Installation Criteria

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When installing a backflow preventer, there are many details that must be evaluated before you break out the wrenches. There are two basic considerations to evaluate in the installation process, the hydraulic conditions and the mechanical conditions. The hydraulic conditions have to do with the flow of water through the piping system. The mechanical conditions have to do with the pipe, valves and fittings needed to properly install the backflow preventer into a piping system. The reason we need to make sure the assembly is properly installed is to assure the assembly continues to protect the drinking water system it is connected to.

To be sure we are installing the assembly properly, we also need to know which rules we are trying to comply with. A backflow prevention assembly can be installed as a service protection assembly or an internal protection assembly. A service protection assembly is installed at the point of service to a water user, this type of assembly is installed to protect the distribution system from a backflow event. These assemblies come under the control of the State Administrative Code. Each state administrative code has restrictions as to what and where some assemblies can be installed. If the installation is an internal protection assembly, the local adopted Plumbing Code will govern the installation. Internal protection assemblies are installed to protect the quality of the drinking water within the water users building. The Plumbing Code will have a different set of rules that must be followed.

The degree of hazard the assembly is being installed for must be determined. The degree of hazard can be a health (high) or non-health (low) hazard. The next problem to evaluate is the type of backflow we are trying to protect against, either backpressure and or backsiphonage. Once the degree of hazard and type of backflow is determined, we can look to our list of approved assemblies. The list of approved assemblies is usually established by the administrative authority that has jurisdiction. The different types of backflow assemblies have restrictions as to how they can be used. It is important that they only be used in the same orientation and type of protection as determined by the approval agency. The most recognized approval agency is the USC Foundation for Cross Connection Control & Hydraulic Research. The Foundation establishes a lab approval and field approval process for each size and installation orientation. Each Manufacturer must submit their assemblies to the Foundation for its evaluation. Not all assemblies pass the approval process. The Foundation publishes a List of Approved Assemblies which contains the model, size and orientation that each assembly is approved in. Most Administrative authority's list of approved assemblies usually begins with the Foundation's list.

A.) Hydraulic Concerns

The hydraulic considerations of installing a backflow preventer must evaluate sizing, pressure and temperature. In most installations, the size of the piping and the backflow preventer has already been determined by an engineer who evaluated the fixture use of a piping system. If there has not been a hydraulic review of an existing or newly designed piping system, be sure the changes to flow and pressure by the installation of a backflow preventer are evaluated before it is installed. Installing a backflow preventer into an existing piping system can change the workings of some piping arrangements such as irrigation or fire systems.

Some installations will require continuous water supply due their water needs. Applications such as hospitals are considered critical services where water cannot be discontinued even for short periods of time. This type of critical service will require the installation of parallel backflow preventers to assure when one backflow preventer is shut off for servicing, the other preventer will allow water to flow to the piping system. When installing parallel installations, be sure the separate and combined flows of the backflow preventers meets the needs of the water user.

In some cases, piping systems may be improperly sized and subjected to sharp changes in pressure due to excessive demand or flows of water within a piping system. This sudden change to supply pressure of assemblies such as RP's can lead to a discharge from the relief valve. The piping system must be evaluated to determine why the pressure fluctuations are occurring and to see if the pressure fluctuations can be minimized if not, a resilient seated check valve at the inlet of the RP may help minimize the fluctuations and minimize any unwanted relief valve discharge.

Pressure considerations must be observed when installing a backflow preventer. The pressure that is consumed by an assembly can be calculated by looking to the flow chart of the particular assembly. Be sure you are observing the flow chart for the orientation the assembly is being installed in. A flow chart for a horizontal or vertical orientation could be different. The other consideration is the incoming supply pressure in the piping system. The maximum working water pressure (MWWP) for an assembly is established by the manufacturer and confirmed in the approval process. The assembly should never be subjected to a pressure that exceeds its MWWP . Exceeding this pressure can void any warranties and also may render the preventer inoperative. The excessive pressures present in a piping system can exert an undue stress on the preventer or piping system. If the supply pressure is above the assemblies MWWP, a pressure regulator must be installed. Most plumbing codes do not allow excess pressure without the installation of a pressure regulator. The supply pressure to a piping system is not always constant. Inlet pressure can fluctuate due conditions such as, level of demand upstream of the point of service, or pumping schedules within the water system. On the upstream side of the assembly the MWWP must not be exceeded for any reason and the minimum amount of pressure must always be delivered which can be calculated by the flow chart.

Even if proper pressure parameters are achieved on the upstream side, the downstream side must also be evaluated. When a backflow prevention assembly is installed, a closed system is established on the downstream side. These means no pressure can escape past a working assembly. This assembly traps any pressure on the downstream side until it is relieved. Even if the normal line pressure is below the MWWP, excessive pressure can easily be created by pumps, thermal expansion, boilers and other conditions and equipment that can quickly create excess pressure beyond the MWWP on the downstream side. The use of quick closing valves such as electronic solenoids or ball valves, can create a water hammer which can lead to excess pressure being trapped on the downstream side unless some type of pressure and or temperature relief device is utilized. Proper pressure parameters must be evaluated on the upstream and downstream side of the assembly. Normal and abnormal pressure events must be evaluated to assure it does not adversely affect the installed assembly.

The working temperature range of a backflow preventer is established by the manufacturer. The approval agency will confirm the temperature range a backflow preventer can work at. The application of excessive temperature can cause the backflow preventer to not work properly. Too high of a temperature can affect the strength of some plastics and rubbers. Too low of temperatures can also cause the backflow preventer to become inoperative. The temperature evaluation is not just the fluid temperature but also the ambient temperature around the installation site which can change fluid temperature.

Any mechanical equipment can be fouled if water entering the backflow preventer is not free of particulate. When properties other than clean water flow through a backflow preventer, these pieces could lodge into a critical sealing area. To collect these particles, the installation of strainers may help to remove the particles from affecting the backflow preventer. A strainer cannot just be installed in any piping arrangement without proper evaluation of rules and hydraulics.

A strainer cannot be arbitrarily installed in front of any backflow preventer. If a backflow preventer is installed for service protection, many cross connection control program rules do not allow the installation of any connection before a backflow preventer. A strainer usually has a blow off hole to remove the accumulated particles from the piping system. In some cases, this blow off hole is improperly used as a connection to piping fixtures before the assembly, such as irrigation connections or hose bibbs. If a strainer is needed before a service protection assembly, be sure to consult with your local administrative authority before proceeding.

Strainers can usually be installed in front of internal protection backflow preventers. Strainers will affect the flow of water into a piping system. A strainer contains screens which will restrict the volume of water that can flow past it. Strainers cannot be installed where this reduction in effective area leads to a restriction that prohibits the working of the piping system in installations such as fire or irrigation systems. When strainers must be installed, be sure the piping system will still work properly.

B.) Mechanical Concerns

Once we get past the problems of hydraulics, we must look to the mechanical concerns of installing a backflow preventer. The first concern to evaluate is the installation orientation. Backflow preventers must be installed in the installation orientation they were designed and approved for (vertical, horizontal etc.). There are backflow preventers that can be installed horizontally, vertically and other orientations that can make an installation easier. The key point to realize, is that they can only be installed in the orientation that the approval agency has determined they will work in. Some manufacturers may state that it is acceptable to them to install in other orientations, but we must be sure the list of approved assemblies approves the desired orientation. Some installations a vertical orientation will be more advantageous than a horizontal orientation. By placing a backflow preventer in an orientation other than what it is approved for may cause it to not work properly. To be sure, confirm with your list of approved assemblies but also consult your local administrative authority.

When installing any backflow preventer, it is important that it be installed into the piping system properly. The type of pipe and piping connections used are established in various piping codes for your specific area, and must be followed. The proper installation of braces, brackets, mounting pads or supports assures the installed backflow preventers will continue to work properly. It is important that all pipe, valve and fittings are of the correct material and installed as required. The weight of the assemblies, the attached piping and the force of moving water are all substantial and must be properly evaluated. Even the forces needed to take assemblies apart for servicing could cause problems if the piping is not securely installed.

Another key concern is accessibility to the assembly once it is installed. The installation of the backflow preventer must be in a location where access is not restricted by piping, walls or any other restriction. All backflow preventers require some type of regular inspection and servicing. To assure this inspection and service can be done properly, an adequate work space must be left around the backflow preventer. This space will vary depending on the type and size of backflow preventer that is installed.

The installation of assemblies in areas where the entry or exit are restricted are considered confined spaces. Installing assemblies in areas that are classified as confined spaces requires specific entry and exit protocols by the technician to assure there is no danger entering into the confined space such as lack of oxygen or accumulation of dangerous gases.

The height the assembly is installed in relation to the surrounding grade is also important. Some assemblies have key minimum height requirements to assure the relief valve will not be submerged or engulfed. Most Plumbing Codes also establish maximum height requirements. Most codes state if installation heights greater than 5 feet must be used, a permanent work platform must be built around the assembly for servicing.

Installing assemblies that can discharge water (RP, RPDA, PVB, and SVB) can lead to another set of concerns. Water that can discharge from assemblies does not usually cause any concern when installed outside. When assemblies are installed inside buildings, the discharge is usually piped away to a drain. This drain piping must be properly installed so a cross connection is not created between the drain and the assembly discharge. Most manufacturers of RP's also produce an air gap drain attachment that assures the proper separation is achieved from the relief valve discharge and the drain line. An air gap drain is designed to carry away an occasional dripping or mild discharge only. The full discharge of the RP is well beyond the capacity of the air gap drain attachment.

A backflow preventer may be required to be installed where the environment can affect the backflow preventer. Enclosures may need to be installed around a backflow preventer to assure the backflow preventers temperature parameters are maintained. Enclosure can also be installed for vandal control to restrict who can operate the piping system.

Backflow preventers are installed to protect against an identified hazard be it high or low. The degree of hazard and the type of backflow (backsiphonage & backpressure) that has been identified will help dictate the proper type of backflow preventer to use. Even if the correct type of backflow preventer is chosen, the installation of the backflow preventer must be followed for it to work effectively. When installing any mechanical backflow preventer (device or assembly) it is important to follow the manufacturer's restrictions as to its working parameters. It is also important that the backflow preventer is installed only as it is approved by the acceptable approval agency. It is also important to assure the hydraulics of the piping system are not adversely affected by the installation of the backflow preventer and all mechanical considerations are evaluated. Once you have it installed properly, **DON'T FORGET TO TEST IT**.