CSA waterworks line

Upstream pressure sustaining/relief pilot operated automatic control valve

Mod. XLC 420

Rev. 1 – 12/2014

Introduction

This manual will provide you with the information to properly install and maintain CSA automatic control valves XLC 400 series. The contents and the procedure are intended for technicians in charge of CSA valves only, prior to a theoretical and practical training by CSA qualified personnel only.

Safety

All safety messages in the instruction manual are flagged with the following symbol meaning danger, caution and warning. This means and makes reference to procedures that may lead to equipment and system damage and to severe injury or death for the personnel involved.



WARNING!

Personnel involved in the installation or maintenance of valves should always be alert to potential emission of water and pipeline material, and take the necessary safety precautions. Always wear the suitable protection like helmets, gloves, googles, when dealing and handling hazardous pipelines and valves.

Inspection

Your valve XLC series has been packaged to provide protection during shipment, however it can be damaged during transport. Please carefully inspect the unit for damages or discrepancies with the order upon arrival and report a claim immediately before unloading the goods.

Parts

Recommended spare parts for each components are listed on the respective assembly drawings depicted on the following pages. These parts should be stocked to minimize delays in case of malfunction. When ordering spare parts please make reference to the assembly drawing and identification plate present on the valve.

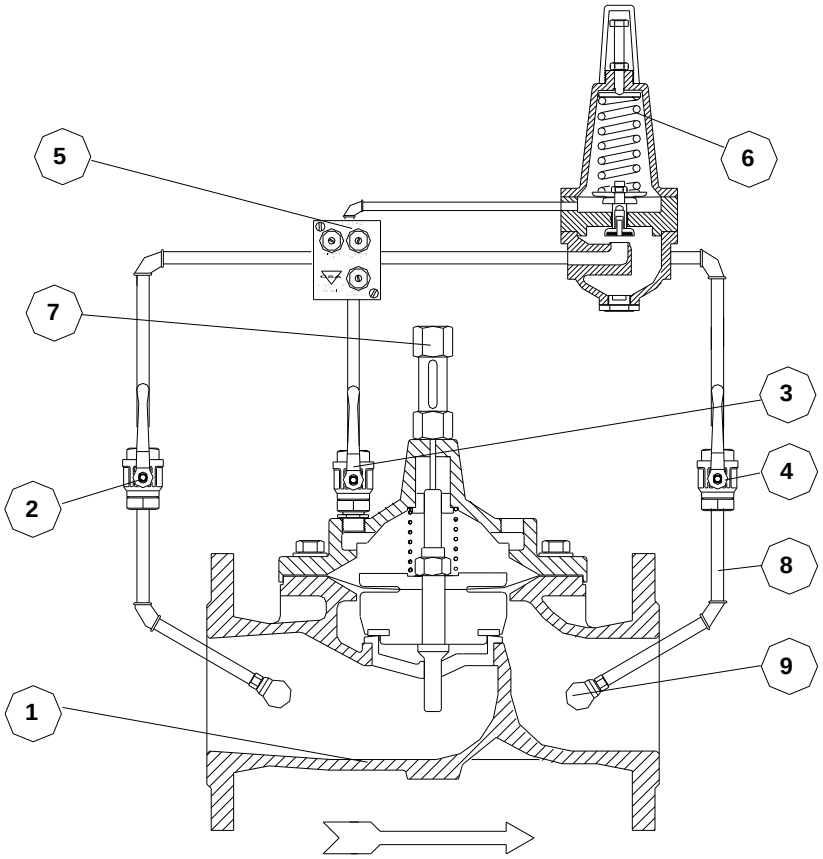
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Description

The pilot operated control valve XLC 400 series Mod. 420 is designed to automatically sustain and relief a upstream pressure value, regardless of variation in demand and upstream pressure fluctuations.

Picture 1



N.	Component	Material
1	Main valve XLC 400	GJS 500-7
2	Isolation valve	AISI 316
3	Isolation valve	AISI 316
4	Isolation valve	AISI 316
5	Grifo 3/8"	AISI 303
6	"MSM" pilot	Bronze/AISI 303
7	Position indicator	Brass/AISI 303
8	Pipes	AISI 303/316
9	Fittings	AISI 316

Handling and storage

Lifting the valve improperly may damage it and the equipments around. It is mandatory not to fasten the valve around the circuit, fittings, pipes, solenoids or position indicators. Valves must be lifted only by cables, chains, located around the body, through the flanges holes or eyebolts. During hoisting always consider that the center of mass depends on the circuitry and pilots installed.

If installation will be delayed place the valve indoors in a secure watertight storage. Should that be unavailable use a vermin proof rain cover around the valve to keep off rain , mud , humidity. Place the valve on a solid and well drained surface base to prevent moisture, flood from reaching the body.



WARNING!

Lifting the valve in the wrong way may cause malfunctioning, emission of water spurts, injuries to the personnel and permanent damages of the valve.

Installation

The automatic control valve XLC 400 must be always installed in a horizontal position with the bonnet upwards. Smaller valves, (up to 150 mm) can be installed in a vertical pipe shouldn't be unavoidable. Prior to that consult us and specify the orientation in the order. A stable and non pulsating source of pressure is necessary for the proper performance of CSA control valves, whose minimum pressure is displayed on the technical brochure and always 0,5 bar on the pilot in addition to the headloss produced during working conditions.

- Gate valves or other sectioning devices must be installed upstream and downstream of CSA control valves to allow for maintenance.
- The operating fluid must be free of air, air valves (CSA Mod. FOX 3F AS combination anti-slam) should be installed downstream and upstream. This to avoid the accumulation of air pockets during working conditions, allow air discharge during pipe filling and entrance in case of pipe burst and draining.
- A suitable by-pass should be provided for servicing of the valve without interrupting the flow. For the by-pass sectioning do not use standard gate valve, likely to get damaged during modulation, but rely on globe pattern gate valves and/or CSA direct acting pressure sustaining / relief valves Mod. VSM.
- If not included in the order install pressure gauges upstream and downstream if necessary, a flow measurement device is always recommended to make sure hydraulic conditions remain within the values used for sizing.



WARNING!

Using the valve with extreme low flow rate and/or excessive differential pressure conditions may cause pulsations and instability. Please make reference to the recommended flow and pressure charts or contact CSA for assistance with the proper sizing.

- A strainer with suitable basket and mesh should be installed ahead of the valve to protect internal components from debris, particles and foreign material.
- Sufficient space should be provided around the valve for disassembly.
- Check direction of flow and make sure it is according to the marking on the valve's casting.
- Make sure the flanges and pipes connection are according to the valve's standard. The nuts and bolts setting has to be conducted in the proper way, gradual and symmetrical, in order not to produced additional stress and deformation.
- During handling be sure not to damage the glass of the position indicator, if present.

Set up

For the proper set up of XLC 400 Mod. 420 reader is advised to use the following points (rif. picture 1 on page 4).

WARNING!

The set up and valve regulation has to be carried out by qualified personnel only, or directly from CSA service. Improper actions can lead to permanent damages to the valve, its internal components and system equipments along with possible injuries of the people involved.

- Make sure the isolation ball valves of the circuitry (2-3-4) are fully open
- The valve is at first isolated from the main line as both sectioning devices, upstream and downstream, are closed.
- Unless a specific setting has been required in the order remove the hood from the pilot (6)

WARNING!

The difference in pressure generated by the valve during the pressure sustaining/relief function will produce a thrust proportional to the pressure itself.

Anchorage blocks and way of preventing valve's movement or shifting need to be taken into account.

and turn clockwise the screw to increase the spring force in the cover almost completely. The upstream set pressure depends on the pilot setting and it is proportional to the charge of the spring. Regulation chart are available on request. Doing so the valve will be brought to the closed position as the upstream set point would become higher than the incoming pressure.

- Slowly operate on the upstream gate valve to open it by 30 %, leaving the downstream sectioning device completely closed.
- Pressure will enter the valve's body, circuitry and bonnet pushing down the diaphragm and mobile block against the obturator and inducing the valve's closure
- Remove the air entrapped in the bonnet, during the operation, by means of the air release device located on top of the position indicator (7) leaving it flowing for at least 20 seconds.
- Open completely the upstream gate valve
- Slowly open the downstream gate valve, to a maximum of 40% of the stroke, act on the spring on the pilot decompressing it to generate some flow through the valve and allow for some time to react, this depends on how big is the system downstream and on the variations in demands.
- Having generated the flow it means that the upstream pressure set point has reached the incoming pressure value.

- Slowly act on the regulation screw on the pilot (6) turning it clockwise to limit the flow increasing the upstream pressure to be sustained or anticlock wise to increase the flow reducing the upstream pressure to be sustained , the variation in pressure depends on the spring range used, and can vary from 0,47 bar to 0,95 bar per revolution with the most

> **WARNING!**
>
> **Regulations of pilots has to be carried out slowly to avoid unwanted pulsations and pressure surges. Always leave enough time for the system to balance, in case of doubts and problems allow for some flow through the by-pass to stabilize the line and call CSA technical support.**

common springs used. Please consult us for more details.

- Once the valve has reached the desired value set the locking nut and place the hood on top of the pilot. Open the downstream gate valve completely then and check once again the pressure gauge and the flow meters.
- The unit flow control device GR.I.F.O. is exclusive from us and contains needle valves, filter and check valves used for the proper valve's stability and regulation. If present do never change the settings before consulting with our technical support.

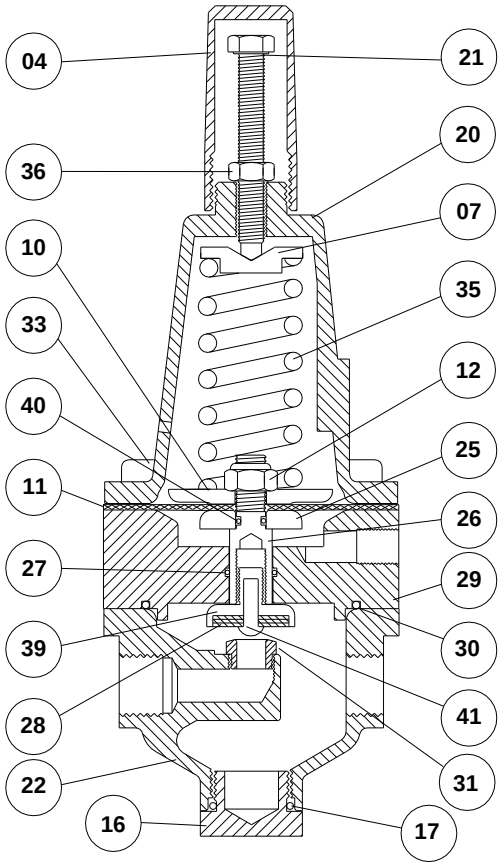
Valves epoxy painted FBT

> **CAUTION!**
>
> **Valves epoxy painted using FBT requires washers flat washers to be installed on the flanges connections to prevent the paint from cracking or chipping.**

Maintenance

CSA automatic control valves XLC 400 series have been designed with a sturdy and reliable construction to minimize servicing and possible malfunctioning. However we recommend to inspect them at least twice per year releasing the air accumulated inside the bonnet and checking the strainer inside the GR.I.F.O, if present, or placed as a separate entity in the circuitry. We recommend a thorough inspection and maintenance with complete disassembly every 4 years, according to the following instructions.

MSM – Upstream pressure sustaining/relief pilot



N.	Component	Material
4	Cap	Brass
7	Spring guide	AISI 303
10	Diaphragm upper flat	AISI 303
11	Diaphragm	Neoprene-Nylon
12	Self tightening nut	AISI 304
16	Tap	AISI 304
17	O-ring	NBR
20	Cover	Bronze
21	Driving screw	AISI 304
22	Body	Bronze
25	Diaphragm lower disk	Brass
26	Main shaft	AISI 303
27	O-ring	NBR
28	Gasket 16X3	NBR
29	Intermediate body	Brass
30	O-ring	NBR
31	Sealing seat	AISI 303
33	Screws M5X40	AISI 304
35	Spring	Stainless steel
36	Blocking nut	AISI 304
39	Gasket container	AISI 303
40	O-ring	NBR
41	Screw M3X6	AISI 304
Mobile block spare parts kit 10-11-12-25-26-27-28-31-39-41		
Set-up spare parts kit 7-21-35-36		

The upstream pressure sustaining/relief pilot is a diaphragm operated valve, spring loaded and direct acting, that can be installed basically in any position.

The function is nothing but to sustain or relief the upstream pressure regardless of flow rate and pressure variations.

Operation

The valve is normally opened thanks to the force exerted by the spring over the diaphragm, that is opposed to the upstream pressure applied directly below it.

When the upstream pressure exceeds the force of the spring the obturator is pushed up closing the passage through the pilot and therefore leading the pressure towards the main chamber and allowing for the valve to throttle, which will result in a pressure increase because of the head loss created between the valves inlet and outlet.

We obtain the regulation by acting on the screw (21), i.e. clockwise to increase the pressure and counter-clockwise to decrease it.

Disassembly

It is not necessary to remove the pilot from the circuit for the disassembly. Instead use the enclosed picture which indicates the numbers specified here below to perform the operations.

1- Remove the hood of the pilot (4) loosen the tightening nut (36) and turn the lead screw (21) anticlockwise, until the spring is completely unloaded.

2- Remove the screws (33) holding the cover (20).

3- Separate the cover, the spring (35) and the spring guide (7).

4- Separate the intermediate body (29) from the lower body (22) paying attention not to damage the o-ring (30)

5- Check the surface of the seat (31) making sure it hasn't been damaged or scratched

6- Holding the gasket container (39), using an aluminum vise or with buffers in order not to damage or scratch the material, with a monkey wrench 13 unscrew the tightening nut (12) to remove the upper flat (10) and the diaphragm (11).

7- With a monkey wrench 24 remove the lower tap (16) and clean it checking for possible dirt or debris , pay attention not to damage the o-ring (17)

8- Check the plane gasket (28) and, if damaged, contact us for further assistance.

Inspection and repair

During these operations carefully check every detail to find damage, in particular the diaphragm and the sealing seat gasket. The pilot is very sturdy and the materials are designed to guarantee many years of working conditions for which, generally, it is sufficient to remove the deposits and make sure to keep the metallic internal components properly lubricated. If that is not enough we strongly recommend you to contact us technical support or order the maintenance kit.

Reassembly

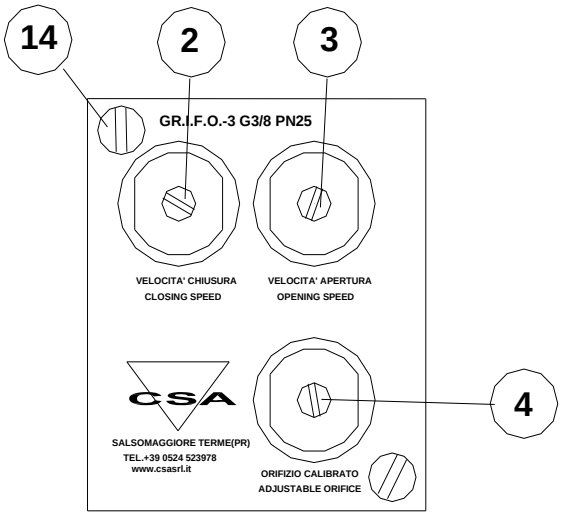
To reassembly the pilot you have to repeat, obviously in reverse sequence, the same steps specified in the dismantling phase, while paying attention to:

- Not to exert excessive torque on the locking nuts and upper flats so as not to wear the internal components, please contact us for any doubt related to the torque required to perform the operation.

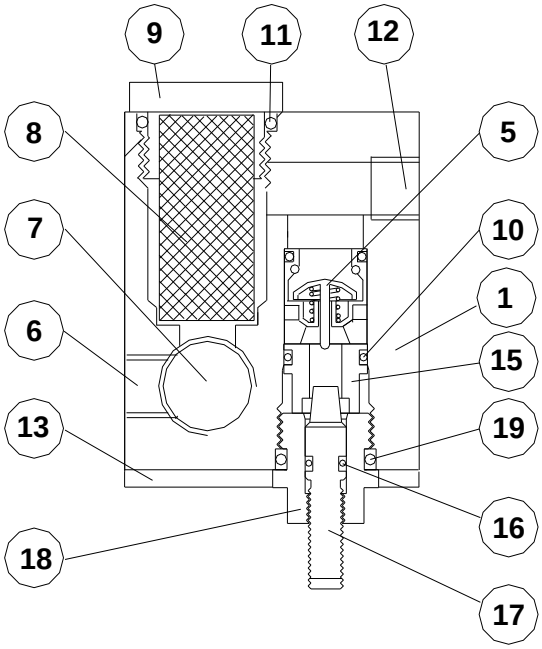
- Insert the o-rings back to their position properly lubricated

- Set the screws tight using a criss-cross pattern

GR.I.F.O. 3 – 3/8″ PN 25



N.	Component	Material
1	Body	AISI 303
2	Closing speed control	AISI 303
3	Opening speed control	AISI 303
4	Reaction time control	AISI 303
5	Check valve	Polyacetal
6	Not filtered pressure outlet 1/8G with tap	Brass
7	Inlet 3/8G	
8	Filter	AISI 304
9	Filter tap	AISI 303
10	O-ring	NBR
11	O-ring	NBR
12	Filtered pressure outlet 1/8G with tap	Brass
13	Cover	Plexiglass
14	Screws M4X6	AISI 304
15	Seal bushing	AISI 303
16	O-ring	NBR
17	Pin	AISI 303
18	Guiding nut	AISI 303
19	O-ring	NBR



Correspondance between the position and the DN orifice	
Turns in opening	DN mm
0,5	1.4
1	1.8
1,5	2.05
2	2.25
2,5	2.45
3	2.65
3,5	2.85
4	3
4,5	3.10
5	3.25
5,5	3.4
6	3.55

The “GR.I.F.O.” (Integrated Group Filter Orifices) is a CSA unit flow control device that includes all the necessary functions, needed for the proper regulation and stability of the main valve. Its compact design makes the entire circuitry easy to be maintained, simple and intuitive yet allowing a tremendous range of regulations compared to other solutions on the market.

It is completely manufactured in stainless steel AISI 303 and contains :

- a fine mesh filter in AISI 304 (8) to protect the pilot circuit from possible dirt, maintained simply by unscrewing the tap (9).

- the intervention also called reaction speed regulator* (4) of the main valve, and the opening (3) and closing (2) speed regulators* of the valve’s main chamber, independent one from the other, obtained by CSA fine adjustment needle valves.

- replaceable check valves placed upstream of every regulator to limit the flow and control the acceleration during the valve opening and closing.
- an upstream outlet not filtered protected by a cap 1/8 G
- an upstream pressure outlet filtered, 1/8 G, protected by an air valve.
- The adjustment is normally done in the factory although it is possible to modify it on the spot, in order to find the optimal regulation according to the function required.

Herewith enclosed are the optimal values for the most common XLC applications expressed in terms of revolutions, starting from the fully closed position and turning anticlockwise.

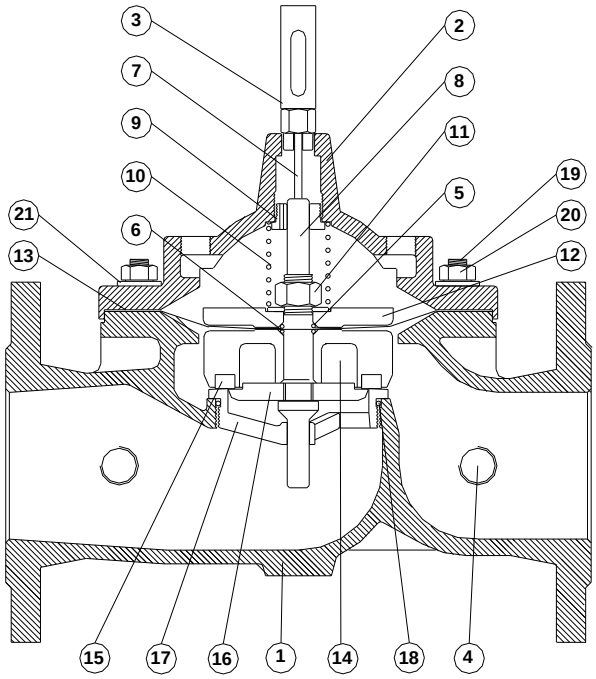
Type	Reaction speed	Opening speed	Closing speed
XLC 410	**3**	**1**	**5**
XLC 412	**3,5**	**4**	**4**
XLC 420	**3**	**3**	**4**
XLC 430	**3**	**1**	**5**
Others	**Please contact us for informations.**		

The regulators are needle valves designed by us and the rotation permits to obtain a specific passage. For example the regulation 3 means that, starting from the complete closed needle (turned clockwise), unscrewing 3 turns in opening you will get the indicated regulation.

Maintenance

The “GRIFO” is particularly sturdy, extremely simple and reliable so it does not require maintenance but we strongly advise to proceed regularly, at least twice per year, with a clearing of the filter from dirt and deposits, simply by unscrewing the tap (9) and washing the mesh. This procedure can be carried out without interrupting the flow through the main valve, and simply by isolating the main circuit by means of the isolation ball valve and removing the pressure right upstream of the GRIFO.

Interventions on the main XLC 400 valve



N.	Component	Material
1	Body	GJS 450-10 or GJS 500-7
2	Cap	GJS 450-10 or GJS 500-7
3	Position indicator	St. steel/Ni-plated brass
4	Pressure outlet tap	AISI 316
5	Upper flat o-ring	NBR/EPDM/Viton
6	Obturator o-ring	NBR/EPDM/Viton
7	Indicator stem	AISI 303
8	Main shaft	AISI 303/AISI 316
9	Guide ring	Bronze/AISI 303/AISI 316
10	Spring	AISI 302
11	Locking nut	AISI 303/AISI 316
12	Upper flat	Painted st./AISI 304/316
13	Diaphragm	Neoprene-nylon
14	Obturator	St. st./paint. st./GJS 450-10/500-7
15	Plane gasket	NBR
16	Gasket holder	AISI 303/AISI 304/AISI 316
17	Seat	AISI 303/AISI 316
18	Seat o-ring	NBR/EPDM/Viton
19	Studs	AISI 304/AISI 316
20	Nuts	AISI 304/AISI 316
21	Washers	AISI 304/AISI 316

In case of malfunctioning or defects, that can be found on the main valve, is possible to intervene without removing the product from the pipeline. The defects can be either internal and external.

The **external defects** mainly concerns the pilot circuit and are not related to the main body of the XLC 400 control valve.

The **internal defects** concern the mobile block, or the deterioration of the internal components.

Problems can be summed up in three categories:

a) the valve is blocked, the mobile block does not move;

b) the mobile block moves but the valve does not react because the diaphragm is damaged.

c) the diaphragm is OK but the valve does not close or leakages is reported.

The possible causes lead to:

- **defects on the diaphragm;**
- **defects on the movements of the mobile block;**
- **friction caused by deposits and corrosion;**
- **problems on the gaskets;**
- **defects on the sealing seat.**

Problems solving

Problem	Cause	Solution
The main valve doesn't close	The gate valves are closed	Open the gate valves
	The ball valves of the circuit are closed	Open the ball valves
	There is no pressure inside the main chamber	Check the pressure coming into the circuit
	The diaphragm is damaged (see the following section "checking the diaphragm")	Replace the diaphragm
	The mobile block is stuck due to corrosion, deposits, cavitation	Clean the main shaft and replace all the components affected by deposit or corrosion
	The mobile block is stuck due to stones, pebbles, trapped inside the main body	Remove the material from the valve
	The plane gasket of the obturator of the main valve and/or of the pilot is ruined	Replace the plane gaskets
	The sealing seat is ruined	Replace the sealing seat
The main valve doesn't open	The gate valves are closed	Open the gate valves
	The ball valves of the circuit are closed	Open the ball valves
	There is no pressure on the main supply line	Check the upstream pressure
	The pilot set point is higher than the incoming pressure value	Reduce the upstream pressure set point by turning the screw anticlockwise to generate the opening
	The mobile block is stuck due to stones, pebbles, debris that remain trapped inside the valve	Clean the main shaft and replace all the components affected by deposit or corrosion

1) Checking the diaphragm

In order to verify if the diaphragm has suffered any damage simply proceed as follows:

a) slowly close the upstream and downstream gate valves;

b) close all the ball valves of the circuit;

c) completely open the air vent valve from the position indicator, if the latter is not present the fitting of the isolation valve on the chamber;

d) open the upstream gate valve slowly but not completely little by little so that the pressure enters the main valve body.

The water that flows will raise the mobile block and the membrane therefore, the air vent will discharge the remaining water trapped inside the main valve bonnet.

When all the water of the main chamber has been expelled (this operation could take a few minutes and is related to the DN of the valve as well as the opening percentage of the upstream gate valve) if the membrane is not damaged, the flow will come to an end and you can be sure the cause of the problem has to be found somewhere else.

On the contrary if the flow keeps going the diaphragm is surely damaged or the nut fixing the membrane to the shaft is not tightened enough, therefore intervene accordingly, simply by replacing the diaphragm or setting the nut tight.

Warning: remember to close the upstream gate and decrease all the remaining pressure inside the valve before removing the bonnet.

Movement of the mobile block

In order to verify the proper movement of the mobile block to proceed as follows: isolate the main chamber closing the two isolation ball valves on the upstream and downstream side of the valve's body, and open the drain port located on top of the position indicator. In this way you will relief the pressure out of the valve's bonnet.

Attention: with this operation we will basically open the valve completely, therefore no regulation will be performed. Make sure to avoid dangerous consequences of the pressure system onto which the valve is acting.

When the main valve is **completely opened mark the glass of the indicator to the corresponding position.**

Now close leave the isolation ball valve downstream and open the correspondent upstream, also close the air release valve on the position indicator. The main valve will close.

Verify that the valve closes following the movement downwards of the indication rod (a slowing down in the final phase is normal and caused by the bending and adjustment of the diaphragm).

When the valve is closed, mark the glass of the indicator to the corresponding position and verify that the movement of the rod is like the one indicated below, if different, then means that there is something preventing the proper movement of the mobile group and please contact us immediately.

DN in mm	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300/400**
Stroke in mm	**15**	**18**	**21**	**27**	**27**	**43**	**56**	**70**	**84**

The clogging can be located between the seat and obturator if the indication rod is in closed position and the flow continues, or between the sealing seat and cap if the valve does not reach the complete opening. Before proceeding to dismantling the cover, it is suggested to do some manual opening and closing operations putting the main chamber under pressure and discharging it. This operation proved to be enough in some situations to flush the dirt downstream. If not take the cover apart.

3) Friction of the shaft

One of the more frequent causes of the mobile group movement obstruction are the corrosion and deposits on the main shaft causing friction. They can be due to particles (conveyed from the water) or to limestone deposits (for extremely hard water) that in the long run cause the jamming of the main shaft on the guiding devices, because of the high friction value.

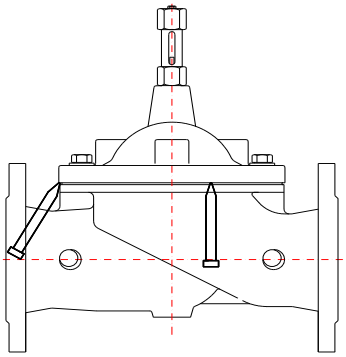
Should that be the case simply proceed to a proper cleaning leaving it in a muriatic acid solution 5% as long as necessary, shouldn't that be sufficient then proceed with a fine abrasive cloth until the deposit is completely removed.

4) Plane gasket

The valve must close watertight once the pressure has entered the main chamber and if we have enough pressure to do it which is at least 0,5 bar acting on the pilot in addition to headloss during outflow, if that doesn't happen proceed with the inspection of the plane gasket performance assuring the closure between the obturator and the sealing seat.

5) Sealing seat

One more reason that could be responsible for the improper closure of the valve may be the sealing seat, occurring in case of dirt and deposits or damaged due to cavitation. In these cases we must proceed with an accurate inspection to clean the component by means of sandpaper then polish it, if the problem can't be solved on the spot please contact us technical support for immediate assistance.



Disassembly

As mentioned before make sure that the gate valves upstream and downstream of the valves have been properly closed and set tight.

Relieve the pressure of the main chamber simply by closing the isolation valves of the circuit and opening one of its fittings. Proceed with the removal of the circuitry, in order to facilitate the intervention on the cover, only after having noted down the layout

Remove the nuts (4) and the washers (5). If the valve has been working for a long time you may notice that all the parts in contact with the diaphragm will tend to get stuck, in this case simply hit the lower part of the cover to loosen it by means of a plastic hammer and a chisel driving it upwards. After that, hoisting the valve vertically using eyebolts. Remove the internal mobile block and put it into a grip with **clamps in soft material such as brass or aluminum**, be extremely careful doing that because the upper and lower main shaft surface responsible of the valve-s guiding mechanism , if worn or etched, may cause the blocking of the valve due to its bind in the bearings.

Remove the nut and the washer (10) take off the upper flat (11) the O-rings (21) check the diaphragm looking for damage and, after having pulled out the plane gasket (13)by means of a screw driver (please make sure not to wear the gasket itself or its housing) examine it carefully.

Check the driving bush on the cover (7).

Examine the sealing seat (15) looking for scratches that may affect the proper water tightness and for possible sign of cavitation.

The sealing seat is made in stainless steel and it usually doesn't require particular maintenance, a very important thing though is to guarantee proper cleaning by means of sand paper.

Up to DN 150 the sealing seat is screwed into the body while for the remaining DN it is set tight by several screws. To carry out a further inspection and removal of the sealing seat, and in case of cavitation, please contact our technical support for immediate assistance.

Inspection

After all the components have been dismantled we need to look for any damage caused by wear of the surface, deposits, corrosion or something else.

It is strongly advised to replace every 4 years all the components made in rubber, responsible for the water tightness of the valve, such as O-Rings, the diaphragm, the plane gasket.

Reassembly

To reassemble do the reverse of the disassembly procedure positioning the main shaft back into the grip along with all the pieces. It is very important not to forget the O-Ring (21) and to **set the nut tight** (10) to assure a proper torque between the diaphragm and the plane gasket. Please be extremely careful with this step because a nut not properly tight may engender movements making the mobile block unstable, therefore affecting the valve's performance.

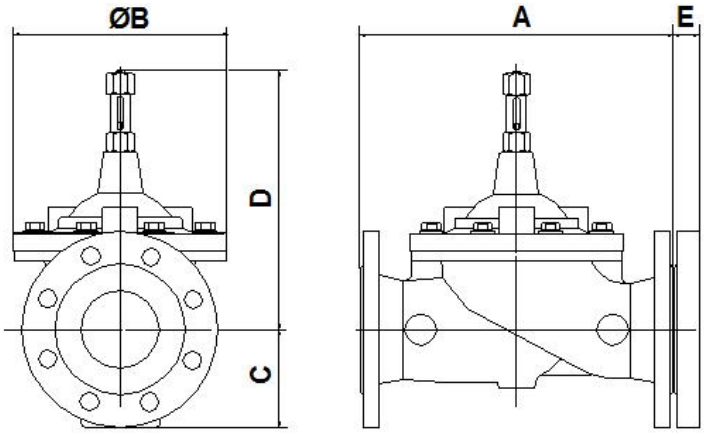
Put the mobile group back into the valve's body placing the shaft into the sealing seat guide, make the holes of the diaphragm match the studs and position the spring (9) under the cover.

Set the nuts tight using a cross over pattern, then put the circuitry back to its original position.

Final inspection

Make sure that the internal mobile block can move without any friction, this can be verified simply by gradually putting the main chamber under pressure and checking the movement of the indication rod, as explained before.

Examine the status of the plane gasket simply by checking the perfect water tightness of the sealing seat. At this point proceed by opening the upstream gate valve full throttle to have the normal working conditions, check for any leakage through the cover or the nuts, should that happen set them tighter.



DN	40	50	65	80	100	125	150	200	250	300	400
A (mm)	230	230	290	310	350	400	480	600	730	850	1100
B (mm)	162	162	194	218	260	304	370	454	570	710	710
C (mm)	83	83	93	100	118	135	150	180	213	242	310
D (mm)	233	233	255	274	316	383	431	523	620	670	709
E (mm)	30	30	30	30	30	30	30	30	40	40	40
Weight (Kg)	18	18	23.5	28	39	47	84	138	264	405	560

Standard drilling according to UNI EN 1092-2.
Standard flange PN16; PN10-25 on request.
Testing procedure according to UNI EN 1074.

Working conditions:
-Potable or treated water filtered with a 2 mm mesh
-Maximum temperature 70° C

We reserve the right to incorporate our latest design and material changes without notice or obligation.

Design features, materials of construction and dimensional data, as described in this manual, are provided for your information only.