

TECH NOTES

VB-TN-005

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R. HANSON

PILOT OPERATED RELIEF VALVE – SUITED FOR WASTEWATER TREATMENT APPLICATIONS

Pilot operated relief valves offer a high performance alternative for pressure relief in biogas handling systems. It is also perfect for pressure and vacuum relief in high-pressure gas storage vessels.

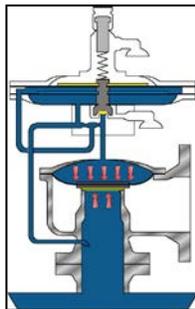
The Series 90/9000 uses system pressure to hold the valve closed. This provides for zero leakage up to 98% of set pressure, thus reducing leakage to the atmosphere and a reduction of gas odors. The Series 90/9000 can be set to snap open at set pressure allowing full rated flow capacity through the valve without requiring system accumulation or allowable overpressure. This often allows the user to size a smaller valve. The 90/9000 Series valves can be also be set to modulate when relieving, achieving zero pressure loss below set pressure. When choosing modulating action on pressure relief, the Series 90/9000 requires only 10% overpressure to meet the rated flow capacity.

The PORV is designed with elastomer or Teflon seats and seals, with construction materials in aluminum and/or stainless steel to resist the corrosive effects of biogas.

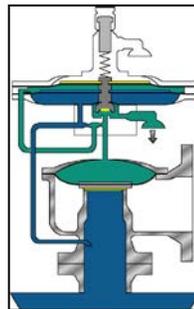
Referring to the figures below:

1. System pressure acts on the bottom of the main valve seat, on top of the main valve diaphragm, and on the pilot diaphragms under normal operating conditions.
2. The main valve seat is held tightly closed by a large force equal to the system pressure, times the unbalanced area of the main valve diaphragm.

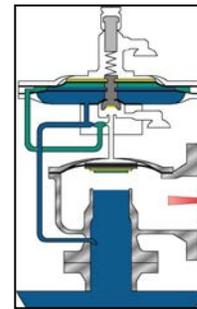
PRESSURE



(Closed) Positive Pressure Relief

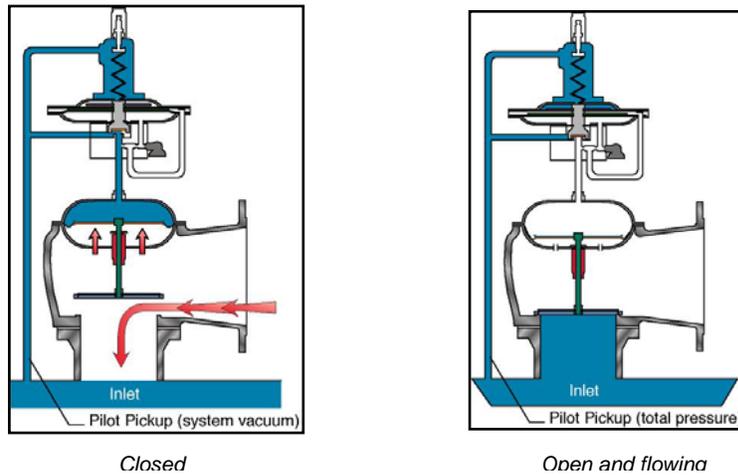


Pilot Open – Positive Pressure Relief



Open and flowing – Positive Pressure Relief

VACUUM



When system pressure reaches set pressure, the pilot seat lifts slightly, setting up a small flow in the pilot sense line through the sense cavity. This results in a large reduction in pressure on top of the main valve diaphragm attaining full lift of the main valve seat. Flow through the main valve continues until system pressure falls below set pressure.

If properly specified, the PORV is suited for use in the following applications:

1. High pressure Gas/Liquid Storage Vessels

Gas Storage Vessels can mean the following:

a. Biogas Conveyed From Digesters To High Pressure Gas Storage Vessels

Gas stored here will be eventually used to run digester gas mixing systems, engine-generators or boilers. Gas stored in high-pressure vessels must have been properly scrubbed and have minimized saturated vapor. As an added safety feature, the installation of a Varec 5000 Series Square Flame Arrester and a 4210A Series Emergency Relief Manhole Cover is recommended practice.

b. Gas Chemical Storage, Handling, Feed Systems and Mixing

In any wastewater treatment plant, Odor Control is a concern and top priority. Odor scrubbers are used to remove odorous compounds from the gas stream through activated carbon adsorption, biological towers, adsorption on soil mounds, and dissolution to liquids containing oxidants using packed towers or aerosol contact vessels, ozonation and combustion. Typical chemicals used for liquid absorption systems include buffered Potassium Permanganate, Sodium Hypochlorite, caustic, Hydrogen Peroxide, Chlorine and Chlorine Dioxide. These chemicals are stored in large vessels within the wastewater treatment plant. A PORV is suitable for these storage tanks because it can be tested and certified for Oxygen Service.

2. Discharge Compressor Lines

The PORV allows for higher pressure rating and full flow capacity at specified set pressures making it suitable to act as a pressure bypass relief valve on gas lines off compressors. The pressure relief valve is meant to relieve excess pressure that can potentially build up downstream of the compressor. This excess pressure can be discharged to the inlet of the compressor. The pilot valve is perfect for this application because it remains unaffected by the compressor inlet pressure.

The above are just a few examples; contact your local sales representative if you require engineering assistance in specifying a PORV for a particular wastewater treatment application.