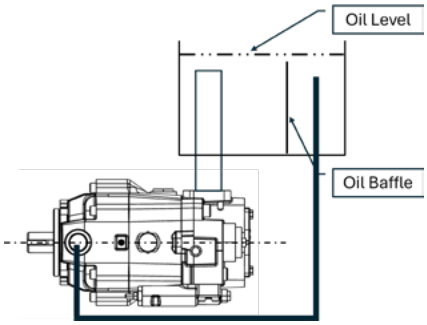


Figure 6

3.2 Tandem pump series installation

To avoid excessive stress on the pump flange, additional pump supports may be required for tandem configurations.

In industrial applications, additional supports are generally not required for combinations of two pumps of the same specification. However, for combinations of more than two pumps stacked together, supports must be provided.

3.3. Pipeline Installation

- Carry out pipeline configuration according to the provisions of the operation manual. The connecting pipes of the hydraulic pump include the inlet and outlet connecting pipes and the leakage oil pipe.
- Remove the plastic protective cover on the pump oil port before installation.
- The oil suction port is preferably located at the bottom or side of the pump. The maximum flow velocity of the oil suction port should not exceed v = 1.0 m/s. Even during the pressure compensation period, the pressure at the suction port should not be lower than 0.8 bar (absolute pressure).
- The oil suction pipe must suck in clean, cooled, filtered oil without air bubbles.
- The oil suction port should be monitored by a proximity switch or a similar device. When the valve is closed, the prime mover should be prevented from starting.
- Install a short oil suction pipe with a 45° bevelled port into the oil tank.
- Use the oil drain port at the highest position on the pump body. It is recommended that the length of the housing drain oil pipe does not exceed 2 meters. If the length exceeds 2 meters, the pipeline size needs to be increased to reduce the restriction.
- The housing drain oil pipeline must never be combined with the return oil pipeline/drain oil pipeline. Always ensure that the housing is filled with oil. In the case of oil shortage, the pump will fail prematurely.
- The maximum allowable housing pressure is 2 bar. (Parameter requirement for the oil drain pipeline.)
- If bearing flushing is required, please refer to the figure 7 for pipeline configuration:

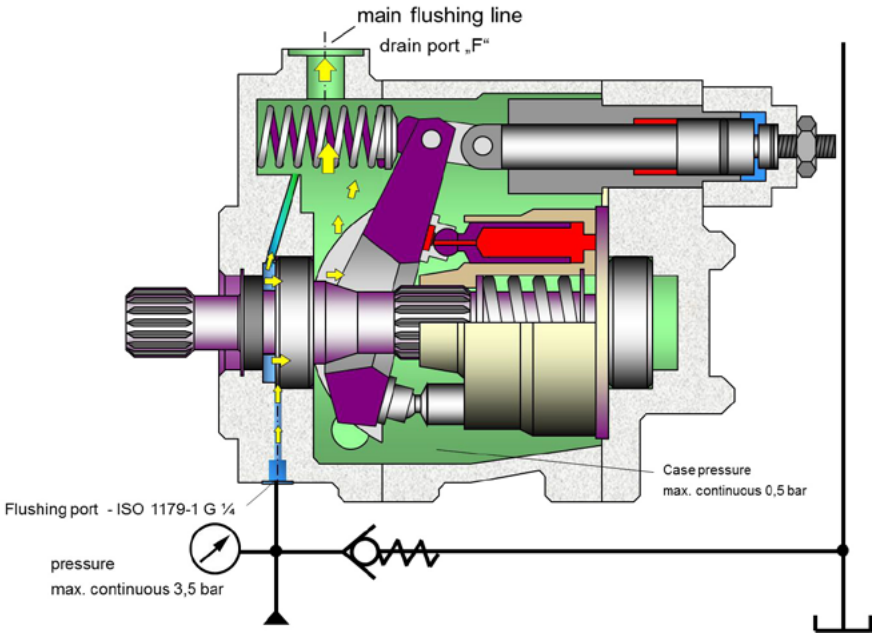


Figure 7

4. Hydraulic Fluids

Fluid	Recommended Operating Viscosity Range	Maximum Viscosity at Startup	Minimum Viscosity @ Max. Intermittent Temperature of 104°C (220°F)
	cSt (SUS)	cSt (SUS)	cSt (SUS)
Use antiwear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE, or SF) per SAE J183 FEB80	16 to 40 (83 to 187)	1000 (4550)	10 (90)

Note: For detailed usage instructions of water-glycol (HFC) hydraulic oil, please refer to the HFC Usage Manual of PVM Pump.

4.1 Fluid Cleanliness

Any form of contamination is a great enemy to any hydraulic component, and it remains the primary cause of component failures. Therefore, for the components that come into contact with hydraulic oil, extreme care must be taken during all operation and management processes to ensure their cleanliness. All oil ports of pumps and other components must be plugged before hard pipes or hoses are installed. It is advisable to carry out the assembly in a dry and dust-free environment. Only use appropriate tools for assembly. The recommended cleanliness level to ensure the maximum service life and reliability of the components is level 18/16/13, which is in compliance with ISO 4406 (NAS7).

5.Start-Up Procedure

- To ensure the normal operation of the oil pump, make sure that the coupling and the motor are correctly connected, and pay attention to the direction of rotation, mechanical connection, etc.
- Confirm that all the plastic plugs on the oil ports have been removed and ensure that the pipeline is unobstructed and correctly connected.

- Conduct a comprehensive inspection of the installation of the hydraulic pump. Check the installation of each oil port to see if there are any issues such as omitted installations or misconnected oil pipes. Pay special attention to ensuring that the oil drain pipeline is unobstructed.
- Manually rotate the shaft of the hydraulic pump as much as possible so that all components of the pump can be lubricated during the trial operation, and the air bubbles inside the pump can also be reduced.
- Check the oil level in the oil tank.
- The cleanliness of the oil should meet the requirements.
- The housing must be filled with oil before startup.

6. Commissioning guidelines

6.1 Pressure Compensator – Code A

After loosening the locknut, turn the pressure adjusting rod clockwise to increase the pressure, and turn the pressure adjusting rod counterclockwise to decrease the pressure. Adjust it to the required pressure and then tighten the locknut (14-20 Nm).

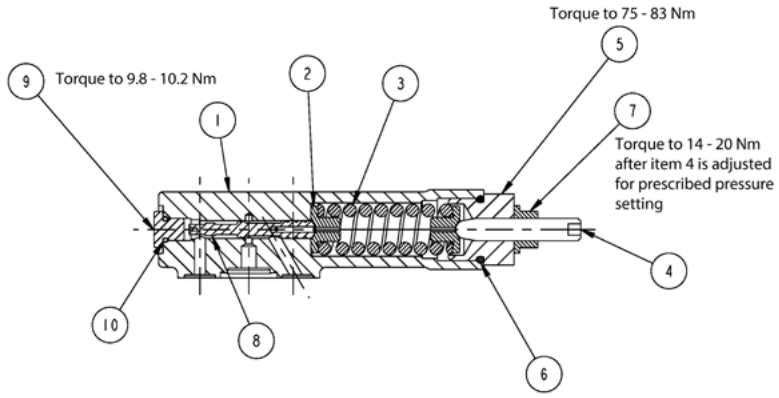


Figure 8

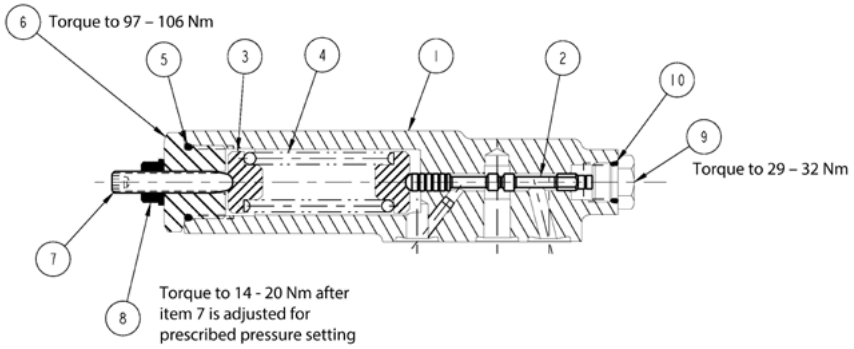


Figure 9

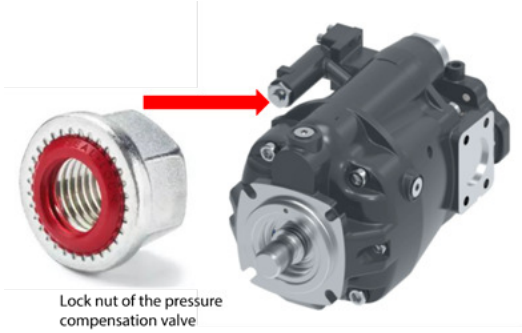


Figure 10

Two types of pressure compensator are offered for sizes from 10 cc to 141 cc

6.1.1 Pressure compensator - High pressure type

Pressure adjustment range 140 bar – 315 bar.
Theoretical pressure regulation coefficient 57 bar/turn.

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-002	●	●	●	●	●	●								
9901517-002									●	●			●	●
9901517-021											●	●		
9901517-041							●	●						

6.1.2 Pressure compensator - Low Pressure type

Pressure adjustment range 35bar – 130 bar.
Theoretical pressure regulation coefficient 27 bar/turn.

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-003	●	●	●	●	●	●								
9901517-003									●	●			●	●
9901517-022											●	●		
9901517-042							●	●						

6.2 Pressure and Flow Compensator – Code B or C

After loosening the lock nut, turn the pressure regulating rod clockwise to increase the pressure, and turn the pressure regulating rod counterclockwise to decrease the pressure. Adjust it to the required pressure and then tighten the lock nut.

Pump size [cc/r]	10cc – 50 cc	57cc – 141 cc
Lock Nut Tightening torque	32 - 38 Nm	14 -20 Nm

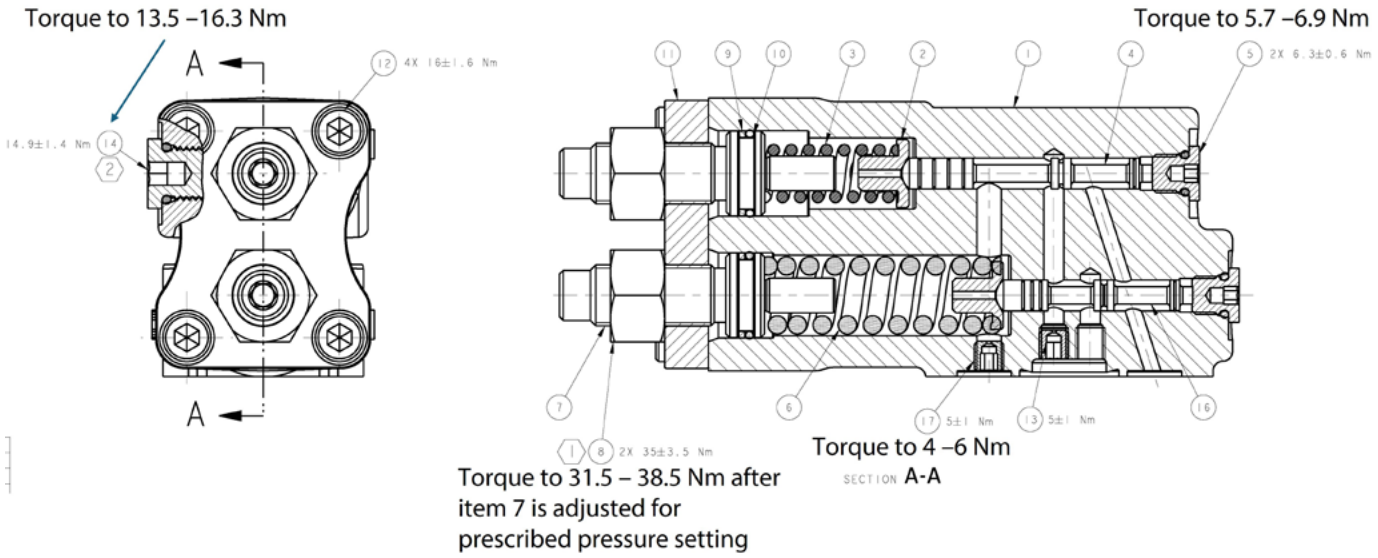


Figure 11

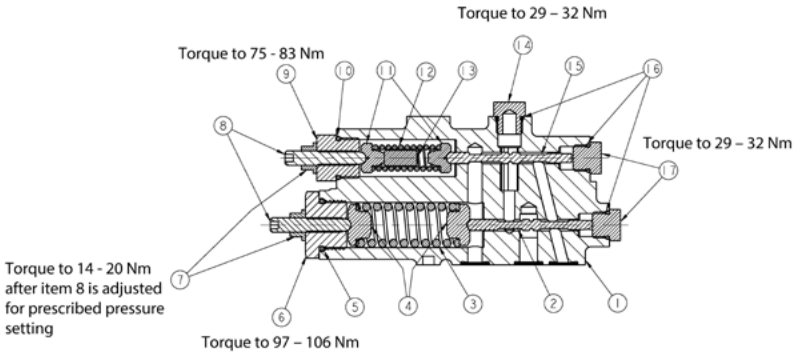


Figure 12

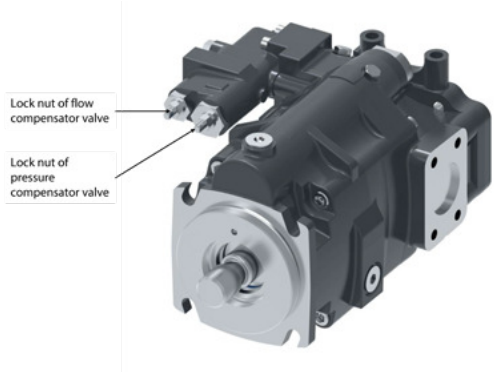


Figure 13

In addition to the 2 types of Pressure compensators, there are 2 types of Flow compensators.

Flow compensator – High pressure type

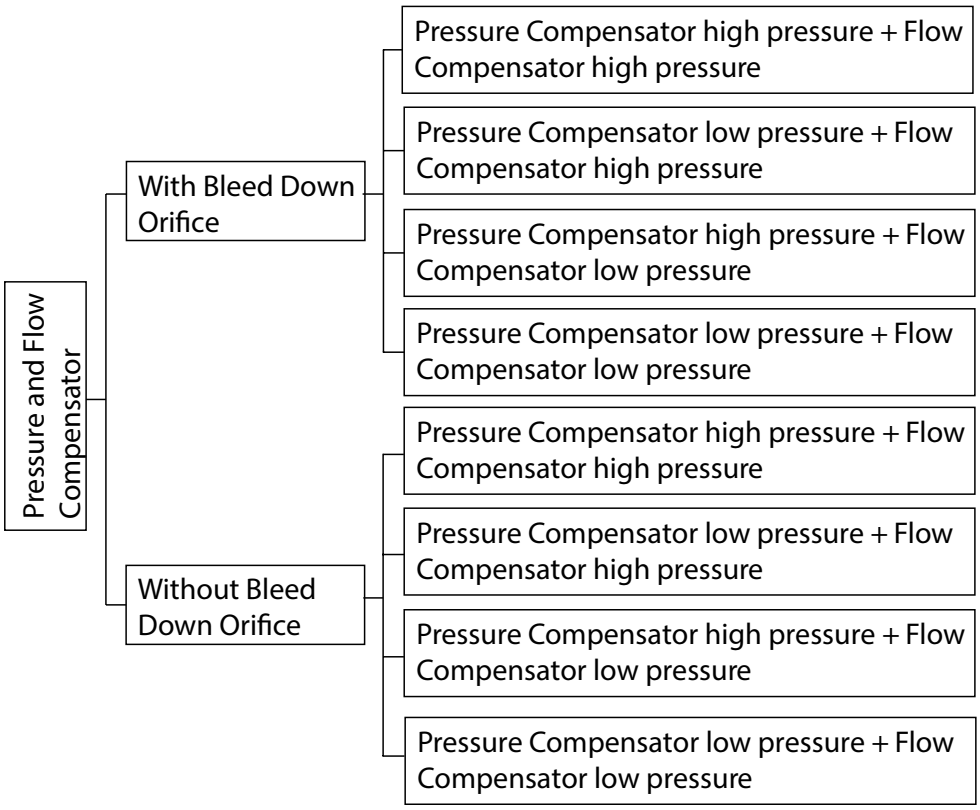
- Pressure adjustment range 21 bar – 41 bar.
- Theoretical pressure regulation coefficient 16 bar/turn

Flow compensator – Low pressure type

- Pressure adjustment range 10 bar – 20 bar.
- Theoretical pressure regulation coefficient 10 bar/turn

The Pressure and Flow Compensator – also identified as Load Sensing compensator – either has the bleed down orifice (Code B) or is without the bleed down orifice (Code C)

This leads to 8 different varieties of Pressure and Flow compensators



6.2.1 Pressure Compensator high pressure + Flow Compensator high pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-005	●	●	●	●	●	●								
9901517-004									●	●			●	●
9901517-023											●	●		
9901517-043							●	●						

6.2.2 Pressure Compensator low pressure + Flow Compensator high pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-005	●	●	●	●	●	●								
9901517-004									●	●			●	●
9901517-023											●	●		
9901517-043							●	●						

6.2.3 Pressure Compensator high pressure + Flow Compensator low pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-007	●	●	●	●	●	●								
9901517-005									●	●			●	●
9901517-024											●	●		
9901517-044							●	●						

6.2.4 Pressure Compensator low pressure + Flow Compensator low pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-011	●	●	●	●	●	●								
9901517-007									●	●			●	●
9901517-026											●	●		
9901517-046							●	●						

6.2.5 Pressure Compensator high pressure + Flow Compensator high pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-004	●	●	●	●	●	●								
9901517-008									●	●			●	●
9901517-027											●	●		
9901517-047							●	●						

6.2.6 Pressure Compensator low pressure + Flow Compensator high pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-008	●	●	●	●	●	●								
9901517-010									●	●			●	●
9901517-029											●	●		
9901517-049							●	●						

6.2.7 Pressure Compensator high pressure + Flow Compensator low pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-006	●	●	●	●	●	●								
9901517-009									●	●			●	●
9901517-028											●	●		
9901517-048							●	●						

6.2.8 Pressure Compensator low pressure + Flow Compensator low pressure

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901512-010	●	●	●	●	●	●								
9901517-011									●	●			●	●
9901517-030											●	●		
9901517-050							●	●						

6.3 Power Control/Torque Limiter

The Power Control limits the maximum torque output by the piston pump by reducing the displacement as pressure increases hence limiting the power rating at a given speed.

After loosening the lock nut, turn the pressure regulating rod clockwise to increase the power, and turn the pressure regulating rod counterclockwise to decrease the power. Adjust it to the required power and then tighten the lock nut (14 - 20 Nm).

Ensure that the damping with a diameter of Φ0.7 exists in the tee joint on the load sensing valve.

If the load sensing function is used, the feedback oil circuit of the load sensing can be directly connected to this tee joint.

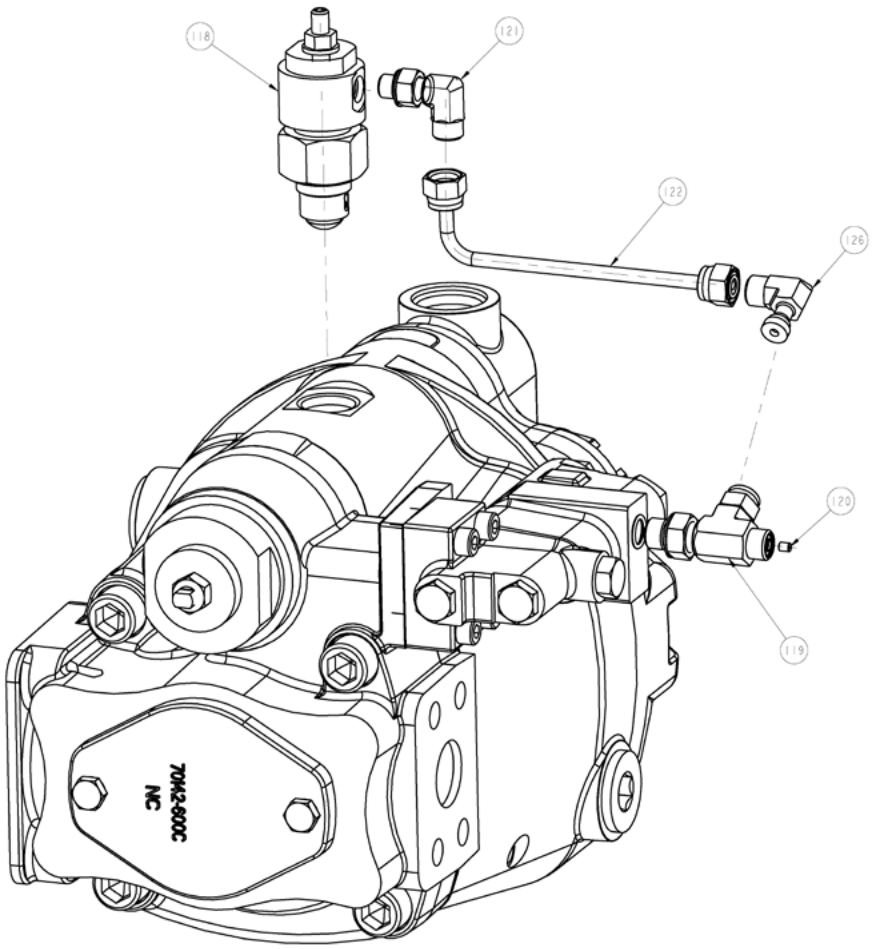


Figure 14

Item No.	*Part description*	*Torque control Kit*	*Torque control pipeline kit*
118	PVM HP Control S/A	●	
119	Adapter ORS Straight thread run tee	●	●
120	Plug-Orifice	●	●
121	Adapter/ ORS 90 Deg straight thread elbow	●	●
122	Tube Assembly	●	●
126	O-Ring Side (ORS) 90 Deg Swivel elbow	●	●

If the load sensing function is not used, the high - pressure oil at the P - port needs to be connected to this tee joint. Do not tighten the screw of the load sensing valve.

The dimension "X" shown below should be checked and controlled after tightening the lock nut of the cartridge valve. Acceptable dimension for each size is mentioned in the table.

Pump Size	*Acceptable value of X*
[cc/rev]	*[mm]*
57	58.5±0.4
63	58.5±0.4
74	60.5±0.4
81	60.5±0.4
98	57.5±0.4
106	57.5±0.4
131	60±0.4
141	60±0.4

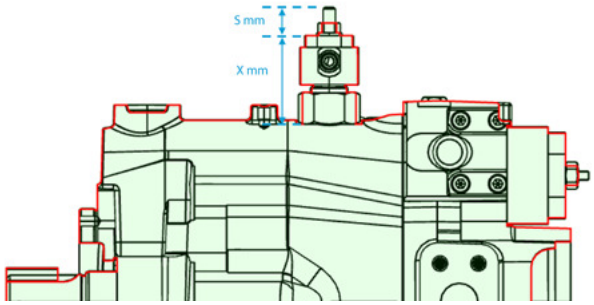


Figure 15

The power limitation value in kW at 1500 rpm can be set by setting the height "S" of the adjusting screw shown below. Rotating adjustment screw clockwise increases the power setting while rotating it anticlockwise reduces it. After adjustment as required ensure that the locknut is tightened properly.

Ordering codes for the Torque controller

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901520-001													●	●
9901520-002											●	●		
9901520-003									●	●				
9901520-004							●	●						

Ordering code for torque control pipeline kit

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901538-000													●	●
9901541-000									●	●				
9901542-000											●	●		
9901543-000							●	●						

Ordering code for torque control pipeline kit

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901537-000							●	●	●	●	●	●	●	●

6.4 Industrial Control

This controller is offered only with the sizes from 57 to 141 cc/rev an s intended to be used when multiple, remote or electronically controlled compensation settings, with (controlled code E) or without load sensing (Controlled code F) is desired. The controller has a NFPA-D03/ISO 4401-03 interface on its top for the various control strategies.

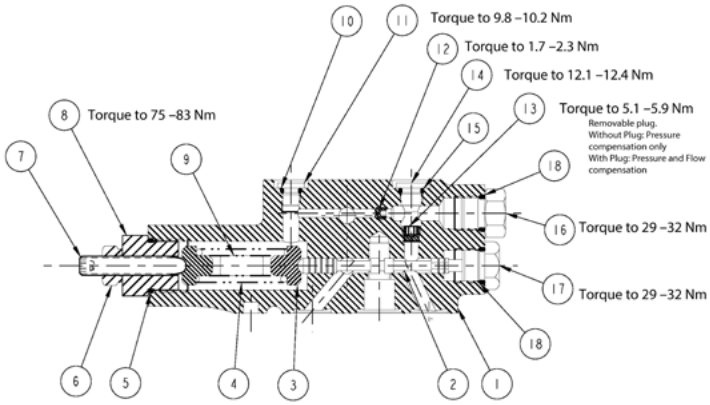


Figure 16

Ordering code for Industrial Controller (Controller code E)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901517-012							●	●	●	●	●	●	●	●

Ordering code for Industrial Controller (Controller code F)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901517-013							●	●	●	●	●	●	●	●

6.5 Maximum Displacement Adjustment Stop

Displacement adjustment can only be carried out after the pump is stopped.

After loosening the lock nut, turn the pressure regulating rod clockwise to increase the displacement, and turn the pressure regulating rod counterclockwise to decrease the displacement. Adjust it to the required displacement and then tighten the lock nut.

The minimum adjustable displacement is 50% of the full displacement.

The reference value of displacement per turn is shown in the following table:

Pump size [cc/rec]	10/13/18/20	45/50	57/63	74/81	98/106	131/141
Size reduction per turn [cc/rev]	1.1	2.1	2.98	3.5	4.5	5.7
Lock nut tightening torque	M8: 10-24 Nm		M10: 24-30 Nm			

7 Maintenance Guidelines

7.1 Disassembly - Pressure compensator (PVM 18 cc to 50 cc)

1. Remove the four screws fastening the compensator housing to the end cap (Figure 17②).

2. Remove the compensator and take out the three O-rings (Figure 17③④).

3. Remove the screw plug (Figure 16⑨⑩).

4. Remove the pressure valve core (Figure 16⑧).

5. Remove the assembly of the screw plug (Figure 16⑤), the adjusting rod (Figure 16④) and the lock nut (Figure 16⑧).

6. Remove the pressure compensator spring (Figure 16③) and the two spring seats (Figure 16②).

7.2 Assembly – Pressure compensator (PVM 18 cc to 50 cc)

1. Install the pressure valve core (Figure 16 ⑧).

2. Install the screw plug (Figure 16 ⑨⑩) and tighten it with a torque ranging from 9.8 to 10.2 Nm.

3. Install the pressure compensator spring (Figure 16③) and the two spring seats (Figure 16②).

4. Install the assembly of the screw plug (Figure 16⑤), the adjusting rod (Figure 16 ④) and the lock nut (Figure 16 ⑧), and tighten the screw plug with a torque of 75 - 83 Nm.

5. Install three O-rings (Figure 17③④). The one in the middle is larger, and the ones at ends are smaller.

6. Fasten the compensator housing to the end cover with four screws (Figure 17②) and tighten them with a torque of 7.4 - 9 Nm. When tightening, use a crisscross pattern and re-tighten the first screw.

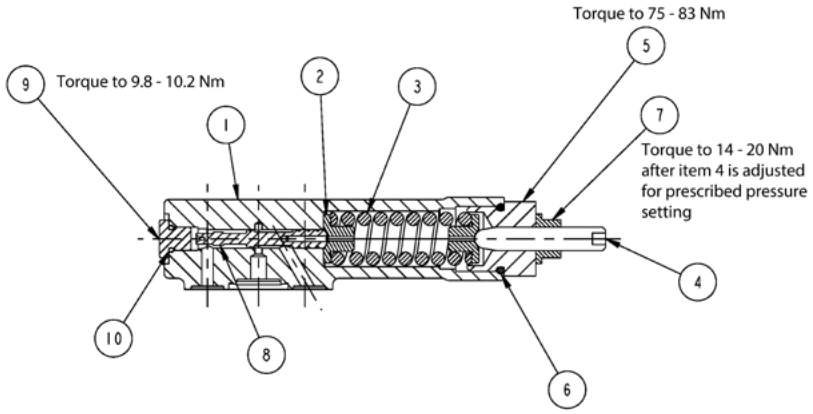


Figure 17

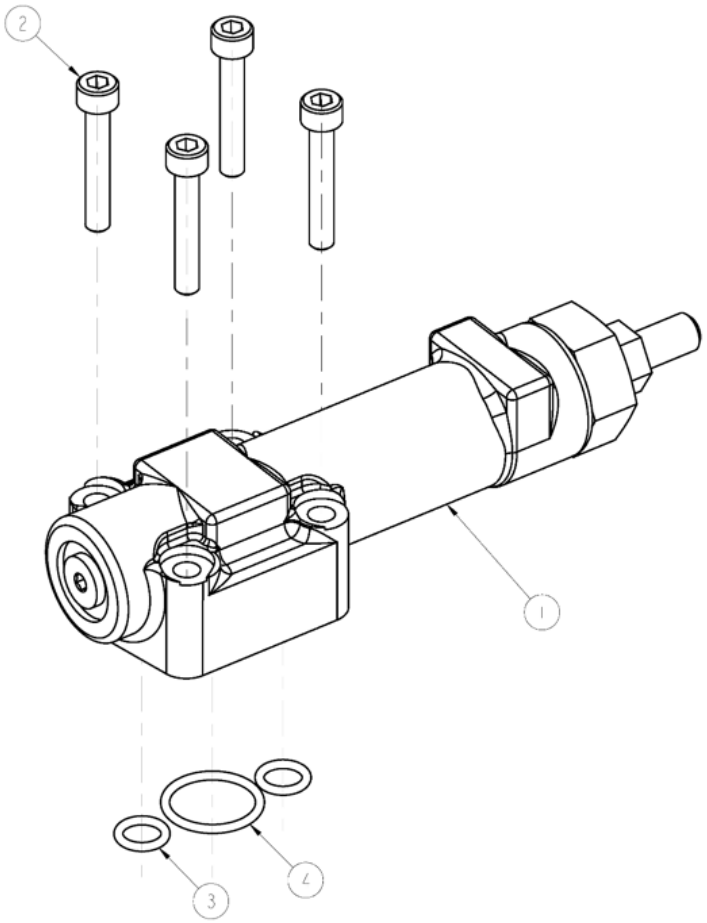


Figure 18

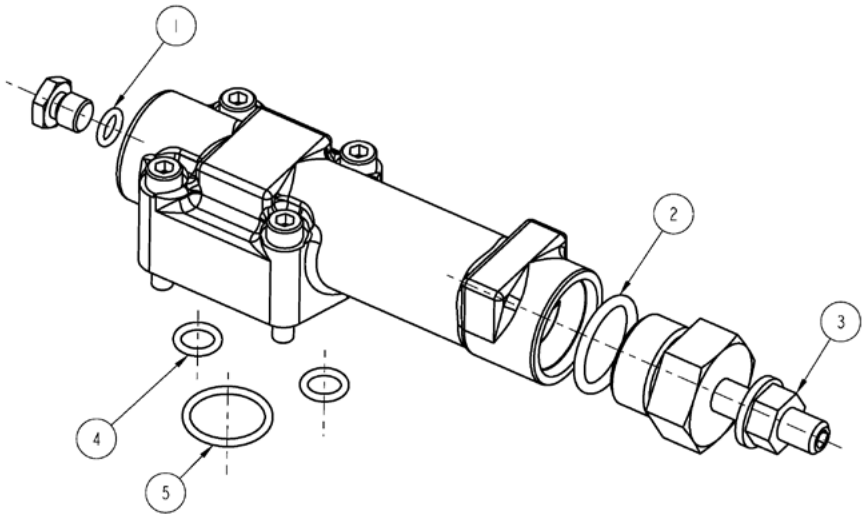


Figure 19

Ordering code for Pressure Compensator Seal Kit (18-50 cc) (Figure 18)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901549-000	●	●	●	●	●	●								

7.3 Disassembly - Pressure and Flow compensator (PVM 18 cc to 50 cc)

1. Remove the four screws that fix the compensator housing to the end cap (Figure 19 ②).

2. Remove the compensator and take out the three O-rings (Figure 19 ③④).

3. Remove the screw plug (Figure 20 ⑤).

4. Take out the pressure compensator valve spool (Figure 20⑯) and the flow compensator valve spool (Figure 20 ④).

5.Remove the four screws at the adjusting end of the compensator (Figure 20⑫)

6. Remove the assembly of the adjusting rod (Figure 2⑦), the lock nut (Figure 20⑧), the retaining ring (Figure 20 ⑨), the O-ring (Figure 20⑩) and the plate (Figure 20⑪).

7. Take out the pressure compensator spring (Figure 2⑥) the flow compensator spring (Figure 20③) and the spring seat (Figure 20②)

8. Remove the side screw plug (Figure 2⑭) and the damping plug (Figure 2⑬⑭).

7.4 Assembly - Pressure and Flow compensator (PVM 18 cc to 50 cc)

1. Install the pressure compensator valve spool (Figure 20⑯) and the flow compensator valve spool (Figure 20④). The rounded ends should face inward. The pressure compensator valve spool has fewer ring grooves and is shorter, while the flow compensator valve spool has more ring grooves and is longer.

2. Install the screw plug (Figure 20⑤) and tighten it with a torque of 5.7 - 6.9 Nm.

3. Install the pressure compensator spring (Figure 20⑥), the flow compensator spring (Figure 20③) and the spring seat (Figure 20②).

4. Install the assembly of the adjusting rod (Figure 20⑦), the lock nut (Figure 20⑧), the retaining ring (Figure 20⑨), the O-ring (Figure 20⑩) and the plate (Figure 20⑪).

5. Install the four screws at the adjusting end (Figure 20⑫) and tighten them with a torque of 14.4 - 17.6 Nm.

6. Install the side screw plug (Figure 20⑭) and tighten it with a torque of 13.5 - 16.3 Nm. Install the damping plug (Figure 20⑬⑰) and tighten it with a torque of 4 - 6 Nm.

7. Install the three O-rings (Figure 19③④). The one in the middle is larger, and the ones at both ends are smaller.

8. Fasten the compensator housing to the end cover with four screws (Figure 19②), and tighten them with a torque of 7.4 - 9 Nm. When tightening, use a cross - crisscross pattern and re - tighten the first screw.

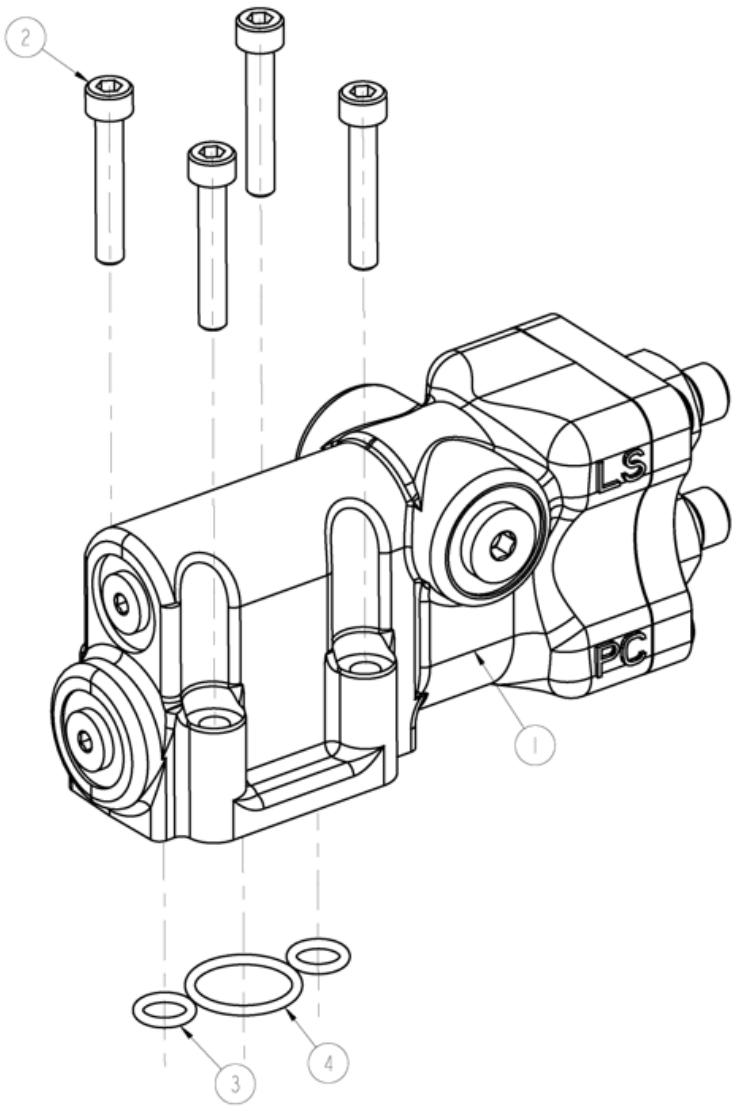


Figure 20

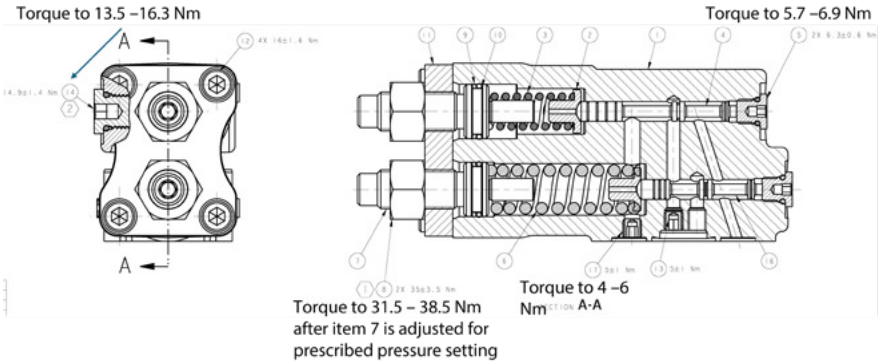


Figure 21

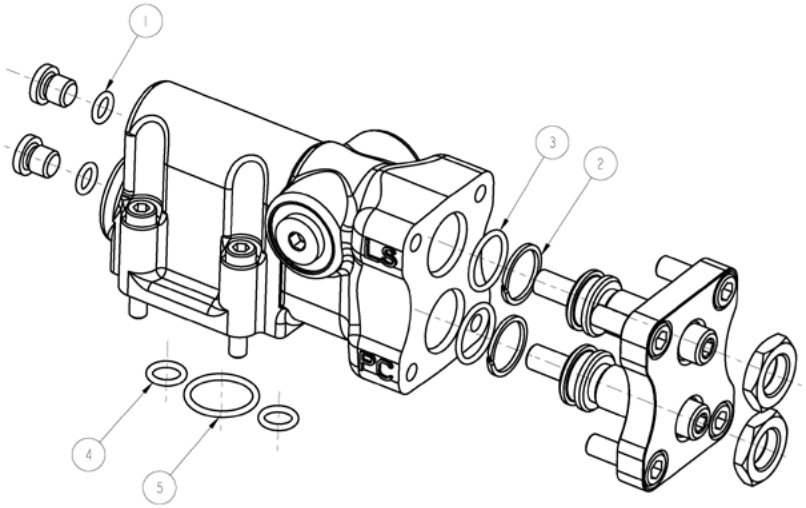


Figure 22

Ordering code for Pressure and Flow Compensator Seal Kit (18-50 cc) (Figure 21)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901550-000	●	●	●	●	●	●								

7.5 Disassembly - Pressure compensator (PVM 57 cc to 141 cc)

1. Remove the four screws that fix the compensator housing to the end cap (Figure 22, item ②).

2. Dismantle the compensator and remove the three O - rings (Figure 22, item ③).

3. Dismantle the screw plug assembly (Figure 23, items ⑨ ⑩).

4. Remove the pressure valve core (Figure 23, item ②).

5. Remove the assembly of the screw plug assembly (Figure 23, items ⑥ and ⑤), the adjusting rod (Figure 23, item ⑦) and the lock nut (Figure 23, item ⑧).

6. Take out the pressure spring (Figure 23, item ④) and the two spring seats (Figure 23, item ③).

7.6 Assembly - Pressure compensator (PVM 57 cc to 141 cc)

1. Insert the pressure valve core (Figure 23, item②).

2. Install the screw plug assembly (Figure 23,⑨⑩), and tighten it with a torque of 29-32 Nm.

3. Install the pressure spring (Figure 23,④) and two spring seats (Figure 23,③).

4. Install the assembly of the screw plug assembly (Figure 23,⑥⑤), the adjusting rod (Figure 23,⑦) and the locknut (Figure 23,⑧), and tighten the screw plug with a torque of 97-106 Nm.

5. Install three O-rings (Figure 22,③).

6. Fix the compensator housing to the end cover using four screws (Figure 22,②), and tighten them with a torque of 31-37 Nm. When tightening, do it in a crisscross pattern and retighten the first screw.

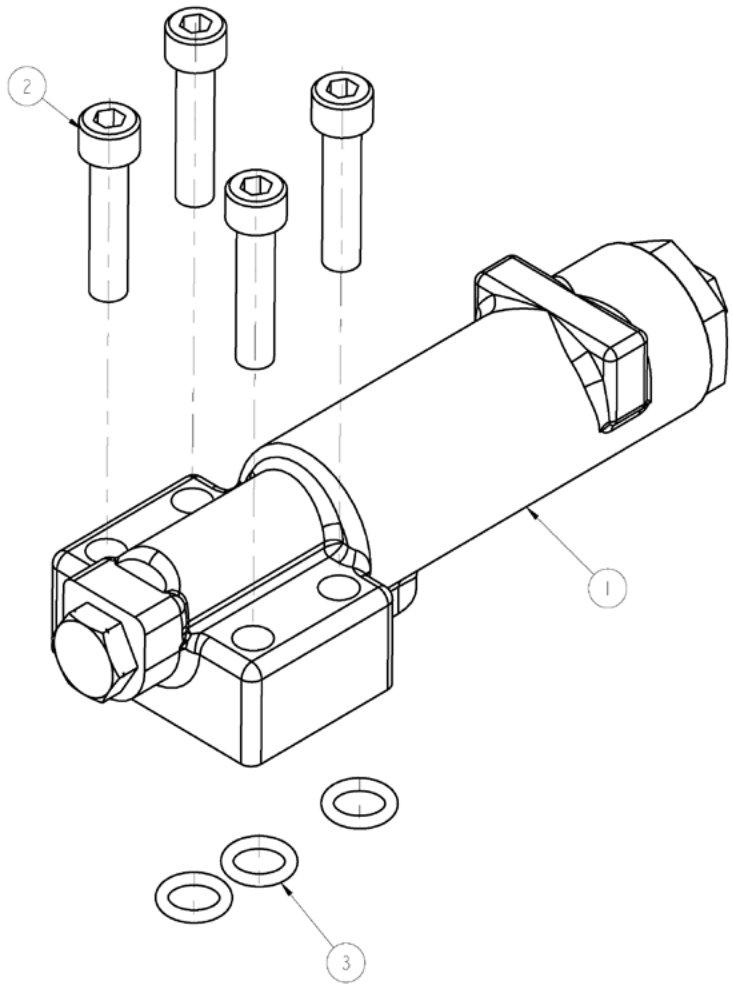


Figure 23

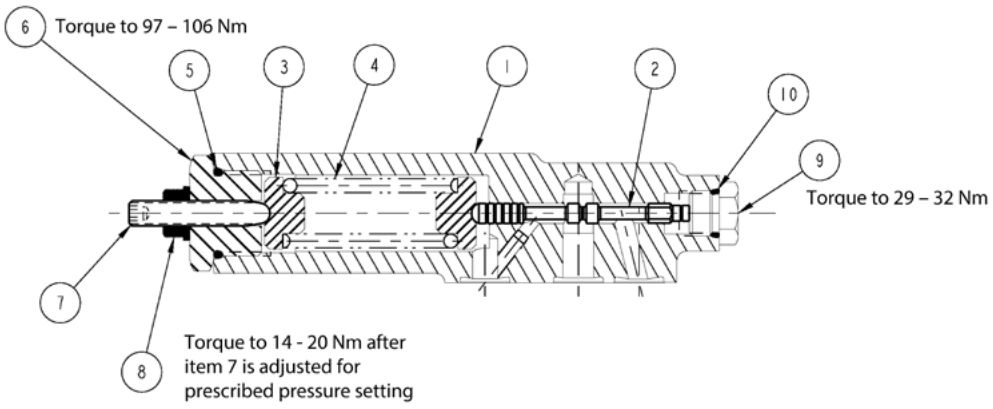


Figure 24

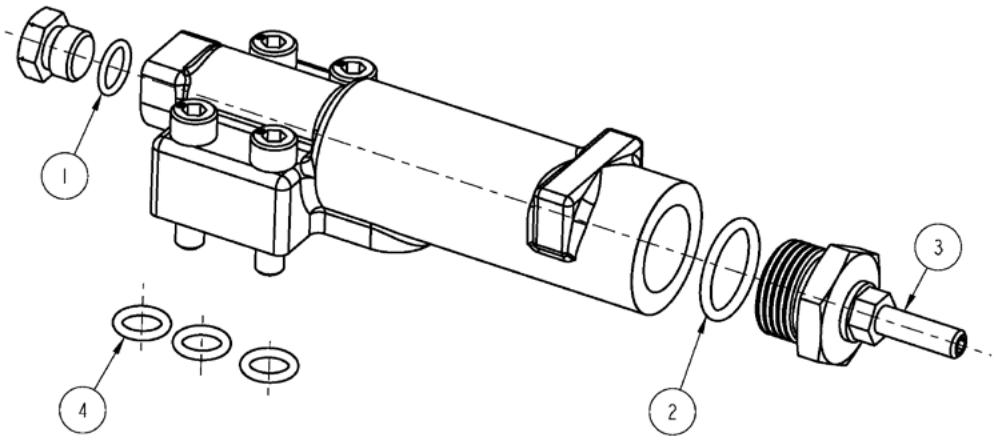


Figure 25

Ordering code for Pressure Compensator Seal Kit (57-141 cc) (Figure 24)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901545-000							●	●	●	●	●	●	●	●

7.7 Disassembly – Pressure and Flow Compensator (PVM 57 cc to 141 cc)

1. Remove the 4 screws that fix the compensator housing to the end cap (Figure 25, item ②).

2. Remove the compensator and take out the three O-rings (Figure 25, item ③).

3. Remove the two screw plugs (Figure 26, item ⑰).

4. Take out the pressure compensator valve core (Figure 26, item ②) and the flow compensator valve core (Figure 26, item ⑮).

5. Remove the screw plug assembly (Figure 26, items ⑨ and ⑩), and take out the flow compensator spring seat (Figure 26, item ⑪), the flow compensator spring (Figure 26, item ⑫), and the limit pin (Figure 26, item ⑬).

6. Remove the screw plug assembly (Figure 26, items ⑥ and ⑤), and take out the pressure compensator spring seat (Figure 26, item ④) and the pressure compensator spring (Figure 26, item ③).

7. Remove the upper screw plug (Figure 26, item ⑭) and the damping plug (Figure 26, item ⑱).

7.8 Assembly – Pressure and Flow Compensator (PVM 57 cc to 141 cc)

1. Install the pressure compensator valve core (Figure 26, item ②) and the flow compensator valve core (Figure 26, item ⑮), with the round heads facing inward. The pressure compensator valve core has more ring grooves and is longer, while the flow compensator valve core has fewer ring grooves and is shorter.

2. Install two screw plugs (Figure 26, item ⑰) and tighten them with a torque of 29 - 32 Nm.

3. Insert the flow compensator spring seat (Figure 26, item ⑪), the flow compensator spring (Figure 26, item ⑫), and the limit pin (Figure 26, item ⑬).

4. Install the screw plug assembly (Figure 26, items ⑨ and ⑩), and tighten it with a torque of 75 - 83 Nm.

5. Insert the pressure compensator spring seat (Figure 26, item ④) and the pressure compensator spring (Figure 26, item ③).

6. Install the screw plug assembly (Figure 26, items ⑥ and ⑤), and tighten it with a torque of 97 - 106 Nm.

7. Install the upper screw plug (Figure 26, item ⑭) and tighten it with a torque of 29 - 32 Nm.

8. Install the damping plug (Figure 26, item ⑱) and tighten it with a torque of 1.7 - 2.3 Nm.

9. Install three O - rings (Figure 25, item ③).

10. Use four screws (Figure 25, item ②) to fasten the compensator housing onto the end cap and tighten them with a torque of 31 - 37 Nm. When tightening, do it in a crisscross pattern and re-tighten the first screw.

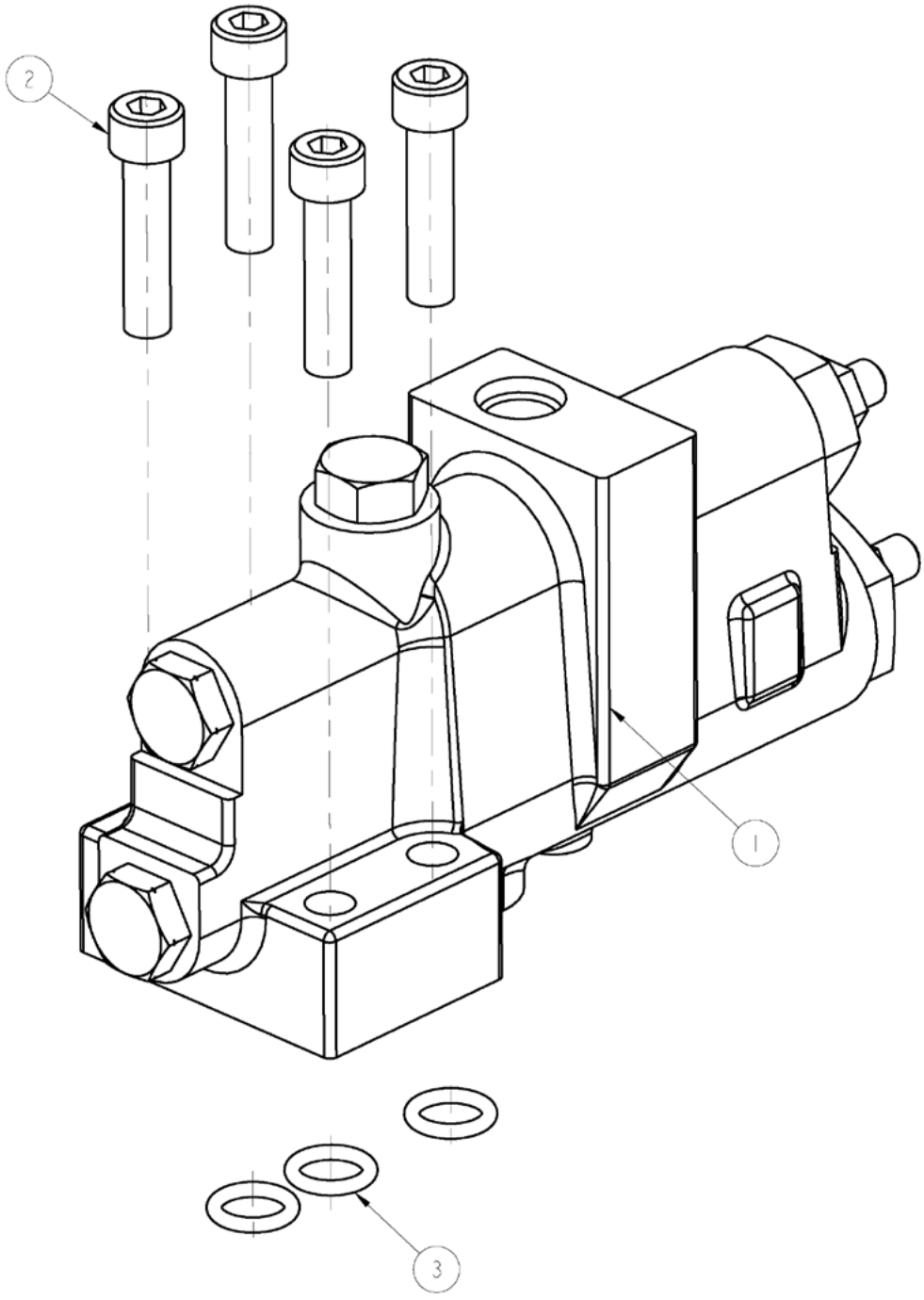


Figure 26

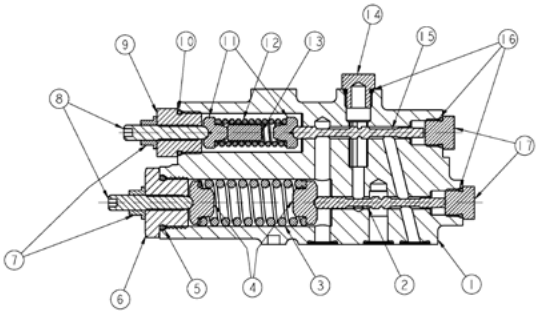


Figure 27

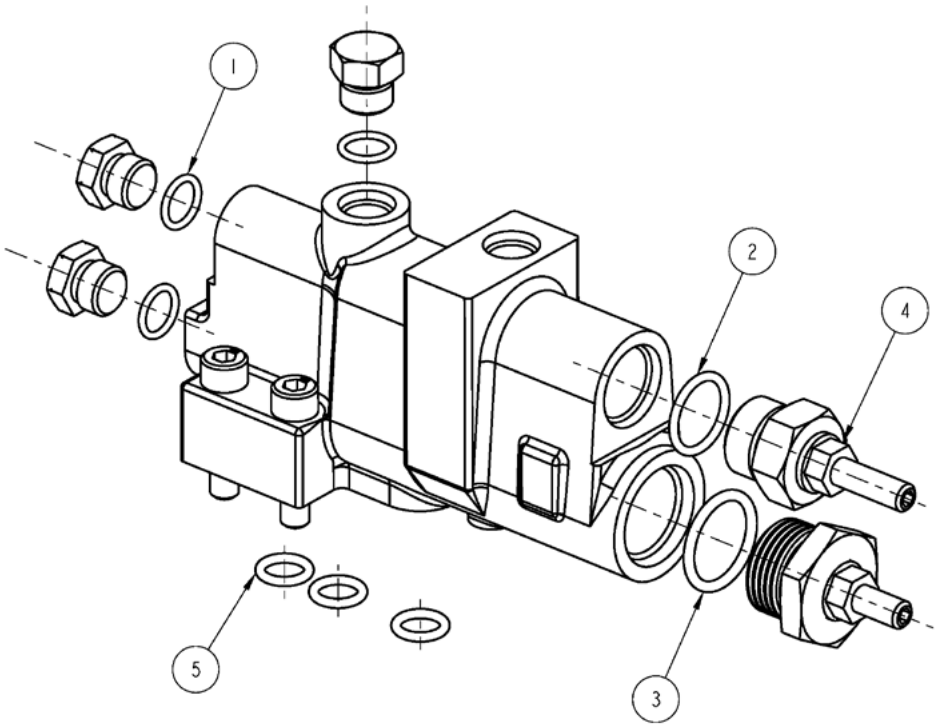


Figure 28

Ordering code for Pressure and Flow Compensator Seal Kit (57-141 cc)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901546-000							●	●	●	●	●	●	●	●

7.9 Disassembly – Industrial Controller (PVM 57 cc to 141 cc)

1. Remove the four screws (Figure 28,②78) that fix the compensator housing to the end cover.
2. Remove the compensator and take out the three O-rings (Figure 28,③85).
3. Remove the screw plug assembly (Figure 29,⑰⑱).
4. Take out the compensator valve core (Figure 29,②).
5. Remove the screw plug assembly (Figure 29,⑤⑥⑦⑧), and take out the spring seat (Figure 29,③), the compensator spring (Figure 29,④) and the limit pin (Figure 29,⑨).
6. Remove the screw plug assembly (Figure 29,⑯⑱), and remove the damping plug (Figure 29,⑫).
7. Remove the screw plug assembly (Figure 29,⑭⑮), and remove the damping plug (Figure 29,⑬).
8. Remove the screw plug assembly (Figure 29,⑩⑪).

7.10 Assembly – Industrial controller (PVM 57 cc to 141 cc)

1. Install the compensator valve core (Figure 29,②).
2. Install the screw plug assembly (Figure 29,⑰⑱), and tighten the screw plug with a torque of 29-32 Nm.
3. Install the spring seat (Figure 29,③), the compensator spring (Figure 29,④) and the limit pin (Figure 29,⑨).
4. Install the screw plug assembly (Figure 29,⑤⑥⑦⑧), and tighten the screw plug with a torque of 75-83 Nm.
5. Install the damping plug (Figure 29,⑫), and tighten it with a torque of 1.7-2.3 Nm.
6. Install the screw plug assembly (Figure 29,⑯⑱), and tighten the screw plug with a torque of 29-32 Nm.
7. Install the damping plug (Figure 29,⑬), and tighten it with a torque of 5.1-5.9 Nm.
8. Install the screw plug assembly (Figure 29,⑭⑮), and tighten the screw plug with a torque of 12.1-12.4 Nm.
9. Install the screw plug assembly (Figure 29,⑩⑪), and tighten the screw plug with a torque of 9.8-10.2 Nm.
10. Install three O-rings (Figure 28,③85).
11. Use four screws (Figure 28,③85) to fasten the compensator housing to the end cover. Tighten the screws with a torque of 31-37 Nm. When tightening, do it in a crisscross pattern and retighten the first screw.

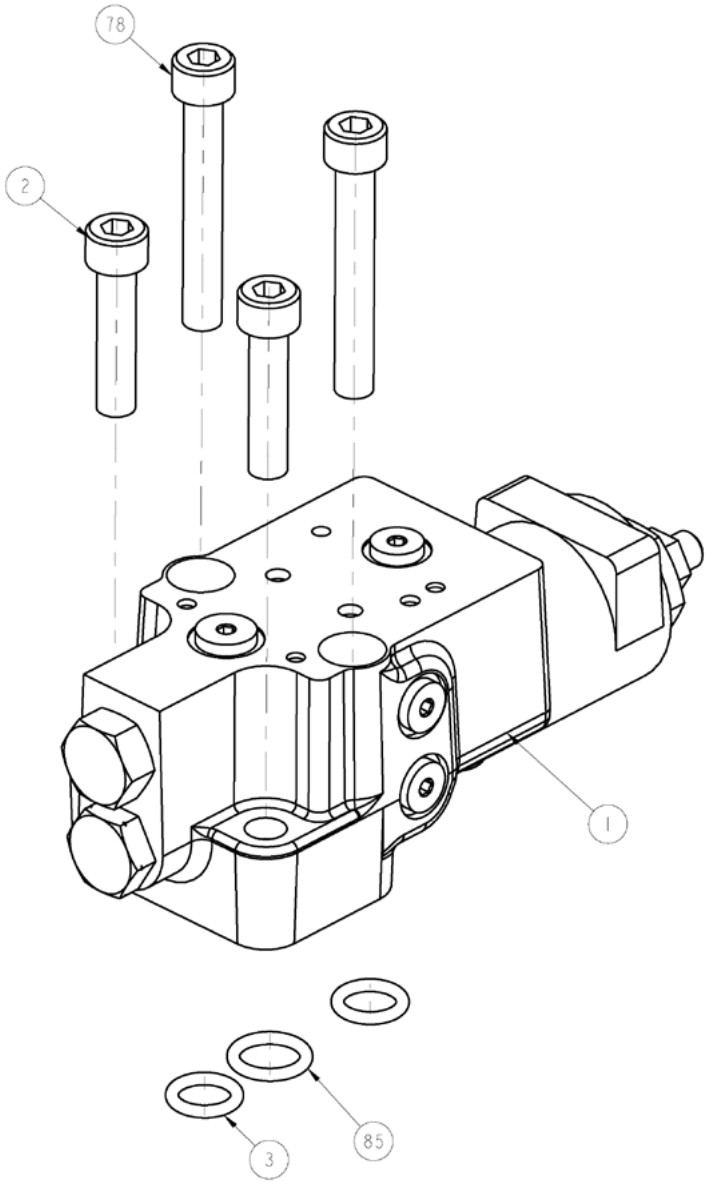


Figure 29

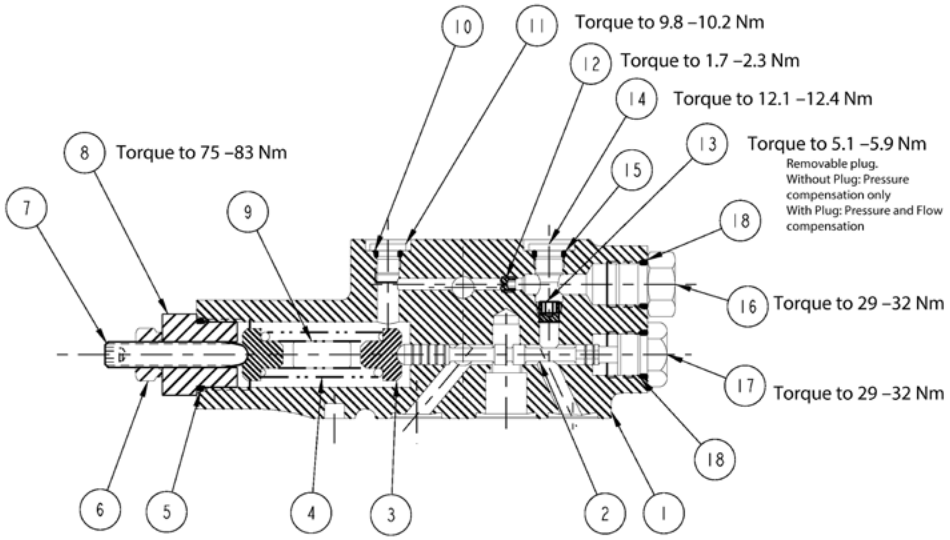


Figure 30

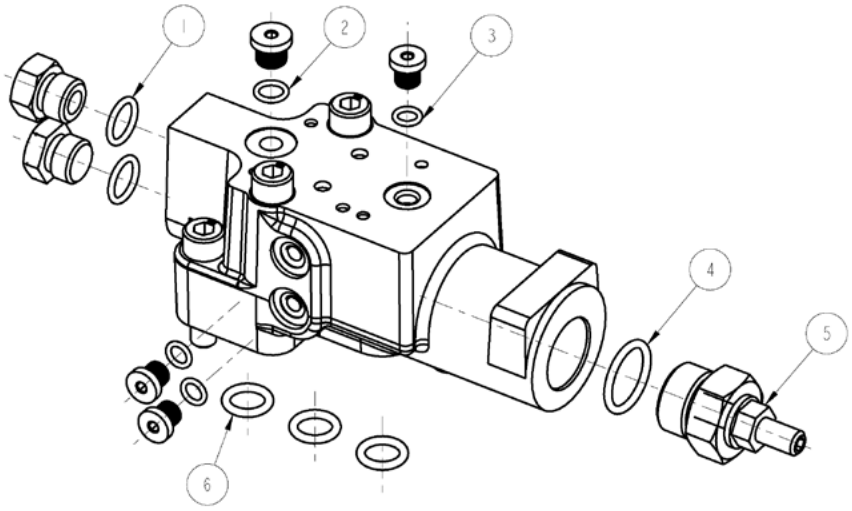


Figure 31

Ordering code for Industrial Controller Seal Kit (57-141 cc)

	Pump displacement [cc/rev]													
Ordering code	10	13	18	20	45	50	57	63	74	81	98	106	131	141
9901547-000							●	●	●	●	●	●	●	●

7.11 Disassembly – Torque Controller/Power Limiter (PVM 57 cc to 141 cc)

1. Remove the oil pipe (Figure 31, 122) and remove it at both ends.
2. Remove the joint (Figure 31, 126) and the joint (Figure 31, 121).
3. Remove the tee (Figure 31, 119), which contains a damping plug (Figure 31, 120).
4. Remove the torque valve (Figure 31, 118).

7.12 Assembly – Torque Controller/Power Limiter (PVM 57 cc to 141 cc)

1. Install the torque control valve (Figure 31, 118). Set the installation height as shown in Figure 2. After adjusting the height, tighten the torque control valve with a torque of 40 - 44 Nm.
2. Install the tee (Figure 31, 119), which contains the damping plug (Figure 31, 120). Tighten the tee with a torque of 33-35 Nm.
3. Install the joint (Figure 31, 126) and tighten it with a torque of 14-16 Nm.
4. Install the joint (Figure 31, 121) and tighten it with a torque of 20-22 Nm.
5. Install the oil pipe (Figure 31, 122) and tighten both ends with a torque of 14-16 Nm.

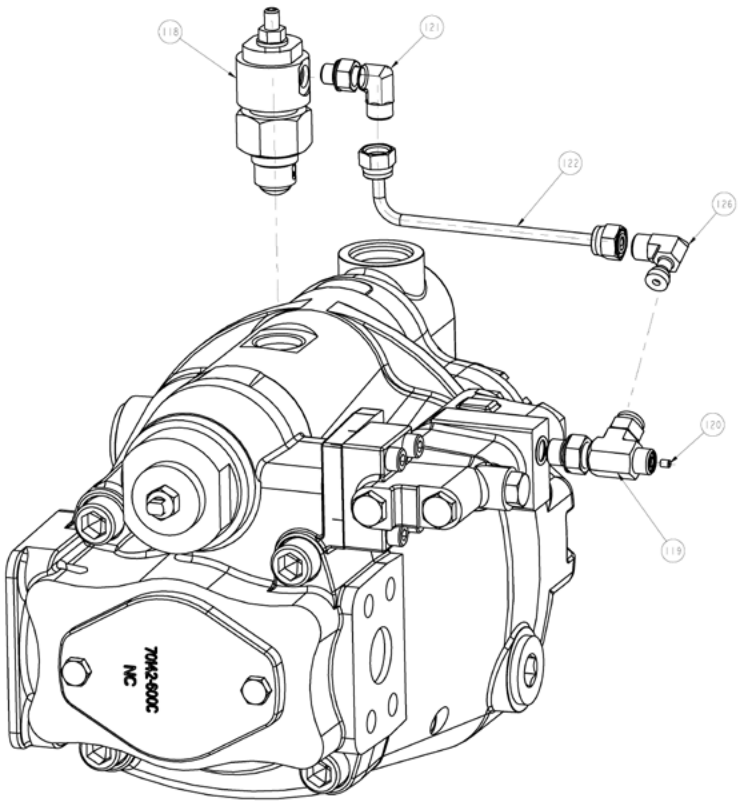


Figure 32

7.13 Disassembly – Auxiliary Mounting Flange (PVM 45 cc to 141 cc)

1. Remove the O-ring (Figure 32, 71).
2. Remove the coupling (Figure 32, 73).
3. Remove the screws (Figure 33, 70) (there are 3 screws for PVM45 and 4 screws for PVM57-141) and take off the series pump flange (Figure 32, 69).
4. Remove the O-ring (Figure 32, 72).

7.14 Assembly – Auxiliary Mounting Flange (PVM 45 cc to 141 cc)

Apply lubricating grease to the O-ring (Figure 32, 72) and then fit it onto the series pump flange (Figure 32, 69).

Install the screws (there are 3 screws for PVM45 and 4 screws for PVM57-141), and fix the series pump flange (Figure 32, 69) to the end cover. Tighten the screws of the PVM45 series with a torque of 63-77 Nm and tighten the screws of the PVM57-141 series with a torque of 103-127 Nm.

Apply lubricating grease to the O-ring (Figure 32, 71) and then put it over the series pump flange (Figure 32, 69).

Insert the coupling (Figure 32, 73).

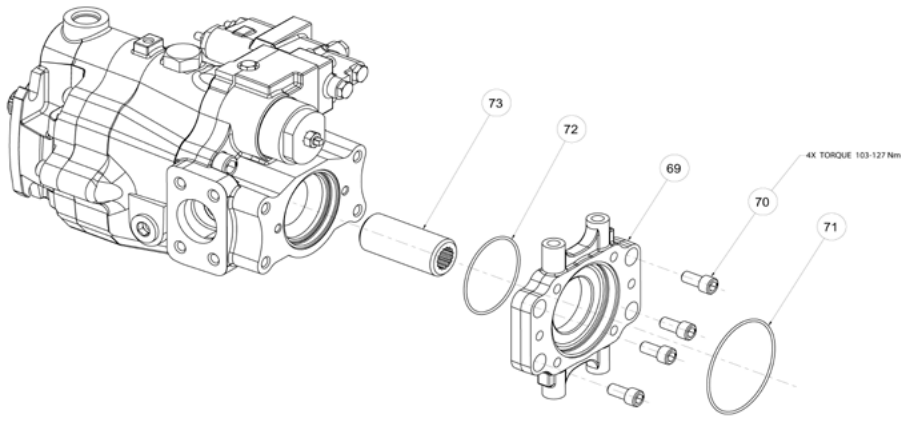


Figure 33

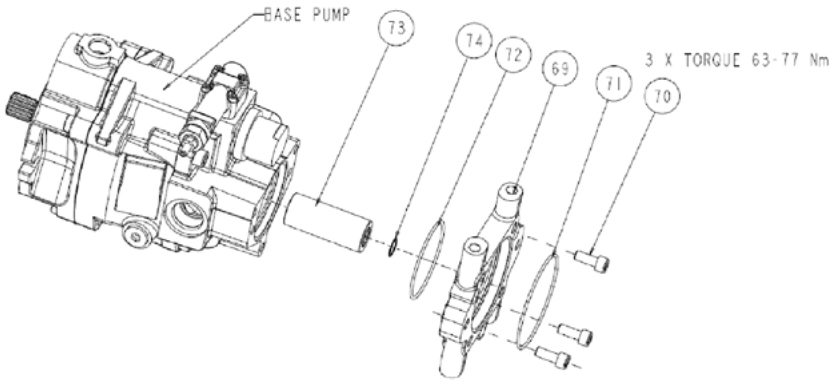


Figure 34

Item Number	Part Description	Auxiliary mounting code
69	Adaptor	C,D,E,F
70	Screw	C,D,E,F
71	O-Ring	C,D,E,F
72	O-Ring	A, B, C,D,E,F
73	Coupler	A, B, C,D,E,F

7.15 Disassembly - Shaft Seal (PVM 10 cc to 141 cc)

1. Use an appropriate circlip plier to remove the circlip 16 inside the front housing.

2. Use a sealing ring hook or a circlip plier to pierce the end face of the shaft seal and remove the shaft seal 15.

7.16 Assembly – Shaft Seal (PVM 10 cc to 141 cc)

1. Check whether there is rust, wear or contamination in the sealing area of the shaft. If necessary, polish the sealing area of the shaft.

2. Lubricate the lip of the new shaft seal with clean hydraulic oil. Install a shaft sleeve on the shaft end to prevent the shaft seal from being damaged during installation.

3. Keep the shaft seal placed perpendicular to the shaft. Press the new shaft seal into the housing, positioning it adjacent to the snap ring groove.

4. Use an appropriate circlip plier to install the circlip.

5. Remove the shaft sleeve.

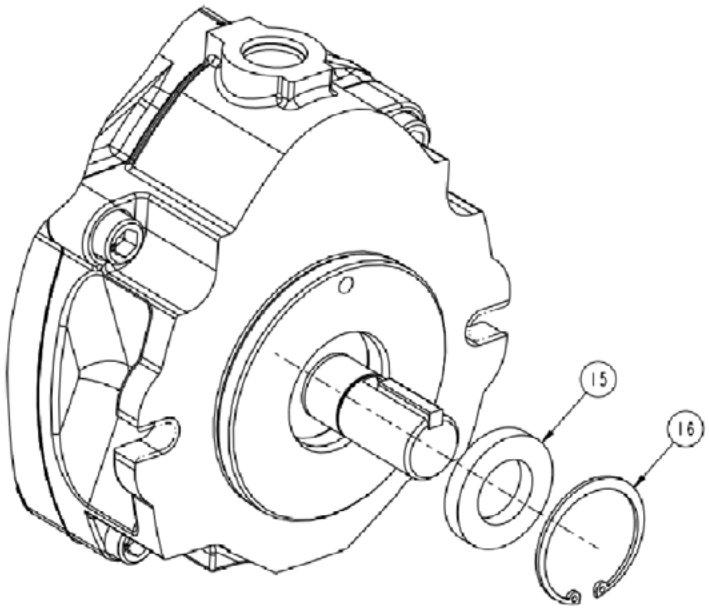


Figure 35

7.17 Pump Seal Kits

7.17.1 Pump seal Kit 10-13-18-20 cc

Item	Part Number	QTY	Description
14	943990	1	Gasket (Flange)
15	937340	1	Seal, Shaft, FKM
16	101680-162	1	Snap Ring
22-A	115044-008	2	O-Ring
24	937317	1	Gasket (End cover)
25-A	115044-002	1	O-Ring
26-A	115044-004	2	O-Ring
33	104166-221	1	O-Ring
36	197573	1	Back-Up Ring
37	104166-015	1	O-Ring
40	937455	1	Ring, Glide
41	104166-110	1	O-Ring
43	115001-023	1	Back-Up Ring
44	104166-023	1	O-Ring
45	115001-022	1	Back-Up Ring
46	104166-022	1	O-Ring
58	101680-145	1	Snap Ring
72	104166-152	1	O-Ring

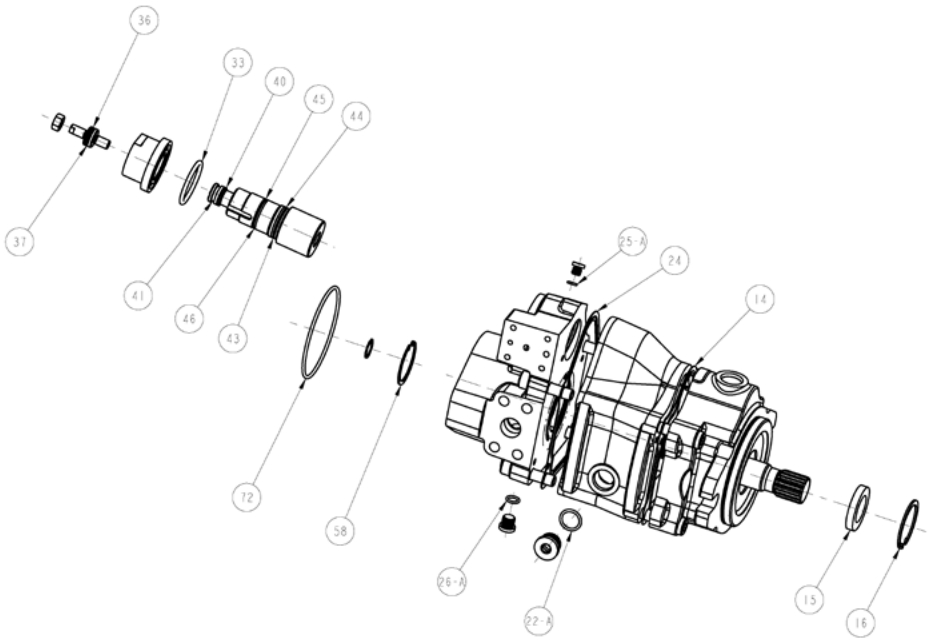


Figure 36

7.17.2 Pump seal Kit 45-50 cc

Item	Part Number	QTY	Description
4	107275-017	1	O-Ring
14	932915	1	Gasket (Flange)
15	626933	1	Seal, Shaft
16	101680-175	2	Snap Ring
22-A	115044-010	1	O-Ring
24	932916	1	Gasket (Endcover)
26-A	115044-006	2	O-Ring
33	104166-224	1	O-Ring
36	197573	1	Back-Up Ring
37	104166-015	1	O-Ring
40	932924	1	Ring, Glide
41	104166-210	1	O-Ring
43	4993969-028	1	Back-Up Ring
44	104166-028	1	O-Ring
45	4993969-027	1	Back-Up Ring
46	104166-027	1	O-Ring
71	104166-155	1	O-Ring
72	104166-152	1	O-Ring

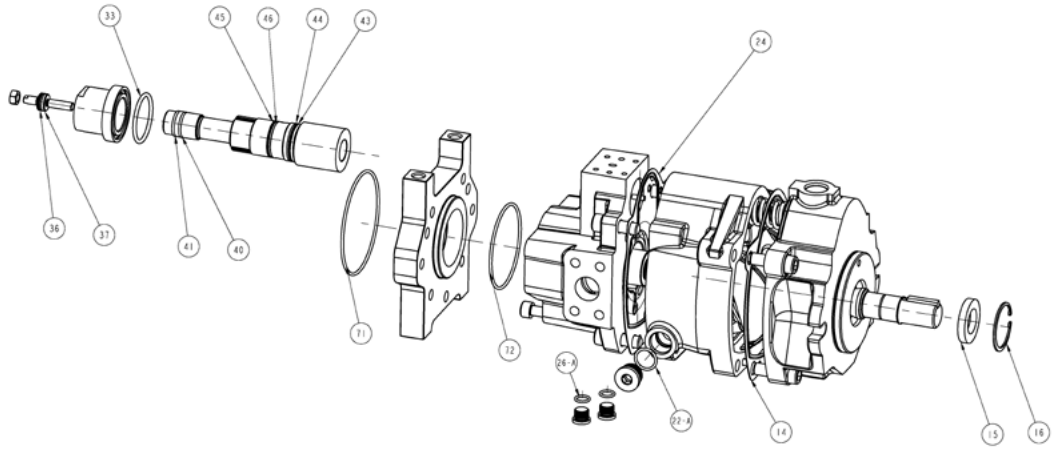


Figure 37

7.17.3 Pump seal Kit 57-63 cc

Item	Part Number	QTY	Description
14	934445	1	Gasket (Flange)
15	513439	1	Seal, Shaft, FKM
16	101680-200	2	Snap Ring
22-A	115044-010	1	O-Ring
24	934444	1	Gasket (Endcover)
26-A	115044-006	2	O-Ring
33	104166-134	1	O-Ring
36	12113634	1	Back-Up Ring
37	104166-015	1	O-Ring
40	934489	1	Ring, Glide
41	104166-211	1	O-Ring
43	4993969-127	1	Back-Up Ring
44	104166-127	1	O-Ring
45	4993969-126	1	Back-Up Ring
46	104166-126	1	O-Ring
71	104166-155	1	O-Ring, Adapter, SAE-B Thru-drive Port
71*	104166-159		O-Ring, Adapter, SAE-C Thru-drive Port
72	104166-152	1	O-Ring
130-A	104166-914		O-Ring

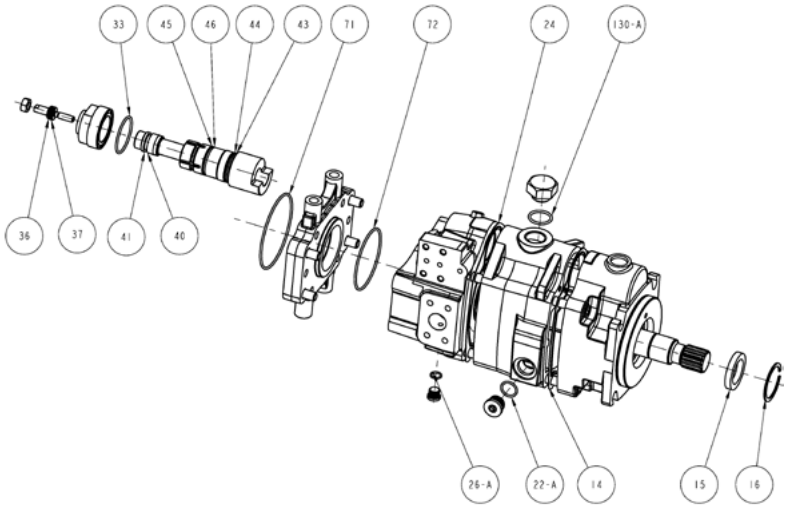


Figure 38

7.14.4 Pump seal Kit 74-81 cc

Item	Part Number	QTY	Description
14	943362	1	Gasket (Flange)
15	6047773-001	1	Seal, Shaft, FKM, High Pressure
16	101680-225	1	Snap Ring
22-A	115044-012	2	O-Ring
24	943361	1	Gasket (Endcover)
26-A	115044-006	2	O-Ring
33	104166-138	1	O-Ring
36	197573	1	Back-Up Ring
37	104166-015	1	O-Ring
40	943367	1	Ring, Glide
41	104166-118	1	O-Ring
43	4993969-131	1	Back-Up Ring
44	104166-131	1	O-Ring
45	4993969-129	1	Back-Up Ring
46	104166-129	1	O-Ring
71	104166-155	1	O-Ring, Adapter, SAE-B Thru-drive Port
71*	104166-159		O-Ring, Adapter, SAE-C Thru-drive Port
72	104166-152	1	O-Ring
130-A	104166-914		O-Ring

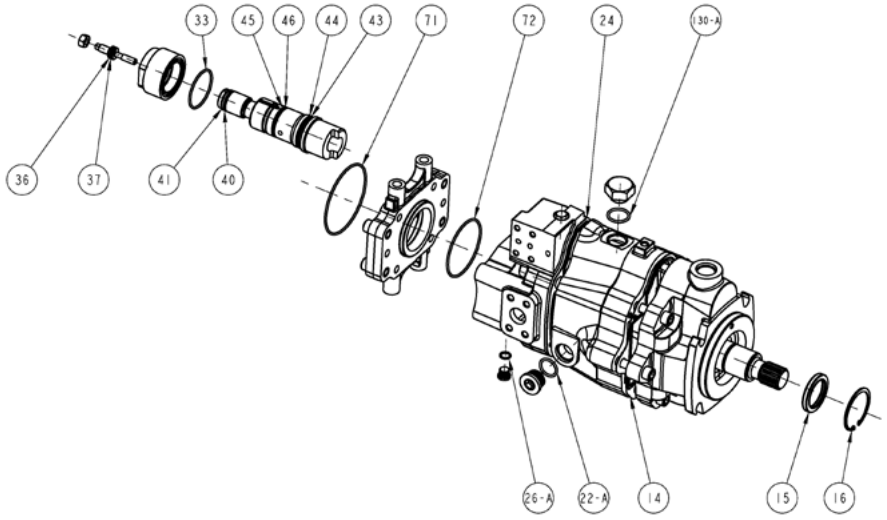


Figure 39

7.14.5 Pump seal Kit 98-106 cc

Item	Part Number	QTY	Description
14	943212	1	Gasket (Flange)
15	6047773-001	1	Seal, Shaft, FKM, High Pressure
16	101680-225	1	Snap Ring
22-A	115044-016	2	O-Ring
24	943211	1	Gasket (Endcover)
26-A	115044-006	2	O-Ring
33	104166-138	1	O-Ring
36	197573	1	Back-Up Ring
37	104166-015	1	O-Ring
40	943367	1	Ring, Glide
41	104166-118	1	O-Ring
43	4993969-131	1	Back-Up Ring
44	104166-131	1	O-Ring
45	4993969-129	1	Back-Up Ring
46	104166-129	1	O-Ring
71	104166-155	1	O-Ring, Adapter, SAE-B Thru-drive Port
71*	104166-159		O-Ring, Adapter, SAE-C Thru-drive Port
72	104166-152	1	O-Ring
130-A	104166-914		O-Ring

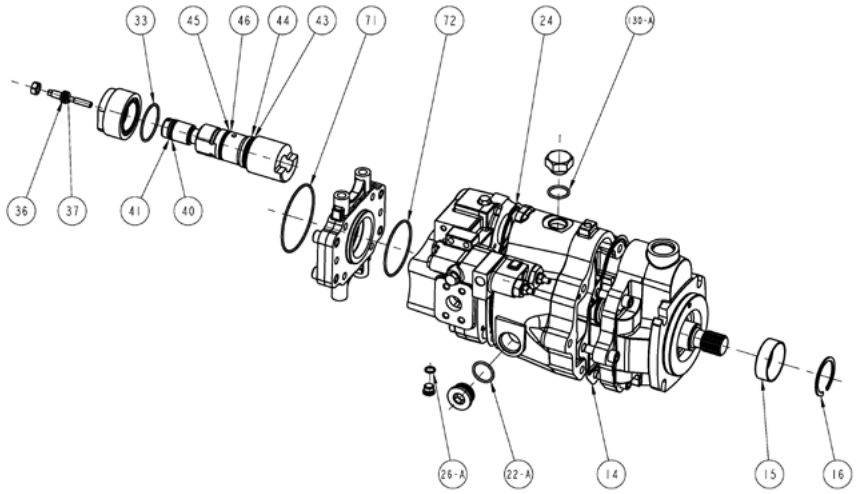


Figure 40

7.14.6 Pump seal Kit 131-141 cc

Item	Part Number	QTY	Description
14	933088	1	Gasket (Flange)
15	6047774-001	1	Seal, Shaft, FKM, High Pressure
16	115019-250	1	Snap Ring
22-A	115044-016	2	O-Ring
24	933087	1	Gasket (Endcover)
26-A	115044-006	2	O-Ring
33	104166-229	1	O-Ring
36	197593	1	Back-Up Ring
37	104166-116	1	O-Ring
40	933078	1	Ring, Glide
41	104166-123	1	O-Ring
43	4993969-033	1	Back-Up Ring
44	104166-033	1	O-Ring
45	4993969-032	1	Back-Up Ring
46	104166-032	1	O-Ring
71	104166-155	1	O-Ring, Adapter, SAE-B Thru-drive Port
71*	104166-159		O-Ring, Adapter, SAE-C Thru-drive Port
72	104166-152	1	O-Ring
130-A	104166-914		O-Ring

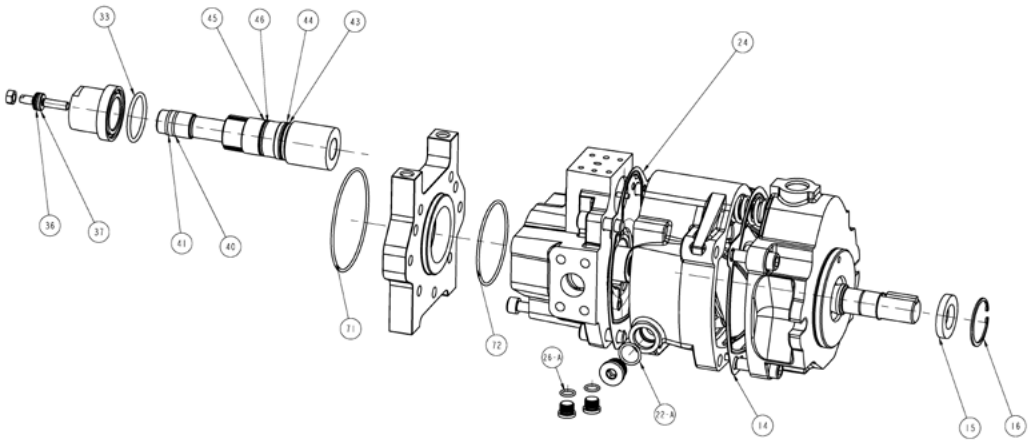


Figure 41

8. Troubleshooting for common faults

8.1 Excessive noise and/or vibration

Item	Description	Action
Check fluid level in reservoir.	Insufficient hydraulic fluid causes cavitation.	Fill the reservoir to proper level.
Check for air in system.	Air in system causes noisy, erratic control.	Purge air and tighten fittings. Check inlet for leaks.
Check pump inlet pressure/vacuum.	Improper inlet conditions cause erratic behaviour and low output flow.	Correct pump inlet pressure/vacuum conditions. Refer to the Hydraulic Parameters topic.
Inspect shaft couplings.	A loose or incorrect shaft coupling causes excessive noise and/or vibration.	Repair or replace coupling and ensure that correct coupling is used.
Check shaft alignment.	Misaligned shafts create excessive noise and/or vibration.	Correct shaft misalignment.

8.2 Actuator response is sluggish

Item	Description	Action
Check external system relief valve setting.	Low external relief valve setting slows down system.	Adjust external relief valve setting following manufacturer's recommendations. External relief setting must be above PC setting to operate properly.
Check PC and LS control setting.	Low PC setting prevents the pump from achieving full stroke. Low LS setting limits output flow.	Adjust PC and LS setting. Refer to the
Adjustments chapter.		
Check LS control signal pressures.	Incorrect LS signal will not allow pump to operate correctly.	Inspect system to ensure that proper LS signal transmit to pump.
Internal system leaks.	Misaligned shafts create excessive noise and/or vibration.	Refer to Authorized Service Center for required repair.
Hydraulic fluid viscosity above acceptable limits.	Hydraulic fluid viscosity above acceptable limits or low fluid temperature will not allow the pump to fill or control to operate properly.	Allow system to warm up before operation or sue fluid with the appropriate viscosity grade for expected operating temperatures.
Check external system valving.	Malfunctioning valving may not allow system to respond properly.	Repair or replace system valving as required.
Check pump case pressure.	High case pressure causes the system to be sluggish.	Correct case drain line restrictions.

8.3 System operating hot

Item	Description	Action
Check fluid level in reservoir.	Insufficient volume of hydraulic fluid will not meet cooling demands of system.	Fill reservoir to proper level. Verify proper size of reservoir.
Hydraulic fluid viscosity above acceptable limits.	Fluid viscosity above acceptable limits or low fluid temperature will not allow the pump to fill or control to operate properly.	Allow system to warm up before operation or use fluid with the appropriate viscosity grade for expected operating temperatures.
Check external system relief valve setting.	Fluid passing through relief valve adds heat to system.	Adjust external system relief valve setting following manufacturer's recommendations. External relief valve setting must be above PC setting for proper operation.

Item	Description	Action
Check PC and LS control setting.	Low PC setting will prevent the pump from achieving full stroke. Low LS setting will limit output flow.	Adjust PC and LS setting.
Check pump inlet pressure/vacuum.	High inlet vacuum adds heat to system.	Correct inlet pressure/vacuum conditions.
Check input speed.	Low input speeds decrease flow.	Adjust input speed.
Check pump rotation.	Incorrect rotational configuration will cause low flow.	Use pump with appropriate rotational configuration.

8.4 Low pump output flow

Item	Description	Action
Check fluid level in reservoir.	Insufficient hydraulic fluid will limit output flow and cause internal damage to pump.	Fill the reservoir to proper level.
Hydraulic fluid viscosity above acceptable limits.	Fluid viscosity above acceptable limits or low fluid temperature will not allow the pump to fill or control to operate properly.	Allow system to warm up before operating or use fluid with the appropriate viscosity grade for expected operating temperatures.
Check external system relief valve setting.	Eternal relief valve set below PC setting causes low output flow.	Adjust external relief valve following manufacturer's recommendation. External relief valve setting must be above PC setting to operate properly.
Check PC and LS control setting.	Low PC setting prevents the pump from achieving full stroke.	Adjust PC and LS setting. Refer to the Adjustments chapter.
Check pump inlet pressure/vacuum.	High inlet vacuum causes low output flow.	Correct inlet pressure conditions.
Check input speed.	Low input speeds decrease flow.	Adjust input speed.
Check pump rotation.	Incorrect rotational configuration causes low flow.	Use pump with appropriate rotational configuration.

8.5 Pressure or flow instability

Item	Description	Action
Check for air in system.	Air in system causes erratic operation.	Activate PC allowing system to bleed air. Check inlet line for leaks and eliminate source of air ingression.
Check control spools.	Sticking control spools cause erratic operation.	Inspect spools for free movement in bore. Clean or replace.
Check LS setting.	Low LS setting may cause instability.	Adjust LS setting to proper level. See the Adjustments chapter.
Check LS signal line.	Blocked LS signal line interferes with proper LS operation.	Remove blockage.
Check external relief valve and PC setting.	Insufficient pressure differential between PC setting and external relief valve.	Adjust external relief valve or PC control settings to appropriate level. Relief valve setting must be above PC setting to operate properly.
Check external relief valve.	Chattering external relief valve may cause unstable feedback to pump control.	Adjust or replace relief valve.

8.6 System pressure not reaching PC setting

Item	Description	Action
Check PC control setting.	System pressure will not rise above PC setting.	Adjust PC to appropriate setting. Refer to the Adjustments chapter.
Check external relief valve.	External relief valve setting below PC setting presents pressure compensation.	Adjust external relief valve according to manufacturer's recommendations. External relief valve must be set above PC setting to operate properly.
Inspect PC control spring.	Broken, damaged, or missing spring will cause erratic operation.	Replace the spring as required.
Inspect PC spool for wear.	Wear of PC spool causes internal leakage in the control.	Replace the spool as required.
Inspect PC spool for proper orientation.	Improper orientation results in poor operation.	Correct orientation of spool.
Check PC control for contamination.	Contamination may interfere with movement of the PC spool.	Clean PC control components, take appropriate action to eliminate contamination.

8.7 High inlet vacuum

Item	Description	Action
Check fluid temperature.	Low temperature increases viscosity. High fluid viscosity causes high inlet vacuum.	Allow system to warm up before operating.
Inspect inlet screen.	Blocked or restricted inlet screen causes high inlet vacuum.	Clean screen/remove blockage.
Check inlet piping.	Too many fittings, bends, or long piping causes high inlet vacuum.	Eliminate fittings to make path more direct.
Hydraulic fluid viscosity above acceptable limits.	High fluid viscosity causes high inlet vacuum.	Select fluid with appropriate viscosity for expected operating temperature.

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