Traversing the Ins and Outs of Double Containment

A successful and safe system must hold leakage for at least a minimal amount of time and have some form of leak detection. Here are guidelines for selection, system design, and installation

Just the Facts About Double Containment

By Gary Sample The EPA requires that hazardous substances be secondarily contained when stored or transported underground. To accomplish this, secondary containment systems, also known as double containment systems, are used. Double containment systems include an "inner" carrier pipe, which transports the hazardous fluid, and an "outer" containment pipe, which contains the fluid in the event of inner pipe failure. EPA regulations also specify that these double containment systems must have leak detection capabilities and that any releases (spills or leaks) must be contained or diverted to a proper collection system. By summarizing some of the issues relating to secondary containment and focusing on the most important things to remember during selection, system design, and installation, this article seeks to make easier the somewhat daunting task of compliance. There is a variety of double containment materials and systems on the market. Most of these systems are constructed of thermoplastic material because of its ease of installation and wide range of chemical compatibility. Thermoplastic piping materials include PVC (polyvinyl chloride), CPVC (chlorinated polyvinyl chloride), PP (polypropylene), PE (polyethylene), and PVDF (polyvinylidene). Various grades of stainless steel and fiberglass systems are also available. To begin the process of installing a double containment system, material selection of the inner pipe must be decided. To determine the proper pipe material, identify the type of fluid the line will carry, the concentration of chemicals in the fluid, the temperature and operating pressure, and the expected flow rate. These factors will determine whether the inner pipe can be thermoplastic or either stainless steel or fiberglass. Chemical compatibility charts provided by pipe manufacturers help in this process by showing which pipe materials are compatible with various types of chemicals at specific concentrations and temperatures.

Material selection of the outer pipe is based on a number of factors not associated with inner pipe selection. An important consideration is whether the system is going to be underground. If it will be underground, you must determine if it will run through an area where heavy equipment will pass over it often. If it will be above ground, you must determine how it will be supported and if UV and fire considerations need to be addressed. Other important factors include operating pressure and leak detection requirements. There are three differences between the design of inner and outer piping system components. First, the outer system is designed for use only in the event of failure of the inner system. Second, the outer system must take into account any and all interactions between the two systems. And third, the outer system must be able to vent and drain the system in the event of failure of the inner pipe. When considering system design, one factor to remember is to allow enough space for the outer pipe &#151 whether it's a buried system or an above-ground system. This is perhaps the most common mistake made in the field: designers specify the inner pipe size but don't account for the outer pipe size. When you have a four-inch inner pipe, you have an eight-inch outer pipe to contain it &#151 it's almost twice the size of the inner pipe so clearances become critical. Forgetting this important point often results in additional time and expense. For buried systems, the point where the system comes out of the ground must also be considered; the containment must be sealed with a termination fitting. This prevents leaks below ground from coming out the top. While most double containment installations are below ground, above-ground systems are becoming more common. For above-ground installations, spacing becomes an issue of hangars and structural clearances, again with proper allowance being critical. Pipe slope must be considered.

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In addition to ensuring enough space for the actual pipe and fitting size, there are two other issues to address: thermal expansion and contraction. For systems that will maintain a consistent temperature, compensation for thermal expansion and contraction may not be necessary. However, when temperature fluctuations come into play, two basic thermal relationships may exist. In one case, either the inner or the outer pipe &#151 but not both &#151 will experience thermal expansion/contraction. In the second case, both the inner and the outer pipe will experience different magnitudes of thermal expansion/contraction. Thermal expansion and contraction are usually handled by using either a floating system or a restrained system. In the floating system, the inner pipe is allowed to move within the outer pipe. With a restrained system, the inner system is rigidly attached to the secondary system. For underground installations where the outer pipe cannot stretch due to soil friction and anchoring effects, the expansion of the inner pipe is completely offset by the elastic/plastic compression of it. For above-ground installations, the restrained system accommodates thermal expansion by deformation of both the inner and outer pipe, depending on relative stiffness. Another key concern is leak detection. Regulations require that double containment piping systems include leak detection capability. The system must also be able to collect and contain any leaking fluid for 30 days. This explains how the inner and outer pipe can be different materials. For example, even though the inner pipe may be stainless steel because the application requires a service life of five years, the outer containment pipe material could be PVC because a service life of only 30 days is required. As a result, a chemical that is not good for PVC for five years may be fine with PVC for a year.

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Pressure systems are required to have automatic monitoring that restricts the flow of the media if a leak is detected. Drainage systems, on the other hand, require only monthly manual inspections. There are three acceptable leak detection methods: the low point probe method, continuous cable method, and visual method. (The visual method is only acceptable for drainage systems). The low point method offers simple design and uses probes placed at strategic locations within the system. These probes allow for quick identification of a leak and its approximate location. The low point method reinforces the notion that more is better. In this case, it makes sense to use a few more probes on the front end than to have a leak and not be able to pinpoint its location. The continuous cable method is the most accurate and sophisticated method of leak detection. It can be zoned, installed, and fed back to a control panel &#151 some systems provide the leak location within six inches of the source. With this method, the double containment installation must have a minimum of 3/4 inch of annular space through which the sensing cable can be pulled. A pull rope must be specified for installation by the manufacturer. Depending on the level of sophistication, single- or multiple-channel alarms can be installed. With visual leak detection, low point wells are installed at strategic locations. These wells can be opened and visually inspected monthly. Basins can also be placed at the end of the lines and visually inspected on a regular basis. This article has focused on new double containment system installations. However, in many instances, expanding EPA regulations may require piping systems already in existence to become secondarily contained. In these situations, there are snap-in-place systems that allow an outer containment pipe to be installed around an existing pipe without having to start from scratch. In other words, there is no need to disturb anything with the current system or shut down the system. *Gary Sample is technical services manager for GF Piping Systems at the company's Little Rock, AR facility. He has more than 12 years of experience in containment piping systems and is a member of the American Society of Plumbing Engineers. He has degrees in mechanical engineering, manufacturing engineering, and operations management. Questions about this article can be directed to him at 501-490-7376 or 800-423-2686 or at gary.sample@georgfischer.com Additional information is available at www.gfpiping.com.*