

# SAFETY/RELIEF VALVE

## PVS 782



### TECHNICAL MANUAL MT 014

INSTRUCTIONS FOR THE INSTALLATION, ENTRY INTO SERVICE  
AND MAINTENANCE

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## **1.0 INTRODUCTION**

This manual aims to provide essential information for the installation, commissioning and maintenance of the PVS 782 model safety valves.

Moreover, we consider it necessary to herewith provide a brief illustration of the valves main specifications

In FIGURE 1 the valve functional diagram is illustrated.

## **1.1 MAIN SPECIFICATIONS**

The PVS 782 valves are safety accessories fit for the use on preliminary treated non aggressive gaseous fluids.

Such valves may be installed both on pipelines and on pressure vessels.

The main specifications of these valves are:

- Top-entry body fit for the flanged coupling;
- Soft insert on the seat for a better tightness

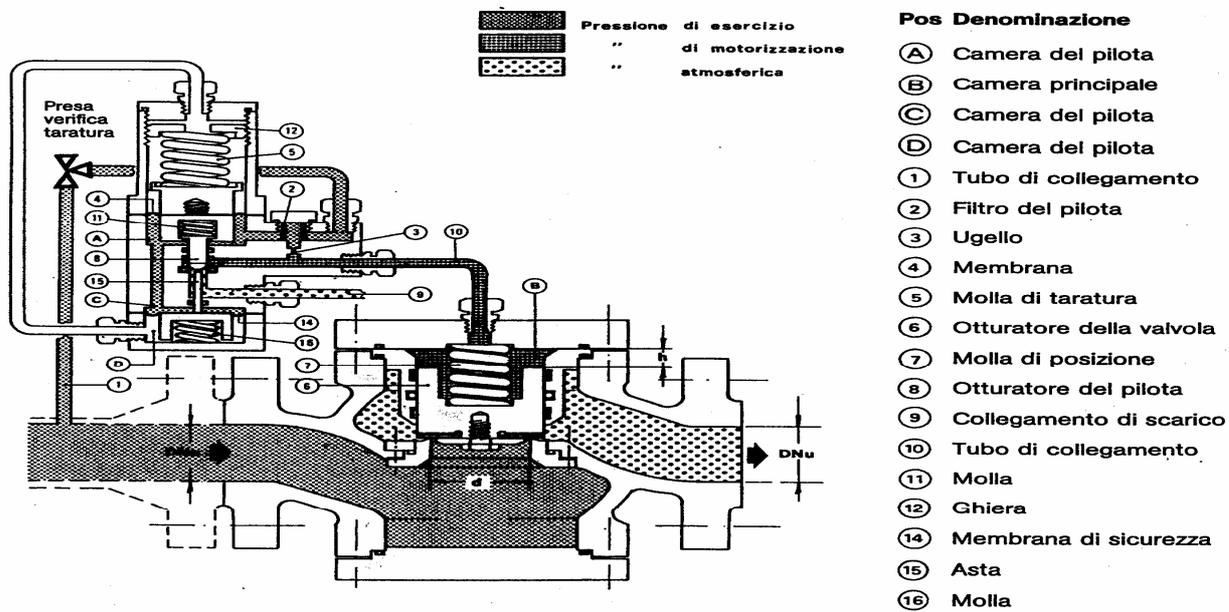


Figure 1

Figure 1: setting inspection port

Operating pressure,  
Motorization pressure,  
Atmospheric pressure

Posit.	Noun
(A)	Pilot chamber
(B)	Main chamber
(C)	Pilot chamber
(D)	Pilot chamber
	(1) Connection pipe
	(2) Pilot filter
	(3) nozzle
	(4) diaphragm
	(5) setting spring
	(6) valve plug
	(7) positioning spring
	(8) pilot plug
	(9) discharge connection
	(10) connection pipe
	(11) spring
	(12) ring nut
	(13) safety diaphragm
	(14) rod
	(15) spring

## 1.2 VALVE CONTROL

The PVS 782 valve is a pilot-operated valve therefore the valve opening and closing operations are controlled by a pilot device.

The below listed pilot devices are available:

Pilot P 15/A field of intervention 1,5 – 43 bar ( see figure 2 );

Pilot P 16/A field of intervention 11,5 – 43 bar (see figure 2 );

Pilot P 17/A field of intervention 140 – 70 bar ( see figure 2 );

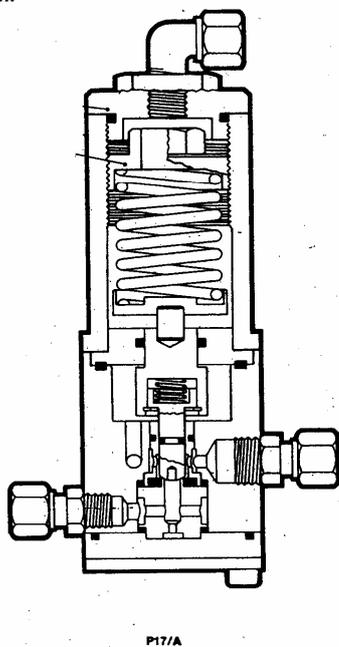
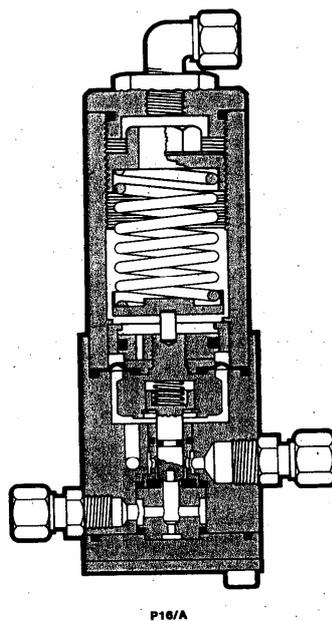
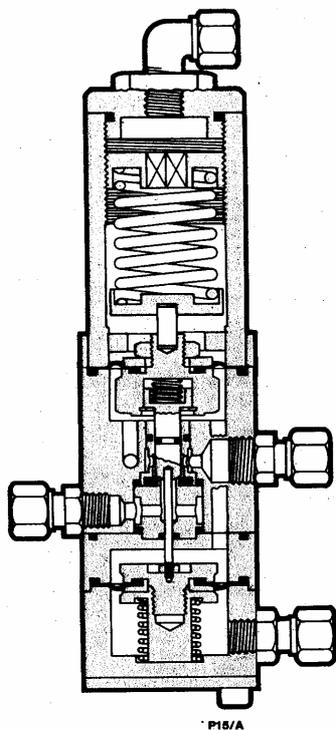


Figure 2

### 1.3 DESCRIPTION OF THE OPERATION

Make reference to figure 1.

Under ordinary conditions the controlled pressure, that is the valve inlet pressure reaches the pilot chamber (A) and (C) (1) through the connection pipe (1) and the filter (2), and, through the nozzle (3) it reaches the valve main chamber (B).

On the pilot diaphragm (4) the controlled pressure acts on one side and the load of the setting spring acts on the other side (5); on the pilot safety diaphragm (14) the controlled pressure acts on the chamber (C), the spring (16) and the leakage pressure from the diaphragm, if any (4) ) acts on the chamber (D); on the valve main plug (6) the controlled pressure and the positioning spring (7) act on the chamber (B) on one side, on the other side the same pressure, but applied on a smaller section, corresponding to the main diameter of the valve bore acts. Therefore, contrary to what happens in the traditional spring safety valves, when the controlled pressure is near the setting pressure, the load applied on the plug seat increases instead of decreasing thus ensuring a perfect seal also with values very near to the intervention values.

Until the controlled pressure is lower than the setting value, the spring action (5) prevails on the value of the fluid thrusts on the diaphragm (4) and the plug-pilot (8) keeps the discharge connection shut (9).

When instead the pressure reaches the setting value, the plug-pilot (8) opens allowing to discharge the fluid in the chamber(E) and the consequent full opening of the plug (6)

When the plug-pilot (8) begins to discharge, a flow is formed thus determining a pressure drop on the orifice (3) and this determines the value of the valve blowdown The equipment is designed in such a way that in case one of the main components of the valve or of the pilot device breaks the valve opens; in fact:

- a) the breakage of the small connection pipes (1), (10) or of the relevant fittings causes the emptying of the chamber (B) and therefore the opening of the plug (6).
- b) the breakage of the spring (7) does not determine considerable operating variations, because it only keeps the plug (6) in the closing position when the valve is commissioned.
- c) the breakage of the spring (5) determines the opening of the plug-pilot (8) and therefore the emptying of the chamber (E) and the consequent opening of the plug (6).

d) (**valid for P15/A pilot**) the breakage of the diaphragm (4) does not damage the valve operation because the leakage, if any, feeds the chamber (D) that balancing itself with the ( C ) allows the spring (16) to raise the plug-pilot (8) by means of the rod (15) thus allowing the emptying of the chamber (B).

e) (**valid for P 16/A and P 17/A pilot**) the breakage of the diaphragm (4) does not damage the valve operation because any leakage through the “piston effect” on the spring support causes the opening of the valve-pilot ( 8 ) and the consequent opening of the valve plug ( 6 ).

The adjustment of the setting value is made by means of the ring nut (12) inside the pilot and by using different springs according to the predetermined setting value.

The spring (11) allows the extra stroke of the spring-diaphragm unit without loading the plug-pilot (8) on its seal seat

#### 1.4 VALVE SIZING

The PVS 782 valve is sized by means of the formula reported on the RACCOLTA E chapter E. 1. D. that is

$$q = ( 0,9 \times K ) \times ( 394,9 \times C ) \times P_1 \times A \times \sqrt{\frac{M}{Z_1 \times T_1}}$$

where:

q = max. flow rate to be discharged in Kg/h

A = min. passage way in cm<sup>2</sup> ( see table 1 )

K = flow coefficient ( 0,56 )

P<sub>1</sub> = setting pressure plus 10% (abs. bar)

T<sub>1</sub> = temperature of the fluid at the valve inlet in °K

M = molecular mass of the fluid in Kg/Kmol

Z<sub>1</sub> = compressibility factor of the fluid at the discharge conditions ( = 1 if not known)

C = Coefficient of expansion

$$C = \sqrt{k \left( \frac{2}{(k+1)} \right)^{\frac{(k+1)}{(k-1)}}$$

k = coefficient of the isentropic equation

Table 1

Dimension	1"	1" 1/2	2"	2" 1/2	3"	4"	6"	8"
Area cm <sup>2</sup>	5,31	13,85	22,89	35,24	54,08	102,02	203,48	359,50

## 2. INSTALLATION

### 2.1 GENERAL WARNINGS

Before the installation , commissioning, or maintenance, the operators shall:

- examine the safety devices applicable to the installation where they have to work
- obtain the necessary authorizations to work, when required
- equip oneself with the necessary individual protections ( helmet, goggles, etc.. )
- make sure that the area where they have to work is equipped with the required collective protections and with the necessary safety signs.

The handling of the equipment and of its components shall be carried out after evaluating that the lifting devices are fit for the loads to be lifted ( lifting capacity and functionality ). The handling of the equipment shall be carried out by using the lifting eyes arranged on the equipment itself .

The use of motorized means is reserved to the personnel in charge of this.

In case the installation of the system and of its accessories requires the application of compression fittings, these shall be installed by following the instructions of the manufacturer of the compression fittings. The choice of the compression fittings shall be compatible with the use specified for the equipment and with the plant specifications, where required.

The commissioning shall be carried out by properly trained personnel.

During the commissioning, non strictly personnel shall be moved away and the prohibition area shall be properly signaled (signs, barriers, etc...).

## **2.2 GENERAL INSTRUCTIONS**

The valve installation shall be carried out in compliance with the prescriptions (laws or regulations) in force in the place of installation.

In particular the specifications of natural gas plants shall be in compliance with the law provisions or regulations in force in the place of installation, or at least in compliance with the EN 12186 or EN12279 regulations (we remind that the installation in compliance with such laws minimizes the risk of fire hazard).

The valve shall be installed by making sure that the operating pressure of the unit where it is installed never exceeds the value of the permissible maximum pressure (PS).

The user shall moreover arrange suitable venting or draining system to discharge the pressure and fluid inside the plant before carrying out any inspection or maintenance operation.

In case the installation specifications require it, the valve may be sealed with lead after having been adjusted at the required intervention value; lead seals may be carried out at the factory directly by the manufacturer or on site by the user.

## **2.3 SPECIAL INSTRUCTIONS**

Before installing the valve it is necessary to be sure that :

- the valve may be inserted in the arranged space and it is sufficiently accessible for the following maintenance operations, dimensions and weights are reported in table 2;
- the upstream and downstream pipelines are at the same level as the inlet and outlet connections and they can support the weight of the valve;
- the pipeline inlet/outlet flanges are parallel to the valve seal surfaces;
- the inside of the valve is clean and the valve itself was not damaged during the transport;
- the upstream pipeline was cleaned in order to expel residual impurities such welding slag, sand, varnish waste, water, etc.

Install the valve considering that the flow direction is compulsory and it is showed with an arrow on the valve body itself.

The valve may be installed both with vertical flow direction and horizontal flow direction.

For the installation please refer to figures 3 and 4.

The valves placed upstream from the valve, if any, shall be of a total flow type, so that the discharge capacity is not limited.

Connect the pilot sensing line by means of compression fittings, according to the plant specifications.

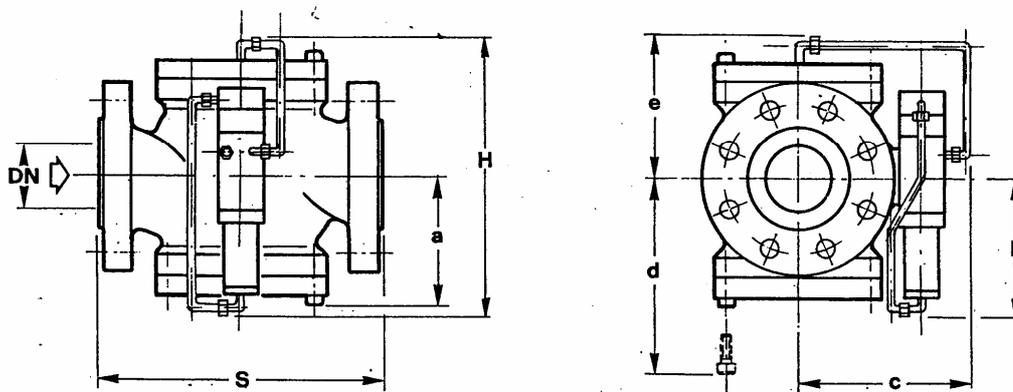
In case the plant specifications require it, connect the pilot vent to the specific drain pipe.

On the valve drain pipe arrange a protection end against water and nesting

The connections to the inlet and outlet pipelines are carried out by means of standardized flanges the sizes and types of which are showed on the data plate ( see chapter 2.4 ); the choice of the connecting screws and of the seal gaskets shall be made by the installer who shall consider such information and the conditions of use in the place of installation.

Table 2

Note: the dimensions and the weights for S 150 are also valid for the PN 16 version


**Dimensioni d'ingombro**

	DN							
	1"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"
<b>ANSI 150</b>		223	254	277	298	352	451	543
<b>S ANSI 300</b>	197		267		317	368	473	568
<b>ANSI 600</b>	210		286		336	394	508	609
<b>a</b>	95	125	125	145	145	180	240	285
<b>b</b>	150	150	150	150	150	150	150	150
<b>c</b>	160	165	185	190	210	230	290	330
<b>d</b>	110	150	150	170	170	215	270	315
<b>e</b>	125	155	155	175	175	210	270	315
<b>H</b>	275	305	305	325	325	360	420	465

**Peso in Kg.**

<b>ANSI 150</b>	18	26	32	42	50	86	175	265
<b>ANSI 300</b>	19	28	34	44	54	91	185	280
<b>ANSI 600</b>	20	30	36	46	58	100	207	375

Legend of Figure

Dimensioni d'ingombro: overall dimensions, peso in kg: weight in Kg

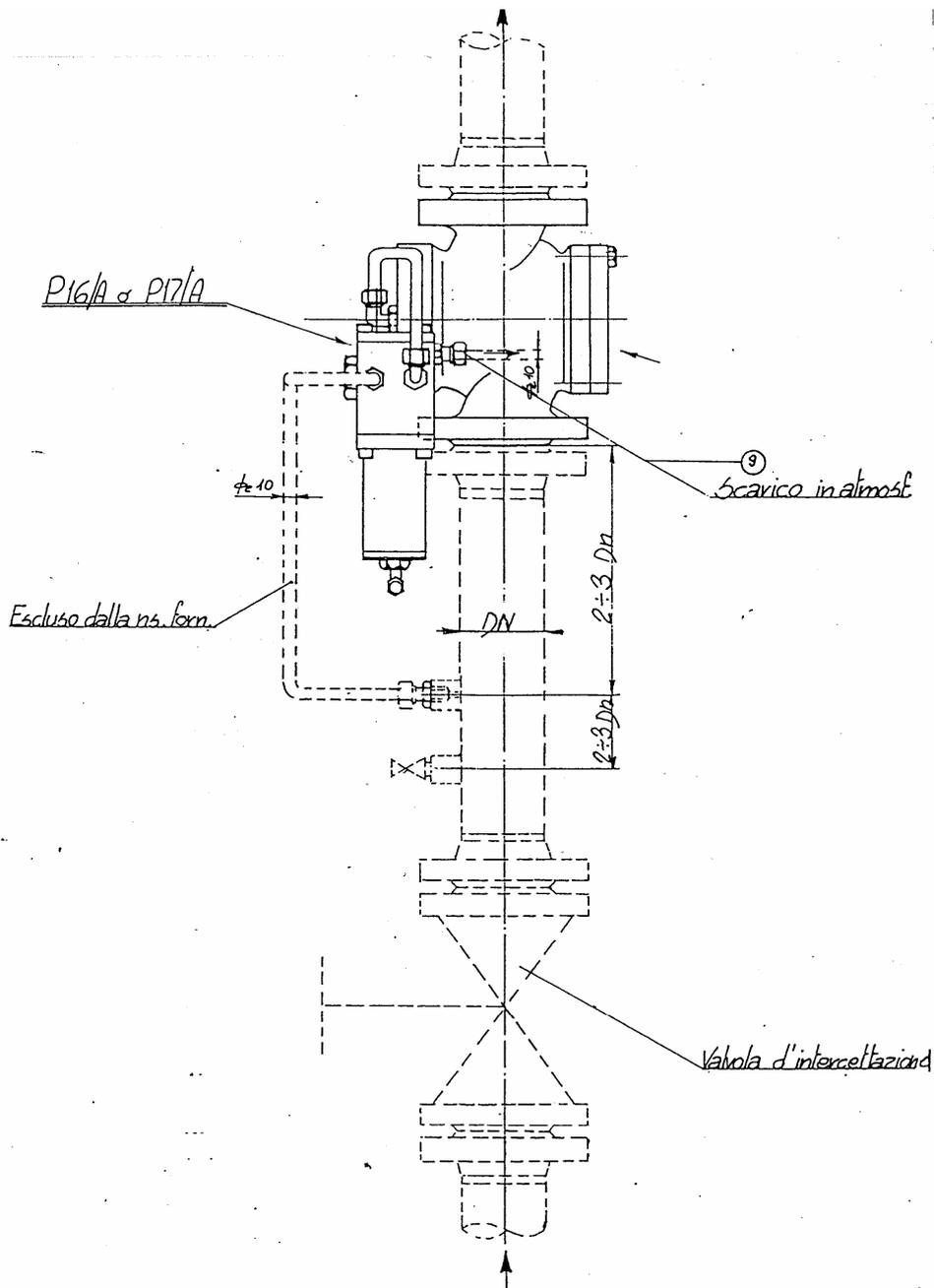


Figure 3

Not included in our supply,  
Discharge to the atmosphere,  
Cut-off valve



## 2.4 CONDITIONS OF USE

We recommend to check, before commissioning, that the conditions of use are in compliance with the equipment specifications.

Such specifications are reported on the identification plates of each valve (figure 5).

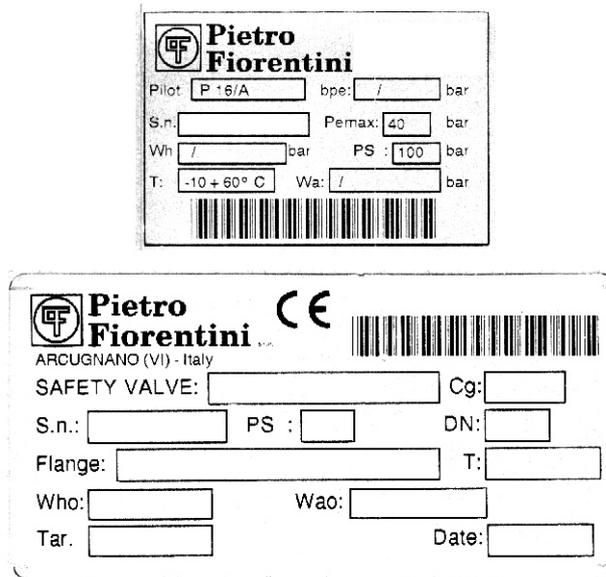


Figure 5

The meaning of the symbols written on the plate is the following

Safety valve	valve model
Cg	flow rate coefficient ( where foreseen )
S. n.	serial number
PS	max. permissible pressure
DN	valve nominal diameter
Flange	type of flange
TS	permissible operating temperature
Who	total intervention pressure field
Wao	specific intervention pressure field of the inserted spring
Tar.	Set-point value ( when applicable )
Date	date of test
Pilot	type of pilot

bpe	inlet pressure field
Pemax	max inlet pressure
Wh	total intervention field
Wa	specific intervention pressure field with inserted spring

In particular we would like you to draw your attention to the following specifications:

- PS max. permissible pressure.
- TS design temperature (the minimum and maximum values are shown).
- the inlet and outlet connections class.

Moreover, the user shall check that the used materials and the applied surface treatments, if any, are compatible with the expected use.

Considering the valve geometric specifications, during the design phase no stresses due to traffic, wind, or seismic events were taken into consideration; therefore, the user shall take proper precautions in order to limit the effects of such events on the assembly, when these are expected

### **3.0 COMMISSIONING**

#### **3.1 PRESSURIZATION**

After the installation check that the connections to the line are correctly executed and that the vents and drainages on the plant, if any, are closed.

Slowly pressurize the plant ( or the plant section) by means of the upstream process valve or of other systems arranged for this and make sure that the pressure is at a value than the valve setting value

#### **3.2 CONTROL OF THE EXTERNAL TIGHTNESS**

The tightness test of the valve connections to the plant shall be carried out according to the provisions in force in the place of installation.

The external tightness is ensured when coating the element under pressure with a foaming agent, no bubbles appear

### **3.3 CONTROL OF THE INTERNAL TIGHTNESS**

The valve internal tightness may be checked by placing the valve in full close position, keeping the line pressure upstream from the valve and checking that there is not fluid leaks downstream from the valve and from the pilot blowdown.

### **3. 4 COMMISSIONING ( INSTALLATION ACCORDING TO DIAGRAM IN FIG. 3 ).**

- a) On the data plate check that the required intervention value is within the listed limits ( Wao value on the plate )
- b) Fully tighten the adjusting ring nut of the setting on the pilot
- c) make sure that the pressure upstream from the cut-off valve is lower than the intervention value
- d) slowly open the cut-off valve
- e) check the tightness of all the joints placed under pressure with the previous operation
- f) increase the pressure up to the intervention value, slowly unscrew the ring nut until the pilot pipe starts to discharge the gas.
- h) very carefully carry on the previous operation until the valve opening
- i) decrease the pressure and check that the pilot valve is close again and their tightness.

### **3. 5 COMMISSIONING ( INSTALLATION ACCORDING TO DIAGRAM IN FIG.4 )**

- a) With the same order carry out the operations a, b, c, d, e, of paragraph 3.4
- b) Connect the C way of the three-way switch valve ( PUSH ) to a chamber with controlled pressure
- c) stabilize the test pressure in the chamber at the same value as the pressure at the safety valve inlet
- d) actuate the three-way valve by connecting the controlled pressure chamber to the pilot sensing line.
- e) increase the test pressure in the controlled chamber up to the intervention value of the safety valve
- f) with the same order repeat the operations g,h, of the previous paragraph.
- g) decrease the pressure and check that the pilot valve is close again and their tightness.
- h) restore the three-way valve position in order to connect the chamber to be controlled with the pilot sensing line.

## **4.0 MAINTENANCE**

### **4.1 GENERAL INSTRUCTIONS**

The inspection and maintenance interventions are strictly linked to the type of installation. It is therefore advisable to perform a preventive maintenance, which periodicity, if not established by the regulations, is relevant to:

- the quality of the transported fluid;
- the cleanness and preservation state of the pipelines in the plant; in general, after the first start of the plants, more frequent maintenance services are required because of the poor cleanness inside the pipelines

It is recommended to periodically check the intervention value of the valve according to the provisions in force on the place of installation and, depending on the needs, perform a preventive maintenance of the valve and of its pilot.

The periodical inspections concern also the state of the external surface of the valve. In particular the surface protections shall be restored ( usually the varnishing) in case they are worn.

Before performing any intervention, make sure that the plant section where you operate has been upstream and downstream cut-off and that the pressure in the concerned pipeline section has been discharged.

Moreover, make sure to have a series of recommended spare parts. The spare parts shall be Pietro Fiorentini Spa genuine spare parts.

NOTE. The use of non genuine spare parts relieves the manufacturer from any liability.

## **4.2 DISASSEMBLY**

For the disassembly no special wrenches are required.

Before carrying out the disassembly, put some reference signs on the elements of the pilot that connect it to the valve

It is necessary to pay particular attention in order not to damage the valve and the o'rings seats.

Inspect the state of all rubber parts as far as tightness is concerned and replace the damaged ones or the ones with a long life. Lubricate the surfaces of the moving elements with a thin grease layer as showed in paragraph 5.

## **4.3 REASSEMBLY**

Reassemble the parts by referring to the signs put on the parts during the disassembly, so that all the connections match correctly

## **5.0 LUBRICATION**

The valves are already lubricated during the assembly phase (with the most suitable product for the operation if it is specified in the order) for the following reasons:

- 1) ease the components assembly
- 2) improve maneuverability
- 3) ease the preservation in case of warehouse storage

During the ordinary operation, it is not necessary to lubricate the valve.

We recommend to lubricate the moving elements during the maintenance operations (plug,... ) and the seals with silicone grease.

## 6.0 STORAGE

The PVS 782 valves do not require specific precautions in case of storage for long periods; anyway it is recommended to pay attention to:

- keep the valves in the original packing;
- keep the protections applied in the factory on the flanged connections;
- store the rubber parts away from direct sun light, in order to avoid a fast aging;

## 7.0 SPARE PARTS

For the spare parts please refer to the spare part lists

SR 164 Valve PVS/782

SR 182/1 Pilot P 15, P 15/A

SR 182/2 Pilot P 16, P 16/A

SR 182/3 Pilot P 17, P 17/A

Note: the pilots P 15, P 16 e P 17 are no more manufactured.

When ordering the spare parts, list:

**Type of valve**

**Built-in accessories,**

**Serial no.**

**Year of manufacture**

**Type of fluid used**

**Part no. (position)**

**Quantity**