VENT VIEWPOINT

Flow Characteristics of Weight-Loaded Pressure / Vacuum Vents

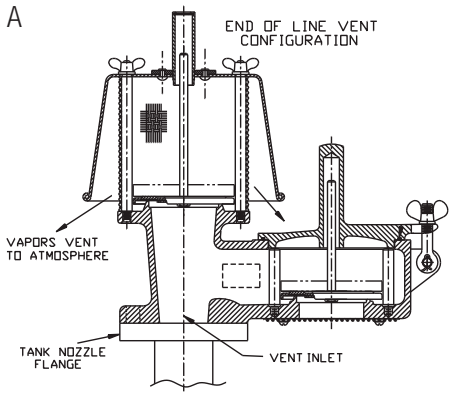
OBJECTIVE

It is important to understand how Protectoseal Weight-Loaded Vents control the flow of vapors under various pressure and vacuum conditions. The manner in which this flow information is documented and presented to an end user is also significant. This article explains how the design characteristics of a vent influence its flow performance. The use of flow charts to convey flow performance information is described.

CHARACTERISTICS OF WEIGHT-LOADED VENTS

A typical weight-loaded vent includes a housing that: 1) provides the threaded or flanged connection to a tank; and 2) contains the operating components that allow the vent to flow air or vapors, as required, to maintain the tank's vapor space in a safe operating range. The housing may be end-of-line or pipe-away configuration.

Fig. A



In an end-of-line device (Fig. A), a single flanged / threaded connection (inlet) is included as a part of the housing. The vent is mounted to the tank's nozzle and any flow of vapor/air into or out of the tank is communicated to the atmosphere.

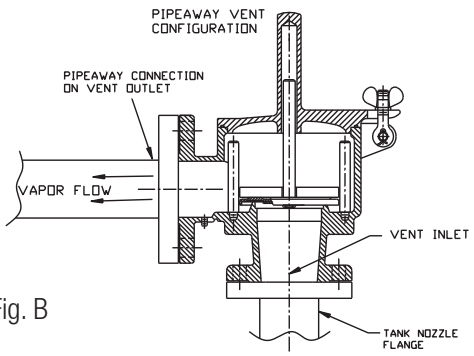


Fig. B

A pipe-away device (Fig. B) usually includes two mounting connections. One connection mounts the vent to the tank (inlet) and the other connection (outlet) is usually joined to a pipe that directs vapors to some location for further processing.

The size of a weight-loaded vent is determined by the inlet connection that mounts to the tank's nozzle. Depending on the style of vent, connection sizes ranging from 2" through 24" are readily available. As the inlet connection size increases, the housings, internal vent components, etc., all become proportionately larger. An obvious result of the larger housings and internal components is that a properly designed weight-loaded vent series will provide higher flow rates (under the same tank pressure conditions) as the vent size increases. Under identical set point and tank pressure conditions, a 12" vent will flow significantly more vapor/air than will a 2" vent.

In order to maximize the flow through a weight-loaded vent, restrictions to flow must be minimized. The vent inlet connection must have an opening larger than the opening in the tank mounting flange. The diameter of the housing seat must be larger than the vent inlet opening. The pallet assembly in the vent must be able to lift a distance sufficient to insure that the annular flow area between the seat and the lifted pallet is at least equal to the flow area of the seat. Pipe-away housings are typically provided with outlet connections that are larger than the inlet connections, although equal sized outlets and inlets are available to meet specific end user requirements.

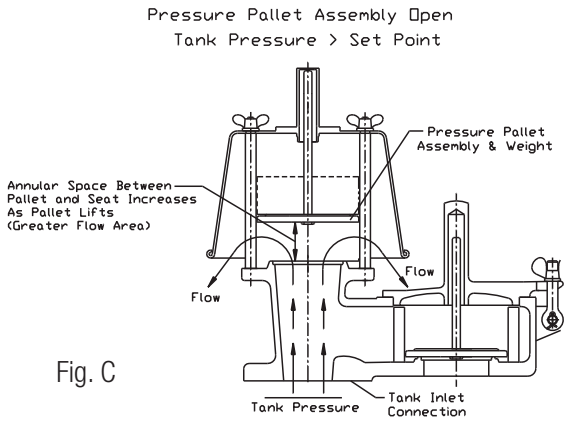


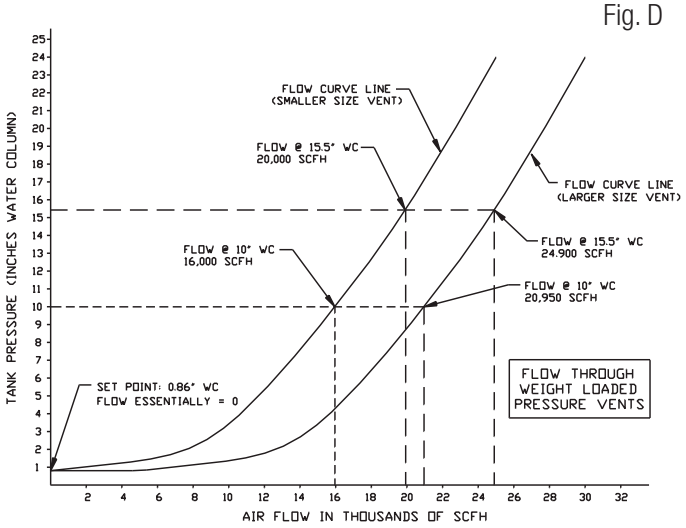
Fig. C

The set point of a weight-loaded vent is the pressure at which the combined weight of the pallet assembly and the setting weights is equal to the force of the pressure in the tank's vapor space acting on the area of the housing seat diameter (Fig. C). At the set point, the weighted pallet assembly remains very close to the machined seat (little or no lift - no significant flow). As the tank pressure increases above the set pressure, the pallet assembly lifts off the seat, allowing flow of vapors past the seat to the outlet. As the pallet lifts, a larger annular flow area is realized. Eventually the pallet assembly reaches its mechanically full open position (no additional lift possible). After this point, increased flow is due solely to the increase of pressure in the tank's vapor space. The set point and flows into the tank operate in the same fashion, only under vacuum conditions. The most effective way to demonstrate the flow capabilities of a vent is by using a flow curve (Fig. D). The curve clearly identifies the vent set point and shows the flow capacity of the device at pressures above the set point.

CHARACTERISTICS OF FLOW CURVES

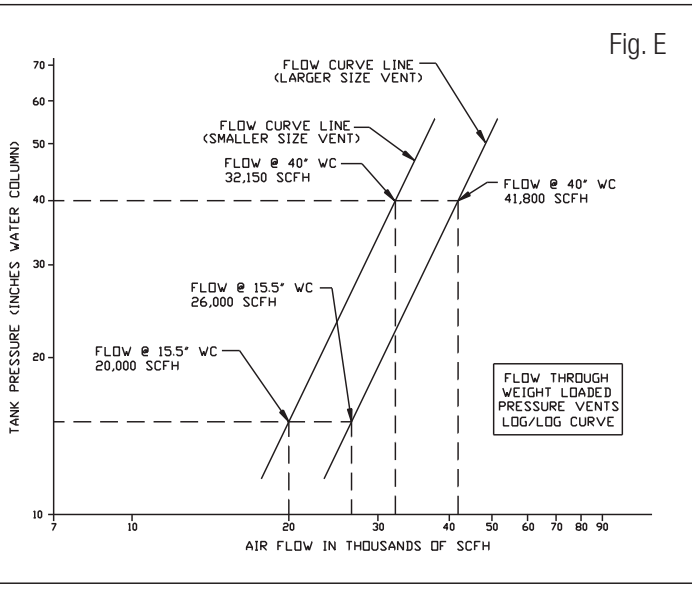
1. Vertical Axis - Tank Pressure (in appropriate units of measure)
2. Horizontal Axis - Flow (in appropriate units of measure)
3. Flow curve intersects vertical axis at set point.
4. As tank pressure increases, pallet assembly lifts and flow through the vent increases. At some point, the pallet assembly is opened to the extent that increased flow is attributable solely to increased tank pressure.
5. Flow characteristics for vacuum flows are represented on a separate curve.

Fig. D



Flow data is sometimes presented in a Log/Log Curve format (Fig. E). Such curves do not include "zero" points on their axes (flow = 0 or pressure drop = 0). For this reason, when using a Log/Log Curve, it is impossible to determine the flow characteristics of a vent at a pressure very near to its set point. It is difficult to accurately read very small increments of flow or pressure on a Log/Log Curve. Since flow data on Log/Log Curves is represented by a straight line, such curves are useful for displaying pressure drops and flows when tank pressures are significantly above the set point. A reputable manufacturer should be able to provide flow data for their equipment in both curve formats.

Fig. E



Protectoseal Storage Tank Fittings, Vents and Accessories are sold and serviced by a technically-oriented network of representatives located across the United States, Mexico, Canada, South America, Europe, Middle / Far East and elsewhere throughout the industrial world.

Please call 1-630/595-0800 or visit our website at www.protectoseal.com for the name and address of the Protectoseal Representative in your area.

THE PROTECTOSEAL COMPANY
ISO 9001 CERTIFIED
225 Foster Ave., Bensenville, IL 60106-1690
Ph: 1-630-595-0800 Fax: 1-630-595-8059

SAFETY WITHOUT COMPROMISE