

MT-302-I

ENGLISH

SAFETY

VALVE VS/AM 58



TECHNICAL MANUAL

INSTRUCTIONS FOR INSTALLATION,
COMMISSIONING AND
MAINTENANCE

TECHNICAL M

 **Pietro
Fiorentini®**

WARNINGS

GENERAL WARNINGS

The equipment described in this manual is a device subject to pressure installed in pressurized systems.

The equipment in question is normally installed in systems which transport flammable gases (for example natural gas).

WARNINGS FOR OPERATORS

Before installation, commissioning or maintenance, operators must:

- take note of the safety regulations applicable to the installation in which they must work;
- obtain the necessary permits to operate when required;
- acquire the necessary personal protective equipment (helmet, goggles, etc.);
- ensure that the area in which they operate is equipped with the required collective protection and the necessary safety information.

PACKAGING

The packaging for transporting the equipment and related spare parts have been specifically designed and manufactured in order to prevent damage during normal transportation, storage and handling activities. Therefore the equipment and spare parts must be kept in their respective original packaging until their installation at the final site. On opening the packaging, the condition of the materials contained within should be checked. In the event of damage, report the damage to the supplier keeping the original packaging for inspection.

HANDLING

The equipment and its components must be handled after ensuring that the lifting means are adequate for the loads to be lifted (lifting capacity and functionality).

The equipment must be handled, when required, using the lifting points provided on the equipment itself. The use of motorized means is reserved for the persons in charge.

INSTALLATION

The installation of the valve must comply with the regulations (laws or standards) in force in the place of installation.

In particular, systems for natural gas must possess characteristics in accordance with the legal requirements or regulations in force at the installation site or at least in accordance with EN 12186 or EN 12279; in particular paragraphs 6.2, 7.5.2, 7.7 and 9.3 of EN 12186 and 6.2, 7.4, 7.6 and 9.3 of EN 12279 must be adhered to. Installation in accordance with these standards minimizes the risk of a fire hazard and the formation of potentially explosive atmospheres.

The equipment is without internal pressure limiting devices, therefore, it must be installed making sure that the operating pressure of the unit on which it is installed never exceeds the maximum permissible pressure value (PS).

The user should therefore provide, when it is deemed necessary, for the installation on all adequate pressure limiting systems; he must also set up the system with appropriate venting or drainage systems in order to discharge the pressure and the fluid contained in the system before carrying out any inspection and maintenance activities.

If the installation of the equipment requires the field application of compression fittings, these must be installed in accordance with the instructions of the manufacturer of the fittings themselves. The choice of the fitting must be compatible with the use specified for the equipment and with the specifications of the system when provided for.

COMMISSIONING

Commissioning must be carried out by **properly trained personnel**.

During the commissioning activities, personnel who are not strictly necessary must be kept at a distance and the forbidden area must be suitably marked (signs, barriers, etc.).

Make sure that the equipment settings are those requested; if necessary, reset them to the required values in accordance with the procedures indicated in this manual.

During commissioning the risks associated with any discharges to the atmosphere of flammable or noxious gases must be evaluated.

For installation on distribution networks for natural gas you must consider the risk of formation of explosive mixtures (gas / air) inside the piping.

COMPLIANCE WITH DIRECTIVE 97/23 / EC (PED)

The **VS/AM 58** valve is classified as a pressure accessory according to Directive 97/23/EC (PED).

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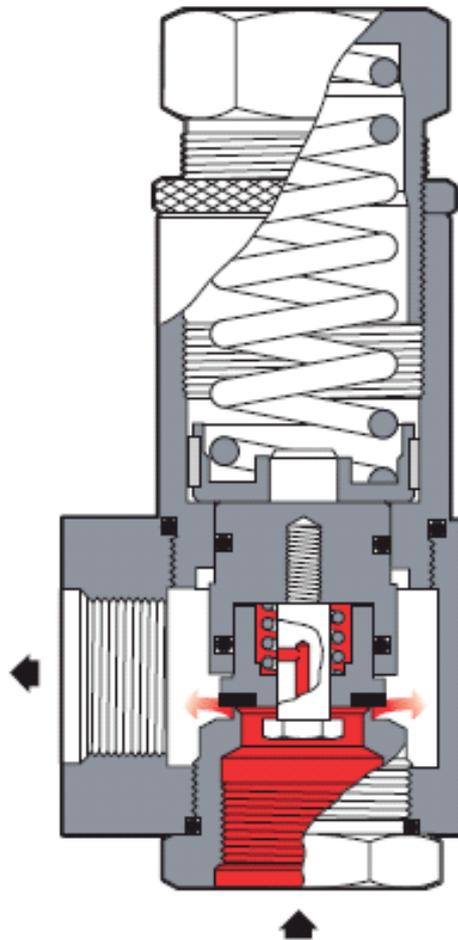
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VS/AM 58

RELIEF VALVE



Ps 517 November.13

 Feed Pressure

Figure 1

1.0 INTRODUCTION

The purpose of this manual is to provide essential information for the installation, commissioning, disassembly, re-assembly and maintenance of the safety valves model **VS/AM 58**.

It is also considered appropriate to provide a brief illustration of the main features of the valve.

In figure 1 a functional diagram of the valve is shown.

1.1 MAIN FEATURES

The **VS/AM 58** valves are safety devices suitable for use with previously filtered, non-aggressive gaseous fluids.

Such valves may be installed either on ducts or on pressure vessels. Without external control sources aside from the process fluid itself, these valves discharge a certain amount of gas at a certain calibration pressure and then close when pressure is restored below the set value.

The VS/AM 58 valve is a spring-loaded direct-acting valve with the following main features.

- body design pressure (PS): 100 bar
- design temperature: -20 ÷ 60° C
- triggering range (Who): 15 ÷ 43 bar

1.2 SETTING SPRINGS

The calibration fields are the following:

ORANGE spring (2702080) - 15 ÷ 18 bar

RED spring (2702290) - 18,001 ÷ 25 bar

GREEN spring (2702460) - 25,001 ÷ 30 bar

BLACK spring (2702660) - 30,001 ÷ 43 bar

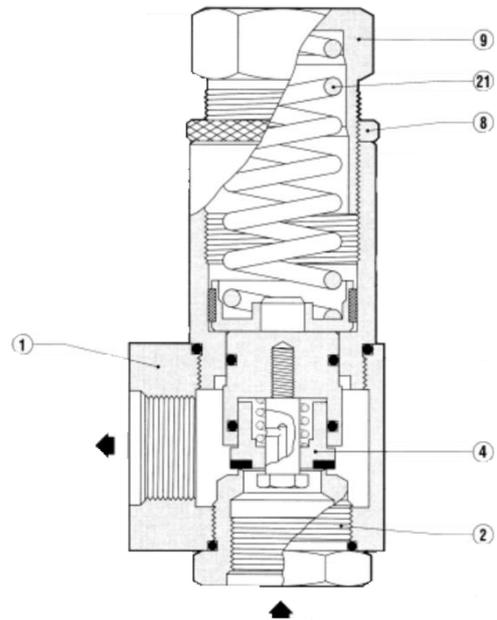
1.3 DESCRIPTION OF OPERATION

It is based on the comparison between the thrust on the piston 4 deriving from the gas pressure to control and the thrust deriving from the setting spring 21.

The weight of the mobile unit and the static and dynamic residual thrusts on the obturator 4 affect this comparison.

When the thrust deriving from the gas pressure exceeds that of the setting spring, the obturator 4 is raised and a certain amount of gas is discharged.

As soon as the pressure drops below the set value, the obturator re-closes. Triggering of the relief valve can be controlled and adjusted by appropriately turning the adjusting ring nut 9.



The device is designed in such a way that any breakage to one of the main constituent parts of the valve or the pilot device leads to the opening of the valve itself; in fact:

1.4 VALVE SIZING

The VS/AM 58 valve is sized using the given formula:

$$Q_m = p_0 C A K_{dr} \sqrt{\frac{M}{Z T_0}}$$

Where:

- Q_m = maximum flow rate to discharge in kg/h
- K_d = discharge coefficient
- K_{dr} = declassified discharge coefficient (0,9K_d)
- C = expansion coefficient
- p₀ = calibration pressure plus 10% in absolute bars
- A = minimum passage area in mm² (see table 1)
- M = molecular weight of fluid in kg/kmol
- Z = compressibility factor of the fluid under discharge conditions (= 1 if unknown)
- T₀ = temperature of fluid at valve inlet in Kelvin degrees

$$C = 3.948 \sqrt{k \left(\frac{2}{k+1} \right)^{\frac{k+1}{k-1}}}$$

k = isentropic equation coefficient

Table 1

Rated inlet size	1"
Minimum diameter [mm]	23
Minimum passage area [mm²]	415.48

Table 2 Molecular mass and coefficient of expansion

	Molecular mass M	Coefficient of expansion
Relative density	28,97	0,685
Carbon dioxide	44,01	0,668
Hydrogen	2,02	0,686
Methane	16,04	0,669
Natural gas*	18,04	0,669
Nitrogen	28,02	0,685
Oxygen	32,00	0,685
Propane	44,09	0,635

*Average value

2.0 INSTALLATION

2.1 GENERAL WARNINGS

Before installation, commissioning or maintenance, operators must:

- Take note of the safety regulations applicable to the installation in which they must work;
- Obtain the necessary permits to operate when required;
- Acquire the necessary personal protective equipment (helmet, goggles, etc.);
- Ensure that the area in which they operate is equipped with the required collective protection and the necessary safety information.

The equipment and its components must be handled after ensuring that the lifting means are adequate for the loads to be lifted (lifting capacity and functionality). The equipment must be handled using the lifting points provided on the equipment itself.

The use of motorized means is reserved for the persons in charge.

If the installation of the equipment or its accessories requires the application of compression fittings, these must be installed following the instructions of the manufacturer of the fittings themselves. The choice of fittings must be compatible with the use specified for the equipment and with the specifications of the system when provided for.

Commissioning must be carried out by properly trained personnel: during commissioning activities, personnel who are not strictly necessary must be kept at a distance and the forbidden area must be suitably marked (signs, barriers, etc.).

2.2 GENERAL REQUIREMENTS

The valve must be installed in compliance with the regulations (laws or standards) in force in the place of installation.

In particular, systems for natural gas must possess features in accordance with the legal requirements or regulations in force at the installation site or at least in accordance with EN 12186 or EN 12279 (please note that installation in compliance with these regulations minimizes the risk of fire hazard).

The valve must be installed making sure that the operating pressure of the unit on which it is installed never exceeds the maximum permissible pressure value (PS).

The user must also set up the system with appropriate venting or drainage systems in order to discharge the pressure and the fluid contained in the system before carrying out any inspection and maintenance activities.

The pilot of the valve is sealed after being tested and calibrated; the sealing is done in three points:

- On the adjustment plug

2.3 SPECIAL REQUIREMENTS

Before installing the valve, you must ensure that:

- The valve can be inserted in the space provided and is sufficiently accessible for subsequent maintenance operations Table 2 shows the dimensions and weights;
- In the case of installation with horizontal flow direction, the upstream and downstream piping is at the same level as the input and output connections;
- The upstream piping (and downstream only if installed with horizontal flow direction) can bear the weight of the valve;
- The inlet / outlet flanges of the piping are parallel to the valve sealing surfaces;
- The inside of the valve is clean and the valve itself has not been damaged during transport;
- The upstream piping has been cleaned in order to expel residual impurities such as welding slag, sand, paint residues, water, etc.;

Install the valve taking into consideration that the direction of flow is required and is indicated with an arrow on the body of the valve itself. The connections to the input and output pipes are done using standard flanges whose sizes and types are indicated on the rating plate (see section 2.4); the choices of connecting screws and seals must be made by the installer considering this information and the conditions of use at the installation site.

N.B The valve is designed to operate at atmospheric backpressure (=0). Please pay attention in ensuring compliance with the valve design conditions during the sizing of the line downstream of the valve itself.

NOTE: the correct sizing of the discharge line downstream of the valve is the responsibility of the system designer.

2.3 REACTION FORCES DUE TO DISCHARGE

After opening of the valve due to overpressure of the control fluid, reaction forces are generated due to the motion of the fluid. These forces are then transmitted to the junctions and couplings in the valve installation phase. The designer of the system is therefore responsible to provide appropriate supports to correctly withstand the dynamic forces generated.

When calculating the reaction forces with gas, refer to standard API 520-Part II (August 2003):

$$F = 129W \sqrt{\frac{kT}{(k+1)M}} + 0.1 (AP)$$

where

- F = reaction force at the point of discharge to the atmosphere [N]
- W = flow of any gas or vapor [kg/s]
- k = ratio of specific heats (C_p/C_v) at the outlet conditions
- C_p = specific heat at constant pressure
- C_v = specific heat at constant volume
- T = temperature at the outlet [°K]
- M = molecular weight of the process fluid
- A = area of the outlet at the point of discharge [mm²]
- P = static pressure within the outlet at the point of discharge [barg]

2.5 CONDITIONS OF USE

It is recommended to check, before commissioning, that the conditions of use conform to the features of the device. These specifications are recalled on the rating plates with which each valve is provided (figure 3).

The meaning of the symbols shown on the rating plate is shown below:

 Pietro Fiorentini <small>ARGIGNANO (VI) - ITALY</small>	 ID n. _____ EN 4126-1	Material: Body: Al 6012 Seat: AISI 303		
		SAFETY VALVE	PS: _____ Bar	
S.n. _____		T: _____ °C		
Flow area: _____ mm ²		DN: _____		
Set press.: _____ Bar		Fluid: _____		
Overpress.: _____ %	Lift: _____ mm	Kdr: G-		

Safety valve	the valve model
PS	maximum allowable pressure
S. n.	serial number
T	permitted service temperature
DN	rated diameter of valve and type of flanging (if included)
Flow area:	Diameter corresponding to minimum cross-section
Set press.	Calibration value
Fluid	Fluid
Overpress.	Overpressure to which the declared Kd value refers
Kdr	declassified discharge coefficient

In particular, it draws attention to the following features:

- Maximum allowable pressure PS
- Design temperature T (the minimum and maximum value are shown)
- The class of the input and output connections

Moreover the user must verify that the materials used and the surface treatments which may have been applied are compatible with the intended use.

Given the geometric features of the valve, in the design phase certain stresses from traffic, wind or earthquakes were not considered. Therefore, the user must take appropriate precautions to reduce the effects on all of these events when they are expected.

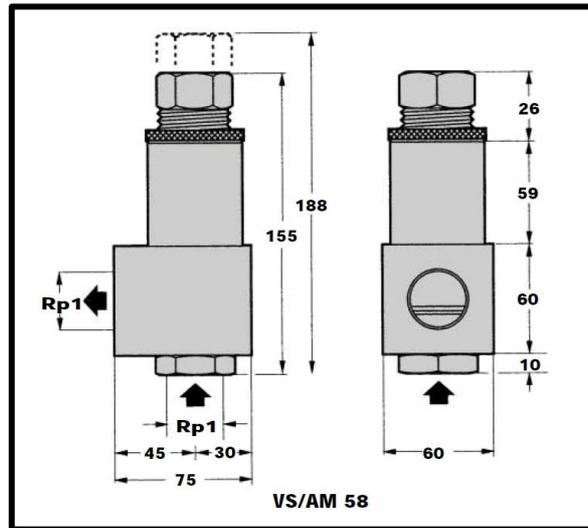
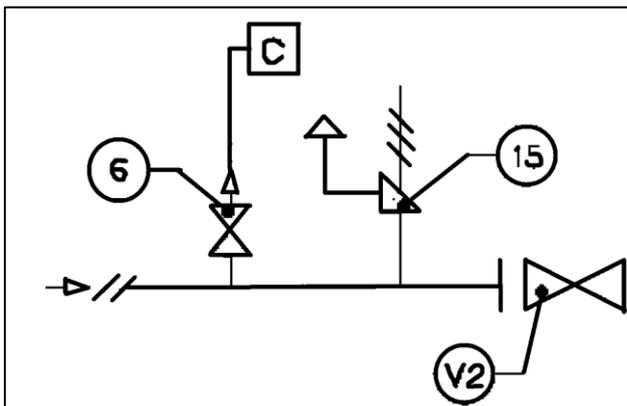


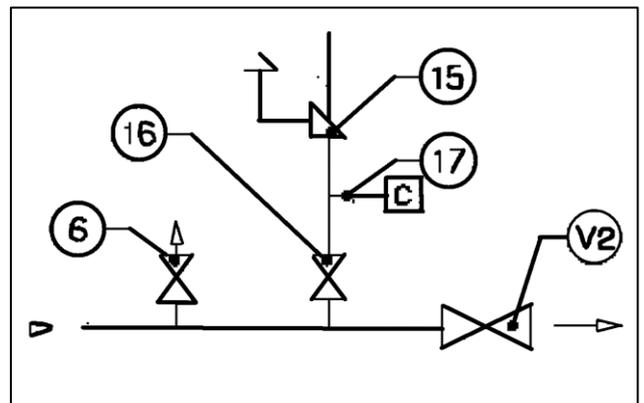
Fig. 5 – Overall dimensions

2.6 INSTALLATION DIRECTLY ON LINE

When the safety valve is installed directly on the line, namely without interposing a shut-off valve.



2.7 INSTALLATION WITH SHUT-OFF VALVE



- V2 Downstream shut-off valve
- 6 Air vent valve
- 15 VS/AM relief valve...
- 16 Shut-off valve
- 17 Pressure outlet
- C Controlled auxiliary pressure

3.0 COMMISSIONING

3.1 PRESSURIZATION

After installation, check that the connections to the line have been carried out properly and that any relief and discharge valves on the system are closed and that the inlet/outlet shut-off valves, bypass valves and the air vent valve are closed.

It is recommended to check, before commissioning, that the conditions of use conform to the features of the equipment. These features are shown with symbols on the equipment's rating plates.

Slowly pressurize the system (or the system section) by means of the upstream process valve or other systems provided for this purpose.

Make sure that pressure is lower than that for which the valve was calibrated and the temperature of the gas does not cause malfunctions.

3.2 CONTROL OF THE OUTER SEAL

The leak test of the connections of the valve to the system should be carried out as prescribed in the installation site.

The outer seal is guaranteed when sprinkling the pressure element with a foaming agent, no bubbles form.

3.3 CONTROL OF THE INNER SEAL

The inner seal can be checked with the valve in the closed position, keeping the line pressure at its inlet and checking that downstream of the valve there is no fluid leakage.

3.4 COMMISSIONING WITH INSTALLATION DIRECTLY ON LINE (FIG. 4)

When the relief valve is installed directly on the line, namely without interposing a shut-off valve, proceed as follows:

- 1) Make sure that the downstream shut-off valve V2 and the air vent valve 6 are closed.
- 2) Increase pressure in the upstream segment to the intended triggering value in one of the following ways:
 - if the spring installed on the regulator/pilot allows it, increase calibration of the pilot regulator until it reaches the desired value;
 - connect an auxiliary controlled pressure to the valve 6 and stabilize it at the desired value;
- 3) Check triggering of the relief valve and, if needed, adjust it by turning the adjustment plug 9 appropriately (clockwise to increase the setting and counterclockwise to decrease it).

3.5 COMMISSIONING WITH SHUT-OFF VALVE (FIG. 5)

In case of installation with shut-off valve:

Close the shut-off valve 16.

- 2) Connect an auxiliary controlled pressure to the outlet 17 and slowly increase it to the intended triggering level
- 3) Check triggering of the relief valve and, if needed, adjust it by turning the adjustment plug 9 appropriately (for VS/AM 58) (clockwise to increase the setting and counterclockwise to decrease it).

4.0 MAINTENANCE

4.1 GENERAL INFORMATION

The inspection and maintenance operations are closely related to the type of installation. Preventive maintenance is therefore always recommended, the intervals of which, if not established by regulations, depend on:

- The quality of the transported fluid;
- The state of cleanliness and conservation of the piping making up the system; in general, after the first start-up of the plants, they require more frequent maintenance for the precarious state of cleanliness inside the piping.

It is recommended to periodically check the cut-out value of the valve following the rules in force in the place of installation and, as

necessary, to provide for a preventive maintenance of the valve and its pilot.

Regular checks will also affect the status of the external surfaces of the valve. In particular, one will have to restore the surface protection (usually paint) in case of their deterioration.

Before carrying out any work, make sure that the section of the system in which one operates has been cut off upstream and downstream and that the pressure has been discharged into the affected pipe section.

Also make sure you have a set of recommended spare parts. The spares must be original Pietro Fiorentini parts.

N.B. The use of non-original spare parts relieves the manufacturer of any liability.

If your qualified staff takes care of this maintenance, before disassembly, we recommend applying reference signs on parts which could pose problems of direction or mutual positioning when reassembling them.

Also remember that the O-rings and mechanical sliding parts (rods, etc.) must be lubricated with a thin coat of silicone grease before reassembling them.

4.2 DISASSEMBLY

With the exception of the OR valve seat (21), where the use of a special key is required, for the disassembly of all the other components special keys are not necessary.

Before disassembling, place the reference marks on the elements to be disassembled.

You should take particular care not to damage the sealing seats and housings of the sealing rings.

Examine the status of all the rubber parts affected by the seal and replace damaged ones or those that have been in use for a long time. Lubricate the surfaces of the moving parts with a thin coat of grease as described in Chapter 5.

4.2.1 Disassembly and maintenance of the valve

Proceed according to the steps described below for disassembly and maintenance of the valve, with reference to the parts in the diagram in Figure 6.

1. Loosen the ring nut pos ⑧.
2. Loosen and remove the adjustment plug pos ⑨.
3. Remove the spring pos ⑳.
4. Loosen and remove the valve seat pos ②.

5. Remove the obturator guide-valve obturator unit
6. Separate it by unscrewing the lock screw pos ③.
7. **Replace all the components belonging to the spare parts kit.**

4.3 REASSEMBLY

Reassemble the parts, using the references put on the parts in the disassembly phase, to correctly match all the connections and following the procedures described in the preceding paragraphs in reverse order

- 1- Reassemble the obturator guide-obturator unit.
- 2- Refit it inside the body pos. ①.

- 3- Screw the valve seat pos ② onto the body.
- 4- Position the spring pos ②① and the spring holder plug pos ⑨.

4.4 CHECKING SEALS AND CALIBRATION

- 1- See par.3.3 for this check.
- 2- Secure the spring holder plug pos ⑨ by means of the ring nut pos ⑧.

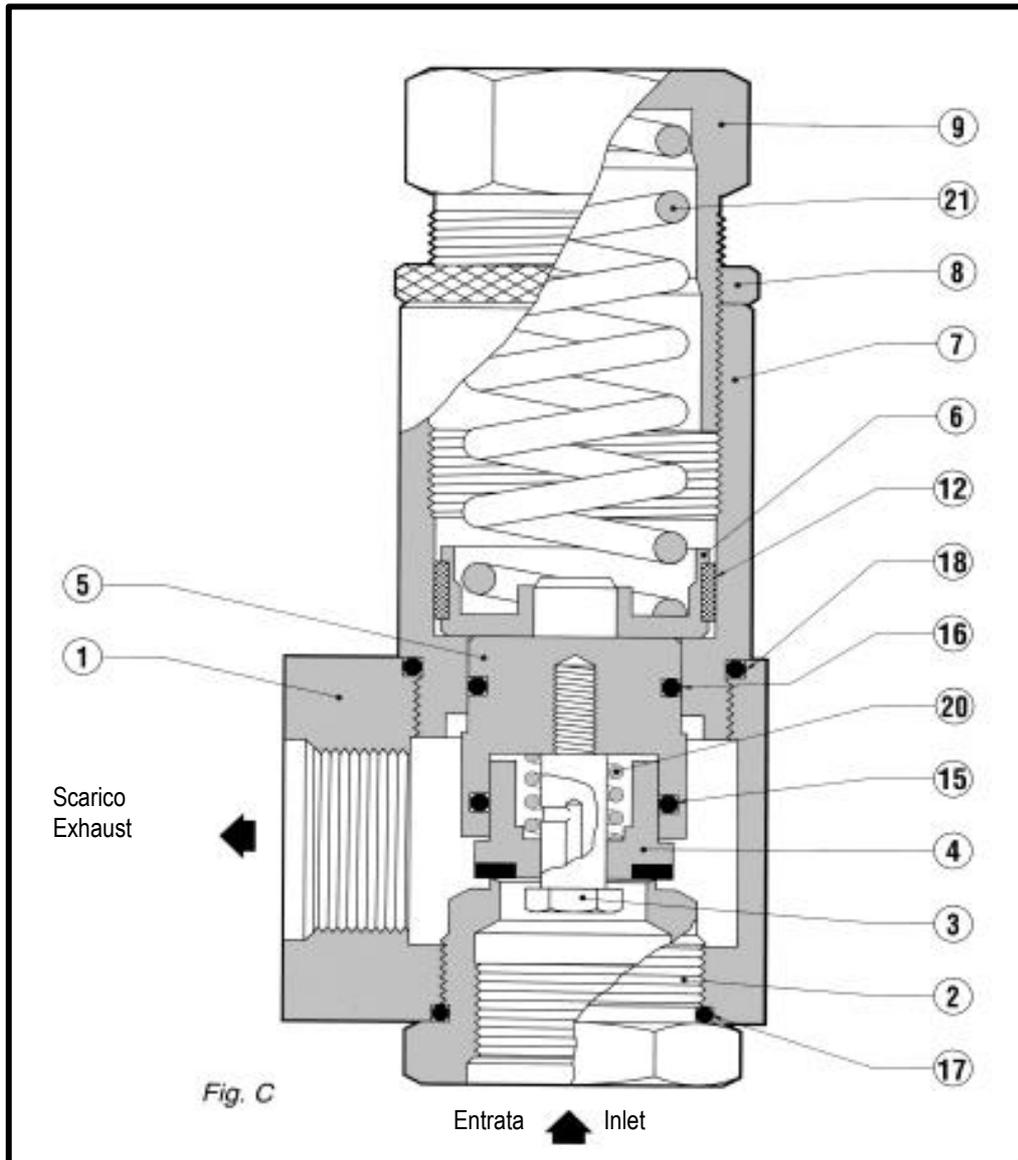


Figure 6

5.0 LUBRICATION

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

1. To facilitate the fitting of components.
2. To improve functionality.
3. To facilitate preservation in case of warehouse storage

During normal operation it is not necessary to provide for lubrication of the valve.

When performing maintenance, it is recommended to lubricate the moving parts (obturator) and seals with silicone grease.

6.0 STORAGE

The VS/AM 58 valves do not require special precautions in the event of storage for long periods; however it is important to:

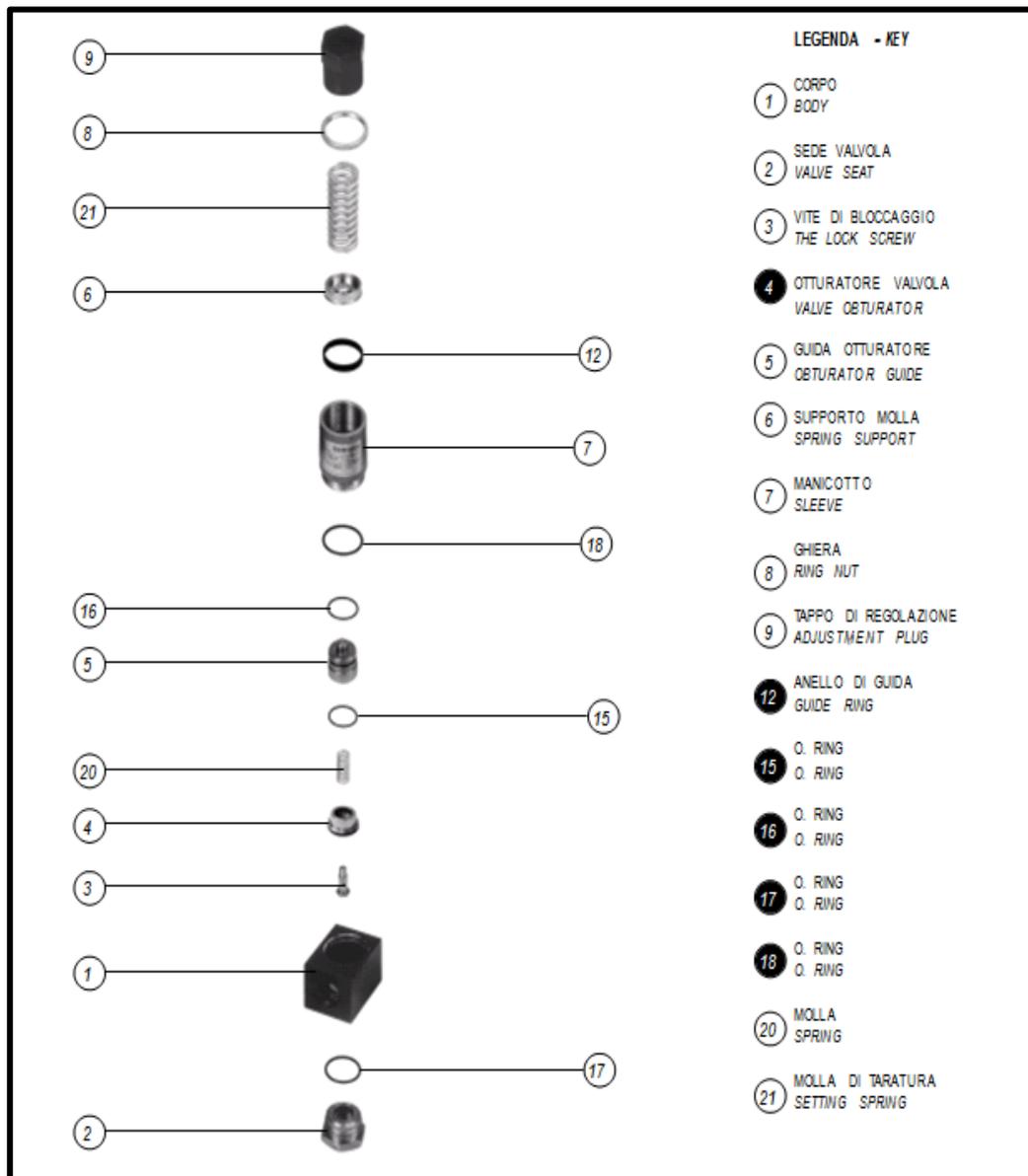
- Keep the valves in the original packaging;
- Keep the protections applied in factory on the flanged connections;
- Keep the rubber parts away from exposure to direct sunlight to avoid rapid aging

7.0 SPARE PARTS

For the identification of spare parts refer to figure 7
When ordering spare parts specify:

Type of valve
Serial number
Year of manufacture
Type of fluid used
Number of article
Quantity





N. PEZZI
POS. DESCRIZIONE/DESCRIPTION N. OF PIECES

4	Otturatore <i>Obturator</i>	1
12	Anello di guida <i>Guide ring</i>	1
14	O. Ring	2
15	O. Ring	1
16	O. Ring	1
17	O. Ring	1
18	O. Ring	1

Figure 7



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