CHEMETRON™ Fire Systems

CARDOX

CARBON DIOXIDE and FM-200

Application Bulletin

Carbon Dioxide or FM-200® Fire Suppression —

Utilizing Selector Valves for Multiple Hazard Protection

In the fire suppression applications for which Cardox low pressure CO_2 systems are used, it is probably the rule rather than the exception that storage of CO_2 is used to protect more than one hazard and sometimes even a great many. (One system in an automotive research facility has over one hundred different hazards protected from the same tank.) However, with high pressure CO_2 and FM-200 applications, the use of central storage to protect more than one hazard occurs much less often. However, there are times when this arrangement (which spreads the cost of the agent and its storage among the hazards protected) could result in lower cost, yet still effective, protection. Taking advantage of the use of selector valves (sometimes called directional valves) requires some considerations that may not be obvious; this bulletin is written to discuss these considerations.

⚠ NOTE

SELECTOR VALVES CAN ALSO BE USED ON THE CHEMETRON ARGONITE AND WATER MIST SYSTEMS. THEY ARE OF A DIFFERENT DESIGN AND OPERATION, WHICH IS DISCUSSEDIN THE MANUALS FOR THESE SYSTEMS. HOWEVER, THE PRINCIPLES DEFINING WHERE IT IS APPROPRIATE TO USE SELECTOR VALVES ARE THE SAME. CONTACT CHEMETRON FOR DETAILED INFORMATION.

Consideration of Hazard Size

If the hazards are small (5 cylinders or less with $HPCO_2$ or 1 cylinder with FM-200), the economics do not favor the use of selector valves, as the cost of the selector valves and their controls may be nearly as much as the savings gained by spreading the cost of agent and storage over the number of hazards protected. The disadvantages of a selector valve system would override any cost savings. (Refer to the Disadvantages section later in this bulletin.)

If the hazards are of significant size and are in the same general area, selector valves should be considered. The hazards protected do not have to be the same size, nor does the same amount of gas have to be discharged into each.

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For example: With $HPCO_2$, if the hazards are of significant but different sizes, the system can be arranged to use selector valves and still give each hazard its proper amount of CO_2 by installing check valves in the cylinder manifold and multiple actuation kits on the cylinders.

Let's say one hazard requires 700 lbs while a second requires 1,200 lbs for protection. The system is sized with 12-100 lb cylinders and in the manifold, between the seventh and eighth cylinder, a check valve is installed with flow toward the eighth cylinder. Primary completer kits are installed on cylinders on both sides of the check valve. The manifold is piped downstream of the check valve to selector valves that are sized for the hazard protected.

If the larger hazard is tripped, the actuators on the cylinders ahead of the check are operated - all cylinders (1,200 lbs of agent) are released. The selector valve for the larger hazard is also opened. If the smaller hazard is tripped, the actuators on the cylinders downstream of the check are tripped, releasing the cylinders on that side of the check valve only (700 lbs of agent). (A bleeder valve shall be installed on the manifold upstream of the check to bleed off any CO_2 that may leak through the check before the pressure has a chance to build up to where it will release the cylinders ahead of the check.) The selector valve for the smaller hazard is also opened upon actuation. A system like this would save refilling 5 cylinders. (See Figure #1.)

While selector valves can be used on FM-200 systems, these cylinders are filled to the amount of gas required rather than having standard fills as is done with CO_2. Rather than adding cylinders, larger cylinders are normally used as gas requirements increase. If the gas requirements for two hazards are large, the hazards are about the same size and close enough to each other to be able to calculate the flow, and there is little chance of needing simultaneous operation, selector valves will work fine. With hazards of various sizes there is a problem of discharging too much FM-200. Discharging a large amount of FM-200 into a relatively small enclosure will create a concentration above the "people compatible" range. There is an option in the case of larger systems protecting various size hazards. Since the cost of the FM-200 gas is such a high proportion of the system cost, the storage could be broken down into smaller cylinders in order to be able to discharge only a portion of the gas into a smaller enclosure. For example, let's look at a system protecting a hazard requiring 800 lbs and another hazard requiring 400 lbs of FM-200. Two 400 lb cylinders would be used in place of an 800 lb cylinder. Following the arrangement described above, both cylinders would be discharged into the larger hazard, but only one cylinder would be discharged into the smaller hazard. However, if the hazard requirements were 200 lbs and 800 lbs, it may not be practical to use 4-200 lb cylinders.

Selector Valve Arrangements

■ Standard Arrangement

The Chemetron selector valve operation scheme is shown in Figure #2. Operation of the selector valve utilizes an actuator valve with a handwheel release and is operated electrically by a solenoid valve. The actuator valve applies pressure from the piping upstream of the selector valve to the selector valve operating chamber (See Figure #3). Utilizing the mechanical/pneumatic advantage represented by the force generated when the same pressure is applied to different size areas (piston vs. valve seat), the valve is opened when pressure is applied. It closes from spring action when the pressure is released.

All Chemetron systems are designed to provide an emergency manual release (EMR). The handwheel on the selector valve pilot control (Figure #4), together with the manual pneumatic actuator (FM-200) or the pilot head(s) ($HPCO_2$) on the pilot cylinder(s) allows an operator to release the system if there is a failure of all electric controls. The handwheel release on the actuator becomes part of the EMR; therefore, the selector valve actuator should be accessible. This is an actuator, not a handwheel valve. Turning the handwheel until the actuator piston is unseated (about 1/4 to 1/2 turn) is all that is necessary to operate the selector valve. The Chemetron selector valves are designed to close automatically when depressurized at the end of the discharge.

NOTE

SINCE IT IS POSSIBLE FOR THE CYLINDERS TO BE RELEASED WHILE THE SELECTOR VALVES REMAIN CLOSED, THUS TRAPPING GAS IN THE HEADER, A PRESSURE RELIEF VALVE IS INSTALLED IN THE HEADER.

■ Arrangement for Simultaneous Hazard Protection

In the case where it is necessary to anticipate the need to discharge cylinders simultaneously to protect two different hazards from the same system, a scheme as illustrated in Figure #5 is used. One set of hazards is served from one cylinder bank while the alternate hazards are served by a second bank. They are interconnected by a cross-connection so that if only one hazard is discharged, the remaining cylinder bank can provide protection for all hazards until the discharged cylinders can be refilled.

Advantages of Using Selector Valve Systems

When the agent storage represents a major portion of the system cost, it is advantageous to be able to spread that cost over the protection of as many hazards as possible. Selector valves allow you to do this.

In CO_2 total flooding system hazards, CO_2 operated alarms can be used for predischarge warning in the event that the system is tripped by any means. This is very desirable. The selector valve can be arranged to serve as the "blocking valve" that is needed for this (see Figure #6).

Disadvantages of Using Selector Valve Systems Rather Than Separate Systems

As previously discussed, when there is a potential for interexposing hazards that need simultaneous protection, the use of a single bank of cylinders with selector valves serving these hazards is not an acceptable arrangement. This would apply even where there is a potential for an operator to accidentally operate the control for the wrong hazard when there is also a need for operation of the correct hazard, such as might occur in the confusion at the time of a fire.

NOTE

A DESIGN USING SELECTOR VALVES AND TWO CYLINDER BANKS TO DEAL WITH THIS SITUATION IS DESCRIBED ABOVE AND SHOWN IN FIGURE 5.

If there is more than one hazard protected from a common cylinder bank and the system discharges, all hazards are left without protection while the system is being refilled. In this case, most major Authorities Having Jurisdiction will want a connected reserve agent supply, whereas they might accept a system without the reserve if only one hazard is protected. With two hazards this will necessitate more equipment and cost than individual, separate systems.

NFPA Standard No. 12, Carbon Dioxide Extinguishing Systems, calls for a full discharge acceptance test [Paragraph 1-6.3 (d)]. It could be difficult to handle multiple tests necessitating recharge of the CO_2 supply if the other hazard(s) has to remain protected while one is tested. (Provision of "test cylinders" may be needed, incurring an associated added cost.)

If the protected areas are a distance apart, an analysis of the cost of installing the system between the hazards and the common cylinder bank needs to be made to determine whether the savings on equipment are offset by higher installation costs. This analysis may be difficult without knowledge of the installation conditions. For example, if stainless steel pipe is needed due to a corrosive atmosphere, the cost for same will consume much of the equipment cost savings.

Introduction of the need to operate an additional solenoid (s) when selector valves are used may limit the electrical control panel options.

The availability of selector valve control across the complete range of Chemetron systems can provide the opportunity for much more cost-effective fire suppression. Chemetron Fire Systems' Application Engineering group is available to assist with any analysis needed to evaluate a particular opportunity for their use.

NOTE

MARINE (SHIPBOARD) SYSTEMS UTILIZE SELECTOR/BLOCKING VALVES WITH A SOMEWHAT DIFFERENT CONFIGURATION THAN LAND-BASED SYSTEMS. CONTACT CHEMETRON FOR FURTHER INFORMATION ON MARINE SYSTEMS.

For your information, the equivalent lengths of the various Cardox selector valves are given in the chart below.

Valve Size Inches	Valve Stock Number	Nominal Pipe Size Inches	EQL of Pipe	
			Pipe Schedule	
			40	80
1	10610371	3/4	13	8
1	10610371	1	47	29
1	10610663	1	40	24.5
1-1/2	10610369	1-1/2	72	49
1-1/2	10610312	1-1/2	71	48
2	10610370	2	67	48
3	10610733	2-1/2	31	23
3	10610733	3	99	73
4	10610734	3-1/2	61	44
4	10610734	4	120	92
6*	10610740	5	70	55
6*	10610740	6	185	142

* not suitable for High Pressure CO_2

Lockout Valves

On systems where persons not familiar with their operation may be present in a CO_2 protected hazard, provision to lockout the protection in the hazard during that time is made by the use of a supervised lockout valve installed in the piping, in line with the selector valve. A safety relief valve is required between the lockout valve and the selector valve.

When the lockout valve is closed and the system is disabled, a Trouble signal is given at the control panel. Supervision of the valve ensures that the system will not be inadvertently left locked out.

It is recommended that the lockout valve be installed upstream of the selector valve so that it can be used when the selector valve is being inspected or serviced to avoid disabling any other hazard.

See NFPA Standard #12, Paragraph 1-6.1.7 and Chemetron's CO_2 Safety Manual.

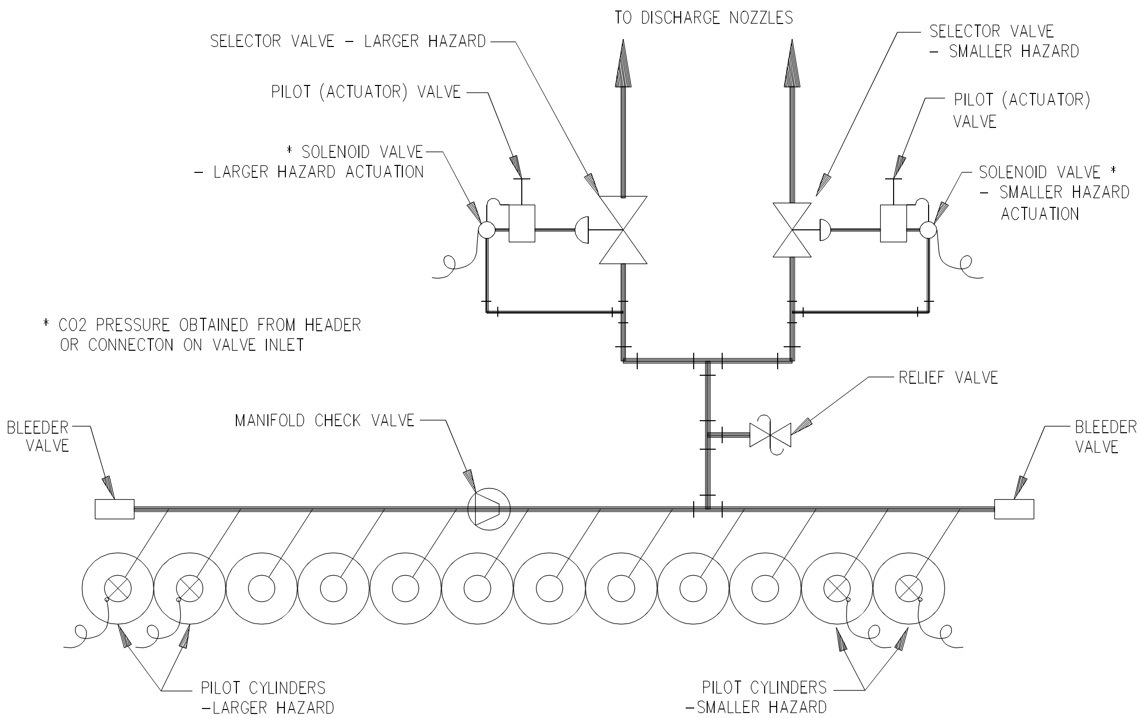

Figure 1 - High Pressure CO_2 Selector Valve System protecting 1 larger and 1 smaller hazard

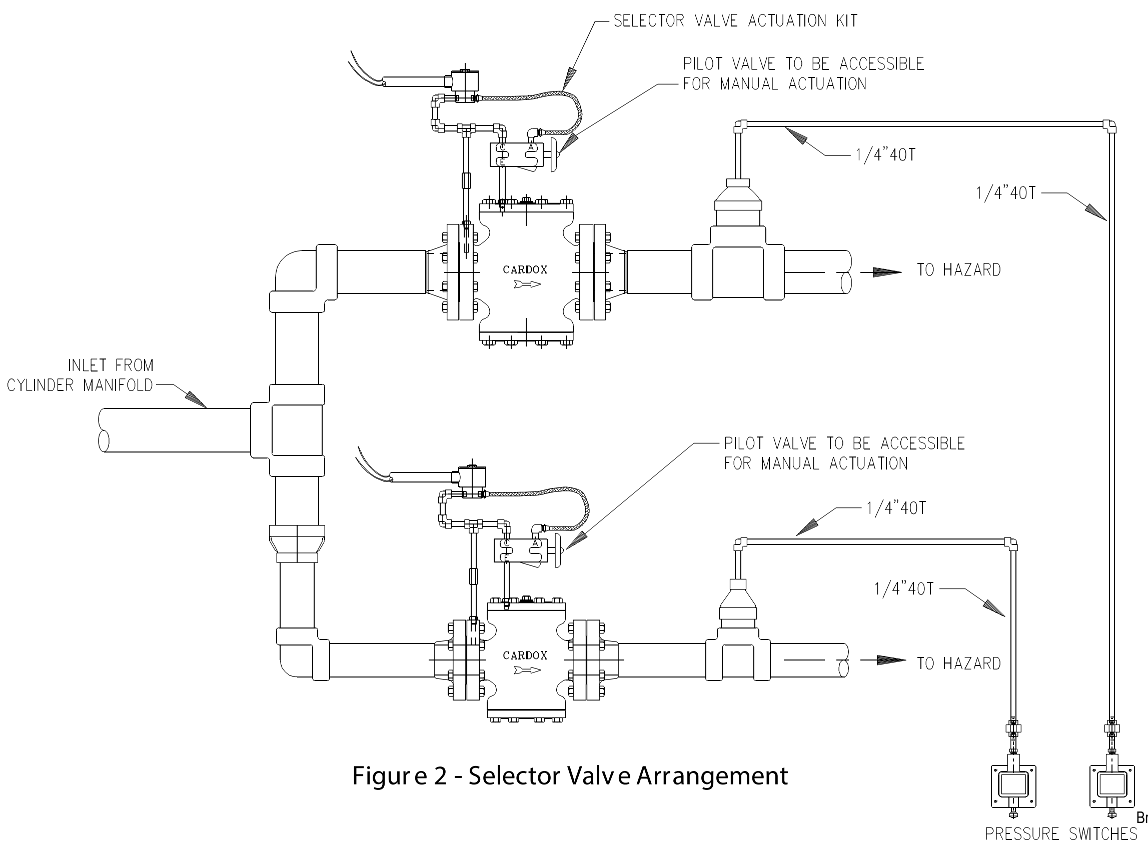

Figure 2 - Selector Valve Arrangement

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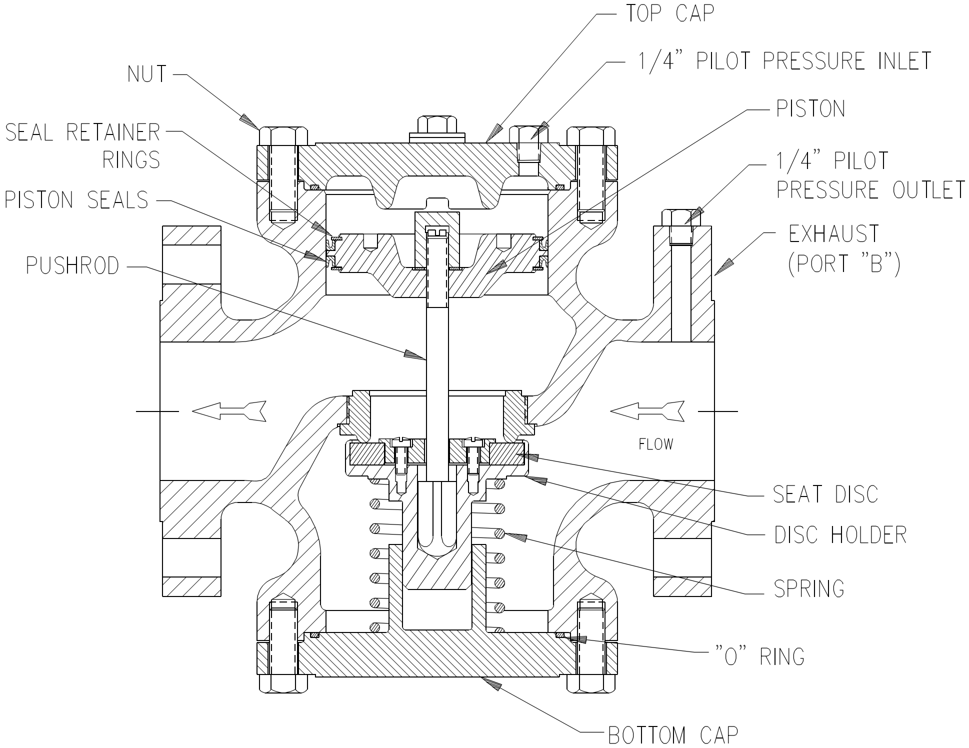

Figure 3 - Typical pressure operated discharge valve

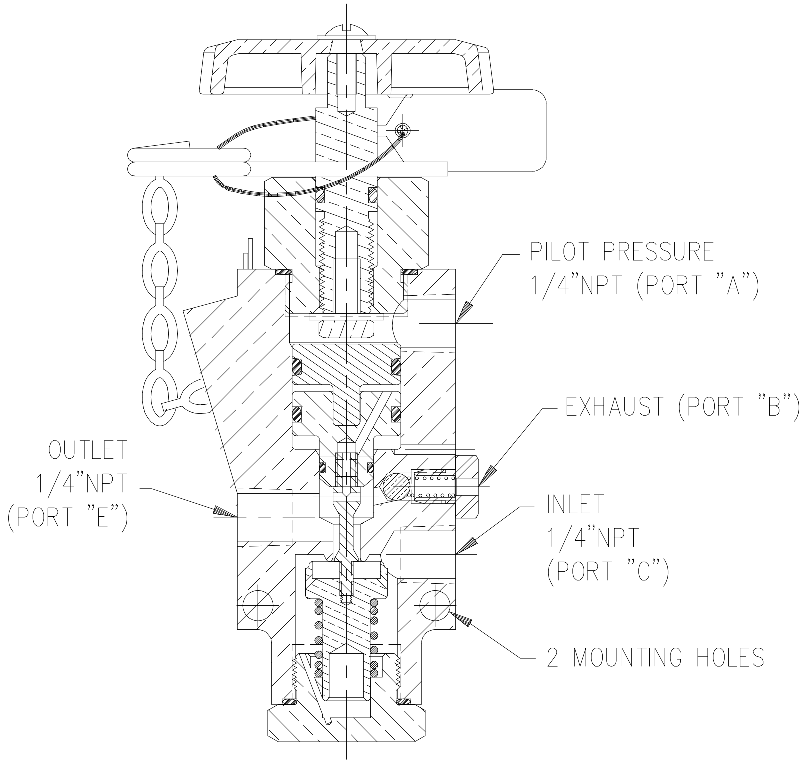

Figure 4 - Pilot control valve

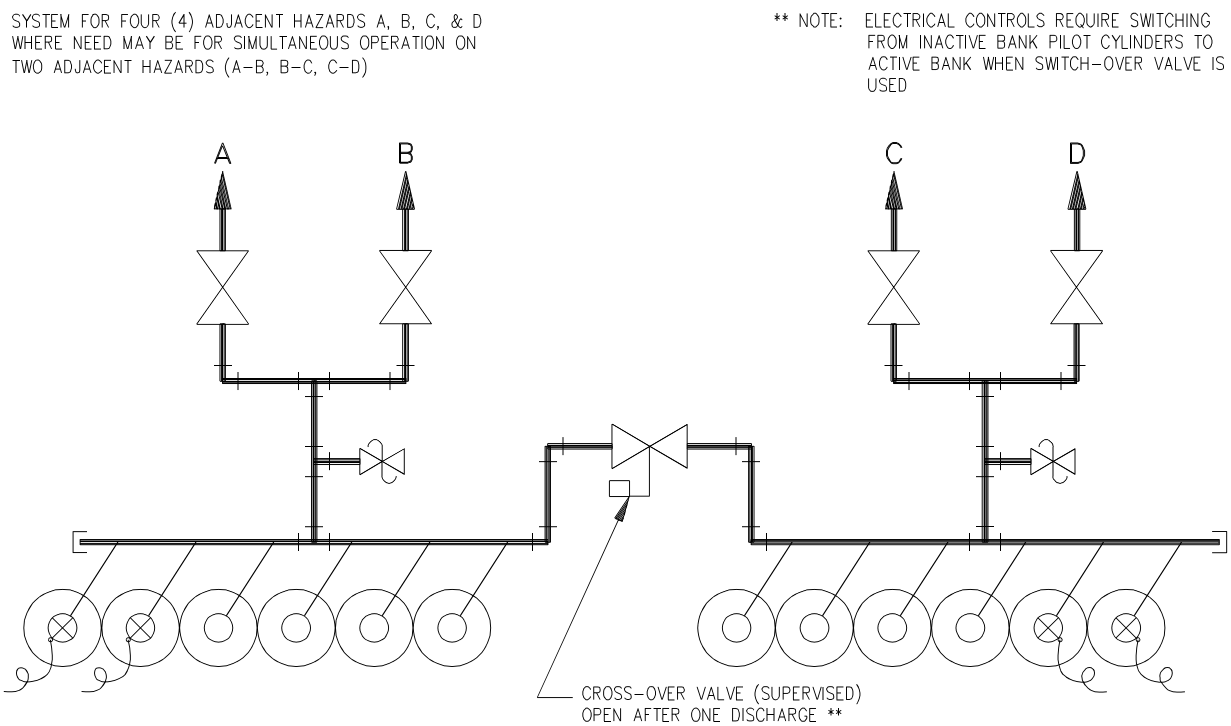

Figure 5 - Selector valve system protecting 4 adjacent hazards
where the potential exists for simultaneous discharges on two adjacent hazards.

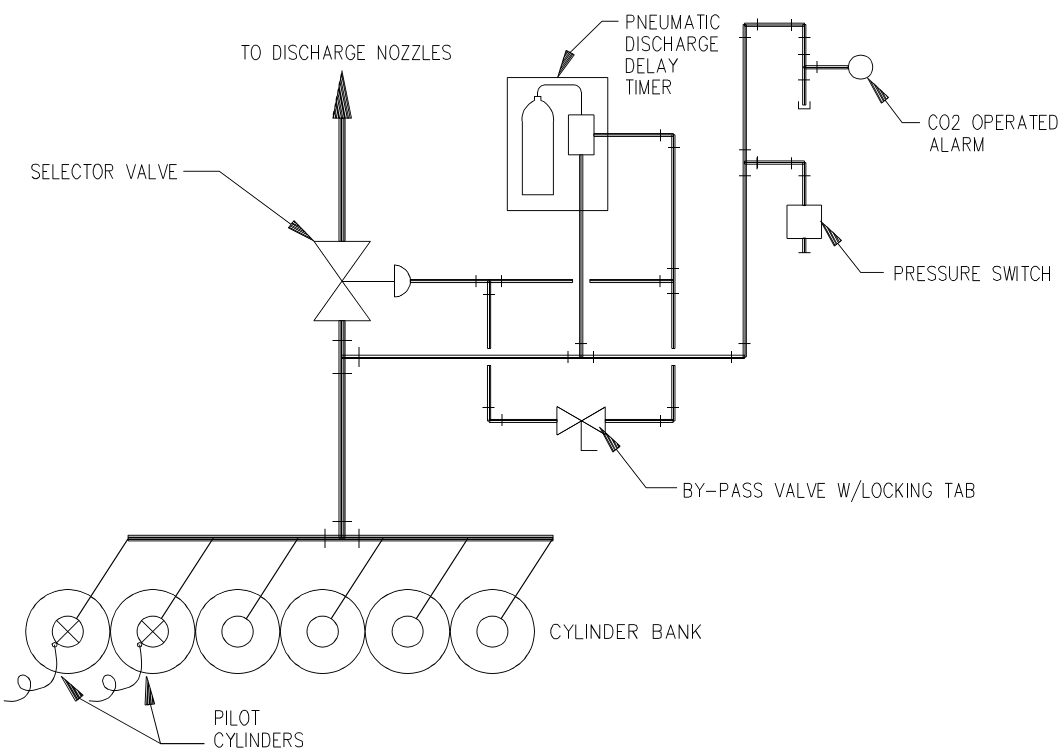

Figure 6 - System where the selector valve is functioning as a blocking valve

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