

RPL-X series

Regulator Pressure Liquid Installation, operation, and maintenance manual



Figure 1: RPL-X14

Regulators in this series are also commonly known as XHPR-regulators
(engraved on housing)

REVISIONS

Rev.	Date/ID	Changes
00	25.02.2015	First issue 25th of February 2015
06	OBS-P09-231116	Implement information on service of fixed version
07	OBS-P09-240109	Included RK 60-00082 – Piston with support-ring (P720 version)
08	OBS-P09-250825	Added info for calibration of dump-valve
09	OBS-P09-260309	Added information actuator and gear RPL-X26

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1 Introduction RPL-X-Series

The OBS RPL-X (XHPR) series pressure regulators are engineered for high-performance applications, capable of controlling pressures up to 950 bars with AISI 316 stainless steel housing and up to 1035 bar with duplex stainless-steel housing.

These regulators utilize internal springs and pressure sensors to modulate the inlet pressure, achieving an adjustable output pressure of up to 370, 690, 720, and 900 bars. Within the specified flow range, the outlet pressure is maintained close to the set value. The regulators are designed to handle differential pressures up to 300 bars.

Additionally, a variable geared adjustment mechanism is integrated into the regulator to minimize the required operating torque across the operating range.

The four variants listed below are part of the RPL-X series. Each design is tailored to accommodate different thread dimensions and specific customer requests for pre-set versions.

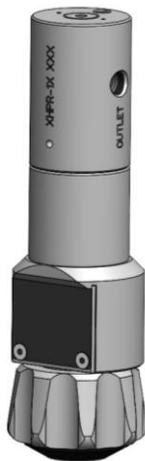


Figure 2: RPL-X14

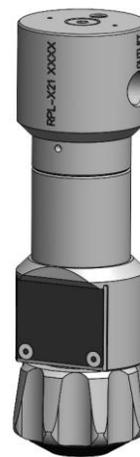


Figure 3: RPL-X21



Figure 4: RPL-X26



Figure 5: RPL-X-Fixed

2 References

- | | | |
|-----|-------------------|---|
| [1] | Assembly drawings | 00-00128, 00-00134, 00-00148, 00-00176, 00-00216, 00-00217,
00-00218, 00-00239, 00-00264, 00-00265, 00-00267 |
| [2] | GA Drawing | P03-GA-00-00128, P03-GA-00-00134 etc. |
| [3] | Product datasheet | RPL-X-P04-DS-Datasheet |

3 Functional Description

3.1 RPL-X14 / RPL-X21 / RPL-26

All regulators in the RPL-X-Series are based on the same principle, the main difference between the regulators is their design for different working pressure ranges. The RPL-X26, is a customized version of the RPL-X14 / RPL-X21. It is similar internally, with a few minor changes made to enable remote control with an actuator and gear. See figure below for illustration.

The RPL-X is engineered as a high-flow regulator developed for fluid operations.

To prevent critical flow conditions, it is essential to control extreme pressure drops across the regulators. Operators must thoroughly understand this document before attempting to operate the regulator.

The RPL-X14 and RPL-X21 valves are equipped with an internal bleed valve designed to relieve excess pressure resulting from downstream pressure increases due to thermal expansion or other factors. This bleed valve is preset during manufacturing, and the specific offload pressure is recorded in the test certificate provided with each regulator. For high-pressure (HP) regulators, the offloading pressure is approximately 30 bar above the set pressure, whereas for low-pressure (LP) regulators, it is approximately 20 bars above the set pressure.

These valves are designed to handle flow rates up to 10 liters per minute (lpm) during normal operation and intermittent flow rates up to 30 lpm. Flow rates exceeding these values are not recommended but may occur if the pressure drop across regulator is not limited by downstream system. The flow coefficient (Cv) of a fully open inlet valve is approximately 0.2.

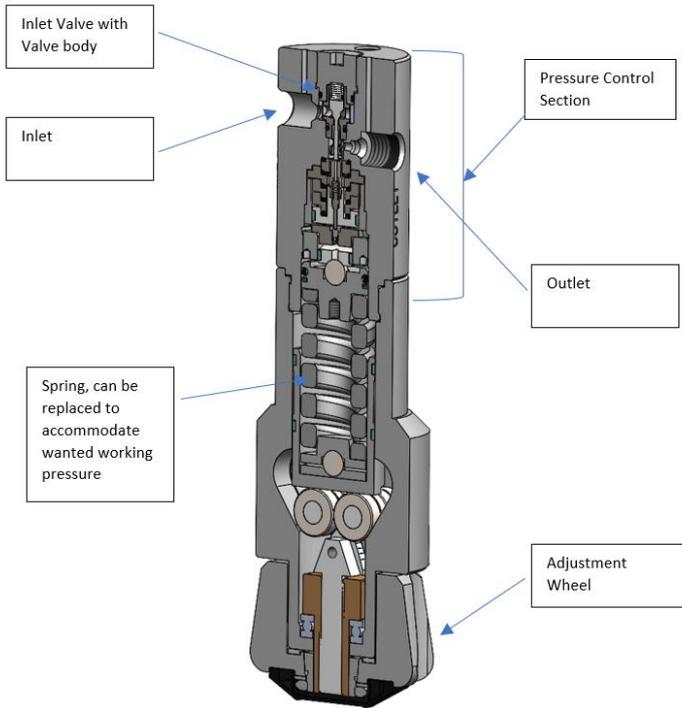


Figure 6: RPL-X14 Split section view

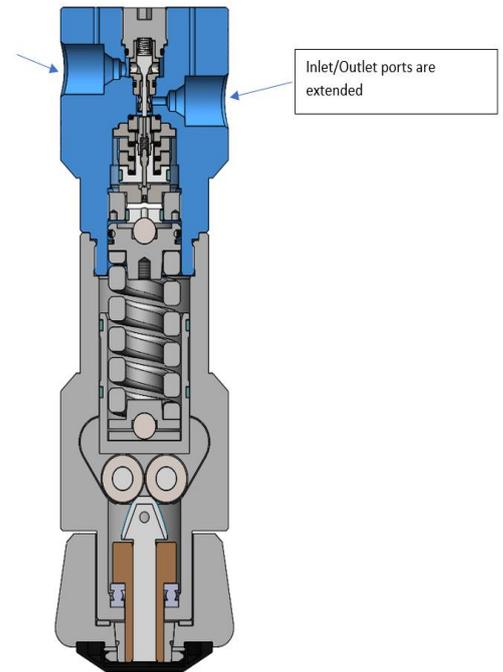


Figure 7: RPL-X21 Split section view

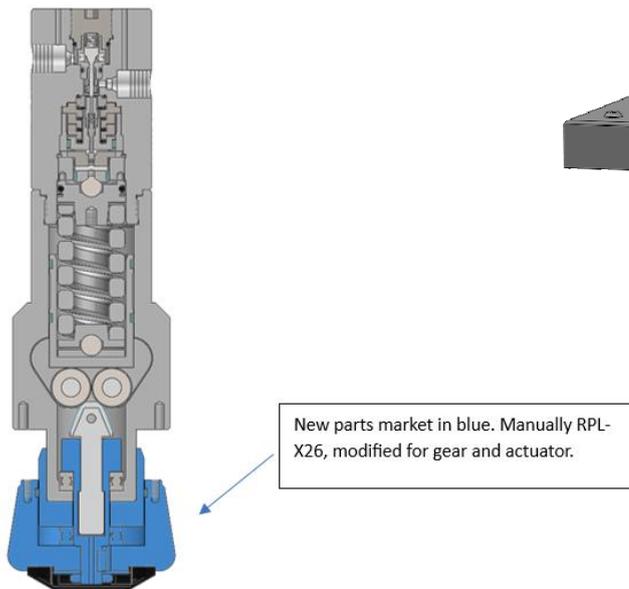


Figure 8: RPL-X26 Split section view

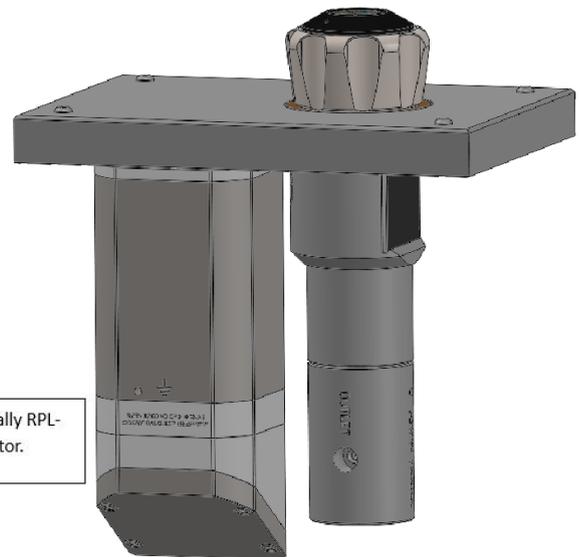


Figure 9: RPL-X26-Actuated

3.2 RPL-X-FIXED

The RPL-Xxx-F is a simplified high-pressure reduction valve based on our RPL-X (XHPR) regulators. The regulator is compatible with the same fluids as the RPL-X (XHPR). The adjustment wheel, geared mechanism and bleed valve from the XHPR has been removed. No adjustment during operation is possible. The pressure output is pre-set and fixed by OBS.

Like RPL-X (XHPR), the RPL-Xxx-F has an internal flexible chamber which stabilizes pressure if downstream pressure increases due to thermal expansion.

The regulator is designed for the same flow ranges as the RPL-X (XHPR); up to 10 liter/minute during normal operation and intermittent flow up to 30 liter/minute.

4 Installation / Start-up

IMPORTANT NOTICE:

The RPL-X series are manufactured to high precision and with tight tolerances and relies on metal-to-metal sealing in the valve to maintain proper operation. Hence, the cleanliness of connected tubing, fittings, and other auxiliary equipment as well as the hydraulic fluid is of utmost importance to the function and reliability of the regulator. Ensure that all connected units and tubing is properly flushed and that the fluid is filtered and verified clean before it is set in operation.

4.1 INSTALLATION

When connecting tubing, pay close attention to markings of Inlet/Outlet.

The function of the RPL-X series regulators is virtually unaffected by its orientation. RPL-X 14 / RPL-X21 is typically mounted with clamps around the body. The RPL-X26 (Actuated RPL-X regulator) are equipped with a mounting plate to fix regulator, actuator and gears.

Mounting/Dismounting procedure:

To mount/dismount regulator and actuator, the wheel with gear (7) must be removed.

1. First remove cover (2) held by 4x M5x10 screws (1).
 2. Then remove plastic cover (3) by using a bent pin.
 3. Undo the M10 nut (4) and lift of disc (5) and wheel (7). Be careful not to lose the key (6) or the plastic disc inside the wheel.
 4. Remove the ball bearing (8) and Adapter (9)
 5. Regulator and actuator can now be removed by undoing M5x12 screws (10).
- The small gear (12) is mounted on top of actuator with disc (13), key (14), and M4x10 screw (15).

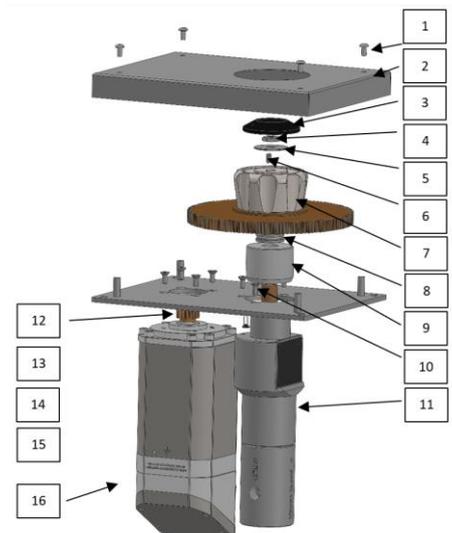


Figure 10: RPL-X26-Actuated

4.2 PROCEDURE FOR START-UP

The startup phase is the most critical part of operating a fluid regulator because air or gas may still be present in the downstream system. Trapped air can cause sudden high flow rates and pressure shocks (water hammer), which may damage the regulator and connected equipment. To prevent this, the startup procedure described on page 6 must be followed every time the system is put into operation.

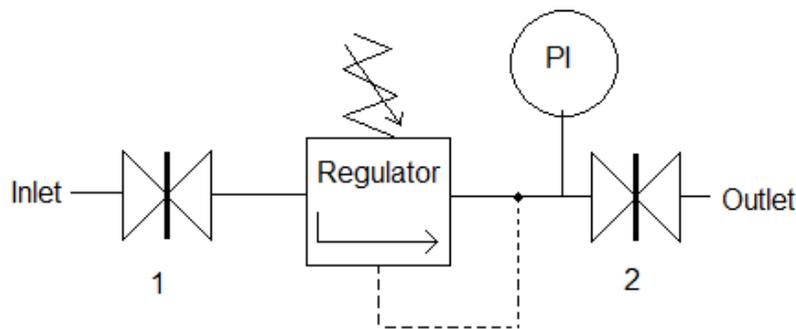


Figure 11: Example P&ID

1. Close valve 1 and valve 2 and verify that regulator is fully closed CCW (counterclockwise).
2. Turn the regulator handwheel approx. 2 turns CW (clockwise). This will result in 20 to 50 barg output pressure, but no indication will be visible on PI since valve 1 is closed.
3. Carefully open valve 1 and verify pressure on PI.
4. Continue to open valve 1 fully.
5. Set regulator to correct pressure and check that the pressure is regulated and stable. If the pressure outlet keeps on rising without turning the handweel, try to turn the regulator to closed and start over again.
6. Open valve 2 carefully and let downstream system pressure.
7. The regulator is now set and will maintain set pressure.

For the RPL-X14-Fixed version, make sure inlet pressure increases stabile and slow up to set working pressure. The outlet pressure is preset.

5 Operation

The function of the RPL-X-series is virtually unaffected by its orientation. The RPL-X-M-versions (Manually operated) is typically mounted with clamps around the body.

The outlet pressure is set by operating the handwheel on top of the regulator.

- CW turns will increase regulated pressure.
- CCW will decrease regulated pressure.
- Increase/decrease regulated pressure can be done manually or by actuator.

There are no additional limitations to flow or operation of the valve if the regulator is operated within the parameters / specifications in the product datasheet.

During operation no action is required. The regulator will keep the pressure at set pressure. High pressure difference combined with high flow rate must be avoided.

Make sure that $P_{in} - P_{out}$ does not exceed 300 bars in combination with high flow. Flow above 10 lpm is defined as high flow in this case.

IMPORTANT NOTICE:

If significant force must be exerted to rotate the adjustment wheel, there may be an internal damage. Normally you should be able to rotate the wheel with one hand.

Contact OBS support if necessary. E-mail: post@obstechnology.no

6 Troubleshooting

Symptom / problem	Probable cause	Action
Unstable Regulating Characteristics	Pressure sensor damaged	Replace Pressure sensor
Leaking to Return Line	Dump valve damaged, possible causes: <ul style="list-style-type: none"> Contamination Incorrect operation (downstream should not be bled through the regulator but via separate bleed valves) 	Replace pressure sensor complete with the integrated dump valve. <ul style="list-style-type: none"> Verify fluid cleanliness in the system Ensure correct operational procedures are followed
	O-rings damaged, possible causes: <ul style="list-style-type: none"> Incompatibility between the fluid and O-ring material Wear over time Liquid contamination The specified service interval has not been followed 	Replace O-rings. Verify fluid and material compatibility
	A leaking inlet valve would also cause leaking to return line after a small pressure Build-up. The dead band is adjusted by standard to appr.30 bar above set-pressure. If there is a buildup when not turning the hand-wheel, before the leaking through the return line and the inlet valve is new, try to reset/flush the system.	Reset/flush: Close HP and see that the leakage stops. Turn the regulator to closed. Make sure the LP line is opened and try to open the HP slowly. Open the regulator to half open. (4 rounds) Close the LP, and reopen after 5 sec. If the leakage still comes from return line after 10 seconds, try to close inlet and then reopen inlet. If the leakage doesn't stop after 5 seconds - try to replace the inlet valve.
	The dump valve needs to be calibrated Small leakage at start up after service	Adjust/Calibrate dump-valve
Pressure Build-Up in Downstream System	Leakage across Inlet valve, possible causes: <ul style="list-style-type: none"> Contamination Incorrect operation 	Replace Inlet Valve <ul style="list-style-type: none"> Verify fluid cleanliness in the system Follow proper start-up and operational procedures

If the above actions don't fix the problem, or for any other issues, the regulator should be returned to vendor for service/refurbishment. OBS has qualified offshore personnel, who can perform on-site service if necessary.

E-mail: post@obstechnology.no

7 Periodic Maintenance

All maintenance of the regulator should be performed by qualified maintenance personnel. Any maintenance performed, or executed by unqualified personnel, may void manufacturer guaranty and/or reduce system integrity and/or lead to damage of downstream system.

IMPORTANT NOTICE: Ensure the regulator is isolated and depressurized before disconnecting and dismantling the unit.

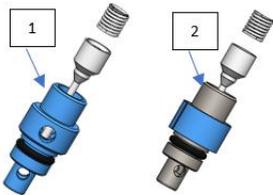
Interval	Maintenance Activities Recommendation
Weekly Continuously	Inspect connection points and watch for pressure build up or leakage. Monitor for any signs of leakage across the return line.
Every 2 years	Change O-rings in the Pressure sensor. (WOCS and other systems with high operation frequencies)
Every 3 years	Change O-rings in the Pressure sensor. (HPU and other static systems)
3-5 years	Regulator refurbishment: Replacement of inlet valve, dump valve and all O-rings.

If there are any concerns, or if qualified personnel are not available on-site, we recommend sending each operational RPL-X unit to OBS for maintenance at least every three years. OBS has qualified offshore personnel who can perform on-site service if necessary. E-mail: post@obstechnology.no.

Service tasks	Internal procedure
Inspection, control prior to disassembly	<i>OBS-P06-KA-000190</i>
Maintenance incl. complete disassembly, cleaning and inspection of all parts, replacement of all O-rings. If Inlet Valve and Dump Valve are worn, these parts will be replaced.	<i>OBS-P06-KA-000190</i> <i>OBS-P06-KA-000157</i>
Re-Assembly	<i>RPL-X-P06-KM-000174</i>
Final test RPL-X-regulator (functional testing in the test rig, functionality according to specified working pressure.)	<i>RPL-X-P06-KC-000173</i>
FAT test Report	<i>RPL-X14-P04-RF-FAT</i>

8 Service RPL-X-series

8.1 PROCEDURE FOR CHANGE OF INLET VALVE – ALL VERSIONS



1. Spare Parts:

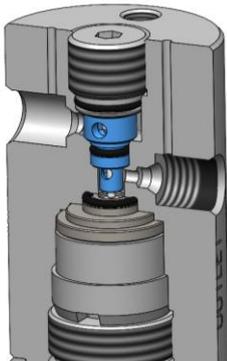
- [1] in figure 7 refers to Spare Part 01-00432 Valve Seat with Guide.
- [2] in figure 7 refers to Spare Part 01-00438 Valve Seat with Guide and Filter.

2. Preparation:

- Ensure the system is depressurized.
- Close all upstream and downstream valves to the regulator.
- Follow local procedures if necessary.

3. Disassembly:

- Remove the Cap using a 5mm hex key.
- Remove the Spring.
- Inspect the O-ring; replace if damaged. Lubricate threads with DX paste if necessary.
- Extract the Valve Body.
- Extract the Valve Seat using a special tool to avoid damage.



4. Assembly:

- Lubricate threads with Molykote DX paste.
- Position the Valve Seat and push it into the Pressure Housing using your finger or a special tool. Ensure not to damage the Valve Seat during assembly. The holes in the Valve Seat must be aligned 90° to the inlet/outlet ports, refers to figure 8.
- Insert the Valve Body into the Valve Seat.
- Insert the Spring.
- Assemble the Cap into the Pressure Housing, ensuring the Spring is correctly positioned. If there is friction, reassemble for inspection.

8.2 PROCEDURE FOR CHANGE OF DUMP VALVE / O-RINGS FLEXIBLE CHAMBER

1. Preparation:

- Ensure the system is depressurized.
- Close all upstream and downstream valves to the regulator.
- Follow local procedures if necessary.

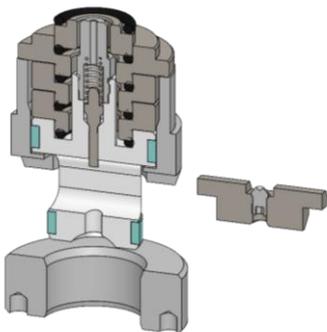
2. Disassembly:

- Split the regulator by separating the HP housing from the Spring Housing.
- Disassemble the Ring (figure 9) using a special tool.
- Extract the O-ring stack along with the Dump Valve.
- Visually inspect the O-rings and rings; replace any damaged parts.



3. Assembly:

- Insert the rings and O-rings according to the drawing.
- Using the same Calibration Bolt (figure 10), assemble the Guide Ring. The Sleeve (10-01668) should enter the assembled Dump Valve. Insert this into the Piston Guide (10-01669).
- Assemble the complete Dump Valve into the High Pressure Housing, applying a tightening torque of 40 Nm.
- Lubricate threads with Molykote DX paste.



8.3 CALIBRATION OF DUMP VALVE / DEAD BAND

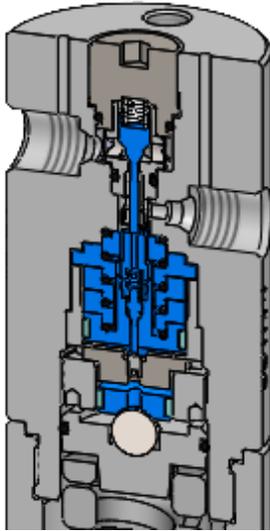


Figure 12: RPL-X14-Flexible chamber

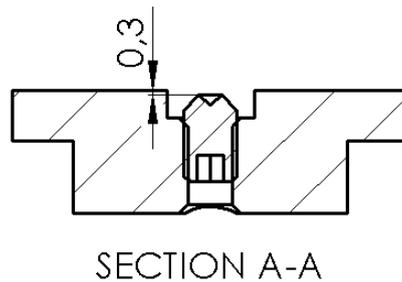


Figure 13: Calibration bolt

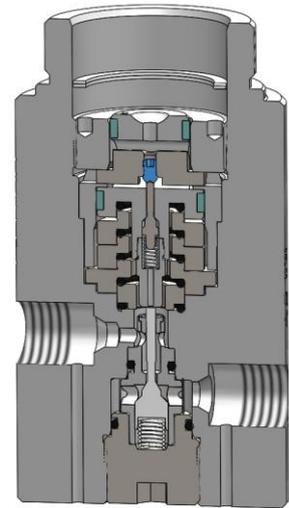


Figure 14: RPL-X14-calibration bolt marked blue

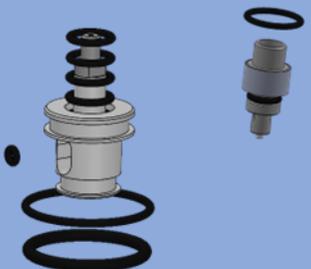
The calibration bolt 01-00476 is fixed within the regulator when assembled.

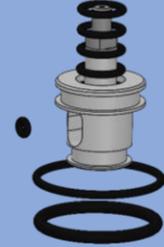
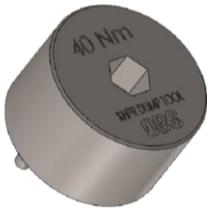
To adjust the deadband remove the spring housing, spring, piston and metal ball. To adjust the deadband rotate the set screw either clockwise (CW) or counterclockwise (CCW) by using a 1,5mm hex key. Clockwise rotation decreases the deadband range, while counterclockwise rotation increases it.

Note! Only a small degree of rotation is required to modify the deadband, particularly when the initial position of the adjustment screw is approximately 0.3 mm. Refer to the illustration for further clarification

9 Spare parts

	PN	Description	Illustration
P370-P720 NF	PN:60-00055	COMPLETE REP KIT No Inlet Filter RPL-X14 370/690/720 (RK1-NF/RK4/SSK1) RPL-X14-M-S-T-P370-XX-H-A3 RPL-X14-M-S-T-P690-XX-H-A3 RPL-X14-M-S-V-P720-XX-H-A3 RPL-X21-M-S-T-P370-XX-H-A3 RPL-X21-M-S-T-P690-XX-H-A3 RPL-X21-M-S-V-P720-XX-H-A3 RPL-X26-A-S-V-P720-XX-H-A3	
P370-P720 IF	PN:60-00056	COMPLETE REP KIT With Inlet Filter RPL-X14 & -X21 370/690/720 (RK1-IF/RK4/SSK1) RPL-X14-M-S-T-P370-XX-H-A3 RPL-X14-M-S-T-P690-XX-H-A3 RPL-X14-M-S-V-P720-XX-H-A3 RPL-X21-M-S-T-P370-XX-H-A3 RPL-X21-M-S-T-P690-XX-H-A3 RPL-X21-M-S-V-P720-XX-H-A3 RPL-X26-A-S-V-P720-XX-H-A3	
All models NF	PN:60-00017	XHPR-14 RK1 INLET REP KIT -NF (no filter)	
All models IF	PN:60-00053	XHPR-14 RK1 INLET REP KIT -IF (with internal filter)	

<p>P370-P720 NF & IF</p>	<p>PN:24-00021</p>	<p>XHPR-14 SSK-1 SOFT SEAL KIT FOR 370/690/720 BARG</p> <p>RPL-X14-F-S-V-P720-XX-H-A3 RPL-X14-M-S-T-P370-XX-H-A3 RPL-X14-M-S-T-P690-XX-H-A3 RPL-X14-M-S-V-P720-XX-H-A3 RPL-X21-M-S-T-P370-XX-H-A3 RPL-X21-M-S-T-P690-XX-H-A3 RPL-X21-M-S-V-P720-XX-H-A3 RPL-X26-A-S-V-P720-XX-H-A3</p>	
<p>P370-P720 NF & IF</p>	<p>PN:60-00020</p>	<p>XHPR-14 RK4 DUMP VALVE KIT FOR 370/690/720 BARG</p> <p>RPL-X14-M-S-T-P370-XX-H-A3 RPL-X14-M-S-T-P690-XX-H-A3 RPL-X14-M-S-V-P720-XX-H-A3 RPL-X21-M-S-T-P370-XX-H-A3 RPL-X21-M-S-T-P690-XX-H-A3 RPL-X21-M-S-V-P720-XX-H-A3 RPL-X26-A-S-V-P720-XX-H-A3</p>	
<p>P900 NF</p>	<p>PN:60-00057</p>	<p>COMPLETE REP KIT No filter RPL-X14 900Barg (RK1-NF/RK5/SSK2) RPL-X14-M-D-L-P900-XX-H-A3 RPL-X21-M-D-L-P900-XX-H-A3</p>	
<p>P900 IF</p>	<p>PN:60-00058</p>	<p>COMPLETE REP KIT with Inlet Filter RPL-X14 900 Barg (RK1-IF/RK5/SSK2) RPL-X14-M-D-L-P900-XX-H-A3 RPL-X21-M-D-L-P900-XX-H-A3</p>	

P900 NF & IF	PN:24-00022	XHPR-14 SSK-2 SOFT SEAL KIT FOR 900 BARG RPL-X14-M-D-L-P900-XX-H-A3 RPL-X21-M-D-L-P900-XX-H-A3	
P900 NF & IF	PN:60-00022	XHPR-14 RK5 DUMP VALVE KIT FOR 900 BARG RPL-X14-M-D-L-P900-XX-H-A3 RPL-X21-M-D-L-P900-XX-H-A3	
All models	PN:60-00033	XHPR-14 GUIDE RINGS FOR DUMP VALVE	
All models	PN:60-00034	XHPR-14 GUIDE RINGS FOR SPRING SLEEVE	
All models	PN:60-00035	XHPR-14 DUMP TOOL	
All models	PN:60-00037	XHPR-14 CALIBRATION BOLT	
All models	PN:60-00082	RPL-X Customized Piston with support ring Standardized piston for P720 & P900 versions	