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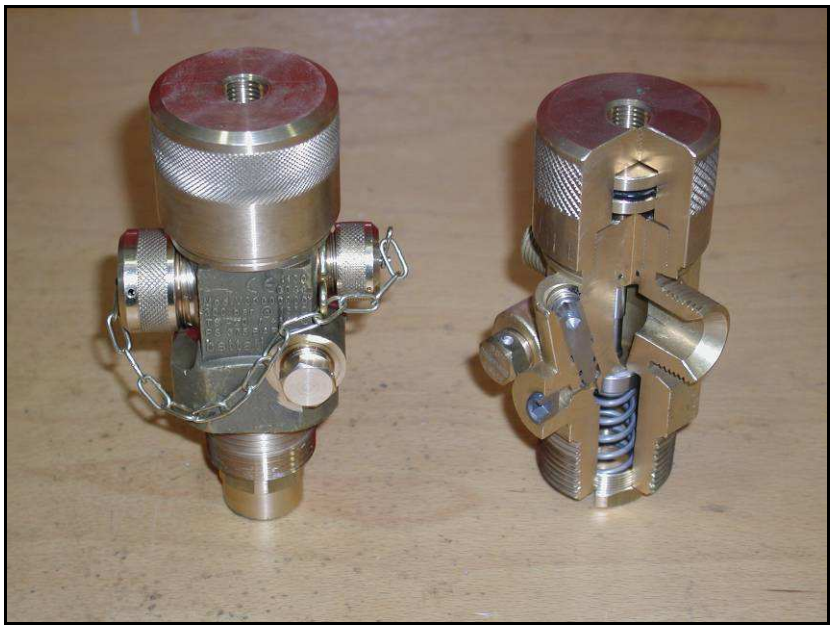
INSTALLATION MANUAL

FOR INERT GAS SYSTEM

IG 100 – IG 01 – IG 55 – IG 541



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Contents

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1. Introduction

1.1 General information

The systems described in this manual use inert gases as extinguishing agents, and consist of two basic units. The basic units used for these system are:

- Storage/Distribution units (fig. 1.1);
- Detection and alarm devices and control panels (fig. 1.2).

Storage/Distribution units

Tab. 1.1 List of components

	Standard Ref.	List of components
1	EN 12094-8	Connectors
2	EN 12094-5	Directional valve
3	PED 97/36/CE	Discharge Manifold
4	EN 12094-4	Discharge Valve and its actuator
5	TPED 99/36/CE	Cylinder
6	EN 12094:10	Pressure gauge and pressure switch
7	EN 12094-13	Non-return Valve and Check Valve
8	EN 12094-7	Nozzle

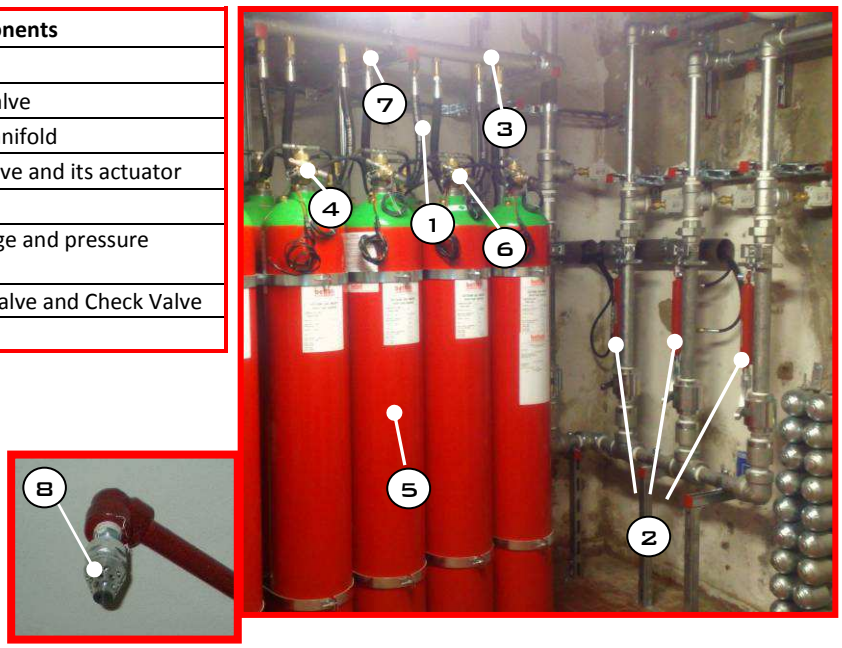

Fig. 1.1 List of mechanical components

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Detection and alarm devices and control panel

Fig.1.2 List of components of the detection system

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1.2 Scope and purpose of manual

This manual is a comprehensive guide containing all recommendations necessary to install the ""Argon IG01", "Nitrogen IG100", "Nitrogen+Argon IG55" and "Nitrogen+Argon+CO_2 IG541" Gas Extinguishing Systems, and it concerns the 300 bar gas extinguishing systems supplied by Bettati Antincendio srl.

	**Discharge of an unsecured and disconnected cylinder could be extremely dangerous and may result in injury or death, and/or damage the property.**

	**NEVER complete all pneumatic connections between cylinders and the actuating system as well as the electrical connection between the solenoid actuator and the control unit UNTIL cylinders are properly secured in the cylinder rack and the discharge connection fittings are connected to the pipeline.**

	**High-pressure-stored gases are involved in the installation of this system**

	**The installation of the system must comply with the requirement of this manual**

	**The installation shall be done ONLY by recommended Bettati Antincendio trained technicians**

1.3 Standards and Code of practice

Systems that use extinguishing agents "Argon IG01", "Nitrogen IG100", "Nitrogen+Argon IG55" and "Nitrogen+Argon+CO_2 IG541" are designed according to these standards:

- UNI EN 15004-1:2008 "Fixed firefighting systems. Gas extinguishing systems. Part 1: Design, installation and maintenance".
- UNI EN 15004-7:2008 "Fixed firefighting systems. Gas extinguishing systems. Part 7: Physical properties and system design of gas extinguishing systems for IG-01 extinguishant".
- UNI EN 15004-8:2008 "Fixed firefighting systems. Gas extinguishing systems. Part 8: Physical properties and system design of gas extinguishing systems for IG-100 extinguishant".
- UNI EN 15004-9:2008 "Fixed firefighting systems. Gas extinguishing systems. Physical properties and system design of gas extinguishing systems for IG-55 extinguishant".
- UNI EN 15004-10:2008 "Fixed firefighting systems. Gas extinguishing systems. Physical properties and system design of gas extinguishing systems for IG-541 extinguishant"

Components used in the system that use extinguishing agent "Argon IG01", "Nitrogen IG100", "Nitrogen+Argon IG55" and "Nitrogen+Argon+CO_2 IG541" are designed according to these standards:

- UNI EN 12094-4:2004 "Fixed firefighting systems. Components for gas extinguishing systems. Requirements and test methods for container valve assemblies and their actuators".
- UNI EN 12094-5:2004 "Fixed firefighting systems. Components for gas extinguishing systems. Requirements and test methods for high and low pressure selector valves and their actuators".
- UNI EN 12094-6:2006 "Fixed firefighting systems. Components for gas extinguishing systems. Requirements and test methods for non-electrical disable devices".
- UNI EN 12094-8:2006 "Fixed firefighting systems. Components for gas extinguishing systems. Requirements and test methods for flexible connectors".
- UNI EN 12094-10:2004 "Fixed firefighting systems - Components for gas extinguishing systems . Requirements and test methods for pressure gauges and pressure switches"
- UNI EN 12094-13:2002 "Fixed firefighting systems. Components for gas extinguishing systems. Requirements and test methods for check valves and non-return valves".

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1.4 Transport and material management

For gas extinguishing cylinders transport, proper means must be used and the MSDS (*Material Safety Data Sheet*), attached with the technical file, must be consulted.

The cylinder must:

- remain either in the pallets or in the proper containers until the ground placement (fig.1.3),

Fig. 1.3a Cylinders located on pallets (horizontal position)

Fig. 1.3b Cylinders placed in a container (vertical position)

- be moved by skilled personnel and with proper means,

⚠	**During the cylinders handling the valve cap must be correctly placed on the top of the cylinder (Fig. 1.4)**

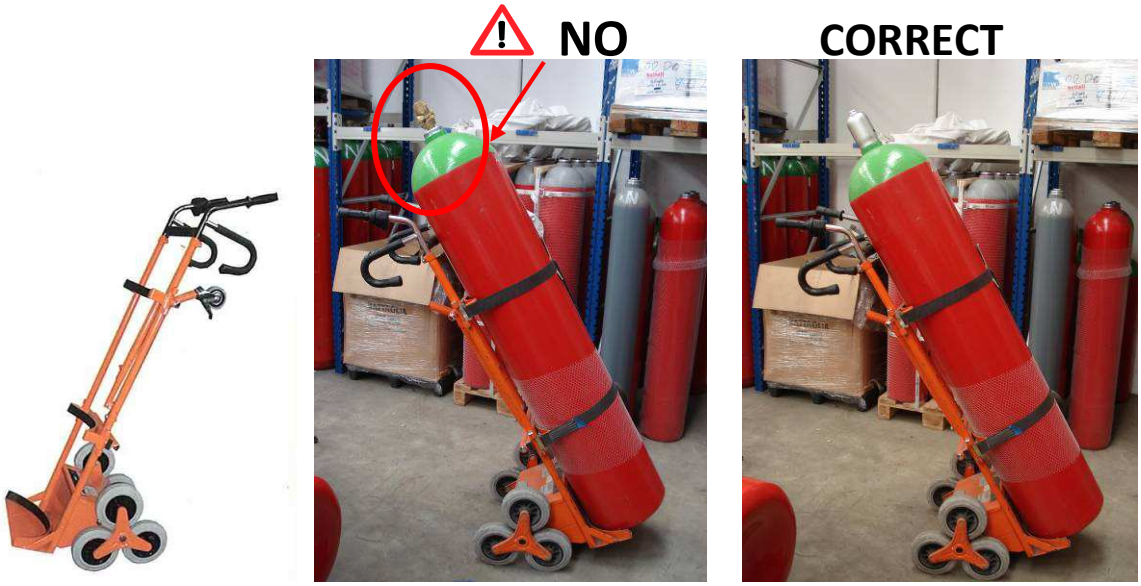

Fig.1.4 Trailer truck used to move cylinders

- be placed in a clean and dry place,
- be stored in a sheltered place, protected from heat and atmospheric agents,
- avoid aisles and other high traffic areas where physical damage or tampering is more likely. Containers should never be mounted where the container could potentially be splashed with, or submerged in any liquid,
- cylinder valve cap and all the safety plugs for the pressure connection (fig. 1.5) must be in place when the cylinders are moved or transported (fig. 1.4),

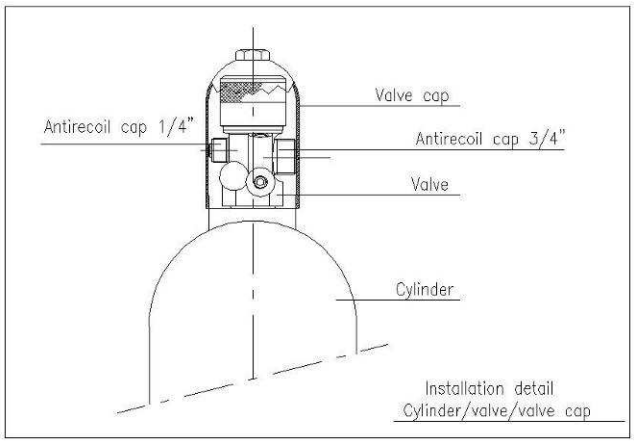

Fig.1.5 Cylinder's cap and Anti-recoil details

- Ensure the correct installation position of every cylinder, as shown in the technical drawing.

Every cylinder is provided with specific nameplates (fig. 1.6) that:

- provides the specific information (contained gas, serial number, operating pressure, weight information: tare, gross and agent);
- shows the valve outlet position (this nameplate is useful for the placement of the cylinder, as the valve outlet is hidden by cylinder cap);
- describes the safety information for handling and storage;
- describes the transport data.


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SISTEMI GAS INERTI
Inert Gas System

CARICATA CON Filled with		
MATRICOLA/Serial no.		
PRESSIONE DI CARICA @ 15°C Filling pressure @ 15°C		bar
CAPACITA'/Capacity		Litre
TARA/Tare		Kg
PESO VALVOLA E CAPPELLOTTO Valve and cup wheight		Kg
PESO CARICA Filling Wheight		Kg
PESO LORDO Gross Wheight		Kg

Cylinder nameplate


HIGH PRESSURE CYLINDER FILLED BY GAS
EXTINGUISHING AGENT

WARNING

FOLLOW THE INSTRUCTION SHOWN IN THIS LABEL AND IN THE INSTALLATION AND MAINTENANCE MANUAL

KEEP IN GOOD CONDITION THIS LABEL, DO NOT REMOVE, COVER OR DAMAGE IT

DO NOT KEEP THE CYLINDER UNDER DIRECT SOLAR RADIATION AND HOWEVER AT TEMPERATURE HIGHER THAN 50°C

DO NOT MOVE OR HANDLING THE CYLINDER WITHOUT THE CYLINDER SAFETY CAP

ATTENTION
Remove the cylinder cap and the antirecoil cap after the cylinder installation

INSTALLATION

In order to avoid an accidental gas discharging DO NOT install the solenoid actuator on the valve before this operations:
1. Make sure the cylinder is correctly fixed
2. Make sure the discharge hose is correctly connected with the cylinder and the manifold
3. Make sure the pneumatic conenct is correctly installed and checked
4. Make sure ther are not any leakages in the solenoid actuator connection before monting the flex hose

MAINTENANCE

Before making any operation:
1. Do not break the seal and do not remove the safety pin on the solenoid actuator
2. Remove the coil of the solenoid actuator in order to avoid accidental gas discharging

For further information cosult the istallation or maintenance manual or contact:

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Safety nameplate

Transport tag

Valve outlet nameplate

Fig.1.6 Cylinder tags and labels

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1.5 Preliminary control and operations:

- Check that the cylinders support base (especially in case of floor or underfloor voids placement) and the entire structure can support the total loads shown in the following tab. 1.2;

Tab. 1.2 Cylinder and extinguishing agent characteristics

300 bar Cylinders

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
140	360	1750±30	190±3
NITROGEN		Agent weight [kg]	43.5
		Valv. weight [kg]	2.5
		Tot. weight [kg]	236±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
80	273	1790±30	114±3
NITROGEN		Agent weight [kg]	24.9
		Valv. weight [kg]	2.5
		Tot. weight [kg]	141.4±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
140	360	1750±30	190±3
ARGON		Agent weight [kg]	70.5
		Valv. weight [kg]	2.5
		Tot. weight [kg]	263±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
80	273	1790±30	114±3
ARGON		Agent weight [kg]	40.3
		Valv. weight [kg]	2.5
		Tot. weight [kg]	156.8±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
140	360	1750±30	190±3
IG55		Agent weight [kg]	56.1
		Valv. weight [kg]	2.5
		Tot. weight [kg]	248.6±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
80	273	1790±30	114±3
IG55		Agent weight [kg]	32.1
		Valv. weight [kg]	2.5
		Tot. weight [kg]	148.6±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
140	360	1750±30	190±3
IG541		Agent weight [kg]	57.9
		Valv. weight [kg]	2.5
		Tot. weight [kg]	250.4±3

Cylinder capacity [L]	Ext.diam. [mm]	Length [mm]	Weight [kg]
80	273	1790±30	114±3
IG541		Agent weight [kg]	33.1
		Valv. weight [kg]	2.5
		Tot. weight [kg]	149.6±3

- Check that the protected area has kept the design volume and that the structural solidity of the walls for the right installation of the pipes and cylinders can be guaranteed ;
- Make a visual check of the material, ensuring that the quantity of the items matches the quantity reported on the data sheet and that it has got the technical specifications reported on the manual “Engineered System”;

All the other materials must be stored in a shelter place, protected from the atmospheric agents, in order to prevent any damage.

The cylinder valve cap can be removed ONLY after the installation of the cylinders.

In order to avoid accidental discharge, the connection between hose and ¼” nipple placed on the solenoid actuator must be done ONLY after a suitable test. (see Chapter 5)

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The cylinders and the accompanying hardware will be supplied with the necessary accessory, in accordance with Bettati Antincendio standards.

The cylinder installation shall be wall-mounted, therefore a suitable place must be found. The brackets and the raw plugs used for the installation must support the total load. Normally, the cylinder should be placed in a dry and well-ventilated place, in order to avoid corrosion and usury phenomena.

Execute the following control procedure; in case of not accordance with the original design, please inform Bettati Antincendio before the installation begins.

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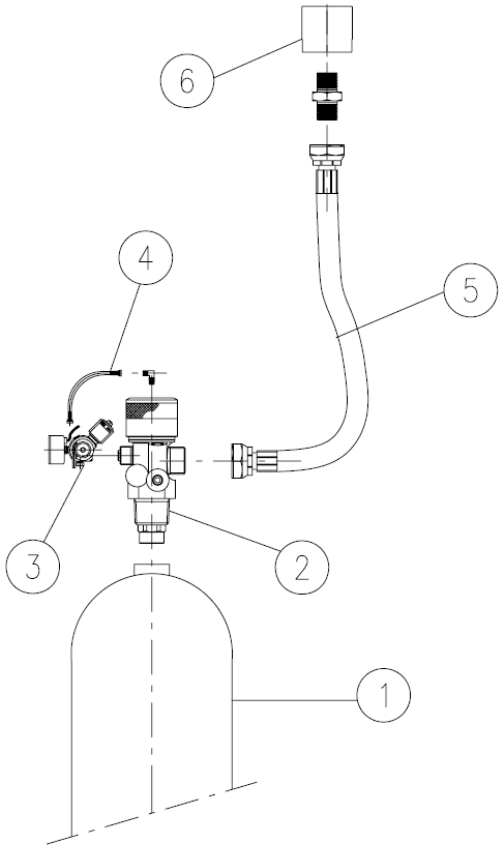
2 System description

The gaseous extinguishing systems “Argon IG01”, “Nitrogen IG100”, “Nitrogen +Argon IG55” and “Nitrogen +Argon+CO_2 IG541” can be subdivided in four different typologies:

- Single cylinder systems
- Multi-cylinder systems, number of cylinders less than 20
- Multi-cylinder systems, number of cylinders more than 20
- Multi-cylinder systems with directional valves

2.1 Single cylinder system



N°	COMPONENT
1	80 L or 140 L pressurized cylinders with extinguishing gas at 300 bar
2	Inert gas valve with 3/4” outlet and anti-recoil cap
3	Bettati solenoid/manual actuator composed by: solenoid pilot valve 24 Vcc, manual swivel actuator, pressure gauge with supervisory pressure switch 0-400 bar, bleeder valve
4	3/16” pilot flex hose
5	3/4"discharge flex hose
6	Pressure reducing device

Fig. 2.1 Single cylinder

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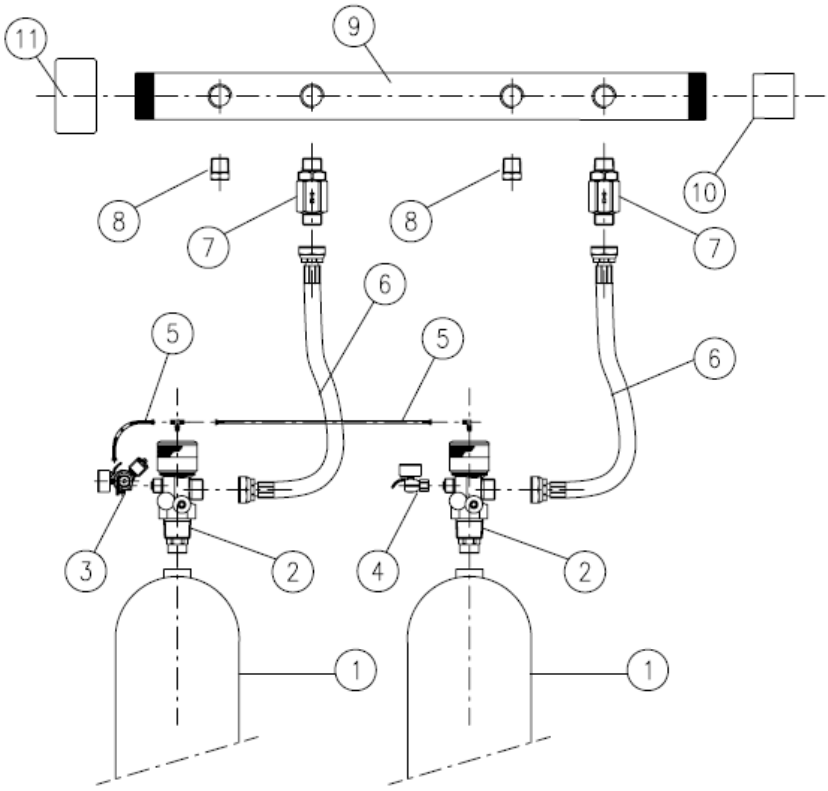
2.2 Multi-cylinder system (number of cylinders less than 20)



N°	COMPONENT
1	80 L or 140 L pressurized cylinders with extinguishing gas at 300 bar
2	Inert gas valve with 3/4" outlet and anti-recoil cap
3	Bettati solenoid/manual actuator composed by: solenoid pilot valve 24 Vcc, manual swivel actuator, pressure gauge with supervisory pressure switch 0-400 bar, bleeder valve
4	pressure gauge assembly with supervisory pressure switch 0-400 bar (N.O.)
5	3/16" pilot flex hose
6	3/4"discharge flex hose
7	3/4"check valve
8	3/4" plug
9	Discharge manifold made of steel XXS type
10	Pressure reducing device
11	Manifold plug

Fig. 2.2 Multiple Cylinders

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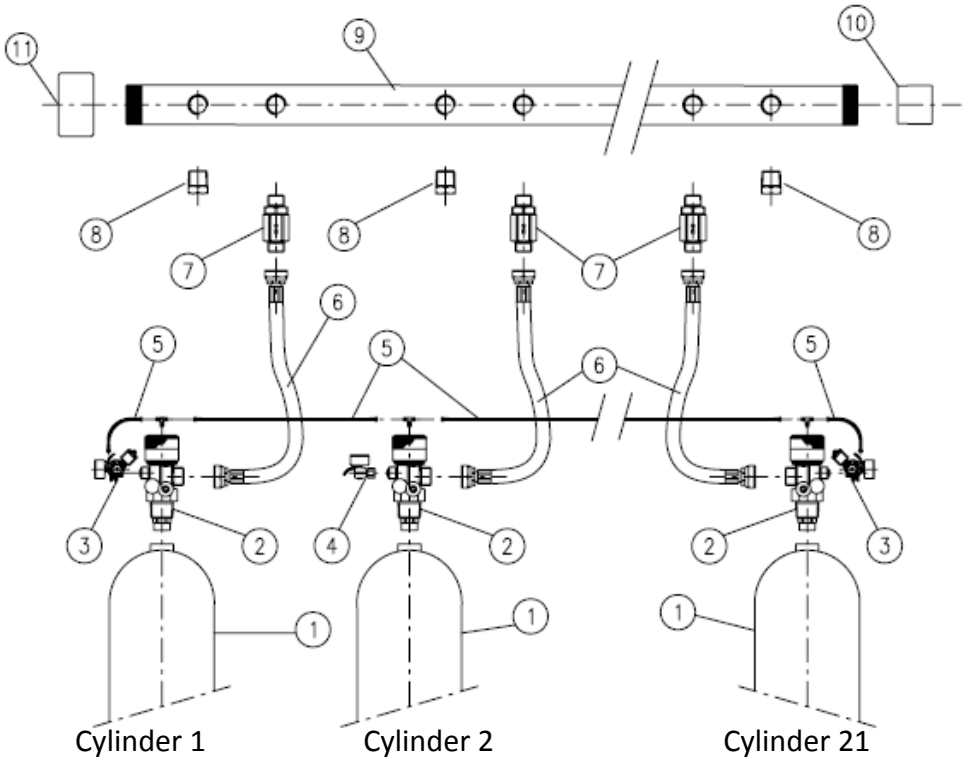
2.3 Multi-cylinder system (number of cylinders more than 20) with 2 solenoid actuators



N°	COMPONENT
1	80 L or 140 L pressurized cylinders with extinguishing gas at 300 bar
2	Inert gas valve with 3/4” outlet and anti-recoil cap
3	Bettati solenoid/manual actuator composed by: solenoid pilot valve 24 Vcc, manual swivel actuator, pressure gauge with supervisory pressure switch (N.O.), bleeder valve
4	pressure gauge assembly with supervisory pressure switch (N.O.)
5	3/16”pilot flex hose
6	3/4"discharge flex hose
7	3/4”check valve
8	3/4” plug
9	Discharge manifold made of steel XXS type
10	Pressure reducing device
11	Manifold plug

Fig. 2.3 Multiple Cylinders, more than 20 cylinders system

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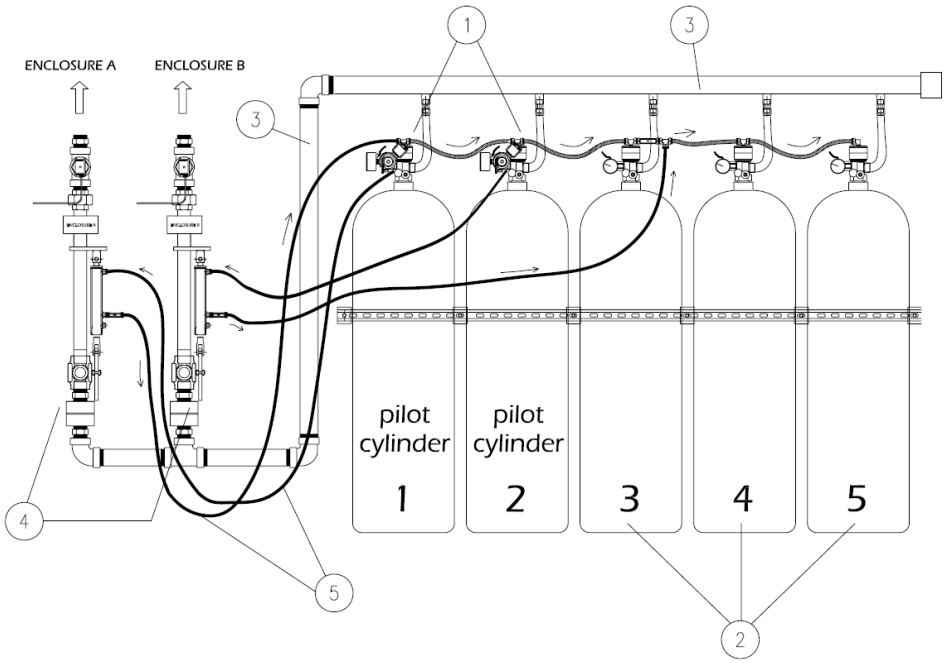
2.4 Multi-cylinder system with directional valves



N°	COMPONENT
1	Pilot cylinder assembly
2	Slave cylinder assembly
3	Manifold
4	Directional valve assembly
5	3/16” pilot flex hose

Fig. 2.4 Multi-cylinder system with 2 directional valves

Fig. 2.5 Inert gas extinguishing system with directional valves

2.5 Components description

The following sections describe the components of Bettati Antincendio srl systems. For more details, please contact Bettati Antincendio at this address:

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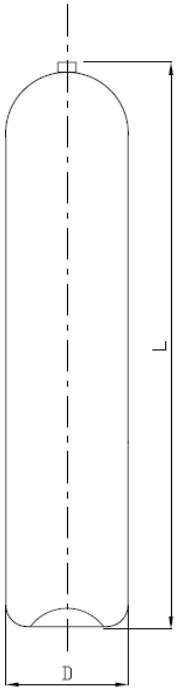
2.5.1 Cylinder

The seamless steel cylinders are manufactured according to EN 1964-1 : 2010/35/UE (TPED)



Capacity (L)	External diameter (mm)	Length (mm)	Weight (kg)	Connection (inch)	Test pressure (bar)	Working Pressure (bar)
80	269	1790	103	1" NPT G	450	300
140	355.6	1810	215	1" NPT G	450	300

Inert gas	Color of body	Color of shoulder
Argon IG-01	red – RAL3000	green – RAL6018
Nitrogen IG-100	red – RAL3000	green – RAL6018
IG-55	red – RAL3000	green – RAL6018
IG-541	red – RAL3000	green – RAL6018

Fig. 2.6 Cylinder characteristics

Technical specifications about the cylinder (such as capacity, weight, wall thickness, etc.) are stamped on the cylinder shoulder, as shown in figure:

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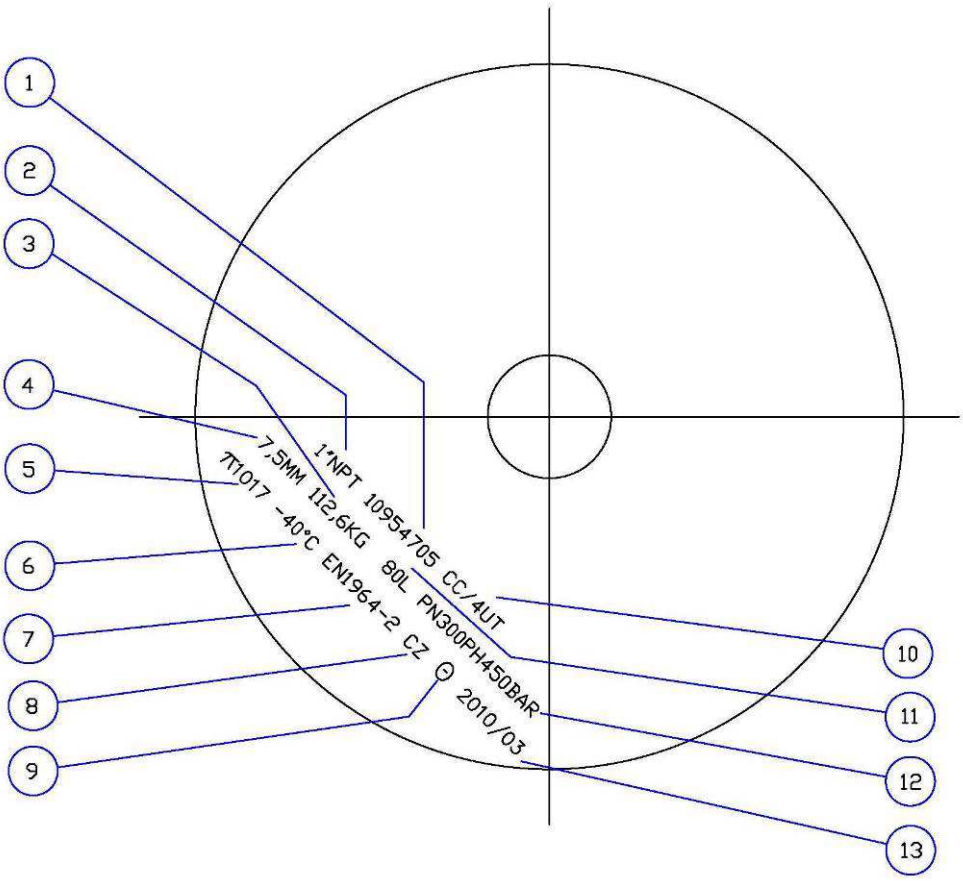

POS	DESCRIPTION	POS	DESCRIPTION
1	Number of cylinder	8	Manufacturing Country
2	Cylinder thread	9	Stamp of the notified body
3	Weight of the empty cylinder	10	Non destructive inspection (ultrasonic)
4	Minimum wall thickness	11	Minimum water capacity
5	TPED mark	12	Nominal pressure (PN) and test pressure (PH)
6	Temperature test	13	Test date
7	Standard		

Fig. 2.7 Technical specifications about the cylinder are stamped on the shoulder

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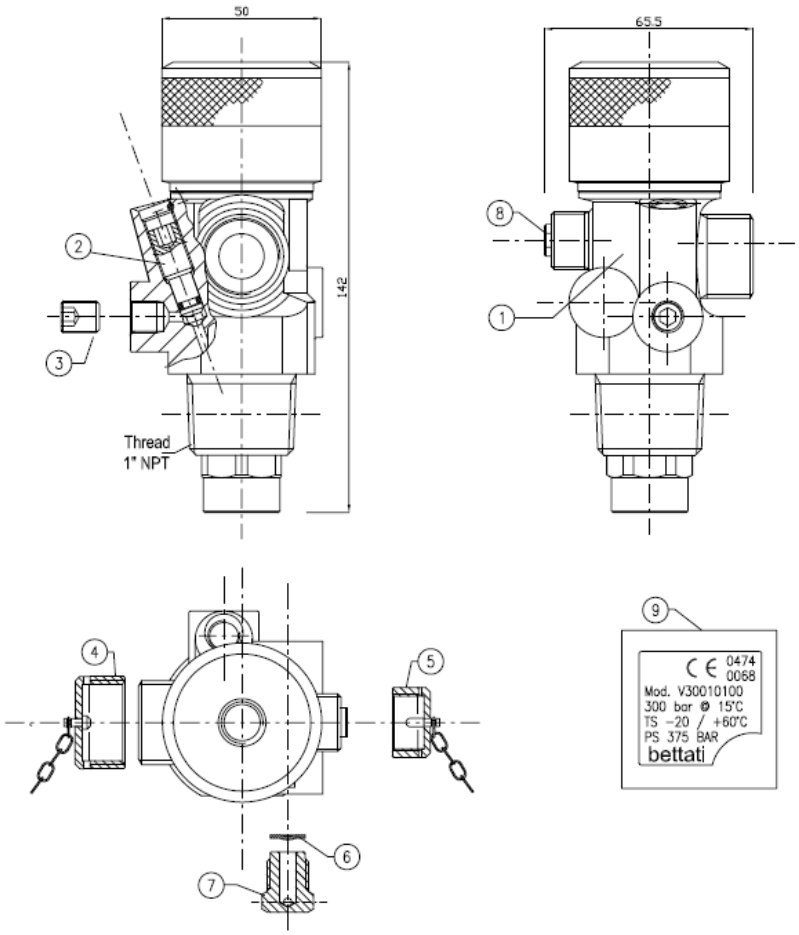
2.5.2 Discharge valve

The discharge valve is a pressure operated cylinder valve having brass body, activated through an operating piston at the top. The discharge valve is certified according to the requirements of EN 12094-4.



N°	COMPONENT
1	Brass body
2	Device for refill on site
3	Plug
4	Anti-recoil cap
5	Pressure socket anti-recoil cap
6	Bursting safety disc
7	Safety disc plug
8	Pressure socket
9	Detail of CE marking

Fig. 2.8 300 bar discharge valve with CE marking

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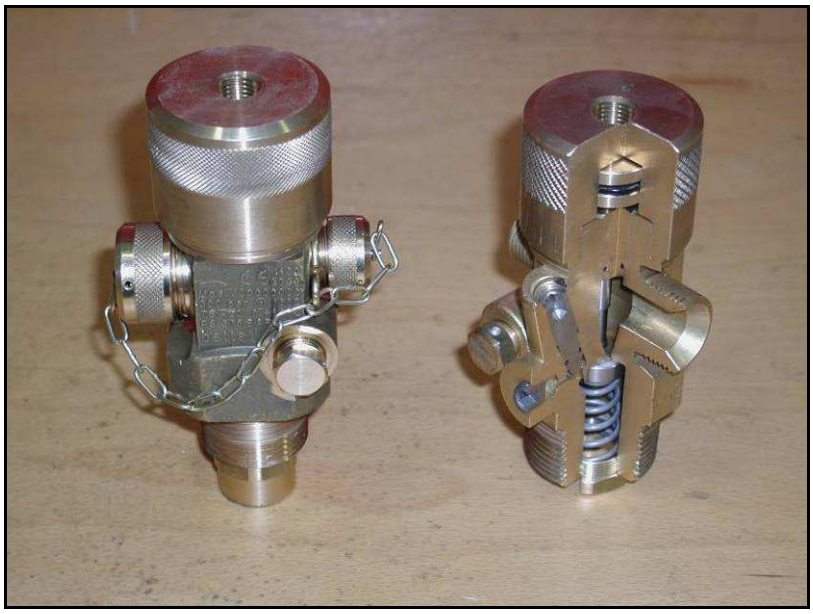
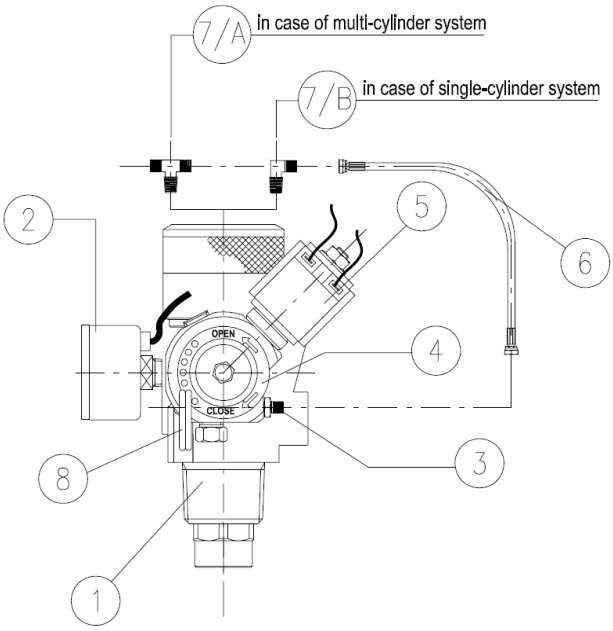


Fig. 2.9 Discharge valve, inlet 1” NPT – outlet 3/4" BSPP

Pilot valve assembly



N°	COMPONENT
1	Valve body
2	Pressure gauge with supervisory pressure switch
3	Pressure outlet with 1/8” BSPT x 1/4" BSPP nipple
4	Manual handwheel
5	Solenoid 24 Vcc 11 W
6	3/16”pilot flex hose
7/A	TEE 1/4" BSPP - 1/4" NPT - 1/4" BSPP
7/B	Elbow 1/4" NPT - 1/4" BSPP
8	Safety pin

Fig. 2.10 Pilot valve assembly

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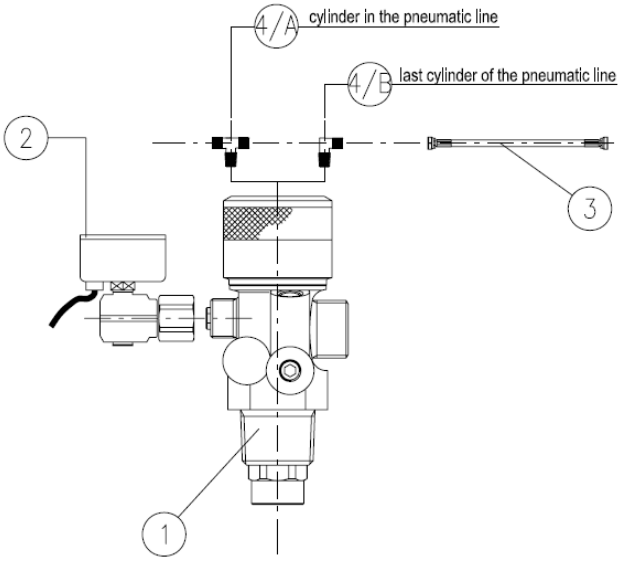
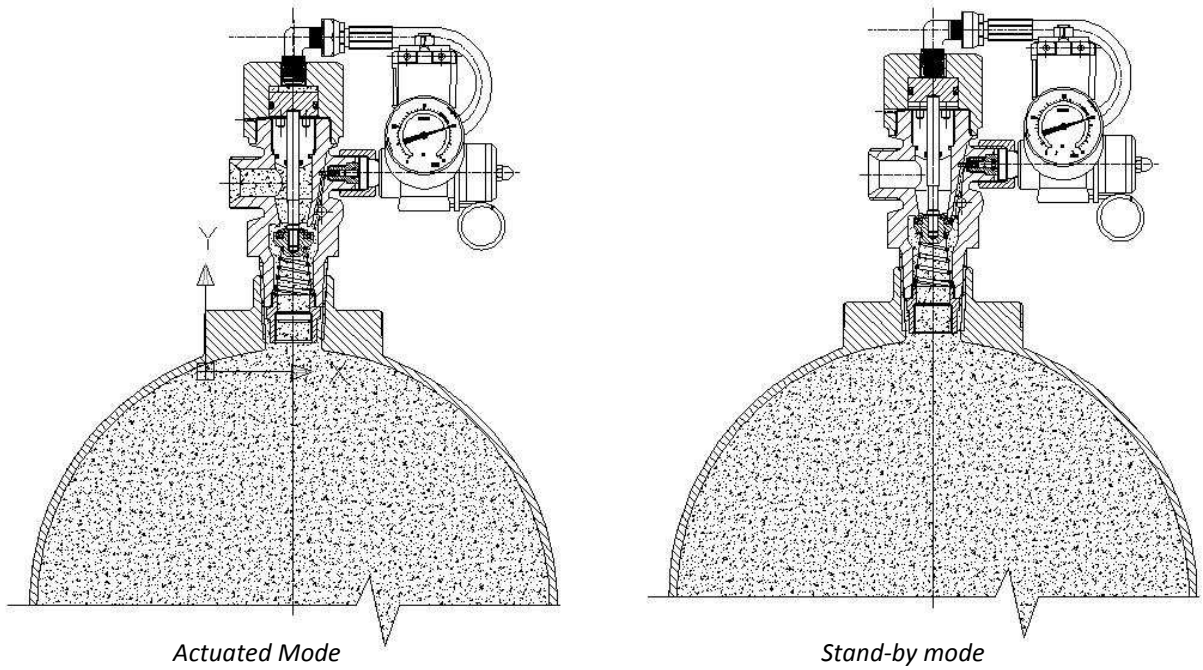
Slave valve assembly



N°	COMPONENT
1	Valve body
2	Pressure gauge with supervisory pressure switch
3	3/16”pilot flex hose
4/A	TEE 1/4" BSPP - 1/4" NPT - 1/4" BSPP
4/B	Elbow 1/4" NPT - 1/4" BSPP

Fig. 2.11 Slave valve assembly

Actuated mode / stand-by mode



Actuated Mode *Stand-by mode*

Fig. 2.12 Actuated mode and stand-by mode of the discharge valve

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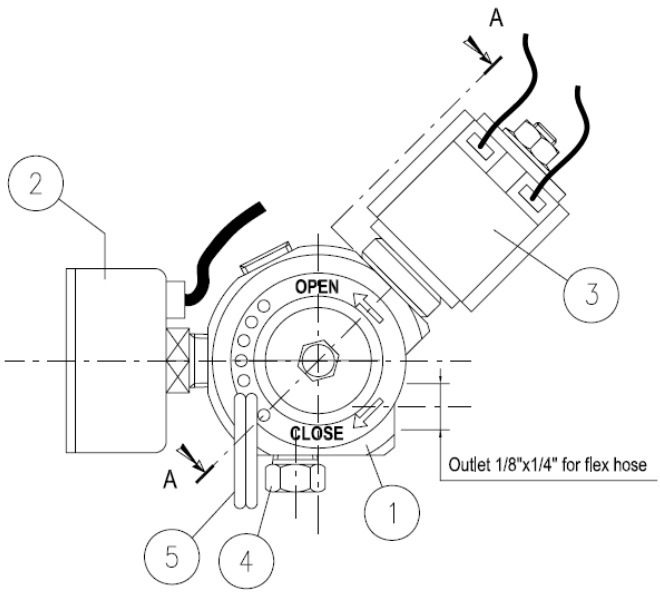
2.5.3 Solenoid/manual actuator

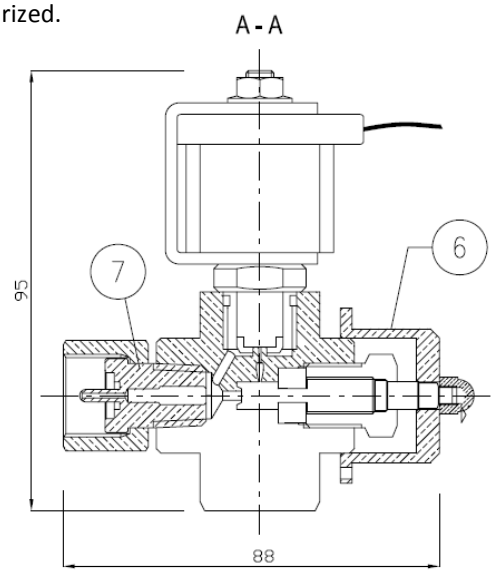
This solenoid / manual actuator is used to open the pilot discharge valve; its assembly includes a pressure gauge with supervisory pressure switch, a bleeder valve and a swivel connection.

ELECTRICAL SPECIFICATIONS OF SOLENOID ACTUATOR	
Nominal tension:	24 Volt DC
Field current:	0.4 A
Power:	11 W
Factor of utilization:	100% ED (continuos)
Protection:	IP67

The solenoid/manual actuator is certified in compliance with EN 12094-4 and the pressure gauge with EN 12094-10

The solenoid/manual actuator can be manually removed from the valve through the swivel nut (7) with the cylinder pressurized.





N°	COMPONENT
1	Body
2	Pressure gauge with supervisory pressure switch 0-400 bar, Ø 40
3	Solenoid 24 Vcc 11 W
4	Bleeder valve
5	Safety pin
6	Manual swivel actuator
7	Swivel nut (connection to valve)

Fig. 2.13 Solenoid manual actuator assembly

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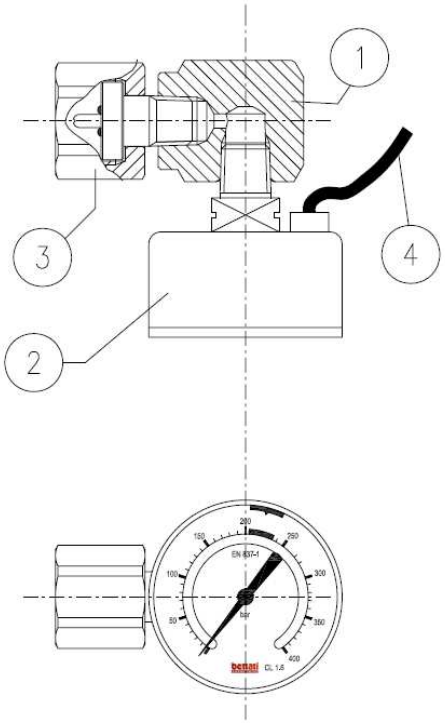
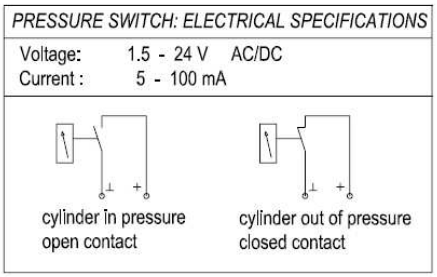
2.5.4 Pressure gauge with supervisory pressure switch

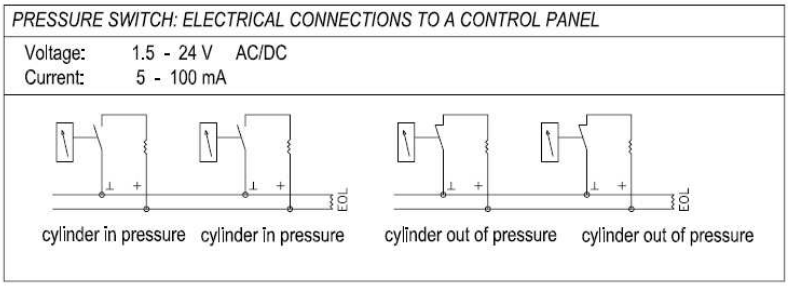
The unit is required for the installation on the slave cylinder, in order to provide a continuous monitoring of the internal pressure of the container.





The gauge is certified according to
UNI EN 12094-10

The pressure gauge assembly can be manually removed from the valve through the swivel nut (3) with the cylinder pressurized.



N°	COMPONENT
1	Pressure socket body
2	Pressure gauge with supervisory pressure switch 0-400 bar Ø 40
3	Swivel nut (connection to valve)
4	Electrical plug

Fig. 2.14 Pressure gauge

N.B. As shown in fig. 2.12, the pressure gauge presents a calibrated pressure (shown in red) which is determined calculating the working pressure at -20°C and reduced by 10%.

W.P@-20°C ≈240 bar → 240 bar – 10% ≈ 220 bar

⚠	**To know which electrical resistance shall be used for all the electrical connections, see the technical manual of the extinguishing panel (which is not included in this documentation).**

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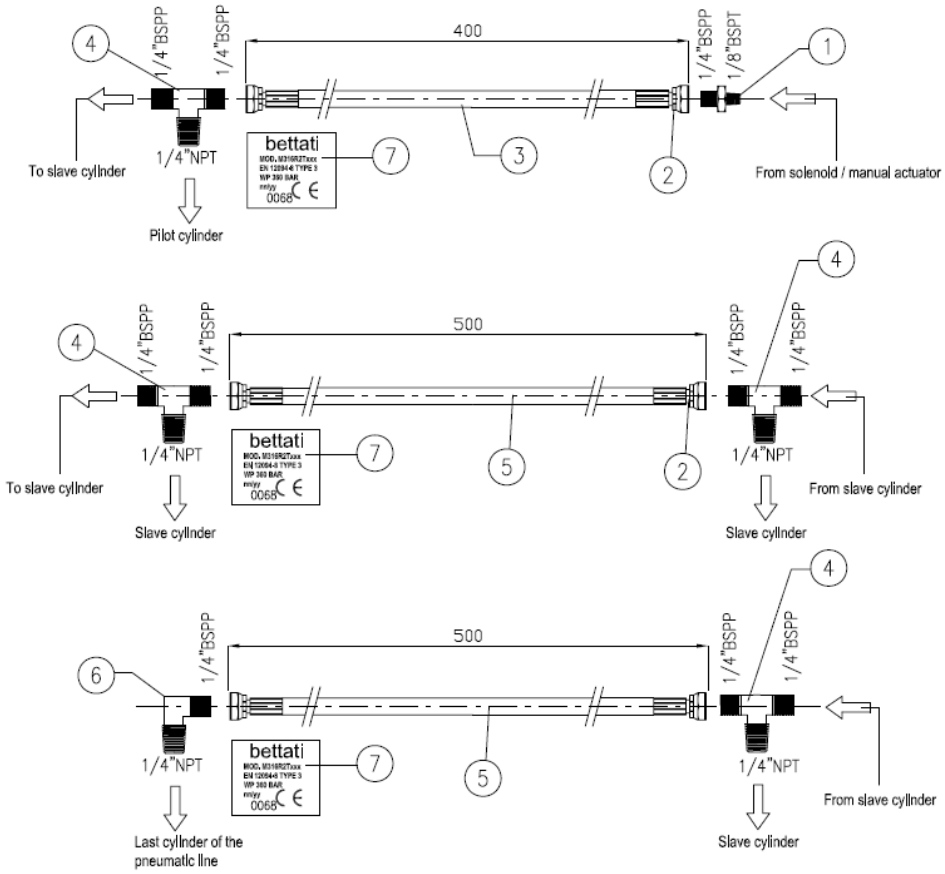
2.5.5 Pilot flex hose

This flexible connectors are used to interconnect cylinder valves and all the mechanical devices involved in the actuating system. 3/16" reinforced rubber flex hose has threaded connections that allow interface between components. The flexible hoses are certified according to UNI EN 12094-8.

Hose Nominal Diameter (inch)	*Connections*	*Working Pressure (bar)*
3/16”	1/4" BSPP	360



1	Nipple 1/8 BSPT – ¼ BSPP
2	Swivel nut 1/4" BSPP
3	Actuator – pilot cylinder 3/16” hose connection
4	TEE 1/4" BSPP - 1/4" NPT - 1/4" BSPP
5	Cylinder – cylinder 3/16” hose connection
6	Elbow 1/4" NPT - 1/4" BSPP
7	CE marking
N°	**COMPONENT**

Fig. 2.15 Flex hose connectors

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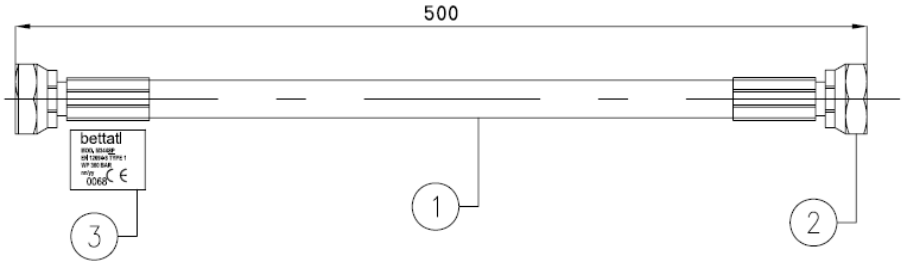
2.5.6 Flex discharge hose

This flexible hose is connected to the valve outlet and allows the discharge of the extinguishing gas.
The flexible hoses are certified complying with UNI EN 12094-8.

Hose Nominal Diameter (inch)	*Connections*	*Working Pressure (bar)*
3/4”	3/4" BSPP	360



1	3/4" discharge hose
2	3/4" BSPP swivel nut
3	CE marking
N°	**COMPONENT**

Fig. 2.16 Flex discharge hose

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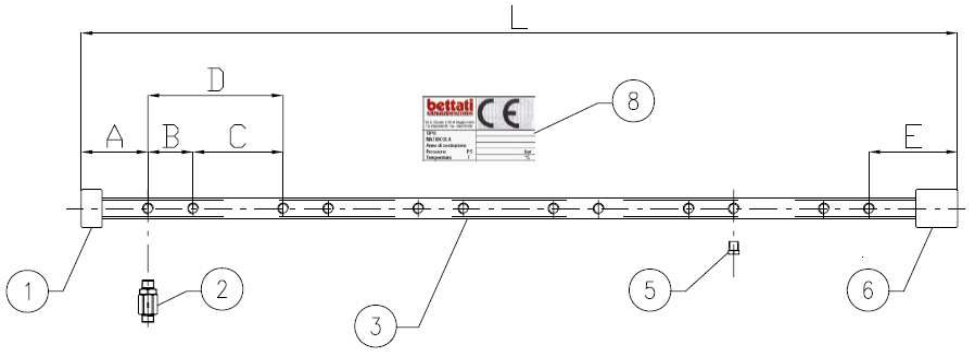
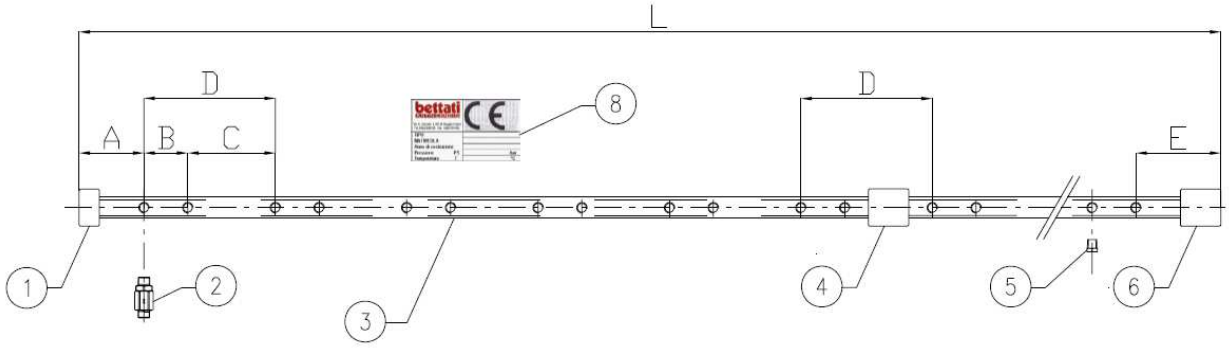
2.5.7 Manifold

The manifold is used to convey the extinguishing gas contained in cylinders to the pipeline. Every manifolds, completed with plugs, check valves and restrictor, is tested by hydrostatic test complying with PED 97/23/EC.

Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
80	Single row	NO	6	125	0	300	300	125	1750
80	Double row	NO	12	75	100	200	300	75	1750



Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
80	Single row	NO	12	125	0	300	300	125	3500
80	Double row	NO	24	75	100	200	300	75	3500



1	2” NPT manifold plug ASA 6000
2	3/4" check valve
3	XXS type pipe
4	2” NPT straight coupling
5	3/4" plug
6	2” NPT pressure reducing device
8	CE marking
N°	**COMPONENT**

Fig. 2.17 Manifolds for 80L cylinder rack, without directional valves

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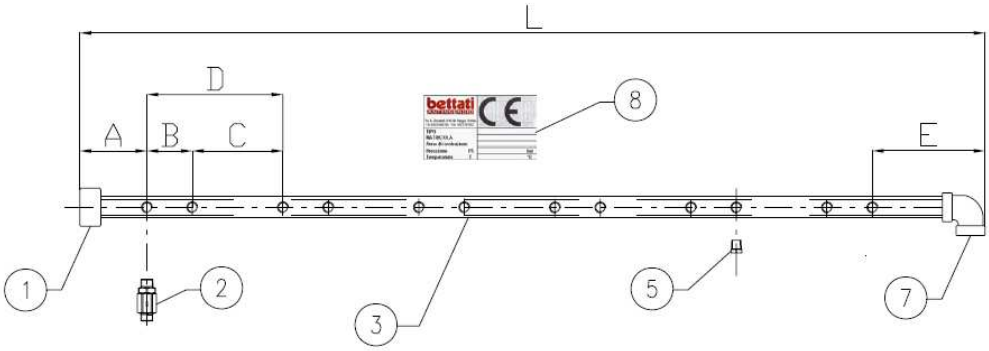
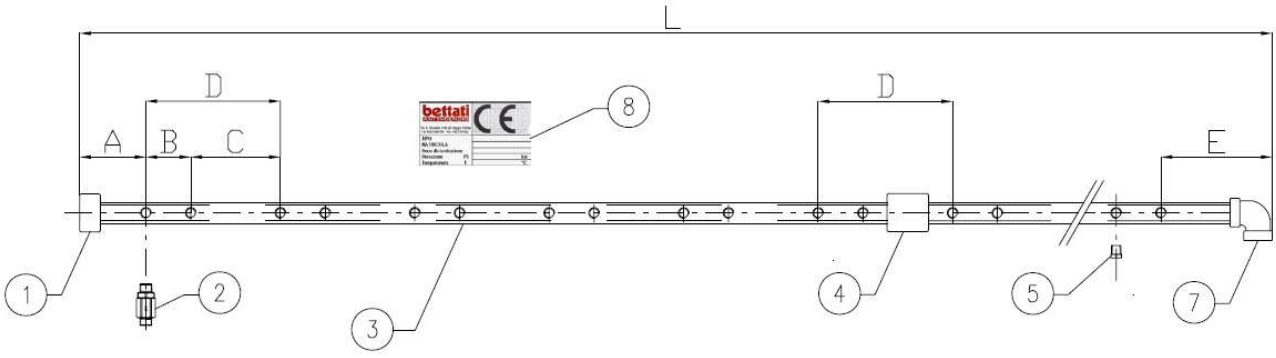
Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
80	Single row	YES	6	125	0	300	300	300	1925
80	Double row	YES	12	75	100	200	300	300	1975



Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
80	Single row	YES	12	125	0	300	300	300	3850
80	Double row	YES	24	75	100	200	300	300	3950



1	2” NPT manifold plug ASA 6000
2	3/4" check valve
3	XXS type pipe
4	2” NPT straight coupling
5	3/4" plug
7	ASA 6000 90° elbow
8	CE marking
N°	**COMPONENT**

Fig. 2.18 Manifolds for 80L cylinder rack, with directional valves

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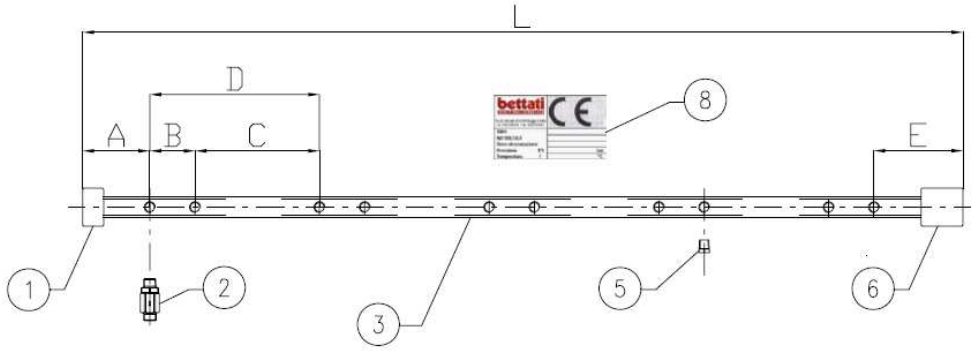
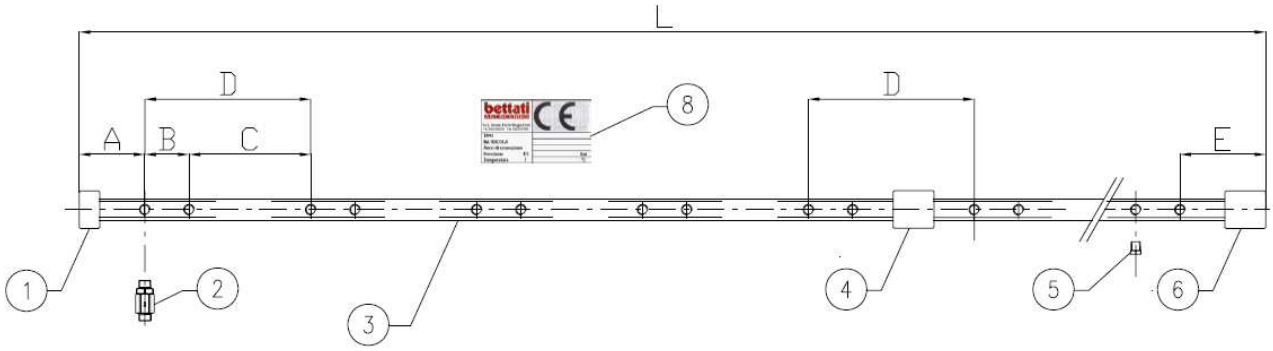
Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
140	Single row	NO	5	175	0	400	400	175	1950
140	Double row	NO	10	125	100	300	400	125	1950



Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
140	Single row	NO	10	175	0	400	400	175	3900
140	Double row	NO	20	125	100	300	400	125	3900



1	2” NPT manifold plug ASA 6000
2	3/4" check valve
3	XXS type pipe
4	2” NPT straight coupling
5	3/4" plug
6	2” NPT pressure reducing device
8	CE marking
N°	**COMPONENT**

Fig. 2.19 Manifolds for 140L cylinder rack, without directional valves

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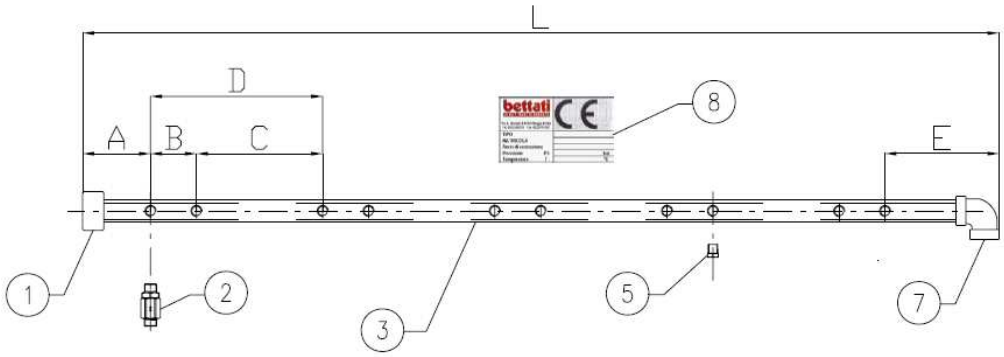
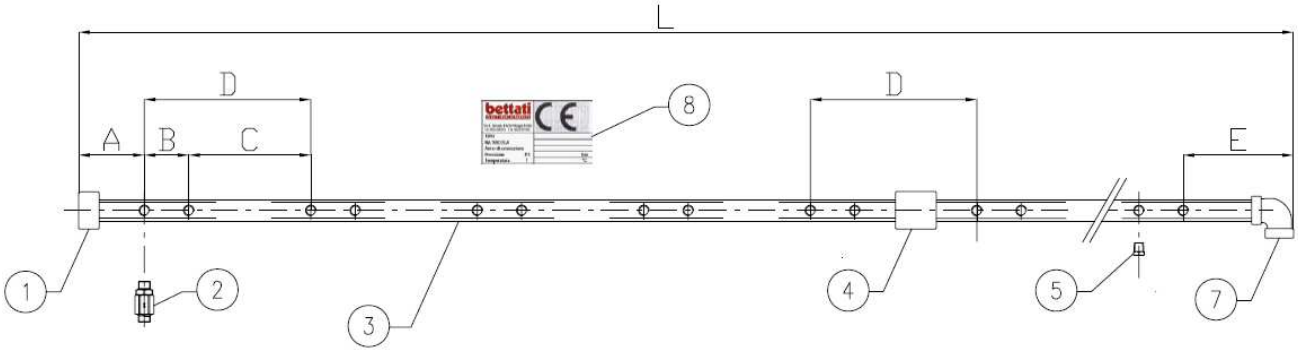
Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
140	Single row	YES	5	175	0	400	400	350	2125
140	Double row	YES	10	125	100	300	400	350	2175



Cylinder capacity (L)	*Cylinder configuration*	*Directional valve*	*Nr. max. cylinders*	*A (mm)*	*B (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*L (mm)*
140	Single row	YES	10	175	0	400	400	350	4250
140	Double row	YES	20	125	100	300	400	350	4350



N°	**COMPONENT**
1	2” NPT manifold plug ASA 6000
2	3/4" check valve
3	XXS type pipe
4	2” NPT straight coupling
5	3/4" plug
7	ASA 6000 90° elbow
8	CE marking

Fig. 2.20 Manifolds for 140L cylinder rack, without directional valves

Don’t modify the provided manifold: the modification would make useless the tests carried out by BETTATI ANTINCENDIO and the granted certification.

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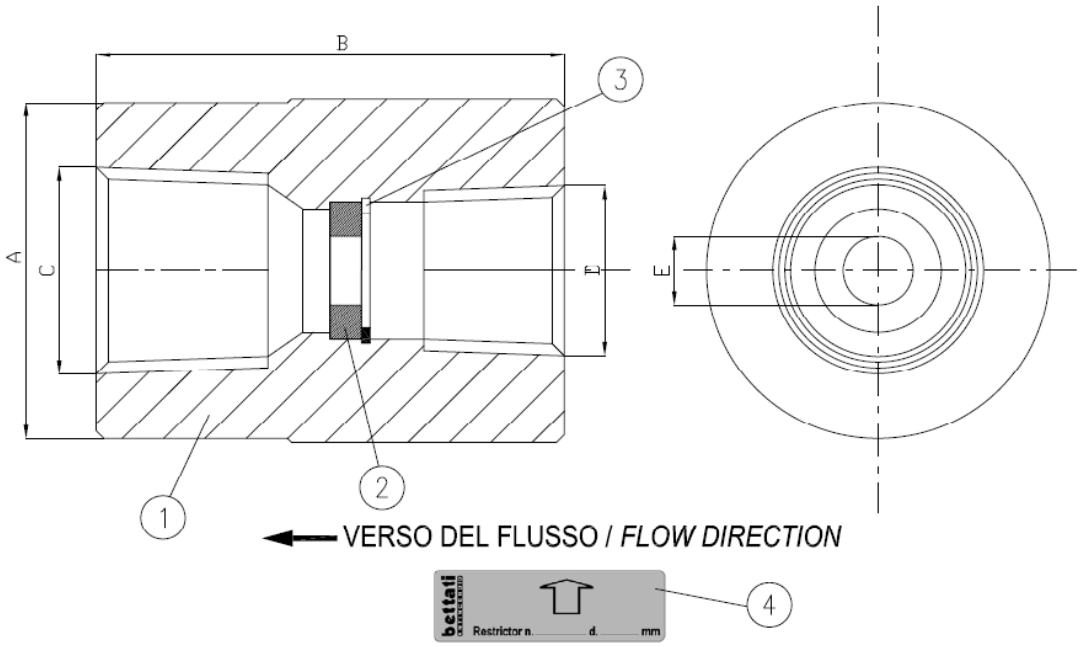
2.5.8 Pressure reducing device

The pressure reducing device allows the reduction of the gas pressure from 300 bar to 60 bar, thanks to a calibrated orifice. The orifice diameter is determined by software calculation.



Nominal Diameter (inch)	*A (mm)*	*B (mm)*	*C (inch)*	*D (inch)*	*E (mm)*	*Seeger*
3/4”	45	60	3/4"	1/2"	min. 3,8 – max. 14,2	DN18
2”	94	87	2”	2”	min. 10,1 – max. 38,1	DN55

N°	**COMPONENT**
1	Body
2	Plate with calibrated orifice
3	Seeger
4	Label

Fig. 2.21 Pressure reducing device

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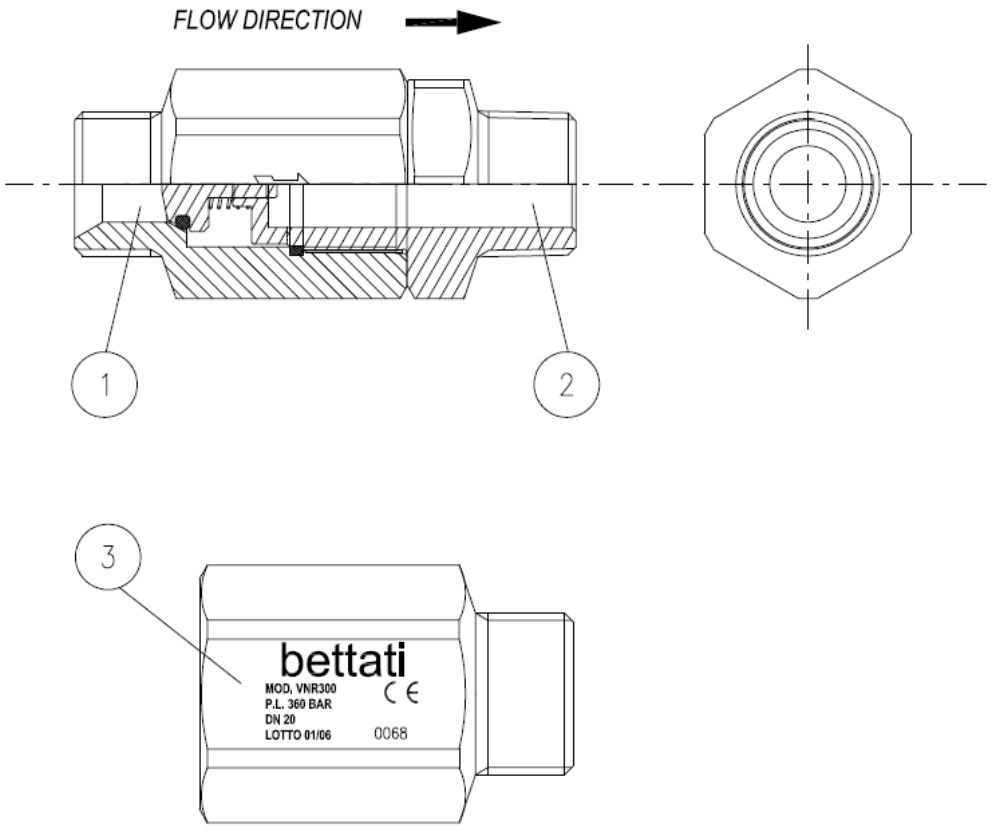
2.5.9 Check valve

The check valve is installed between the flexible connection connected to the cylinder valve discharge outlet (upstream) and the discharge manifold (downstream). It prevents high pressure gas back flow from the manifold. The component is certified according to UNI EN 12094-13.



N°	COMPONENT
1	3/4" BSPP inlet connection
2	3/4" NPT outlet connection
3	CE marking

Fig. 2.22 Check valve

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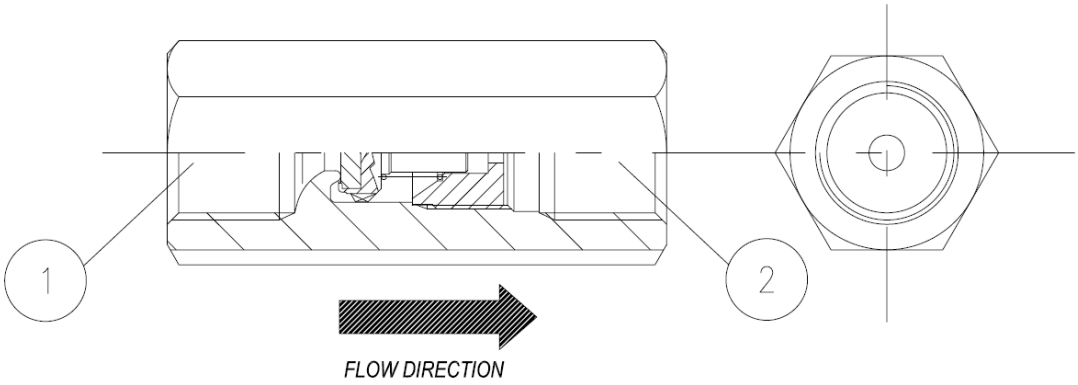
2.5.10 Non-return valve

Non-return valves are used in systems with directional valves and they are mounted on the actuating pneumatic circuit; in this application, back flows shall be absolutely avoided because they would produce a serious malfunction of the system; these components guarantee a stringent non-return condition and allow the correct actuation of a suitable number of cylinders, according with design parameters. The component is certified according to UNI EN 12094-13.



N°	COMPONENT
1	1/4" BSPP inlet connection
2	1/4" BSPP outlet connection

Fig. 2.23 Non-return valve

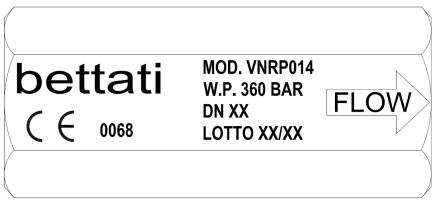


Fig. 2.24 Mark on the non-return valve for CE approval of the component

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2.5.11 Pipeline pressure switch

The pipeline pressure switch is activated by flow pressure during the discharge of the extinguishing agent. Its function is to generate a signal (to be received by the control panel) in case of system activation. The pressure switch is supplied with a resetting stud.

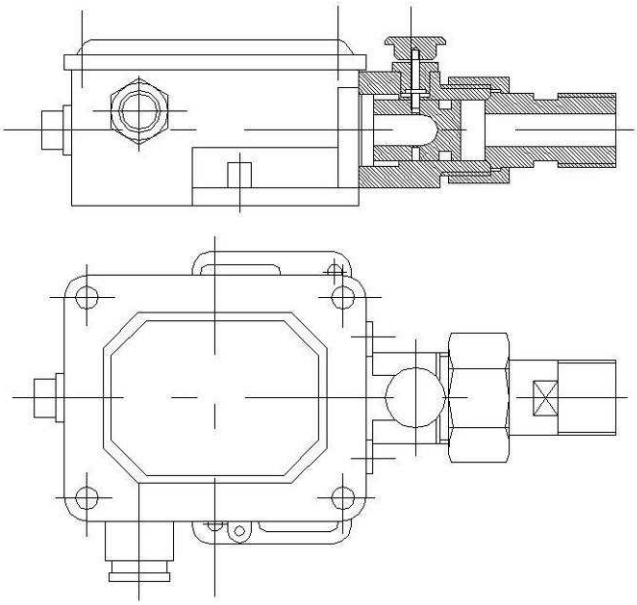
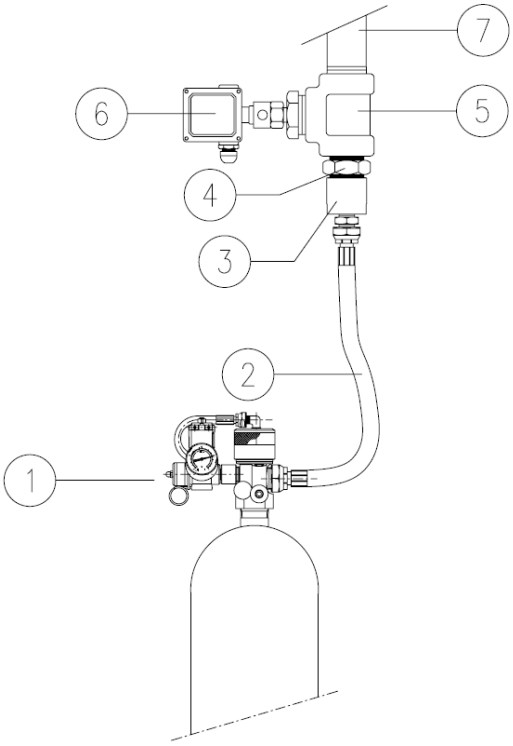


Fig. 2.25 Pipeline pressure switch

Installation with single cylinder



N°	COMPONENT
1	Pilot cylinder assembly
2	3/4" discharge flex hose
3	3/4" pressure reducing device
4	Nipple ASA 3000
5	TEE ASA 3000
6	Pipeline pressure switch
7	Pipeline

Nipples, TEE and the fittings adapter are NOT supplied by Bettati Antincendio

Fig. 2.26 Pipeline pressure switch: installation with single cylinder

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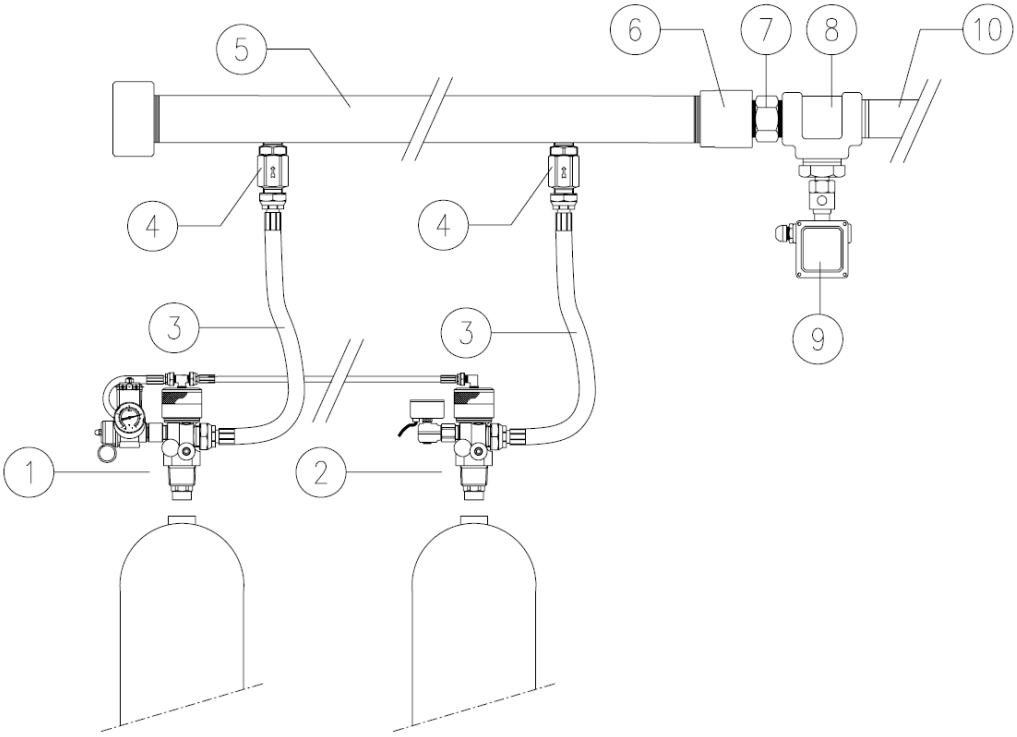
Installation with multi-cylinder system



N°	COMPONENT
1	Pilot cylinder assembly
2	Valve cylinder assembly
3	3/4" discharge flex hose
4	3/4" check valve
5	Manifold
6	2” pressure reducing device
7	Nipple ASA 3000
8	TEE ASA 3000
9	Pipeline pressure switch
10	Pipeline

Nipples, TEE and the fittings adapter are NOT supplied by Bettati Antincendio

Fig. 2.27 Pipeline pressure switch: installation with multi-cylinder system

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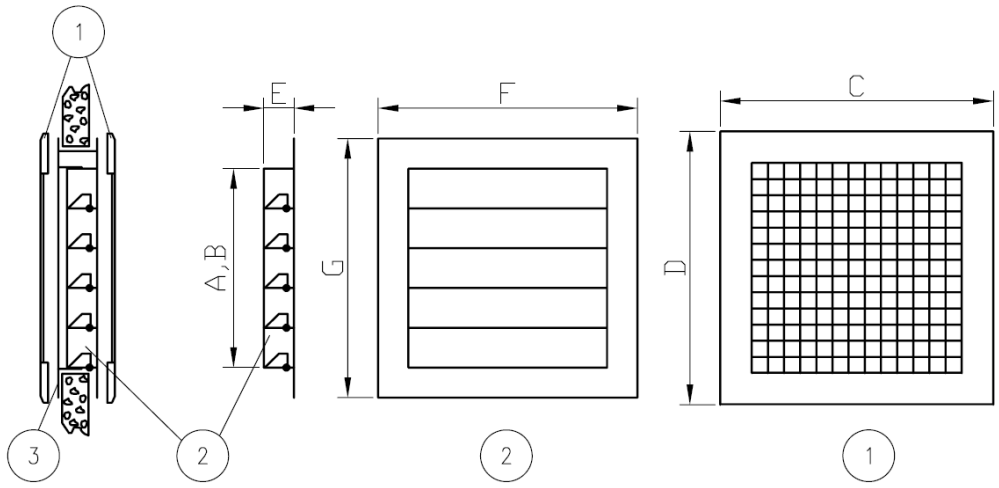
2.5.12 Overpressure damper

It's used to keep the overpressure inside an enclosure (due to gas discharge) below a specified limit.



Nominal vent size (mm x mm)	*A(w) (mm)*	*B(h) (mm)*	*C (mm)*	*D (mm)*	*E (mm)*	*F (mm)*	*G (mm)*	*Unit weight (kg)*	*Hole cut-out Size (mm x mm)*
300x300	340	350	420	420	120	415	415	12	360x350
500x500	540	550	620	620	120	615	615	19	560x550
700x700	740	750	820	820	120	815	815	34	760x750
1000x1000	1040	1050	1120	1120	120	1115	1115	53	1060x1050

N°	**COMPONENT**
1	Grill
2	Pressure vent
3	Wall sleeve

Fig. 2.28 Overpressure damper

Tab. 2.8 Effective areas for each overpressure damper size.

Nominal vent size (mm x mm)	*Nominal vent area (m^2)*	*Effective vent area (m^2)*
300x300	0.09	0.076
500x500	0.25	0.212
700x700	0.49	0.416
1000x1000	1.00	0.85

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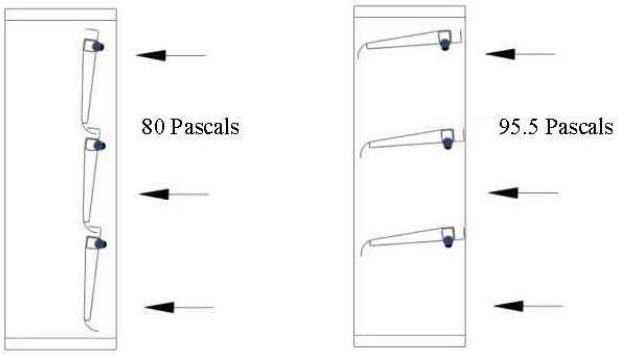

Fig. 2.29 Opening of the blades: pressure inside the room rises from 80 to 95.5 pascal.

Fig. 2.30 Three parts of an overpressure damper.

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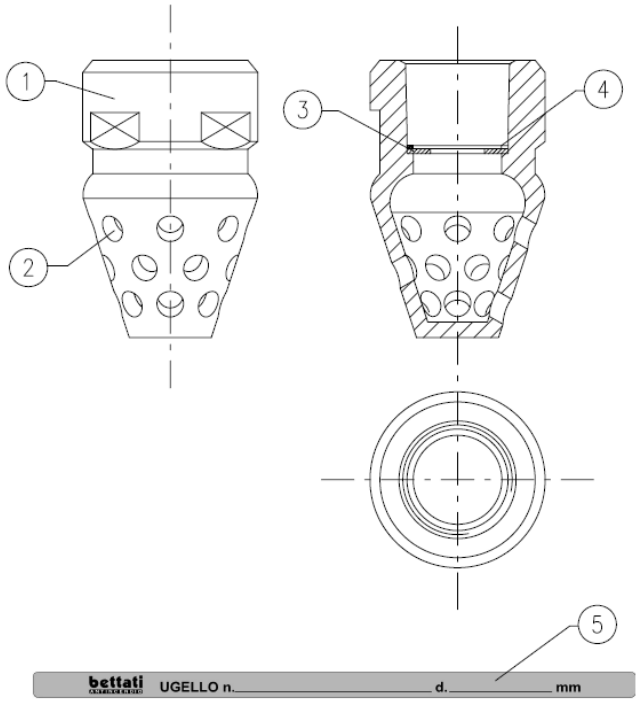
2.5.13 Nozzle

The number of nozzles required is based on size and configuration of the protected enclosure and on the coverage provided by the nozzle.
The orifice plate hole diameter is determined by the VdS hydraulic calculation software.
Bettati Antincendio has performed tests to verify the characteristics of distribution of its nozzles at the Institute for Research and Testing, "M. Masini". Tests were conducted according to the draft prEN 12094-7:2008, complying with the procedure described in section 5.4.3 of the standard.

Nominal Diameter (inch)	*Orifice diameter (mm)*	*Seeger*
1/2"	min. 2,5 – max. 9,5	DN 18
3/4"	min. 3,8 – max. 14,2	DN 23
1"	min. 5,0 – max. 19,0	DN 30
1 ½"	min. 7,6 – max. 28,5	DN 42

The room used for the test has an area of 39,8 m^2 and a volume of 139,4 m^3.
The results confirmed that all requirements expressed by the standard with regard to distribution and concentration of oxygen delivered mass (flooding) are met, as declared by the manufacturer. The percentage of oxygen in the ambient after the discharge is 13 $\pm$ 1%, and the difference measured by different sensors within 60 seconds from the discharge is equal to 0.4%, less than 0.7% indicated by the standard.



1	Brass body
2	24 holes placed in three holes
3	Calibrated plate
4	Seeger
5	Label
N°	**COMPONENT**

Fig. 2.31 Nozzle

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2.5.14 Directional valves

Directional valves allow the distribution of the extinguishing gas into different protected enclosures, each of them with different design requirements, maintaining a single cylinder rack. Total gas quantity and equivalent number of cylinders are chosen on the basis of the enclosure with maximum required agent quantity to be discharged.

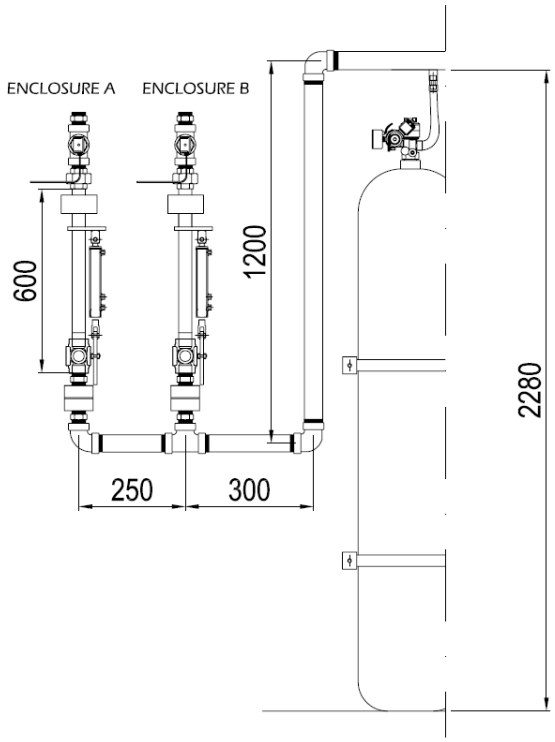

Fig. 2.32 Overall dimensions and layout of 2 directional valves system

Fig. 2.33 Example of a 2 directional valves system

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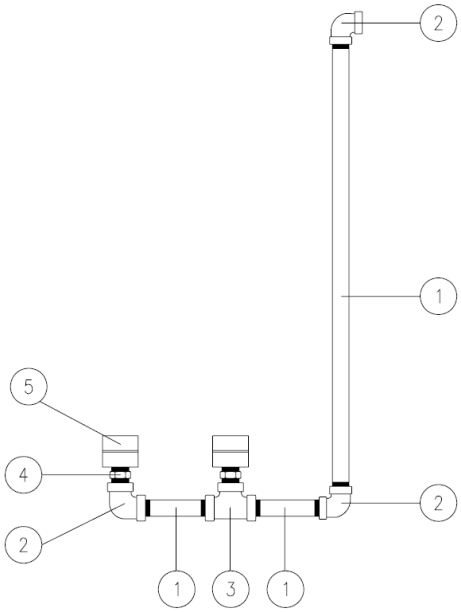
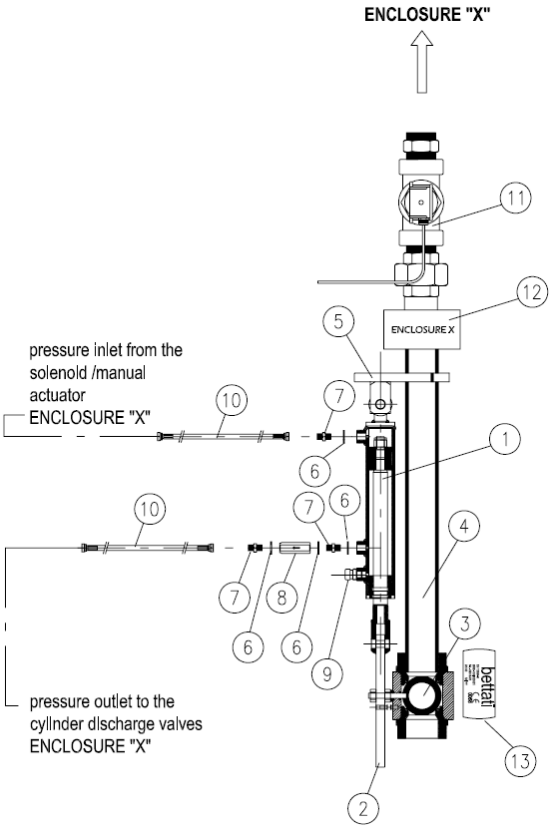
Manifold and pressure reducing devices



N°	COMPONENT
1	Schedula 160 steel pipe
2	ASA 6000 90° elbow
3	ASA 6000 TEE
4	ASA 6000 Nipple
5	Pressure reducing device

Fig. 2.34 Manifold and pressure reducing devices in a system with directional valves

Directional valve assembly



N°	COMPONENT
1	Actuating piston
2	Lever
3	2” ball valve
4	2” sch. 40 pipe
5	Piston holder
6	Bonded seal
7	Nipple 1/4” BSPP – 1/4” BSPP
8	Non-return valve 1/4” BSPP
9	Bleeder
10	3/16”pilot flex hose
11	Pipeline pressure switch assembly
12	Enclosure label
13	CE marking

Fig. 2.35 Directional valve assembly

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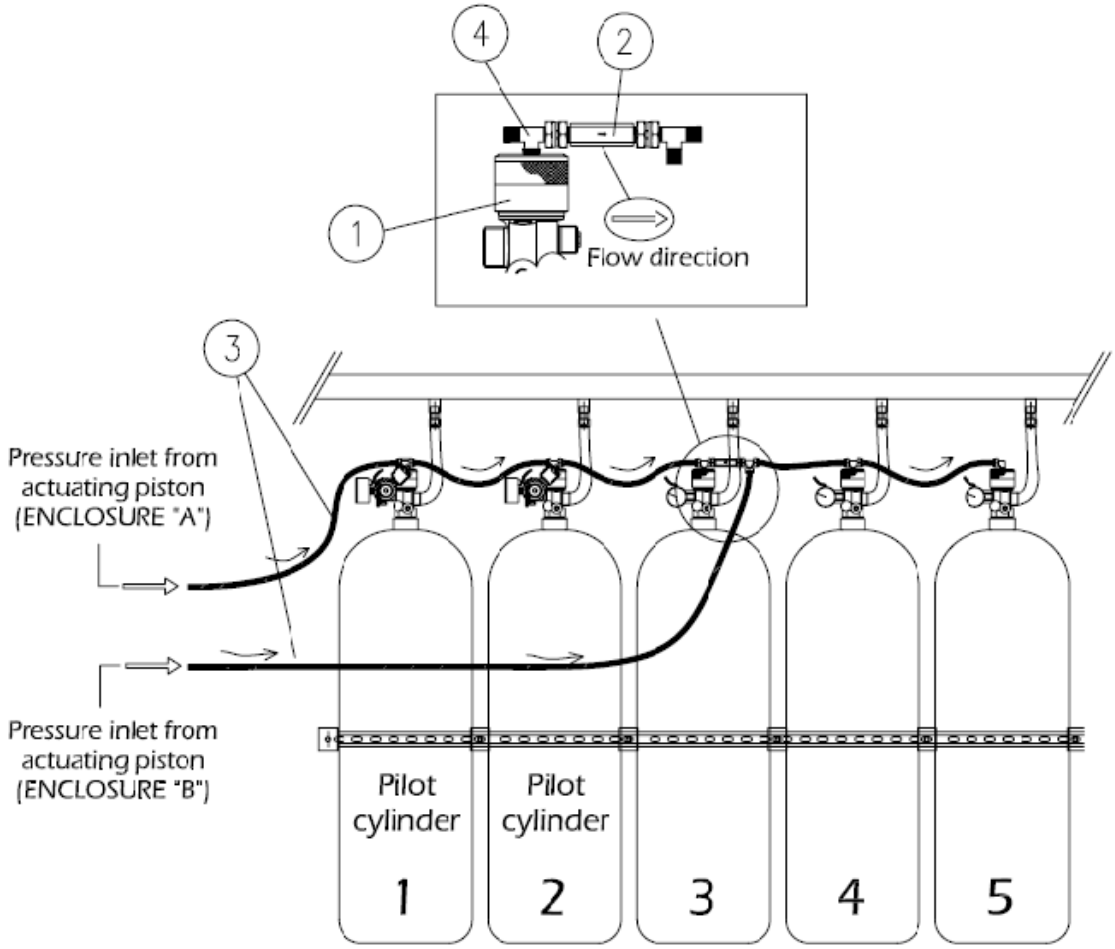
Pneumatic connections on the cylinder rack



N°	COMPONENT
1	Discharge valve
2	Non-return valve 1/4” BSPP
3	3/16” pilot flex hose
4	TEE 1/4" BSPP - 1/4" NPT - 1/4" BSPP

N.B. For better clarity, pneumatic connections FROM solenoid/manual actuators TO actuating pistons (see component 1, fig. 2.35) are not represented in this drawing.

Fig. 2.36 Pneumatic line on the cylinder rack in a directional valve system

N.B. Example shown in fig. 2.36:

An alarm signal in ENCLOSURE A will actuate discharge valves of all five cylinders; if signal comes from ENCLOSURE B, only cylinders 4 and 5 will discharge the extinguishing gas.

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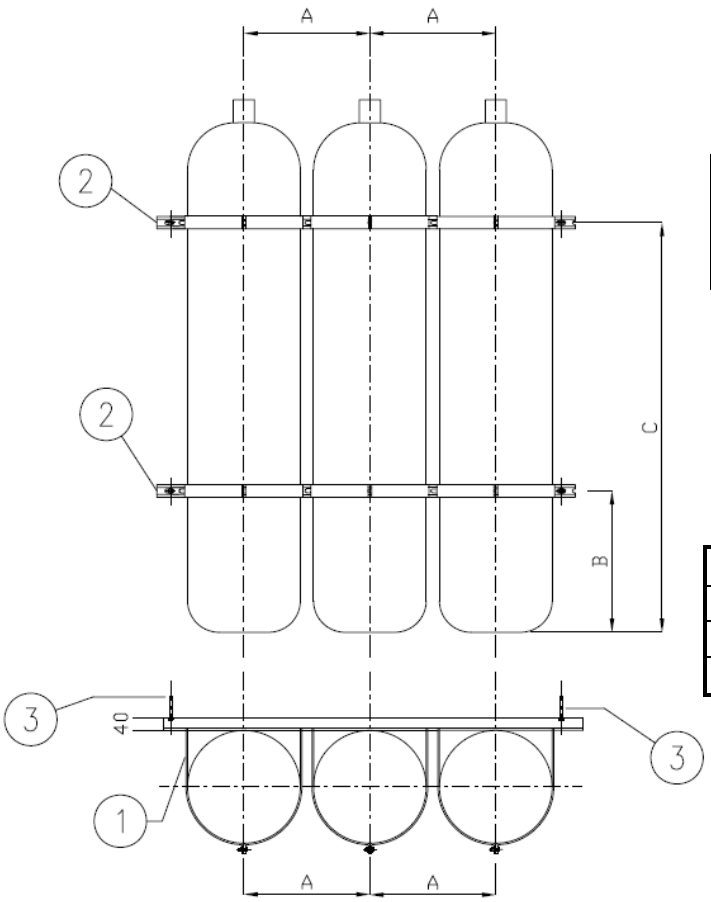
2.5.15 Cylinder fixing components

Single-row cylinder rack fixing



Cylinder capacity (L)	*A (mm)*	*B (mm)*	*C (mm)*
80	300	500	1300
140	400	500	1300

N°	COMPONENT
1	Strap
2	Bracket
3	Fixing device

Fig. 2.37 Components of a single-row cylinder rack fixing

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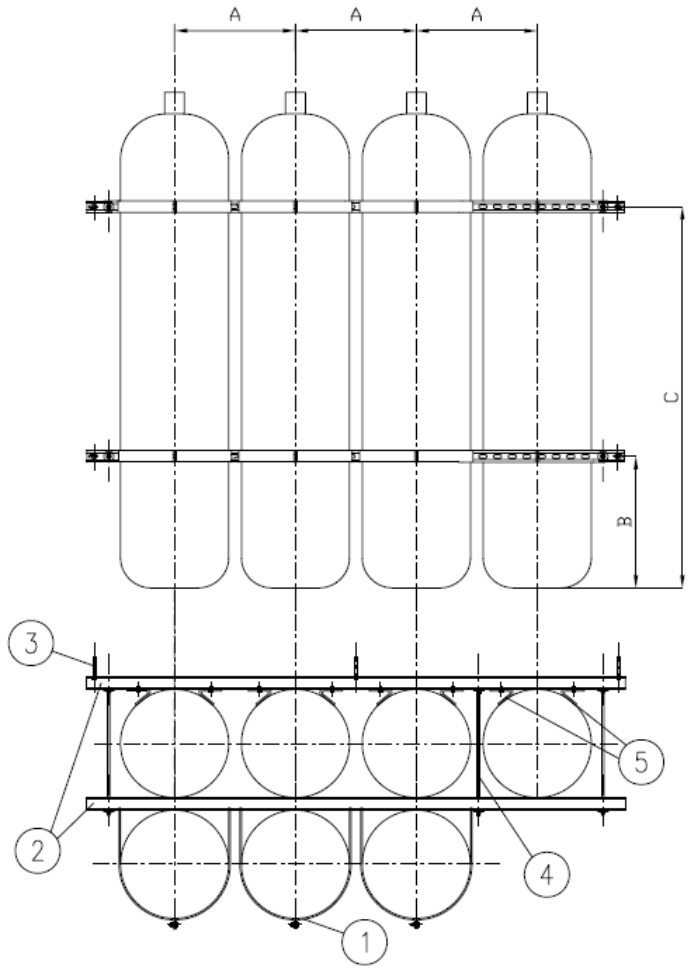
Double-row cylinder rack fixing



Cylinder capacity (L)	*A (mm)*	*B (mm)*	*C (mm)*
80	300	500	1300
140	400	500	1300

N°	**COMPONENT**
1	Strap
2	Bracket
3	Fixing device
4	Second bracket fixing device
5	Angular device

Fig. 2.38 Components of a single-row cylinder rack fixing

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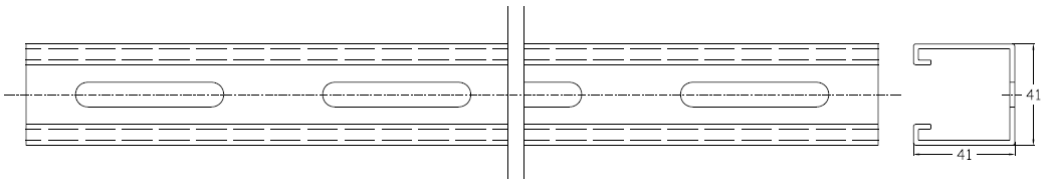


Fig. 2.39 Bracket

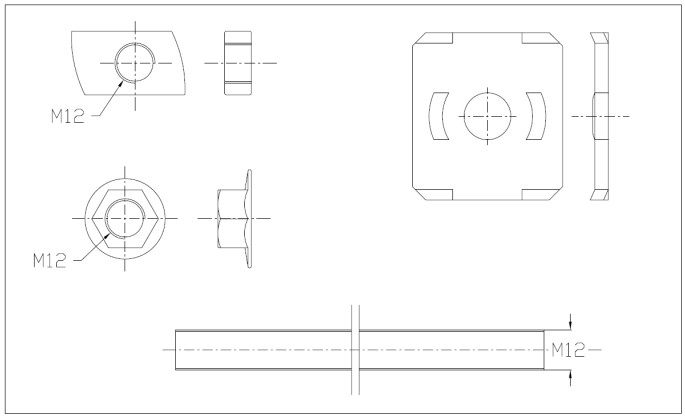


Fig. 2.40 Second bracket fixing device

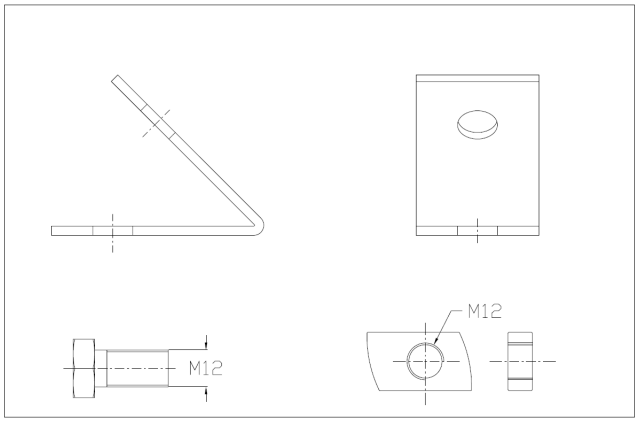
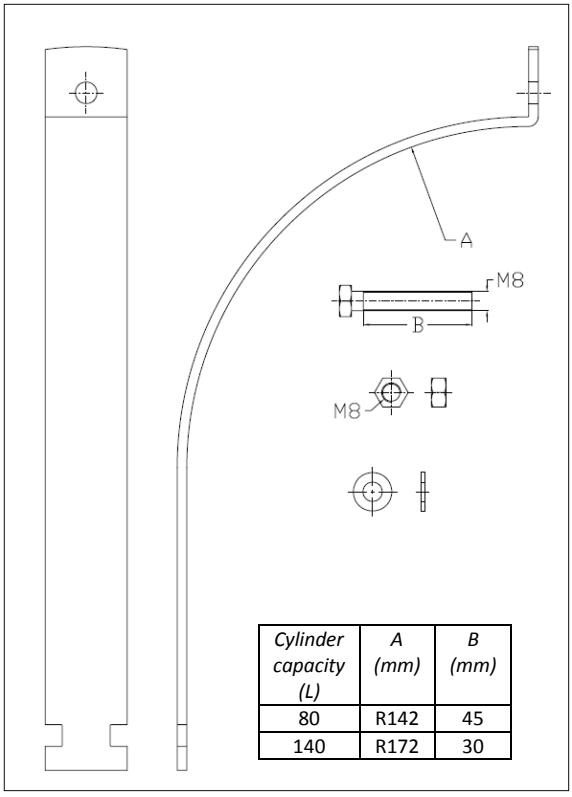


Fig. 2.41 Angular device



Cylinder capacity (L)	*A (mm)*	*B (mm)*
80	R142	45
140	R172	30

Fig. 2.42 Strap

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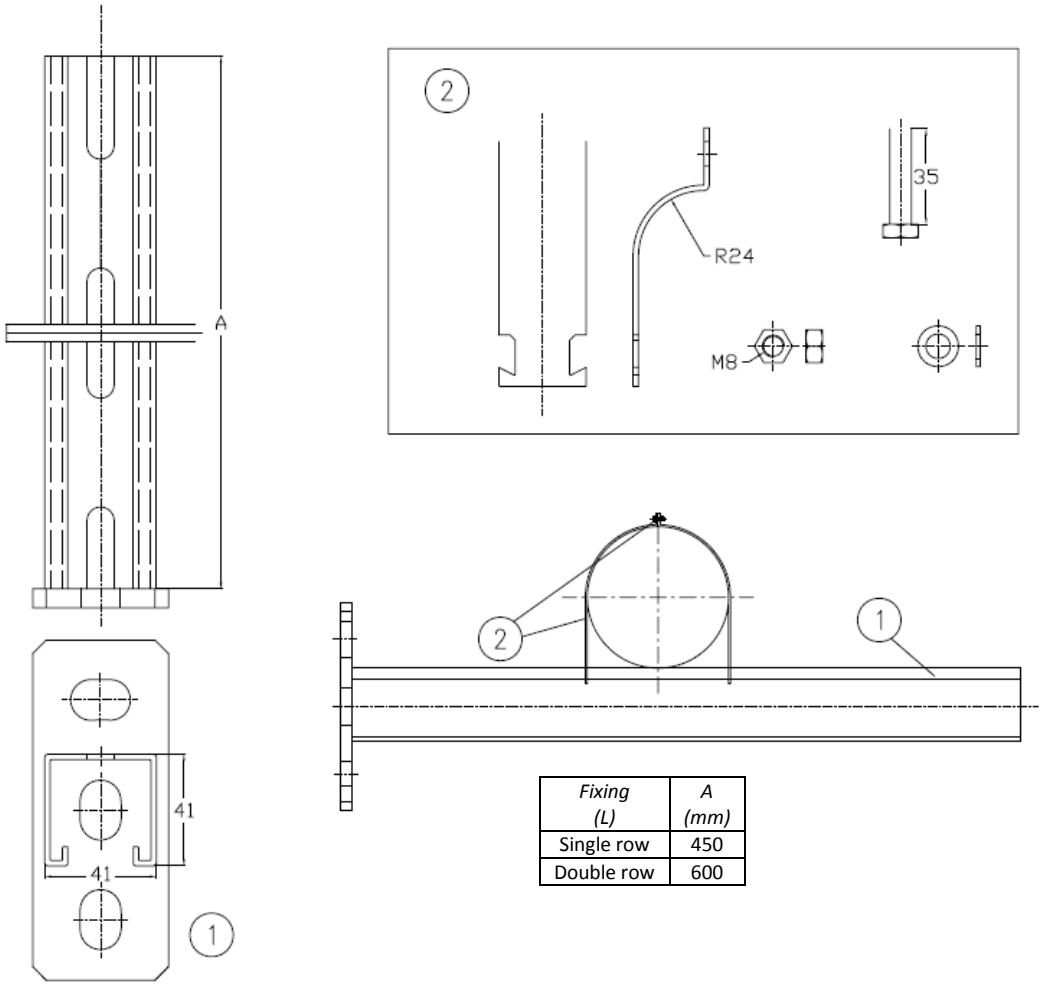
2.5.16 Manifold fixing components

This set of components is used to fix the discharge manifold above the cylinder rack.



Fixing (L)	*A (mm)*
Single row	450
Double row	600

N°	COMPONENT
1	Strap
2	Bracket

Fig. 2.43 Manifold fixing components

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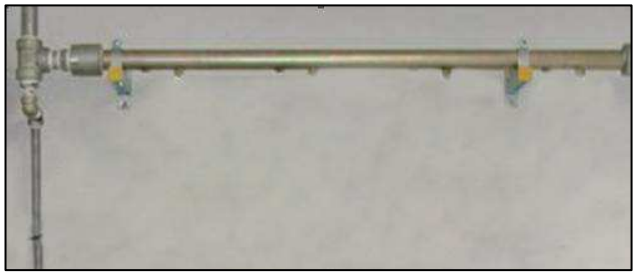
3 Mechanical and electrical installation

3.1 Procedure of installation

1 Install the **discharge manifold** and the pipeline pressure switch



2 Check the correct **cylinder arrangement** and install the cylinder mounting brackets. Place the cylinders (usually the valve outlet, as indicated on the nameplate, is placed on the left) **and rotate it by about 20°** toward the wall to enable the connection between the discharge hose and the manifold

3 **Install the discharge flex hoses**

4 **Install pressure gauges** (slave cylinders);

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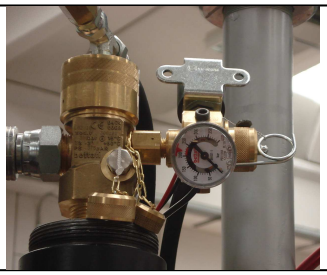
5 Install the **solenoid/manual actuator** on the pilot cylinders



6 Install **pilot pneumatic connections**, connecting the cylinders with the flex hose

7 Install the **extinguishing gas pipeline**. The pipeline shall be made of steel (type schedule 40) with ASA3000 fittings

8 Install the **overpressure dampers** in the walls of the room, whose total leakage area is determined with the Door Fan Integrity Test

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3.2 Discharge manifold installation

Fix the manifold brackets to the wall; the manifold shall be fixed with proper supplied devices. The manifold is supplied with assembled check valves and restrictor and it reports a label certifying that the manifold test complies with the PED standard.

⚠	**Don't modify the provided manifold. The modification would make useless tests carried out by BETTATI ANTINCENDIO and the granted certification.**

SINGLE ROW: The distance between the wall and the longitudinal axis of the manifold shall be 169 mm for 140 L cylinder systems.
The distance between the wall and the longitudinal axis of the manifold shall be 140 mm for 80 L cylinder systems.

The manifold base support shall be positioned 2280 mm above floor level from both for 140 L and 80 L cylinders.

DOUBLE ROW: The distance between the wall and the longitudinal axis of the manifold shall be 426 mm for 140 L cylinder systems;
The distance between the wall and the longitudinal axis of the manifold shall be 340 mm for 80 L cylinder systems;

The manifold base support shall be positioned 2280 mm above floor level from both for 140 L and 80 L cylinders.

Fig. 3.1 Distance between manifold and floor level

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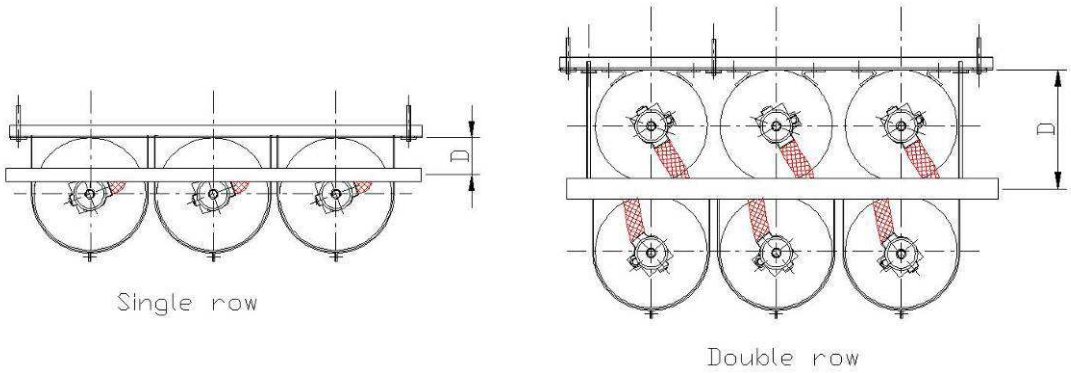

Fig. 3.2 Distance between manifold and wall

Tab. 3.1 Recommended distances for manifold installation

	80 L	140 L
	Single Row	
Distance wall-manifold (D) [mm]	140	169
Distance floor-manifold [mm]	2280	
	Double Row	
Distance wall-manifold (D) [mm]	340	426
Distance floor-manifold [mm]	2280	

The height of cylinders could be slightly different

Fig. 3.3 Examples of system installation in single and double row configuration

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Before installing the manifold, make sure that the arrow drawn on the label is in the same direction as the gas flow inside.

On the label the room name, the orifice diameter (ø) and the arrow indicating the direction of flow are reported

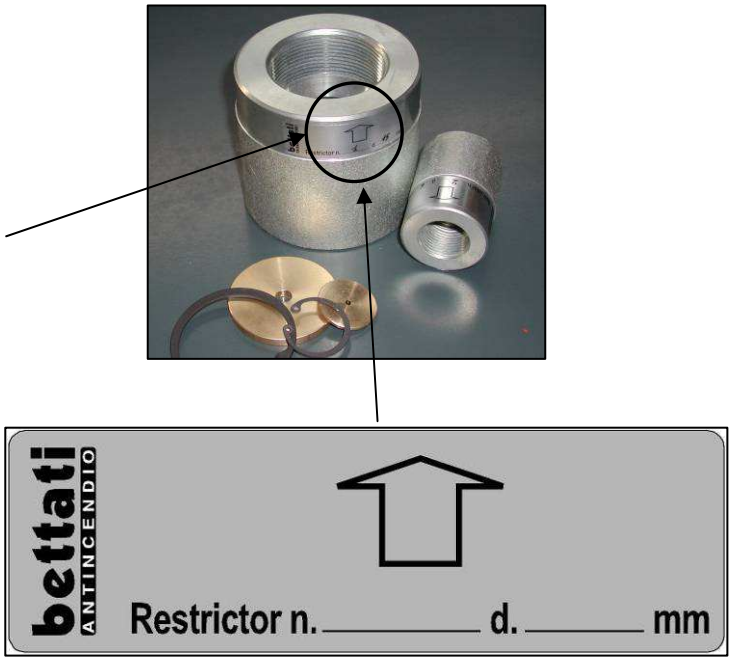

Fig. 3.4 Pressure reducing device and its label

3.2.1 Discharge manifold fixing

The following components are needed to fix properly the discharge manifold;

1. bracket supports
2. plugs
3. screw anchors or equivalent fixing devices
4. screws, nuts and washers
5. straps

Bracket supports

The length of bracket supports is dependent on the number of rows. For single-row installation, L=450mm; for double row installation, L=600mm.
The number of bracket supports is dependent on the number of cylinders composing the row. Bettati Antincendio recommends to use 2 bracket supports when the number of cylinders per row is minor or equal than 4. For higher numbers of cylinders, Bettati Antincendio suggests to use a bracket support every 3 cylinders, beside 2 bracket supports to be mounted at the ends of the manifold. For example, in a row composed of 9 cylinders, the right number of bracket supports shall be equal to 5.

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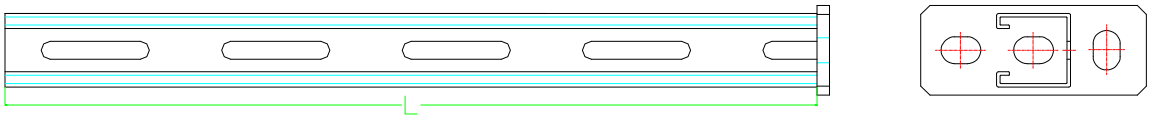

Fig. 3.5 Bracket support for the discharge manifold fixing. L varies in relation to the number of cylinder rows

Plug

A plug must be inserted at the end of each bracket support, as shown in figure.

Fig. 3.6 Plug for the bracket support

Screw anchor or equivalent fixing device

If the wall to which the discharge manifold has to be fixed is made of reinforced concrete, the bracket supports must be fixed to the wall with 2 screw anchors per bracket. Generally, the fixing device depends on the material of the wall the discharge manifold has to be fixed to.

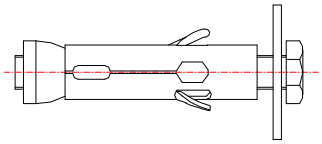

Fig. 3.7 Screw anchor for the fixing of the bracket support to a reinforced concrete wall

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Screw, nut and washer assembly

In order to fix the discharge manifold to the bracket support with the straps, an assembly composed by 1 screw, 1 nut and 1 washer has to be used. A typical screw employed in this application is shown in the figure below.

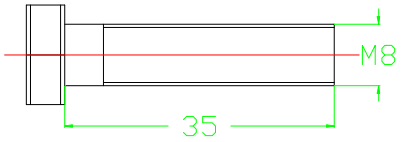

Fig. 3.8 Screw for the fixing of the two straps

Straps

In order to fix the discharge manifold to the bracket support, a couple of straps must be used. The number of straps needed for the installation is therefore two times the number of bracket supports. They must be fixed to the bracket supports, and the fixing of the manifold has to be assured by a nut, a bolt and a washer, a shown in figure.

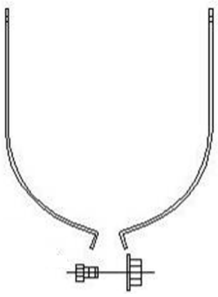

Fig. 3.9 Fixing assembly composed by two straps, a nut, a screw and a washer.

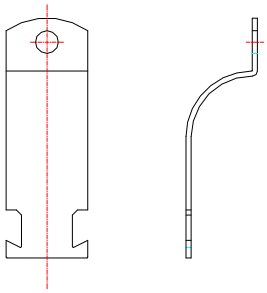

Fig. 3.10 Straps

3.3 Cylinder fixing

3.3.1 General consideration for cylinder installation

⚠	**The cylinder is pressurized at 300 bar and must be handled carefully. Although the cylinder valve is made of heavy forged brass, it could get damage if the cylinder is dropped. Discharge of an unsecured and disconnected cylinder could be EXTREMELY DANGEROUS and may result in serious injury or even death, and/or damage to property. The cylinders cannot be accidentally discharged unless mishandled.**

⚠	**Under normal conditions, the cylinder valve cannot discharge the extinguishing gas if pilot devices are not interconnected by flexible connectors. NEVER complete all pneumatic connections between cylinders and the actuating system as well as the electrical connection between the solenoid actuator and the control unit UNTIL the cylinders are properly secured in the cylinder rack and the discharge connection fittings are connected to the pipeline.**

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⚠	**Remove the valve anti-recoil cap ONLY after the installation of the cylinder.**

During the installation, the mounting straps should not be drawn up too tight around the cylinder. Little rotations of cylinders should be permitted during alignment of the cylinder valve discharge outlet with the discharge hose. The cylinder fixing is ensured by screwing tight the bolt and the nut shown in the figure.

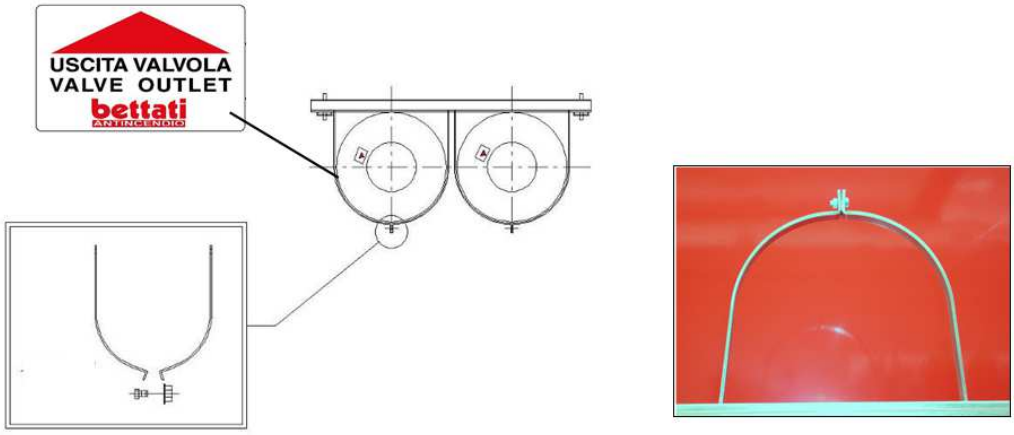

Fig. 3.11 Cylinder mounting straps

According to this manual, the valve outlet is normally positioned on the left. Otherwise, a different arrangement (such as on the right) does not compromise the correct installation and the readability of the displays since both the solenoid actuator assembly and the pressure gauge assembly allow rotations. In fig. 3.12 both methods of installation are shown.

⚠	**Remove the valve cylinder cap ONLY after the installation of the cylinder.**

⚠	**The orientation of the valve outlet is indicated by a label placed on the top of the cylinder. The valve outlet is usually positioned on the left. To enable the connection between the discharge flex hose and the manifold, rotate the cylinder 20°clockwise.**

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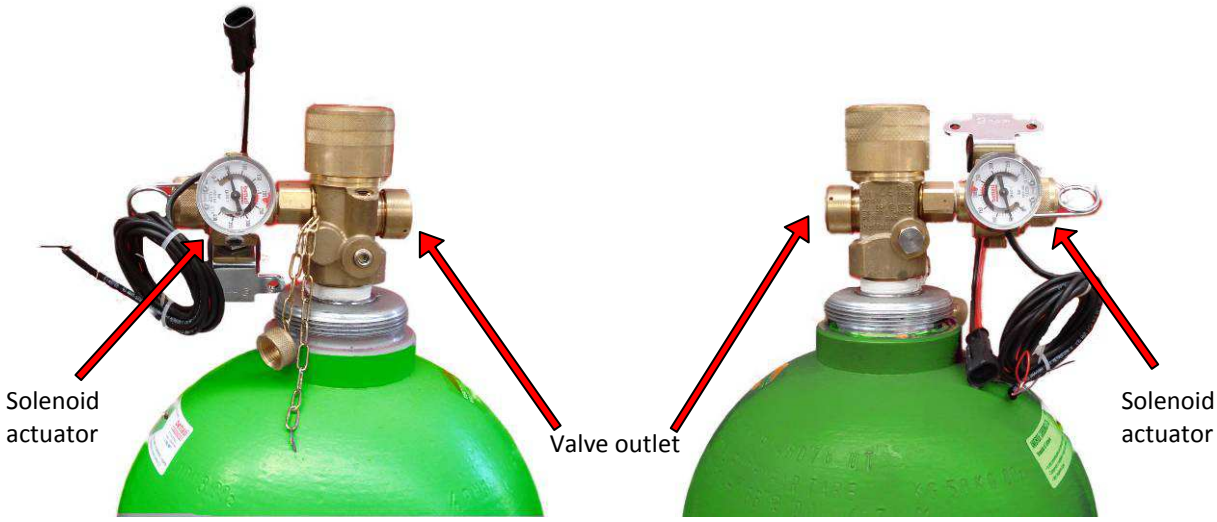

Fig. 3.12 Valve orientation

Once cylinders are positioned near the support, rotate it toward the wall, as shown in fig. 3.6.

Fig. 3.13 Outlet valve label

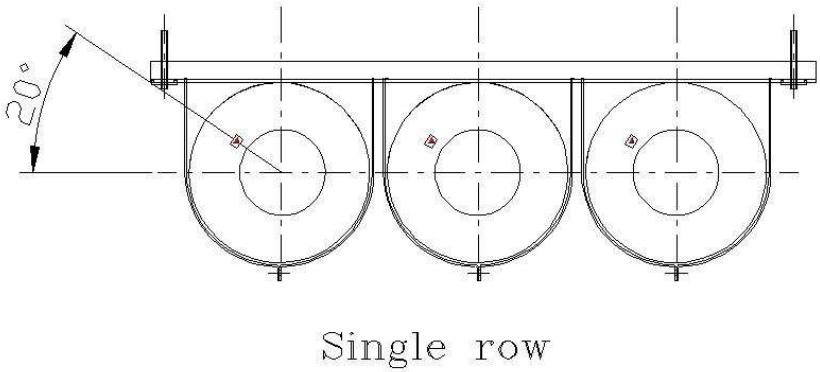

Fig. 3.14 Arrangement of cylinders - single row

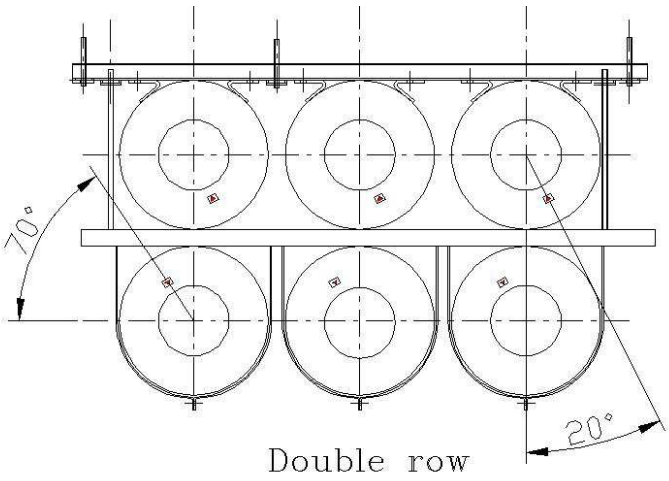

Fig. 3.15 Arrangement of cylinders - Double row

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3.3.2 Single cylinder fixing

Fix the rear support to a wall; check the quotes shown in the figure and in the table, and secure the cylinder to a wall with the mounting straps. Be sure that the nameplate indicating the valve outlet, is in the right position. The mounting straps should not be drawn up tight against the cylinder.

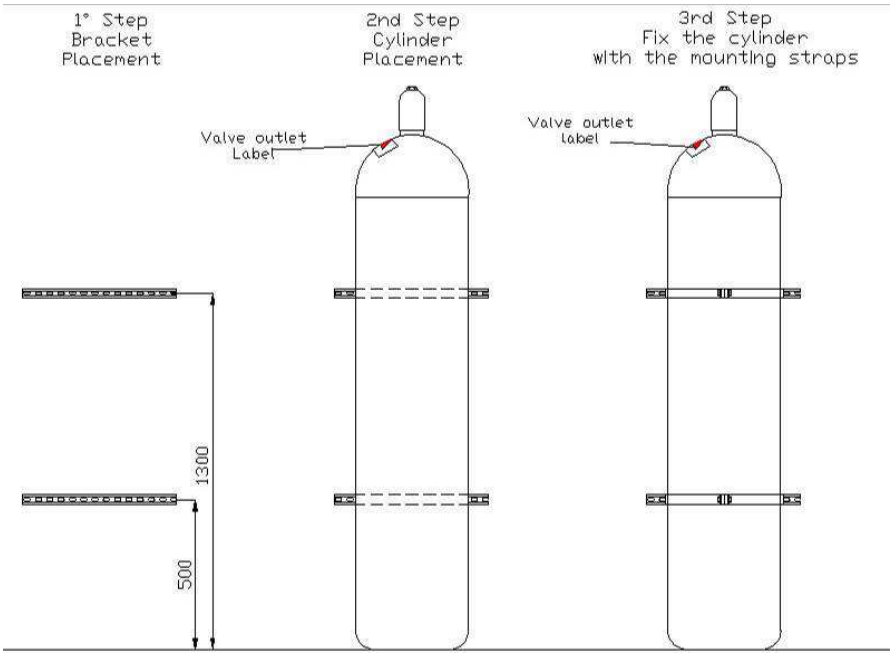

Fig. 3.16 Cylinder fixing – Single cylinder system

Fig. 3.17 Valve outlet label

Tab. 3.2 Height of rear supports

Capacity [L]	H1 support [mm]	H2 support [mm]
80	500	1300
140	500	1300

3.3.3 Single-row multi-cylinder fixing

Fix the rear support to a wall, check the quotes shown in the figure and secure the cylinder, taking care of the distance between the cylinder axles to a wall with the mounting straps. Be sure that the nameplate, indicating the valve outlet, is in the right position. The mounting straps should not be drawn up tight against the cylinder.

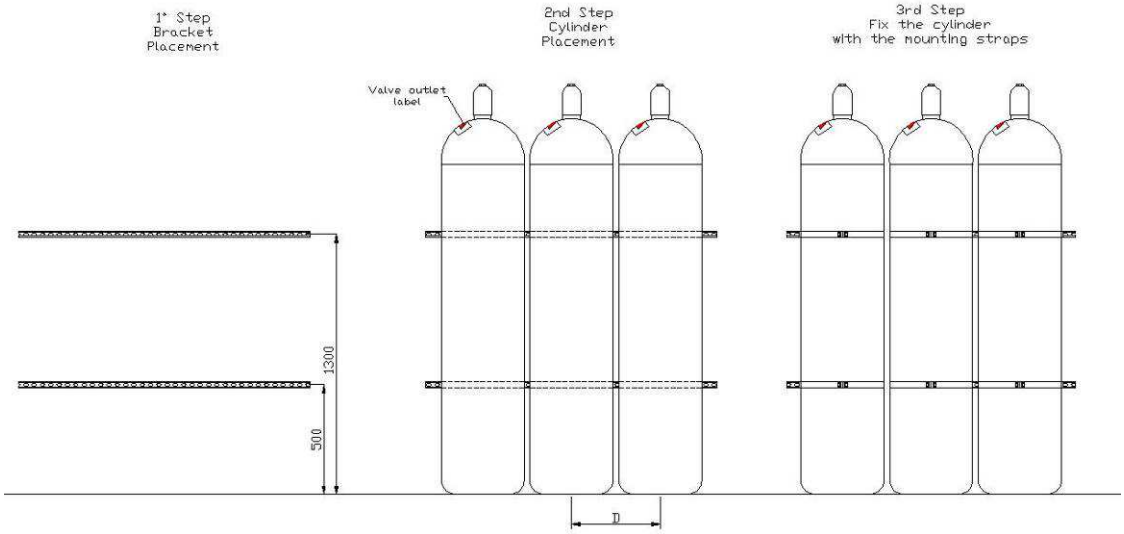

Fig. 3.18 Cylinder fixing – Single-row multi-cylinder system

Fig. 3.19 Valve outlet label

Capacity [L]	Distance between cylinder axles [mm]
80	300
140	400

Tab. 3.3 Distance between the cylinder axles

The following components are needed to fix properly cylinders to the wall in a single-row configuration:

1. brackets
2. screw anchors or equivalent fixing devices
3. screws, nuts and washers for the fixing of the straps
4. straps

Brackets

The length of brackets is dependent on the number of cylinders in the row.

Screw anchors or equivalent fixing devices

If the wall to which the brackets have to be fixed is made of reinforced concrete, the brackets must be fixed to the wall with screw anchors. Generally, the fixing device depends on the material of the wall.

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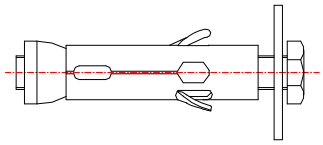

Fig. 3.20 Screw anchor for the fixing of the bracket support to a reinforced concrete wall

Screws, nuts and washers for the fixing of the straps

In order to fix the discharge manifold to the bracket support with the straps, an assembly composed of screw, 1 nut and 1 washer have to be used. Typical screws employed in this application is shown in the figure below.

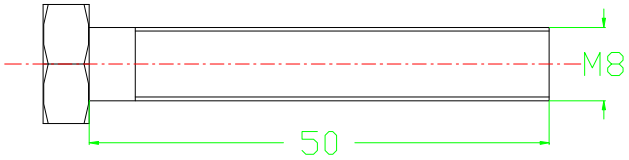

Fig. 3.21 Screw for the fixing of 80 L cylinders

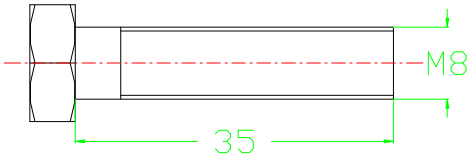

Fig. 3.22 Screw for the fixing of 140 L cylinders

Straps

In order to fix the cylinders to the brackets, 2 couples of straps per cylinder must be used. The number of straps needed for the installation is therefore four times the number of cylinders for a single-row configuration. They must be fixed to the brackets, and the fixing of the cylinders has to be performed with an assembly composed by a nut, a screw and a washer, as shown in figure. The dimensions of the straps vary in relation to the dimensions of the cylinder to be fixed.

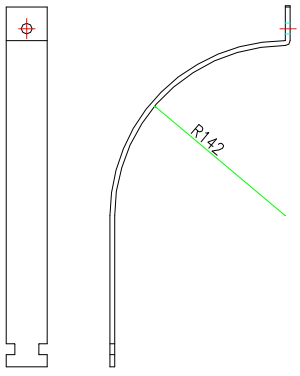

Fig. 3.23 Straps for the fixing of 80 L cylinders

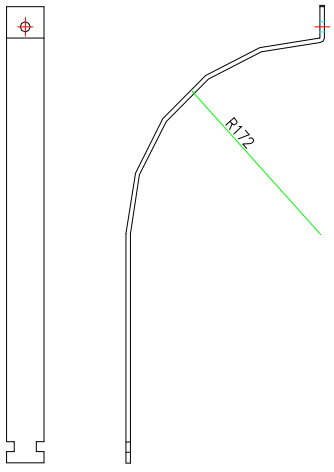

Fig. 3.24 Straps for the fixing of 140 L cylinders

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3.3.4 Double-row multi-cylinder fixing

First cylinder row mounting

Fix the rear support to a wall; check the quotes shown in the figure. Fix the angular divisor device (four per cylinder); it shall be placed with the shorter side on the rear support. The installation should comply with the quotes shown in the table.

Table 3.4 Distance between angular divisors and distance between cylinders

Cylinders capacity [L]	D1 Angular divisor device distance [mm]	D Distance between the cylinder axles [mm]
80	270	300
140	300	400

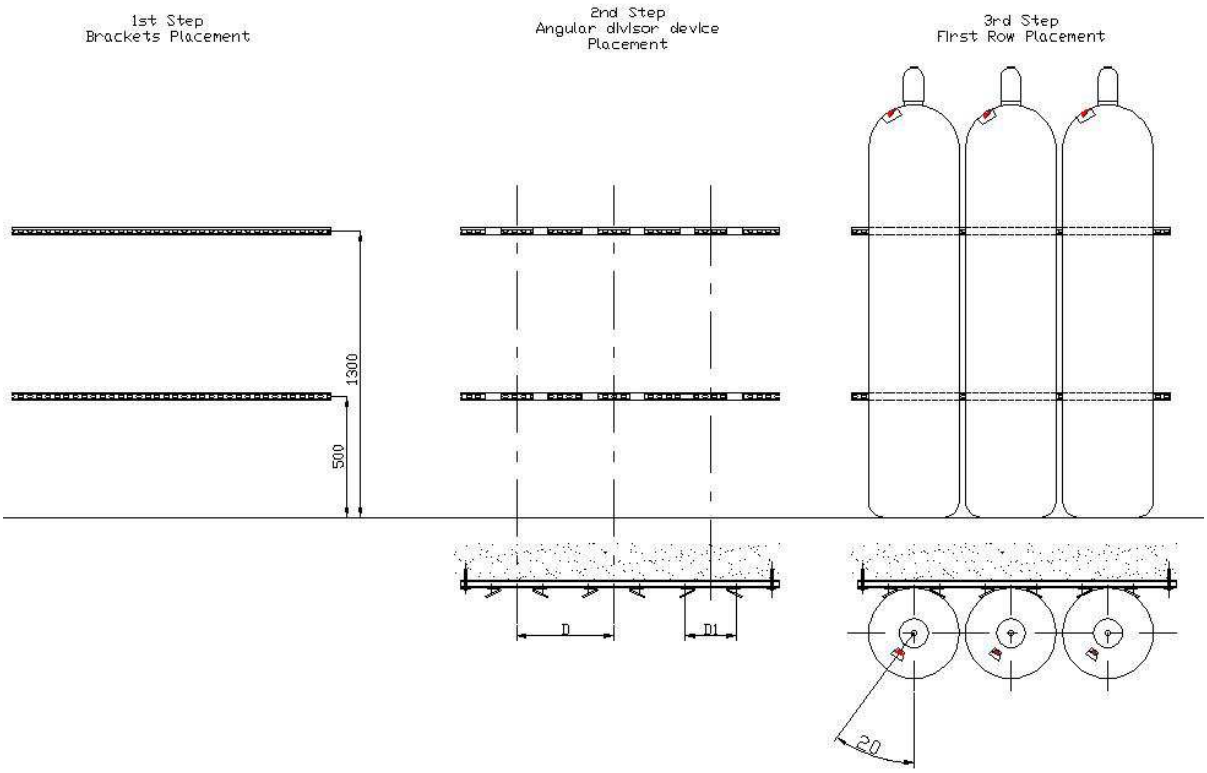

Fig. 3.25 Cylinder fixing – Double-row multi-cylinder system

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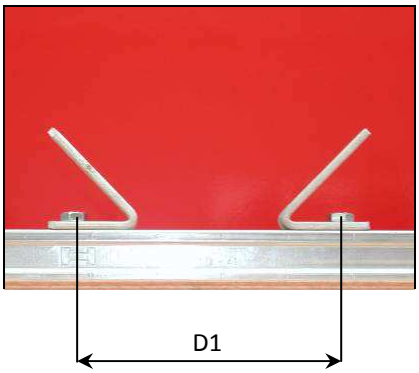

Fig. 3.26 Angular divisor

⚠	**The location of the valve outlet is indicated with a label placed on the top of the cylinder. Usually the valve outlet is placed on the left. To enable the connection between the discharge flex hose and the check valve placed on the manifold, rotate the cylinder 20° clockwise .**

Second cylinder row mounting

Fix the front support and secure the cylinder, taking care of the distance between the cylinder axles; then fix every cylinder to the brackets with the straps.

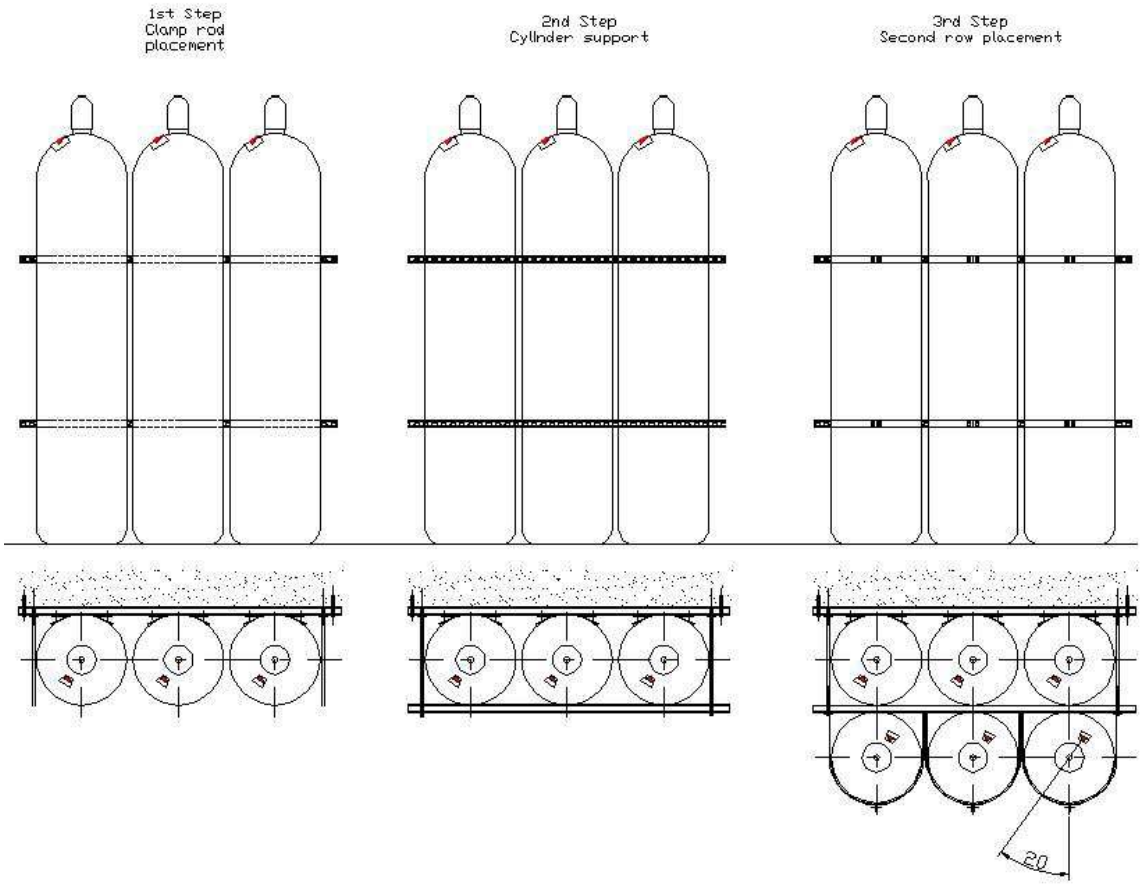

Fig. 3.27 Cylinder fixing – Double-row multi-cylinder system

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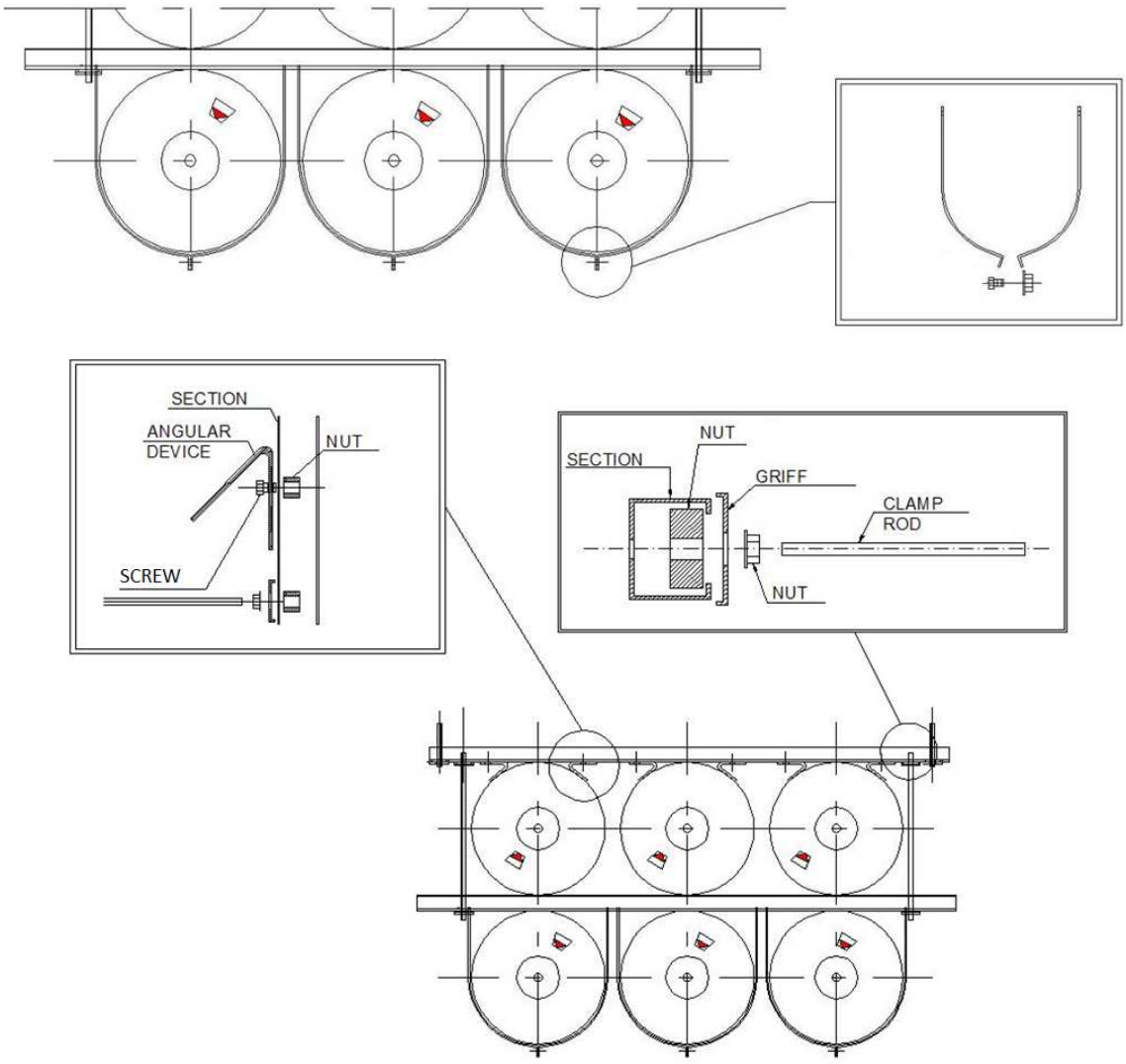

Fig. 3.28 Cylinder fixing – Angular device and clamp rod installation

⚠	**Remove the valve cylinder cap ONLY after the installation of the cylinder**

⚠	**Usually the valve outlet is placed on the left. To enable the connection between the discharge flex hose and the manifold, rotate the cylinder 40° counterclockwise.**

The following components are needed for the fixing of the cylinders to the wall in a double-row configuration:

1. first bracket
2. screw anchors or equivalent fixing devices
3. screw, nut and washer for the fixing of the straps
4. straps
5. angular device assembly
6. second bracket assembly

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Lengths of first and second bracket

The length of the brackets is dependent on the number of cylinders in the row.

Screw anchors or equivalent fixing devices

If the wall to which the brackets have to be fixed is made of reinforced concrete, the brackets shall be fixed to the wall with some screw anchors. Generally, the fixing device depends on the material of the wall the brackets have to be fixed to.

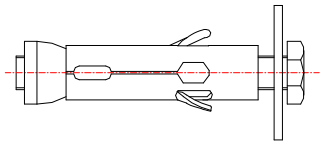

Fig. 3.29 Screw anchors for the fixing of the bracket support (reinforced concrete wall)

Angular device assembly

The lateral movement of the cylinders placed in first row is prevented by mounting 4 angular devices assemblies per cylinder; every angular device assembly is composed by: 1 angular device, 1 square nut and 1 screw, as shown in the figure below:

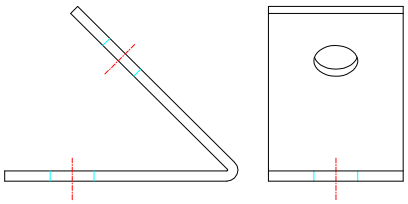

Fig. 3.30 Angular device

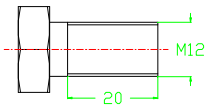

Fig. 3.31 Screw

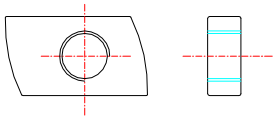

Fig. 3.32 Square nut

The angular device assembly shall be mounted as shown in the nearby figure. The square nut has to be inside the back channel, and the angular device has to be fixed to the back channel by connecting the screw to the square nut.

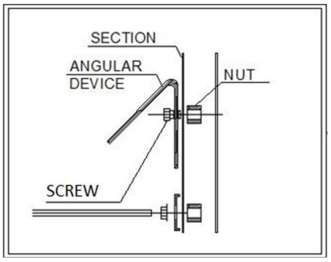

Fig. 3.33 Fixing of angular devices

Second bracket assembly

A second bracket is needed in a double-row installation of the cylinders. It shall be connected to the first bracket through an assembly composed by 1 rod clamp, 2 tabs, 2 square nuts and 2 nuts.

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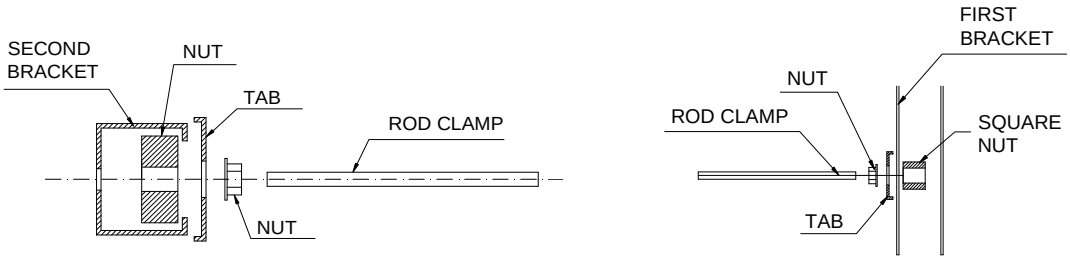

Fig. 3.34 Fixing of first and second bracket

The second bracket assembly shall be mounted as shown in the figures above. 2 square nuts have to be inside the first and the second brackets respectively, and the nuts have to be screwed to the rod clamp, by clamping both tabs to both brackets. Bettati Antincendio recommends to use 2 assemblies when the number of cylinders per row is minor than or equal to 4. For an higher number of cylinders, Bettati Antincendio suggests to use an assembly every 3 cylinders, beside the 2 assemblies to be mounted at the ends of the bracket. For example, in a row composed of 9 cylinders, the right number of second bracket assemblies shall be 5.

Screw, nut and washer for the fixing of the straps

In order to fix the cylinder to the brackets with straps, an assembly composed of 1 screw, 1 nut and 1 washer have to be used. A typical screw employed in this application is shown in the figure below.

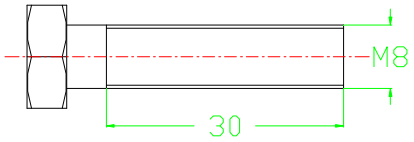

Fig. 3.35 Screw for the fixing of 80 L cylinders

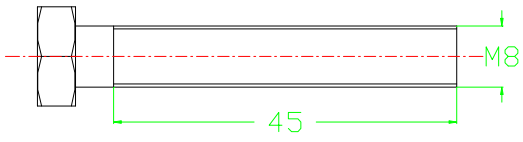

Fig. 3.36 Screw for the fixing of 140 L cylinders

Straps

In order to fix the cylinders to the second bracket, 2 couples of straps per cylinder shall be used. The number of straps needed for the installation is therefore four times the number of cylinders in the second row. They shall be fixed to the second bracket, and the fixing of the cylinders has to be performed with an assembly composed by 1 nut, 1 screw and 1 washer, as shown in figure. The dimensions of the straps vary in relation to the dimensions of the cylinder to be fixed.

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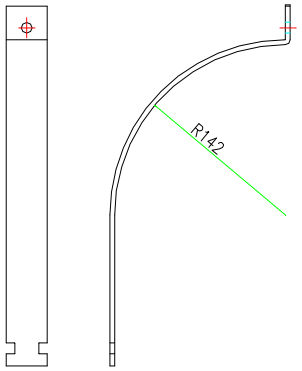

Fig. 3.37 Straps for the fixing of a 80 L cylinder

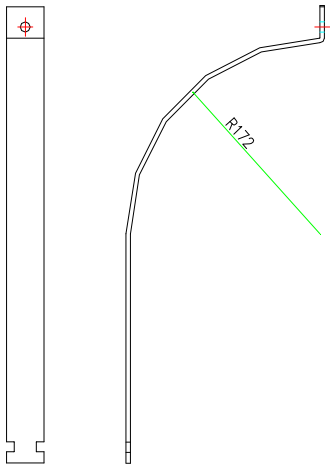

Fig. 3.38 Straps for the fixing of a 140 L cylinder

3.4 Discharge flex hose installation

The following instructions involve the installation of the discharge flex hose.

⚠	**Remove the valve anti-recoil cap ONLY after the installation of the cylinder**

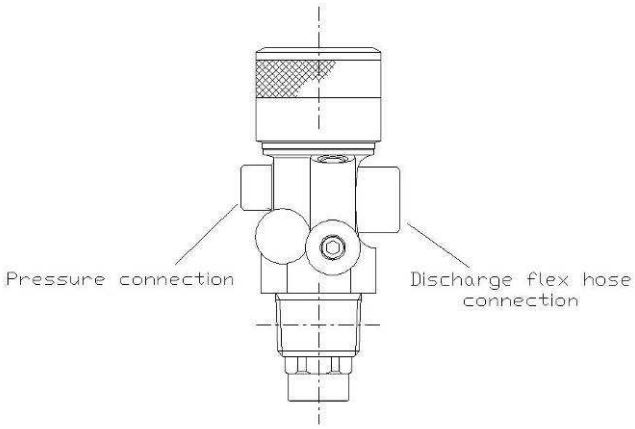

Fig. 3.39 Valve connections and discharge flex hose installation

Unscrew the anti-recoil cap screwed on the cylinder valve discharge outlet. Through the discharge flex hose, connect the check valve placed on the manifold to the valve outlet.

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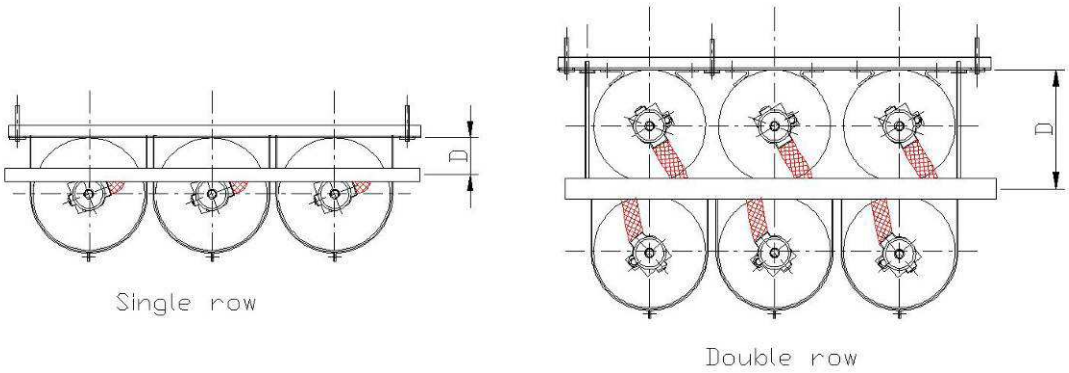

Fig. 3.40 Discharge flex hose installation

3.5 Pressure gauge with supervisory pressure switch installation

SLAVE CYLINDERS: unscrew the pressure socket anti-recoil cap and manually install the pressure gauge assembly: make sure that the nut is tightly secured. In normal conditions, the pressure gauge will indicate the operating pressure reported on the cylinder nameplate. With a leak detector make sure that there is no gas leak from the connections.

⚠	**Unscrewing the pressure connection plug could result in a little gas leak; supposing that the following procedure is done as fast as possible, the leak won't seriously reduce the total pressure of the cylinder.**

With a Ø22 mm spanner, screw the pressure gauge assembly

With a leak detector, make sure that there is no gas leak from the connections.

Fig. 3.41 Leak detection (slave cylinders)

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In the figure below, the main points in which leakages can occur are shown.

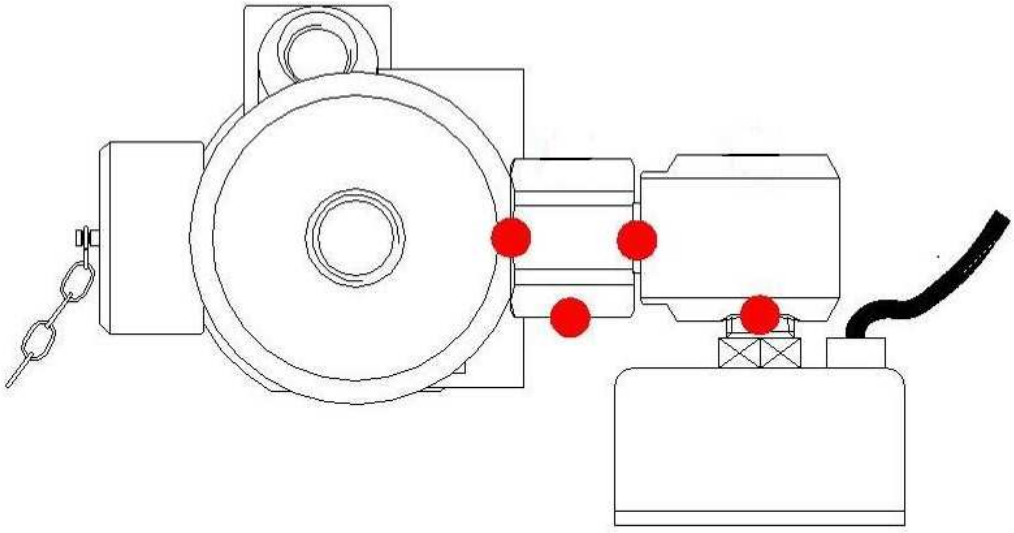

Fig. 3.42 Leakages can occur in the red points

3.6 Solenoid / manual actuator installation

Unscrew the pressure socket anti-recoil cap and manually install the actuator: place correctly the solenoid/manual actuator, and then screw the nut until the connection is locked properly. In normal conditions, the pressure gauge will indicate the operating pressure reported on the cylinder nameplate. With a leak detector, check that there is no gas leak from the connections.

⚠	**Unscrewing the pressure connection plug could result in a little gas leak; supposing that the following procedure is done as fast as possible, the leak won't seriously reduce the total pressure of the cylinder.**

With a Ø22 mm spanner screw the pressure gauge

With a leak detector check that there is no any leak from the connections.

Fig. 3.43 Leak detection (pilot cylinders)

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In the figure below the main points in which leakages can occur are shown.

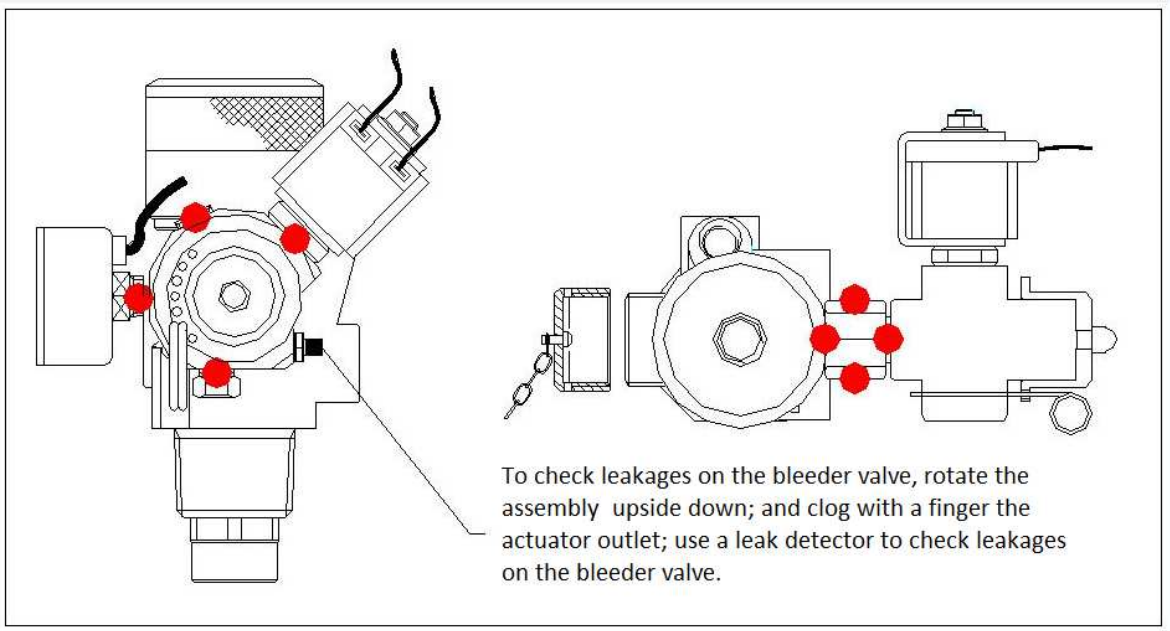

Fig. 3.44 The leakages can occur in the red points

3.7 Pneumatic connections

3.7.1 Single cylinder

⚠	**WARNING: In order to avoid accidental discharge, the connection between 3/16” flex hose and 1/8”BSPT-1/4” BSPP nipple placed on the solenoid actuator must be done ONLY after the test.**

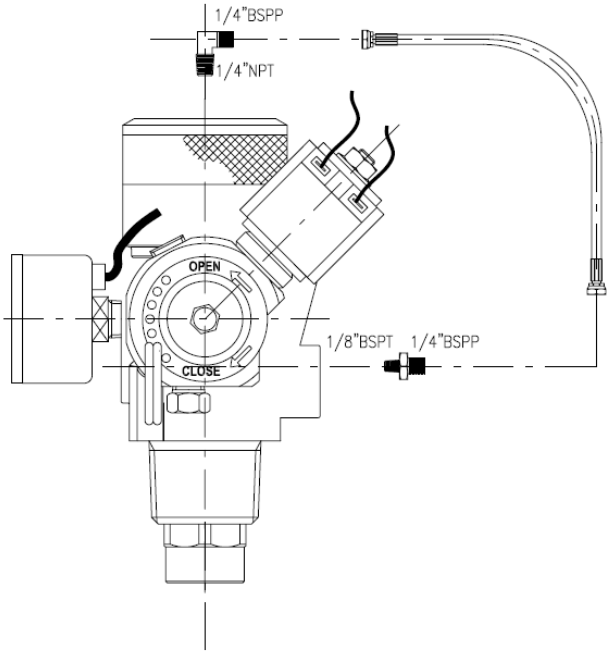

Fig. 3.45 Pneumatic connections: single cylinder

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Screw the 1/4” NPT-1/4” BSPP elbow on the top of the pilot valve and connect it to the 3/16” flex hose L=400 mm; connect the hose to the actuator outlet, using the 1/8” BSPT-1/4” BSPP nipple.
Since the two threads of the elbow are different (1/4" NPT on the valve e 1/4" BSPP on the flex hose), be careful with its placement on the top of the valve.

3.7.2 Multi-cylinder system - pilot cylinder

⚠	**WARNING: In order to avoid accidental discharge, the connection between 3/16” flex hose and 1/8”BSPT-1/4” BSPP nipple placed on the solenoid actuator must be done ONLY after the test.**

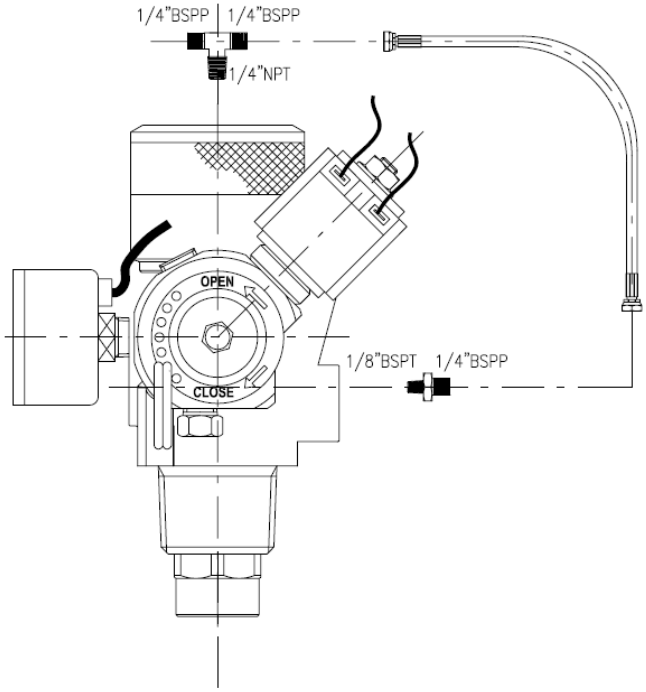

Fig. 3.46 Pilot pneumatic connections: pilot cylinders (multi-cylinder systems)

Screw the 1/4” BSPP x 1/4” NPT x 1/4” BSPP Tee on the top of the pilot valve and connect it to the 3/16” flex hose L=400 mm; connect the hose with the solenoid/manual actuator outlet using the 1/8” BSPT-1/4” BSPP nipple.
Since the two threads of the elbow are different (1/4" NPT on the valve e 1/4" BSPP on the flex hose), be careful with its placement on the top of the valve. With the 3/16” flex hoses L=500 mm connect all the valves.

3.7.3 Multi-cylinder system - slave cylinders

Screw the 1/4” Tee on all the slave valves except the last one where the 1/4" elbow shall be placed.
Be careful with the placement of the elbow on the top of the valve since the threads are different (1/4" NPT on the valve and 1/4" BSPP on the flex hose). Connect all the valves with the 3/16” flex hoses L=500 mm. (see also chapter 2.4.5 for more details).

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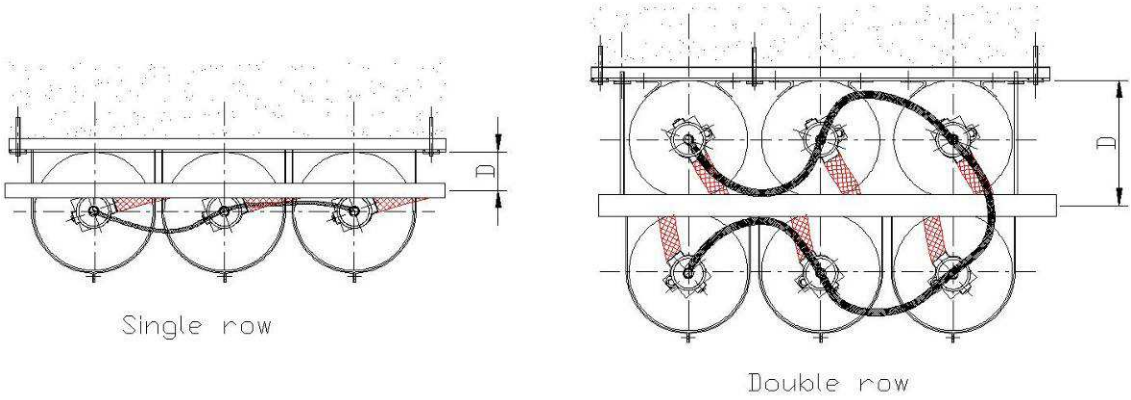

Fig 3.47 Flex hose arrangement (single and double row)

3.8 Pipeline and nozzle installation

⚠	**The gas inside the distribution pipes and nozzles, downstream the pressure reducing device, has a pressure ranging from 60 to 15 bar: during a discharge these components are subjected to high shock vibration. If components are not properly checke, serious damages to people, things and properties may occur.**

Due to the large variety of brackets and support devices existing on sale, one can choose different solutions, depending on the particular application that we take into consideration.
On the basis of the distribution pipeline shown on the technical drawings, proper bracket models and anchor screws (checking that they are adequate to withstand the loads) shall be chosen.
UNI EN 15004 standard prescribes the bracket maximum distances, depending on the pipe diameter.

Fig. 3.48 Pipeline support systems

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Tab. 3.5 Bracket maximum distances (EN 15004)

Pipe diameter	Max. distance [m]
1/2”	1.5
3/4”	1.8
1”	2.1
1”1/4	2.4
1”1/2	2.7
2”	3.4
2”1/2	3.5
3”	3.7

Fittings such as elbows, tees, restrictors, nozzles, etc… shall be supplied, unless different specifications, by Bettati Antincendio with NPT threads.
The tight locking between fittings and pipes must be done with teflon or other proper material.

Each discharge nozzle has a calibrated orifice plate with calculated diameter.
Additionally, each discharge nozzle has got a label on which some information are reported:

- Nozzle serial number (i.e. 11001)
- Nozzle diameter [inch]
- Orifice plate diameter [mm]

Be careful during the installation: each nozzle must be placed as indicated on the design documentation.

Fig. 3.49 Nozzles and label

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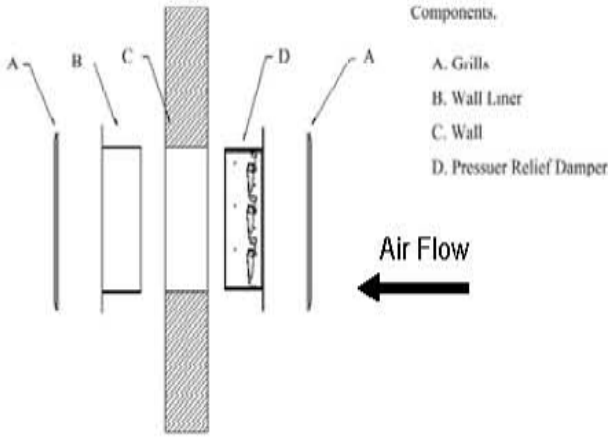
3.9 Installation of overpressure dampers

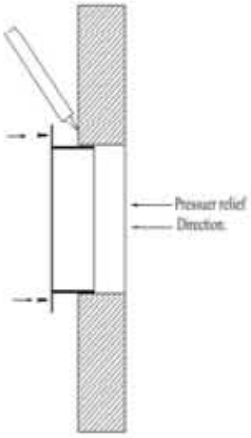
3.9.1 Conventional kit installation

1. Pressure Vent components



The Pressure Relief Vent should be mounted into the wall with the blades opening outward from the protected enclosure.

2. Wall Liner Installation



a. Apply a bead of Intumescent mastic to wall opening to seal around Wall Liner Flange
b. Insert Wall Liner into opening and fix with screws

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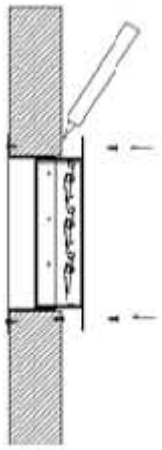
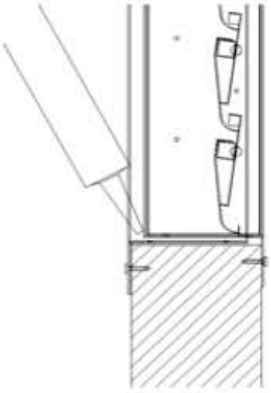
3. Vent Installation



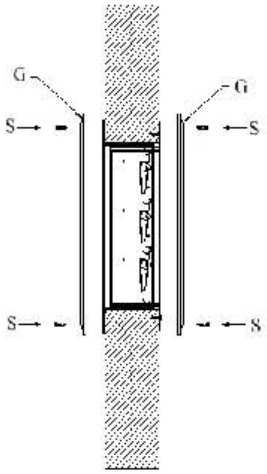
c. Apply a bead of Intumescent mastic to wall opening to seal around Damper flange.
d. Push damper into wall and fix into place with screws.

4. Fire Seal Wall Liner



e. Apply a bead of Intumescent mastic to the join between Wall liner and Damper to form a fire seal

5. Fitting the Grilles



f. Fit grilles using TEK screws provided, making sure not to over tighten

⚠	**Before fitting grilles check that all of the damper blades freely open and close fully.**

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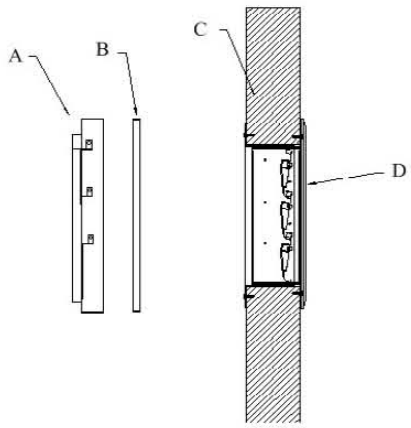
3.9.2 "L" External grill kit / Dynamic weather louver installation

When fitting an SHX pressure relief damper into an outside wall Dynamic Weather Louver is required.
Where walls are more than 200mm thick and less than 350mm a wall liner extension is required. This is supplied in flat pack form with the DWL in the L kit and should be attached to the wall liner with the TEK screws provided before it is installed in the wall.

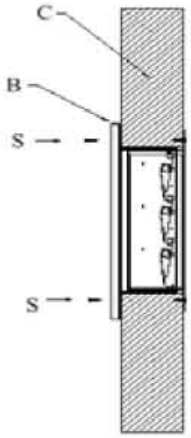
1. Dynamic Weather Louver components



Components.

A. Dynamic Weather Louver
B. DWL Fixing Frame.
C. Wall
D. Pressuer Relief Damper with internal grill.

2. Install Fixing Frame



a. Remove fixing frame from DWL
b. Fix fixing frame B to wall with screws

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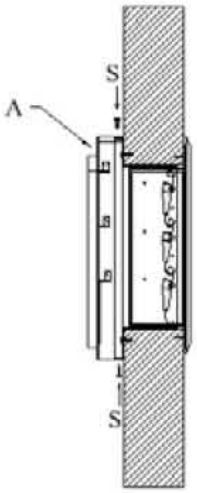
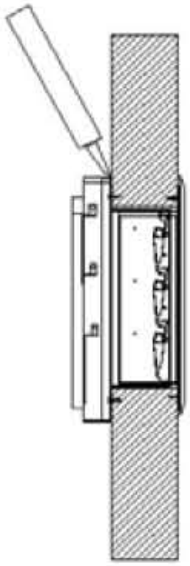
3. Install DWL



c. Attach Dynamic Weather Louver to fixing frame with TEK screws

4. Apply silicon sealer



d. Apply a bead of silicon sealer around perimeter of DWL where it meets the wall.
e. Check to make sure all louver blades are free to open and close.

NOTE: It is not necessary to use intumescent mastic on the inside flange of the damper when fitting into an external wall where no fire rating is required.

3.9.3 "Z" frame installation

If the SHX damper is to be fitted into a door or a thin partition of less than 120mm width then a Z frame will be required to cover the protruding damper casing. The next example is for fitting a Z frame into an internal door.

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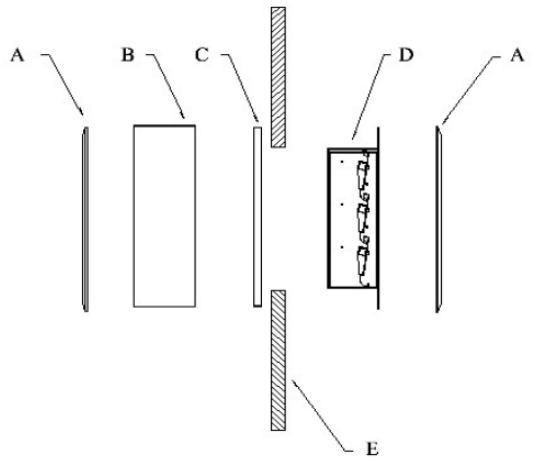
1. Z frame components



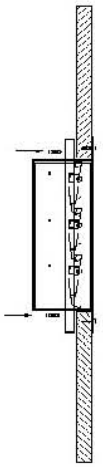
Components.

A. Grills
B. Z Frame
C. Z Frame Fixing Bracket.
D. Pressuer Relief Damper.
E. Wall or Door less than 100mm thick.

2. Prepare fixing frame

a. Remove fixing frame from Z frame
(If Z frame fixing bracket is attached to the Z frame first remove)

3. Attach fixing frame



b. Place fixing frame over damper pressure and fix to wall.

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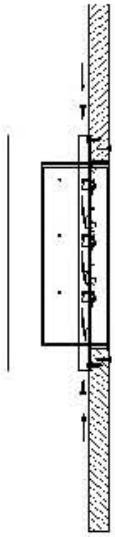
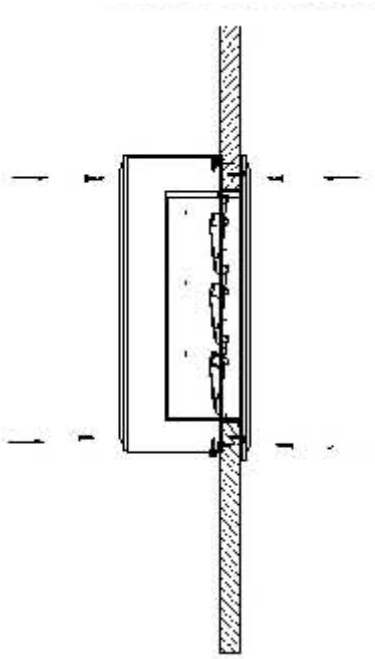
4. Attach Z frame



c. Re-attach Z frame to fixing frame with TEK screws.

5. Attach Grille or DWL



d. Attach grille or DWL with screws

NOTE: If using a dynamics weather louver, first attach its fixing frame to Z frame and then re-attach DWL to the fixing frame and silicon gap.
If the Z frame is exposed to the elements, then silicon should be applied where it meets the wall/door and the gap where the DWL and the Z frame meet should also be filled with silicon.

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4 Installation of directional valves (if applicable)

4.1 Procedure of installation

1 Install the manifold

2 Install the directional valve assemblies

3 Install the pneumatic connections

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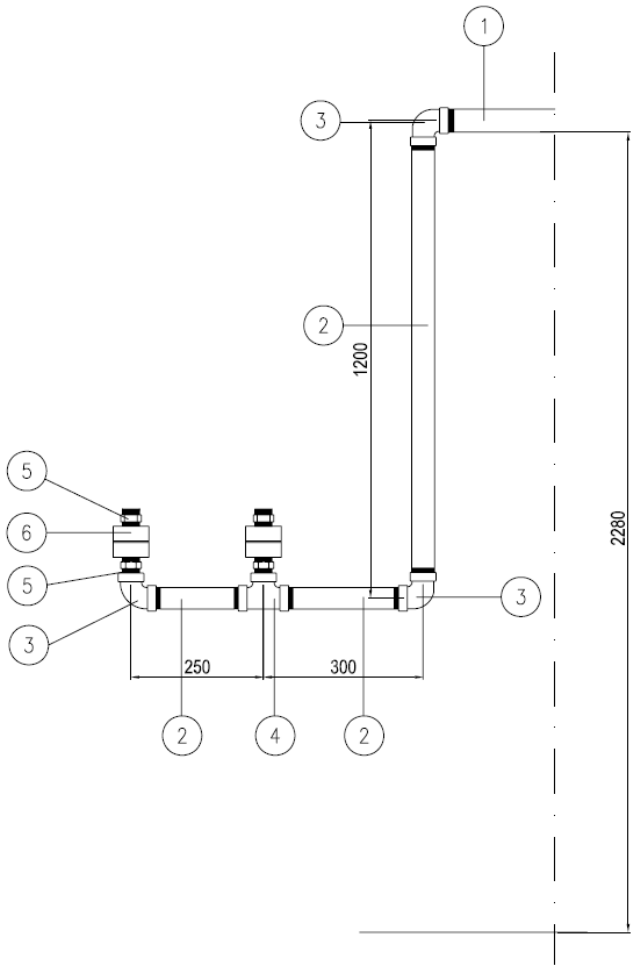
4.2 Discharge manifold installation

The installation of the directional valve manifold is performed using all the materials supplied by Bettati Antincendio, including pipe SCH. 160 and fittings ASA 6000, with NPT threads.

Within the gas discharge manifold XXS, with check valves connected to the cylinders, the gas will be provided pressurized at 300 bar. If the manifold makes changes in respect of our standards, the pipe type shall be SCH.160 and fittings type shall be ASA 6000.

Install the directional valve manifold as shown Fig. 4.1 and Fig. 4.2 using Teflon or other suitable material for threaded pipe connections.



N°	COMPONENT
1	XXS steel pipe
2	Schedula 160 steel pipe
3	ASA 6000 90° elbow
4	ASA 6000 TEE
5	ASA 6000 Nipple
6	Pressure reducing device

Fig. 4.1 Installation of manifold, restrictors and fittings upward of directional valves

Once the SCH.160 manifold and suitable fittings (tee and elbows) have been installed, install the nipples ASA 6000 and the pressure reducing devices. (Fig. 4.1) Check that the arrow indicated on the label is oriented upward.
Install the nipples ASA 6000 downstream of the pressure reducing devices.

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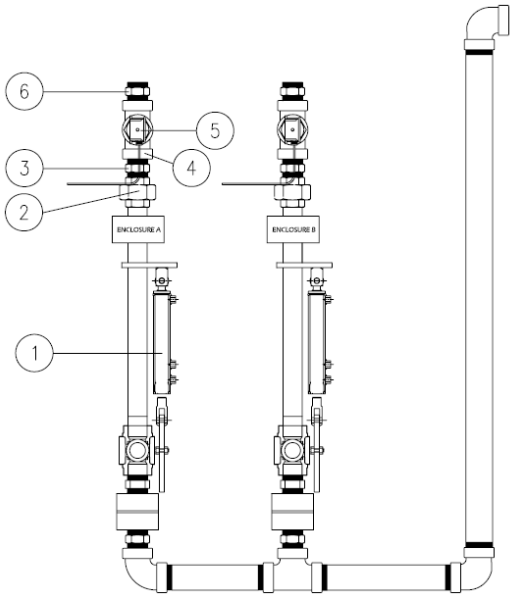
Fig. 4.2 Pressure reducing devices and nipples upstream of the directional valves assemblies

4.3 Installation of the directional valve assemblies



N°	COMPONENT
1	Directional valve assembly
2	3 pieces coupling
3	Nipple ASA 3000
4	Tee ASA 3000
5	Pipeline pressure switch
6	Fitting for connection to the pipeline

Fig. 4.3 Installation of directional valve assemblies

NOTE: Provided ball valves in our directional valve systems are certified for a working pressure of 360 bar.

The system discharge the cylinders after the opening of the selector valves. This prevents the gas remains trapped inside the manifold and reach pressures of 300 bar after the pressure reducing device.

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The directional valve system will be supplied with a section of pipe SCH.40 (length about 600 mm) which is connected to the pneumatic opening system, and screwed with the ball valve; one end of the pneumatic piston is fixed to the ball valve opening lever (Fig. 4.4).
Downstream of the ball valve, pipes and fittings are SCH.40 and ASA 3000 type respectively and they're designed to operate with internal pressures of about 60 bar.

NOTE: Cylinders can be actuated and discharge the extinguishing gas ONLY once the ball valve is properly opened by the pneumatic system; this fact ensures that the pressure in this section cannot reach dangerous values.

Fig.4.4 Pneumatic actuator pistons

Fig.4.5 Pressure switch

Install all the fittings suppl by Bettati Antincendio (ASA3000 nipple ASA3000 TEE - ASA3000 reduction device) for the connection of the pressure switch (Fig. 4.5)

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4.4 Installation of pneumatic connections

For a better and easier understanding of the instructions for a proper and correct installation, let's consider the example shown in figure 4.6

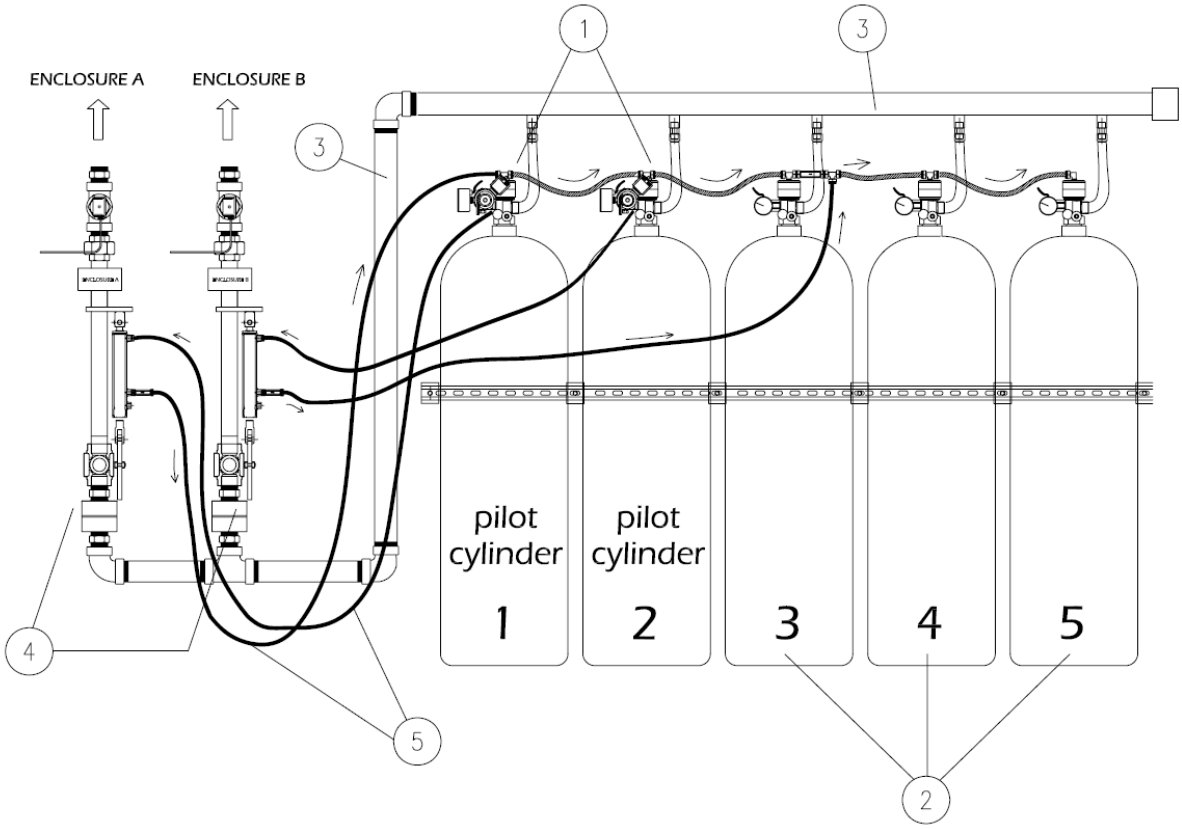

Fig.4.6 Example of a multi-cylinder system with directional valves

The main features of the shown example can be resumed as follows:

- The system is a multi-cylinder system with directional valves and the total number of cylinders in the rack is 5;
- The system is designed to protect two enclosures separately; the rooms to be protected have different volumes;
- There are two pilot cylinders, one for each enclosure to be protected;

NOTE: An alarm signal in ENCLOSURE A will actuate discharge valves of all five cylinders; if signal comes from ENCLOSURE B, only cylinders 4 and 5 will discharge the extinguishing gas.
Pilot cylinder 1 actuates discharge in Enclosure A, pilot cylinder 2 actuates discharge in Enclosure B.

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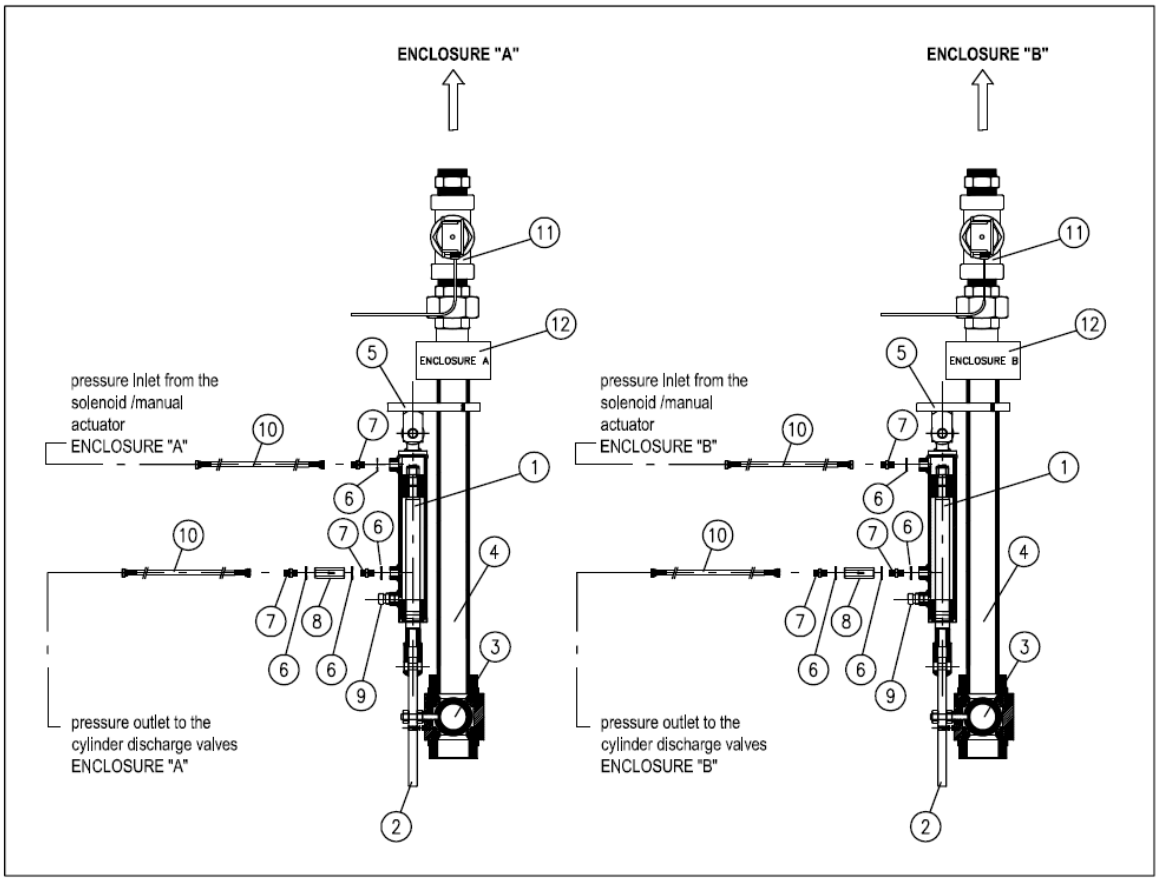
4.4.1 Connections on the pneumatic cylinder

In the figure below all the connections on the pneumatic cylinder are shown (Fig. 4.6)



N°	COMPONENT
1	Actuating piston
2	Lever
3	2” ball valve
4	2” sch. 40 pipe
5	Piston holder
6	Bonded seal
7	Nipple 1/4” BSPP – 1/4” BSPP
8	Non-return valve 1/4” BSPP
9	Bleeder
10	3/16”pilot flex hose
11	Pipeline pressure switch assembly
12	Enclosure label

The cylinder is supplied assembled as shown in Fig.4.6

Fig. 4.7 Pneumatic connections on the cylinder of a directional valve

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4.4.2 Connections on the cylinder rack

As shown in Fig. 4.8, install the TEE ¼" BSPP - ¼" NPT – ¼" BSPP on the top of each discharge valve (including pilot cylinders); install the elbow ¼" NPT – ¼" BSPP on the valve at the end of the pneumatic line.

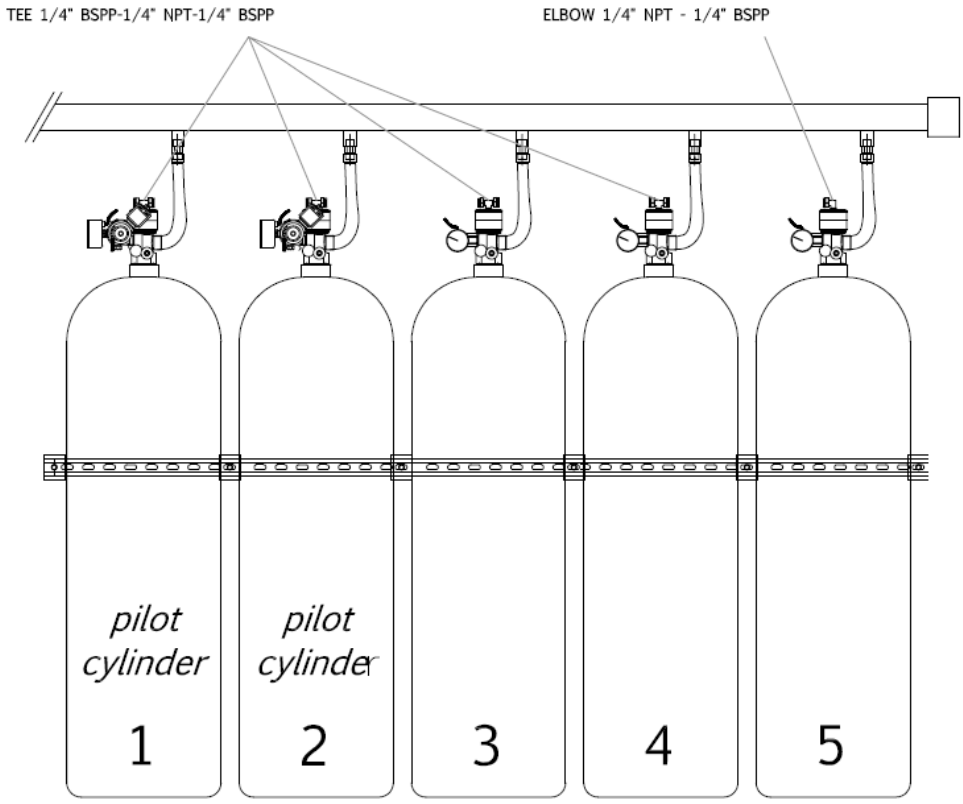

Fig. 4.8 installation of TEE and elbow on the cylinder rack

NOTE: in this case, the ¼" non-return valve shall be connected to the Tee installed on the slave cylinder 3; install the ¼" non-return valve with the arrow oriented in the flow direction as shown in Fig.4.10.

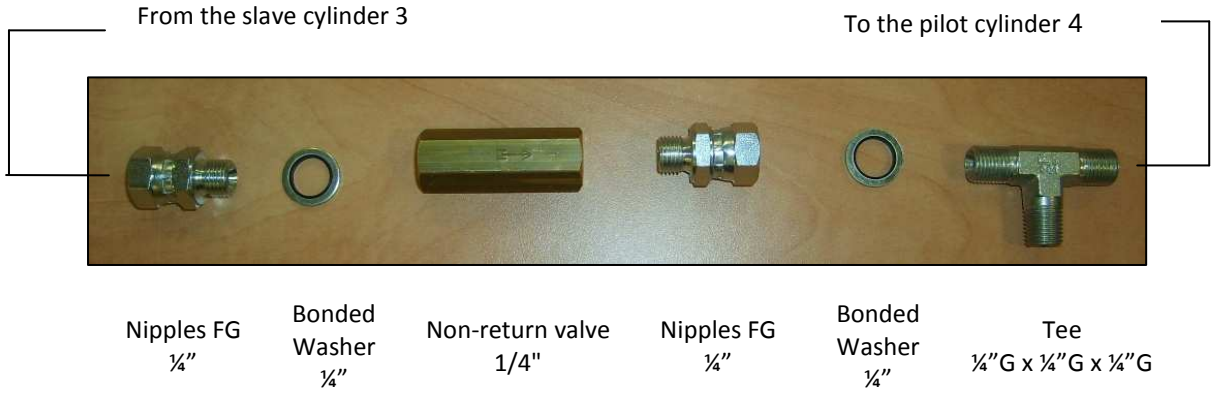

Fig. 4.9 Non-return valve assembly in a multi-cylinder system with directional valves

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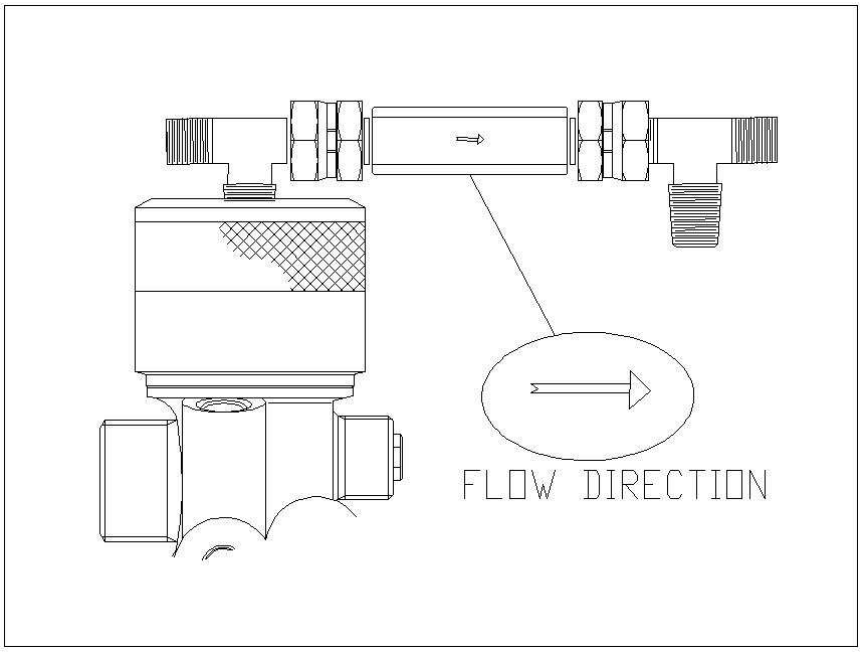

Fig.4.10 Non-return valve assembly in a multi-cylinder system with directional valves

4.4.3 Connection of the pilot valves to the actuating piston inlets

Using 3/16” flex hoses 1 / 4 " flex hose, connect the pressure outlets of the two solenoid actuators to the inlets of both actuating piston; in case of gas discharge actuation, this connection will allow the piston to make its run into the cylinder, opening the directional valve.

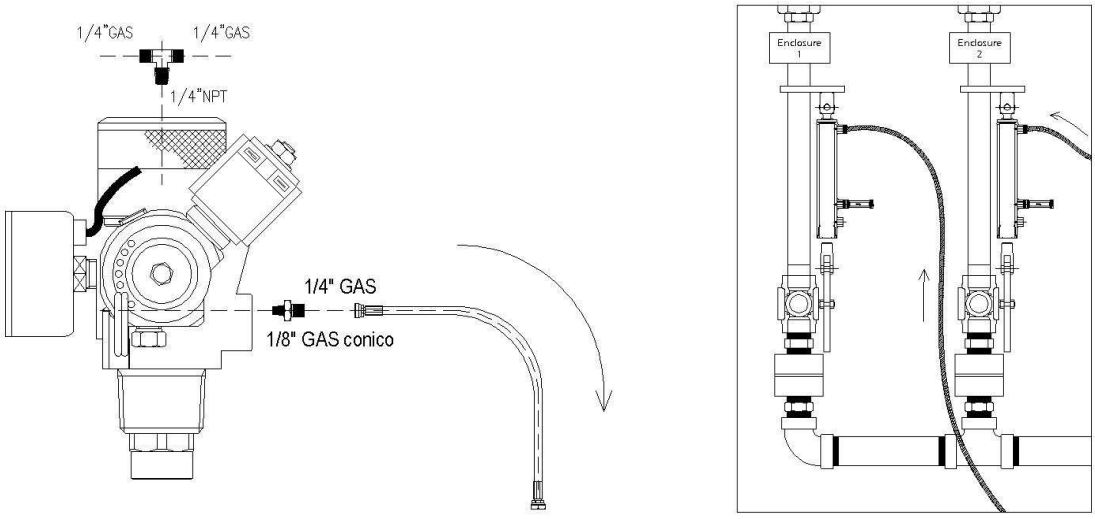

Fig.4.11 Connection of solenoid actuators to pistons

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4.4.4 Connection of slave cylinders

Using 3/16” flex hoses (length = 500 mm), connect the tees and the end line elbow on the tops of each discharge valve.

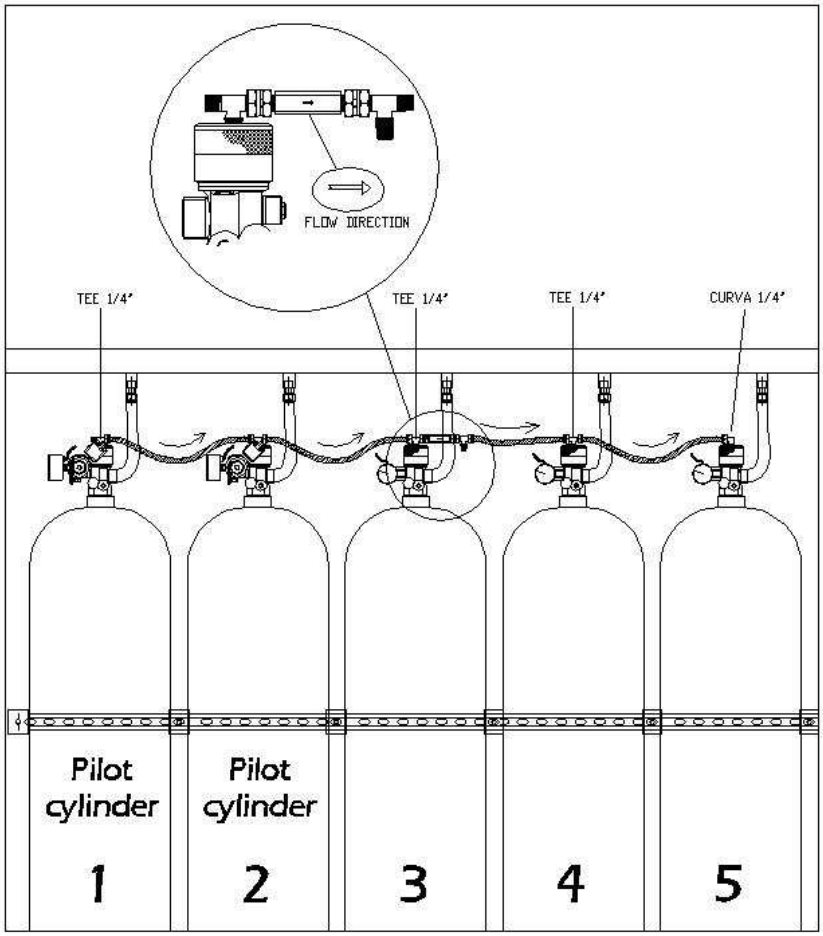

Fig.4.12 Pneumatic connection of the slave cylinders

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4.4.5 Connection of pneumatic piston outlets to discharge valves

The outlets of both actuating piston shall be connected to the top of each cylinder valve. In order to respect the actuation logic explained in the introduction of chapter 4.4, we must secure that each actuating piston will open the correct number of valves.
The directional valve that allows discharge in Enclosure A is actuated by pilot cylinder 1. The discharge of all five cylinders shall be guaranteed; for this purpose, the piston outlet (Enclosure A) shall be connected to the ¼" Tee on the top of pilot valve 1 (Fig. 4.13). Use a 3/16" flex hose to make the connection, making sure that the hose is long enough.

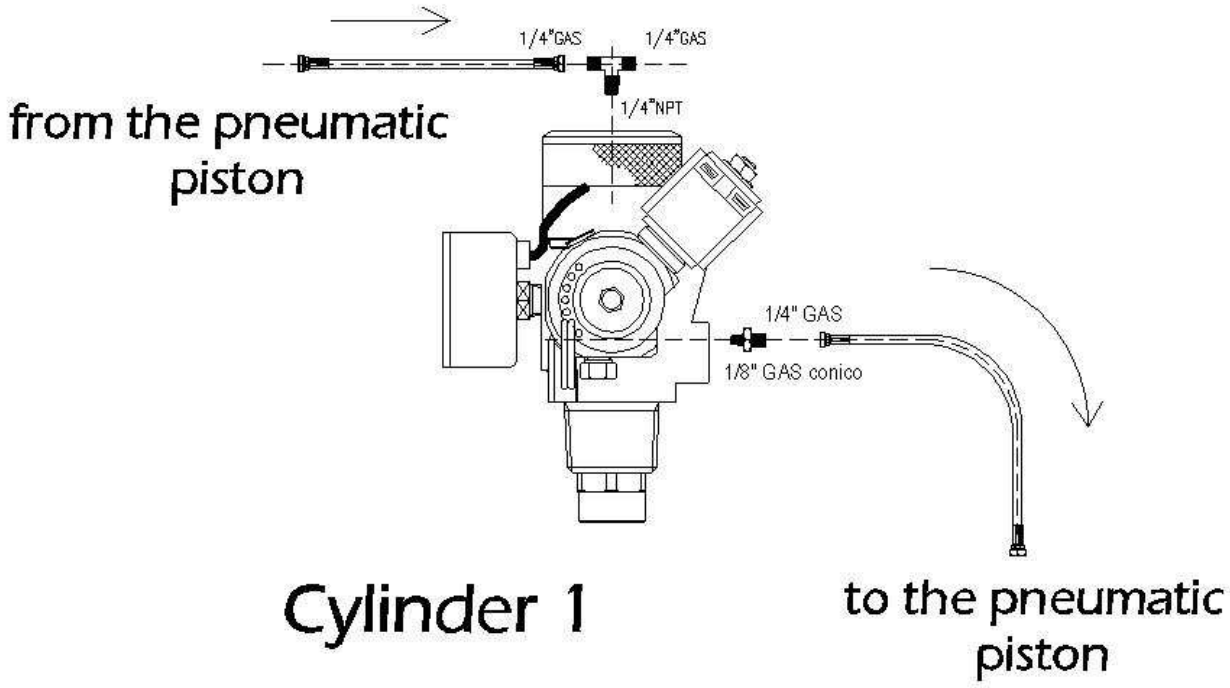

Fig.4.13 Pneumatic connection of piston outlet (Enclosure A) to the pneumatic line on the cylinder rack

The directional valve that allows discharge in Enclosure B is actuated by pilot cylinder 2. The discharge of cylinders 4 and 5 shall be guaranteed; for this purpose, the piston outlet (Enclosure B) shall be connected to the ¼" Tee placed on the pneumatic line between cylinder 3 and 4 (Fig. 4.14). Use a 3/16" flex hose to make the connection, making sure that the hose is long enough.

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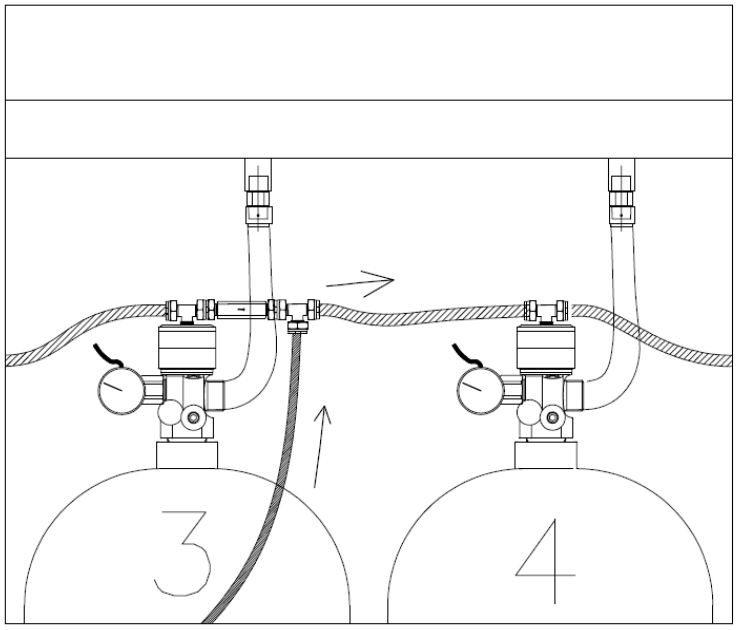
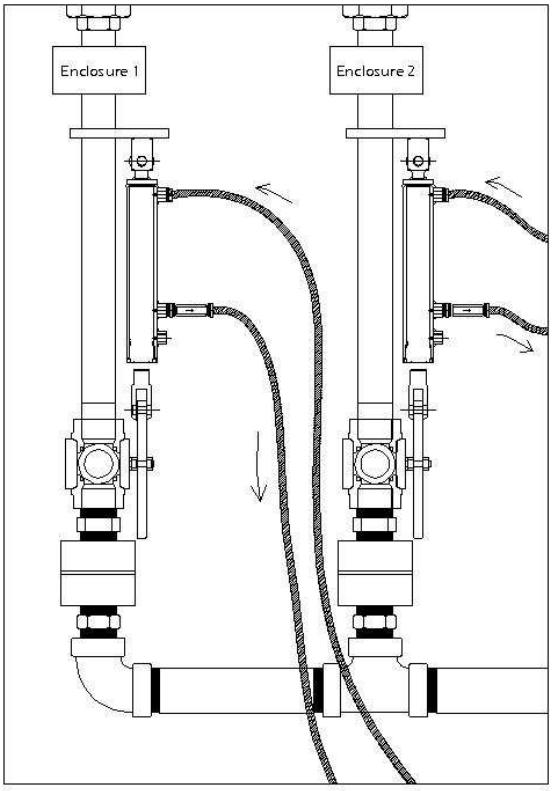


Fig.4.14 Detail of the connection of piston outlet (Enclosure B) to the pneumatic line on the cylinder rack



As shown in Fig. 4.15, non-return valves must be installed on the outlets of the actuating pistons; back flows shall be absolutely avoided because they would produce a serious malfunction of the system; these components guarantee a stringent non-return condition and allow the correct actuation of a suitable number of cylinders, according with design parameters.

Fig.4.15 Pneumatic connections on the actuating pistons

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5. Mechanical system acceptance

5.1 Testing procedures

The tab. 5.1, which summarizes all the steps necessary to successfully perform the testing for the acceptance of the mechanical system;
The first part of the table shows general information about the extinguishing system: customer, location of the system, system type (such as gas type, single tank system or multiple cylinders etc ...) and the date of acceptance; the second part contains data concerning cylinders: this data can be detected on cylinders labels. The third part deals with trials and test performed on the installed system. The result of each test may be "successful", "negative" or "not applicable".

Tab. 5.1 Example of Table for acceptance test

System Location

Costumer	San Polo D'Enza
System Location	Historical Archive, via Levi 1, San Polo D'Enza, Italy
	First Floor
System Type	Extinguishing IG 100 inert gas system
Date	11/29/12

Mechanical system data

Cylinders characteristics			Extinguishing gas data		TEST EXPIRE DATE
CAPACITY	BRAND	SERIAL NUMBER	TYPE	AMOUNT (kg)	
140 L	Xxx	05/8472/001	IG 100	43.5	2022
140 L	Xxx	05/8472/002	IG 100	43.5	2022
140 L	Xxx	05/8472/003	IG 100	43.5	2022
140 L	Xxx	05/8472/003	IG 100	43.5	2022
140 L	Xxx	05/8472/004	IG 100	43.5	2022

Tests description		RESULT		
Protect area volume acceptance				
Enclosure check		yes	no	n.a.
Review of enclosure integrity	Visual checking	yes	no	na
	performed with door fan test (ref. Test report)	yes	no	n.a.
Review of mechanical components				
Design conformity checking of:	Cylinders	yes	no	n.a.
	Pipeline	yes	no	n.a.
	Nozzles	yes	no	n.a.
Cylinders and pipe fixing checking		yes	no	n.a.
Devices locking checking – Cylinder, pipeline, nozzles		yes	no	n.a.
Pneumatic pipeline checking at 3 bar for 10 minutes (loss of pressure lower than 20%) Done with pressure gauge serial number		yes	no	n.a.
Pipeline fluxing checking		yes	no	n.a.
Preliminary functional test				
Blank test		yes	no	n.a.
Actual discharge test		yes	no	n.a.

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Provided documentation			
System technical report	yes	no	n.a.
Material safety data sheet (MSDS)	yes	no	n.a.
Hydraulic Calculation	yes	no	n.a.
Working documents a) drawings, at an indicated scale of extinguishing distribution system, including containers, location of containers, piping and nozzles, valves and pressure-reducing devices and pipe hanger spacing; b) name of owner and occupant; c) location of building in which hazard is located; d) location and construction of protected enclosure, walls and partitions; e) enclosure cross-section, full height or schematic diagram, including raised access floor and suspended ceiling; f) type of extinguishing agent used; g) extinguishing concentration, design concentration and maximum concentration; h) description of occupancies and hazards to be protected against; i) specification of containers used, including capacity, storage pressure and mass (extinguishing included); j) description of nozzle(s) used, including inlet size, orifice port configuration, and orifice size/code and orifice size of pressure-reducing devices, if applicable; k) description of pipes, valves and fittings used, including material specifications, grade and pressure rating; l) equipment schedule or bill of materials for each piece of equipment or device, showing device name, manufacturer, model or part number, quantity and description; m) isometric view of extinguishing distribution system, showing the length and diameter of each pipe segment and node reference numbers relating to the flow calculations; n) enclosure pressurization and venting calculations; o) description of fire detection, actuation and control systems.	yes	no	n.a.
CE guideline 97/23/CE declaration of conformity - Manifold	yes	no	n.a.
CE guideline 97/23/CE declaration of conformity - System	yes	no	n.a.
Legislative decree 37/08 declaration of conformity	yes	no	n.a.
Door fan test results	yes	no	n.a.
Cylinders certificate	yes	no	n.a.
CE declaration of conformity - Valves	yes	no	n.a.
User and maintenance manuals	yes	no	n.a.
Testing minutes	yes	no	n.a.

The first part of the table shows general data for the fire-fighting system: user, protected area position, system type (i.e. gas type, single cylinder or multiple cylinder systems, etc.) and the testing date.

The second part of the table shows the cylinders data; these information are read from the cylinders nameplates.

The third part of the table shows the test performed for the system. The result of each test may be “successfully” or “unsuccessfully”. The mandatory test for the system are listed below:

5.1.1 Protected area volume

Protected area volume acceptance: this data must be in accordance with the design.

5.1.2 Protected area integrity

Protected area integrity acceptance: this test can be done only by skilled personnel.

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From the EN 15004:2008 standard:

UNI EN 15004:2 7.8.2: *"It is essential to determine the likely period during which the extinguishing concentration will be maintained within the protected enclosure. This is known as the hold time. The predicted hold time shall be determined by the door fan test specified in Annex E, or a full discharge test based on the following criteria:*

a) at the start of the hold time, the concentration throughout the enclosure shall be the design concentration;
b) at the end of the hold time, the extinguishing concentration at 10%, 50% and 90% of the enclosure height shall be not less than 85% of the design concentration;
c) the hold time shall be not less than 10 min, unless otherwise specified by the authority."

Annex E: "Door fan test for determination of minimum hold time"

FIRST METHOD:
Door fan integrity test.
Mandatory test according to UNI EN 15004, simulating the gas behaviour after a real discharge and establishing the integrity of rooms and enclosures: the extinguishing concentration for the relevant period (hold time) must be maintained.

Fig. 5.1 Equipment for Door Fan Integrity Test

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Fig. 5.2 Actual gas discharge test

SECOND METHOD:
Real gas discharge.

This test consists in a real gas discharge of the fire-fighting system; the cylinder are completely discharged in the protected area.

⚠	**Before beginning the test, alert BETTATI ANTINCENDIO.**

⚠	**The test must be performed in the presence of a BETTATI ANTINCENDIO authorized and skilled operator with the necessary equipment.**

⚠	**It is allowed to remain in the protected area during the test only if you are equipped with a respirator.**

Place in the protected area an oxygen detector, in a visible and easily accessible place.
Activate electrically (with the detector panel) or manually the gas discharge. Check that the oxygen concentration is lower than 14% for at least 10 minutes at the maximum protected height.

5.1.3 Design correspondence

Check the correspondence between the design (cylinders, pipeline and nozzle placement) and the actual installed system.
Every modification must be communicated to Bettati Antincendio, who shall check the correct system working.

5.1.4 Pipeline fixing

Cylinders and manifolds fixing check: Installation shall be be done as described in this manual.

5.1.5 Pipeline locking

Cylinders, pipes, and nozzles locking check: the connections between pipes and threaded fittings shall be done with multi-layer teflon covers (or other adequate materials) in order to improve the leak tightness.

⚠	**The cylinders are pressurized at 300 bar; during the discharge, cylinders are exposed to high vibrations; not to carry out the recurrent check could cause serious danger to things and people.**

⚠	**Nozzles and pipes are pressurized from 60 to 15 bar; during the discharge vibrations and pressures could be very dangerous; not to carry out the proper check could cause serious danger to things and people.**

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5.1.6 Pneumatic circuit

Pneumatic circuit check

Any gas leakage must be avoided in any point of the pneumatic circuit, because it could compromise the system operation.
The following equipment is required to carry out this test :

- nitrogen pressurized cylinder;
- pressure regulator;
- leak detector.

1. Disconnect the flex hose L=400 mm from the Tee placed on the pilot cylinder;
2. Connect the flex hose to the pressure regulator placed on the nitrogen cylinder;
3. Set the pressure regulator to 15-20 bar on the outlet, and pressurize the circuit;
4. With the leak detector, check that there is no gas leak in any connection of the circuit.

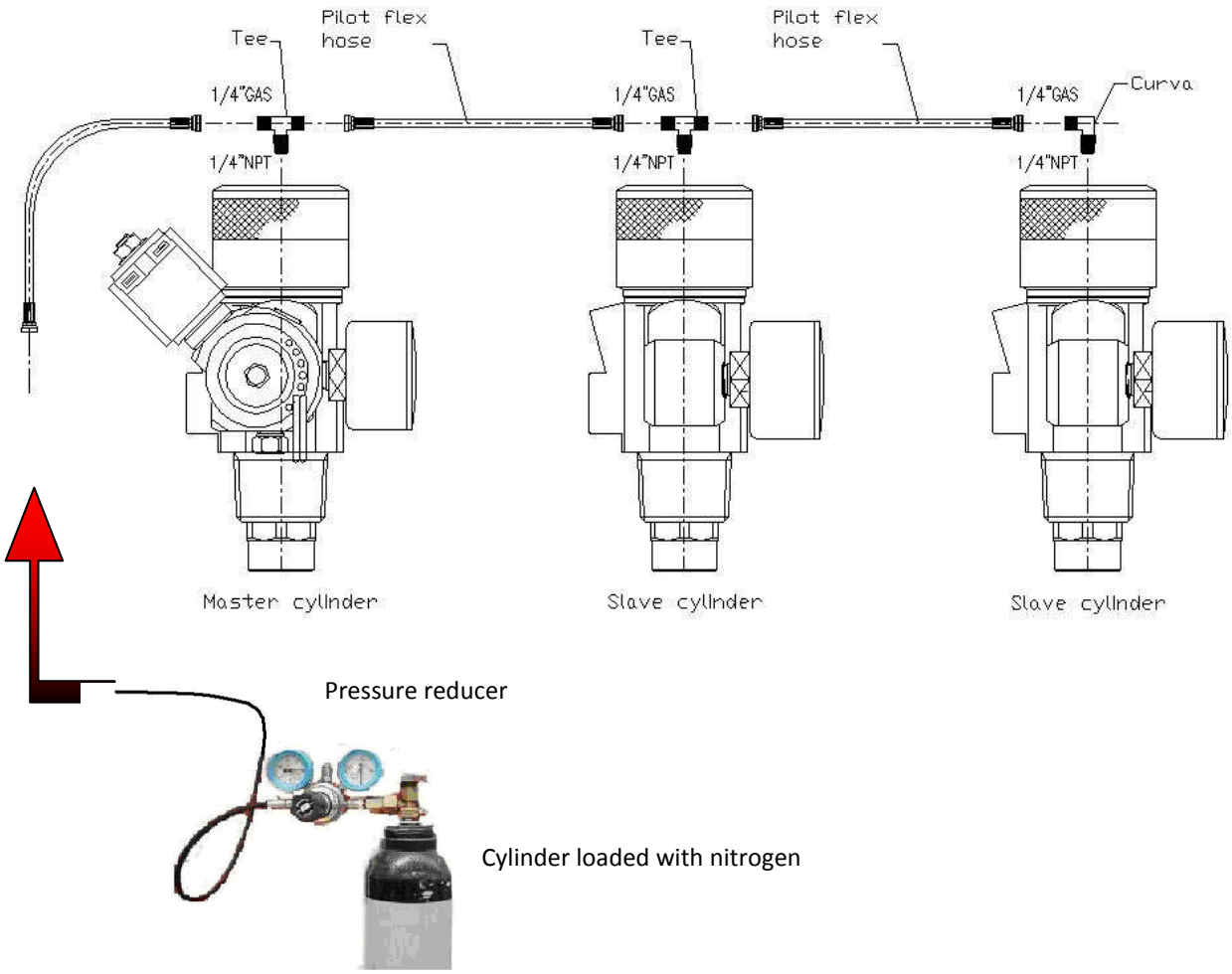

Fig. 5.3 Pneumatic circuit check

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step 1

Step 2

Step 3

Fig. 5.4 Pneumatic circuit check

⚠	**During the test be careful not to exceed 120-130 bar: such pressure would result in the opening of discharge valves**

Step 4

Fig. 5.5 Pneumatic circuit check (step 4, leak detection)

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5.1.7 Functional test

Blank test of the fire-fighting system: it could be performed in different ways.
The aim of the blank test is to check the proper functioning of the system automatism, without actually discharging the extinguishing gas.

FIRST METHOD

1. Dismount the solenoid valve placed on the pilot cylinder, unscrewing the nut M10 (fig. 19)

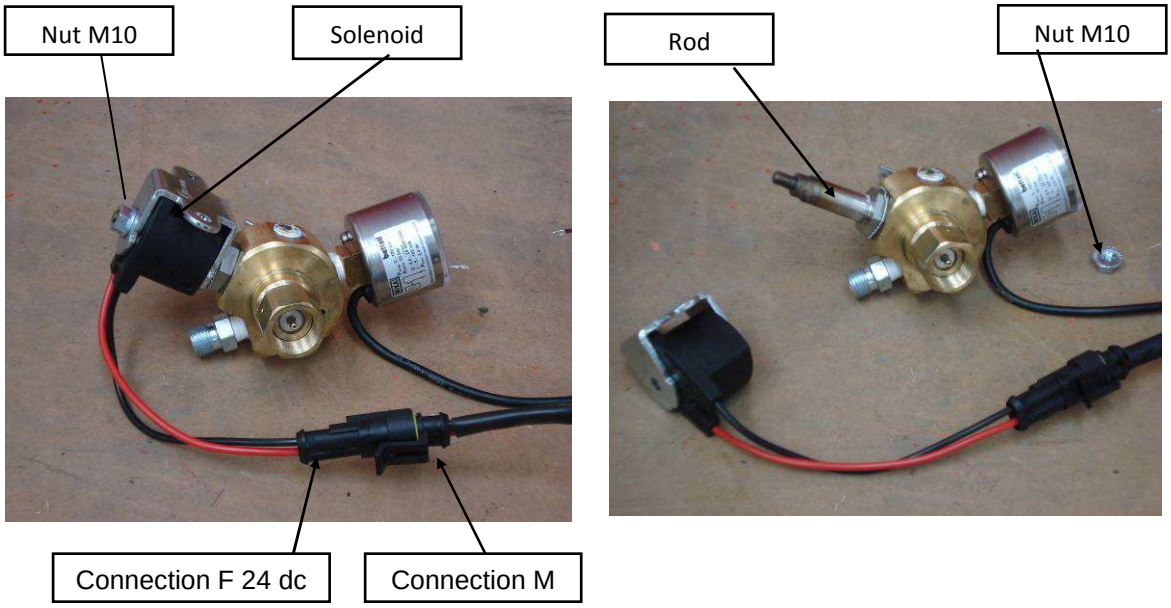

Fig. 5.6 Blank test, coil disconnection

2. Insert a metallic body (e.g. screwdriver) inside the coil and activate the manual discharge button checking the coil switches on. Once the coil is switched on, the metallic body is attracted by the magnetic field. Once the test is succesfully performed, restore the initial conditions of the solenoid actuator.

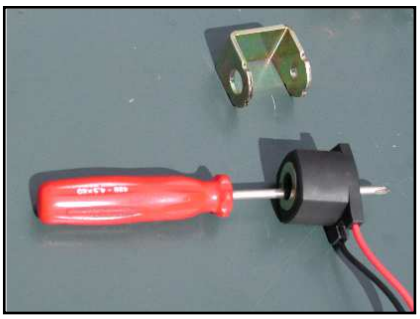

Fig. 5.7 Blank test: coil test

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SECOND METHOD

A tester device is used (fig. 5.8) in order to verify that the valve is correctly actuated, as a consequence of an alarm signal from the control panel. The following steps must be performed:

1. Disconnect the 3/16" pilot flex hose L = 400 mm from the pneumatic line on the top of discharge valves.
2. Dismount the electric connection between the solenoid and the control panel (red/black wires): insert the tester device in the chain connection between the control panel and the solenoid. This can be performed by connecting the tester device to the solenoid on one side (fig. 5.9, connection A), and to the control panel on the other side (fig. 5.9, connection B).
3. Alert the control panel by pushing the button "MANUAL RELEASE" or, alternatively, alarm the smoke detector: the yellow lamp "PRESENZA TENSIONE" on the tester device should immediately turn on (fig. 5.10).
4. Push the black button "PULSANTE TEST" (in central position on the device display, fig. 5.10) for about one second. As a consequence, the green lamp "TENSIONE EV" turns on (fig. 5.11); immediately, a whistle produced by the gas coming out from the flex hose connection can be clearly heard: this is a signal of the gas discharge. If anomalies occur in performing this procedure, please contact Bettati Antincendio.
5. With a leak detector, check that in condition of current suspension there is no gas leak neither from the flex hose connection nor from the bleeder valve (fig. 5.12). If any leak is detected, make sure that actually the electric current is suspended. After this check, if the leakage persists, please contact Bettati Antincendio.
6. After performing the functional test, reset the control panel in order to interrupt the electric current. The yellow lamp should turn off.
7. Disconnect the tester device and connect the solenoid directly to the control panel.
8. Connect the pilot flex hose to the actuation system.

Fig. 5.8 Device for functional test of the fire-fighting system (tester device)

⚠	**This test must be carried out by skilled personnel**

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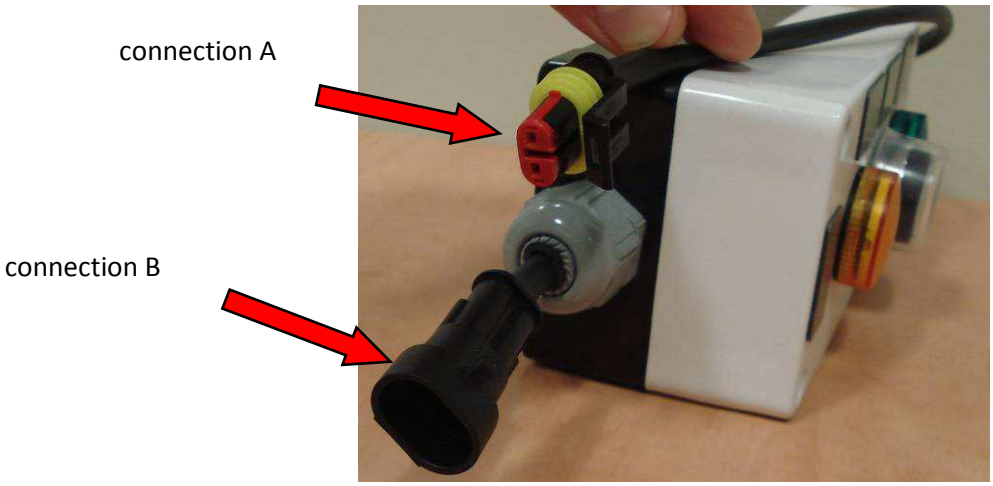


Fig. 5.9 Tester connections

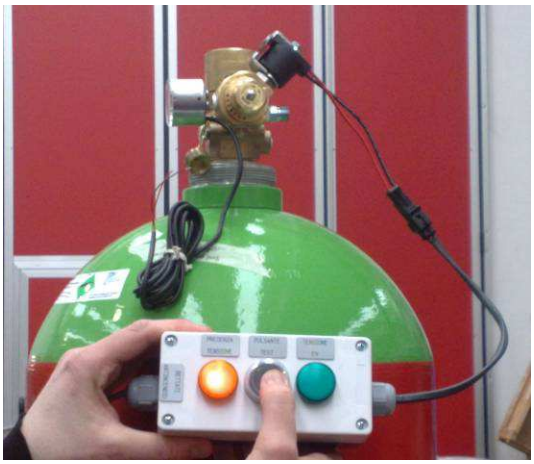
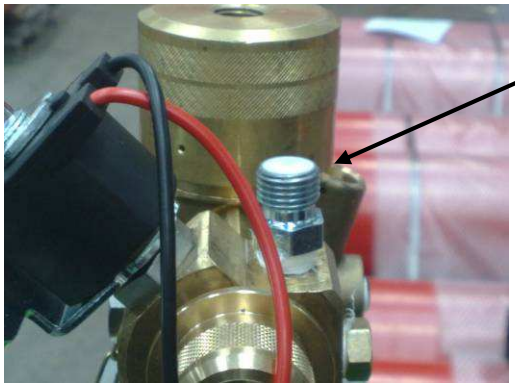


Fig. 5.10 Connection between the tester and the solenoid actuator

Fig. 5.11 Tester device lamps are turned on: gas is discharging.



In condition of current suspension, the leak detector placed on the connection and on the bleeder valve (a slight film of white liquid) must not form any bubble.

Fig. 5.12 Leak detector placed on the connection of the manual/ solenoid actuator and on the bleeder valve

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6. Testing for directional valve systems (if applicable)

6.1 Check the correct functioning of the system

A pneumatic check of the connections between directional valves and cylinders shall be performed. The connections must not show any leakage in any point of the pneumatic line

To carry out this test the following devices are necessary:

- Cylinder filled with pressurized nitrogen;
- Pressure regulator;
- Leak detector.

⚠	**Before performing this procedure, unplug the coil from the solenoid actuator of the pilot cylinder in order to avoid an accidental discharge (Fig. 6.1)**

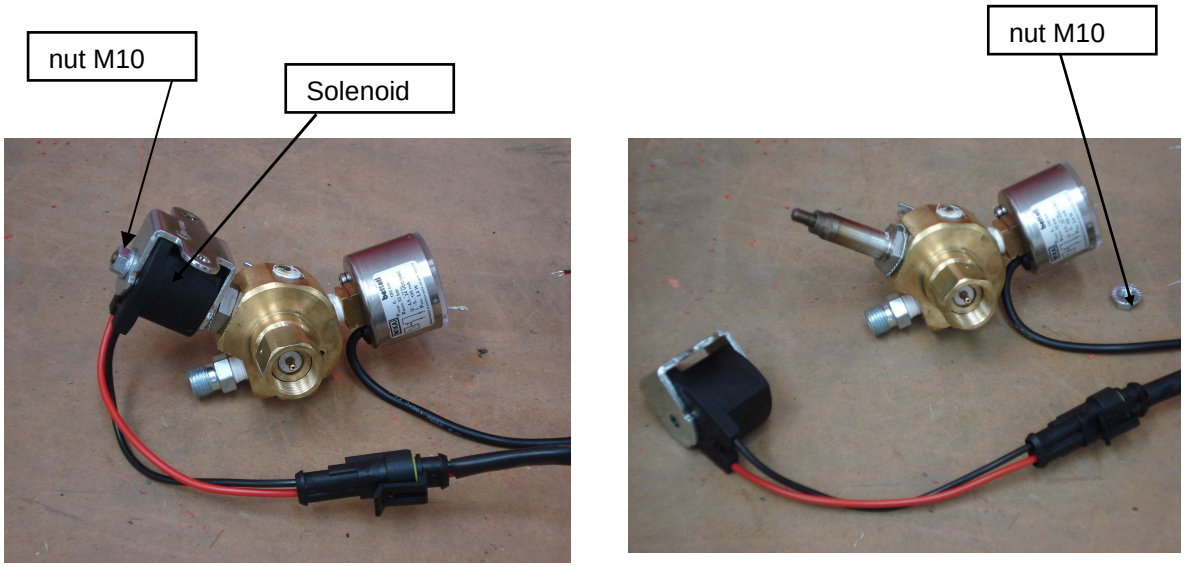

Fig. 6.1

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1. Connect the flex hose diam. 3/16", previously installed on the inlet of the piston, to the outlet of the pressure regulator mounted on the nitrogen cylinder (fig. 6.2)

Fig.6.2

2. Set the outlet of the reducing pressure device at 15/20 bar, then pressurize the pneumatic circuit. (fig. 6.3, step A – step B)

Step A Step B

Fig.6.3

⚠	**Performing this test does not imply any risk to discharge the cylinders as the pressure required to activate them is about 120-130 bar, while test pressures are 15/20 bar.**

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3. Once pressurized, the piston will make its run, opening the directional valve and allowing the flowing of pressurized nitrogen through its outlet (fig. 6.4); the pneumatic circuit on the top of discharge valves will be thus pressurized.

fig. 6.4

4. With a leak detector check that there is no gas leakage in the junction points on the cylinders and in the whole pneumatic line (fig. 6.5)

fig. 6.5-A

fig. 6.5-B

fig. 6.5-C

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7 Extinguishing system start-up

7.1 Electrical-mechanical connection of the solenoid / manual actuator

After a complete checking of the correct functioning of the extinguishing system, it is possible to proceed with the system start-up.

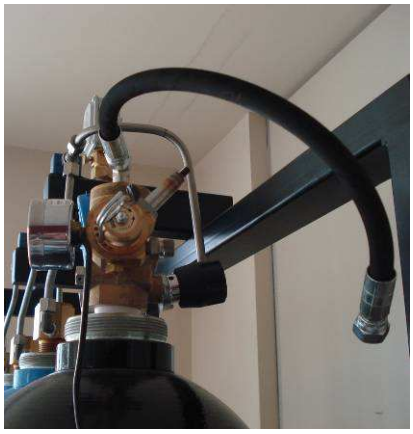

Fig. 7.1 Flex hose connection

Connect the flex hose placed on the top of the pilot cylinder to the nipple on the solenoid actuator.

⚠	**Make sure that circuit is not connected to the power supply and that the solenoid is not switched on.**

Install the solenoid as shown in the picture below:

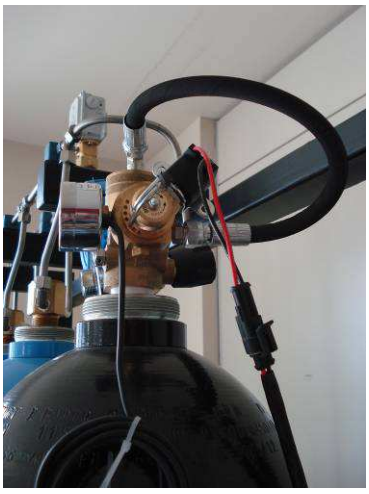

Fig. 7.2 Installation of the solenoid

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At this stage the system is correctly installed and functioning.

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Note:

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