

Benefits of Wireless Monitoring of Tank Storage Pressure Safety Valves



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Low pressure storage tanks are used throughout the world in industries including oil and gas, chemical, petrochemical, pharmaceutical and food and beverage. These tanks hold liquids until they are moved to the next step in a production or supply chain process.

The pressure in these storage tanks is subject to change, due to the following factors:

- Temperature change
- Liquid level change (due to filling or removing liquid content)

In order to maintain a safe tank pressure, special valves are utilized which are able to sense small changes in tank pressure. Examples of these are shown in Figure 1. The large valve at the center is generally referred to as a pressure vacuum relief valve or PVRV, for short. This device contains weighted pallets which will open and close based on pressure. If the pressure inside the tank rises above the set point, the pressure pallet will open, releasing vapors in order to return the pressure to a safe level. Conversely, if the pressure inside the tank drops below a preset level, the vacuum pallet will move open, bringing air into the tank to return the pressure to a safe level. The device shown on the left in Figure 1 is called an emergency valve or vent. If an abnormal pressure situation occurs, this vent will quickly relieve tank pressure. Under normal conditions, it should be closed. Note that the small device shown near the front of the tank is a gauge hatch, which is for inspection and gauging purposes.

Though the devices described above provide vital pressure control, they have historically remained un-monitored, with none of the feedback loops commonly seen in other pressure control devices. In a recent Storage Tank Pressure Control Study conducted by Emerson™, it was found that an undetected maintenance issue is the number one concern of tank safety engineers and managers. More than half (54%) reported more than one pressure control issue in a year. In addition, 65% of the time, these issues were being detected after the fact.

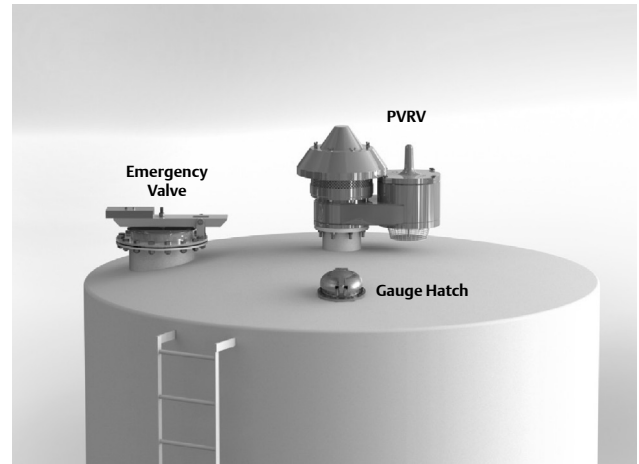


Figure 1. Tank Blanketing System

One way to address this is through the use of a PVRV which integrates a wireless transmitter (see Figure 2). This new device allows the detection of an open or closed position of the pressure and/or vacuum side.

The integration of the wireless transmitter enables quick identification and response to potential issues, in order to address the following:

- Safety – reduce operational emergencies and the climbing onto tanks
- Emissions – reduce unintended emissions that may result in environmental issues and fines
- Assets – protect the valuable tank contents and the tank itself



Figure 2. Smart Wireless PVRV

Built-in proximity sensors allow the transmitter to detect the open or closed position of the valves. Signals received by the transmitter can then be sent to a control room via a WirelessHART® Gateway (Figure 3).

WirelessHART® is a wireless sensor networking technology that is based on the Highway Addressable Remote Transducer (HART®) protocol. It was developed as a multi-vendor, interoperable wireless standard for process field device networks. It is the most widely used standard today and, for this reason, the PVRV described herein was designed to integrate within it. As long as the wireless gateway is WirelessHART®, it will receive the signal from the device. The WirelessHART® gateway will then send the information to a control room which makes use of any number of software integration packages.



Figure 3. WirelessHART® Gateway

Knowing a PVRV's open or closed position can be valuable in a number of ways. For example:

Scenario #1 – Redundant PVRV's

Redundant PVRV's are commonly used for added safety. If the primary PVRV fails in a closed or partially closed position, then the backup PVRV automatically takes over. This is achieved by establishing a pressure set point that is slightly higher for the backup device. In this way, if the primary PVRV fails, the tank remains protected but redundancy is lost and should be addressed as soon as possible. Then how is one to know that this situation has occurred? Remote monitoring the position of the backup PVRV can provide quick identification of this issue, for either the pressure or vacuum side. Under normal conditions, the backup PVRV remains closed. If the backup PVRV is open, this points to either the primary PVRV not functioning as expected or a separate pressure control problem in the tank system that is causing both PVRV's to be open. Ideally, the wireless monitoring of both

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primary and backup devices is preferred in order to better monitor tank operation. Further troubleshooting can then be performed and the problem addressed.

Scenario #2 – Tank Blanketing

Tank blanketing is sometimes used in order to inert the vapor space in a tank for added safety. A tank blanketing regulator controls the inflow of nitrogen or another blanketing gas by responding to a low pressure set point. In this scenario, a PVRV (vacuum side) acts as a backup to the blanketing regulator. If the blanketing system fails for some reason, the PVRV automatically takes over, as its vacuum set point is slightly higher than that of the regulator. But once again, how is one to know that this has occurred? A wireless-monitored PVRV would indicate that the vacuum side is open. Under normal operation, it should be closed.

Scenario #3 – Emergency Vent

A storage tank's emergency vent should remain closed, except in abnormal conditions. If an emergency vent is also remotely monitored, and found to be open, then



there is a pressure control issue somewhere in the system. In this scenario, the PVRV should also be open. If it is not, it could be part of the issue. Again, a wireless-monitored PVRV can readily provide this information.

In summary, the addition of wireless monitoring to a PVRV provides the potential for quick issue identification which can in turn enable a faster resolution – so that an optimally performing PVRV can continue to provide safety, emissions control and asset protection.

For more information about Total Tank Management, visit www.emersonprocess.com/smartpvrv.

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