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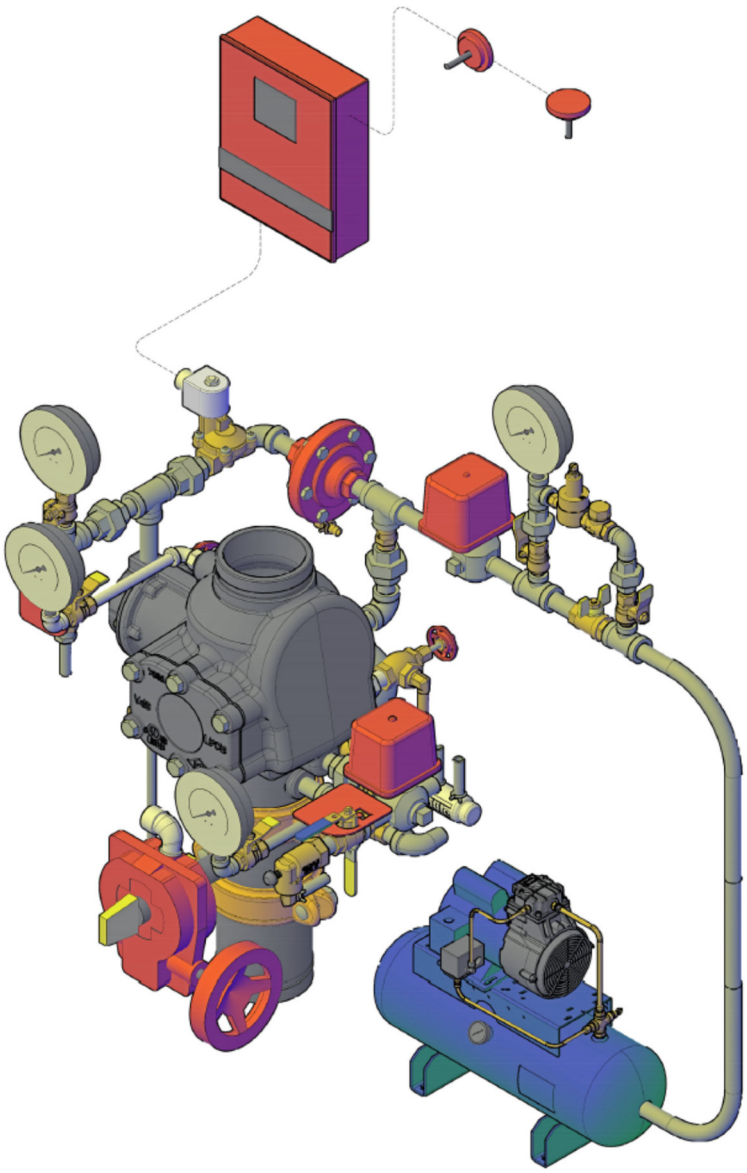

PREACTION SYSTEM DESIGN GUIDE

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TABLE OF CONTENTS

1. INTRODUCTION

This Design Guide has been prepared by The Reliable Automatic Sprinkler Co., Inc. to provide a source of information that will help users understand and select Preaction System components for a wide variety of fire protection applications. It is complemented by other Reliable Automatic Sprinkler Company design guides that provide more specific insight into supplemental equipment necessary to install a complete system. Note that separate design guides have also been prepared for other types of fire protection systems.

This guide will provide a comprehensive overview of Preaction systems and their operation while introducing the specific equipment necessary to complete the installation. For a detailed description of the specific equipment outlined in this guide, it will be necessary to obtain the appropriate bulletin. Where applicable, bulletin numbers have been included to facilitate a more detailed analysis and description of Reliable valves and components.

Note that the information included herein is only a guide. Responsibility for the actual design and installation of any fire sprinkler system rests with the engineer of record, certified layout technician and/or the Authority Having Jurisdiction.

For additional product information and other resources, please visit www.reliablesprinkler.com. Should you have additional questions about Reliable products, please do not hesitate to contact our Technical Services Department at 800.557.2726 or email us at techserv@reliablesprinkler.com.

2. DEFINITIONS

The definitions included in this document are as described in National Fire Protection Association (NFPA) standards where applicable. Those definitions are marked with an asterisk. Where no specific definition is available in the standard, Reliable terminology has been used to describe or define a process, product, or device.

Approved*- Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction (AHJ)*- An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Cross Zoned Detection- A detection method requiring the operation of devices on 2 different circuits before the alarm condition is initiated.

Detector* (electrical)- A device suitable for connection to a circuit that has a sensor that responds to a physical stimulus such as gas, heat or smoke.

Fail-Safe Sprinkler System- A sprinkler piping network that is designed to function despite a loss of service. The idea of fail-safe in fire protection systems is usually related to a loss of electrical power to the system or building.

Listed*- Equipment, materials or services included in a list published by an organization that is acceptable to the authority having jurisdiction.

Non-Interlock Preaction System- A non-interlock preaction system admits water to the sprinkler piping upon a loss of air pressure *or* operation of a detection device. Since these systems are rarely installed, they are not included in this design guide.

Pilot Line Detector*- A standard spray sprinkler or thermostatic fixed-temperature release device used as a detector to pneumatically or hydraulically release the water control valve.

Pneumatic Source- An air compressor, nitrogen generator or some other means to supply supervised air to the sprinkler piping network. A Pneumatic Source Design Guide is available on the Reliable website.

Preaction System*- A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers.

Solenoid Valve- An electrically operated valve wired into the releasing panel and opened with the operation of the electric detection system.

Supervised Air Supply- A piping network in a sprinkler system where the air pressure in the system is monitored for a loss or increase in pressure by a high/low air pressure switch. This switch sends a supervisory alarm when pressure drops below or rises above a preset pressure.

System control Valve- The valve used to manually turn the incoming water supply on or off.

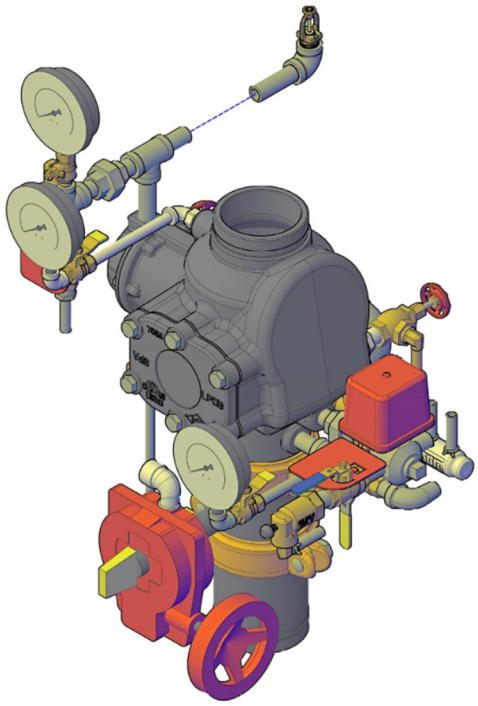
Water control Valve- The valve used to allow the release of water into the system. In most preaction systems this is accomplished with a deluge valve.

3. DETECTION SYSTEMS

Special Systems differ from wet or dry sprinkler systems in that they require the operation of a detection device or manual release for the sprinkler system to discharge. Depending on the type of sprinkler system installed, the detection system can be the only mechanism required to flood the system piping with water or in some cases it can be one of multiple events necessary to release the water control valve. Detection systems can be hydraulic, pneumatic, or electric; and installation rules differ depending on the type of detection system chosen. Choosing the appropriate detection system is dependent upon the type of hazard and location of the hazard that is being protected. Different types of detection offer differing levels of sensitivity and complexity.

3.1 Wet Pilot Detection

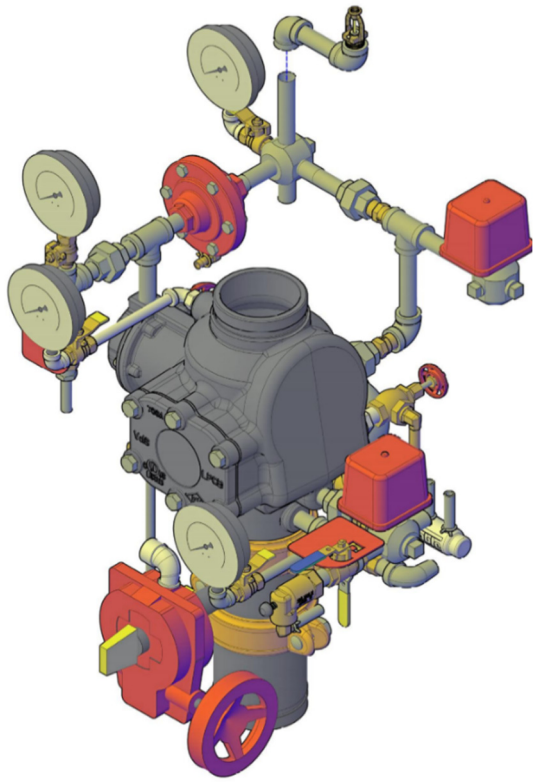
A wet pilot line is a non-electrical type of detection/release system that can be used in conditioned (i.e. freeze protected) areas. Closed sprinklers or fixed-temperature-release pilot line detectors are installed throughout the protected area on small diameter piping that contains water under pressure. When using Reliable valves and equipment, the wet pilot line is an extension of the pushrod or diaphragm chamber. Wet pilot is an acceptable detection method for single interlock preaction or deluge systems. Upon activation of a pilot line sprinkler or pilot line detector, pressure is released from the pilot line and chamber allowing the water control valve to open and fill the system piping in the protected area. Alarm devices are activated upon the flow of water into the sprinkler system piping. In the event the fire continues to grow, individual fire sprinklers in the protected area will activate similar to a wet pipe system. Wet pilot trim is the basis on which dry pilot line and electrical actuation systems are built; additional components are added to the wet pilot trim for each of these systems. *It is important to note that the length and height of wet pilot lines may be limited by the available system water pressure.*



Model DDX
Wet Pilot Trim

3.2 Dry Pilot Detection

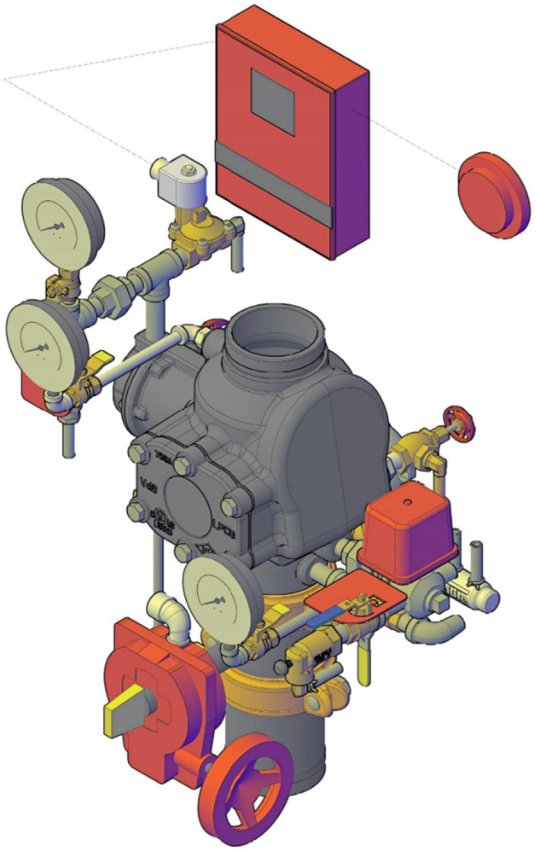
Where freezing conditions exist, or where height/distance limits of wet pilot lines are exceeded, a dry pilot line can be used. Closed sprinklers or fixed-temperature-release pilot line detectors are installed throughout the protected area on small diameter piping that contains pressurized air or nitrogen. With a single interlock preaction system, a single chamber Dry Pilot Actuator is installed on the outlet of the Deluge Valve pushrod or diaphragm chamber. This device provides a separation between the hydraulically pressurized chamber and the pneumatically pressurized pilot line. The dry pilot line is a pneumatic extension of the pressurized pushrod chamber. Upon activation of a pilot line sprinkler or pilot line detector, pneumatic pressure is released from the piping allowing the dry pilot actuator to vent and release hydraulic pressure from the chamber. Alarm devices are activated upon the flow of water into the sprinkler system piping. Pneumatic pressure in the dry pilot line must be maintained by a listed pressure maintenance device and can be provided from several pneumatic sources. A tank-mounted compressor, plant air system, nitrogen generator or nitrogen cylinders are most often used. To prevent accidental system activation, pneumatic pressure is monitored by a pressure switch that will initiate a signal in the event of low pressure due to damage to the pipe, fixed temperature release device, or failure of the compressed gas system.



Model DDX
Dry Pilot Trim

3.3 Electric Detection

Where electrical actuation of the system is preferred over wet or dry pilot lines, or where otherwise required by project specifications, electric detection can be provided. There are numerous types of electrical detectors used for the release of preaction systems including smoke, heat and linear detection. Similarly, there are also multiple ways that detection systems can be implemented. A single detector on a single circuit can be used to initiate activation of the system or detectors can use multiple circuits and cross zoned detection. The installation of a releasing panel is required in addition to the electric detectors when electric actuation of preaction systems is desired or required. When used in a single interlock preaction system, receipt of the signal from the electric detection system immediately causes the releasing panel to open (energize) the solenoid valve. Alarm devices are activated upon the flow of water into the sprinkler system piping. When used in electric release double interlock preaction systems, the electric detection provides the first of two events necessary to release the deluge valve.



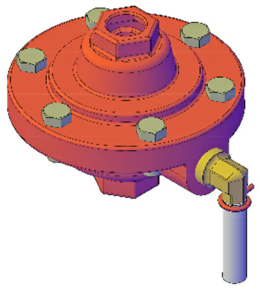
Model DDX Type D
Electric Release Trim

4. RELEASING DEVICES

Releasing devices serve as the basis for the activation of all preaction systems. They are most often located on the water control valve trim and are used to vent hydraulic pressure from the push rod chamber allowing water to flow into the fire protection system. These devices can be manual or automatic. Automatic devices are triggered or released by detection devices located within the protected area and have been previously described. Manual devices are required by NFPA 13 to be located at the water control valve but can also be located remotely within the protected area.

4.1 Dry Pilot Actuator

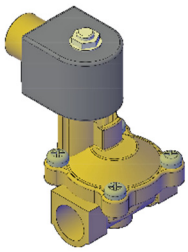
Dry pilot actuators use the same differential principal as a conventional dry pipe valve. They are designed to allow low pneumatic pressure to hold back considerably higher water pressure. The actuator is located in the discharge trim of the deluge valve serving the preaction system and can be used as the single releasing device or in conjunction with an electric releasing device. When used as a single releasing device and air is vented off the actuator, it allows water pressure on the underside of the actuator to overcome the reduced pneumatic pressure on the top side of the actuator. When water flows through the actuator, the pressure holding the water control valve closed is released, thus allowing water to flow into the fire protection piping. Technical information for Reliable dry pilot actuators can be found on the bulletin outlining the system for which it is utilized.



Reliable Model LP Dry Pilot Actuator

4.2 Solenoid Valve

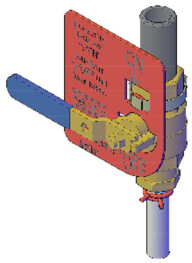
A solenoid valve is an electrically operated control valve. Its purpose is similar to a dry pilot actuator in that it separates water pressure from atmospheric pressure in the releasing trim of the preaction system. A solenoid valve can be used independently to release the preaction system or in conjunction with a dry pilot actuator. When used independently, the operation of an electrical detection device sends a signal to a releasing panel. The releasing panel then sends sufficient current to energize the solenoid valve coil thus opening the solenoid valve and releasing the preaction water control valve to discharge water into the fire protection piping network. Note that typical solenoid valves are rated for 175 PSI water pressure, although high-pressure solenoids are available. Also note that solenoid valves are required to be listed with both the water control valve and the releasing panel. Technical information for solenoids can be found on the bulletin outlining the system for which it is utilized.



Normally Closed Electric Solenoid Valve

4.3 Manual Release

A manual release or pull station is a normally closed, quick opening valve which acts as a system releasing device for a preaction system. This device is required by NFPA for preaction systems and is required to operate hydraulically, pneumatically or mechanically independent of the detection devices. For Reliable preaction systems this device is located on the valve trim and is operated hydraulically. The manual release required on the water control valve trim is shown here and additional manual release devices can be installed as part of the wet pilot or dry pilot detection piping. Refer to Reliable Sprinkler Company Bulletin 506 for detailed information on the Model A Manual Emergency Pull Box when additional devices are desired.



Manual Emergency Release

4.4 Pilot Line Detectors

Like automatic fire sprinklers, pilot line detectors can be used for systems utilizing hydraulic (wet pilot) or pneumatic (dry pilot) actuation. During fire conditions the heat sensitive element of the pilot detector releases, allowing the hydraulic or pneumatic pressure in the pilot line to vent, in turn releasing the deluge water control valve. Technical information for Reliable Model F1-FTR Pilot Line Detectors can be found on Bulletin 180.

Reliable Model F1-FTR Pilot Line Detector

5. SINGLE INTERLOCK PREACTION

A single interlock preaction system is often installed where there is a greater concern that an unintended discharge of water would be detrimental to a building or its contents. Examples of facilities that often incorporate preaction systems include data rooms, museums, historical buildings, electrical rooms, coolers/freezers or surgical suites in hospitals. Single interlock preaction systems are required to utilize a supervised air supply when the system size exceeds twenty sprinklers. These systems use closed sprinklers where each sprinkler is activated individually. Note that the operation of a sprinkler or accidental discharge of air from the system piping is never the event that allows the water control valve to release water into the piping network. The water control valve is only released upon activation of the required supplemental detection system. Detection systems can be wet pilot, dry pilot, or electric as previously described.

A single interlock system can also be described as a dry system that is converted to a wet system upon activation of the detection system. The big advantage to single interlock preaction over double interlock systems is a generally faster system response time in the event of a fire because water has been introduced to the system and available at the sprinkler before the fusible element in the sprinkler releases. This faster response time in most cases offers some design advantages over double interlock preaction systems including smaller design areas and less restrictions on water delivery times. One exception is that NFPA does require an increase in design areas for single interlock preaction systems protecting storage occupancies.

Single interlock preaction systems available from Reliable can be found under the Valves and Systems tab on the Reliable website at www.reliablesprinkler.com .

6. DOUBLE INTERLOCK PREACTION

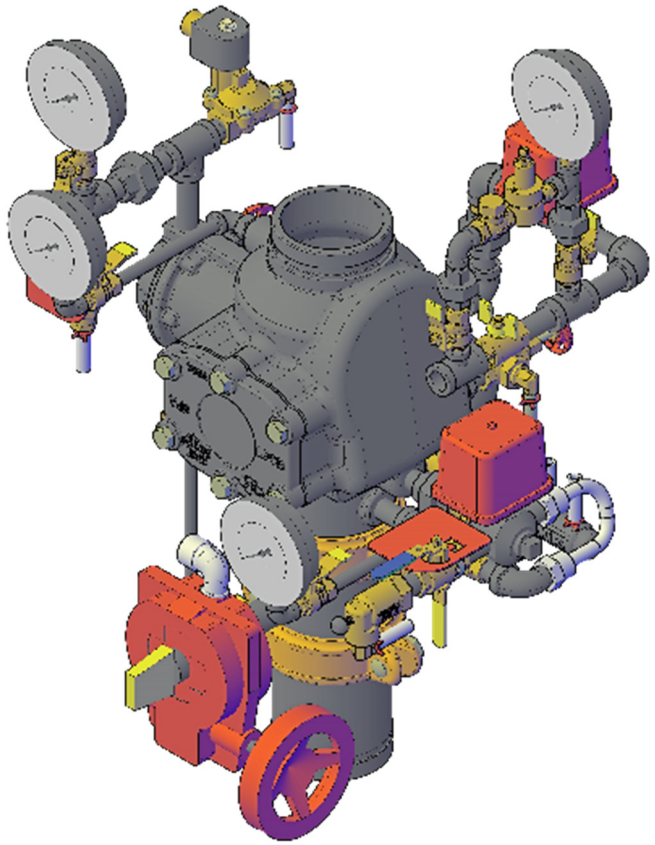
Double interlock preaction systems are designed and installed to protect facilities where the release of water into the protected area has the potential to cause serious disruption to critical control systems (e.g. data centers) or extensive financial impact to business operation (e.g. freezers). Like single interlock preaction systems, a supplemental detection system is required to initiate release of the water control valve and allow the flow of water into the piping network. However, double interlock systems also require a loss of air pressure in the fire protection piping network as a second event before the water control valve is released and water begins to flow. Operation of the water control valve only occurs when both events take place. If only one of these events takes place the system will send an alarm, but the water control valve will not operate.

Double interlock systems provide an extra level of protection against accidental system activation by requiring that two independent conditions coexist for the deluge valve to open. It is important to understand that this extra level of protection also delays the response time of the fire protection system and therefore comes with some additional design restrictions mandated by NFPA. Those design restrictions include an increase in the remote design area and additional limits to system size by requiring water to be available at the remote end of the system within certain time frames.

The installation of double interlock preaction systems can be accomplished by using multiple devices on different types of systems to achieve the desired outcome. Reliable provides three types of double interlock preaction systems that can best be classified as Electric/Electric, Electric/Pneumatic and Pneumatic/Pneumatic. Explanations of each type of system and one possible valve trim arrangement for those systems are shown on the following pages of this Design Guide.

6.1 Electric/Electric Double interlock

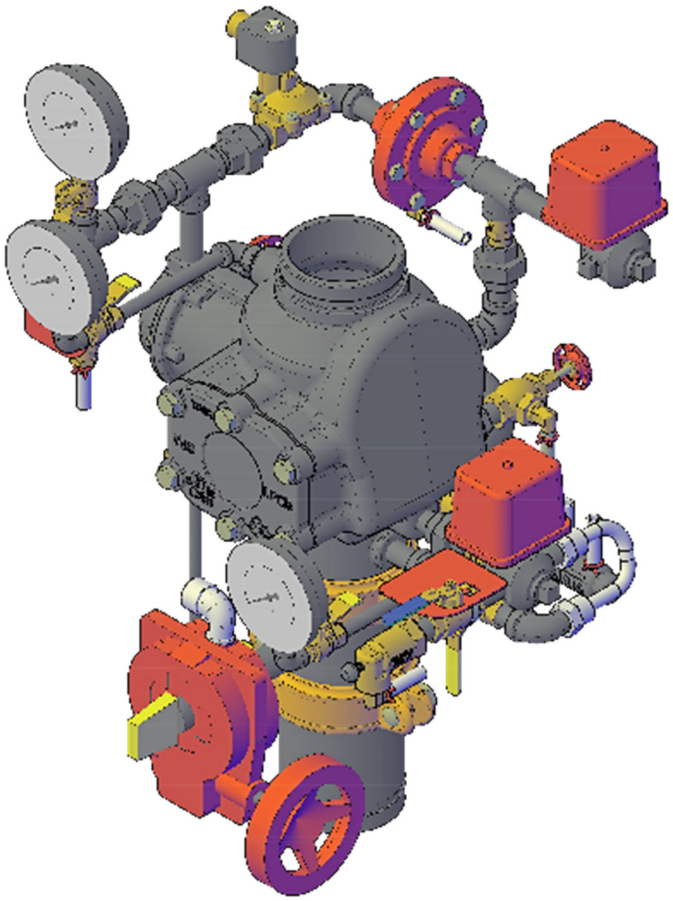
Electric/Electric double interlock preaction systems as manufactured by the Reliable Automatic Sprinkler Company require two independent electric events to be satisfied before the water control valve is opened and the piping network is filled with water. Monitoring of these independent events and energizing the single solenoid valve to release the water control valve is performed by the system releasing panel. An electrical detector satisfies the first condition necessary to release the system while the second electrical event is satisfied by a loss of pressure in the piping network as registered by the low air pressure switch. When the releasing panel receives both inputs, it energizes the coil on the solenoid allowing the water control valve to release water into the system. Information on Electric/Electric double interlock preaction systems manufactured by Reliable can be found on Bulletin 750.



Model DDX Type D Electric/Electric Double Interlock Preaction

6.2 Electric/Pneumatic Double interlock

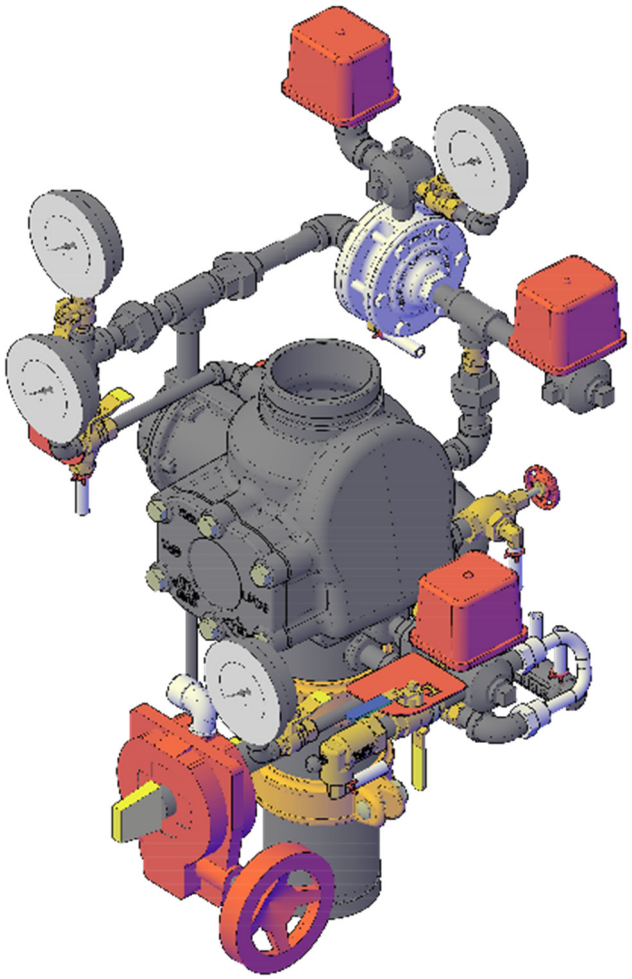
Electric/Pneumatic double interlock preaction systems as manufactured by the Reliable Automatic Sprinkler Company provide an additional level of protection against false system activation. While these systems also require two independent events to be satisfied before the water control valve is opened and the piping network is filled with water, these independent events control two different releasing devices. The electric/pneumatic double interlock preaction system utilizes electrical detection to release the solenoid valve. Pneumatic pressure within the piping network actuator will release pressure on the pneumatic actuator. Both conditions must be satisfied and both devices must open before the water control valve allows water to flow into the system. Information on Electric/Pneumatic double interlock preaction systems manufactured by Reliable can be found on Bulletin 751.



Model DDX Type F Electric/Pneumatic Double Interlock Preaction

6.3 Pneumatic/Pneumatic Double interlock

A Pneumatic/Pneumatic double interlock preaction system as manufactured by Reliable Automatic Sprinkler Company utilizes a two-chamber pneumatic actuator as a releasing device. This type of system provides a fully mechanical option for system actuation and is considered to be "fail safe" by most AHJs. The lower chamber provides separation between the hydraulic pressure in the valve chamber and pneumatic pressure in the dry pilot detection line. The upper chamber is held closed with pneumatic pressure within the sprinkler piping network. The release of pneumatic pressure in either chamber of the LPDI actuator will result in a supervisory alarm sent from the required pressure switches but will not release the system. Operation of the system requires both chambers of the pneumatic actuator to open before water can be released into the piping network. Information on Pneumatic/Pneumatic double interlock preaction systems manufactured by Reliable can be found on Bulletin 752.



Model DDX Type PL Pneumatic/Pneumatic Double Interlock Preaction

7. PREPAKS

Reliable PrePaK systems are completely self-contained riser assemblies that can be readily installed within a small space. All Reliable PrePak cabinets are designed to occupy as little floor space as possible with a minimum cabinet dimension of 30 in. (762 mm) or smaller depending on the size of the valve assembly and the pneumatic source required. Smaller valve assemblies (2"-4") that do not include nitrogen generators will easily fit through a standard 36 in. (914 mm) wide doorway. Installation of these units requires three piping connections: a supply line in, a system line out and a drain line out. Locations of these connections are detailed in the appropriate product bulletin.

All internal electrical devices are factory wired and tested. An optional releasing panel can be selected and mounted inside the cabinet door. Reliable PrePaKs utilize the Potter Model PFC-4410-RC Release control panel. This panel is Underwriters Laboratories (UL) Listed and Factory Mutual Approved and complies with NFPA 13 and NFPA 72. All device and release panel terminals are translated to a watertight terminal box inside the cabinet. Low voltage and line voltage field connections are made to this terminal box. Note that separate 120 VAC electrical connections are required for the release panel and air compressor when so equipped.

PrePaKs are designed, manufactured, assembled, and tested by Reliable in Liberty, SC, USA. They include all piping, fittings, gauges, electrical devices and electrical connectors necessary for a complete system. PrePaK systems can be customized with high pressure solenoids, release panels, air compressors, various air supply components, and system side control valves. All units include a release control disable switch (RCDS) to facilitate safe NFPA 25 inspection and testing. Note that field detection and notification devices are not included with the Reliable PrePaK. Ordering options are available on the last page of the appropriate bulletins.

- Bulletin 733 Type D Single and Double Interlock Preaction
- Bulletin 735 Type D Single and Double Interlock Preaction with Nitrogen Generator
- Bulletin 747 Type F Double Interlock Preaction
- Bulletin 736 Type F Double Interlock Preaction with Nitrogen Generator

Reliable PrePaK™

DESIGN GUIDES AVAILABLE FROM

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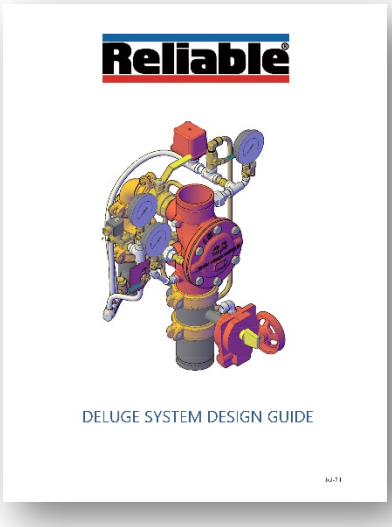

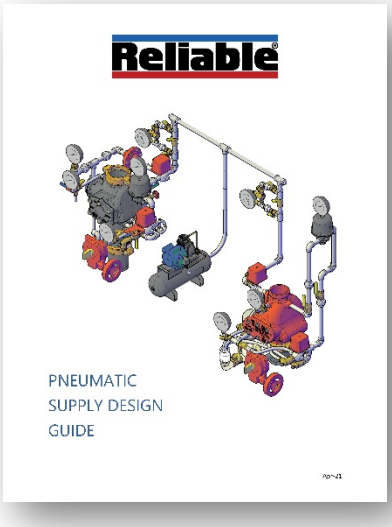

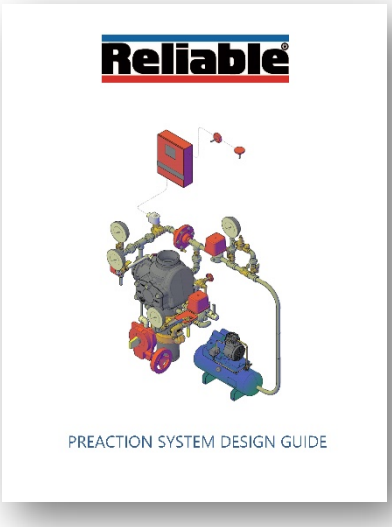

PLEASE CONTACT RELIABLE TECHNICAL SERVICES FOR ADDITIONAL SUPPORT

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