Honeywell Gas Pressure Regulators Series R100

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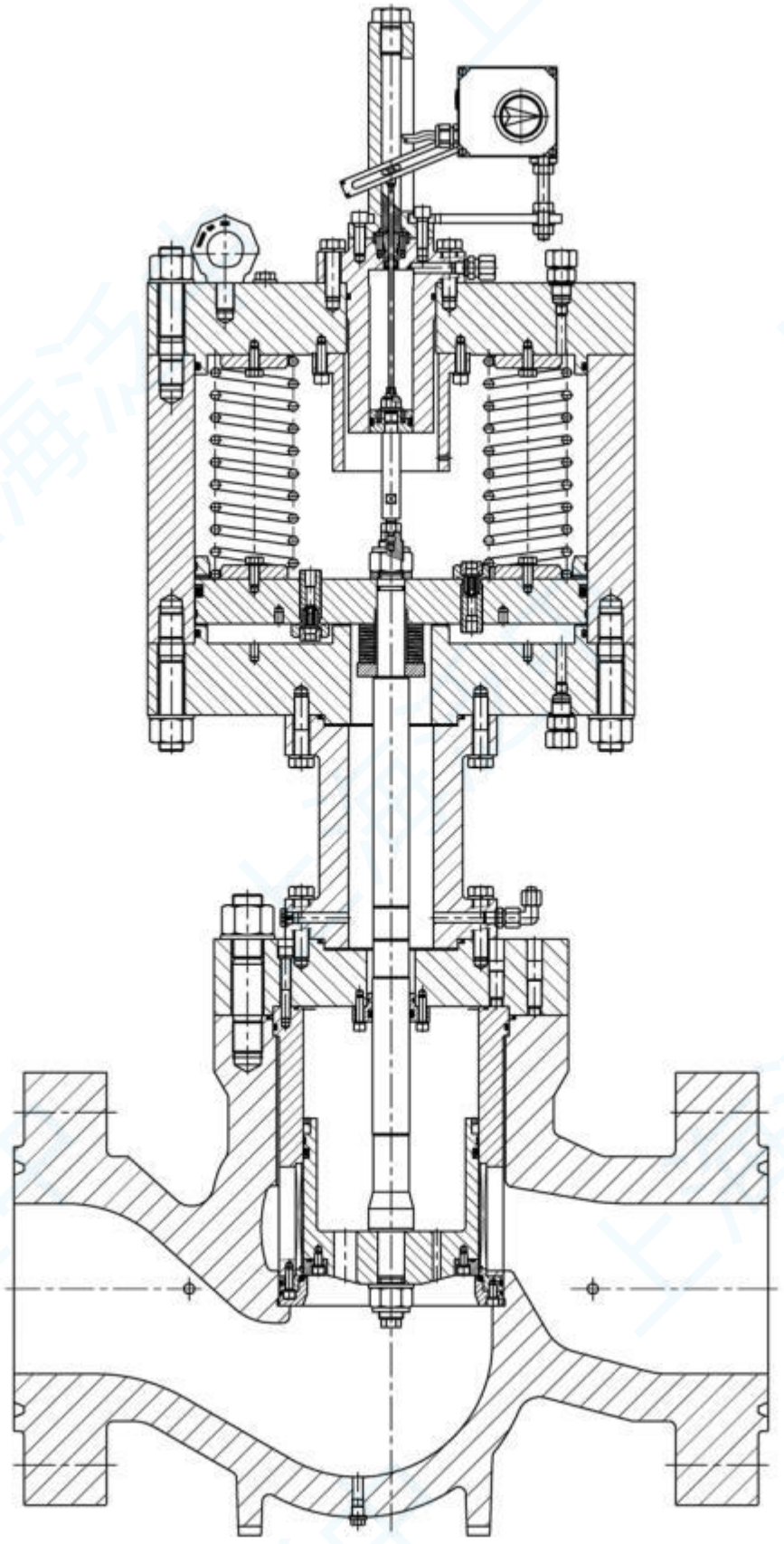


Fig.1.1 Cross Section of Gas Pressure Regulator Series R100 – Typical 8”-900#

1.1 Application

Typical area of application are standalone 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 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, 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 cutoff 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.

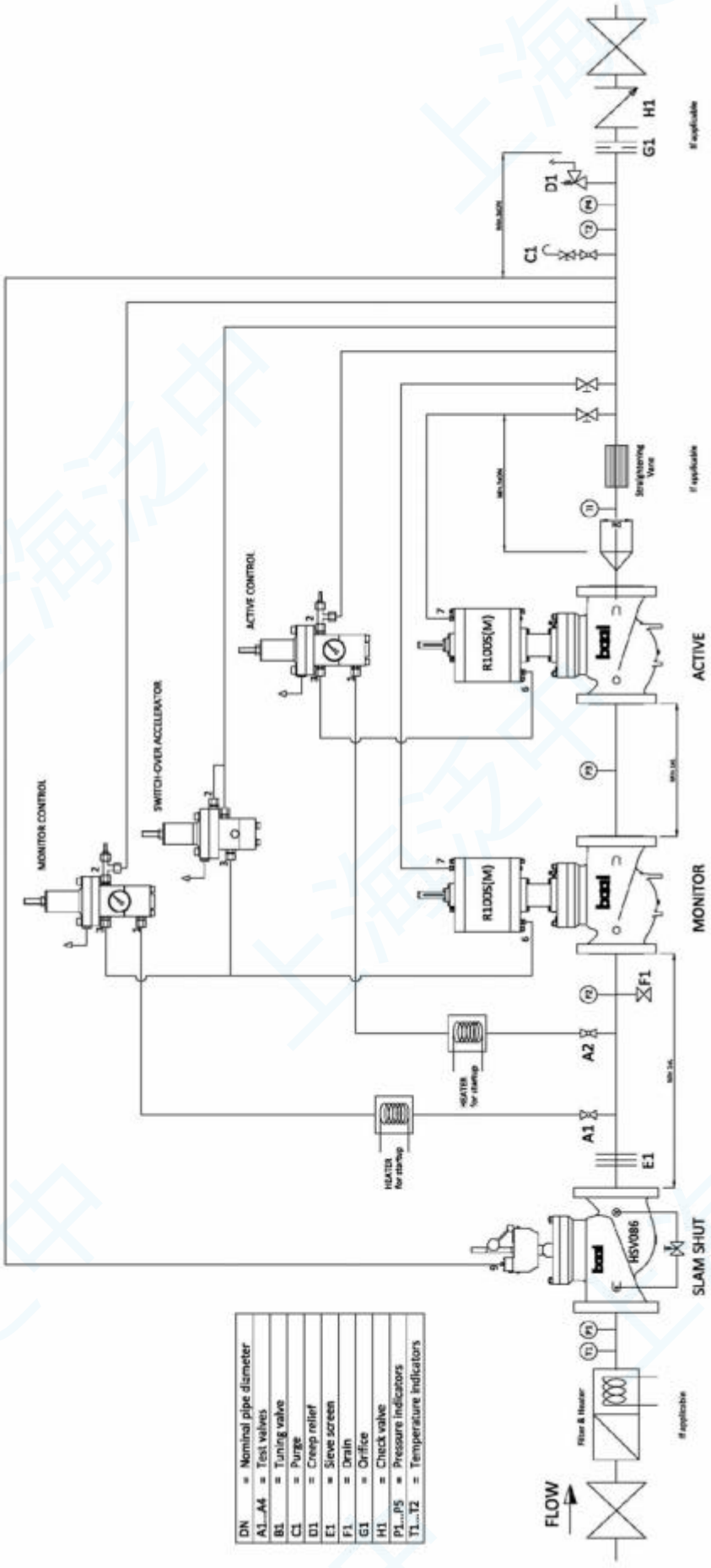


Fig 1.1.1 Layout of control system – Typical wide-open monitor system with R100S(M)-12”

1.2 Components

Active regulator：

- Main line valve : R100S, -SO, -SC, -M
- Active controller : P095, -MPS, -HPS

Monitor regulator：

- Main line valve : R100S, -SO, -SC, -M
- Monitor controller : P095, -MPS, -HPS
- Switch-over accelerator : AP095, -MP, -HP

1.3 Notes

The controller P095-xPS has been optimised for use with 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 P095-xPS as two-stage gas pressure reducer with a small capacity
- The 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 interstage pressure in a working monitor arrangement. The working monitor arrangement consists of an active monitor, which cuts the inlet pressure to a fixed interstage pressure and a regulator which finally reduces the interstage to the required outlet pressure.

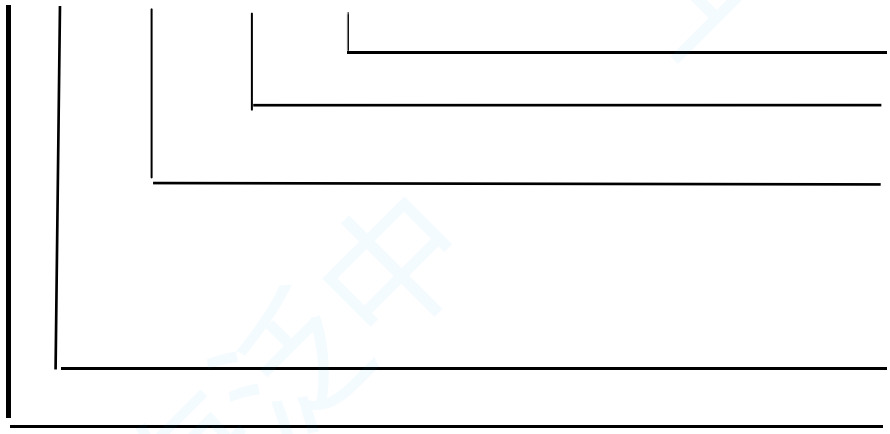
- Accessories are available to enable remote set point adjustment by a pneumatic or electric drive and allow for combination with solenoid valves (e.g. for flow control by PWM)

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

1.4 Type designation

Main line valves

R100 S - x - DN - PN



PN : pressure rating

DN : nominal diameter

x : specific model
SO : spring opened
SC : spring closed
M : monitor *)
default : <blank>

S : silenced

R100 : series

*) features two pistons (for sizes up to 8”-600#) : standard top piston energizes shutoffat increasing pressure differential, additional bottom piston balances interstage pressure acting on valve plug.

Examples:

R100S-4”-600# equals a gas pressure regulator series R100 silenced, standard model, with a nominal diameter of 4” and a class 600 pressure / temperature rating

R100S-M-4”-600# equals a gas pressure regulator series R100, silenced, monitor model with a nominal diameter of 4” and a class 600 pressure / temperature rating.

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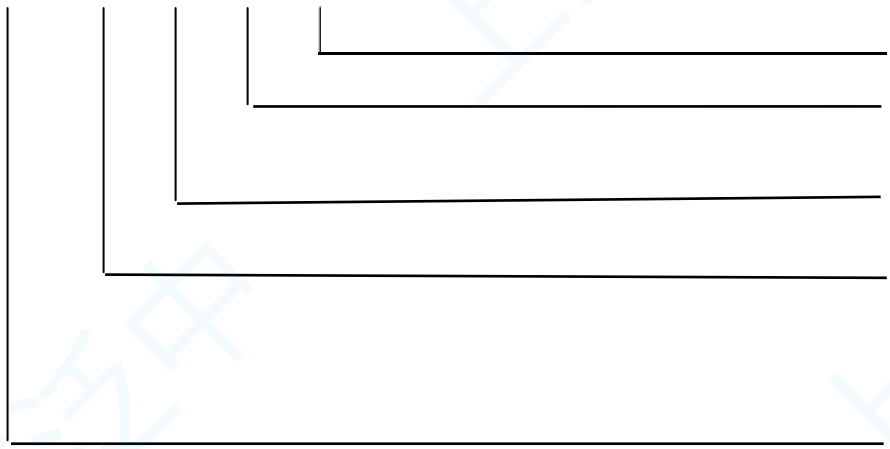
Controller (active & monitor) / Switch-over accelerator

P095 – x P S – x - PN



PN : pressure rating

x : optional models
default : <blank>

S : 2-stage reducer (with stabilizer)

x : pressure range
LP : low pressure range
MP : mid. press.range
HP : high press. range

P095 : series
AP095

Examples:

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

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

1.5 General

Series	: **R100S**
Designation	: Gas Pressure Regulators
Application	: Pressure Control Systems ac. EN 12186
Nominal Diameter	: 1" – 20"
Pressure rating	: ANSI 300 / 600 / 900 / 1500
Design	: EN 334 (DIN 3380), BS 1873, ANSI B16.10
Operating pressure	: up to 250 bar
Pressure setting range	: from 0 to 250 bar
Accuracy	: AC1
Temperature range	: from -30 up to +80° C
Stroking time	: Dependent from pressure gradient, typically <0.5 sec./inch NPS
Shut-off	: Tight shutoff, better than class VI
Minimum DP	: 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 dome in upward position
DIN-DVGW No. R100	: NG-4301AU0385
DIN DVGW certified ranges	: from -20 up to +60° C

- 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/H_2O-dewpoint additional pilot heating is recommended.

1.6 Materials

Valve body	: Cast steel A352LCC or bar steel S355J+N or equivalent
Actuator	: Cast steel A352LCC or bar steel S355J+N or equivalent
Valve stem	: 17.4PH or equivalent
Valve cylinder	: S355J+N / Hardchromium plated
Valve plug	: S355J+N / Ni-PTFE coated
Valve seat	: 17.4PH
Seat sealing	: Metal-to metal with FPM O-ring seal for tight shutoff
Controllers, internals	: Stainless steel
Controllers, externals	: bar steel S355J+N or equivalent S

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

1.7 Capacity

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

$$Qn = \frac{13.57}{d(Te + 273)}.Cg.\ (Pi - Po).Po \qquad \text{if } \frac{Po}{Pi} \geq 0.5$$

$$Qn = \frac{6.78}{d(Te + 273)}.Cg.Pi \qquad \text{if } \frac{Po}{Pi} < 0.5$$

with

Qn = flow rate in m_n^3/h
Pi = inlet pressure in bara
Po = outlet pressure in bara
Cg = capacity rate in $m_n^3/(h.bar)$
d = relative density (air=1)
Te = temperature gas in the inlet side of the regulator
ρ_n = gas density under normal conditions (with T=273 Kelvin)

To natural gas with ρ_n =0.83 kg/m^3 applies: d = 0.643

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

In the above formula, the Cg value of the combination monitor regulator and active regulator should be filled in. This value (Cg_tot) can be calculated as follows:

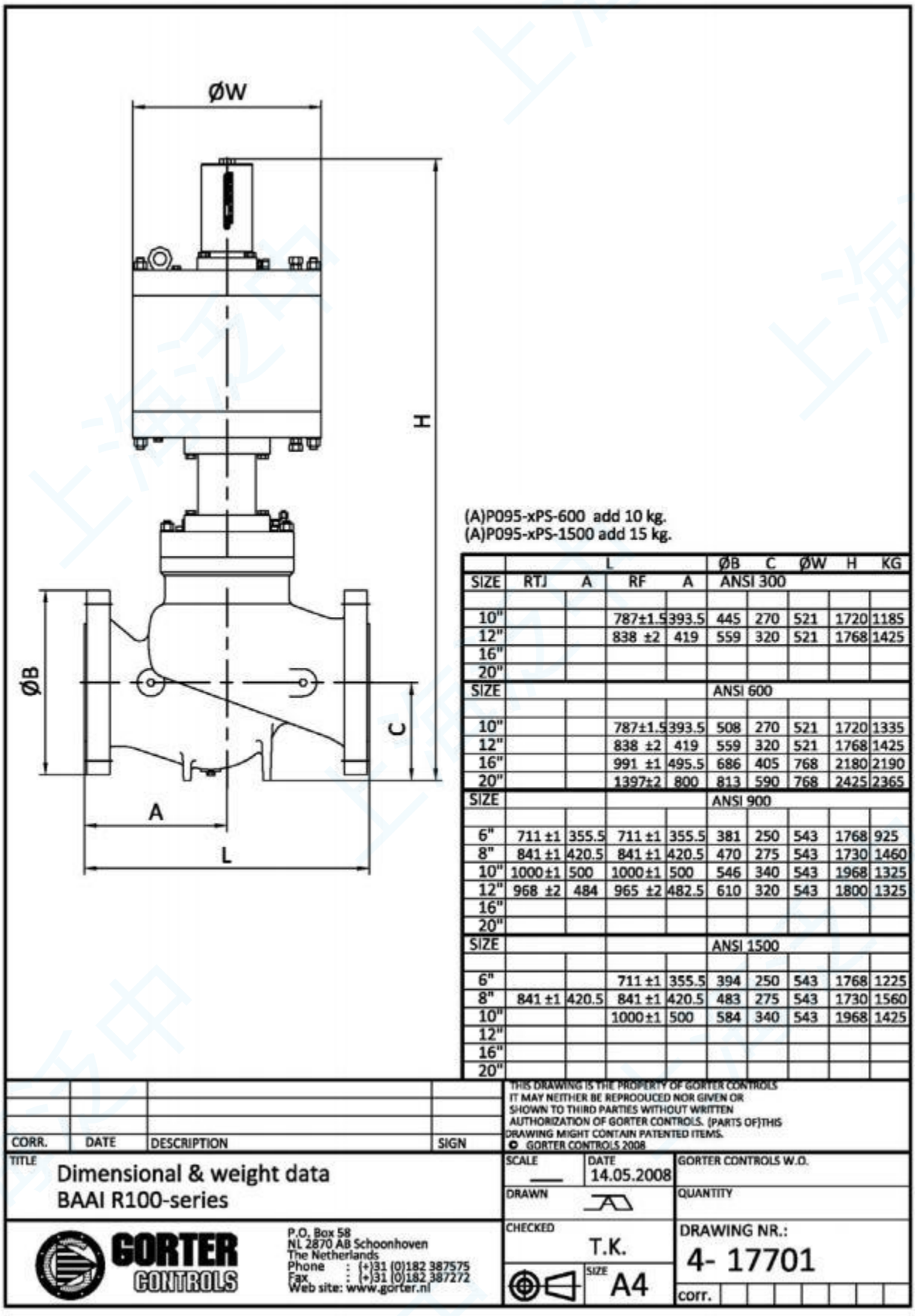
$$Cg\_tot = \sqrt{\frac{1}{\left(\frac{1}{Cg\_active}\right)^2 + \left(\frac{1}{Cg\_monitor}\right)^2}}$$

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

DN	C_G **R100**	C_G **R100 Silenced**
1"	400	370
2"	2000	1210
3"	4000	2800
4"	6760	4970
6"	14400	10100
8"	27100	19700
10”	30100	36700
12”	48600	38500

Table 1.7.1 Cg values regulators of the R100 series – Silenced versions with standard trim

1.8 Dimensions & weight



(A)P095-xPS-600 add 10 kg.
(A)P095-xPS-1500 add 15 kg.

SIZE	L RTJ	L A	L RF	L A	ØB	C	ØW	H	KG
					ANSI 300				
10"			787±1.5	393.5	445	270	521	1720	1185
12"			838 ±2	419	559	320	521	1768	1425
16"									
20"									
SIZE					ANSI 600				
10"			787±1.5	393.5	508	270	521	1720	1335
12"			838 ±2	419	559	320	521	1768	1425
16"			991 ±1	495.5	686	405	768	2180	2190
20"			1397±2	800	813	590	768	2425	2365
SIZE					ANSI 900				
6"	711 ±1	355.5	711 ±1	355.5	381	250	543	1768	925
8"	841 ±1	420.5	841 ±1	420.5	470	275	543	1730	1460
10"	1000±1	500	1000±1	500	546	340	543	1968	1325
12"	968 ±2	484	965 ±2	482.5	610	320	543	1800	1325
16"									
20"									
SIZE					ANSI 1500				
6"			711 ±1	355.5	394	250	543	1768	1225
8"	841 ±1	420.5	841 ±1	420.5	483	275	543	1730	1560
10"			1000±1	500	584	340	543	1968	1425
12"									
16"									
20"									

CORR. | DATE | DESCRIPTION | SIGN

TITLE: Dimensional & weight data
BAAI R100-series

SCALE: —
DATE: 14.05.2008
GORTER CONTROLS W.O.
DRAWN
QUANTITY
CHECKED: T.K.
DRAWING NR.: 4- 17701
SIZE: A4
corr.

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P.O. Box 58
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Table 1.8.1 Dimensions L and H (mm) and weight W (kg)

1.9 Controllers and set point springs

Set point range outlet pressure:

Article number	Range - MPS [barg]	Colour
8501114123240	0.3 - 1.0	blue
850523ST12660	0.5 - 2.5	green
850523ST12670	1.5 - 5.0	blue
850523ST12680	3.0 - 11.0	red
850523ST12690	6.0 - 15.0 *)	yellow
Article number	**Range - HPS [barg]**	**Colour**
850523ST12660		green
850523ST12670	5 - 12 **)	blue
850523ST12680	10 - 35	red
850523ST12690	20 - 50	yellow

*) DIN DVGW-approval up to 12 bar (extended range upto 15 at request)
**) DIN DVGW-approval from 8 bar on

Table 1.9.1 Set point range of pilot (A)P095-xP(S)

If the required setpoint lies in the overlapping range between two springs, it is recommended to take the spring with the lowest setpoint range. This way maximum regulating precision is achieved. This also applies in the event that the required Po 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.

Set point range of 1st stage auxiliary pressure: offset to downstream pressure equals 2 to 6 bar

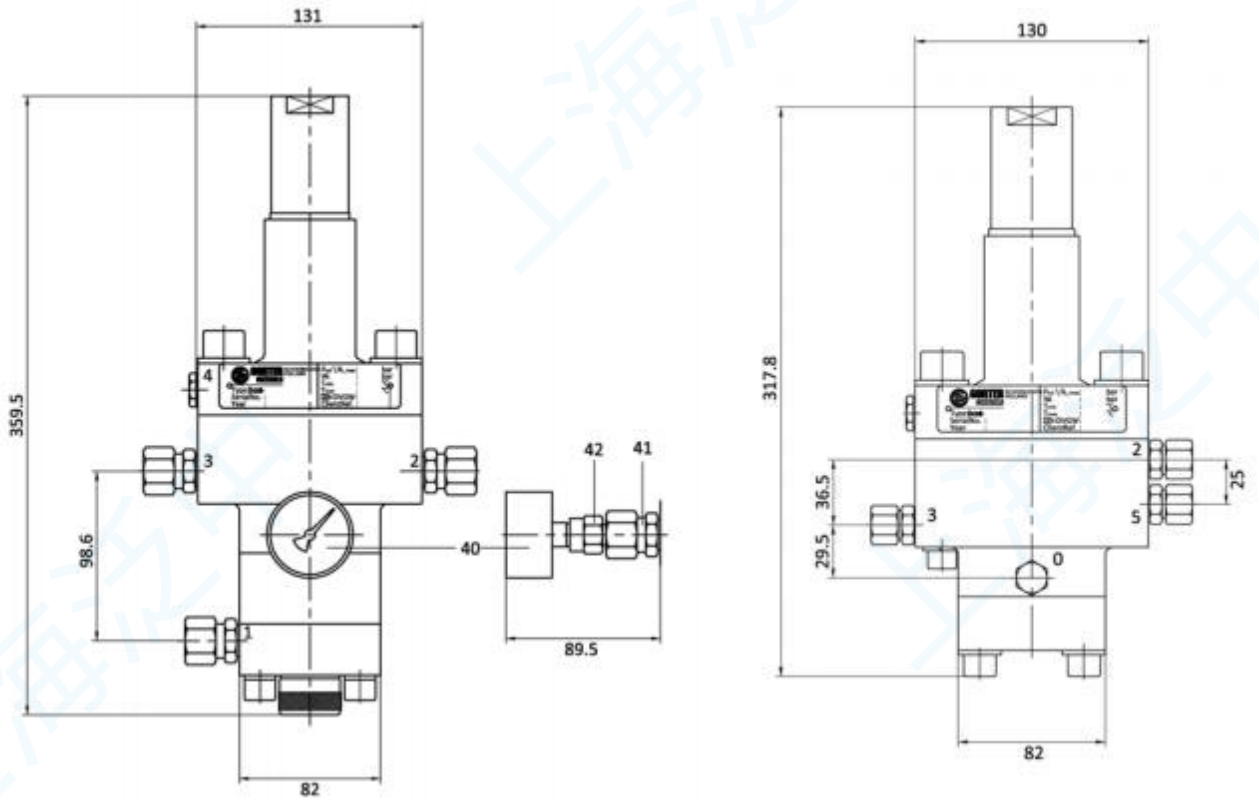

Figure 1.9.2 dimensional drawing P095 xPS-1500# and AP095 –xP-1500#

2 Principle of Operation

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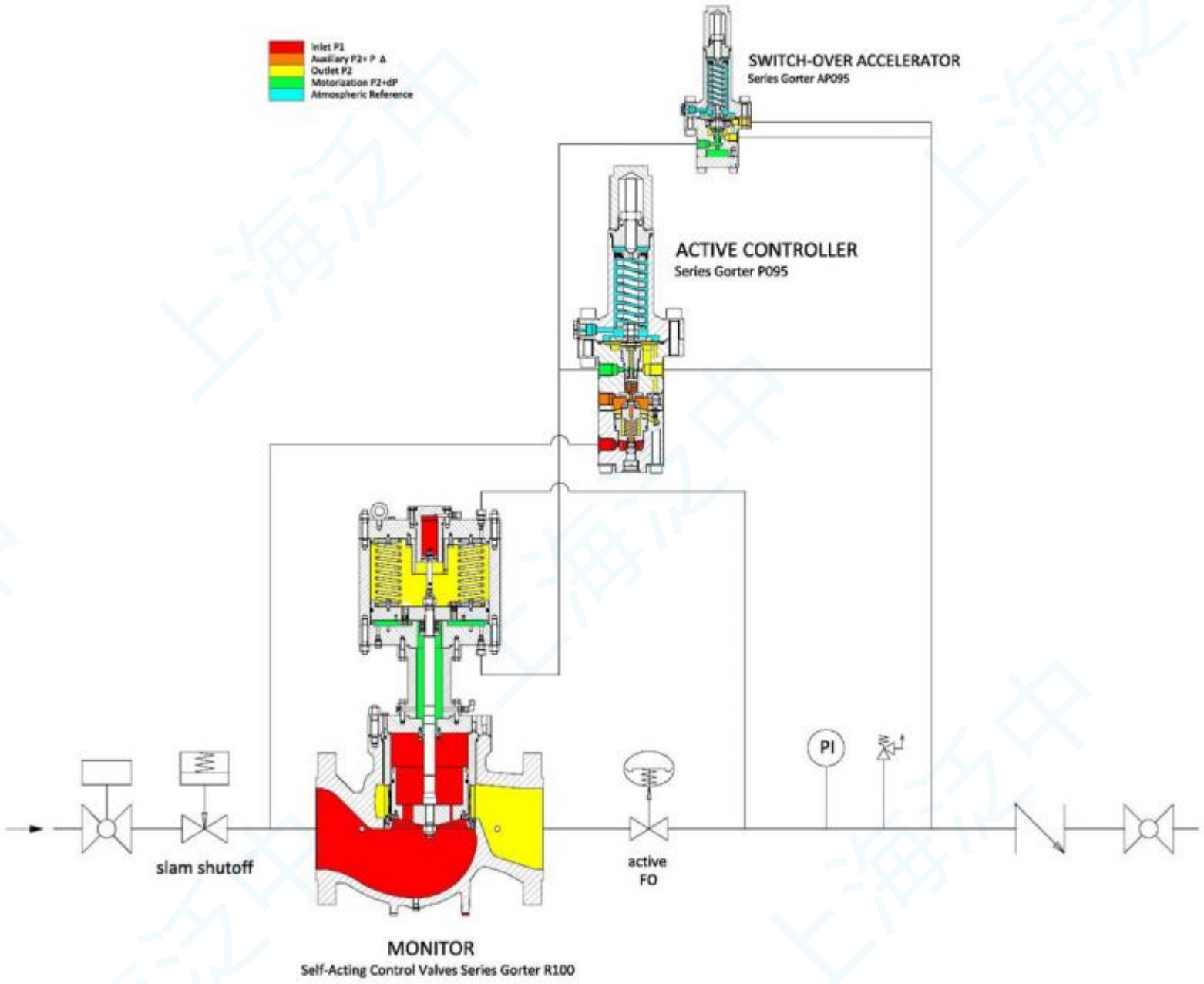

Fig. 2.1 Colored cross section of system with monitor R100S-M + P095 xPS + optional AP095 xP

2.1 General

The control system consists of an active regulator with pilot (typically R100S + P095), a monitor regulator with pilot and accelerator (typically R100S-M + P095 + 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 outlt pressure has risen above its relief setpoint.

2.2 Single stage pressure reduction system

See fig.2.2.1

At a constant outlet pressure Po 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 Po plus spring (9) on the other hand. If more gas is taken offat 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 Po. Pressure control regulator P095 ensures that the outlet pressure is adjusted to the setpoint value, for a reduction of the outlet pressure Po 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 Po 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 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 or 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 Po 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 (Po) 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 P095-MPS and P095-HPS. The pilots are mutually different in the setpoint 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 setpoint range (see also chapter 1 Technical specifications).

The 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..

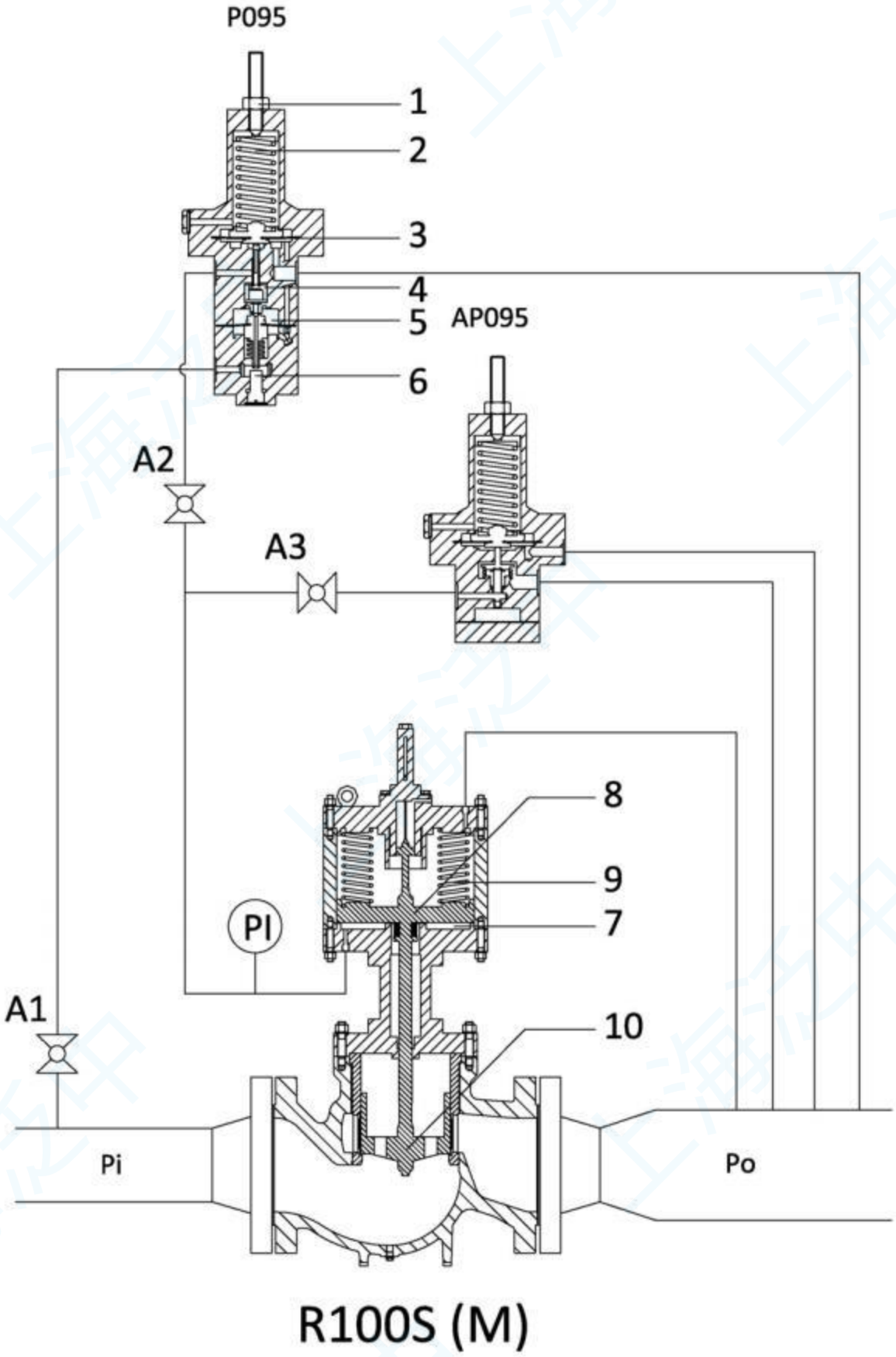

Fig. 2.2.1 Schematic of single stage pressure reduction with R100S-M + P095 xPS + optional AP095 xP

2.3 Single stage pressure reduction with wide-open monitor

See figure 2.3.1

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.

Emergency Operation with active monitor：

If the active regulating system open fails, outlet pressure Po rises. When Po has risen up to the setpoint of the monitor pilot P095-xPS, pilot valve (11) 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 Po rises above the setpoint 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 Po has gone down again to the set monitor setpoint. Valve (16) closes the instant that outlet pressure Po drops again until just below the setpoint of the acceleration pilot 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 Pt in the pipe-piece between monitor regulator and active regulator will be practically equal to the outlet pressure Po.

For other configurations and hookups please don't hesitate to contact our company.

Principle of Operation

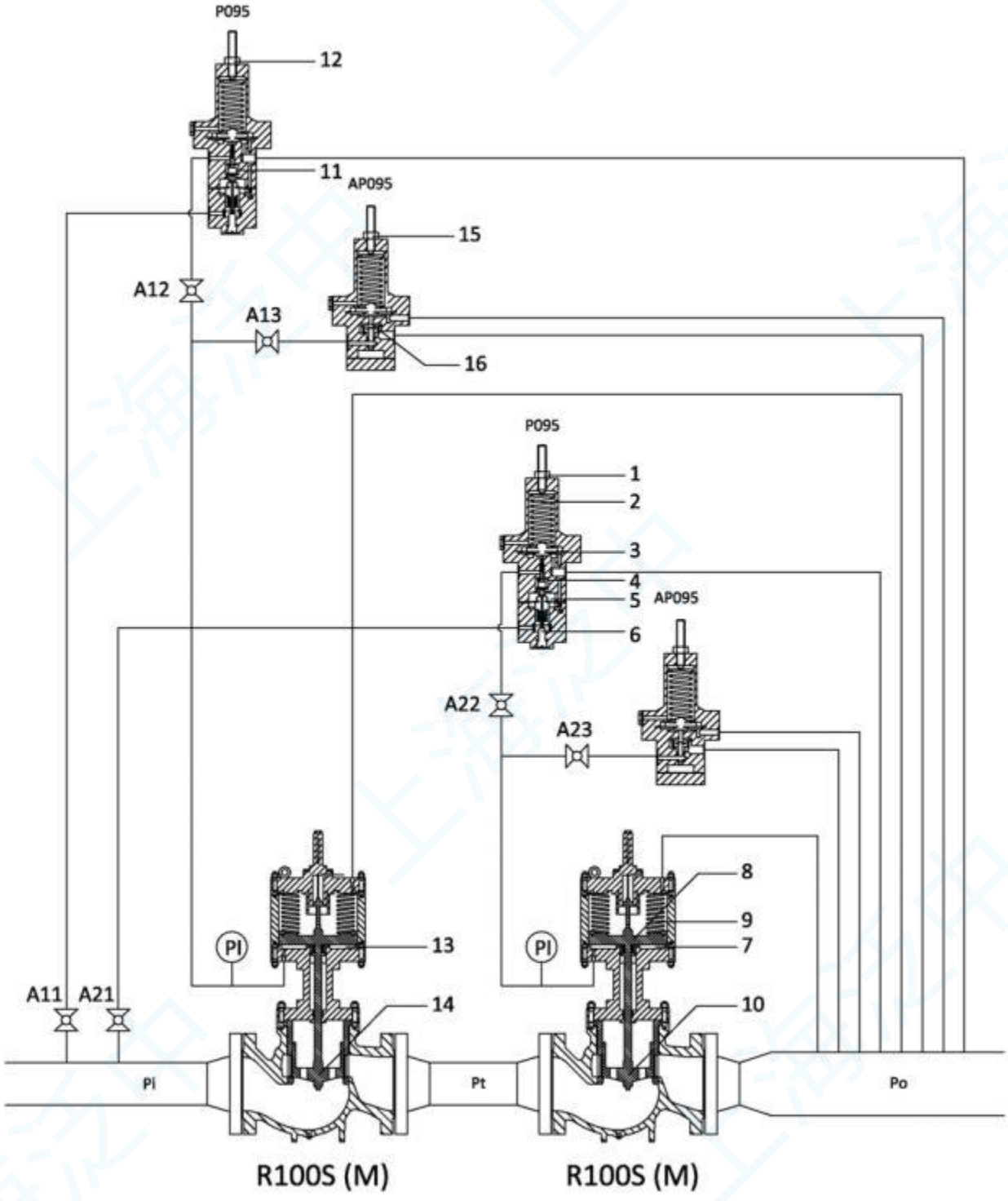

Figure 2.3.1 Schematic diagram wide-open monitor regulating system with R100S-M+P095-xPS+AP095-xP

3 Installation

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3 Installation

3.1 Hookup

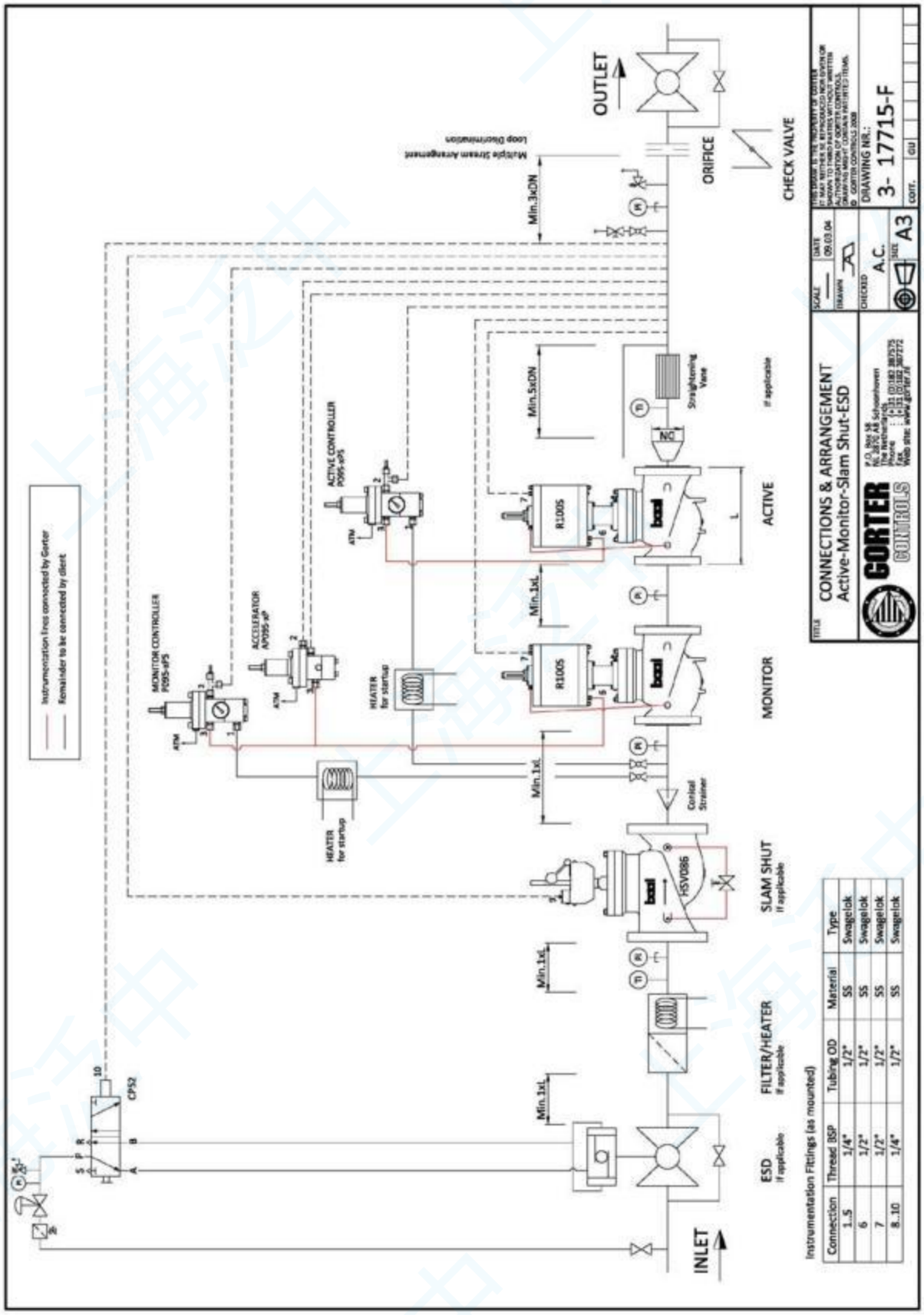

Fig. 3.1.1 Hookup gas pressure regulating system with monitor regulator

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 line 2 of both P095 and numbers 4 of the 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 startup 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 motorizationline (between connection 3 of the pilot P095 and connection 6 of the R100 main lin evalve). 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 is more than enough to fully stroke the valve (maximum 5 bar).

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 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 AP095-xP

Connection No.	Thread Size BSP(P)	Tubing OD	Function
6	¼”	12 / ½’	Motorization
7	¼”	16 / ½”	Sense
8	¼”	12 / ½”	Balancing

Table 3.1.3 Connections of gas pressure regulator Series R100

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

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4 Commissioning Notes

4.1 Single Stage Pressure Reduction

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:

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 setpoint adjusting screw of the pilot until after the run is depressurized.

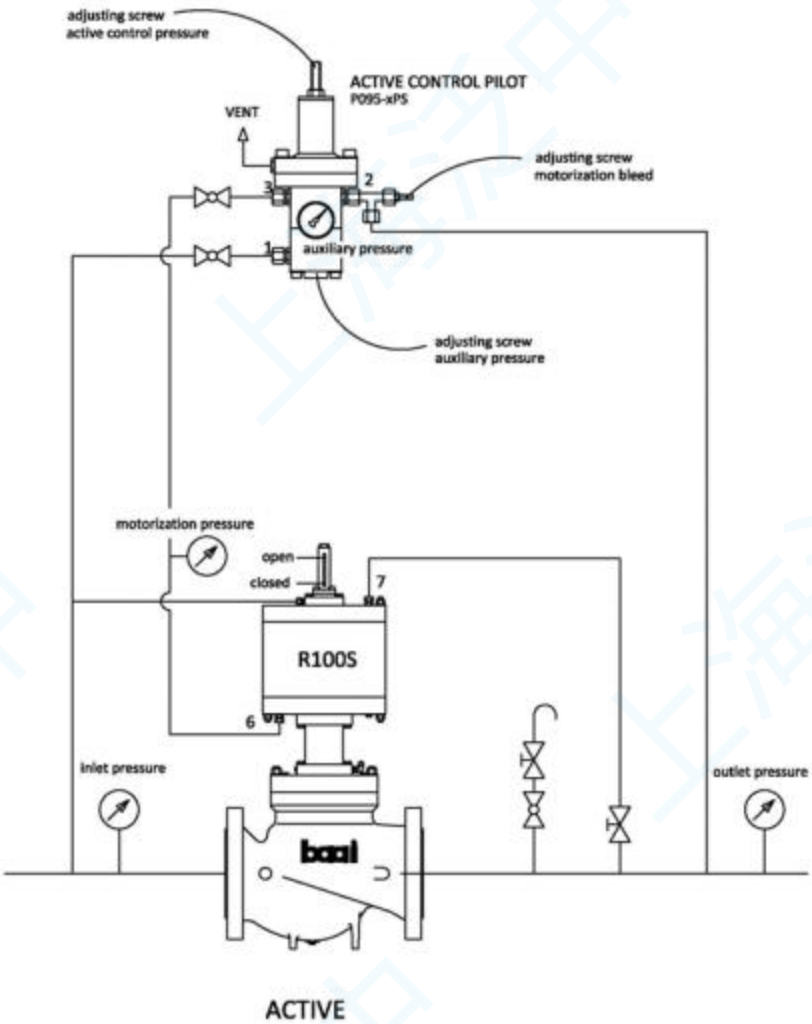

Fig. 4.1.1 Schematic of gas pressure reducing run

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 mainline valves and pilots; therefore purge and dry the upstream pipeline 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** (item 1, fig 5) 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) ½ turn
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 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

Adjustment notes:
. adjust pilots for active and monitor 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 setpoint

. 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

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 (1) 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 (1) 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 it's 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 setpoint

- 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 with Wide-Open Upstream 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:

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 setpoint adjusting screw of the pilots until after the run is depressurized.

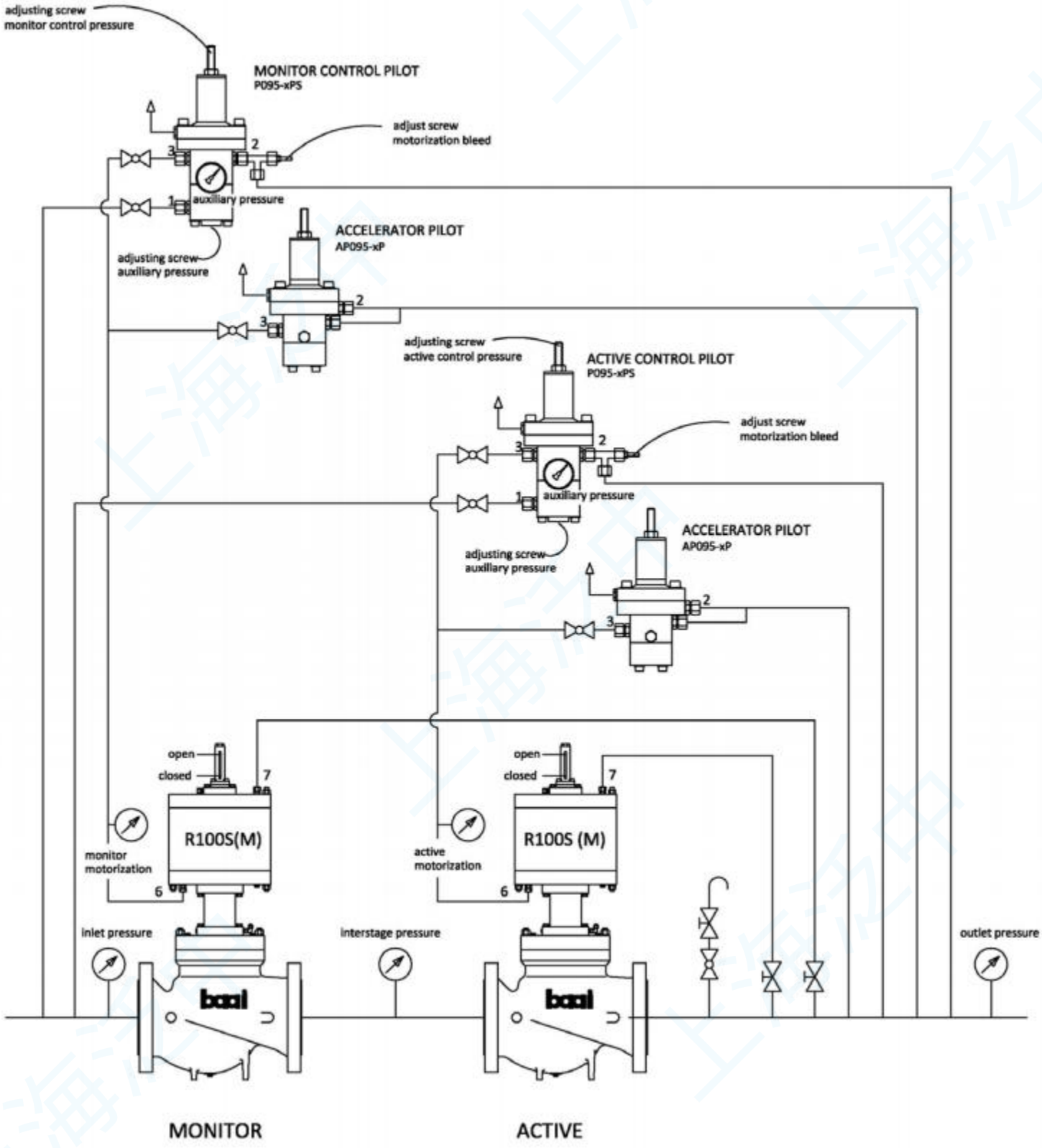

Fig. 4.2.1 Schematic of gas pressure reducing run with monitor regulator

Commissioning

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 (items 1 & 12,fig.6).
  . fully close (turning CW) the adjustable motorization bleed (@ connection no. 2 of pilot)

2. Turn Adjust Screw of both Accelerators fully Inward.
  . (item 15)

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) ½ turn

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 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

Adjustment notes:
. adjust pilots for active and monitor 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 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
. take note that test valves A11 and A21 enable differentiation between the 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 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 (1) 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 (12) 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)

. decrease the outlet pressure to the accelerator setting by slowly backing out the adjust screw (12) of the monitor pilot
. now open the purge valve enough to open the monitor MLV *slightly*
. back out the adjust screw (15) 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 (12)
. 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 the outlet pressure by slowly backing out the adjusting screw of the active (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.

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

Commissioning

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 motorizationis 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 it's setpoint after fully opening the outlet block valve.

15. After Completing Commissioning

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

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

. switch over to the standby run by decreasing active setpoint
. 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:

Set point AP095-MP : set point monitor regulator + 0.3…0.5 bar
Set point AP095-HP : set point monitor regulator + 0.3…1 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 choosen **low enough** to enable trouble-free relatching of the slam shut. (the minimum relatching differential)

. Outlet Pressure Ranges

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

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

*) DIN DVGW-approval up to 12 bar (extended range up to 15 at request)
**) DIN DVGW-approval from 8 bar on

. Auxiliary Pressure Range & Setting

The auxiliary pressure is the output of the first control stage of the P095 and is adjustable between approx. 2 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 (6) and (17).

. 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 betaken 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 Maintenance
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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)：

Molykote BR2 plus
Molykote CU-7439-plus
White grease + PTFE (spray)
Dupont Krytox GPL 206
Parker Super-O-Lube
Fastorque A/G

Lubricants (oil)：

Shell Madrela GS 68

Thread lockers：

Loctite 243
Loctite 222

Sealants：

Loctite 577

Cleaning materials：

Loctite 7063
3M Scotch-Brite Hand Pad

5.3 Guidelines

Unless otherwise indicated, all screw and bolt connections <M10 are to be greased with a graphite-containing high-pressure grease. We recommend Molykote BR2 plus.

Screw and bolt connections >M10 are to be greased with copper-containing grease. We recommend Molykote. CU-7439-plus

To avoid galling on thread connections between stainless steel parts we recommend Fastorque A/G

For both assembly and preservation purposes, all O-rings are to be greased with a suitable product. We recommend Molykote BR2 plus for static seals and Dupont Krytox GPL 206 or Parker Super-O-Lube for more demanding and dynamic seals.

All guiding surfaces are to be treated with a suitable grease. We recommend Dupont Krytox GPL 206
To preserve internal surfaces we recommend use of white spray grease.

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.

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 mainline valve is lubricated with oil (Shell Madrela GS 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

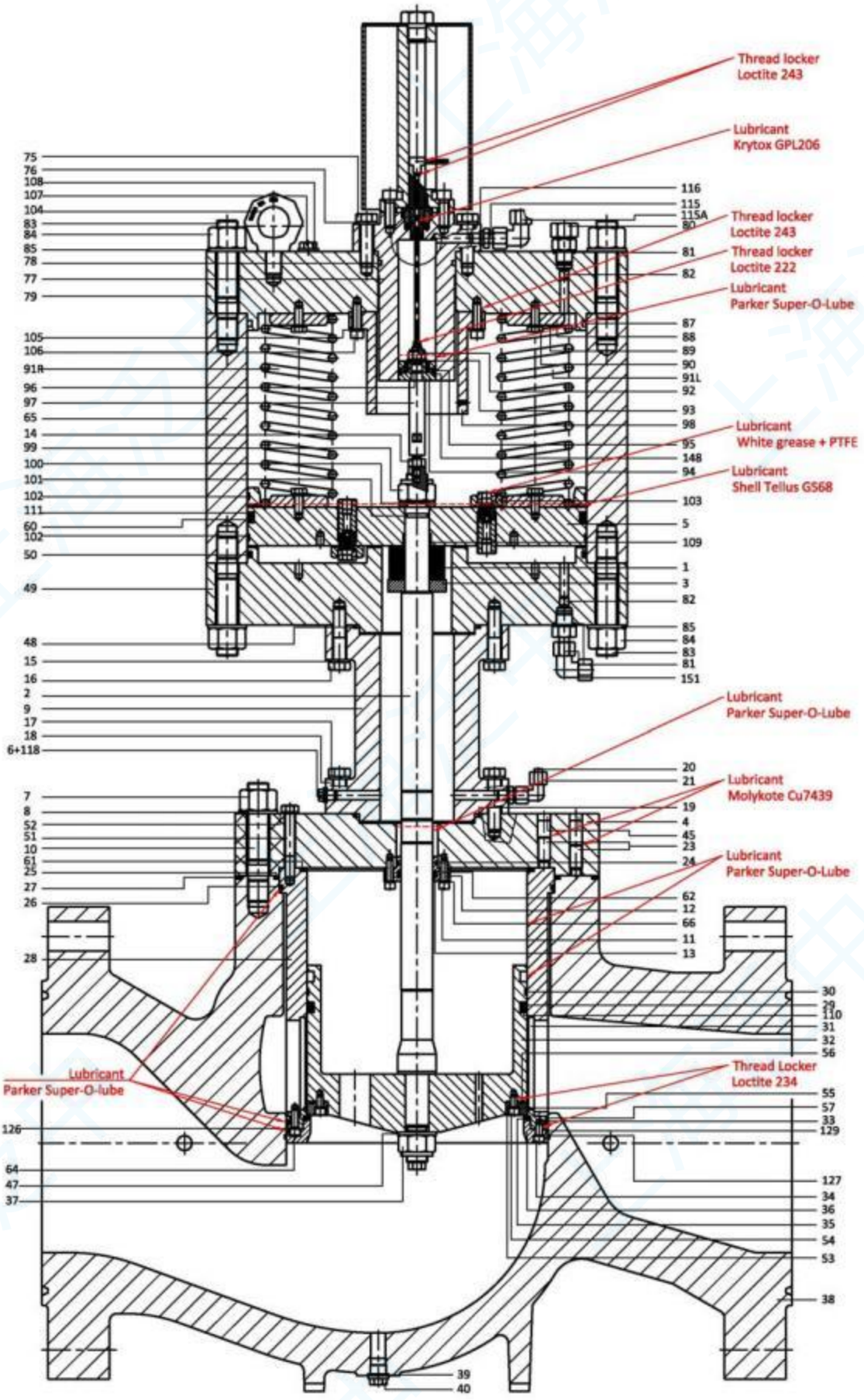

Fig. 5.5.1 Cross Section of Main Line Valve Series R100 typical R100S-M 12”

5.6 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 befitted.

See fig. 5.6.1 and 5.6.2 for relevant cross sections

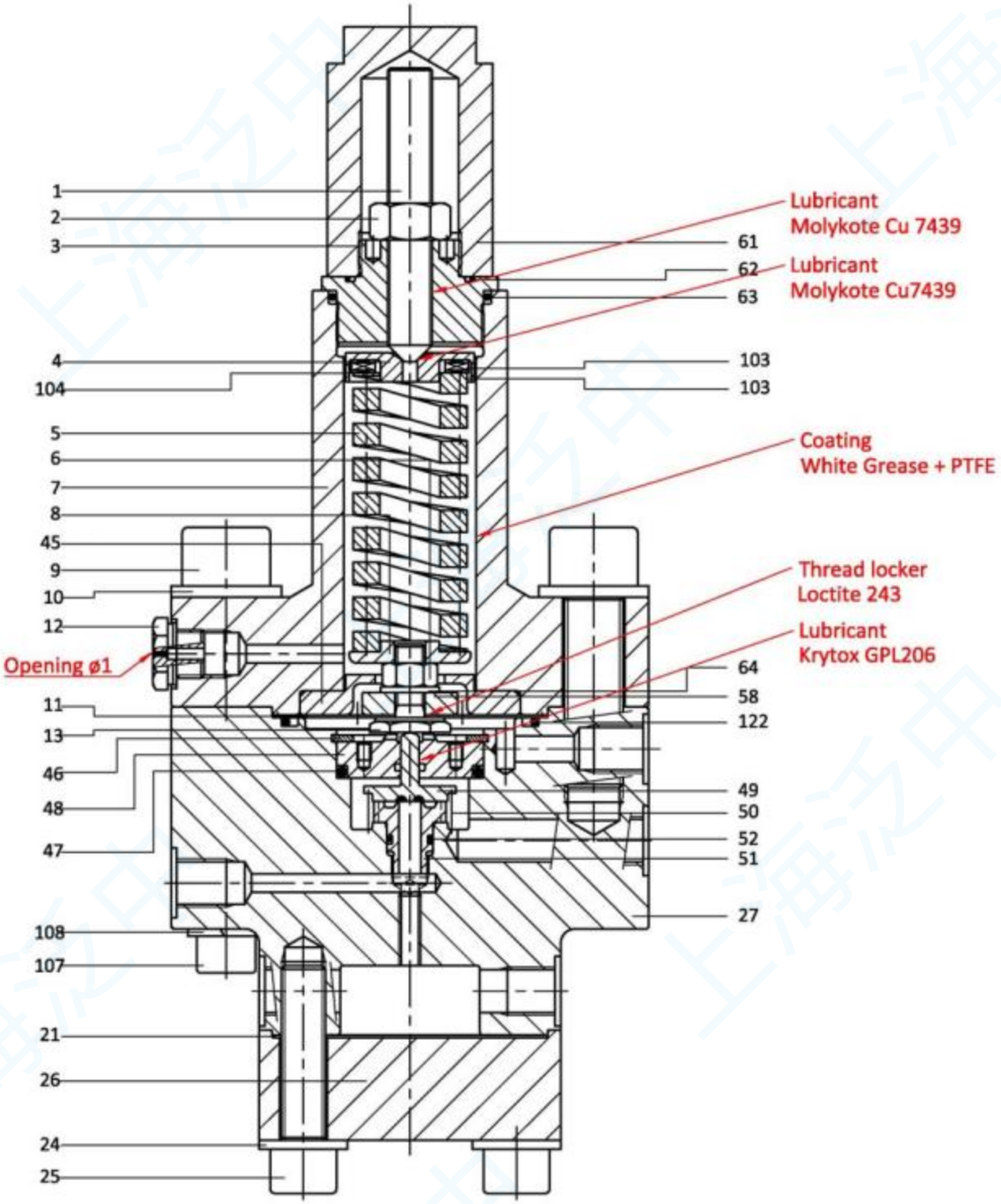

Fig. 5.6.1 Cross Section of Switch-over Acceleratorr Series AP095 typical AP095 xP-1500#

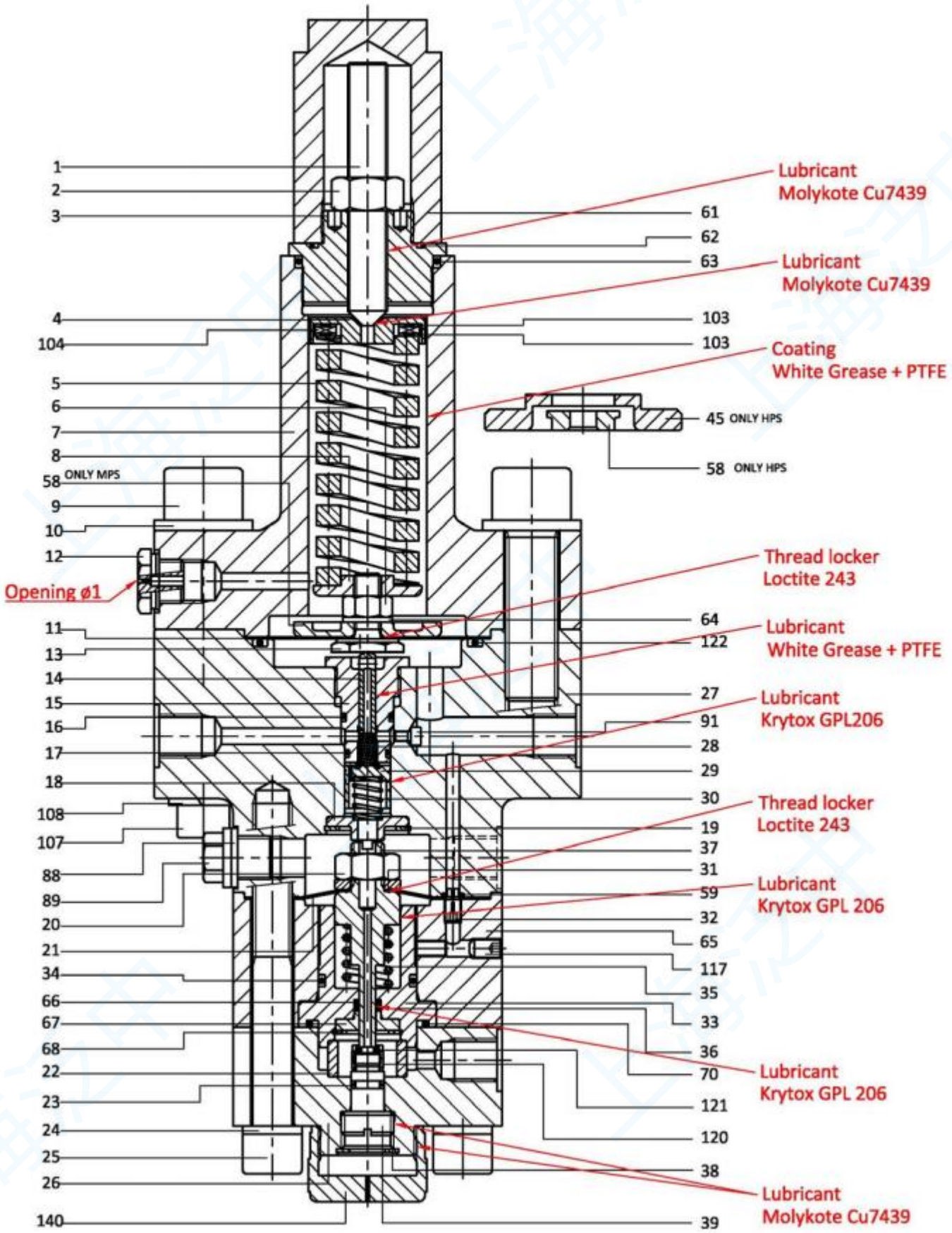

Fig. 5.6.2 Cross Section of Controller Series P095 typical P095 xPS-1500#

5.7 Periodic function test

Recommended periodic function test sequence：

Decommission the duty run by switching over to the standby run by decreasing the active setpoint. 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 mainline valve or result from errative setting.

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 interstage pressure to settle). Otherwise this may indicate leakage of the active.mainline valve or result from errative setting

(3) Tightness of the monitor regulator

Open the bleeder plug or purge valve of the spoolpiece 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 interstage pressure to settle). Otherwise this may indicate leakage of the monitor line valve or result from errative setting.

(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

5.8 Spare part sets

General

For standard maintenance, 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.

Set of Spares (A)P095-xP(S)

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

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

Spare part sets R100S(M)

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

Type	Number	Type	Number
R100S 1” - 300/600	939402 S141830	R100S-M 1”- 300/600	939402 S141840
R100S 1” - 1500	939402 S134470	R100S-M 1”- 1500	939402 S179600
R100S 2” - 300/600	939402 S116920	R100S-M 2”- 300/600	939402 S1278 80
R100S 2” - 1500	939402 S131340	R100S-M 2”- 1500	939402 S140920
R100S 3” - 300/600	939402 S116930	R100S-M 3”- 300/600	939402 S127890
R100S 3” - 1500	939402 S150100	R100S-M 3”- 1500	
R100S 4” - 300/600/900	939402 S116940	R100S-M 4”- 300/600/900	939402 S115200
R100S 6” - 300/600	939402 S116950	R100S-M 6”- 300/600	939402 S127480
R100S 8” - 300/600	939402 S116960	R100S-M 8”- 300/600	939402 S127910
R100S 8” - 1500	939402 S177720	R100S-M 8” - 1500	939402 S177720
R100S 10"- 300/600	939402 S171600	R100S-M 10"- 300/600	939402 S171600
R100S 12” - 300/600	939402 S150490	R100S-M 12"- 300/600	939402 S150490
R100S 12” - 900	939402 S173990	R100S-M 12” – 900	939402 S173990

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

5.9 Cross Section P095-xPS-900/1500#

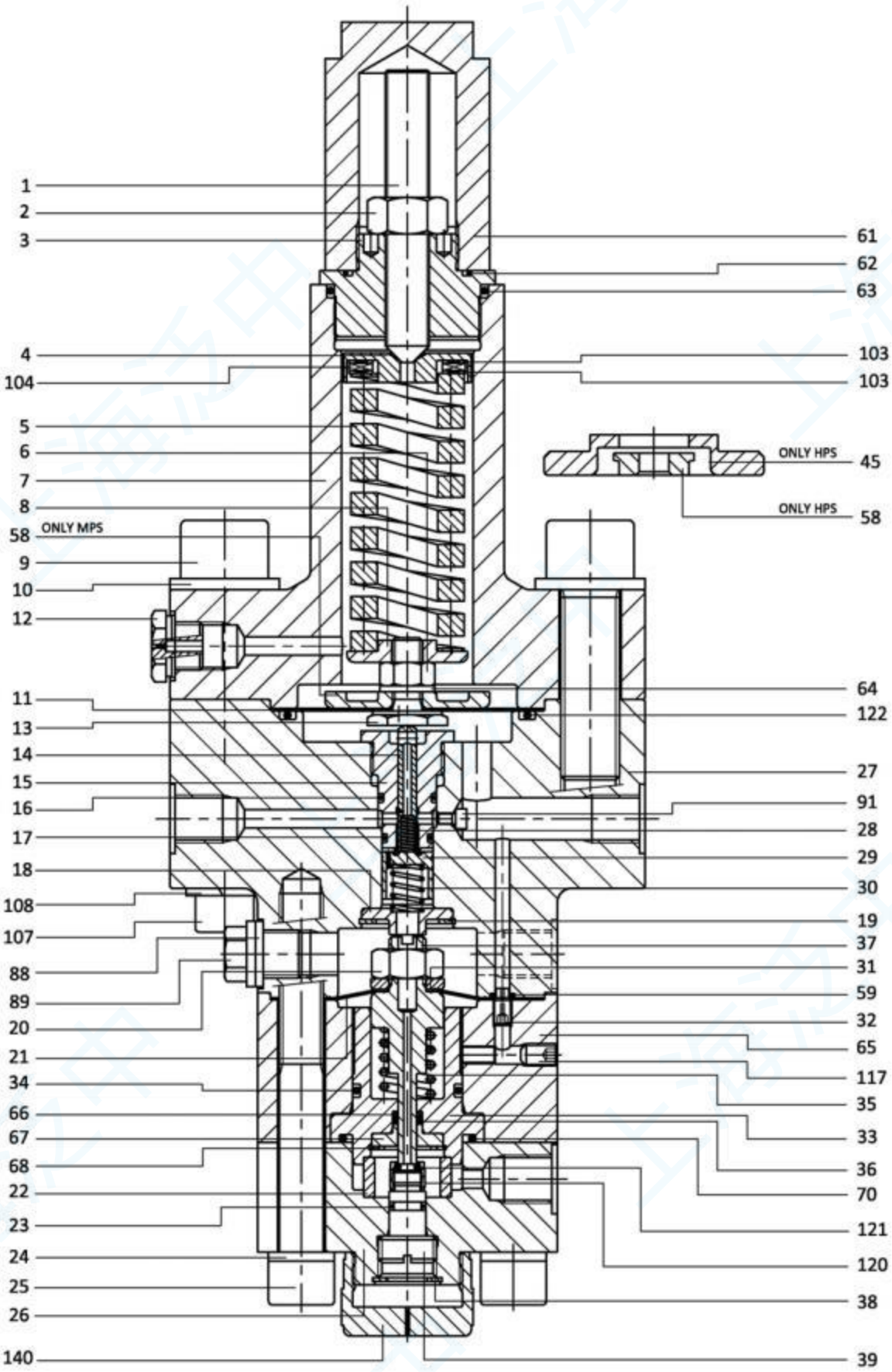

Fig. 5.9.1 Cross section of P095 xPS-900/1500#

Pos	Designation	Spares	Pos	Designation	Spares
01	Set screw		31	Spring seat	
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	Seat	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	Plug	
22	Filter	x	89	Ring	
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

Fig. 5.9.2 Parts listing of P095 xPS-900/1500#

5.10 Cross Section AP095-xP-900/1500#

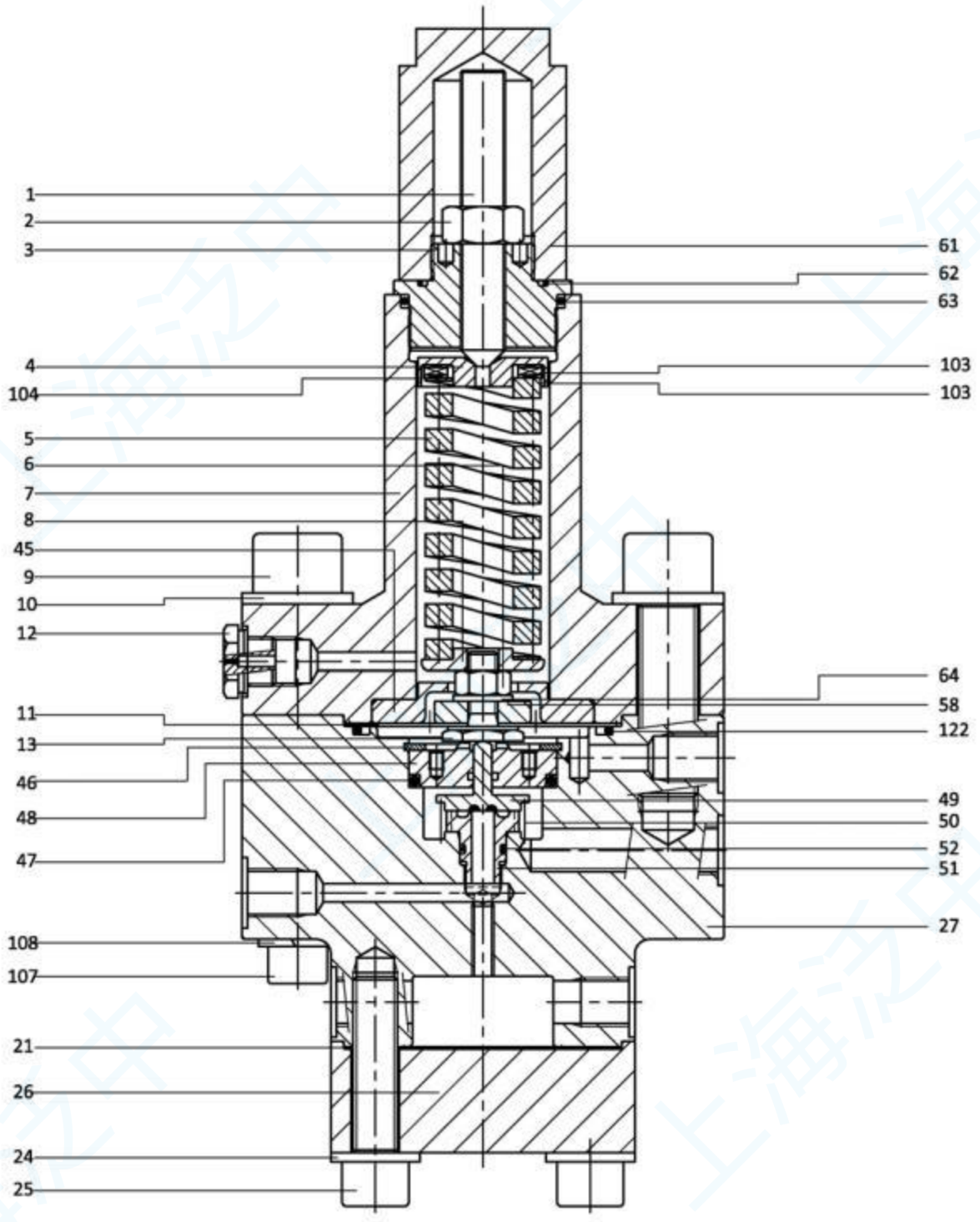

Fig. 5.10.1 Cross section of AP095 xP-900/1500#

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				

Fig. 5.10.2 Parts listing of AP095 xP-900/1500#

5.11 Cross Section R100S(M)-900/1500#

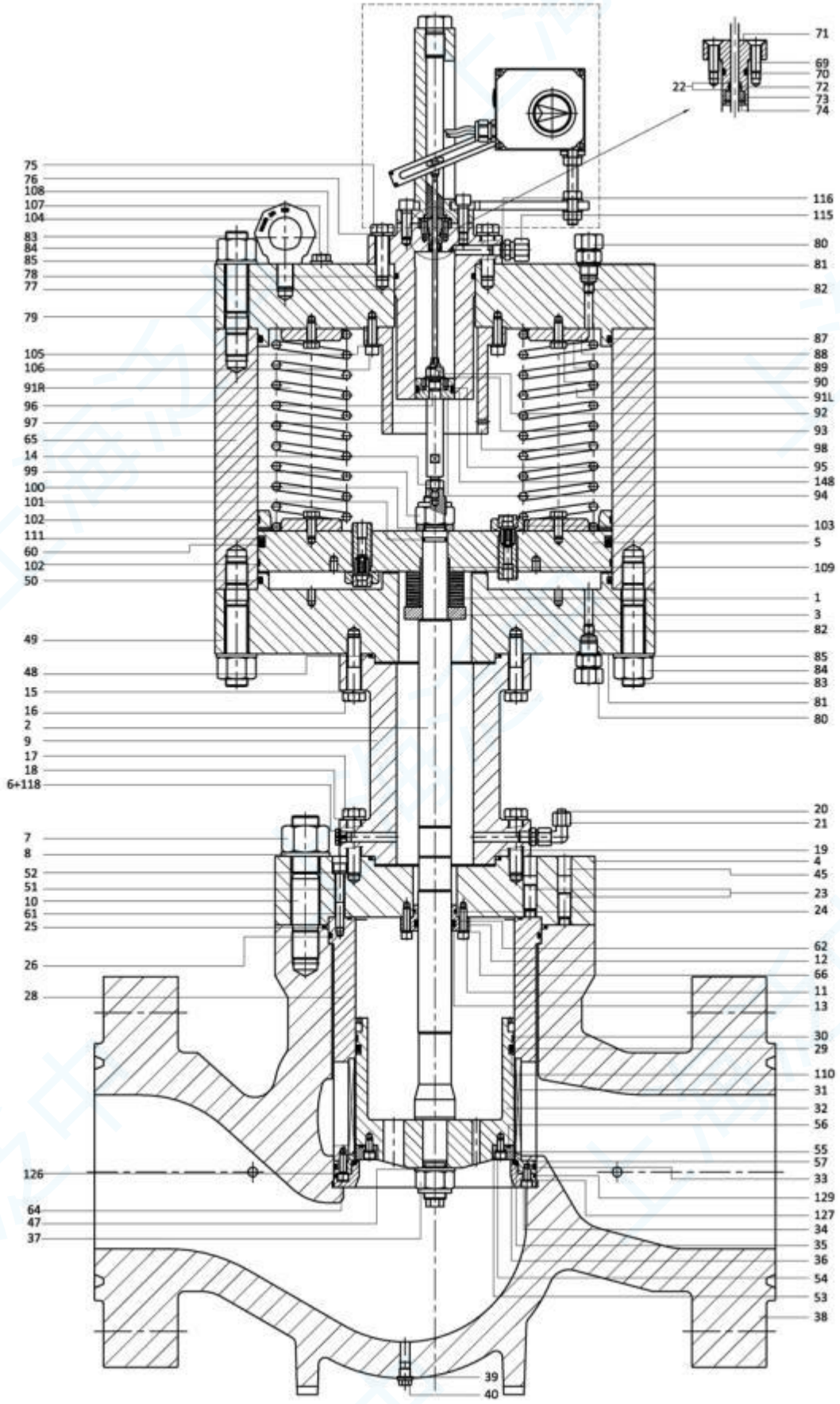

Fig. 5.11.1 Cross Section of R100S(M), typical 8"-900#/1500#

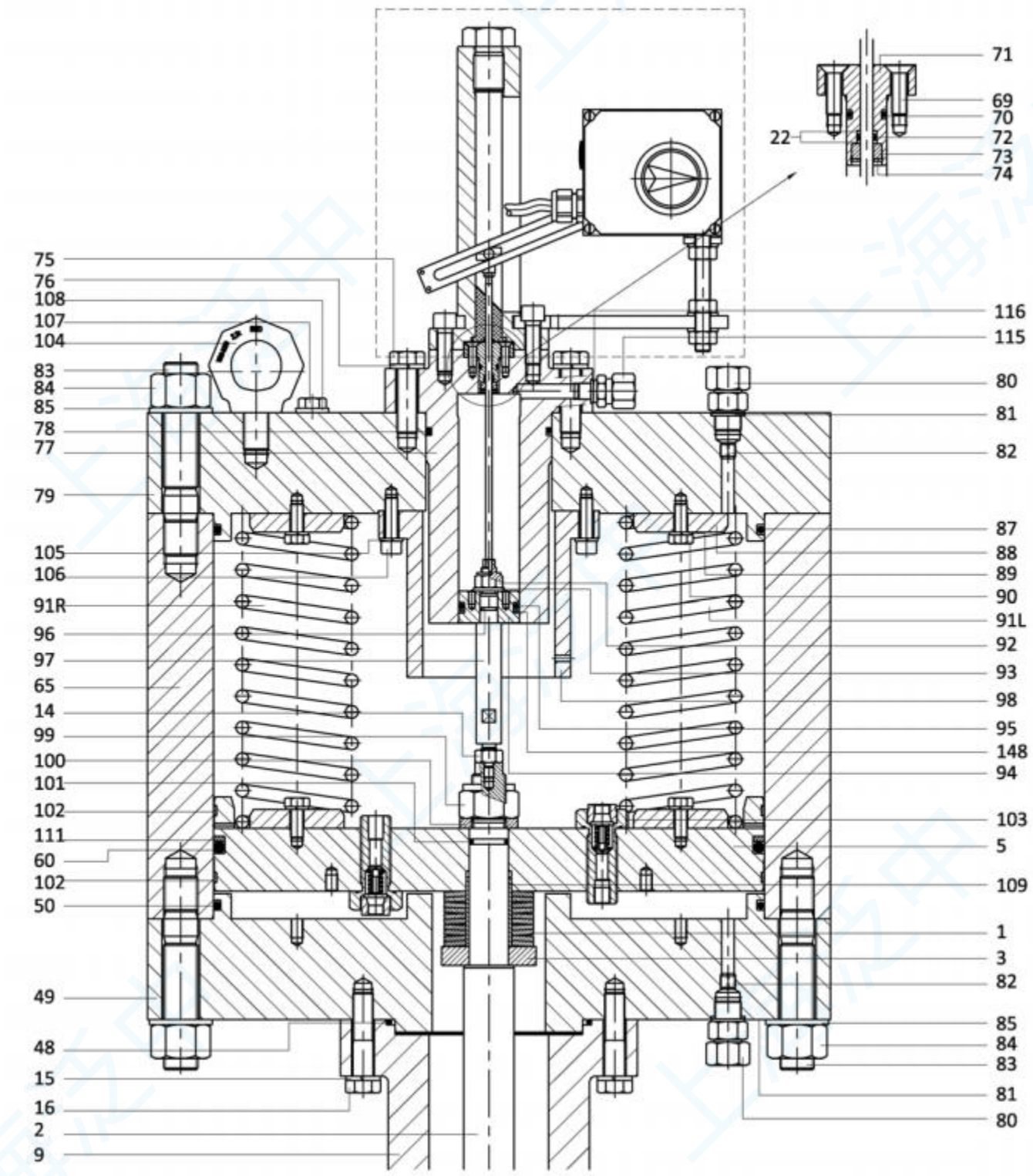

Fig. 5.11.2 Cross Section of R100S(M)

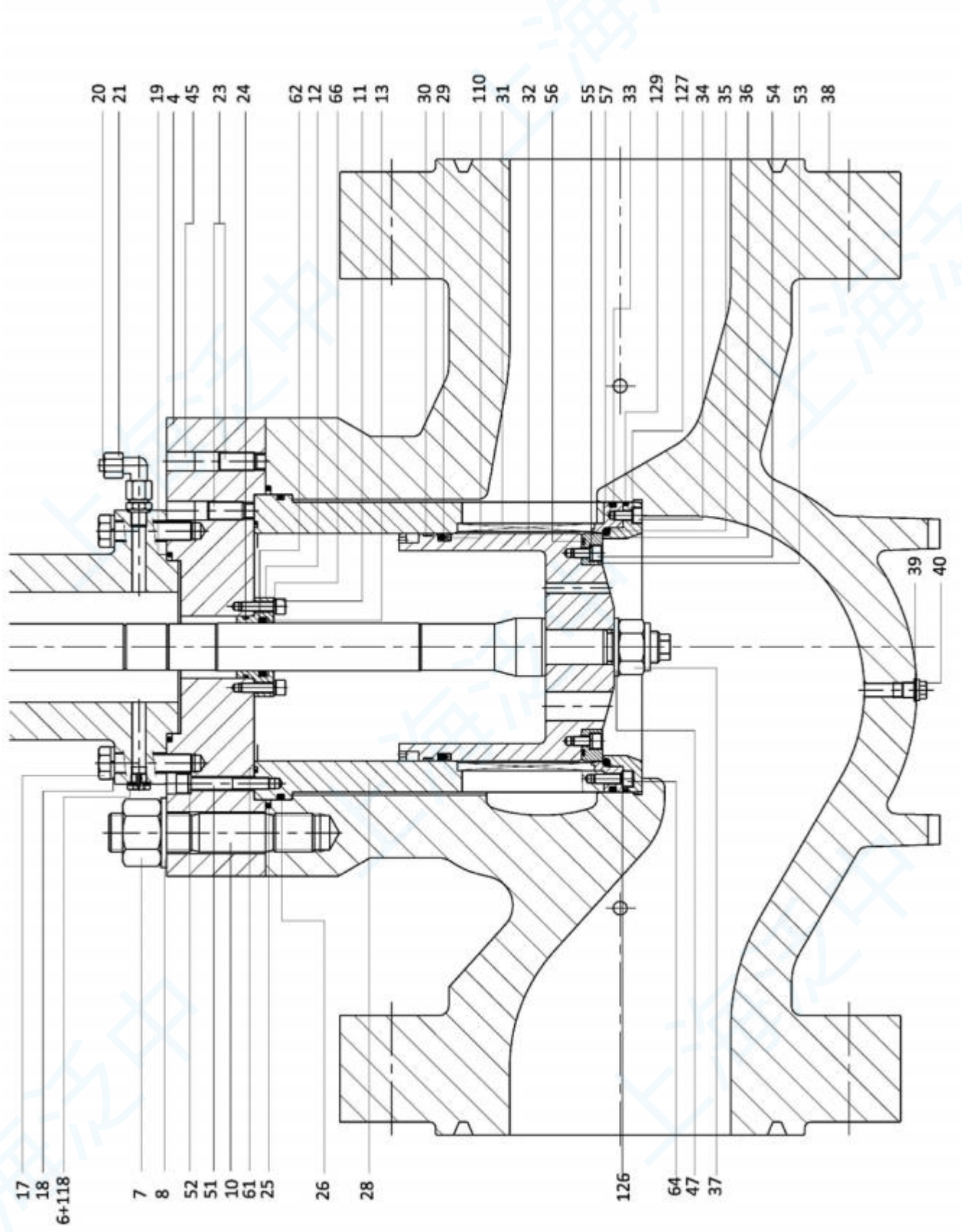

Fig. 5.11.3 Cross Section of R100S(M)

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

Fig. 5.12.4 Parts listing of R100S(M)

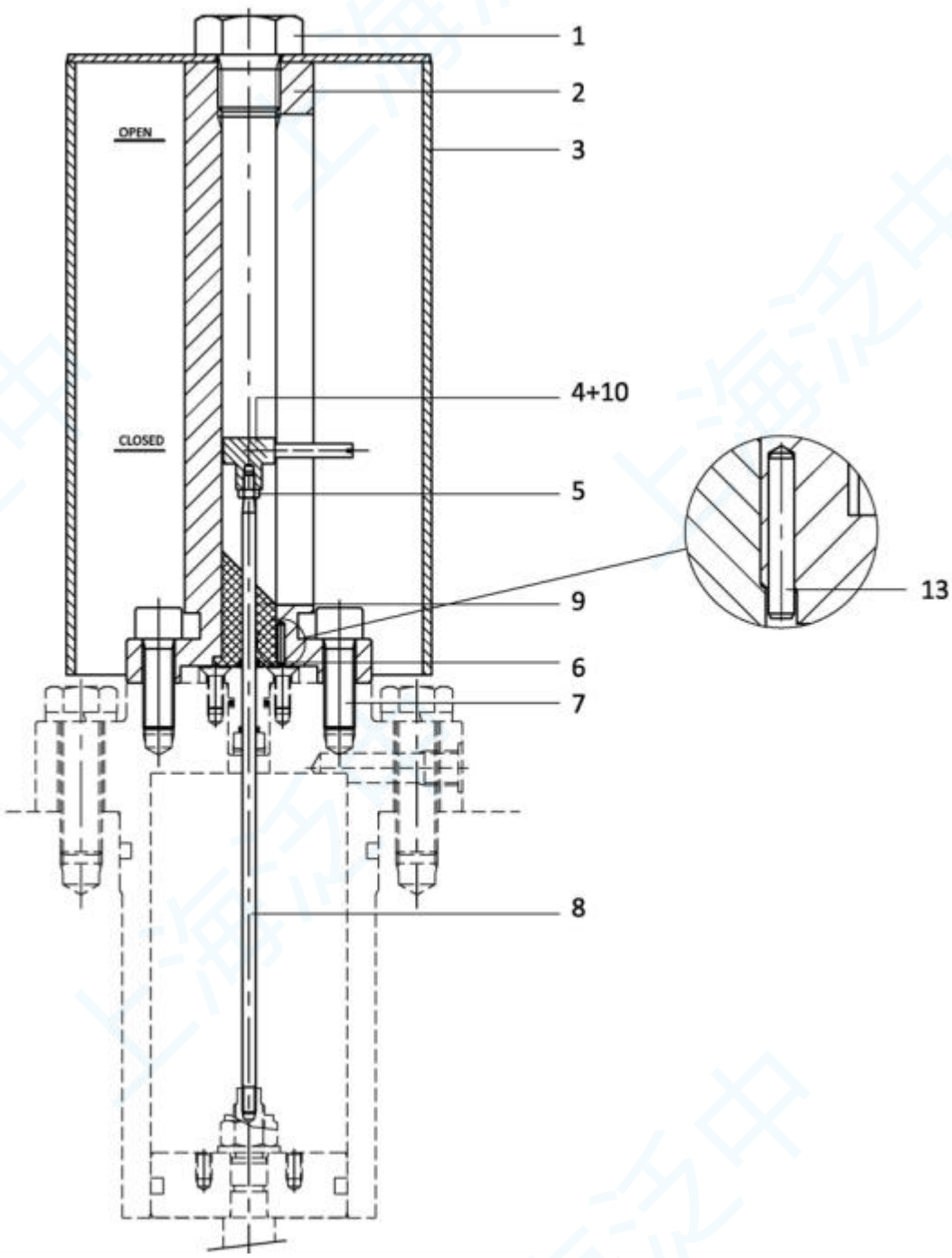

Fig. 5.11.4 Cross Section of position indicator for R100S(M)

Pos	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. 5.11.5 Parts listing of position indicator for R100S(M)

6 Trouble Shooting

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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 built up 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 at zero demand pressure will increase above foreseen settings	Readjust both monitor and switch over accelerator pilot (see 4)
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 built up 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 <u>normal operation</u>	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

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 auxilairy 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 mainline valve shall be free of excessive friction. Abnormal friction may result from : - 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 Gorter
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 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

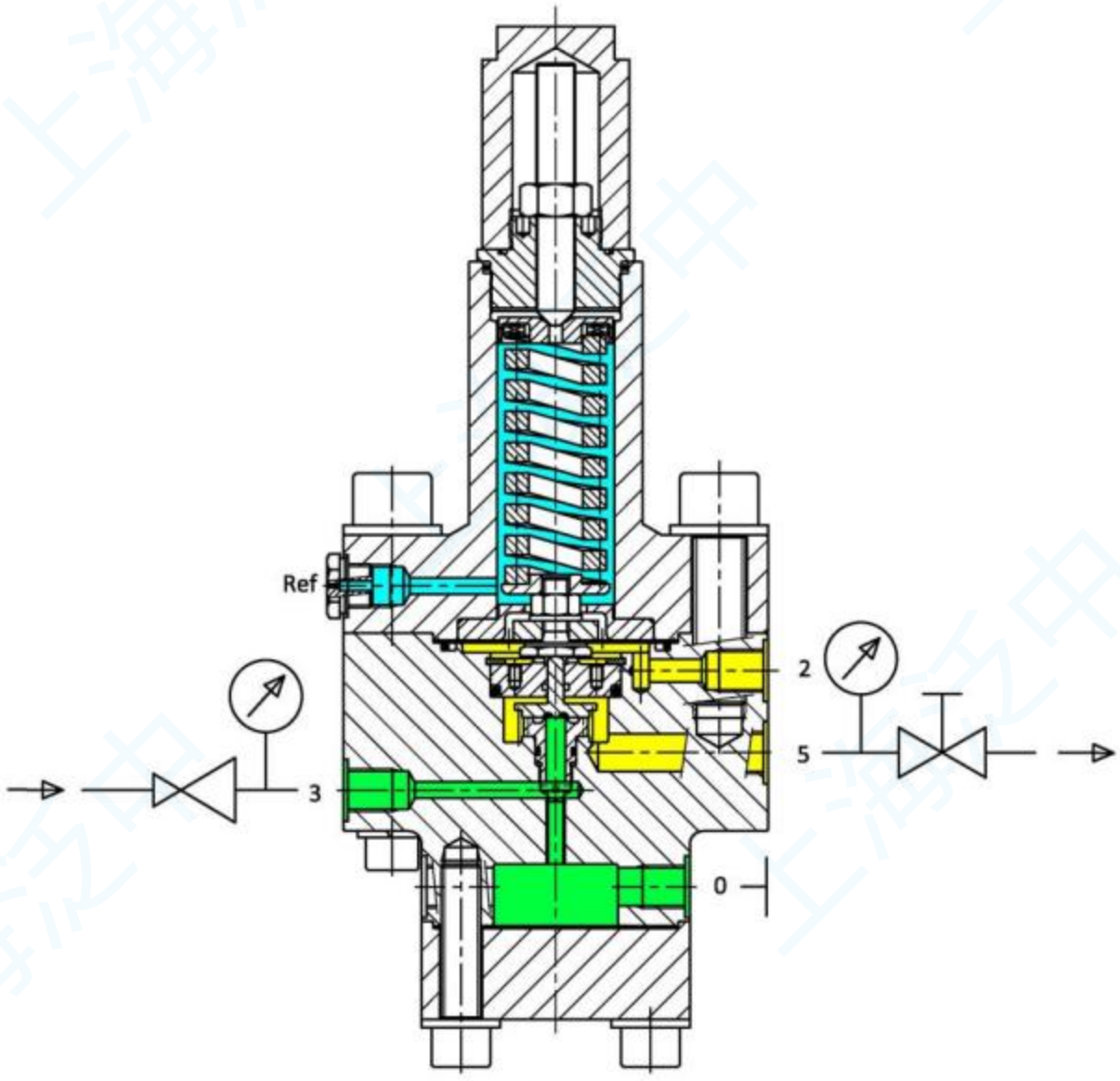

Fig. 5.12.4 Colored Test Setup for AP095 xP

Pressure Controller 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 indicates 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.

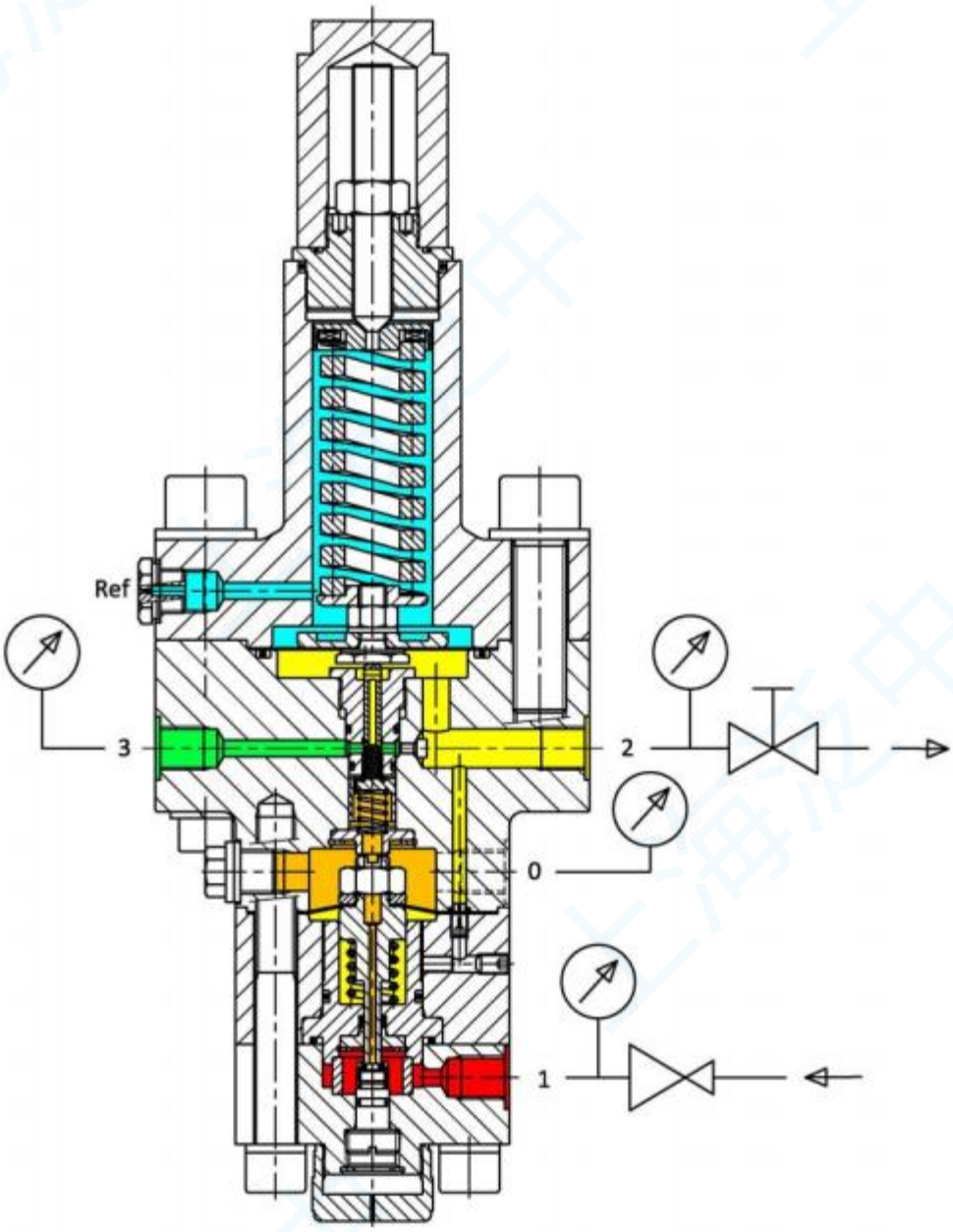

Fig. 6.2 Colored Test Setup for P095 xPS