

RPL-X-Series

Regulator Pressure Liquid

Installation, operation, and maintenance manual

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

REVISIONS

Rev.	Case Id/date	Changes
00	25.02.2015	First issue 25th of February 2015
01	20.05.2017	Updated, new product designation
02	19.01.2019	Updated service instruction
03	OBS-P12-220110	Implemented RPL-X21 and Rep Kits
04	OBS-P12-220125	Referred to the engraved product name XHPR on front of this document to ensure customers this is the same product
05	OBS-P12-230105	Corrected references to document in maintenance section 6

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1 INTRODUCTION

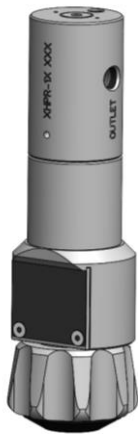


Figure 1: RPL-X08/14



Figure 2: RPL-X-Fixed

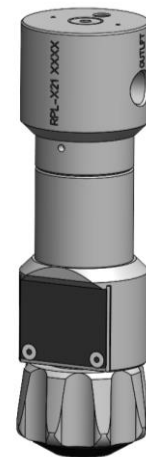


Figure 3: RPL-X21

RPL-X-Series

OBS Technology's RPL-X (XHPR) series are high performance pressure regulators for controlling pressure up to 863 bar with AISI 316 and 1035 bar with duplex housing. Depending on internal springs and pressure sensors the regulators reduce the inlet pressure down to meet required output pressure like 345, 690 and 900 bar. Within the designed flow range, the outlet pressure is kept close to adjusted value. The regulators can handle a differential pressure up to 300 bar. A variable geared adjustment mechanism incorporated in the regulator reduces the required operating torque over the operating range.

All regulators in the RPL-X-Series are based on the same principal, the main difference between the regulators is that they are built for different working pressure ranges.

1.1 RPL-X-SERIES

1.1.1 RPL-X08

The RPL-X08 is a high flow regulator developed for fluid operations. The regulator is designed for 863 to 345 barg (12.500 to 5000 psi) inlet pressure, and a range from 50 to 690 barg (725 to 10.000 psi) regulated output pressure.

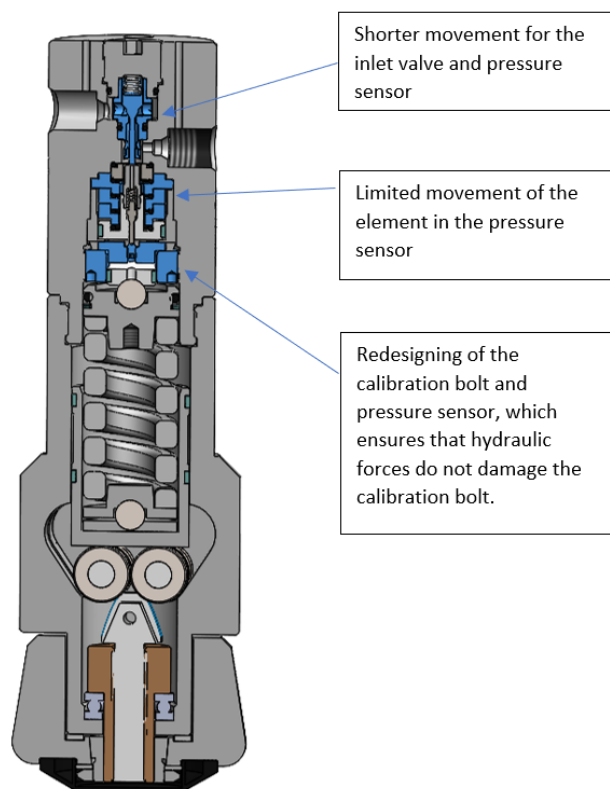
Extreme pressure drops across regulators must be controlled to avoid critical flow conditions. Operator should be fully conversant with this document before attempting to operate regulator.

The valve has an internal bleed valve which offloads pressure if downstream pressure increases due to thermal expansion or similar. The bleed valve has been set during manufacturing and the actual offload pressure is recorded in the test certificate for each regulator. The offloading pressure will be approximately 30 barg above set pressure for HP regulators. For LP regulators the offloading pressure will be approx 20 barg above.

The valve is designed for flow ranges up to 10 lpm during normal operation and intermittent flow up to 30 lpm. Flow ranges above these values are not recommended but will occur if pressure drop across regulator is not limited by downstream system (the Cv value of a fully open inlet valve is approximately 0,2).

1.1.2 RPL-X14

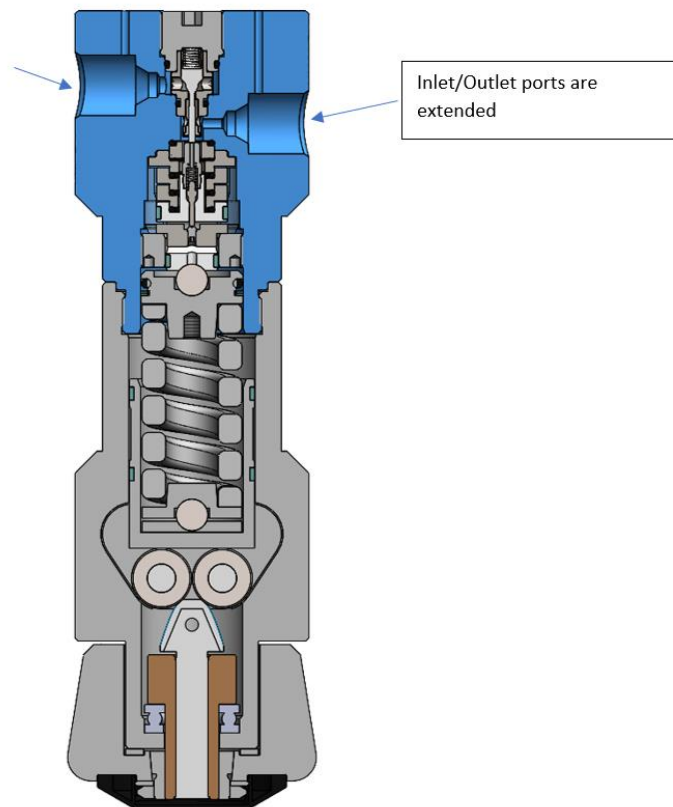
The RPL-X14 is an improved version of the RPL-X08 with the same specifications. Below a short description on performed redesign from RPL-X08(XHPR-08)



1.1.3 RPL-X21

The RPL-X21 is a high flow regulator developed for fluid operations. The regulator is designed for 863 to 345 barg (12.500 to 5000 psi) inlet pressure, and a range from 50 to 690 barg (725 to 10.000 psi) regulated output pressure. Extreme pressure drops across regulators must be controlled to avoid critical flow conditions. Operator should be fully conversant with this document before attempting to operate regulator.

The RPL-X21 regulator is another version of the RPL-X14 regulator, Inlet/Outlet ports are extended upon customer request.



1.1.4 RPL-X-Fixed

The RPL-X14-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 and geared mechanism from the XHPR has been removed. No adjustment during operation is possible. The pressure output is pre-set and fixed by OBS, but the pressure regulation functioning is identical. The spring has been selected for the required pressure range and compressed according to the outlet pressure into the spring housing. The rest of the RPL-X14-F is identical with the original RPL-X (XHPR) regulator and work according to the same principles.

Downstream the RPL-X14-F will now receive lower and almost constant pressure, and will operate with less severe conditions, which will improve its performance and reduce wear.

Like RPL-X (XHPR), the RPL-X14-F has an internal dump valve which offloads pressure if downstream pressure increases due to thermal expansion or similar. The dump valve has been set during manufacturing and its actual offload pressure is recorded in the test certificate of the regulator. The offloading pressure will be approximately 25-35 barg above its set pressure. The dumped fluid should be collected in an atmospheric storage tank.

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.

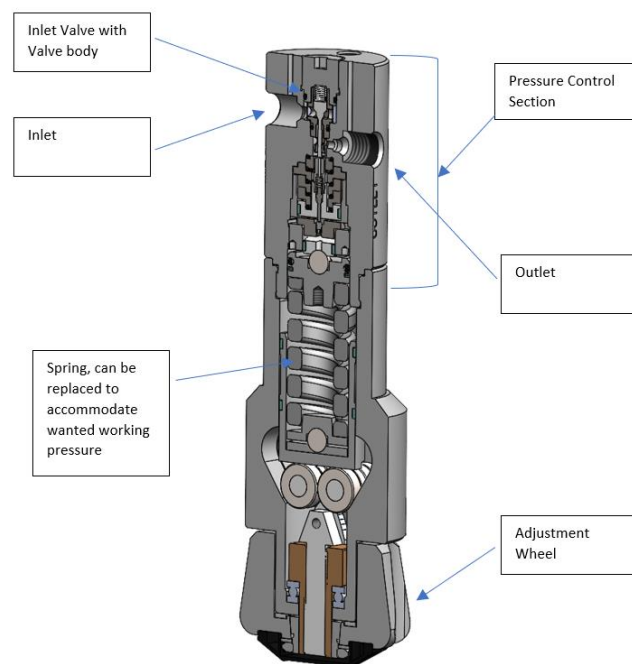


Figure 4: Section View RPL-X14

2 INSTALLATION

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. Some of the RPL-X-series regulators are available with actuator.

To mount/dismount regulator and actuator, the wheel with gear (7) must be removed. First remove cover (2) held by 4x M5x10 screws (1). Then remove plastic cover (3) by using a bent pin. 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. Regulator and actuator can now be removed by undoing M4x20 screws (8) and M5x12 screws (9). The small gear (13) is mounted on top of actuator with disc (12) and M4x10 screw (10).

Installing is done by the same operations in backwards order. Lock M10 nut with medium strong Loctite

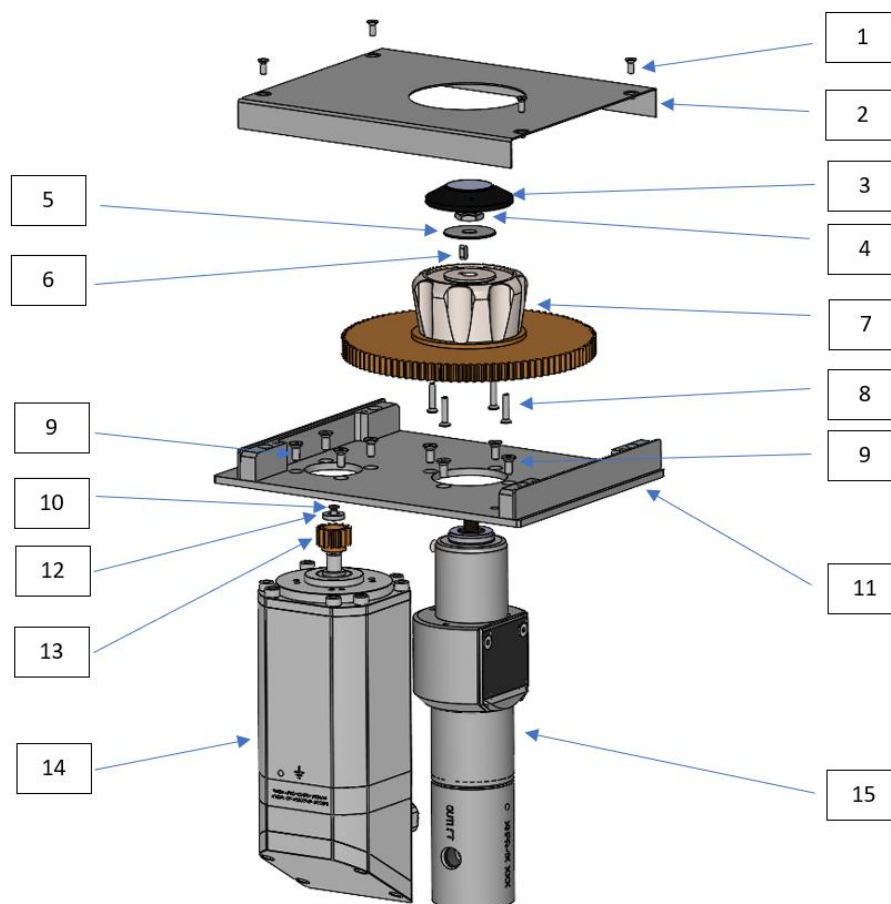


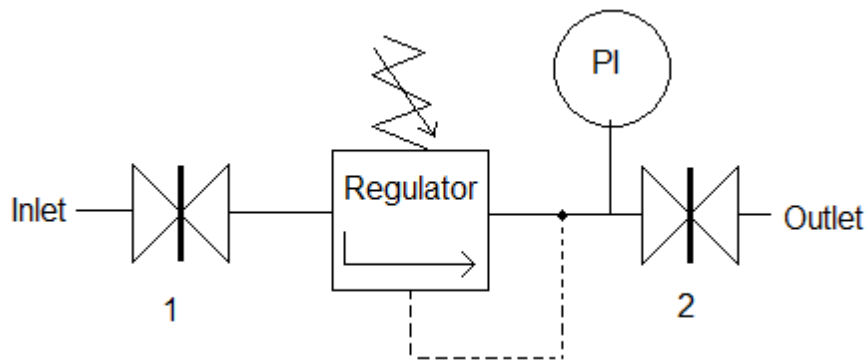
Figure 5: Actuator assembly

3 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.

The critical part of operating a fluid regulator is the startup sequence due to possible presence of air/gas in the downstream systems. This may cause very high flows and water hammers. To avoid damaging the regulator the following procedure shall be employed at start up.



1. Close valve 1 and valve 2 and verify that regulator is set fully CCW (counterclockwise).
2. Turn the regulator handwheel approx. 2 turns CW (clockwise). This will result in 50 to 100 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.
6. Open valve 2 carefully and let downstream system pressurize.
7. The regulator is now set and will keep the pressure at set pressure.

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

4 OPERATION

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 if such is installed.

There are no additional limitations to flow or operation of the valve if the regulator is operated within the parameters defined as "Normal operation".

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

Make sure that $P_{in} - P_{out}$, do not exceed 300 bars

IMPORTANT NOTICE:

If significant force must be exerted to rotate the adjustment wheel, there may be an internal damaged. Normally you should be able to rotate the wheel with one hand. Contact OBS support, if necessary, mail contact: post@obstechnology.no

5 TROUBLE SHOOTING

Symptom / problem	Probable cause.	Action
Regulator show unstable regulating characteristic	Pressure sensor damaged.	Replace Pressure sensor.
Leaking to return line	<p>Dump valve damaged.</p> <ul style="list-style-type: none">- Dump valve may be damaged due to contamination.- Dump valve may be damaged due to wrongful operation. Downstream system shall NOT be bled down through the regulator, but by separate bleed valves in system. <p>O-rings damaged.</p> <ul style="list-style-type: none">- If O-rings get damaged quickly after operation start this is a sign that the fluid is not compatible with the O-ring material.	<p>Replace pressure sensor complete with integrated Dump valve.</p> <ul style="list-style-type: none">- Verify fluid cleanliness in the system.- Verify correct operational procedures and operation. <p>Replace O-rings.</p> <ul style="list-style-type: none">- Verify fluid and material compatibility.
Pressure build up in downstream system	<p>Leakage across Inlet valve.</p> <ul style="list-style-type: none">- Inlet valve may be damaged due to contamination.- Inlet valve may be damaged due to wrongful operation.	<p>Replace Inlet valve.</p> <ul style="list-style-type: none">- Verify fluid cleanliness in the system.- Start up and operation procedure must be followed.

If above actions don't fix the problem or for any other issues, the regulator should be returned to vendor for service/refurbishment.

6 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.

Interval	Recommended maintenance
Weekly	Inspect connection points and downstream pressure. Watch for pressure build up or leakage. Listen for leakage across return line.
2 years	Change O-rings in the Pressure sensor. (WOCS and other systems with high operation frequencies)
3 years	Change O-rings in the Pressure sensor. (HPU and other static systems)
3-5 years	Full service: Replacement of Inlet Valve and Dump Valve and all O-rings.

If there are any concerns or no qualified personnel at site, we recommend that each RPL-X unit in operational use should be sent to OBS for maintenance at least every third year. OBS have qualified offshore personnel and are able to perform service on site if necessary.

Mail contact: post@obstechnology.no.

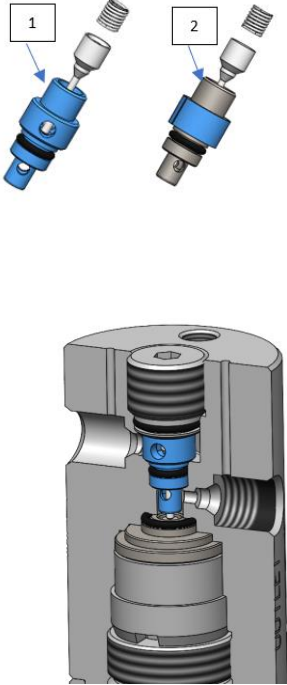
Full service at OBS will include the following steps:

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, we also replace these parts.	<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 due to customers requested working pressure.)	<i>RPL-X-P06-KC-000173</i>
Fill in FAT test Report	<i>RPL-X14-P04-RF-FAT</i>


7 SERVICE RPL-X-SERIES

The RPL-X-Series are based on the same principal, Rep Kit service procedure cover each RPL-X-series regulator. Some may vary, depending on which RPL-X model in use.

7.1 PROCEDURE FOR CHANGE OF INLET VALVE

	<ul style="list-style-type: none">• 1 refers to Spare Part 01-00432 Valve Seat with Guide, 2 refers to Spare Part 01-00438 Valve Seat with Guide and Filter.• The system must be without pressure, and all valves upstream/downstream to the regulator must be closed.• Make sure to follow local procedures if necessary.• Remove cap by using a 5mm hex-key.• Remove Spring• Inspect O-ring, replace if damaged. Lubricate threads with DX paste if necessary.• Pull out Valve Body• Pull out Valve Seat, use special tool to avoid damaging the Valve Seat.• Position the Valve Seat, push the Valve seat into the Pressure Housing by using you finger or special tool. Make sure not damaging the Valve seat while assembling. Holes in Valve seat must be placed 90° across the inlet/outlet ports.• Insert Valve Body into Valve Seat• Insert Spring• Assemble the Cap into Pressure Housing, make sure the Spring is in position, if friction reassemble for inspection.• Lubricate threads with Molykote DX paste• Lubricate all O-rings with Molykote 111
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7.2 PROCEDURE FOR CHANGE OF DUMP VALVE

	<ul style="list-style-type: none">• The system must be without pressure, and all valves upstream/downstream to the regulator must be closed• Make sure to follow local procedures if necessary• Split the regulator, separate HP housing/Spring Housing• Disassemble Ring using a special tool• Pull out O-ring's stack with Dump valve.• Visually inspect O-rings and rings, change parts if damaged.• Insert rings and O-rings, according to drawing.• Use the same Calibration bolt, assemble Guide Ring. Sleeve (10-01668) enters assembled Dump Valve. Insert this into the Piston Guide (10-01669).• Assemble complete Dump Valve into High Pressure Housing, tightening torque 40Nm.• Lubricate threads with Molykote DX paste.• Lubricate all O-rings with Molykote 111• Calibration of "dead band" by tuning the calibration bolt: Clockwise = less "dead band" Counterclockwise = Increasing "dead band"
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7.3 SPARE PART LIST

7.3.1 RPL-X14 / RPL-X21 / RPL-X-Fixed

OBS Product Code regulator			
RPL-X14-F-S-P690	RPL-X14-M-S-P370	RPL-X14-M-SP690	RPL-X14-M-D-P900
RPL-X21-F-S-P690	RPL-X21-M-S-P370	RPL-X21-M-S-P690	

Q	PN: 70-00001	Service/overhaul of RPL-X14 or RPL-X21 regulator
1		Overhaul incl. replacement of inlet valve, dump valve and soft sealings, calibration and test. Doc. incl: COC and test certificate
1		Service report

Q.	PN:60-00055	RPL-X14 370/690 Complete rep kit (RK1-NF/RK4/SSK1)	
1	01-00432	Valve Seat w/guide	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	01-00486	Dump Valve kit 370/690	Sub-assembly
1	24-00021	XHPR-14 SSK-1 SOFT SEAL KIT FOR 370/690 BARG (SAME AS FOR XHPR-08)	

Q.	PN:60-00056	RPL-X14 370/690 Complete rep kit (RK1-IF/RK4/SSK1)	
1	01-00468	Valve Seat w/guide & filter	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	01-00486	Dump Valve kit 370/690	Sub-assembly
1	24-00021	XHPR-14 SSK-1 SOFT SEAL KIT FOR 370/690 BARG (SAME AS FOR XHPR-08)	

Q.	PN:60-00057	RPL-X14 900Barg Complete rep kit (RK1-NF/RK5/SSK2)	
1	01-00432	Valve Seat w/guide	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	01-00487	Dump Valve kit 900	Sub-assembly
1	24-00022	XHPR-14 SSK-2 SOFT SEAL KIT FOR 900 BARG	

Q.	PN:60-00058	RPL-X14 900Barg Complete rep kit (RK1-IF/RK5/SSK2)	
1	01-00468	Valve Seat w/guide & filter	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	01-00487	Dump Valve kit 900	Sub-assembly
1	24-00022	XHPR-14 SSK-2 SOFT SEAL KIT FOR 900 BARG	

Q. PN:60-00017		XHPR-14 RK1 INLET REP KIT (-NF SAME AS FOR XHPR-08)	
1	01-00432	Valve Seat w/guide	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	29C00675	O-ring	HNBR 90 Shore A, black

Q.	PN:60-00053	XHPR-14 RK1 INLET REP KIT -IF (Switch internal filter)	
1	01-00468	Valve Seat w/guide & filter	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	29C00675	O-ring	HNBR 90 Shore A, black

Q. PN:60-00020		XHPR-14 RK4 DUMP VALVE KIT FOR 370/690 BARG	
1	01-00486	Dump Valve kit 370/690	Sub-assembly
5	29C01082	O-ring	HNBR 90 Shore A, black

Q.	PN:60-00022	XHPR-14 RK5 DUMP VALVE KIT FOR 900 BARG	
1	01-00487	Dump Valve kit 900	Sub-assembly
5	29C00875	O-ring	HNBR 90 Shore A, black

Q.	PN:24-00021	XHPR-14 SSK-1 SOFT SEAL KIT FOR 370/690 BARG (SAME AS FOR XHPR-08)	
1	29C00675	O-ring	HNBR 90 Shore A, black
5	29C01082	O-ring	HNBR 90 Shore A, black
1	29C01400	O-ring	HNBR 90 Shore A, black
1	29K02900	O-ring	HNBR 90 Shore A, black

Q.	PN:24-00022	XHPR-14 SSK-2 SOFT SEAL KIT FOR 900 BARG	
1	29C00675	O-ring	HNBR 90 Shore A, black
5	29C00875	O-ring	HNBR 90 Shore A, black
1	29C01400	O-ring	HNBR 90 Shore A, black
1	29K02900	O-ring	HNBR 90 Shore A, black

Q.	PN:60-00035	XHPR-14 DUMP TOOL (SAME AS FOR XHPR-08)	
1	10-01809	Dump Tool	AISI 316L

Q.	PN:60-00037	XHPR-14 CALIBRATION BOLT	
1	01-00476	Calibration Bolt X14 with screw	Sub-assembly

Q.	PN:60-00034	XHPR-14 GUIDE RINGS FOR SPRING SLEEVE (SAME AS FOR XHPR-08)	
2	25-00017	Guide Rings	Turcon (length: 115mm x 2)

Q.	PN:60-00033	XHPR-14 GUIDE RINGS FOR DUMP VALVE	
1	25-00017L061	Guide Ring	Turcon (length: 61,5mm)
1	25-00017L045	Guide Ring	Turcon (length: 45mm)

7.3.2 RPL-X08

OBS Product Code regulator			
RPL-X08-M-S-P370	RPL-X08-M-S-P690	RPL-X08-M-D-P900	

Q.	PN:60-00017	XHPR-08 RK-1 INLET COMPLETE REP KIT (SAME AS FOR XHPR-14)	
1	01-00432	Valve Seat w/guide	Sub-assembly
1	10-01706	Valve Body	Titanium Gr.5
1	29C00675	O-ring	HNBR 90 Shore A, black
Q.	PN:60-00018	XHPR-08 RK-2 DUMP VALVE KIT FOR 370/690 BARG	
1	10-02280	Sleeve	AISI 316L
1	10-01667	Valve body	22 Cr. Duplex
1	10-02312	Dump X-08	AISI 316L
1	14-00174	Spring	SS2331
Q.	PN:60-00019	XHPR-08 RK-3 DUMP VALVE KIT FOR 900 BARG	
1	10-02280	Sleeve	AISI 316L
1	10-01667	Valve body	22 Cr. Duplex
1	10-01842	Piston	AISI 316L
1	14-00174	Spring	SS2331
Q.	PN:24-00021	XHPR-08 SSK-1 SOFT SEAL KIT FOR 370/690 BARG (SAME AS FOR XHPR-14)	
1	29C00675	O-ring	HNBR 90 Shore A, black
5	29C01082	O-ring	HNBR 90 Shore A, black
1	29C01400	O-ring	HNBR 90 Shore A, black
1	29K02900	O-ring	HNBR 90 Shore A, black
Q.	PN:24-00022	XHPR-08 SSK-2 SOFT SEAL KIT FOR 900 BARG (SAME AS FOR XHPR-14)	
1	29C00675	O-ring	HNBR 90 Shore A, black
5	29C00875	O-ring	HNBR 90 Shore A, black
1	29C01400	O-ring	HNBR 90 Shore A, black
1	29K02900	O-ring	HNBR 90 Shore A, black
Q.	PN:60-00035	XHPR-08 DUMP TOOL (SAME AS FOR XHPR-14)	
1	10-01809	Dump Tool	AISI 316L
Q.	PN:60-00036	XHPR-08 CALIBRATION BOLT	
1	01-00475	Calibration Bolt X08 with screw	Sub-assembly
Q.	PN:60-00034	XHPR-08 GUIDE RINGS FOR SPRING SLEEVE (SAME AS FOR XHPR-14)	
2	25-00017	Guide Rings	Turcon (length: 115mm x 2)
Q.	PN:60-00032	XHPR-08 GUIDE RINGS FOR DUMP VALVE	
1	25-00017L061	Guide Ring	Turcon (length: 61mm)
1	25-00017L062	Guide Ring	Turcon (length: 62mm)