White Paper

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Vapor Recovery Systems

Vapor Recovery Systems for Tank Farms or Upstream Process Separators

Product storage tanks and stock feed tanks are used throughout the oil and gas industry to store liquids prior to transfer to a plant or a pipeline. The two common types of storage tanks are floating roof tanks and fixed roof tanks. Floating roof tanks work well for stabilized liquids that do not produce a lot of volatile vapors. These types of tanks are expensive to maintain and are prone to fugitive emissions of volatile organic compounds, as seals between the roof and the walls begin to degrade.

Fixed roof tanks are typically used to store more volatile liquids, and reduce the environmental impact because the vapor space between the liquid and the roof of the tank can be positively contained. A gas blanket of either natural gas or nitrogen is used to maintain a positive pressure, usually a few ounces above atmospheric; and to prevent air, or more specifically oxygen, from entering the tank and creating an explosive mixture.

During normal operations, as the tank is filled with liquid, the level rises and begins compressing the gas blanket, increasing the pressure inside the tank. The increase in pressure must be relieved to prevent tank damage or possibly even tank failure. Solar radiation and ambient temperature increases throughout the day can also lead to pressure increases inside the tank. A Vapor Recovery (VR) system can be used to draw the vapor blanket off to reduce the pressure. If the VR system becomes inoperable or does not have sufficient capacity, the pressure will be relieved directly to atmosphere through the relief valves on the tank.

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When a fixed roof tank is emptied, the pressure inside the tank is reduced as the liquid is evacuated. Most tanks are equipped with vacuum relief valves as well to keep the tanks from collapsing. However, it is preferred that pressure inside the tank is increased using a gas blanket, and reducing the amount of vapor being recovered by a VR system.

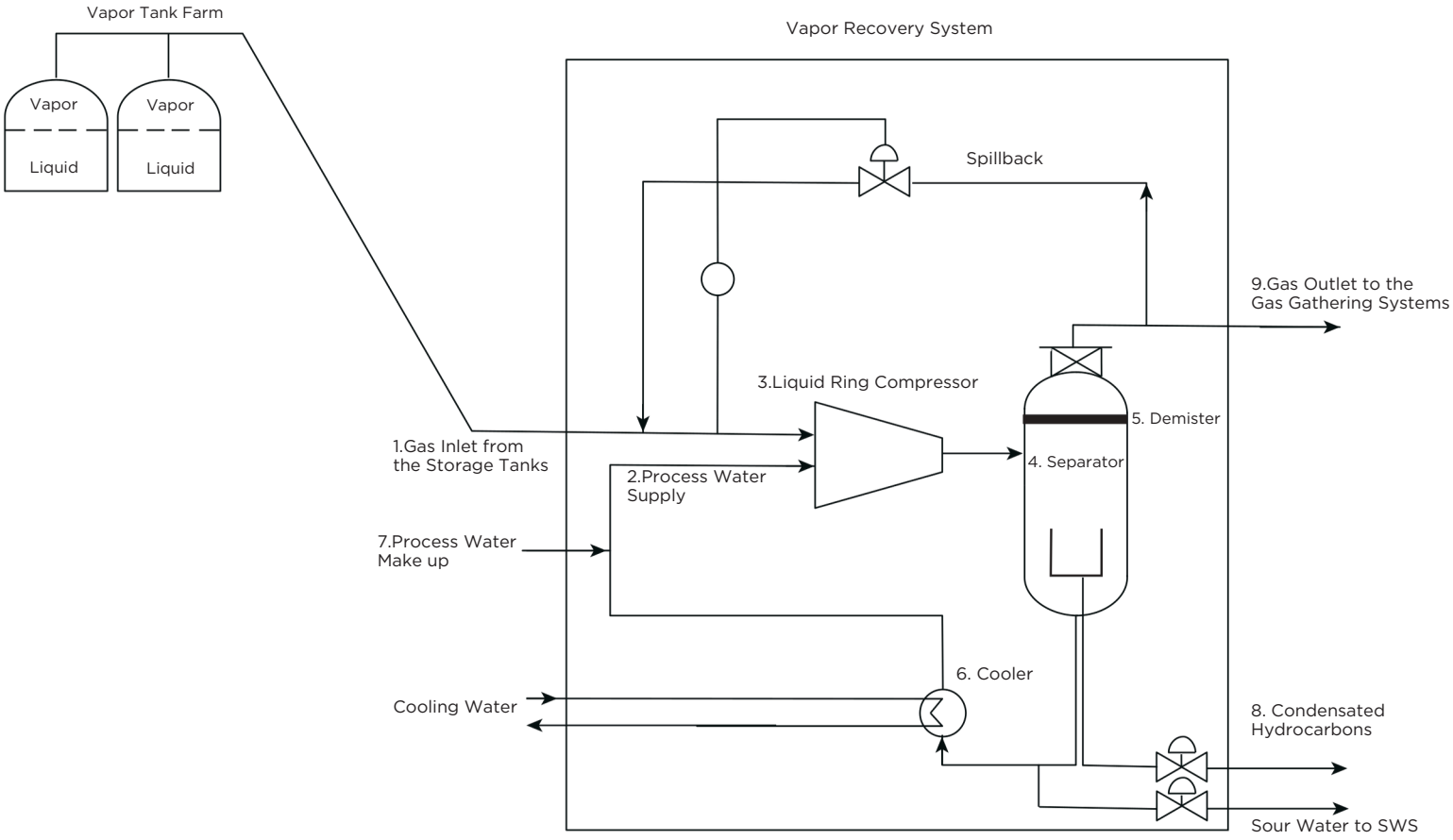
It is essential that VR system be reliable and capable of handling the varying flow capacities and changing gas/vapor composition flowing from the tank. The blanket gas is in equilibrium with the liquid, meaning that there are some VOCs contained within the blanket gas regardless of whether it is nitrogen or natural gas. These constituents added to the blanket gas could be, for example, water vapor, light hydrocarbons, H2S, CO2, or asphaltines. The VR system takes the resulting vapor from the tank at a few ounces of positive pressure and increases it to a usable pressure for processing.

A vapor recovery package can capture about 95% of Btu-rich vapors, generating many benefits, guaranteeing less air pollution, and recovering vapors to be used as fuel.

Process Description

The gas (1) coming from the tank farms enters the Liquid Ring Compressor (2) along with the process water (3). After the compression phase, the gas, water and hydrocarbon mixture enters the separator (4)where the three elements are parted: the gas passes through a demister (5) to have minimum water and leaves the vessel from the top, while condensed hydrocarbons and water are separated by gravity due to lower gas speed. The water is pushed back to the compressor, after being cooled by a cooler (6). Moreover, a continuous process water make up line (7) in the compressor suction is provided to ensure a continuous water ring in the compressor. The condensed hydrocarbons are discarded or put back into the tanks (8). The gas exiting the separator finally heads to the Gas Gathering System (9).

TANK VAPOR RECOVERY UNIT - TYPICAL PROCESS SCHEME



Liquid Ring Compressors for Vapor Recovery

GARO liquid ring compressor systems have been used successfully in vapor recovery systems for more than a decade. There are distinct advantages of using the liquid ring compression for vapor recovery. The compression occurs inside a liquid bath (typically water), making the compression cycle intrinsically safe. The liquid bath also absorbs the majority of the heat generated by compression, actively cooling the gas during the compression cycle. The seal liquid is also cooled to remove heat, and maintain near isothermal compression within the system. The liquid bath is also effective at removing fine particulate matter entrained in the flare gas. Liquid ring compressors can also withstand some small amount of free liquids in the incoming gas stream, potentially removing the need for suction knock-out.

Reliable, capable of running low speeds, reducing noise and vibration, and with low maintenance requirements, liquid ring compressors can be constructed from a range of materials to meet customer specific application needs. Liquid ring compressor systems can also handle a range of gas compositions including dirty, explosive, and corrosive gasses and vapors; as well as being suitable for gasses or vapors with a high potential condensate formation at discharge.

GARO's liquid ring compressors are also ideal for handling gasses and vapors with a high concentration of H2S and / or CO2; as evidenced by GARO's patented Washing Amine Integrated System (WAIS), which is capable of scrubbing H2S and CO2 to acceptable levels during a standard compression cycle.

Trust the Experts in Vapor Recovery Systems

With over 70 vapor recovery systems and 130 compressors installed worldwide, Garo has the expertise and experience to help you optimize your refinery operations and minimize your environmental footprint.

Factory tested and pre-engineered for quick delivery and installation, all GARO vapor recovery systems are backed by a global technical service and support base, providing the ultimate peace of mind.

Contact our sales representatives for more information on Garo's range of vapor recovery systems today!

Did you know?

The first GARO Vapor Recovery System was installed in Canada in 2004.

About Garo

Garo delivers a broad range of compressors and custom designed packages to end-users and OEM customers worldwide. We provide reliable and efficient equipment that is put to work in a multitude of demanding industrial process applications. Our products and systems serve industries including oil & gas, chemical, petrochemical, and pulp and paper. Our global offering also includes a comprehensive suite of aftermarket products and services to complement our products.

For further information please visit www.garocompressors.com

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