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To:	All Surveyors/Auditors
Applicable to flag:	All Flags
	Detecting Leaks in Pressure Vessels
Reference:	CONARINA Instructions

7 Best Methods for Detecting Leaks in Pressure Vessels

Commonly used in process industries, pressure vessels are manufactured with the intention that the pressure inside the container will be different from the pressure outside. To ensure this pressure differential can occur, a pressure vessel must be completely sealed; if leaks are present then the pressure will decay, potentially to the point where it renders the pressure vessel unusable. Therefore, it is critical that pressure vessels remain sealed and there are no leaks present.

Leak testing is performed to accomplish this and ensure the pressure. There are several different types of tests that can be performed to check if a pressure vessel is sealed adequately.

Pressure Decay Testing

One such evaluation is a pressure decay test, which is perhaps the most prevalent type of pressure vessel leak testing presently used. For this test, the vessel is pressurized with a fluid (typically air) using a specialized test device known as a pressure decay tester. Once the target pressure is reached, a valve is used to shut off the fluid supply. The fluid's pressure is then monitored over time. The amount of pressure loss, or decay, is captured and recorded. From the amount of pressure loss and the length of time for the loss to occur, the leak rate can be calculated.

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Vacuum Decay Testing

Vacuum decay testing is somewhat the opposite of pressure decay testing. Rather than being pressurized with a fluid, the pressure vessel has all media removed from within it until a vacuum of a specified level is reached. Once the desired degree of vacuum is achieved, any increase in pressure is detected. The flow rate of the leak is then calculated using the amount of pressure increase and the time for the increase to occur.

The vacuum decay test can be useful in conjunction with a pressure decay test just in case a leak opens during one test and closes during the other. Vacuum decay testing is also less sensitive to temperature variations than pressure decay testing.

Hydrostatic Testing

Hydrostatic testing is another common way to measure a pressure vessel leak. Similar to the pressure decay test, this test also uses a fluid to pressurize the container in question. However, hydrostatic testing requires an incompressible fluid (e.g., water) to determine both if there is a leak and what the leak rate is. Water is often used because it is somewhat neutral and rarely affects the future service of the vessel. The leak's flow rate is calculated by the amount of liquid that flowed into the pressure vessel after the desired pressure was reached during the test.

Helium Sniff Testing

During a helium sniff test, the pressure vessel being evaluated is pressurized with helium gas. Once the desired pressure is reached, a special piece of equipment known as a helium sniffer is moved around the vessel. If a high concentration of helium is detected by the sniffer then that information can be used to pinpoint the exact location of the leak. It can detect extremely small leaks; however, the sniffer cannot detect the exact flow rate of a leak. Furthermore, only one leak at a time can be detected. If several leaks are excessive, but any single leak is too small to be detected, then the test is ineffective.

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Radioisotope Testing

Radioisotope testing is an extremely accurate way to detect leaks in a pressure vessel. During this test, a radioisotope is mixed into the media inside the pressure vessel. Common radioisotopes for this process include sodium-24 and krypton-85. It is important to have the right type of radioisotope, as too high a level of radiation will create false positives and too low a level will be undetectable, even if there is a leak. When the pressure vessel has been filled with the proper radioisotope, a radiation detection device is used to determine if any of the radioisotopes escaped the pressure vessel via a leak. While this method can detect very small leaks, it is relatively expensive compared with other methods.

Dye Penetrant Testing

Dye penetrant testing is another method that can be used to determine whether a leak exists. To perform a dye penetrant test, a developer is applied to the outside of the pressure vessel (or inside, depending on where the inspection is occurring). A dye is applied on the opposite wall. The developer is usually a white, chalky substance that creates a good contrast, while the dye is typically bright or fluorescent so that it can be easily detected. If there is a leak, the dye will penetrate through the vessel's wall and the developer and will appear quite obviously on the other side on the developer. This method is useful for determining whether or not leaks exist, but it is unable to measure the flow rate of the leak.

Ultrasonic Testing

Oftentimes, if the media within a pressure vessel is able to escape via a leak, then that leak can also have an effect on sound waves transmitted through the vessel. For the ultrasonic test, equipment is used to send ultrasound waves through the vessel where they can potentially be disrupted by a leak. If a disruption occurs, then the ultrasound equipment can detect it and display it on a screen for an inspector to interpret. The inspector can then pinpoint the location of the leak and estimate its size. Ultrasonic testing, while somewhat accurate, does not give information about the leak's flow rate.

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REFERENCES:

- CONARINA Instruction to Surveyor

- ATTACHMENTS: No

Kindest Regards,

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