
Gas Pressure Regulators Series HON R100 Piston Type

Operation & Maintenance Manual



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Document number: 8098380403010
Document name: HON R100S Piston Type Manual
Revision: D

Revision record

Rev.	Description	Sign	Date
A	Update R100 piston type lubricant drawing and add bolt preload table	J.Tong	05-07-2018
B	Add technical description for external check valve; add cross section for R100S-SO	A.Shen	23-01-2019
C	Updated spare parts list Updated weights on page 11, 12	A.Shen V.Peng	29-03-2023
D	Removed "Stroking time"	V.Peng	07-07-2023

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While great care has been taken in composing the text and illustrations, Honeywell does not accept liability for any inaccuracies.

1 Technical Specifications

1 Technical specifications

1.1 System Components

Active regulator system:

- Main line valve : HON R100S -/-SO
- Active controller : HON P095, -MPS, -HPS

Monitor regulator system:

- Main line valve : HON R100SM
- Monitor controller : HON P095, -MPS, -HPS
- Switch-over accelerator : HON AP095, -MP, -HP

1.2 Area of application

Typical area of application are stand-alone gas pressure regulating and metering installations, where high demands are set for reliability in operation and regulating precision. Both active and monitor regulator are medium controlled.

Besides its application in transport and distribution systems, the control system is especially suitable for gas pressure reduction at end users where a combination of stability and a high speed of response is required at a strongly varying demand.

In addition, the regulating system is highly suitable in those situations where a very small pressure drop across the installation is required. This often concerns bottlenecks in the transport and distribution network. The basic regulating system with HON R100 components requires less than 0.5 bar pressure difference to be able to function. Moreover, the system has a high regulating precision, enabling pressure equation within an installation to be kept within limits. A predictive calculation or simulation may be made for critical situations.

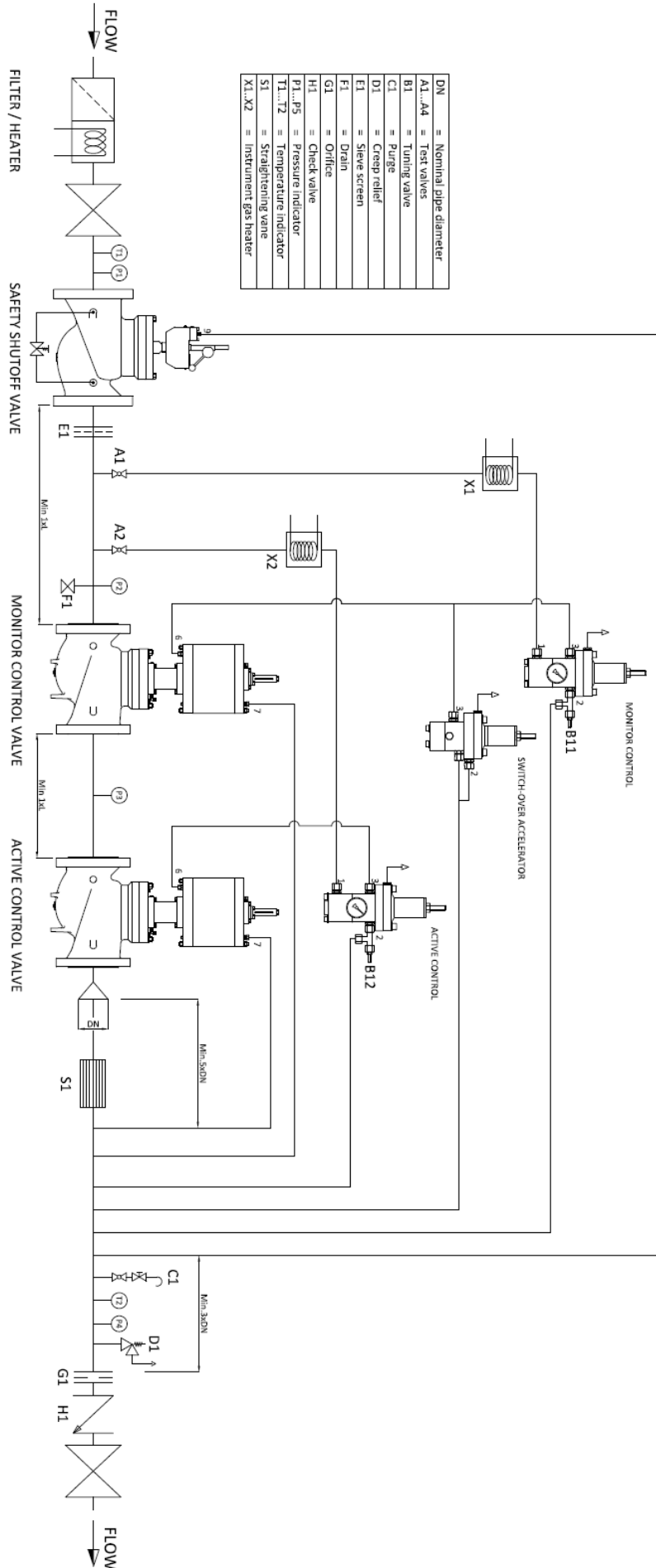
Given its unique construction, the silenced models of the regulators are specifically suitable for situations where high demands are set to both low noise levels and high capacities. If required, Honeywell can make a predictive calculation of the acoustic pressure level belonging to the process conditions concerned.

The addition of a monitor regulator to the system enables increase of operational reliability combined with additional layer of pressure protection. If the active regulating system fails open, the monitor regulator assumes pressure control and the gas supply will continue without intervention and subsequent cut off by a safety shutoff valve.

The acceleration pilot assures quick switch-over from wide-open monitoring to emergency control. The accelerator relieves excessive motorization pressure from the saturated actuator (to the downstream network).

Both active and monitor control valves are 2-path pilot controlled pressure regulators with a fast acting proportional loop and a slower but more accurate integrating loop. This enables high regulating precision and fast response.

Technical Specifications



DN	= Nominal pipe diameter
A1...A4	= Test valves
B1	= Tuning valve
C1	= Purge
D1	= Creep relief
E1	= Sieve screen
F1	= Drain
G1	= Orifice
H1	= Check valve
P1...P5	= Pressure indicator
T1...T2	= Temperature indicator
S1	= Straightening vane
X1, X2	= Instrument gas heater

Fig 1.1.1 Layout of control system – Typical wide-open monitor system
 Operation and Maintenance Manual HON R100 Piston type
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Application of HON P095

The controller HON P095-xPS has been optimized for use with HON R100 gas pressure regulators but experience has taught that it also functions extremely well on other types (makes) of gas pressure regulators.

Other applications are:

- The HON P095-xPS as two-stage gas pressure reducer with a small capacity
- The HON P095-xP as single-stage override controller or working monitor pilot.

The override controller may be used for flow limitation purposes, if combined with an orifice plate or remote controlled drive.

The working monitor pilot sets the inter-stage pressure in a working monitor arrangement. The working monitor arrangement consists of an active monitor, which cuts the inlet pressure to a fixed inter-stage pressure and a regulator which finally reduces the inter-stage to the required outlet pressure.

- Accessories are available to enable remote set point adjustment by a pneumatic or electric drive and allow for combination with solenoid valves (e.g. for flow control by PWM)

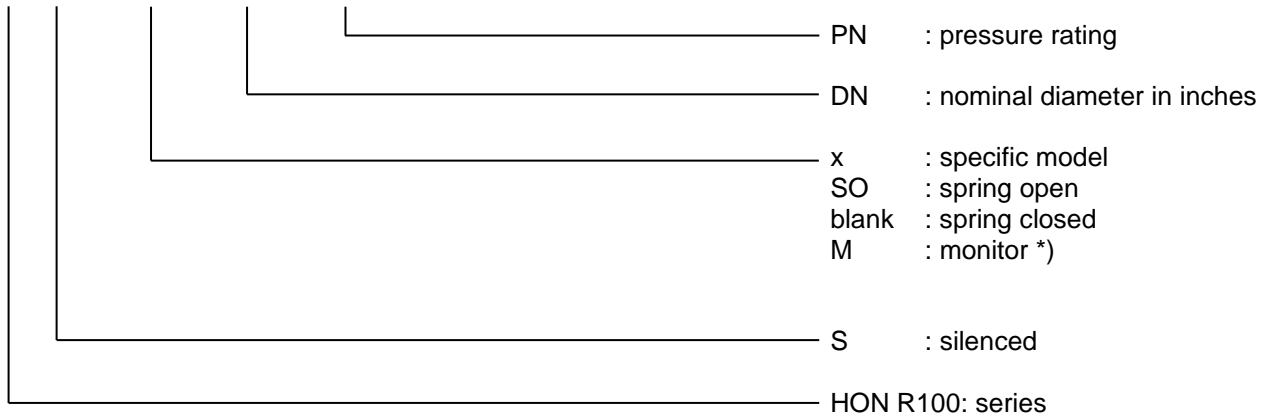
You may contact Honeywell for a detailed description on these other applications. This manual reflects the main use of the HON P095 as a pressure controller for regulators.

1.3 Type designation

Main line valves

HON

R100 S - x - DN - PN



*) features two pistons: standard top piston energizes shutoff at increasing pressure differential, additional bottom piston balances inter-stage pressure acting on valve plug.

Examples:

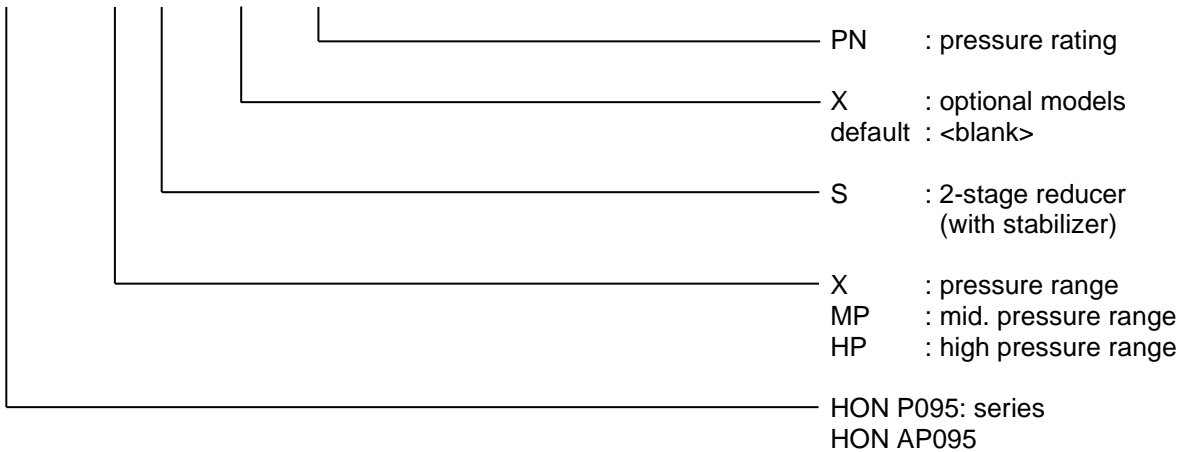
HON R100S-10"-600# equals a gas pressure regulator series HON R100 silenced, standard model, with a nominal diameter of 10" and a class 600 pressure / temperature rating

HON R100S-M-10"-600# equals a gas pressure regulator series HON R100, silenced, monitor model with a nominal diameter of 10" and a class 600 pressure / temperature rating.

Controller (active & monitor) / Switch-over accelerator

HON

P095 - x P S - x - PN



Examples:

HON P095-HPS-600# equals a pressure controller series HON P095, standard model, with 2-stage pressure reduction and a class 600 pressure / temperature rating

HON AP095-HP-600# equals a switch-over accelerator series HON AP095, standard model, single stage and a class 600 pressure / temperature rating

1.4 Technical specifications regulating system

Series	: HON R100S
Designation	: Gas Pressure Regulators
Application	: Pressure Control Systems acc. EN 12186
Nominal Diameter	: 6" – 16"
Pressure rating	: ANSI CL 150 / 300 / 600 / 900 / 1500
Design	: EN 334 (DIN 3380), BS 1873, ANSI B16.10
Operating pressure	: up to 250 bar
Pressure setting range	: from 2.5 to 60 bar
Operating temperature	: from -20 up to +60° C
Ambient temperature	: from -30 up to +80° C
Shut-off	: Tight shutoff, better than class VI
Minimum required pressure difference	: 0.5 bar
Auxiliary energy	: no external supply
Atmospheric bleed	: no bleed to atmosphere
Downstream bleed	: no bleed to downstream (in lockup condition)
Mounting position	: Horizontal with cylinder in upward position

- AC5 / SG10 : up to 3 bar
- AC1 / SG2,5 : from 3 bar on

**) values are given for standard configuration of pilot/regulator and test rig*

**) for high accuracy at operating temperatures far below 0° C and below HC/ H2O-dewpoint additional pilot heating is recommended.*

1.5 Technical specifications regulators

Capacity

To determine the capacity, the following formulas may be used:

$$Q_n = \frac{13.57}{\sqrt{d(T_e + 273)}} \cdot C_g \cdot \sqrt{(P_i - P_o) \cdot P_o} \quad \text{if } \frac{P_o}{P_i} \geq 0.5$$

$$Q_n = \frac{6.78}{\sqrt{d(T_e + 273)}} \cdot C_g \cdot P_i \quad \text{if } \frac{P_o}{P_i} < 0.5$$

With

Q_n	= flow rate in m_n^3/h
P_i	= inlet pressure in bar
P_o	= outlet pressure in bar
C_g	= capacity rate in $m_n^3/(h \cdot bar)$
d	= relative density (air=1)
T_e	= temperature gas in the inlet side of the regulator
ρ_n	= gas density under normal conditions (with $T=273$ Kelvin)

To natural gas with $\rho_n = 0.83 \text{ kg/m}^3$ applies: $d = 0.643$

To gasses other than natural gas applies: $d = \rho_{ngas} / 1.29$

In the above formula, the C_g value of the combination monitor regulator and active regulator should be filled in. This value (C_{g_tot}) can be calculated as follows:

$$Cg_{tot} = \sqrt{\frac{1}{\left(\frac{1}{Cg_{active}}\right)^2 + \left(\frac{1}{Cg_{monitor}}\right)^2}}$$

For the Cg values specific to device and diameter, the values shown in the table below may be used.

DN	C _G	
	HON R100	HON R100 Silenced
6" CL 900/1500	12860	10709
8" CL 900/1500	21178	17638
10" CL 150/600	37000	30100
10" CL 900/1500	32600	25881
12" CL 150/600	48000	38500
12" CL 900/1500	44370	36500
16" CL 150/600	83400	60100

Table 1.5.1 Cg values regulators of the HON R100 series

Dimensions & weight

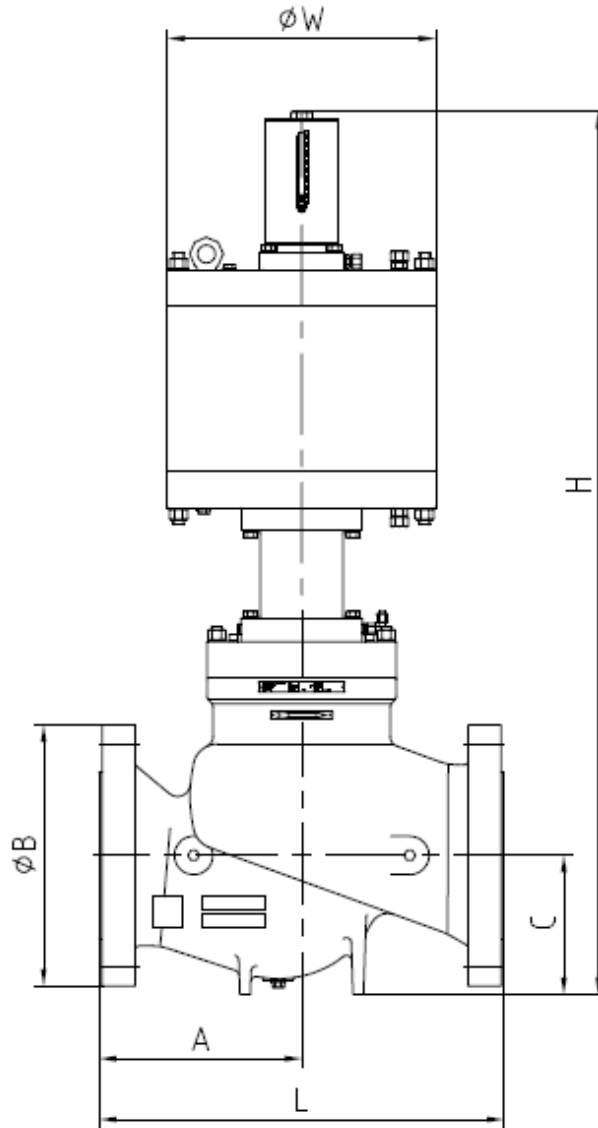


Figure 1.5.2 dimensional drawing for regulators HON R100 series

Dimensions & weight for R100S/SM

DN	PN	A	C	L	W	H	B	W
6"	Cl.900	355.5	250	711	543	1743	381	1175
	Cl.1500						393.7	1225
8"	Cl.900	420.5	275	841	543	1705	469.9	1485
	Cl.1500						482.6	1585
10"	Cl.150	393.5	270	787	521	1716	406.4	1200
	Cl.300						445	1200
	Cl.600						508	1260
	Cl.900	500	340	1000	543	1942	546.1	2025
	Cl.1500						584.2	2030
12"	Cl.150	419	320	838	521	1768	483	1435
	Cl.300						521	1440
	Cl.600						559	1450
	Cl.900	482.5	320	965	543	1778	609.6	1840
	Cl.1500	573	350	1146	543	1808	674	2310
16"	Cl.300	495	404	990	740	2607	648	3365
	Cl.600						686	3415

Technical Specifications

Table 1.5.3 Dimensions (mm) and weight W (kg) for R100S/SM

Dimensions & weight for R100S-SO

DN	PN	A	C	L	W	H	B	W
6"	Cl.900	355.5	250	711	543	1923	381	1200
	Cl.1500						393.7	1250
10"	Cl.150	393.5	270	787	521	1896	406.4	1390
	Cl.300						445	1390
	Cl.600						508	1450
	Cl.900	500	340	1000	543	2122	546.1	2215
	Cl.1500						584.2	2220
12"	Cl.150	419	320	838	521	1768	483	1570
	Cl.300						521	1580
	Cl.600						559	1590
16"	Cl.300	495	404	990	740	2879	648	3660
	Cl.600						686	3710

Table 1.5.4 Dimensions (mm) and weight W (kg) for R100S-SO

Materials regulators

Valve housing	: Cast steel A352-LCC 3.1 certificated
Pressured parts	: Steel 3.1 certificated
Valve stem	: 17-4PH H1150
Guides	: P355N + Hard-chromium plated
Piston	: S355N + Ni-PTFE coated
Valve seat	: 17-4PH H1150
Seat sealing	: Metal-to metal with FPM O-ring seal for tight shutoff
O-rings	: FPM and NBR

If corrosive or aggressive gasses are being used, then other materials may be necessary. Please advise actual gas composition at time of order.

1.6 Technical specifications pilot HON P095 & AP095

If the required set point lies in the overlapping range between two springs, it is recommended to take the spring with the lowest set point range. This way maximum regulating precision is achieved. This also applies in the event that the required P_o lies in the overlapping range of the two pilot types MPS and HPS. In this case it is recommended to opt for the MPS model. As far as construction is concerned, the MPS and HPS types only differ in their diaphragm package, which makes it easy to change a MPS into a HPS type and vice versa.

Weight: approx. 8 kg for P095-xPS
 approx. 5 kg for AP095-xP

Dimensions:

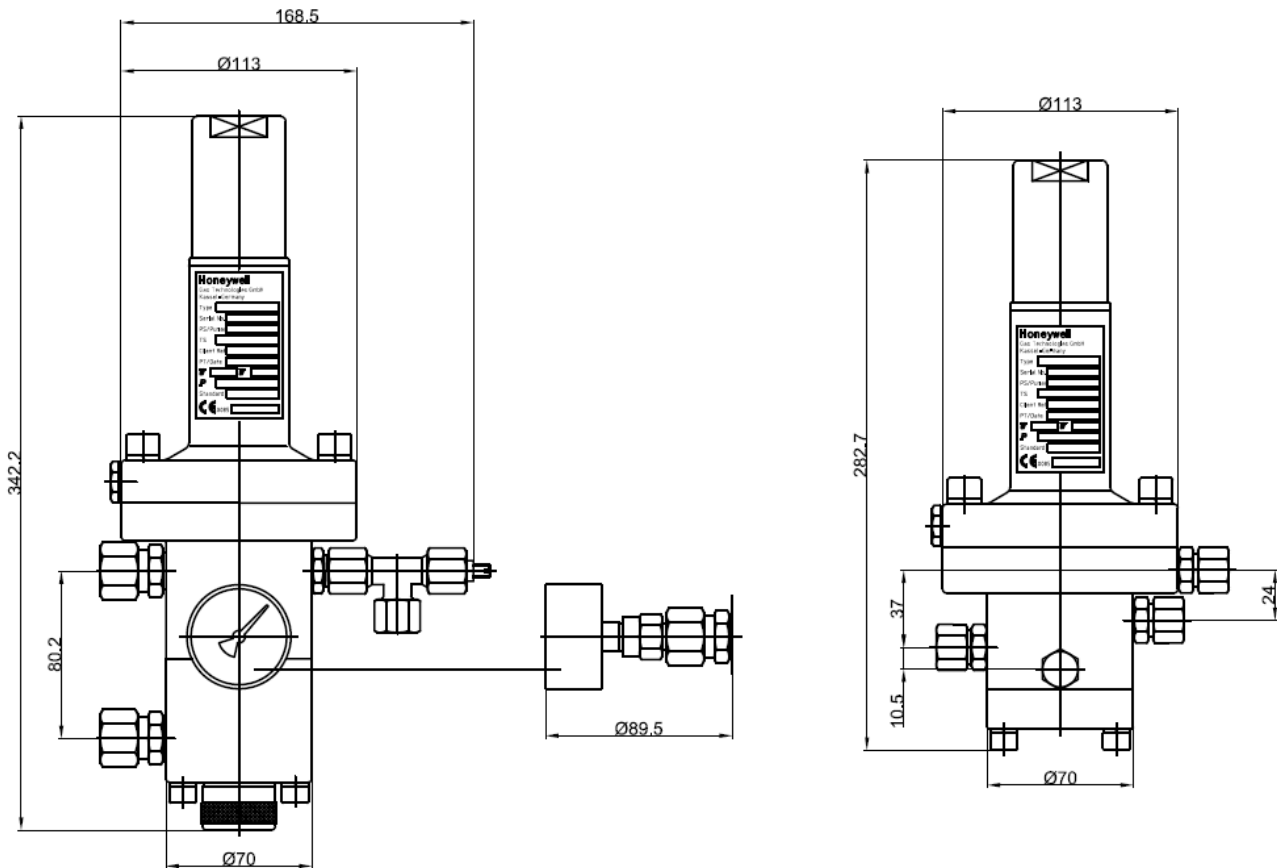


Figure 1.6.2 dimensional drawing (in mm) HON P095-xPS and HON AP095 -xP

Technical Specifications

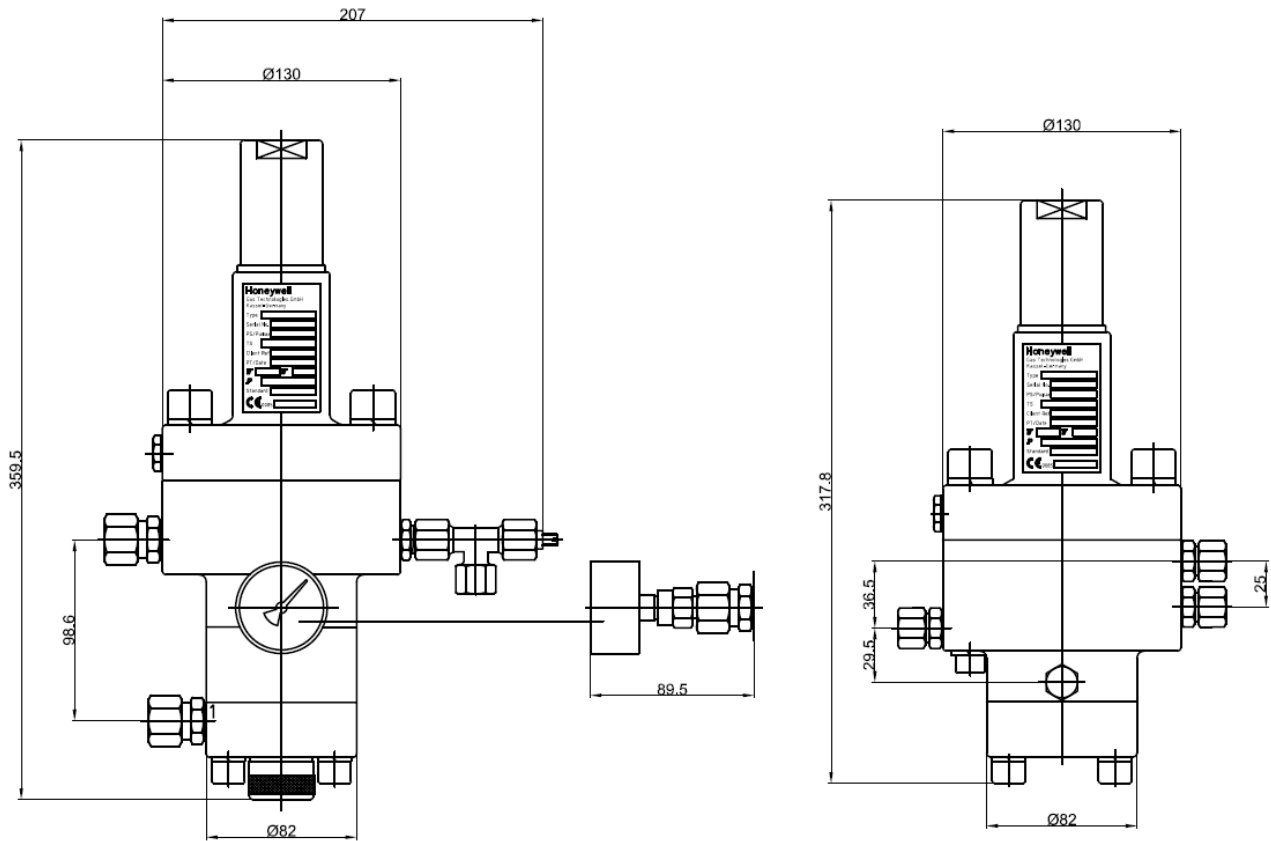


Figure 1.6.3 dimensional drawing (in mm) HON P095 xPS-1500 and HON AP095 -xP-1500

Materials:

Pressurized parts	: S355NL, 3.1 certified
Guides	: CuZn
Internal components	: Mainly X10CrNiS
Diaphragm	: NBR with nylon insert
O-rings	: FPM and NBR

2 Principle of Operation

2 Principle of Operation

2.1 General

The control system consists of an active regulator with pilot (typically HON R100S + HON P095), a monitor regulator with pilot and accelerator (typically HON R100S-M + HON P095 + HON AP095).

As far as construction is concerned, the monitor regulator and active regulator including pilots are practically identical except for dimensional details with regard to balancing of the valve system.

Under normal circumstances the active regulator is in operation, the monitor is fully open and the acceleration pilot stand-by.

The acceleration pilot AP095 accelerates the response of monitor regulator during switch-over (by speeding up the discharge of motorization pressure of the saturated monitor actuator) at the moment the active regulating system fails open and outlet pressure has risen above its relief set point.

2.2 Single stage pressure reduction system (fail close)

See *fig.2.2.1*

At a constant outlet pressure P_o valve (10) allows passage of a flow volume equal to the gas offtake. The forces over the main piston (8) are in equilibrium. The equilibrium is determined by the control pressure (7) on the one hand and the outlet pressure P_o plus spring (9) on the other hand. If more gas is taken off at the outlet side, the outlet pressure drops. Because of feedback of the outlet pressure to the active regulator, valve (10) will open further and allow more gas to pass. The piston movement will increase the volume in the control chamber (7) and further pressed down return spring (9). A new equilibrium occurs at a lower regulated outlet pressure P_o . Pressure control regulator HON P095 ensures that the outlet pressure is adjusted to the set point value, for a reduction of the outlet pressure P_o also results in a lower position of the diaphragm (3). Because of this, supply valve (4) allows a larger gas flow to pass than the gas flow able to discharge to the outlet through the internal restriction. This results in a rise of the pressure in the control chamber (7) until the outlet pressure P_o is practically equal to the required value set by means of the adjusting screw (1).

The system responds in reverse order at a drop of gas offtake.

The check valve (11) is provided to protect valve and piston when moving parts get stuck. Normally the valve starts moving at low pressure difference between the upper and lower surfaces of the piston. When the valve is blocked for some reason, one side of piston will build up pressure, increasing the pressure difference to piston. This will damage the piston when the applied unbalanced force is too high. The check valve will open to balance pressure of chambers separated by piston once the pressure difference is higher than 5bar. The check valve belongs to standard accessory of regulator.

The first control stage of the pilot, called the inlet pressure regulator or auxiliary stage (6), maintains a fixed difference between the regulated pressure and the feeding pressure for pilot valve (4), called the auxiliary pressure (5).

When gas offtake discontinues entirely, the main valve (10) and the pilot valve (4) close, as well as the inlet pressure regulator (6). Via an internal run-off restriction in the pressure control regulator, the pressure in the control chamber (7) is exchanged with P_o so that spring (9) can close valve (10).

Under normal operating conditions there is always a very small runoff from the control chamber (7) to the outlet (P2) so that very stable regulation is obtained.

Before the first control stage there is a fine filter, preventing soiling of the pressure control regulator.

The required outlet pressure can easily be set with spring (2) and adjusting screw (1).

The pilot is available in 2 basic models: the HON P095-MPS and HON P095-HPS. The pilots are mutually different in the set point range of the regulated pressure. As far as construction is concerned, both pilots are identical except for the second stage diaphragm package. The same series of springs (2) is available for both types of pilot. Each spring corresponds to a section of the total set point range (see also chapter 1 Technical specifications).

The HON P095-xPS is provided with a breather plug. It can also be supplied with a male connector for connection to a vent stack by tubing.

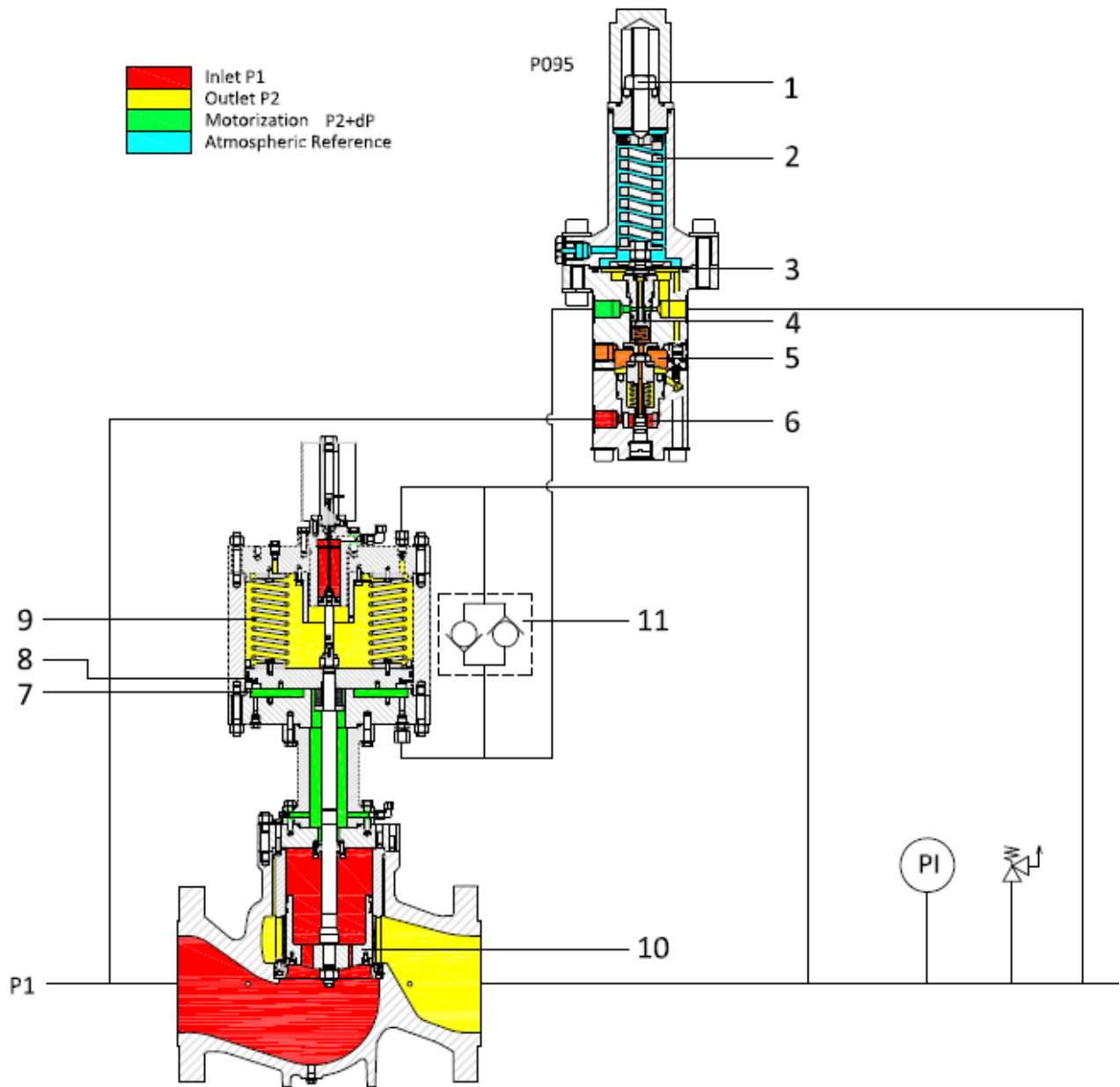


Fig. 2.2.1 Schematic of single stage pressure reduction with HON R100S + HON P095 xPS

2.3 Single stage pressure reduction system (fail open)

At a constant outlet pressure P_o valve (10) allows passage of a flow volume equal to the gas offtake. The forces over the main piston (8) are in equilibrium. The equilibrium is determined by the control pressure (7) plus spring force (9) on the one hand and the outlet pressure plus auxiliary pressure differential (5) on the other hand. If more gas is taken off at the outlet side, the outlet pressure drops. Because of feedback of the outlet pressure to the active regulator, valve (10) will open further and allow more gas to pass. The piston movement will increase the volume in the control chamber (7) and decrease the spring force (9). A new equilibrium occurs at a lower regulated outlet pressure P_o . Pressure control regulator HON P095 ensures that the outlet pressure is adjusted to the set point value, for a reduction of the outlet pressure P_o also results in a lower position of the diaphragm (3). Because of this, supply valve (4) allows a larger gas flow to pass than the gas flow able to discharge to the outlet through the internal restriction. This results in a rise of the pressure in the control chamber (7) until the outlet pressure P_o is practically equal to the required value set by means of the adjusting screw (1).

The system responds in reverse order at a drop of gas offtake.

About the function of check valve (11), please refer to description in chapter 2.2.

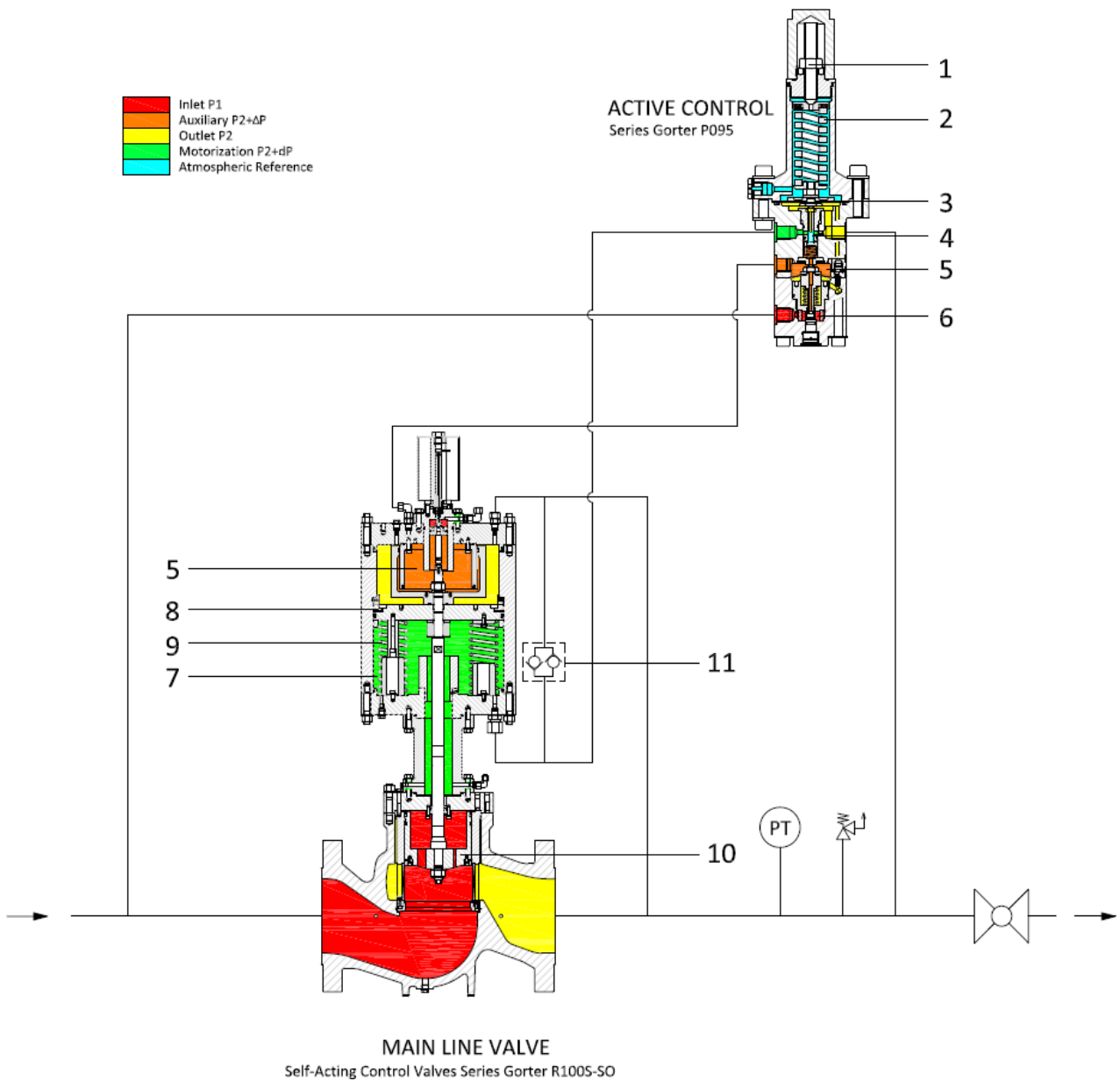


Fig. 2.3.1 Schematic of single stage pressure reduction with HON R100S-SO + HON P095 xPS

2.4 Single stage pressure reduction with wide-open monitor

Normal Operation with passive monitor:

The working of the wide-open monitor system is during normal operation identical to that of the single stage pressure reduction system.

For any other configurations, don't hesitate to contact our company

Monitor take-over:

See figure 2.4.1

If the active regulating system open fails, outlet pressure P_o rises. When P_o has risen up to the set point of the monitor pilot HON P095-xPS, pilot valve (12) will close, resulting in a decrease of the control chamber pressure (13). As the monitor valve (14) is fully open in normal operation (i.e. functioning active regulator) and is limited by a metal stop, it will take a while before it is actually going to close. In order to speed up this process, the acceleration pilot will start acting as soon as pressure P_o rises above the set point set by means of the adjusting screw (15). By means of valve (16), this acceleration pilot creates an extra flow from the control chamber to the outlet, which makes the control chamber pressure drop faster and valve (14) close quicker. The valve will close up to the point when P_o has gone down again to the set monitor set point. Valve (16) closes the instant that outlet pressure P_o drops again until just below the set point of the acceleration pilot HON AP095-xP. Therefore, it is always closed when the monitor regulator is regulating normally and, accordingly, does not contribute to regulation. After the switch-over the pressure P_t in the pipe-piece between monitor regulator and active regulator will be practically equal to the outlet pressure P_o .

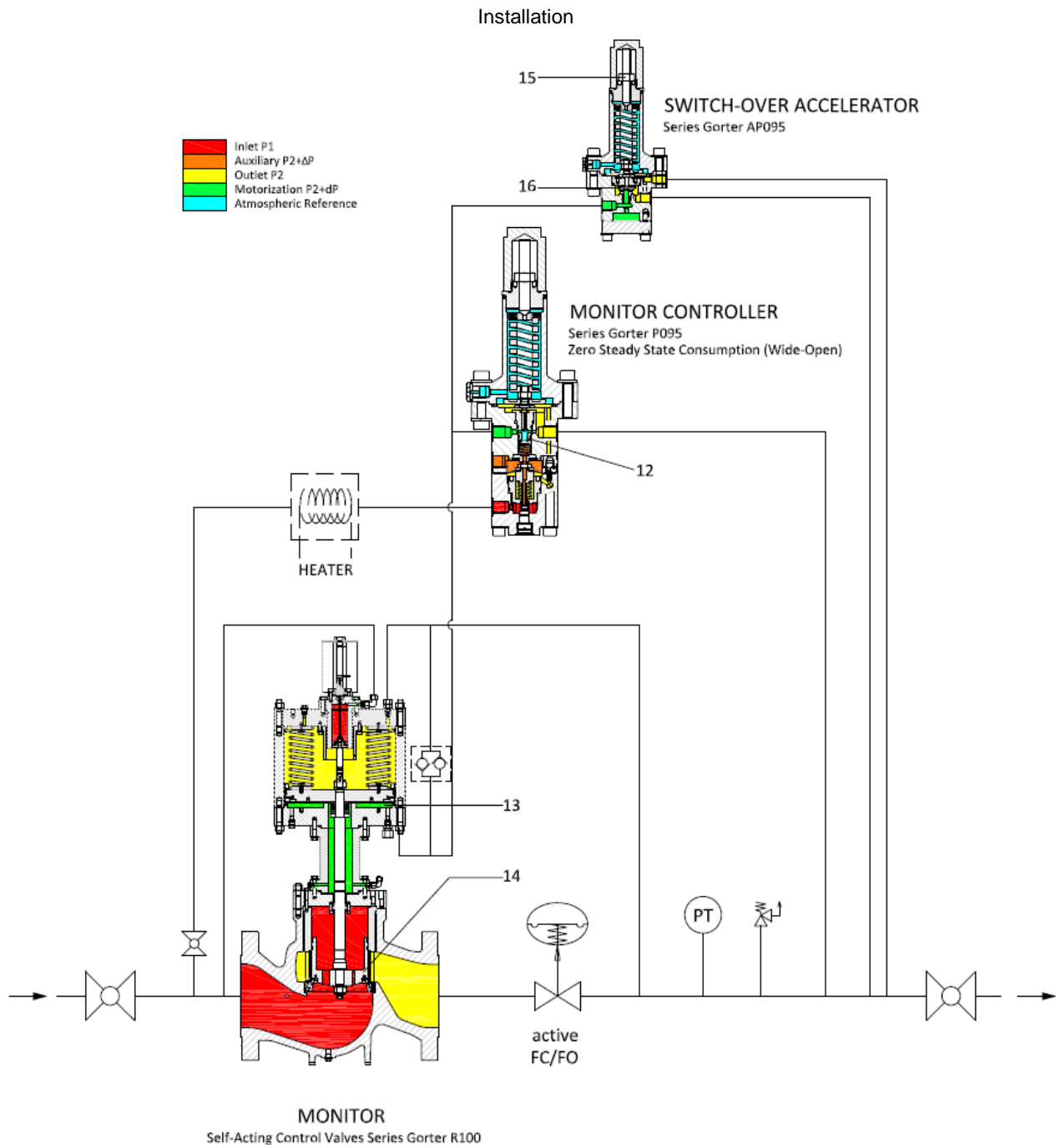


Figure 2.4.1 Schematic diagram wide-open monitor regulating system with HON R100S-M+HON P095-xPS+HON AP095-xP

3 Installation

3 Installation

3.1 Hookup

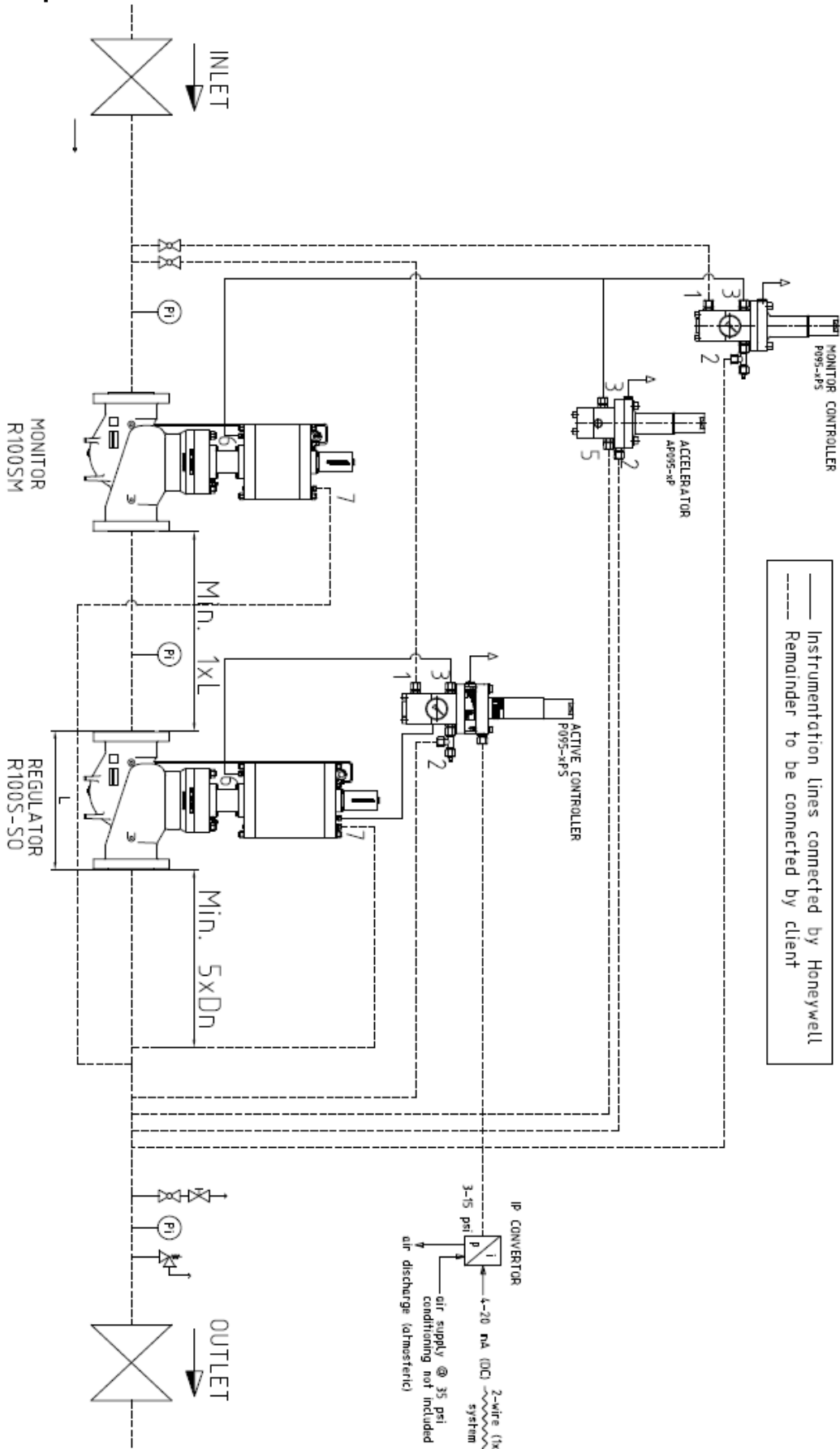


Fig. 3.1.1 Hookup gas pressure regulating system with SO active and SC monitor regulator (recommend)

The connections of the instrumentation lines on the outlet pipe-piece must be situated at least 5 x the nominal diameter of the outlet pipe (DN) from the expander behind the active regulator and at least 3 x the nominal pipe diameter before the next interference (e.g. the end valve).

The connections to the outlet pipe-piece between active regulator and end valve may be distributed around the periphery of the outlet pipe-piece with the exception of the bottom. Metering lines 2 of both HON and HON AP095 should not be combined.

To check and setup the monitor regulator and active regulator, it is recommended to fit a pressure gauge and purge (bleeder valve) on the pipe-pieces between monitor and active and downstream of the active regulator.

For ease of start-up and diagnostics, it is further recommended to mount an isolating valve in the supply line of the pilots.

It may also be useful to mount a valve in the motorization line (between connection 3 of the pilot HON P095 and connection 6 of the HON R100 main line valve). This valve may be used in the event of a failure analysis to isolate the actuator or to stroke the valve (in combination with additional supply connection, a pressure of 2 bar (maximum 5 bar) is more than enough to fully stroke the valve.

If required, spring return opening or closing valves can be supplied for this purpose. These valves are available under type indication ZV-O and ZV-C.

NB. In the remainder of this documentation it is taken for granted that above mentioned practical provisions have been made.

The size and function of the port connections is shown in tables 4 to 7 and figure 6.

Connection No.	Thread Size BSP(P)	Tubing OD	Function
0	¼"	12 / ½"	Auxiliary
1	¼"	12 / ½"	Supply
2	¼"	12 / ½"	Sense
3	¼"	12 / ½"	Motorization (output to actuator)

Table 3.1.1 Connections pilot HON P095-xPS

Connection No.	Thread Size BSP(P)	Tubing OD	Function
2	¼"	12 / ½"	Sense
3	¼"	12 / ½"	Motorization (input from controller)
5	¼"	12 / ½"	Discharge

Table 3.1.2 Connections of acceleration pilot HON AP095-xP

Connection No.	Thread Size BSP(P)	Tubing OD	Function
6	¼"	12 / ½"	Motorization
7	¼"	16 / ½"	Sense

Table 3.1.3 Connections of gas pressure regulator Series HON R100

- For all metric 12 mm instrumentation pipe, fractional equivalent ½"OD may be used and vice versa.
- If the HON P095 is used as a pressure control regulator in combination with a gas pressure regulator other than series HON R100, the nominal diameter of the instrumentation tubing of the feedback line (connection 7) should be checked. The capacity of the HON P095 may be customized on request.

3.2 Important installation notices

The recommended pressure limitations are stamped on the valves nameplate. Some type of overpressure protection is needed if the actual inlet/outlet pressure exceeds the maximum operating inlet/outlet pressure rating.

Regulator operation below the maximum pressure limitations does not preclude the possibility of damage from external sources or debris in the line.

The regulator should be inspected for damage after any overpressure condition.

1. Transport and Handling

Established transport and handling procedures shall be followed to avoid any damage on the pressure containing parts and built up accessories by shocks or anomalous stresses.

2. Start-up

The regulator is not factory set and requires initial adjustment prior start-up. With proper installation completed (as per the following notices) and safety valves properly adjusted, slowly open the upstream and downstream line valves.

See section 4 for commissioning and adjustment.



Fig 3.2.1 Installation of control valves series HON R100 in skid mounted pressure control and protection system

3. Installation

- I. Only qualified personnel shall install or service a regulator. Regulators shall be installed, operated and maintained in accordance with international, applicable codes, regulations and Honeywell instructions.
- II. If the regulator vents fluid or a leak develops in the system, this indicates that service is required. Failure to take the regulator out of service may create a hazardous condition.
- III. Personal injury, equipment damage, and/or leakage due to escaping fluid may result if this regulator is over pressurized or is installed where service conditions could exceed the limits given in the specifications, or could exceed any ratings of the adjacent piping / piping connections.
- IV. To avoid such injury or damage provide pressure relieving or pressure limiting devices (as required by the appropriate code, regulation or standard) to prevent service conditions from exceeding limits. Install the regulator in a safe location.
- V. Before installation service conditions shall be checked for consistency with use limitations.
- VI. All means for venting and draining have to be provided in assemblies where control equipment has been installed.
- VII. Provide cathodic protection and electrical isolation to avoid corrosion
- VIII. Clean gas by proper filters/separators/scrubbers to avoid any technical & reasonable hazard of erosion or abrasion for pressure containing parts
- IX. For start-up a conical strainer shall be installed in between monitor and slam shut valve to avoid ingress of foreign matter (blasting grid, welding slag, chips etc.).
- X. Heat gas above HC and H₂O-dewpoints to avoid leakage or internal blockage by ice or hydrates
- XI. To avoid built-up of hydrates and freezing, additional pilot heating needs to be given due consideration. Probability of such occurrence depends on the gas composition, gas temperature, and pressure cut in relation to HC and H₂O-dewpoints. In particular at start-up residual water may result in reduced performance or complete failure on demand
- XII. In applications where the ambient temperature may drop far below 0°C, pilot heating is recommended to obtain optimal precision. In particular for outdoor installations
- XIII. Clean out all pipelines before installation of the regulator and check to be sure the regulator has not been damaged or has collected foreign material during shipping.
- XIV. Be sure flow through the body is in the direction indicated by the arrow on the body, and the axis of the actuator casing(dome) is vertical
- XV. Installation must be done avoiding anomalous stresses on the body and using suitable joint means according equipment dimensions and service conditions
- XVI. User has to check and carry out any protection suitable for assembly's specific environment
- XVII. The controllers have to be installed in such a way that the vent hole in the spring housing is unobstructed at all times
- XVIII. Avoid placing the regulator beneath eaves or downspouts, and assure the regulator is above the probable snow or water level
- XIX. Hoisting facilities or craning arrangements shall be provided to enable maintenance

4 Commissioning

4 Commissioning Notes

4.1 Single Stage Pressure Reduction, spring-closed active

Warning

Never pressurize a reducing run in reverse by first opening the outlet block valve. This may provoke overload of the valve internals.

Pressurizing and depressurizing needs time, do not push it!

Before getting started:

Familiarize yourself with the applicable safety regulations and operations instructions.

The reducing run between the slam shut or inlet block valve and the outlet block valve should be completely depressurized (check if the outlet block valve is closed).

To depressurize the run:

- Isolate the gas run and slightly open the purge valve
- Do not relax the set point adjusting screw of the pilot until after the run is depressurized.

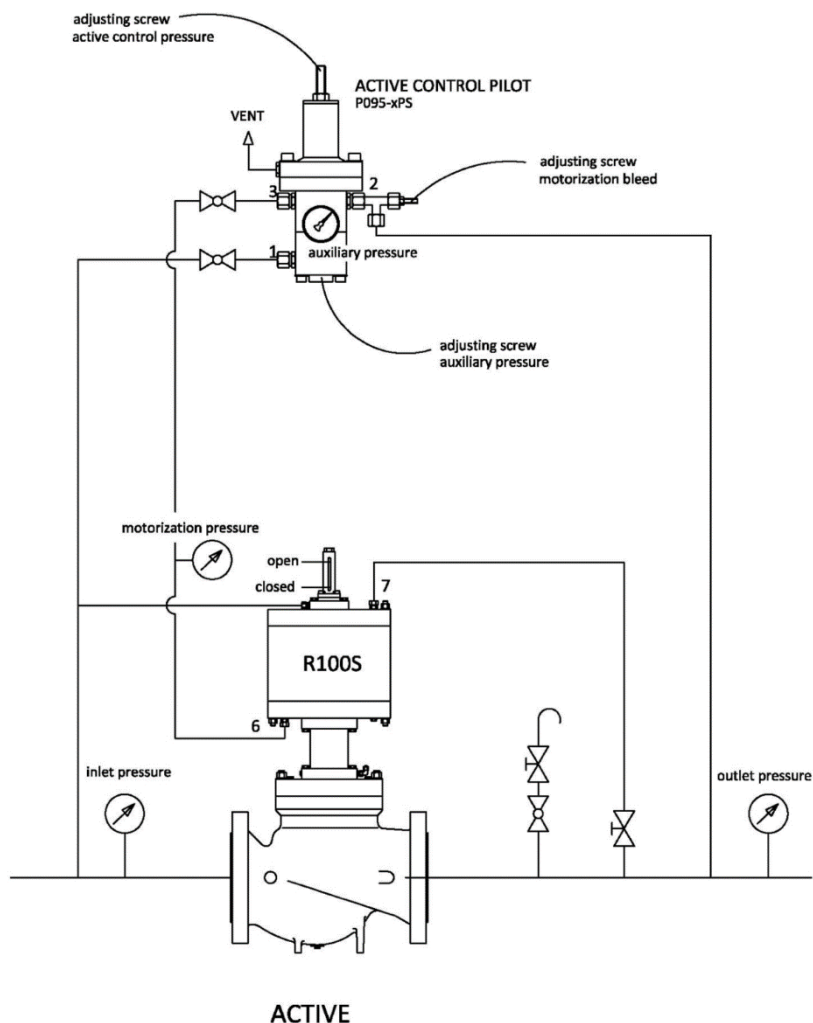


Fig. 4.1.1 Schematic of gas pressure reducing run

Recommendations:

Prior to commissioning and start-up consider the following:

- **Any** residual water left from hydrostatic testing will cause trouble to the operation of both main line valves and pilots; therefore purge and dry the upstream pipe line thoroughly and increase the outlet temperature temporarily
- **Any** particles left from welding, grinding, tapping or any solid contamination resulting from corrosion in the piping between filter and regulator (also the heat exchanger) will damage the valve disc and/or it's guide cylinder, therefore clean this part thoroughly
- Should contamination be found then act as follows to minimize damage
 - remove pipe spool upstream of regulator, blind flange downstream part
 - purge the run thoroughly via the open end
 - refit the pipe spool, include strainer to exclude contamination
- Check all instrument lines for proper arrangement and all fittings for proper connection
- Provide 'emergency' spares

Sequence of Commissioning

1. **Fully Unwind the Adjusting Screw** on top of the Pilot.
 - fully close (turning CW) the adjustable motorization bleed (@ connection no. 2 of pilot)
2. **Preset the Auxiliary Pressure** of the Pilot:
 - fully turn the adjusting screw (located at bottom of the pilot) inward (CW) carefully until it just stops on to the seat inside
 - then screw the adjusting screw out again (turning CCW) one turn (360°)
3. **Slowly Pressurize the Regulator and Pilot**
 - by either cracking the upstream block valve or opening the bypass over the slam shut(s)
4. **Adjust the Auxiliary Pressure:**

The minimum setting for the auxiliary pressure differential on HON P095 pilots should be as follows:

Note: "Differential" refers to the difference between the set point of the auxiliary pressure and the set point pressure of the pilot.

- 200..600 kPa normal range for general purpose
- 200 kPa lower end of range, used to slow-down opening pilot response
- 600 kPa higher end of range, used to speed-up opening pilot response
- 300 kPa is normally used for 6" and 400 kPa for 12" (600#). The larger the regulator the higher differential pressure to overcome the higher friction over the larger O-rings.
- Higher pressures may be needed for higher ratings or older equipment

Adjustment notes:

- adjust pilots for active regulators to approx. 300 kPa pressure differential
- make adjustments to the auxiliary pressure adjusting screw only when the pilot is operating (supplying condition)
- adjust the set screw carefully, checking after each adjustment for lock-up

Check if fine-tuning is required after commissioning the equipment

- open/close the adjustable motorization bleed to speed-up/slow-down the pilot response
- you may also adjust the auxiliary pressure differential to change the pilot response
- if the aux. setting has been adjusted, then correct the set point
- So without the need for adjustment the auxiliary pressure differential should range between 300 and 400 kPa above outlet pressure

** Activate the pilot by slightly opening the purge valve and tensioning the set spring a little*

5. **Check the Regulator for Lock-up.**
 - (first unload or relax the set spring of the pilot)
 - slowly apply full inlet pressure to the upstream side of the regulator by either cracking the block valve or opening the bypass of the slam shut.
 - Check the downstream pressure for leakage of the MLV(main line valve) and the pilot
6. If necessary **slowly** bypass the regulator, or pressurize from outlet to increase the outlet pressure above the UPSO (under-pressure protection switch off) setting of the slam shut valve(s), max 2 bar.
7. **Open the Slam Shut Valve.**
 - fully equalize pressure over the valve prior to opening
8. **Check or Set the Slam Shut Valve.**
 - increase the outlet pressure to the OPSO (over-pressure protection switch off) setting by slowly advancing the adjust screw of the pilot.
 - for adjustment itself consult the manual of the relevant slam shut
 - repeat this action to test the **safety relief valve** (to be blocked while testing the SSV)

To avoid quick opening and overshoot of the regulator during commissioning you may

- open the adjustable motorization bleed valve a few turns @ large pressure differentials
- open the outlet valve (provided that pressures are equal)
- always start with inlet valve and slam shut valve fully open

9. **Check and Test the Regulator.**
 - slightly open the purge valve and decrease the outlet pressure by slowly backing out the adjusting screw of pilot CCW.
 - close the purge valve to check the regulator and pilot for lock-up (tightness).
10. **Check Operation** by opening the outlet block valve
 - Normally the regulator will be set slightly lower than the network pressure. The pilot setting can be increased and fine-adjusted to its set point after fully opening the outlet block valve
11. **After Completing Commissioning**
 - lock the adjusting screw with the nut provided for this purpose.
12. **To take the run out of operation and depressurize it, act as follows :**
 - switch over to the standby run by decreasing active set point
 - close the inlet block valve
 - Allow the pressure upstream of the regulator to drop to outlet pressure
 - close the block valve in the supply to the pilot (if provided)
 - close the outlet block valve
 - slightly open the downstream purge valve to depressurize the run

We recommend to use a digital pressure gauge during setup of multiple streams

4.2 Single Stage Pressure Reduction, spring-open active

Warning

Never pressurize a reducing run in reverse by first opening the outlet block valve. This may provoke overload of the valve internals.

Pressurizing and depressurizing needs time, do not push it!

Before getting started:

Familiarize yourself with the applicable safety regulations and operations instructions.

The reducing run between the slam shut or inlet block valve and the outlet block valve should be completely depressurized (check if the outlet block valve is closed).

To depressurize the run:

- Isolate the gas run and slightly open the purge valve
- Do not relax the set point adjusting screw of the pilot until after the run is depressurized.

Recommendations:

Prior to commissioning and start-up consider the following:

- **Any** residual water left from hydrostatic testing will cause trouble to the operation of both main line valves and pilots; therefore purge and dry the upstream pipe line thoroughly and increase the outlet temperature temporarily
- **Any** particles left from welding, grinding, tapping or any solid contamination resulting from corrosion in the piping between filter and regulator (also the heat exchanger) will damage the valve disc and/or its guide cylinder, therefore clean this part thoroughly
- Should contamination be found then act as follows to minimize damage
 - remove pipe spool upstream of regulator, blind flange downstream part
 - purge the run thoroughly via the open end
 - refit the pipe spool, include strainer to exclude contamination
- Check all instrument lines for proper arrangement and all fittings for proper connection
- Provide 'emergency' spares

Sequence of Commissioning

1. **Fully Unwind the Adjusting Screw** on top of the Pilot.
 - fully close (turning CW) the adjustable motorization bleed
2. **Preset the Auxiliary Pressure** of the Pilot:
 - fully turn the adjusting screw (located at bottom of the pilot) inward (CW) carefully until it just stops on to the seat inside
 - then screw the adjusting screw out again (turning CCW) one turn(360°)
3. **Slowly Pressurize the Regulator and Pilot**
 - by either cracking the upstream block valve or opening the bypass over the slam shut(s)

4. Adjust the Auxiliary Pressure:

The minimum setting for the auxiliary pressure differential on HON P095 pilots should be as follows:

Note: "Differential" refers to the difference between the set point of the auxiliary pressure and the set point pressure of the pilot.

- 200..600 kPa normal range for general purpose
- 200 kPa lower end of range, used to slow-down opening pilot response
- 600 kPa higher end of range, used to speed-up opening pilot response
- 300 kPa is normally used for 6" and 400 kPa for 12" (600#). The larger the regulator the higher the differential pressure to overcome the higher friction over the larger O-rings.
- Higher pressures may be needed for higher ratings or older equipment

Adjustment notes:

- adjust pilots for active regulators to approx. 300 kPa pressure differential
- make adjustments to the auxiliary pressure adjusting screw only when the pilot is operating (supplying condition)
- adjust the set screw carefully, checking after each adjustment for lock-up

Check if fine-tuning is required after commissioning the equipment

- open/close the adjustable motorization bleed to speed-up/slow-down the pilot response
 - you may also adjust the auxiliary pressure differential to change the pilot response
 - if the aux. setting has been adjusted, then correct the set point
- So without the need for adjustment the auxiliary pressure differential should range between 300 and 400 kPa above outlet pressure

** Activate the pilot by slightly opening the purge valve and tensioning the set spring a little*

5. Check the Regulator for Lock-up.

- (first unload or relax the set spring of the pilot)
- slowly apply full inlet pressure to the upstream side of the regulator by either cracking the block valve or opening the bypass of the slam shut.
- Check the downstream pressure for leakage of the MLV and the pilot
- *note that while closing from wide-open position the actuator will built-up pressure and outlet pressure may rise temporarily*

6. If necessary **slowly** bypass the regulator, or pressurize from outlet to increase the outlet pressure above the UPSO setting of the slam shut valve(s), max 2 bar.

7. Open the Slam Shut Valve.

- fully equalize pressure over the valve prior to opening

8. Check or Set the Slam Shut Valve.

- increase the outlet pressure to the OPSO setting by slowly advancing the adjust screw of the pilot.
- for adjustment itself consult the manual of the relevant slam shut
- repeat this action to test the **safety relief valve** (to be blocked while testing the SSV)

To avoid quick opening and overshoot of the regulator during commissioning you may

- open the adjustable motorization bleed valve a few turns @ large pressure differentials
- open the outlet valve (provided that pressures are equal)
- always start with inlet valve and slam shut valve fully open

9. Check and Test the Regulator.

- slightly open the purge valve and decrease the outlet pressure by slowly backing out the adjusting screw of pilot CCW.
- close the purge valve to check the regulator and pilot for lock-up (tightness).
- the adjustable restrictor has been provided to fine-tune MLV response, open initially restrictor one (1) full turn; higher settings result in faster response but may provoke instability at low flow conditions

10. **Check Operation** by opening the outlet block valve
 - Normally the regulator will be set slightly lower than the network pressure. The pilot setting can be increased and fine-adjusted to its set point after fully opening the outlet block valve
11. **After Completing Commissioning**
 - lock the adjusting screw with the nut provided for this purpose.
12. **To take the run out of operation and depressurize it**, act as follows :
 - switch over to the standby run by decreasing active set point
 - close the inlet block valve
 - Allow the pressure upstream of the regulator to drop to outlet pressure
 - close the block valve in the supply to the pilot (if provided)
 - close the outlet block valve
 - slightly open the downstream purge valve to depressurize the run

We recommend to use a digital pressure gauge during setup of multiple streams

4.3 Single Stage Pressure Reduction, spring-open active and spring-closed monitor

Warning

Never pressurize a reducing run in reverse by first opening the outlet block valve. This may provoke overload of the valve internals.

Pressurizing and depressurizing needs time, do not push it!

Before getting started:

Familiarize yourself with the applicable safety regulations and operations instructions.

The reducing run between the slam shut or inlet block valve and the outlet block valve should be completely depressurized (check if the outlet block valve is closed).

To depressurize the run:

- Isolate the gas run and slightly open the purge valve
- Do not relax the set point adjusting screw of the pilots until after the run is depressurized.

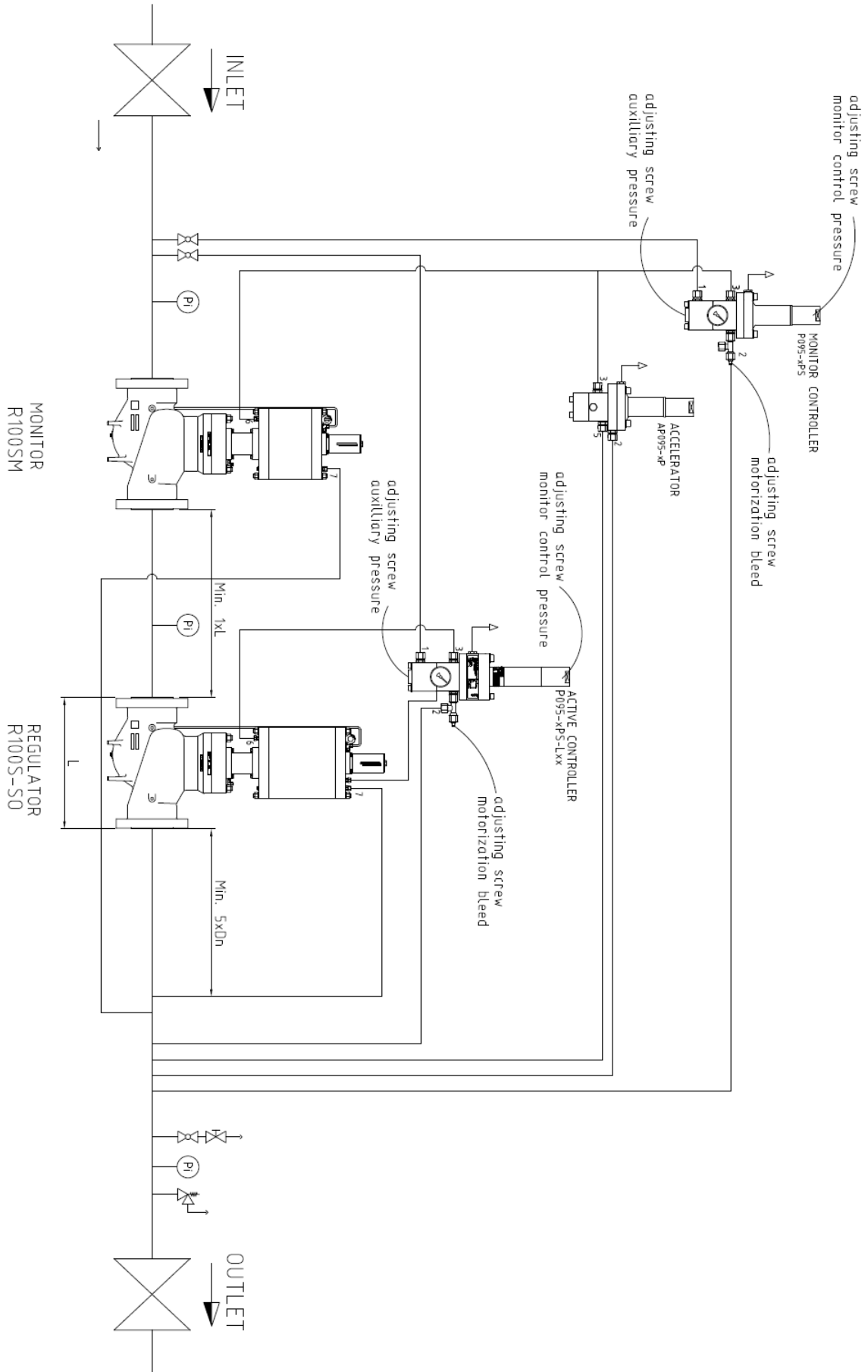


Fig. 4.3.1 Schematic of gas pressure reducing run with SO active and SC monitor

Recommendations:

Prior to commissioning and start-up consider the following:

- **Any** residual water left from hydrostatic testing will trouble operation of both main line valves and pilots; therefore purge and dry the upstream pipe line thoroughly and increase the outlet temperature temporarily
- **Any** particles left from welding, grinding or tapping and any solid contaminants resulting from corrosion in the piping between filter and regulator (also the heat exchanger) will damage the valve disc and/or it's guide cylinder, therefore clean this part thoroughly
- Should contamination be found then act as follows to minimize damage
 - remove pipe spool upstream of regulator, blind flange downstream part
 - purge the run thoroughly via the open end
 - refit the pipe spool, include strainer to exclude contamination
- Check all instrument lines for proper arrangement and all fittings for proper connection
- Provide 'emergency' spares

Commissioning sequence

1. **Fully Unwind the Adjusting Screws**
 - of the active and monitor Pilots
 - fully close (turning CW) the adjustable motorization bleed (@ connection no. 2 of pilot)
2. **Turn Adjust Screw of Accelerators fully inward(CW).**
3. **Preset Auxiliary Pressure of the Pilots:**
 - fully turn the adjusting screw (located at bottom of the pilot) inward (CW) carefully until it just stops on to the seat inside
 - then screw the adjusting screw out again (turning CCW) one turn (360°)
4. **Slowly Pressurize Upstream of the Monitor**
 - by either cracking the upstream block valve or opening the bypass over the slam shut valve(s)
5. **Adjust the Auxiliary Pressure:**

The minimum setting for the auxiliary pressure differential on HON P095 pilots should be as follows:

Note: "Differential" refers to the difference between the set point of the auxiliary pressure and the set point pressure of the pilot.

- 200..600 kPa normal range for general purpose
- 200 kPa lower end of range, used to slow-down opening pilot response
- 600 kPa higher end of range, used to speed-up opening pilot response
- 300 kPa is normally used for 6" and 400 kPa for 12" (600#). The larger the regulator the higher the differential pressure to overcome the higher friction over the larger O-rings.
- Higher pressures may be needed for higher ratings or old equipment

Adjustment notes:

- adjust pilots for active regulators to approx. 300 kPa pressure differential
- make adjustments to the auxiliary pressure adjusting screw only when the pilot is operating (supplying condition)
- adjust the set screw carefully, checking after each adjustment for lock-up

Check if fine-tuning is required after commissioning the equipment

- open/close the adjustable motorization bleed to speed-up/slow-down the pilot response
- you may also adjust the auxiliary pressure differential to change the pilot response
- if the aux. setting has been adjusted, then correct the set point

- So without the need for adjustment the auxiliary pressure differential should range between 300 and 400 kPa above outlet pressure

** Activate the pilot by slightly opening the purge valve and tensioning the set spring a little*

6. Check the Monitor for Lock-up.

- completely unwind the adjustment screws of both the active and the monitor HON-P095 pilots
- slowly apply full inlet pressure to upstream of the monitor by either cracking the upstream block valve or opening the bypass of the slam shut.
- check the intermediate pressure for leakage of the MLV
- check the downstream pressure for leakage of both pilots

7. Check the Regulator MLV for lock-up.

- put full inlet pressure upstream of the regulator by tensioning the set spring of the monitor pilot temporarily until it opens.
- completely unwind the adjustment screws of both the active and the monitor HON-P095 pilots
- use the bypass valve of the slam shut valve if necessary to pressurize upstream of the monitor
- check the outlet pressure for leakage of the MLV

Note that the regulator pilot has been checked already

6. Fail the Regulator Wide-Open

- by advancing the adjusting screw fully inward. Open the purge valve slightly to depressurize the outlet and vent the pilot bleed of the regulator

7. If necessary *slowly* bypass the regulators, or pressurize from outlet to increase the outlet pressure above the UPSO setting of the slam shut valve(s), max 2 bar.**8. Open the slam shut.**

- fully equalize pressure over the valve prior to opening

9. Check or Set the Slam Shut Valve.

- increase the outlet pressure to the OPSO setting by slowly advancing the adjust screw of the monitor pilot.
- for adjustment itself consult the manual of the relevant slam shut
- repeat this action to test the **safety relief valve** (to be blocked while testing the SSV)

To avoid quick opening and overshoot of the regulator at commissioning you may

- open the adjustable motorization bleed valve a few turns @ large pressure differentials
- open the outlet valve (provided that pressures are equal)
- always start with inlet valve and slam shut valve fully open

10. Check or Set the Accelerator (of monitor)

- open the purge valve enough to open the monitor MLV *slightly*
- decrease the outlet pressure to the accelerator setting by slowly backing out the adjust screw of the monitor pilot
- back out the adjust screw of the accelerator until it interferes with the pressure control.
- a slight drop in the outlet pressure indicates interference and activation of the accelerator pilot

11. Set and Check the Monitor.

- decrease the outlet pressure by slowly backing out the adjusting screw of the monitor pilot
- open & close the purge valve to check the monitor for response
- be aware of the pilot bleed from the active regulator which is searching for a higher set point at this time.

12. Set and Check the Regulator.

- Decrease pilot setting of active regulator by slowly backing out the adjusting screw, until it starts taking over (1) CCW.
- take note that the regulator does not have an accelerator pilot to speed-up take over
- open the purge valve enough to vent the pilot bleed of the monitor
- a rise of the intermediate pressure indicates take-over
- open & close the purge valve to check the regulator for response
- be aware of the pilot bleed from the monitor regulator which is searching for a higher set point at this time.
- the adjustable restrictor has been provided to fine-tune MLV response, open initially restrictor one (1) full turn; higher settings result in faster response but may provoke instability at low flow conditions.

Note that for initial operation of the regulator, the accelerator will not be set

13. Check the System for Lock-up.

- close the purge valve
- check the outlet pressure for leakage
- the outlet pressure will first rise to regulator lock-up, then rise to monitor lock-up
- a further rise will occur as the pressure from the monitor motorization is equalized with the outlet pressure
- you may vent temporarily a little to reduce this outlet pressure to monitor lock-up

14. Check Operation

slowly open the outlet block valve. Normally the regulator will be set slightly lower than the network pressure. The pilot setting can be increased and finely-adjusted to its set point after fully opening the outlet block valve.

16. After Completing Commissioning

lock the Adjust Screws with the nut provided for this purpose.

15. To take the Run out of Operation and Depressurize it, act as follows :

- switch over to the standby run by decreasing active set point
- close the inlet block valve
- allow the pressure upstream of the regulators to drop to outlet pressure
- close the block valve in the supply to the pilots (if provided)
- close the outlet block valve
- slightly open the downstream purge valve to depressurize the run

We recommend to use a digital pressure gauge during setup of multiple streams

4.4 Settings & Considerations

- **Accelerator** (of monitor)

The following settings for initial operation are generally recommended:

HON AP095-xP: set point monitor regulator + 0.3...0.5 bar

Use staggering lower end value of 0.3 bar only if you are familiarized with setting procedure. Use higher end value for quick setup

- **Monitor**

The set point of the monitor regulator should be chosen **high enough** to avoid interference during dynamic response of the regulator.

- **Regulator**

The set point of the regulator should be chosen **low enough** to enable trouble-free relatching of the slam shut. (The minimum relatching differential)

The set point should be chosen **low enough** to comply with safety standards on operational pressure limits of the downstream piping system and equipment

For multiple stream installations consideration should be given to stream discrimination and stream protection in order to avoid spurious tripping.

- **Outlet Pressure Ranges**

The outlet pressure ranges for the pilots can be chosen from the following table

Colour	Code	MP-Range	HP-Range
		[bar]	[bar]
Blue	850523ST12670	1.5 - 5	8 -15
Red	850523ST12680	3 – 11	10 – 35
Yellow	850523ST12690	6 – 12	20 – 50

If the required set point lies in the overlapping range between two springs, it is recommended to take the spring with the lowest set point range. This way maximum regulating precision is achieved. This also applies in the event that the required P_o lies in the overlapping range of the two pilot types MPS and HPS. In this case it is recommended to opt for the MPS model. As far as construction is concerned, the MPS and HPS types only differ in their diaphragm package, which makes it easy to change a MPS into a HPS type and vice versa.

- **Auxiliary Pressure Range & Setting**

The auxiliary pressure is the output of the first control stage of the HON P095 and is adjustable between approx. 2(for spring-closed)/ 3(for spring-open) and 6 bar above the outlet pressure. The 1st stage of the pilot determines the accuracy of the regulator and can be changed by adjusting it's setting with screws.

- High settings (turn CCW) result in higher amplification which equals improved accuracy and faster response of the pilot control loop. However settings that are too high may provoke instability.
- Low settings (turn CW) result in lower amplification which equals more stability and slower response of the pilot control loop. Settings that are too low may disable a valve to open (partly or fully).

Always check if the setting of the auxiliary pressure differential meets the installed operating conditions during set-up and testing. See also 'commissioning notes'

The amount of care to be taken while adjusting the auxiliary pressure must be accentuated as this may cause many problems during commissioning and start-up.

- **Adjustable Motorization Bleed**

To fine-tune the pilot response an adjustable motorization bleed has been provided on the pilots. This enables reduced amplification without change of auxiliary pressure setting by opening (CCW) the needle valve. See also 'auxiliary pressure range & setting for considerations on high and low amplification.

5 Maintenance

5 Maintenance

5.1 Life

Under normal operating conditions with properly conditioned gas, assuming the medium is clean and dry and does not contain any constituents which are harmful to the applied materials, life without any maintenance is 4 years minimum but may be extended to 8 or 12 years based on your own field experience.

Generally, seals and diaphragms (soft parts) are to be replaced during maintenance work. The spare part sets for the equipment contain these soft parts and all other parts necessary for standard maintenance.

5.2 Necessities

The equipment has been designed in such a way that no special tools are required for maintenance. Valves and pistons are provided with tapped holes to which simple pulling tools may be connected. For refurbishment and overhaul the following consumables shall be made available:

Lubricants (grease):

Unisilikon RK44 N2
Weicon anti-seize
White grease + PTFE (spray)
Parker Super-O-Lube

Lubricants (oil):

Gas Compressor Oil S4 RN 68

Thread lockers:

Loctite 243
Loctite 222

Sealants:

Loctite 577

Cleaning materials:

Loctite 7063
3M Scotch-Brite Hand Pad

5.3 Guidelines

For both assembly and preservation purposes, all O-rings are to be greased with a suitable product. We recommend unisilikon TK44 N2, or DuPont Krytox GPL 206 for all o-rings.

All guiding surfaces are to be treated with a suitable grease. We recommend Parker super-o-lube for large surfaces.

5.4 Disassembly and assembly

Provide adequate tooling, spares, cleaning materials, sealants, lubricants and thread lockers

Put all loose internal components on a clean cloth during assembly, prevent sand or other dirt from soiling these components or from damaging them. Clean all disassembled components, polish any irregularities and then grease these for proper function and preservation.

Bolt for pressure retaining part is shown below.

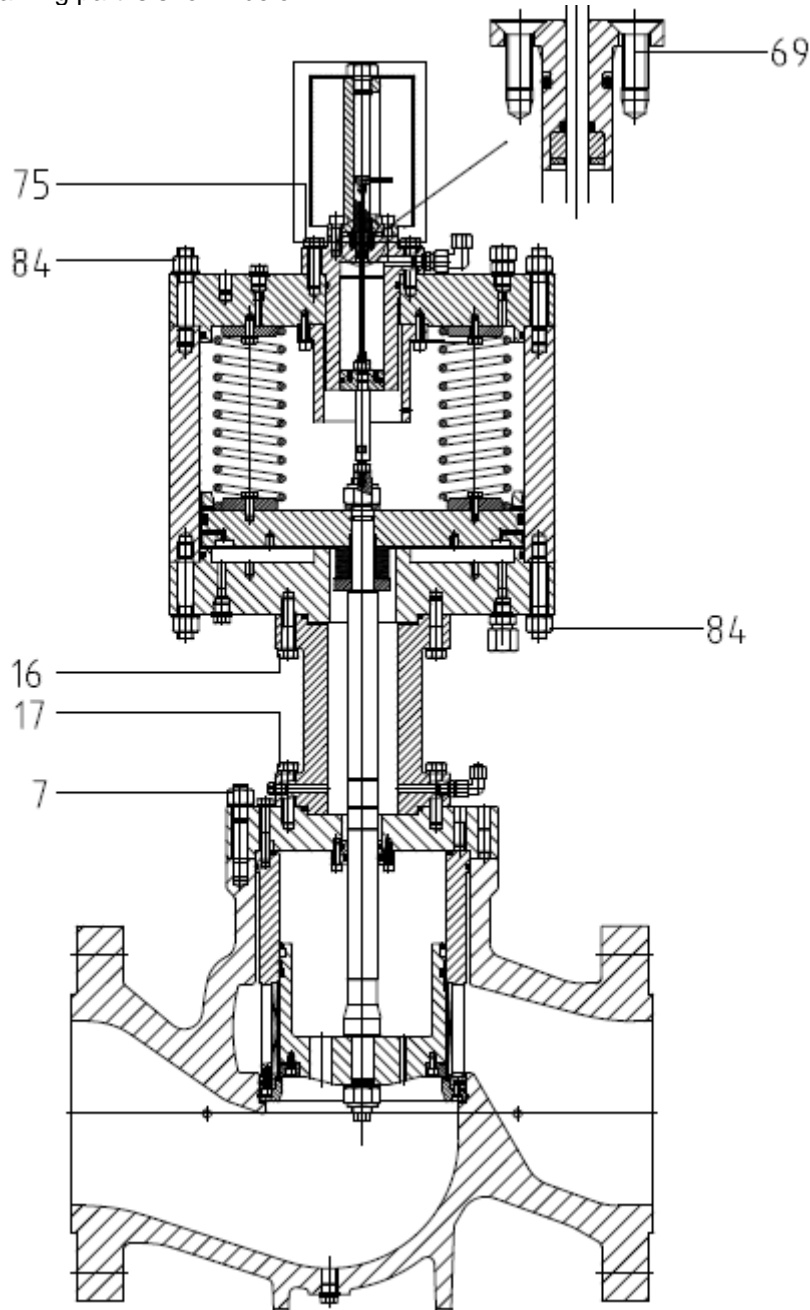


Fig. 5.4.1 Bolt for pressure retaining part of R100 piston type

Recommended bolt preload for pressure retaining part is shown in table below.

R100 piston type regulator bolt torque(Nm)						
size	Rating	Pos.				
		69	75	84	16&17	7
6"	CL900/1500	4	120	1000	220	1150
8"	CL900/1500	4	120	1000	220	2050
10"	CL150/600	1.5	120	460	130	450
	CL900	4	140	1150	180	1900
12"	CL150/600	1.5	120	460	130	600
	CL900/1500	4	120	1000	220	1100
16"	CL150/600	1.5	110	1560	130	780

Table 5.4.2 Recommended bolt preload for pressure retaining part

5.5 Main line valve

The regulators are top entry, all internals can be removed from top

For instance, after unscrewing the nuts below the top flange of the valve body, the actuator can be lifted, complete with all internal parts. Mounting back this unit is to be done with utmost care to prevent any damage onto external seals and sealing surfaces.*)

It is also possible and preferred to remove and assemble the components one by one. *)

Take care of level position of valve body and actuator, both should be water level.

The piston of the main line valve is lubricated with oil (Gas Compressor Oil S4 RN 68). After the valve has been completely disassembled, this oil will be lost and needs to be refilled upon assembly.

Only after completion of maintenance and validation by combined tightness test and functional check, the valves can be re-tested and put into operation.

* Only to be done by certified & dedicated engineers

See fig.5.5.1 for relevant cross section

Maintenance

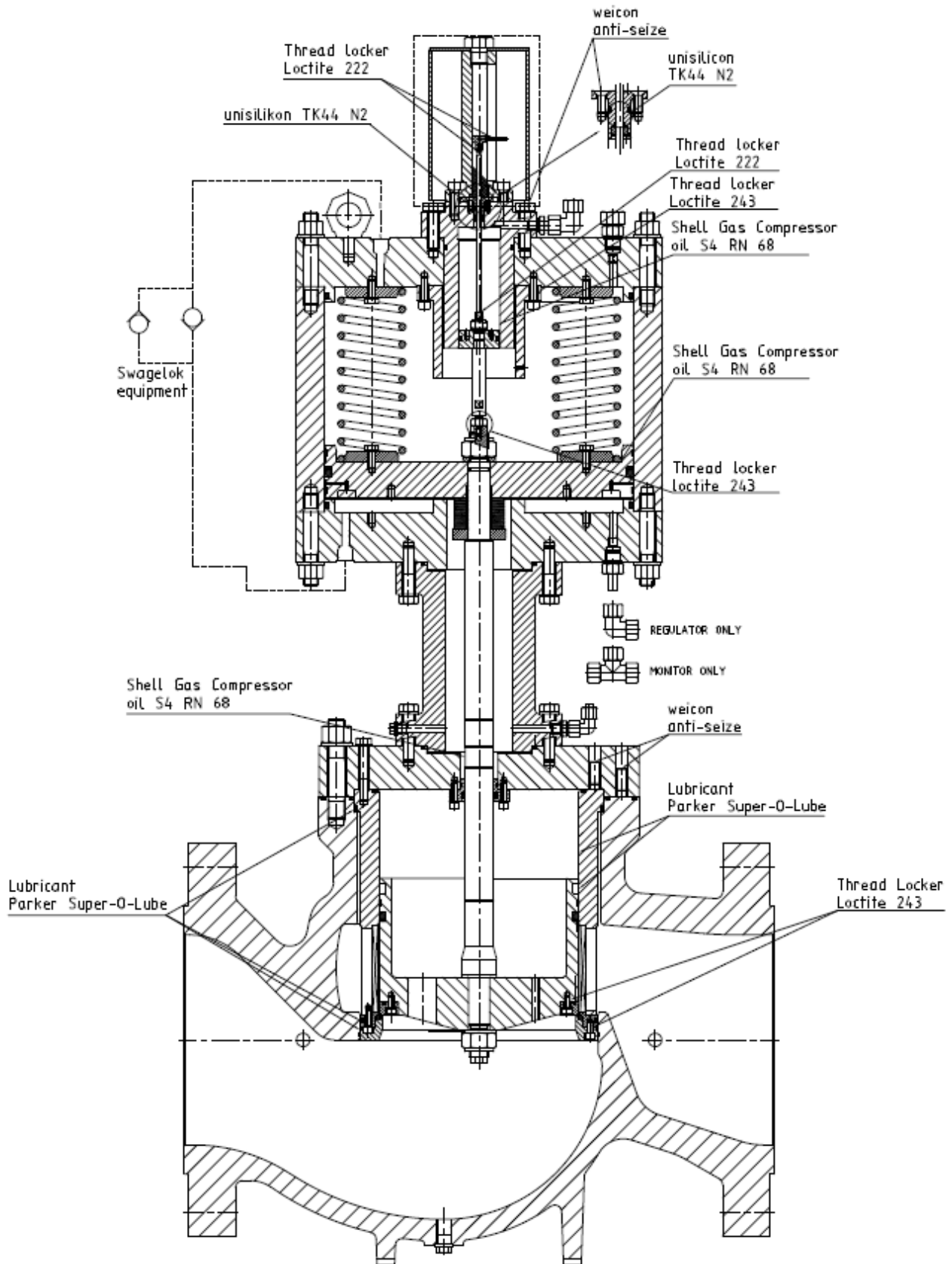


Fig. 5.5.1 Cross Section of Main Line Valve Series HON R100 typical HON R100S-M 12"

5.6 Check valves

When the check valves fail working properly after being activated, they **must be replaced**.

Once check valves are activated, there's something severely troubled with regulator. Trouble shoot must be done immediately to find the cause and solutions.

Check valve needs to be ordered separately in Section 5.9.

Technical Change Notes

To reduce maintenance work, the check valves were redesigned in year 2014 to be removed from inside regulator to outside. The spare listed in Section 5.9 refers to current designed check valve. If the old one needs to be ordered, please contact Honeywell for proper solution first.

5.7 Controllers

The controllers can either be considered as one inseparable item and exchanged completely or can be considered as an assembly and maintained item wise.

There is no need to depressurize the entire installation in order to replace the pilot setting spring. After decommissioning of the run the locking nuts can be removed and a new set spring can be fitted.

See fig. 5.6.1 and 5.6.2 for relevant cross sections

Maintenance

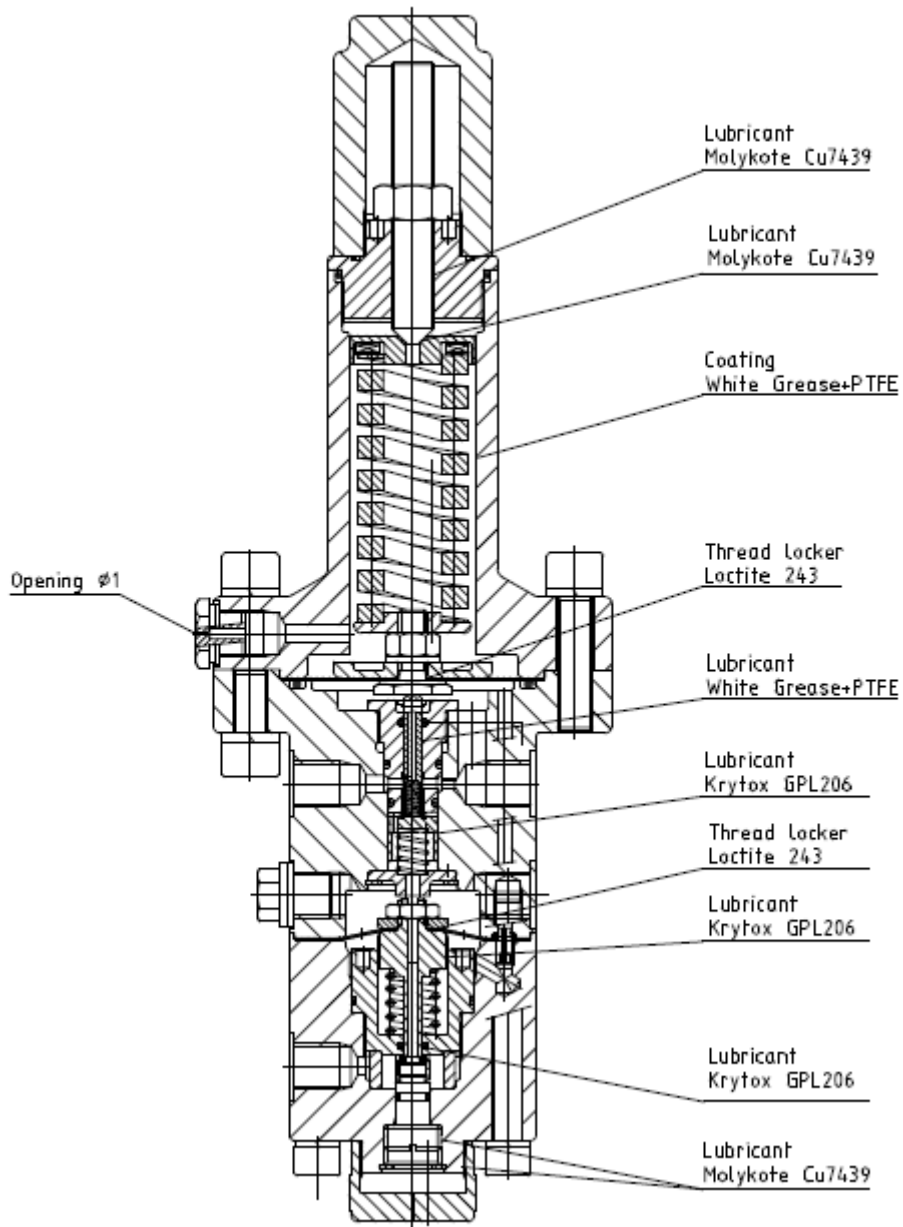


Fig. 5.6.1 Cross Section of Switch-over Accelerator Series HON P095

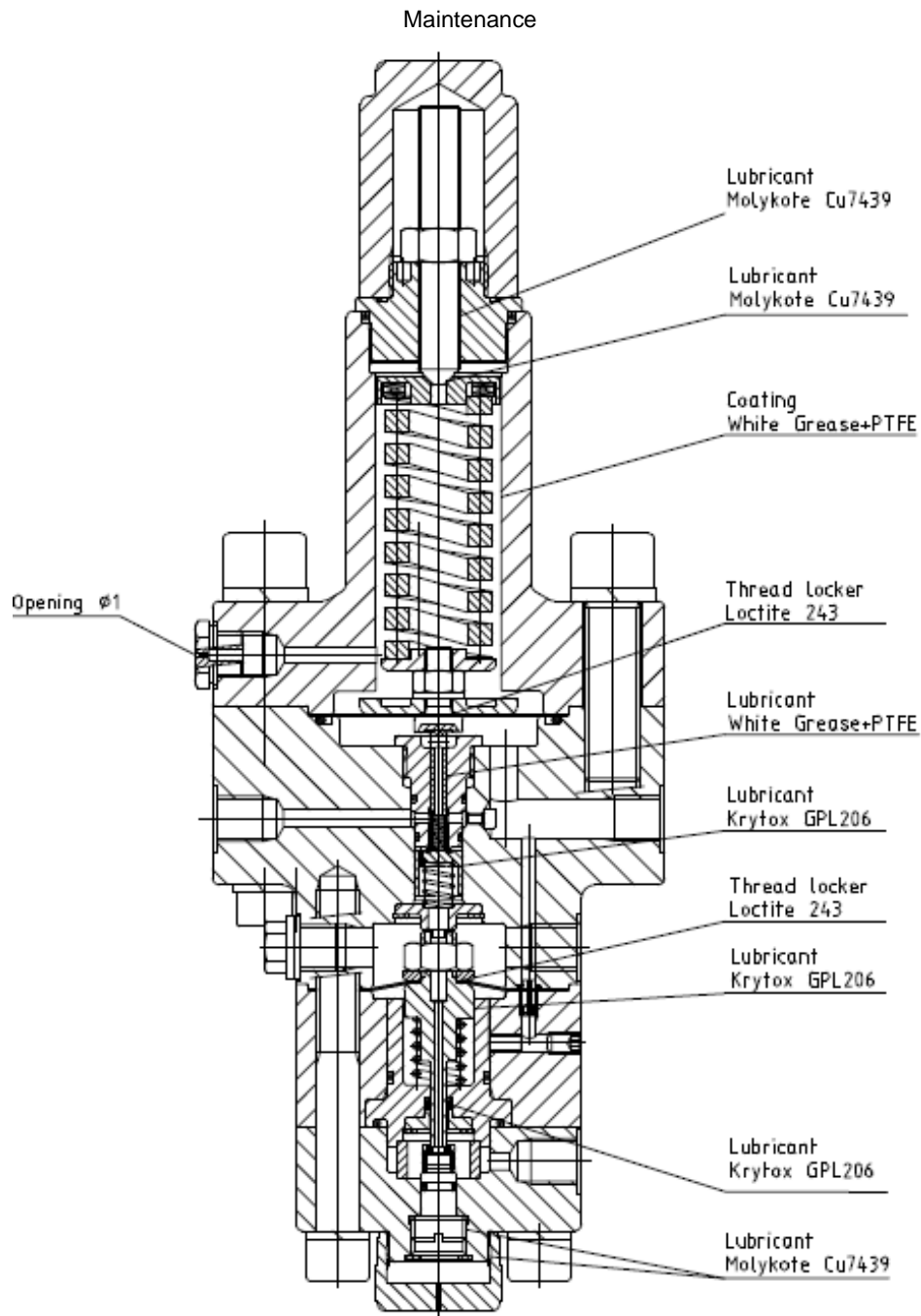


Fig. 5.6.2 Cross Section of Controller Series HON P095 typical HON P095 xPS-1500#

5.8 Periodic function test

Recommended periodic function test sequence:

Decommission the duty run by switching over to the standby run by decreasing the active set point. After the standby run has assumed control the duty run can be isolated

- **(1) Tightness of the monitor regulator and controllers**

The lockup pressure of the system corresponds to the closing pressure of the monitor regulator. The system as a combination, can easily be tested for tightness by slowly closing the downstream isolation valve of the line. The outlet pressure should not increase after the monitor has fully closed. Otherwise this may indicate leakage of the controllers and/or monitor main line valve.

Take note that the monitor starts only closing after the outlet pressure has risen to its set point. During its closing action the controller equalizes actuator pressure with downstream outlet pressure. This may take some time and result in a small additional pressure increase for small control volumes such as given during offline testing.

- **(2) Tightness of the active regulator**

After closing of the monitor the pressure (Pt) in the spool piece between monitor and active shall not decrease significantly (while allowing some time for the inter-stage pressure to settle). Otherwise this may indicate leakage of the main active line valve.

- **(3) Tightness of the monitor regulator**

Open the bleeder plug or purge valve of the spool piece between monitor and active until the pressure (Pt) is slightly above the outlet pressure. After closing the bleeder plug the pressure shall not increase significantly, (while allowing some time for the inter-stage pressure to settle). Otherwise this may indicate leakage of the monitor line valve.

- **(4) Tightness of the controllers (auxiliary stages)**

After closing of the monitor and active the indicated auxiliary pressure on the pilot pressure gauges shall not increase significantly (while allowing some time for the pressure to settle). Otherwise this may indicate leakage of the auxiliary stage.

- **(5) Tightness of the switch-over accelerator**

During normal operation of the (wide-open) monitor the switch-over accelerator should not discharge motorization pressure to the downstream outlet. Upon occurrence of such the discharge connection will feature a temperature difference compared to other tubing connections. The temperature difference will most likely result in condensation.

- **(6) Function of active regulator**

Open the upstream isolation valve, and open the purge valve downstream of the active, wait until monitor opens and active assumes control

- **(7) Function of monitor regulator**

Increase the set point of the active to above the accelerator setting and wait until the monitor closes and assumes control. Restore active control by decreasing its set point, wait until monitor opens fully and active closes.

Decrease the active set point slightly below the momentary grid pressure and open the outlet isolation valve. Increase the duty set point until it assumes control.

See section 4 for stepwise procedure to check for tightness, function and setup

5.9 Spare part sets

General

For standard maintenance, Honeywell has put together spare-part sets. The spare parts can be ordered under the numbers as mentioned below.

When ordering parts, the following data must be submitted:

- type of regulator, including diameter and pressure class
- serial number and year of construction.
- item and drawing number to which this number relates and the required number of items.

Spare part sets HON (A)P095-xP(S)

The spare-part set can be ordered under the following numbers:

Type	Number
HON P095-HPS/MPS	939401S115080
HON AP095-HP/MP	939401S134270
HON P095-HPS/MPS-900/1500#	939401S134200
HON AP095-HP/MP-9001500#	939401S178770

Spare part sets HON R100S(M)/SO

The spare-part sets can be ordered under the following numbers:

Type	Number	Type	Number
HON R100S(M) 6"- 900/1500	939402S183810	HON R100S-SO 6"- 900/1500	939402S183820
HON R100S(M) 8"- 900/1500	939402S177720		
HON R100S(M) 10"- 150/600	939402S171600	HON R100S-SO 10"- 150/600	939402S182840
HON R100S(M) 10" - 900/1500	939402S183830	HON R100S-SO 12"- 900/1500	939402S183840
HON R100S(M) 12" - 150/600	939402S150490	HON R100S-SO 12"- 150/600	939402S182830
HON R100S(M) 12" - 900	939402S173990		
HON R100S(M) 16" - 150/600	939402S180370	HON R100S-SO 16" - 150/600	939402S196550

Spare Check Valve

Description	Number	
Check Valve 3/8" BSP 5 bar	9203020000002	Qty. 2 as one set

The contents of these sets are specified in the parts listings in the following sections.

5.10 Cross Section HON P095-Xps

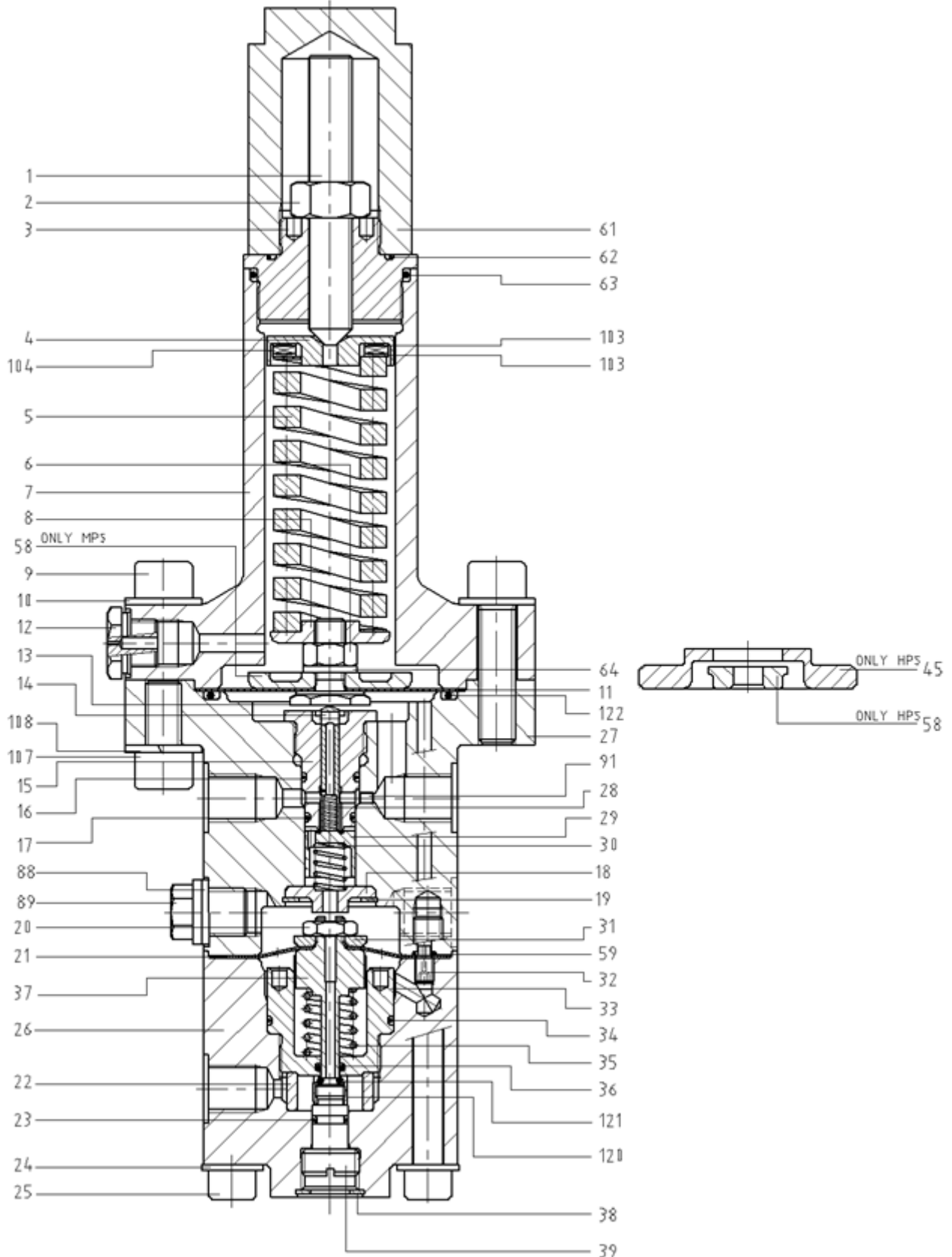


Fig. 5.9.1 Cross section of HON P095 xPS

Maintenance

Item	Designation	Spares	Item	Designation	Spares
01	Set screw		31	Spring seat	x
02	Hexagon nut		32	Restriction	
03	Locking nut		33	Guide	
04	Spring seat		34	O-ring	x
05	Compression spring		35	Spring	
06	Hex. nut		36	O-ring	x
07	Spring housing		37	Valve	x
08	Spring seat		38	Retainer ring	
09	Socket screw		39	Adjusting screw	x
10	Washer		40	Pressure gauge	
11	Diaphragm	x	41	Coupling	
12	Plug		42	Pressure gauge screwed coupling	
13	Bolt		43	Type plate	
14	Valve		45	Reducing ring	
15	Guide		58	Diaphragm disc	
16	O-ring	x	59	O-ring	x
17	O-ring	x	61	Sealing nut	
18	Retaining plate		62	O-ring	x
19	Circlip		63	O-ring	x
20	Low hex. nut		64	Washer	
21	Diaphragm	x	88	Washer	
22	Filter	x	89	Plug	
23	O-ring	x	91	Adjusting screw	
24	Washer		103	Thrust washer	
25	Socket screw		104	Trust bearing	
26	Housing		107	Socket screw	
27	Housing		108	Spring washer	
28	Compression spring		120	Nut	x
29	Valve	x	121	O-ring	x
30	Compression spring		122	O-ring	x

5.11 Cross Section HON AP095-xP

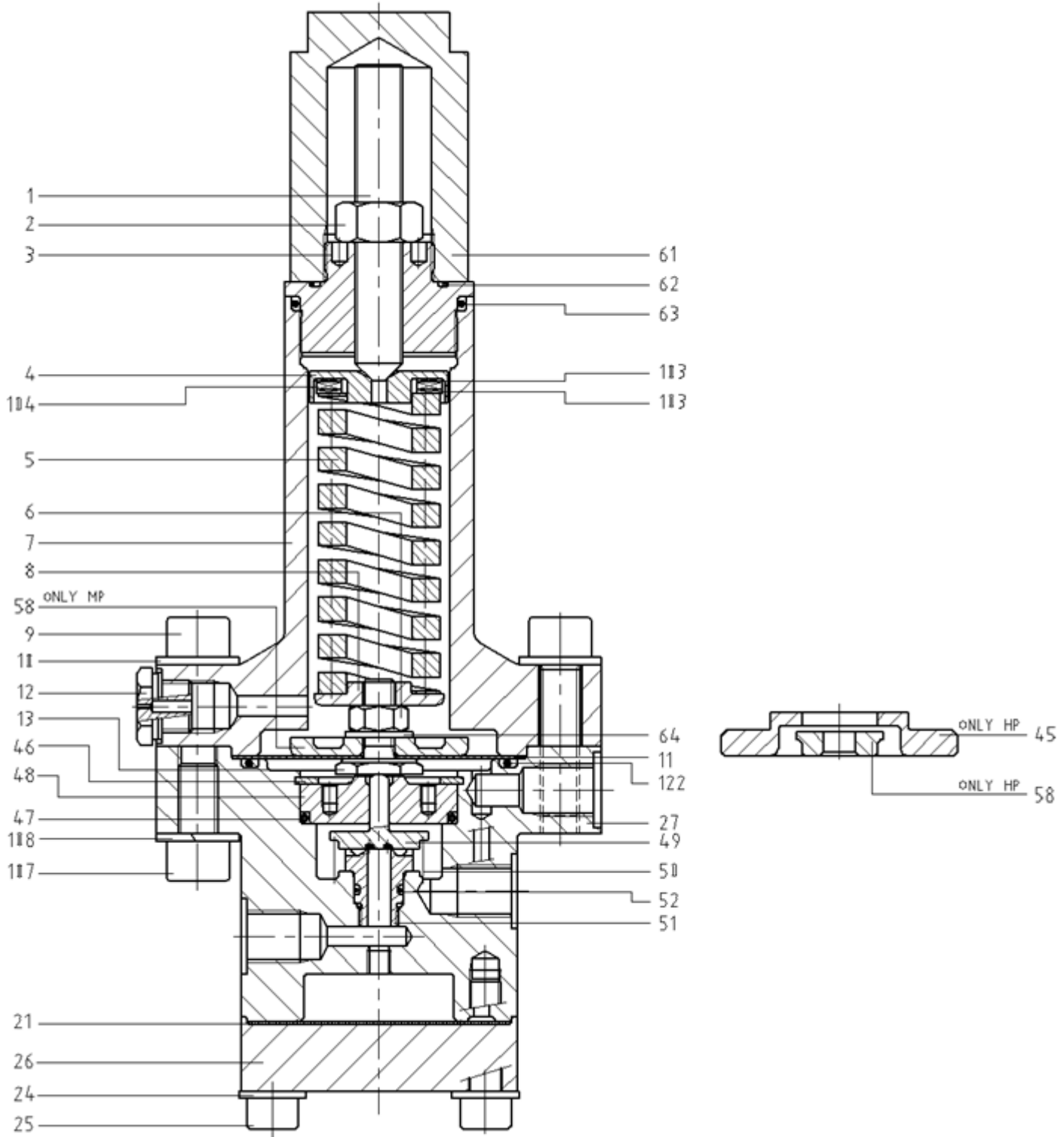


Fig. 5.10.1 Cross section of HON AP095 xPS

Maintenance

Item	Designation	Spares	Item	Designation	Spares
01	Set screw		46	Circlip	
02	Hexagon nut		47	O-ring	x
03	Lock nut		48	Guide	
04	Spring seat		49	Valve	x
05	Compression spring		50	Spring	
06	Hex. nut		51	Nozzle	
07	Spring housing		52	O-ring	x
08	Spring seat		58	Diaphragm disc	
09	Socket screw		61	Sealing nut	
10	Washer		62	O-ring	x
11	Diaphragm	x	63	O-ring	x
12	Plug		64	Washer	
13	Bolt		88	Plug	
21	Diaphragm	x	89	Ring	
24	Washer		103	Thrust washer	
25	Socket screw		104	Trust bearing	
26	Cover		107	Socket screw	
27	Housing		108	Spring washer	
43	Type plate		122	O-ring	x
45	Reducing ring				

5.12 Cross Section HON P095-xPS-900/1500#

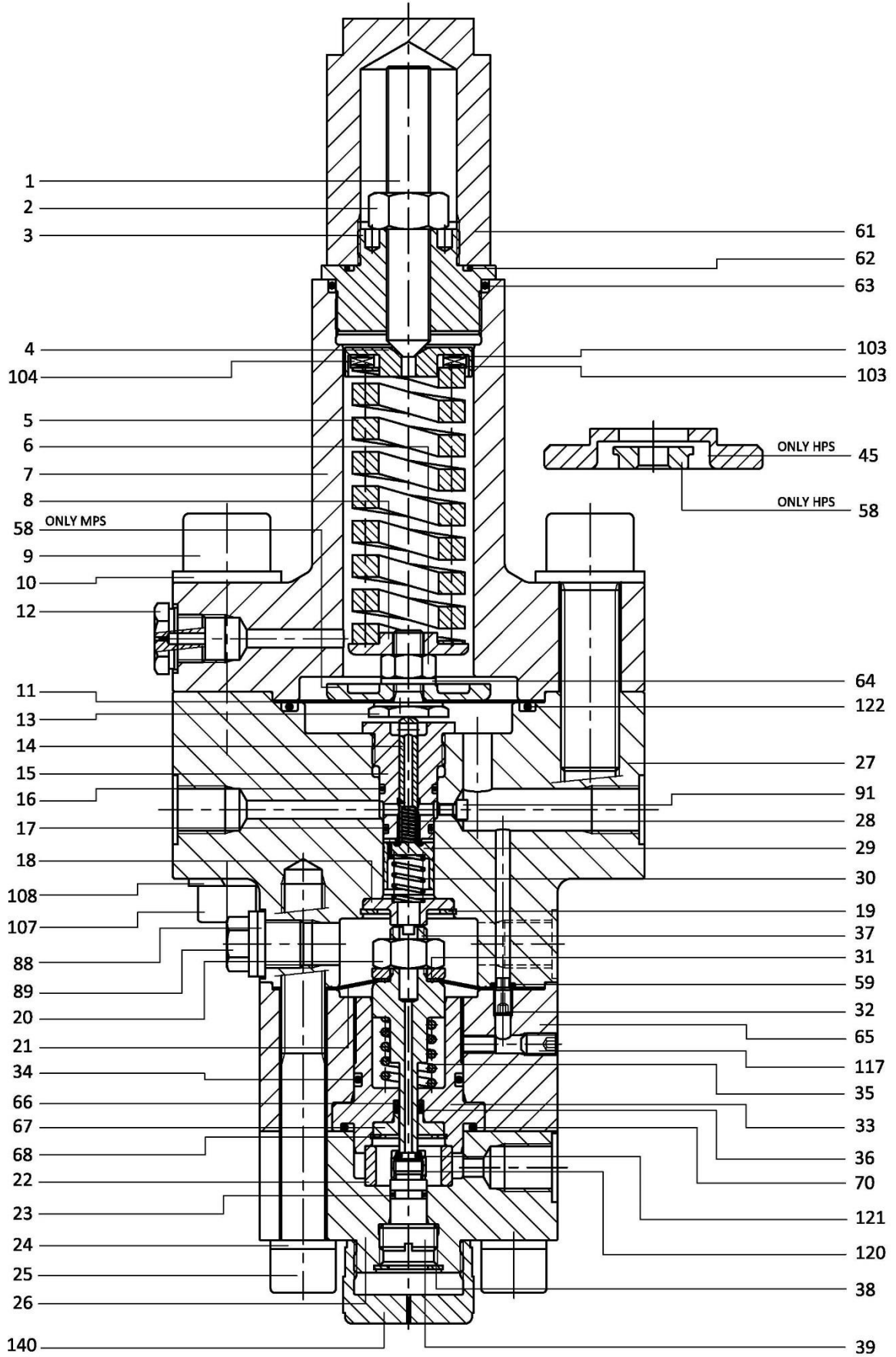


Fig. 5.11.1 Cross section of HON P095 xPS-900/1500#

Maintenance

Item	Designation	Spares	Item	Designation	Spares
01	Set screw		32	Restriction	
02	Hexagon nut		33	Guide	
03	Locking nut		34	O-ring	x
04	Spring seat		35	Spring	
05	Compression spring		36	O-ring	x
06	Hex. nut		37	Valve	x
07	Spring housing		38	Retainer ring	
08	Spring seat		39	Seat	x
09	Socket screw		40	Pressure gauge	
10	Washer		41	Coupling	
11	Diaphragm	x	42	Pressure gauge screwed coupling	
12	Plug		43	Type plate	
13	Bolt		45	Reducing ring	
14	Valve		58	Diaphragm disc	
15	Guide		59	O-ring	x
16	O-ring	x	61	Sealing nut	
17	O-ring	x	62	O-ring	x
18	Retaining plate		63	O-ring	x
19	Circlip		64	Washer	
20	Low hex. nut		66	Back-up ring	x
21	Diaphragm	x	70	O-ring	x
22	Filter	x	88	Plug	
23	O-ring	x	89	Ring	
24	Washer		91	Adjusting screw	
25	Socket screw		103	Thrust washer	
26	Housing		104	Trust bearing	
27	Housing		107	Socket screw	
28	Compression spring		108	Spring washer	
29	Valve	x	120	Nut	x
30	Compression spring		121	O-ring	x
31	Spring seat		122	O-ring	x

5.13 Cross Section HON AP095-xP-900/1500#

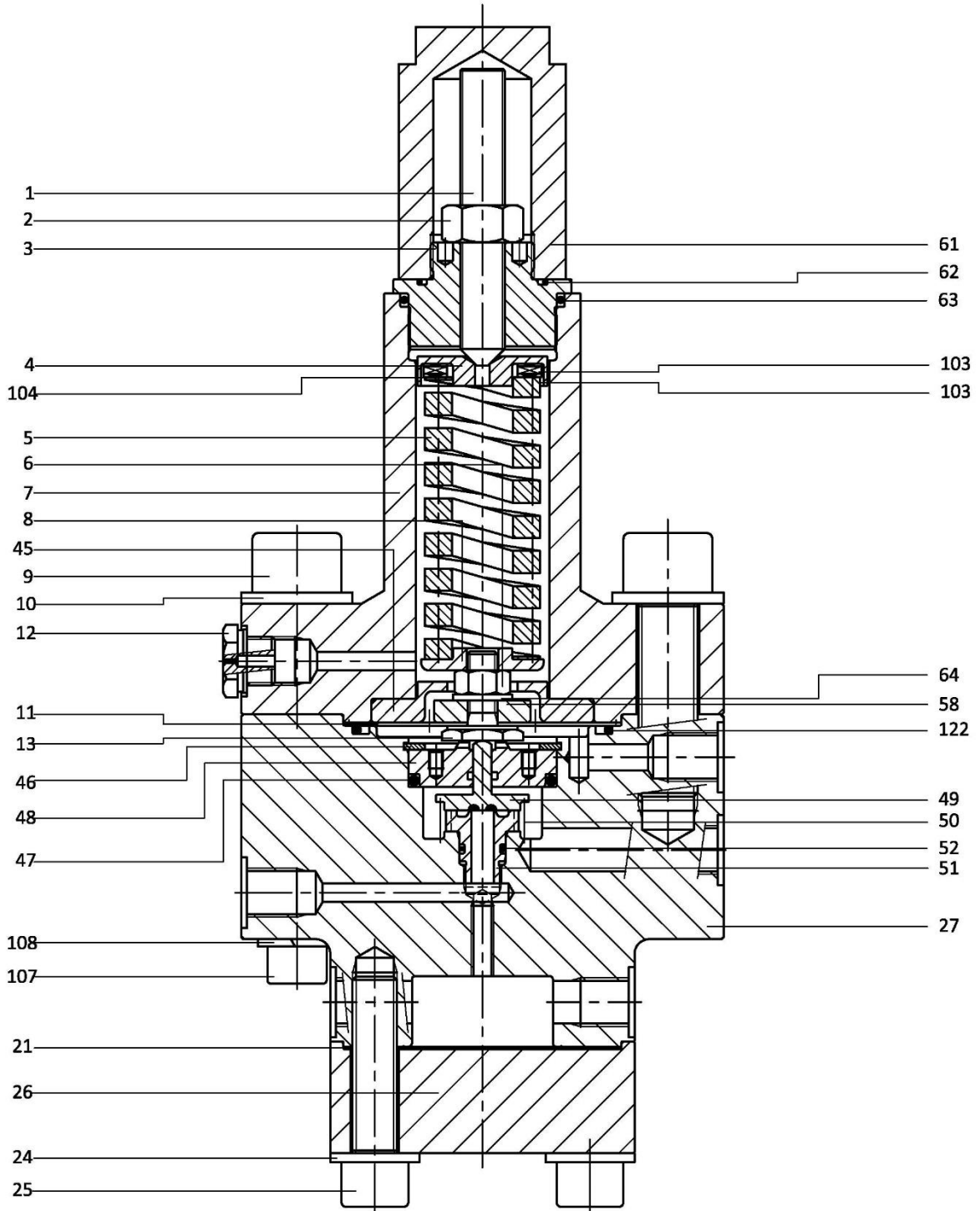


Fig. 5.12.1 Cross section of HON AP095 xP-900/1500#

Maintenance

Item	Designation	Spares	Item	Designation	Spares
01	Set screw		46	Circlip	
02	Hexagon nut		47	O-ring	x
03	Lock nut		48	Guide	
04	Spring seat		49	Valve	x
05	Compression spring		50	Spring	
06	Hex. nut		51	Nozzle	
07	Spring housing		52	O-ring	x
08	Spring seat		58	Diaphragm disc	
09	Socket screw		61	Sealing nut	
10	Washer		62	O-ring	x
11	Diaphragm	x	63	O-ring	x
12	Plug		64	Washer	
13	Bolt		88	Plug	
21	Diaphragm	x	89	Ring	
24	Washer		103	Thrust washer	
25	Socket screw		104	Trust bearing	
26	Cover		107	Socket screw	
27	Housing		108	Spring washer	
43	Type plate		122	O-ring	x
45	Reducing ring				

5.14 Cross Section HON R100S(M)

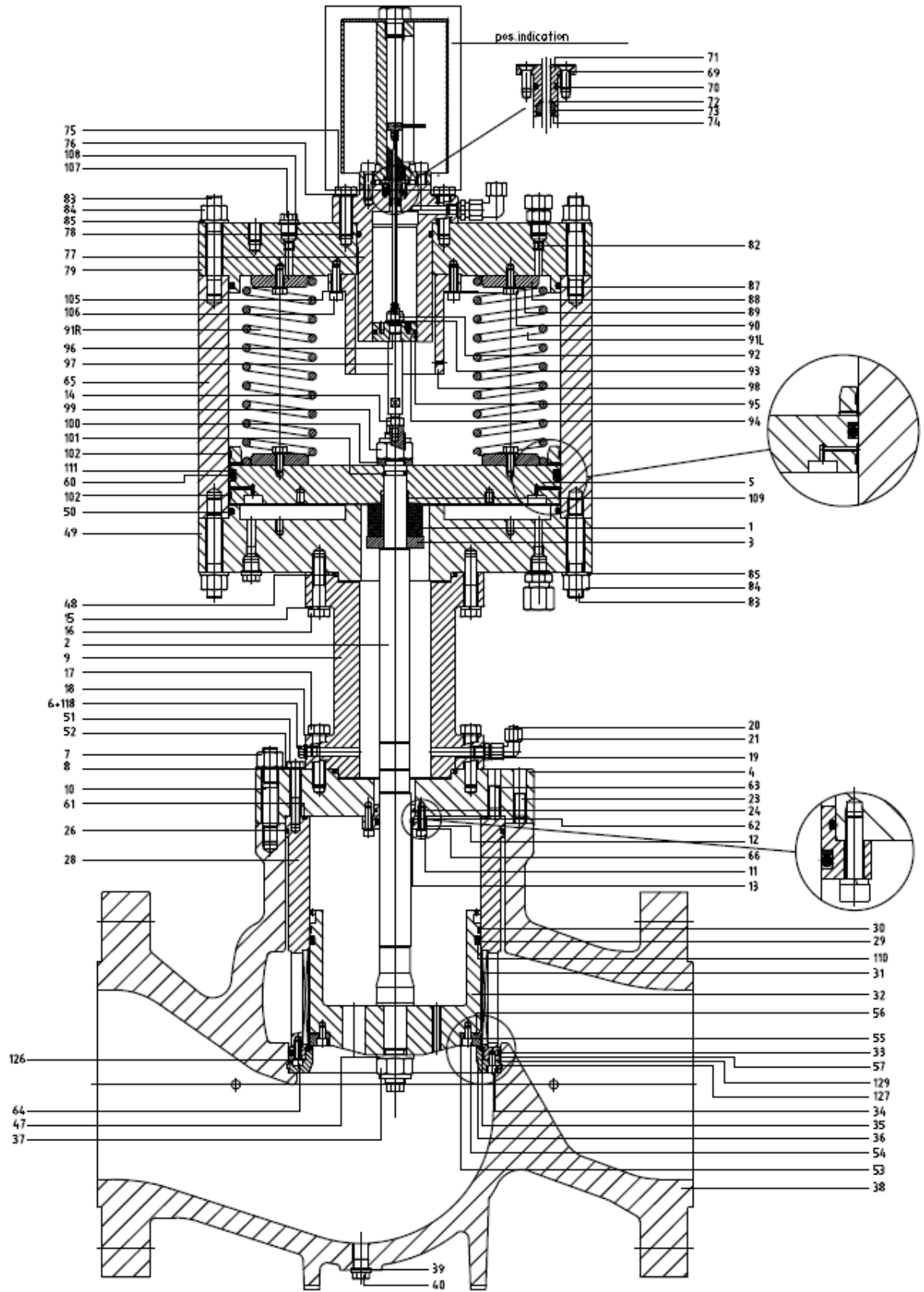


Fig. 5.13.1 Cross Section of HON R100S(M)

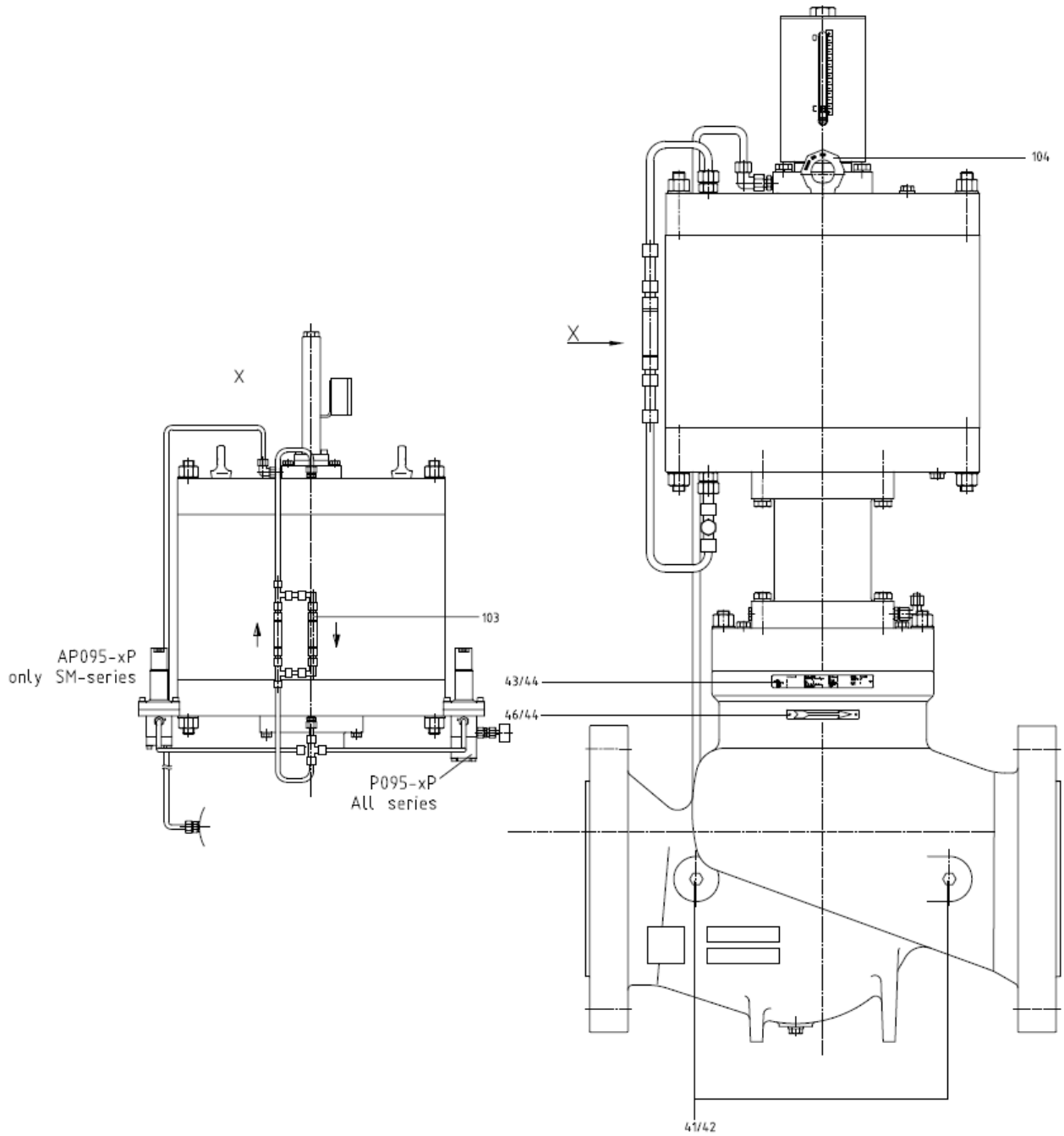


Fig. 5.13.2 Side view of HON R100S(M)

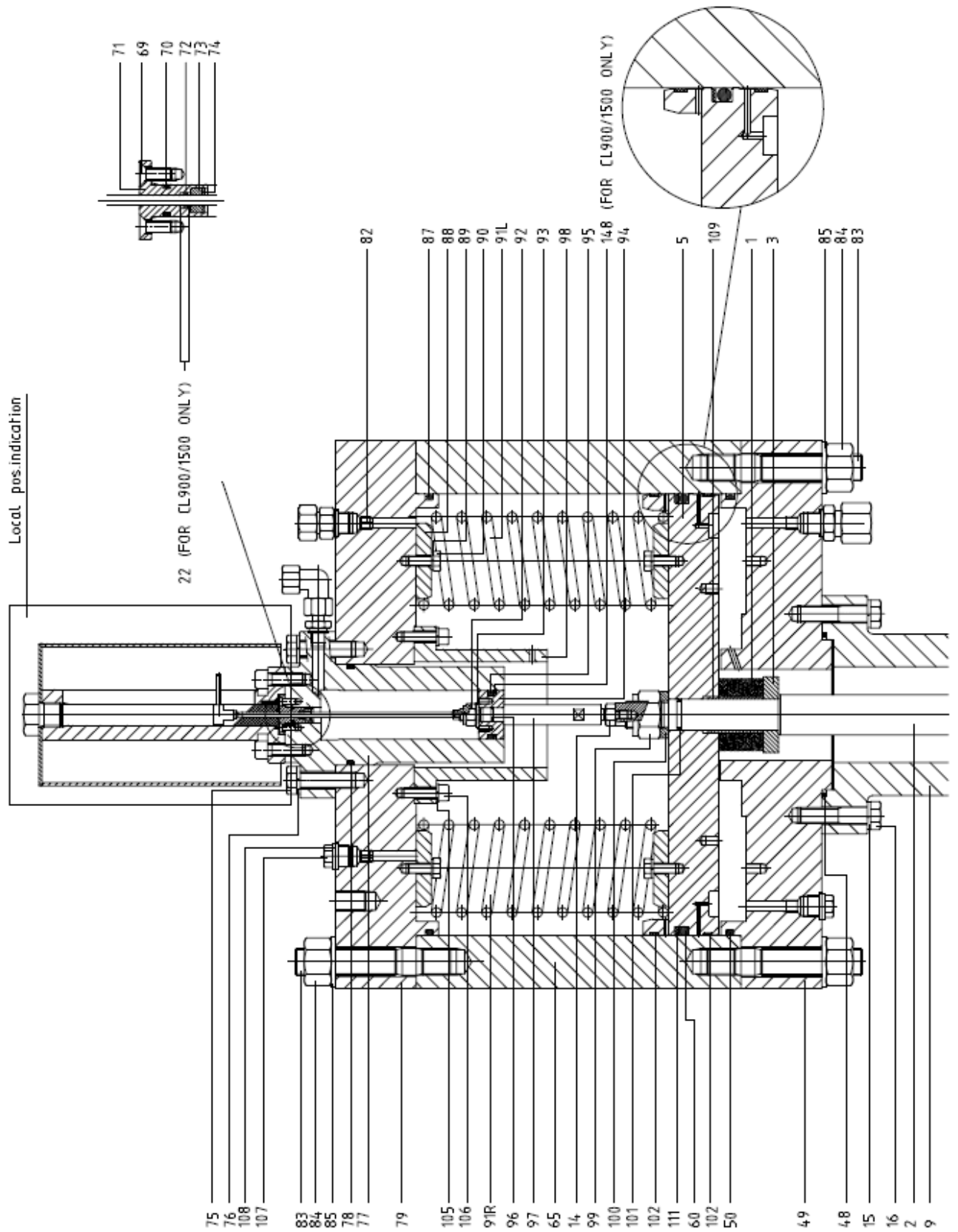


Fig. 5.13.3 Cross Section of HON R100S(M)

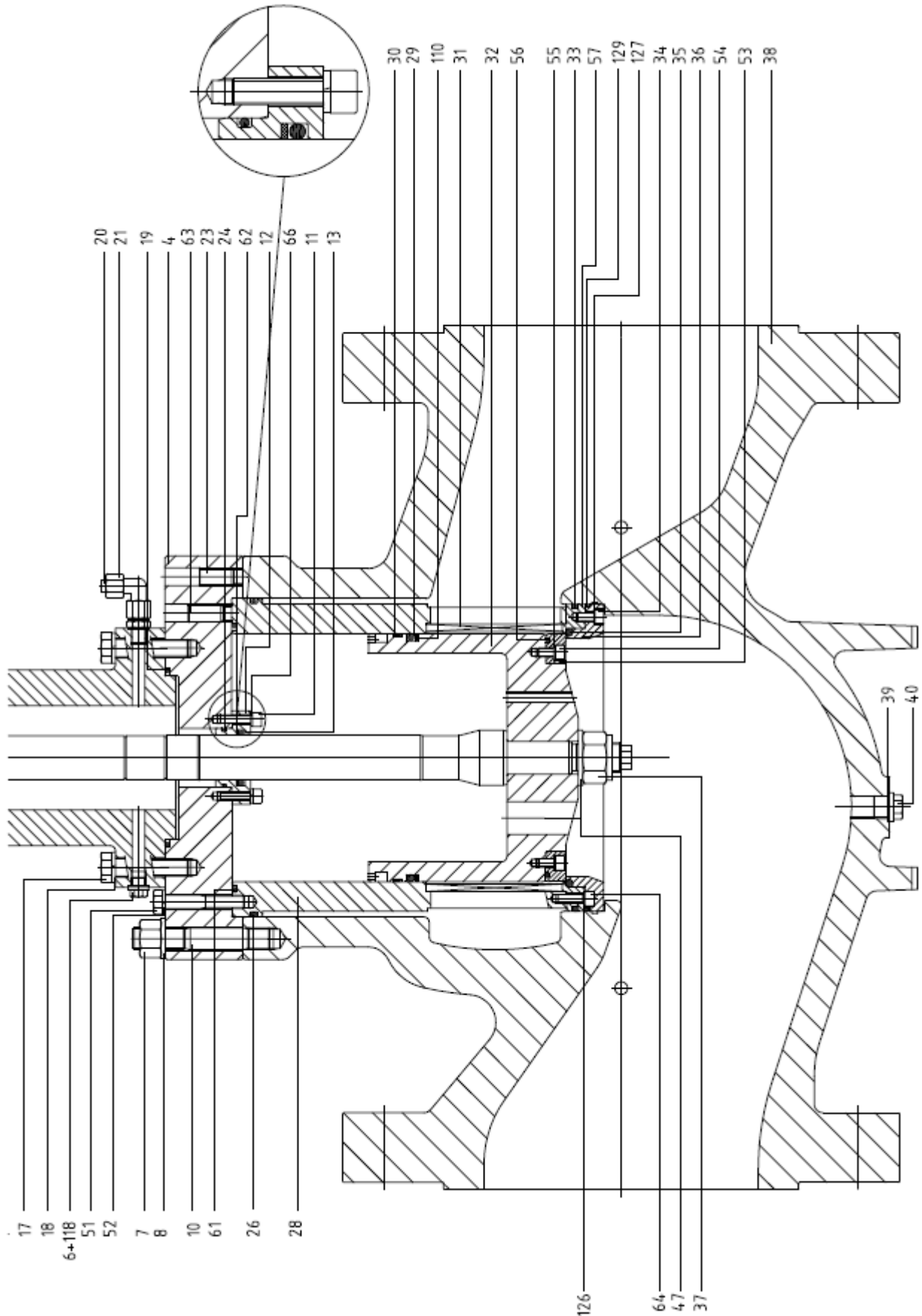


Fig. 5.13.4 Cross Section of HON R100S(M)

Maintenance

Item	Designation	Spares	Item	Designation	Spares
1	Cup spring		60	O-ring	x
2	Stem		61	O-ring	x
3	Spring disc		62	Back-up ring	x
4	Cover		63	Set screw hex. socket	
5	Piston		64	Hex. socket head cap screw	
6	Plug (only for 10" CL600)	x	65	Cylinder	
7	Nut		66	Spring washer	
8	Washer		69	Hex. socket countersunk head screw	
9	Pedestal		70	O-ring	x
10	Stud		71	Connection rod guiding	
11	Hex. socket head cap screw		72	O-ring	x
12	Guide bush		73	Retaining ring	
13	O-ring	x	74	Circlip	
14	Nut		75	Hex. bolt	
15	Spring lock washer		76	Spring washer	
16	Hex. bolt		77	Cylinder	
17	Hex. bolt		78	O-ring	x
18	Spring lock washer		79	Top plate	
19	O-ring	x	80	Tube fitting	
20	Plug		81	Sealing washer	
21	Tube fitting		82	Restriction	
22	Back-up ring (only for CL 900/1500)	x	83	Stud	
23	Set screw hex. socket		84	Nut	
24	O-ring	x	85	Washer	
25	O-ring (except 10" CL150/600)	x	87	O-ring	x
26	O-ring	x	88	Spring plug	
27	O-ring (only for 12")	x	89	Spring washer	
28	Guiding bush		90	Hex. bolt	
29	O-ring	x	91R	Spring	
30	Strip	x	91L	Spring	
31	Silencer		92	Nut	x
32	Valve		93	Washer	
33	O-ring	x	94	Piston	
34	Hex. socket head cap screw		95	O-ring	x
35	O-ring	x	96	O-ring	x
36	Seal retainer		97	Rod	
37	Nut	x	98	Stroke limiter	
38	Body		99	Nut	x
39	Sealing washer		100	Ring	
40	Plug		101	O-ring	x
41	Sealing washer		102	Strip	x
42	Plug		103	Check valve	
43	Name plate		104	Lifting lug	
45	Dust cap		105	Spring washer	
46	Direction arrow		106	Hex. socket head cap screw	
47	Washer		107	Plug	
48	O-ring	x	108	Sealing ring	
49	Bottom plate		109	Bush	
50	O-ring	x	110	Back-up ring	x
51	Hex. bolt		111	Back-up ring	x
52	Spring washer		118	Sealing ring	
53	Valve ring		126	Sealing ring (for 12" only)	x
54	Hex. socket head cap screw		126	O-ring (for 16" only)	x
55	Spring washer		127	Sealing ring (for 12" only)	x
56	O-ring	x	129	O-ring	x
57	Locking ring		148	Back-up ring (only for 6" to 12" CL 900/1500)	x
59	Spring washer		169	O-ring (for 16" only)	x

5.15 Cross Section HON R100S-SO

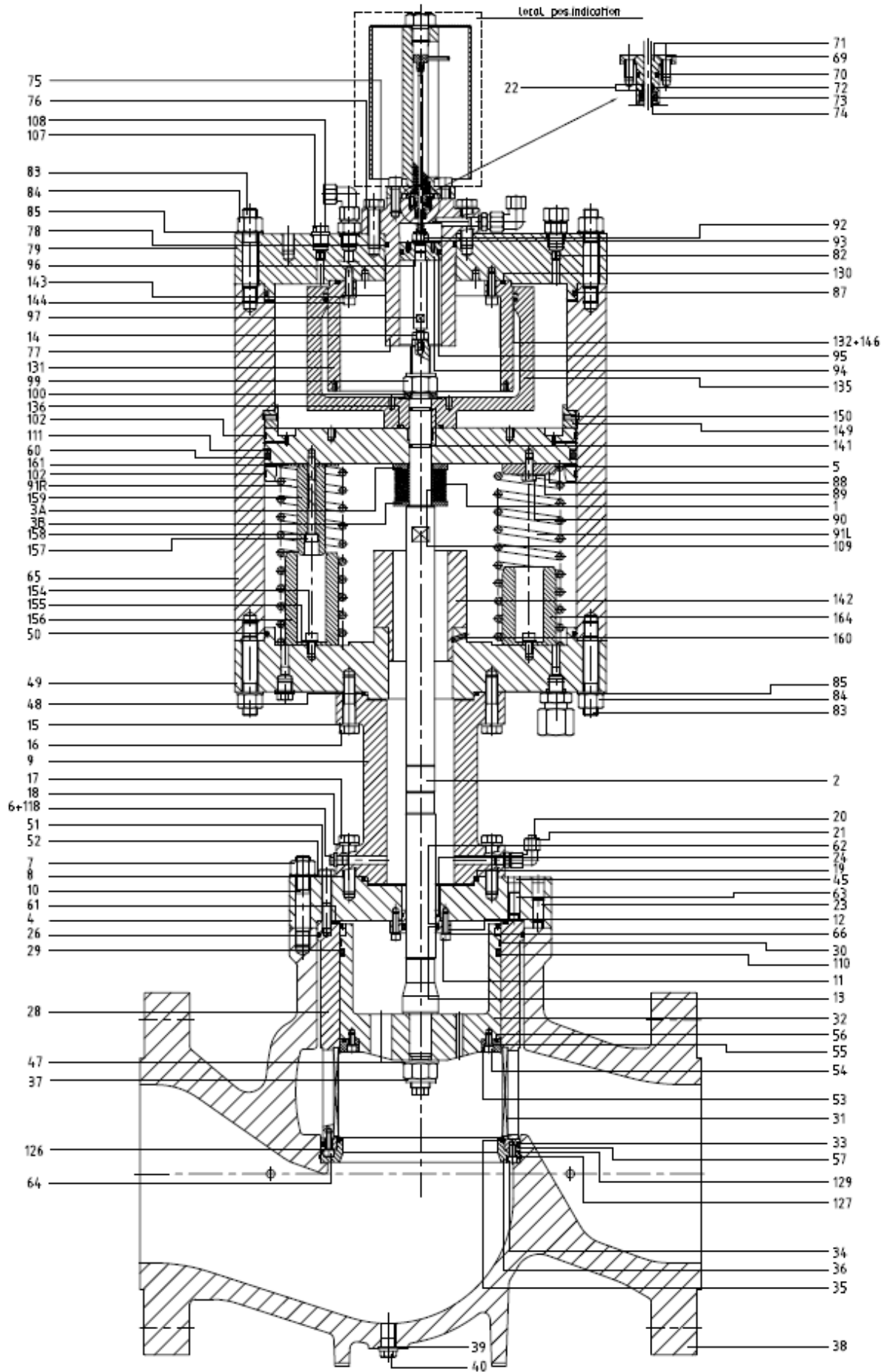


Fig. 5.14.1 Cross Section of HON R100S-SO

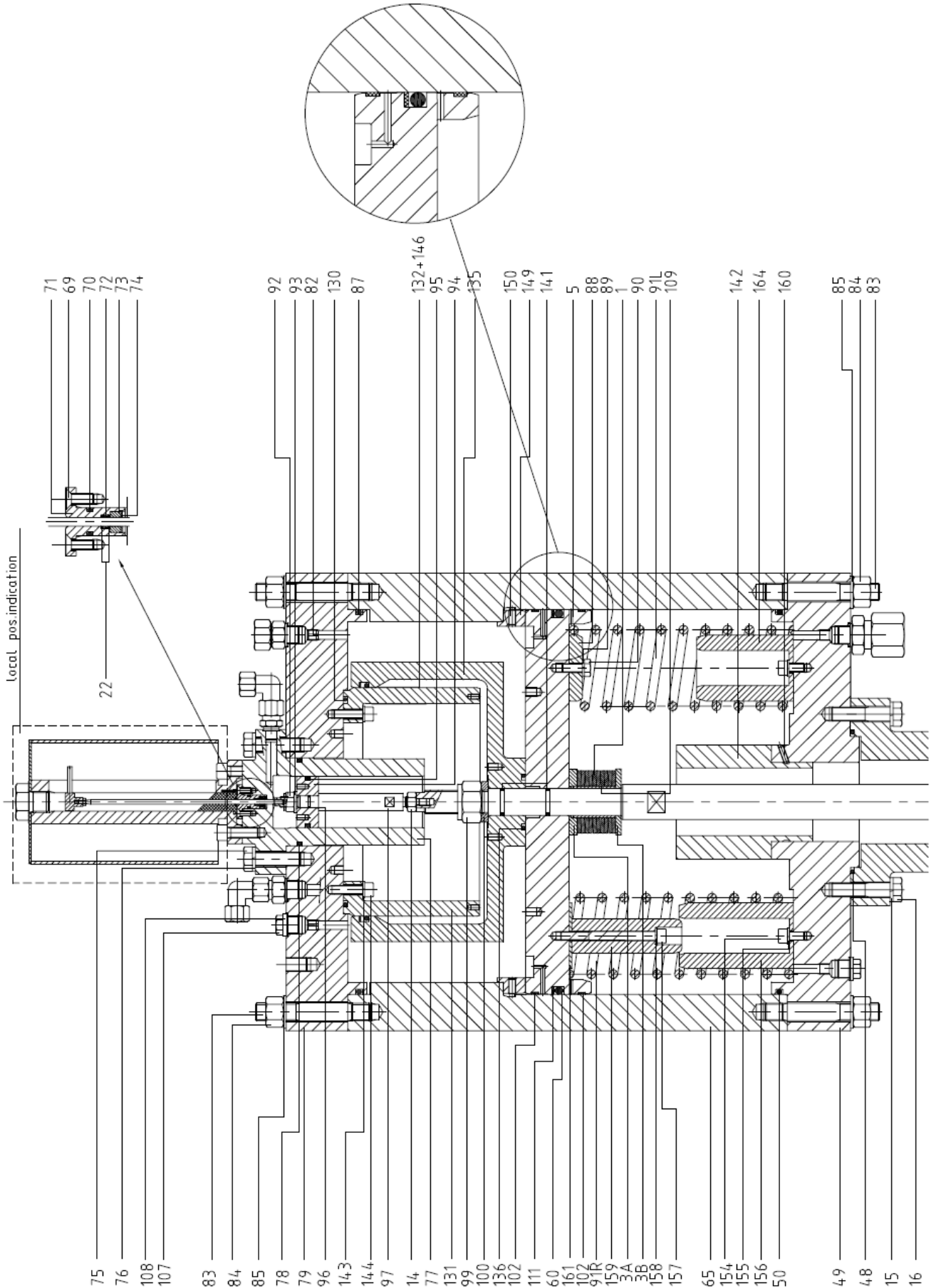


Fig. 5.14.2 Cross Section of HON R100S-SO

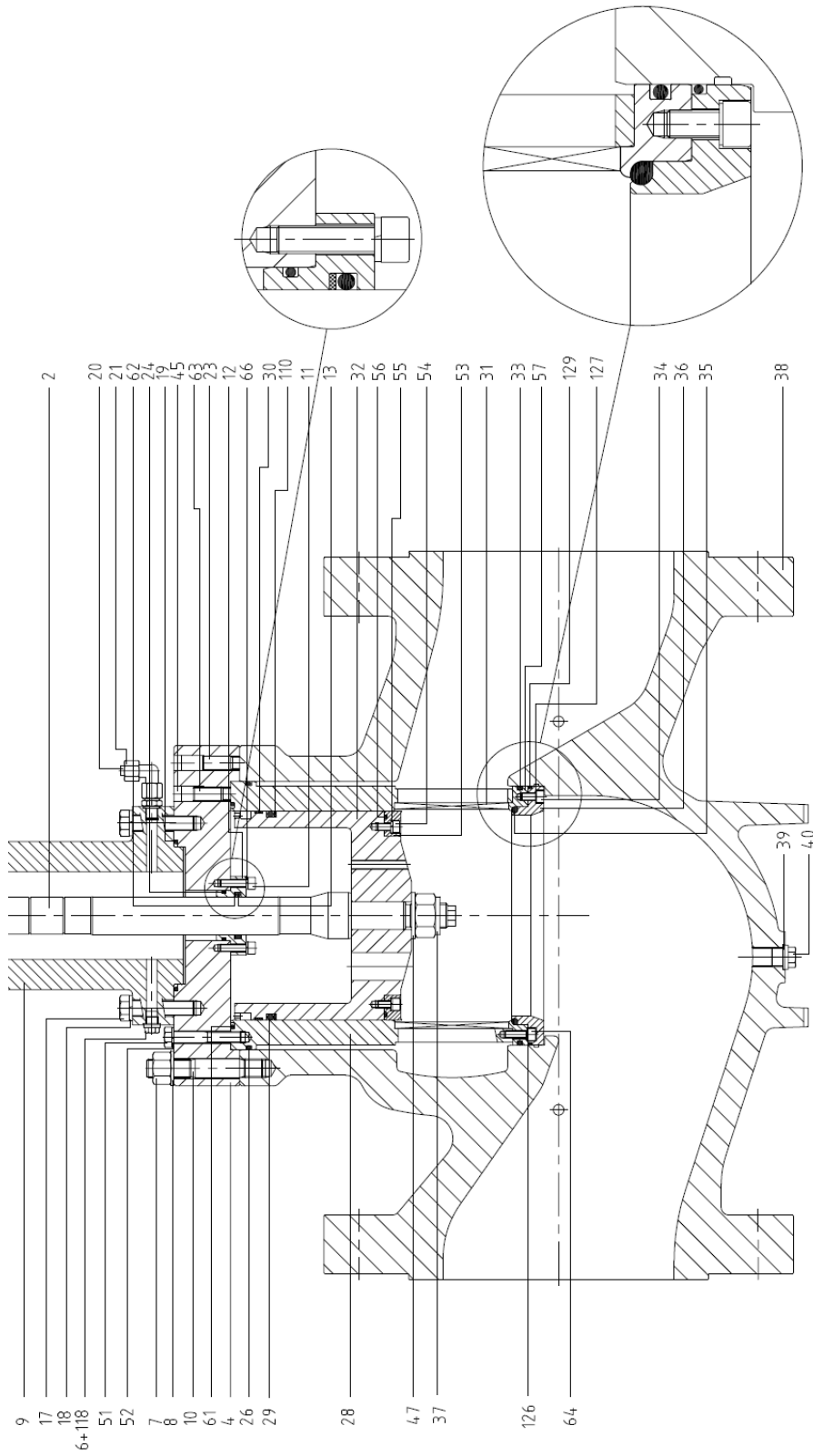


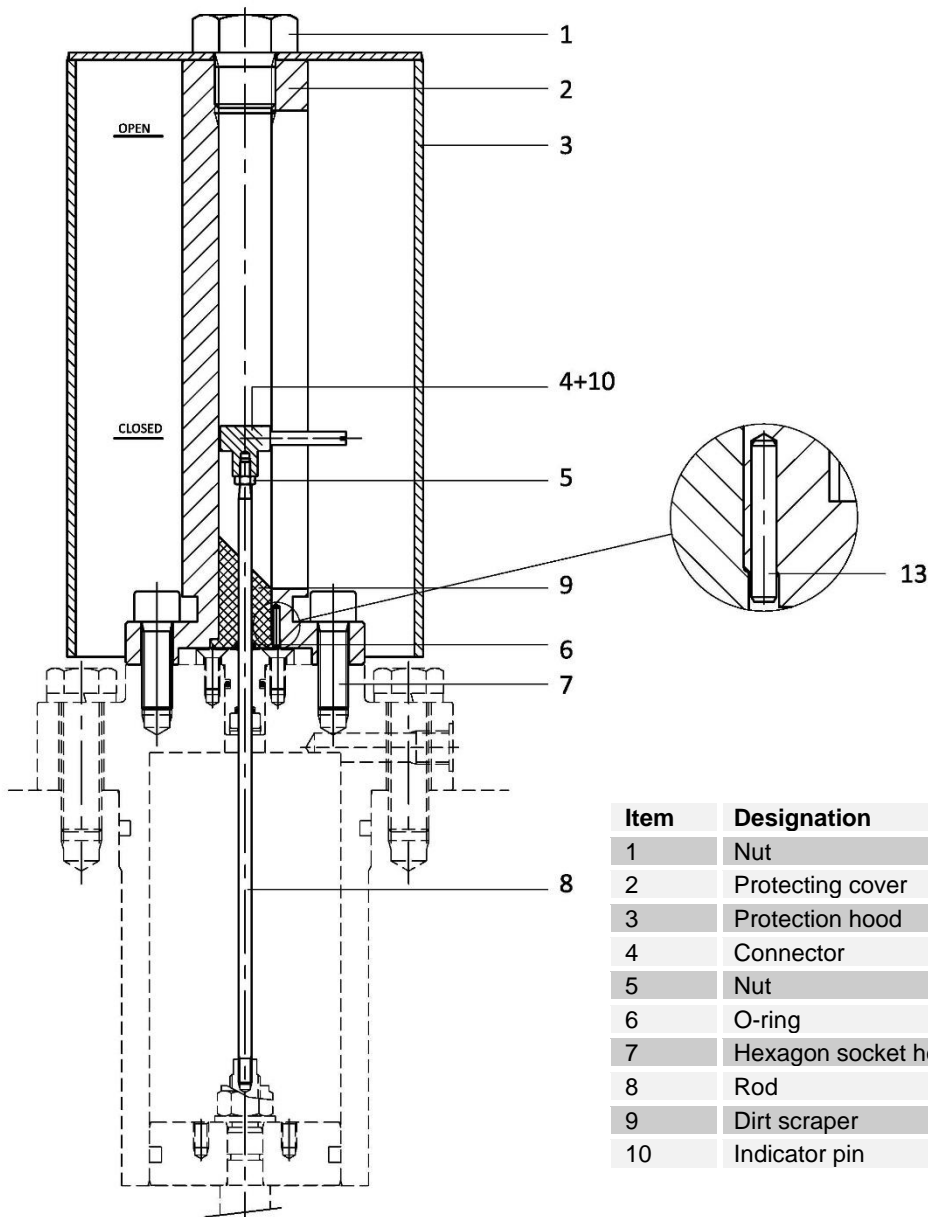
Fig. 5.14.3 Cross Section of HON R100S-SO

Trouble Shooting

Item	Designation	Spares	Item	Designation	Spares
1	Cup spring		56	O-ring	x
2	Stem		57	Locking ring	
3	Spring disc		60	O-ring	x
4	Cover		61	O-ring	x
5	Piston		62	Back-up ring	x
6	Plug (only for 10" CL600)	x	63	Set screw hex. socket	
7	Nut		64	Hex. socket head cap screw	
8	Washer		65	Cylinder	
9	Pedestal		66	Spring washer	
10	Stud bolt		69	Hex. socket countersunk head screw	
11	Hex. socket head cap screw		70	O-ring	x
12	Guide bush		71	Connection rod guiding	
13	O-ring	x	72	O-ring	x
14	Nut		73	Retaining ring	
15	Spring lock washer		74	Circlip	
16	Hex. bolt		75	Hex. bolt	
17	Hex. bolt		76	Spring washer	
18	Spring lock washer		77	Cylinder	
19	O-ring	x	78	O-ring	x
20	Plug		79	Top plate	
21	Tube fitting		82	Restriction	
22	Back-up ring (only for CL 900/1500)	x	83	Stud bolt	
23	Set screw hex. socket		84	Nut	
24	O-ring	x	85	Washer	
25	O-ring (except 10" CL150/600)	x	87	O-ring	x
26	O-ring	x	88	Spring plug	
27	O-ring (only for 12")	x	89	Spring washer	
28	Guiding bush		90	Hex. bolt	
29	O-ring	x	91R	Spring	
30	Strip	x	91L	Spring	
31	Silencer		92	Nut	x
32	Valve		93	Washer	
33	O-ring	x	94	Piston	
34	Hex. socket head cap screw		95	O-ring	x
35	O-ring	x	96	O-ring	x
36	Seal retainer		97	Rod	
37	Nut	x	99	Nut	x
38	Body		100	Ring	
39	Sealing washer		101	O-ring (only for 12" / 16")	x
40	Plug		102	Strip	x
41	Sealing washer		103	Check valve	
42	Plug		104	Lifting lug	
43	Name plate		107	Plug	
45	Dust cap		108	Sealing ring	
46	Direction arrow		109	Bush	
47	Washer		110	Back-up ring	x
48	O-ring	x	111	Back-up ring	x
49	Bottom plate		118	Sealing ring	
50	O-ring	x	126	O-ring (only for 16")	x
51	Hex. bolt		126	Sealing ring	
52	Spring washer		127	Sealing ring	
53	Valve ring		129	O-ring	x
54	Hex. socket head cap screw		130	O-ring	x
55	Spring washer		131	Compensation plunger	

Item	Designation	Spares	Item	Designation	Spares
132	O-ring	x	150	Socket-head set screw	
134	O-ring (except 12" CL600)	x	154	Hex. socket head cap screw	
135	Cylinder		155	Spring washer	
136	O-ring	x	156	Jacket	
141	O-ring (except 16")	x	157	Hex. socket head cap screw	
142	Stroke resistor		158	Spring washer	
143	Spring washer		159	Pin	
144	Hex. socket head cap screw		160	Socket-head set screw	
146	Back-up ring	x	161	Plate	
148	Back-up ring (only for CL 900/1500)	x	164	Jacket	
149	Spacer		169	O-ring (only for 16")	x

5.16 Cross section position indicator



Item	Designation	Spares
1	Nut	
2	Protecting cover	
3	Protection hood	
4	Connector	
5	Nut	
6	O-ring	x
7	Hexagon socket head cap screw	
8	Rod	
9	Dirt scraper	
10	Indicator pin	

Fig. 5.15.1 Cross Section of position indicator for HON R100

6 Trouble Shooting

6 Trouble Shooting

Findings	Possible Cause	Possible Solution
High outlet pressure	System lockup pressure at zero demand equals monitor setting with monitor in closed position	Not required, not abnormal (see 5.7.1)
	The controller of the active is set too high	Readjust the active controller (turn CCW @ top, see 4)
	The active has failed, the monitor has assumed control	Switch over to standby and isolate duty run for function test (see 5.7.1)
	The active pilot has failed open due to buildup of hydrates or ice	Provide adequate heating.
	The active features no full shutoff due to ingress of foreign matter	Clean internals
	The vent openings of the controllers are blocked by coating or ice	Remove coating or ice from vent openings
	The monitor controller is set too high and the switch over accelerator is set too low	Readjust both monitor and switch over accelerator pilot (see 4)
	at zero demand pressure will increase above foreseen settings	
Low outlet pressure	The controller of the active is set too low	Readjust the active controller (turn CW, see 4)
	The active pilot has failed open due to buildup of hydrates or ice	Provide adequate heating.
	Auxiliary pressure too low	Readjust the active controller (turn CCW @ bottom, see 4)
	Capacity too low, silencer of monitor and/or active clogged by foreign matter	Clean internals, take note that soiling of monitor will be indicated by lowered interstage pressure
	No supply to the active, due to intervention by the safety shut-off valve or monitor	Switch over to standby and isolate duty run for reset and function test
	The switch over accelerator is set too low	Readjust the accelerator pilot (turn CW @ top, see 4)
	The pressure drop across the valve is less than 0.5 bar.	Increase the inlet pressure or allow lower outlet pressure
Monitor activated during normal operation	Set point differential between monitor and active too small	Readjust the monitor controller (turn CW @ top, see 4)
	Set point differential between accelerator and active too small	Readjust the monitor controller (turn CW @ top, see 4)
Safety shut-off valve trips closed prior monitor intervention	Set point differential between monitor controller/accelerator and safety shut-off too small	Readjust the slam shut controller

Trouble Shooting

Findings	Indicators	Possible Cause
Cycling outlet pressure (online operation)	Low frequency pulsation < 0.2 Hz	Control loop instability. To rectify a stepwise procedure is recommended
Solution 1	Solution 2	Solution 3
Lower the auxiliary pressure This reduces both amplification and contribution of the auxiliary pressure in the final control stage of the pilot. This will often solve the problem. If pulsation has not been eliminated, then continue with solution 2.	Tune the response of the pilot Open the adjustable motorization bleed in the Tee to the sense line of the active pilot, start from closed position If pulsation has not been eliminated, then continue with solution 3.	Tune the response of the MLV Install a full bore velocity restrictor in the sense line of the active MLV, start from open position If pulsation has not been eliminated, then continue with solution 4.
Solution 4	Solution 5	Solution 6
Replace the active setting spring by the next stiffer spring in the range If pulsation has not been eliminated, then continue with solution 5	Try a combination of 1, 2, 3, 4. If pulsation has not been eliminated, then continue with solution 6	Refurbish the equipment Both controller and main line valve shall be free of excessive friction. Abnormal friction may result from: <ul style="list-style-type: none"> ▪ ageing of the dynamic sealings ▪ soiled guiding surfaces ▪ damaged internals If pulsation has not been eliminated, then continue with solution 7
Solution 7	Solution 8	Solution 9
Check for mutual interference The upstream or downstream offtake station may feature similar instability. The instability may also occur from interaction with process. Restore normal operation If pulsation has not been eliminated, then continue with solution 7	Change internal orifices Fit different sized orifices, these are available on request. If pulsation has not been eliminated, then continue with solution 7	Consult Honeywell
Findings	Indicators	Possible Cause
Cycling outlet pressure (online operation)	High frequency pulsation > 0.2 Hz	Control loop instability. To rectify a stepwise procedure is recommended similar to the above mentioned, however concentrate on Solution 3, 6, 7

Controllers

Isolated testing of controllers is optional. It can be done in the installation or in the workshop. After decommissioning and depressurizing of the run proceed as follows:

Switch-over Accelerator HON AP095 - xP

Disconnect all connection ports from the pilot. Connect port no.3 to low pressure supply (nitrogen, argon or conditioned air) and adjust it to approx 2 bar.

Unscrew the locking nut and assure that the top adjusting screw is completely relaxed (1).

Advance the adjusting screw after pressurizing until discharge stops and valve has seated. Check for leakage. Replace seat (item 49) if necessary.

Now slightly back out the adjusting screw until valve starts relieving again. Finalize the cycle by advancing the adjusting screw until the accelerator has seated. Run this cycle a few times and then check for leakage again

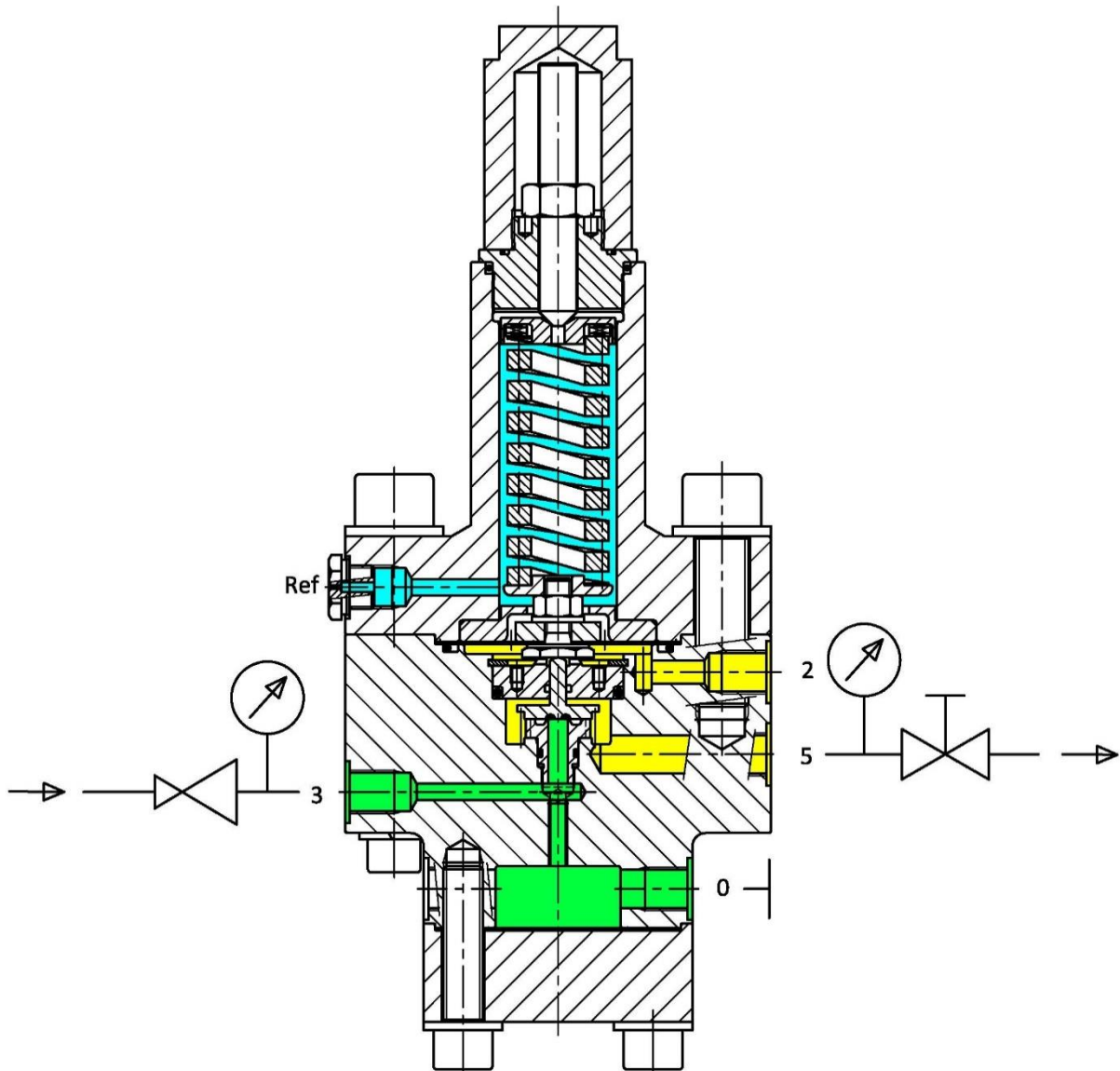


Fig. 6.1 Colored Test Setup for HON AP095 xP

Pressure Controller HON P095 - xPS

Disconnect port no. 2 (downstream sense) and 3 (motorization output) from the pilot. Connect port no.1 to high pressure supply (natural gas *, nitrogen, argon, or conditioned air).

Unscrew the locking nut and assure that the top adjusting screw is completely relaxed (1).

- After pressurizing, the auxiliary pressure gauge should indicate the auxiliary pressure offset, ranging from approx. 2 to 6 bar. The auxiliary pressure should not increase after initial lockup, otherwise the 1st stage may feature a leakage. Replace seat (item 121) if necessary
- Check with adjusting screw completely unscrewed (1) whether there is gas flowing from port connections 2 and 3. If gas is flowing then the 2nd stage may feature a leakage. Replace seat (item 29) if necessary

Now slightly advance the adjusting until the controller starts supplying gas at port connections 2 and 3. Finalize the cycle by fully relaxing the adjusting screw. Run this cycle a few times and then check for leakage again.

*) to use line pressure: pressurize inlet up to monitor with bypass of the closed slam shut valve.

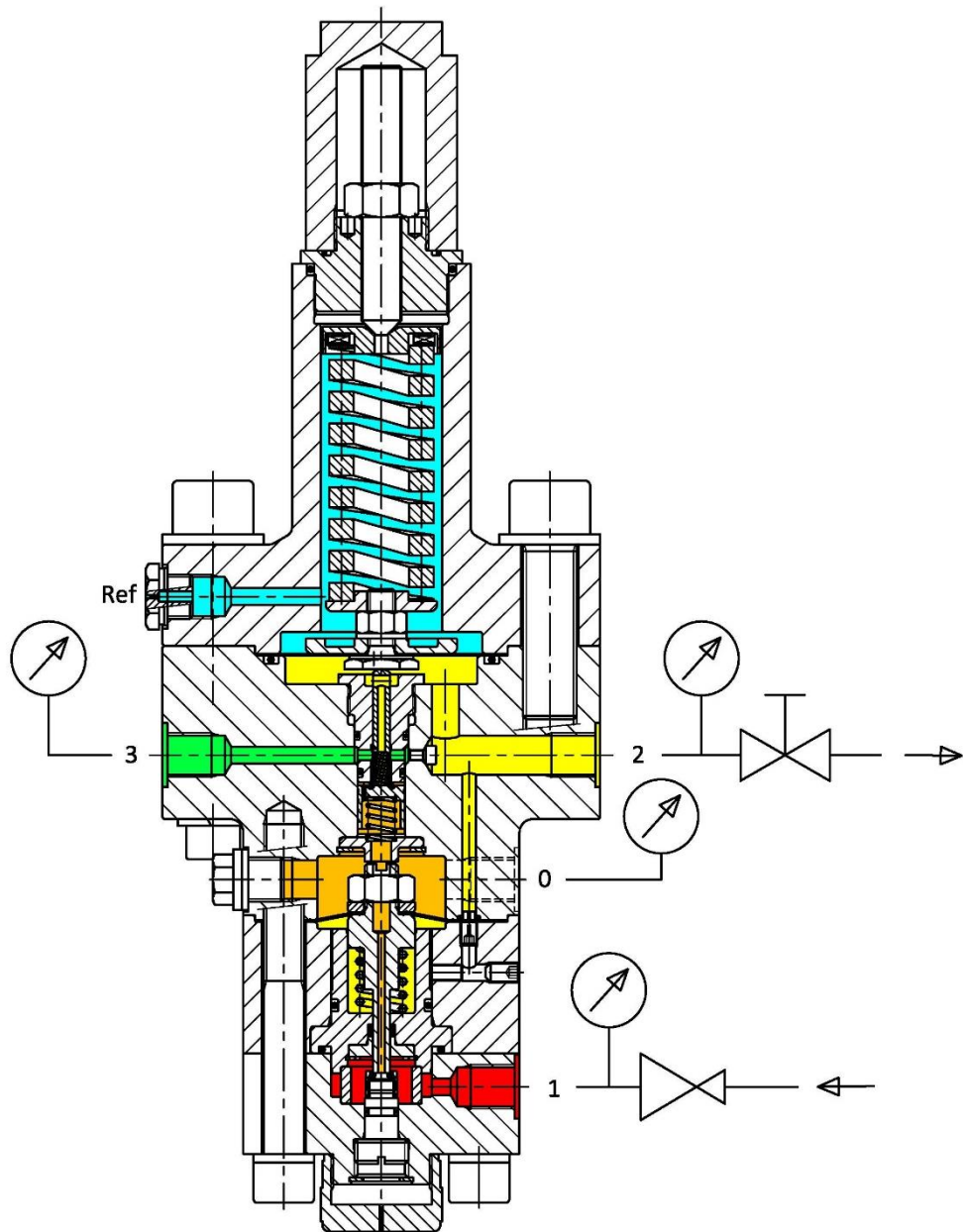


Fig. 6.2 Colored Test Setup for HON P095 xPS