

Tank Site Walkdowns - an Enabler of Operational Certainty



Introduction

Unexpected downtime due to system failure costs time and money to repair and puts the integrity of your tanks and their content at risk. You not only need to extend the life of your hard assets but also the integrity of your gaseous and liquid assets. Minimizing oxidation and maintaining optimal tank pressure to reduce contamination is vital in preserving product integrity. As such, an optimized Preventive Maintenance Program is vital to the plant.

Emerson's Site Walk Down (SWD) services are being offered for the purpose of accurately determining scope and planning work for the Preventive Maintenance execution. Enhanced SWDs with tools such as VOC meters can be greatly beneficial to improve equipment downtime and reduce costs.

Optimal emissions control is not only to comply to the latest environmental regulations but limits product loss. This is achieved through accurate pressure

control and a knowledgeable partner that can help you manage your total tank protection needs.

SWDs are increasingly performed before the beginning of Plant Shutdowns, Turnarounds and Outages (STOs). STOs are complex and costly events which require careful planning and scheduling to safely execute on time and on budget. However, with early planning and performing targeted SWDs, the proper scope can be determined prior to the scope freeze date

Emerson can also conduct Discovery SWDs on the storage tanks at customer site to discuss specific site challenges and brainstorm possible solutions including emission requirement. The outcome of the SWD creates the scope of work for the Plant's Preventive Maintenance program for Plant Safety, Reliability or Efficiency.

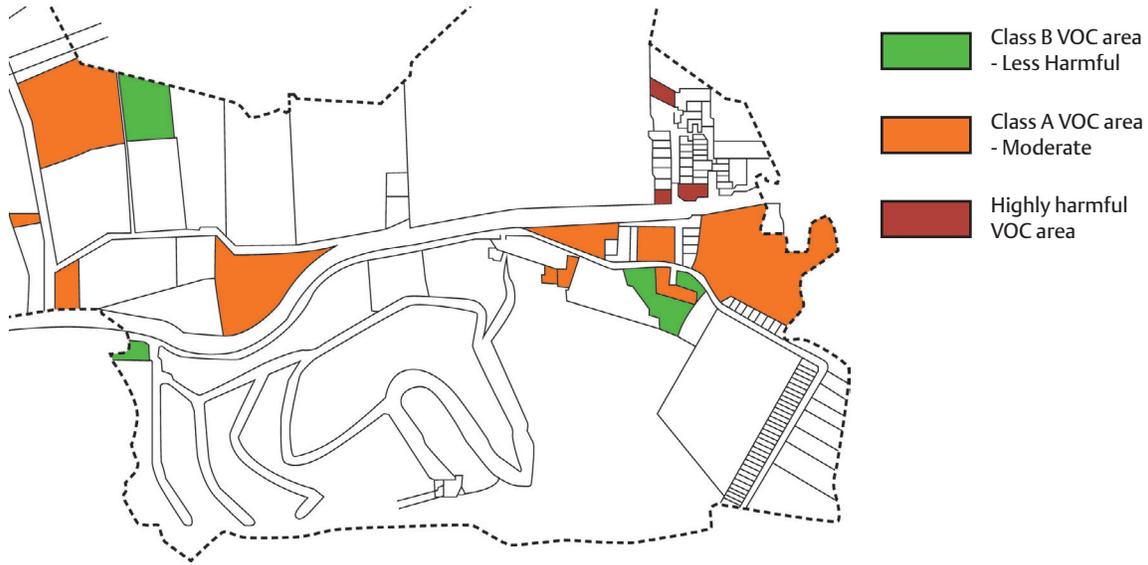


Figure 1. Example of regulatory body's site audit on VOC emissions in India

VOC Emissions and Regulatory Compliance

Detriments of VOC emissions

Volatile Organic Compounds (VOCs) are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. A wide range of carbon-based molecules, such as aldehydes, ketones and other light hydrocarbons are VOCs.

Ambient air levels of VOC are required to be monitored primarily because of their role in adverse impacts on human health, as well as on ecology and on the adverse impact on atmospheric factors relating to other environmental changes (Ozone Layer Depletion etc.) i.e., increases in levels of troposphere (ground-level) ozone and decreases in levels of stratospheric ozone. Most of the chlorinated VOCs may contribute for 35 – 55% of outdoor air borne cancer risk.

The development of effective strategies for controlling VOCs refers on quantifying the ambient concentrations and the identification of emission sources of these pollutants.

The following are the effects of VOCs:

- Human health impacts; some VOCs are known or suspected carcinogens.
- Nuisance effects such as odors.
- Contribute to global warming; and
- Some VOCs also react with nitrogen oxides in the air in the presence of sunlight to form ozone.

Regulations over VOC emissions

To limit the emission of VOC to the atmosphere and limit its impact to humans and the environment, numerous countries have enacted regulations that oversee emission limits. Emission regulations are not guidelines, they are strict standards that are enforceable. Companies that do not adhere to national regulations run the risk of unnecessary fines.

A recent check done by a national regulatory body on a refinery plant produced a report that showcased areas within the plant that had emission levels dangerously close to the limit (Orange) and over the limit (Red). Unfortunately, penalties were imposed on the said Refinery plant for non-adherence to national regulations.

Emerson's Tank SWD: Focus, Steps and Process

Tank SWD Focus

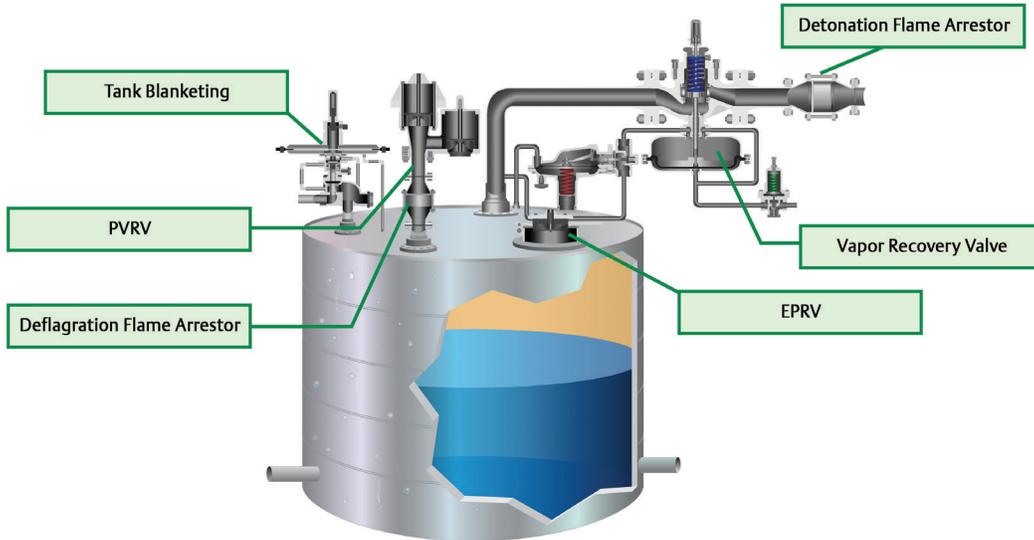


Figure 2. Typical tank protection equipment

The SWDs focuses on safety, product quality, environment and tank integrity through tank assets in a specific process stream or area. During the SWD, the following assets are surveyed:

Asset Class	Example Assets	Activities Performed
Tank Pressure Control Devices	<ul style="list-style-type: none"> • Tank Blanketing • PVRV • EPRV • Detonation/ Deflagration Flame Arrestor • Vapor Recovery Valve 	<ul style="list-style-type: none"> • Application Review • Maintenance • Obsolescence Planning • Spare parts recommendation and Critical spares review • Installation assessment • Prioritized regulator issues • Spare Pool Program • VOC Emission Compliance
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Flame & Detonation Arrestors</p> </div> <div style="text-align: center;"> <p>Pressure/Vacuum Relief Valves</p> </div> <div style="text-align: center;"> <p>Emergency Vents & Hatches</p> </div> <div style="text-align: center;"> <p>Blanketing Regulators</p> </div> </div>		

Figure 3. Typical assets that are surveyed

Tank SWD Steps

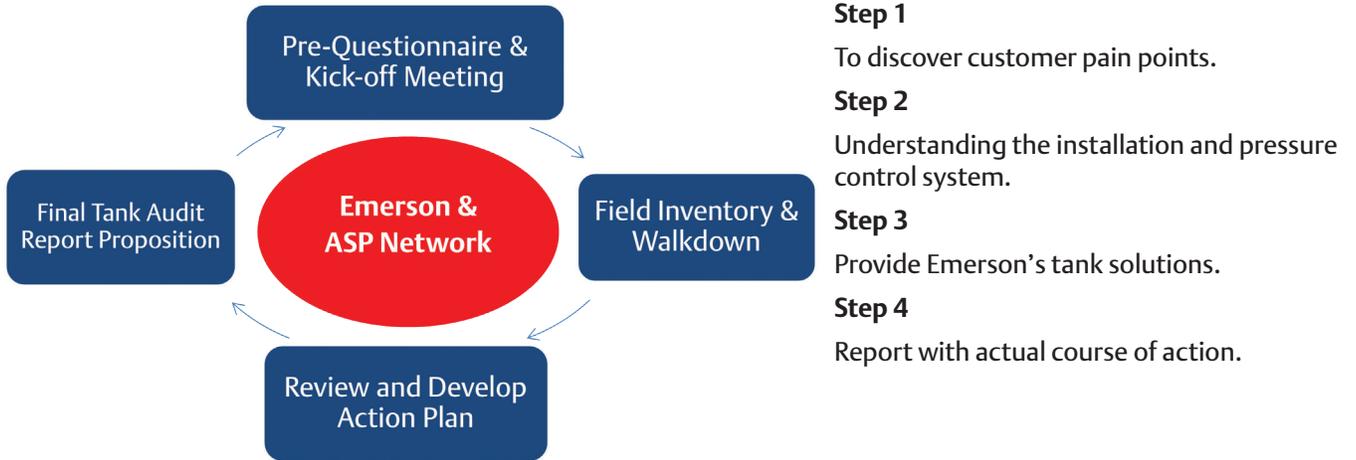


Figure 4. Tank SWD Process



Figure 5. Emerson Specialists on Enhanced SWDs

- Step 1: Kick off Meeting Pre-Planning – Refer to SWD Agenda document to understand the concerns, gather tank information and set dates
- Step 2: Field Inventory and Walk Down Walk each tank using high end VOC detection meters that detect and record specific emissions.
- Step 3: Review and Develop Actions Emerson reviews tank information and SWD findings
- Step 4: Final Report Review Final Report with specific action proposals

Tank Walk Down Swim Lane Process

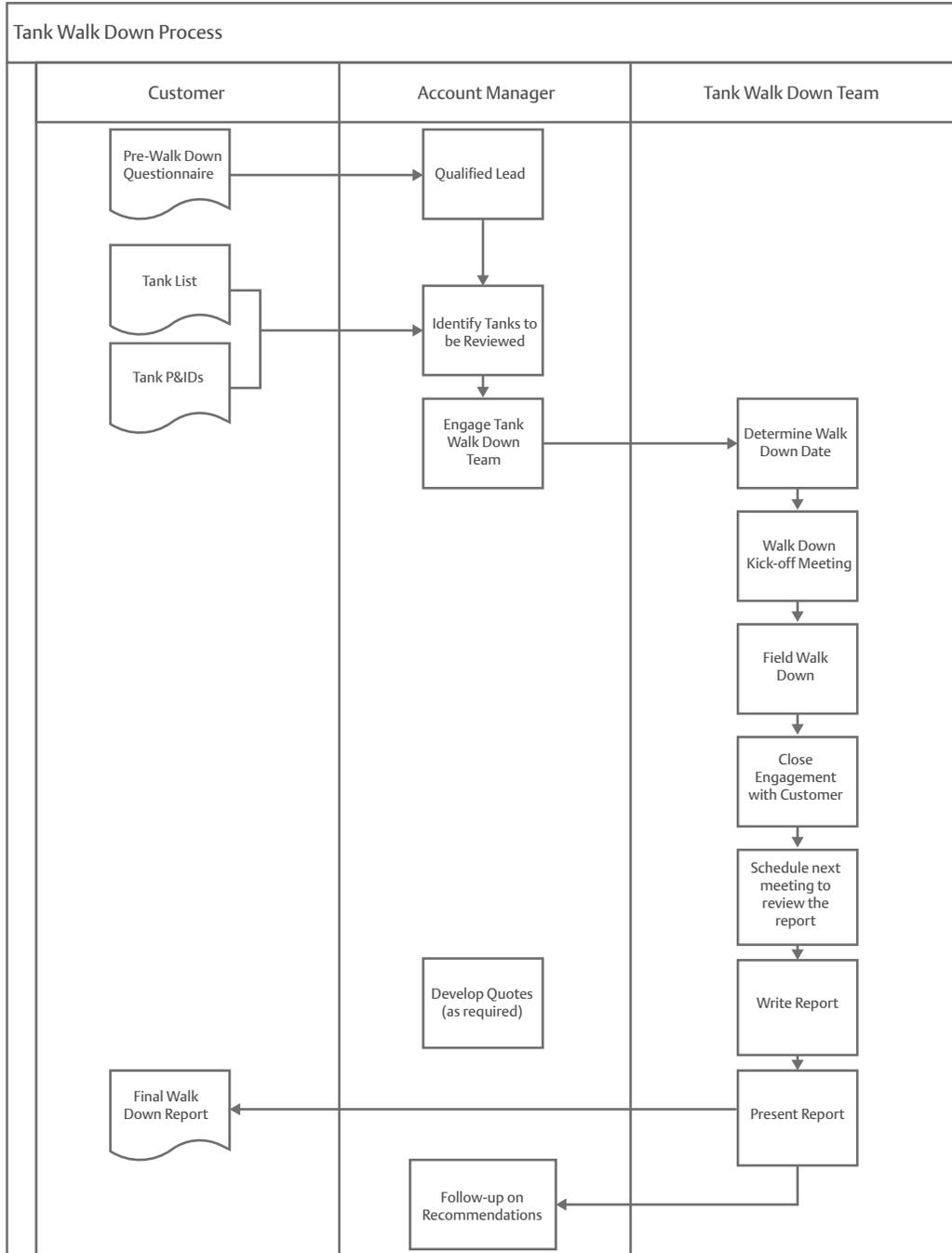


Figure 6. Emerson’s Tank SWD Swim Lane Process

Benefits of Emerson's Tank SWD: Reduce emissions, limit product loss and protect the integrity of the products in your tanks



Figure 7. Some examples of Emerson's top quality Tank top equipment

Reduce emissions and product loss by 15% - This exceeds the most stringent standards for allowable leakage and provides excellent setpoint accuracy.

Reduce maintenance and improve service life - Vents feature replaceable seats and arrestors that are easier to clean.
Reduce system cost - Arrestors that are designed with flame cell openings that are 3 times larger than others in the industry, reducing pressure drop and blower cost.

Reduce your tank blanketing expense by 50% - Regulators that provide low-setpoint technology which allows only the amount of blanketing gas required, delivered to the tank, minimizing this expense.

Solutions implemented from findings from Emerson's Tank SWD has helped companies in Singapore save up to US\$12K a year.

Operational Certainty

Emerson's Tank SWD is a critical part of minimizing emissions. As part of our Operational Certainty Framework, minimizing emissions form a key pillar in achieving Top Quartile Performance for our customers.

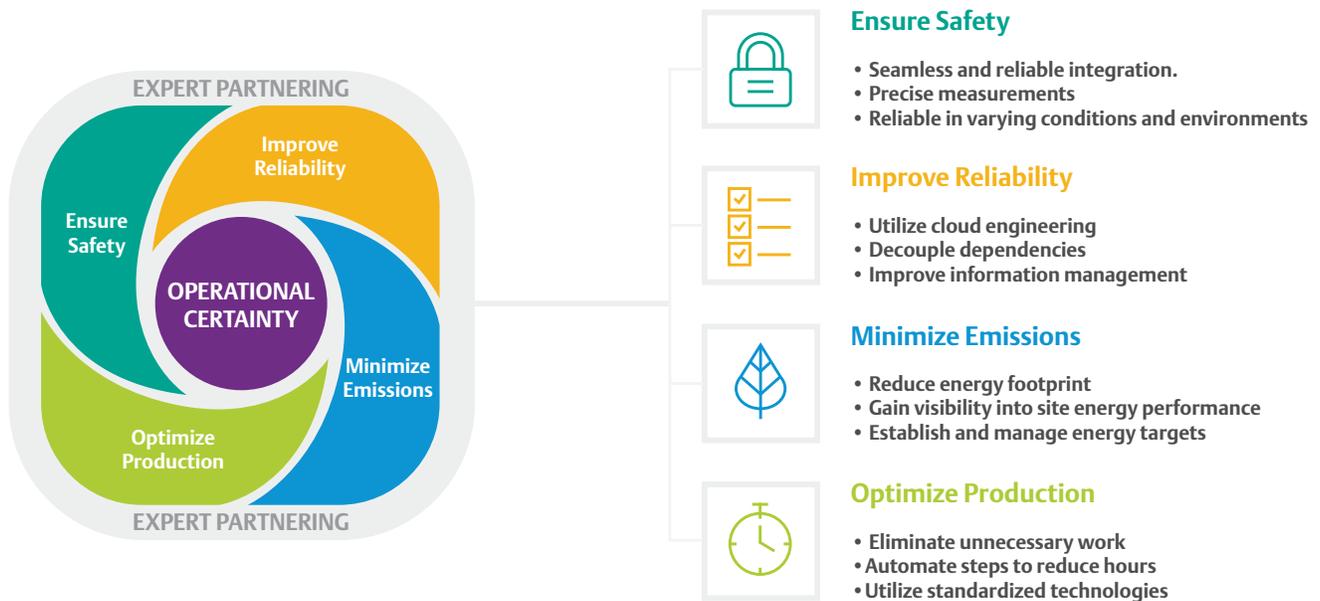


Figure 8. Emerson's Operational Certainty framework

To ensure safety, improve reliability, minimize emissions and optimize production, Emerson leverages on its comprehensive Lifecycle Services program that can be customized to the needs of each plant.

With 27 authorized service centers and 500 service technicians across Asia Pacific, Emerson has established capabilities that will proactively support every plant's Operational Certainty.

Key capabilities of Emerson's Lifecycle Services:

- Enhanced SWDs
- Remote Assistance
- Mobile Service Containers
- Asset Management through RFID tagging
- Inventory Management and Spare Pool programs
- Quickship Hubs – providing deliveries before standard lead times
- World Class Training
- Valve Monitoring

Challenges at Plant addressed during the Emerson’s Tank SWD

Challenges at Plant	Emerson Tank Pressure Control Solutions	Benefits
Tanks where odors and/or venting is a problem or concern	Low leakage rate (<0.5 SCFH) PVRV and EPRV Anderson Greenwood™ PVRV with 10% over pressure technology	Low leakage rate, better venting seal tightness, full lift at 10% overpressure
Product quality issues due to air getting into your tanks or tank blanking failure	High precision tank blanketing regulators	Emerson’s vapor recovery regulator throttles the flow within 95% - 102.5% of set pressure (as opposed to industry average of 75% - 130% which leads to pressure fluctuation and unnecessary venting due to valve flutter) Thus, it helps to maintain a constant tank pressure and reduce >25% of unnecessary emission
Product leakage concern. Tight pressure control system with minimum discharge	AGCO PVV Type 93000 series <ul style="list-style-type: none"> • Zero leakage • High capacity flow • Field maintenance with no downtime 	Cost saving for product loss and the EPA safety is the greatest values of this product
Tank pressure control issue due to under or over pressure limits	Tank blanketing regulators, PVRV and EPRV	The three-layered tank over and under pressure control is critical to ensuring personnel and equipment safety
Does the tank require continuous operations (Without any shutdown)	Wireless monitoring	These devices minimize operating costs and improve safety performance by knowing the operational status of the device in real time to know if it is open when it should be closed or vice versa.
Issues with tank pressure control detection (e.g., tank pressure alarms)	Wireless monitoring	The sensors combined with built-for-purpose analytics helps you identify problems before having to send a maintenance crew out.
Vapor recovery system in the tank	High precision tank blanketing regulators	Our high precision tank blanketing regulators help to maintain a constant tank pressure and reduce >25% of unnecessary emission
Issues with flame arrestors on top of any of your tanks	Deflagration and detonation flame arrestors	Flame arrestors are passive safety devices that protect your assets when all the active devices stop functioning
Issues with tank blanketing systems	High precision tank blanketing regulators	Our high-precision tank blanketing regulators help to maintain a constant tank pressure and reduce >25% of unnecessary emission
Maintenance strategy for the tank pressure control devices 1. Reactive Maintenance Plan 2. Predictive Maintenance Plan 3. Preventive Maintenance Plan	<ul style="list-style-type: none"> • Database Management of the historical service records for Risk based Inspection • Spare Inventory Program including interchangeability recommendation • Pool Program with or without RFID for digital upgrade 	<p>Effective Maintenance management of the asset for planning, safety, efficiency.</p> <p>Efficiency management of the asset’s identification in the plant</p> <p>For Proactive maintenance for plant planning and accurate identification of valve assets RFID acquire information on records for repair and recertification</p>

Challenges at Plant addressed during the Emerson's Tank SWD

Reduce Emission and Product Loss through the Vent

Industry Standard Requirement

API 2000 7th Edition: 5.4.2 Leak-rate Test:

Maximum leak rate for 8 - 16" pressure/vacuum vents is up to 5 SCFH @75% of set pressure.

Chinese standard SY-T 0511.1-2010: 6.6 Leak-rate Test:

Maximum leak rate for >8" pressure/vacuum vents is up to 15 SCFH @75% of set pressure.

Reduce Emission and Product Loss by lowering the set point of Tank Blanketing Regulator

Tanks are not 100% sealed.

Higher tank set pressure - more vapor leakage and emission - higher operating cost.

Majority of welds and connections have tiny escape paths.

Reduce Emission and Product Loss by utilizing a precise vapor recovery regulator

Use PVRV as first stage vent may cause extra pollution.

PVRVs normally maintain tank pressure within 75% - 130% of set pressure.

PVRVs normally have on/off actions, which results in tank pressure fluctuation and unnecessary venting.



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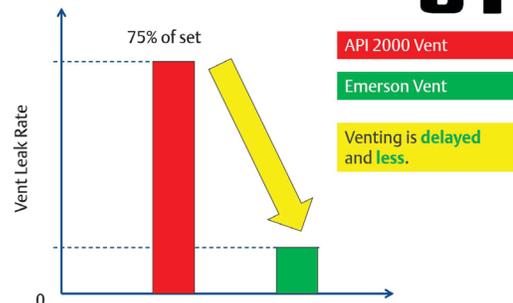


Figure 9. Reduced Emission Rates with Emerson's Vents

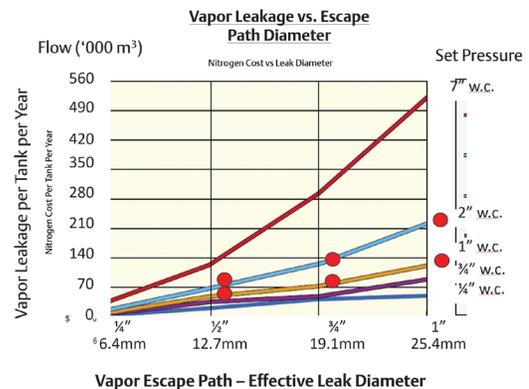


Figure 10. Emerson's Regulators can be set at lower set points resulting in 50% less vapor loss

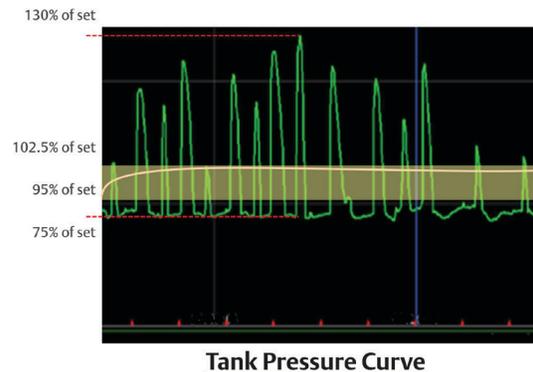


Figure 11. Emerson's vapor recovery regulator maintains constant tank pressure (yellow line)

Reduce Emission and Product Loss by improving vent sealing tightness.

Improper seal will cause continuous bleeding and pollution

- Emerson PVRV is using US patented Saber Guide System.
- The only dual guided pallet system, which minimizes vent flutter and makes sure the plug sits back to the seat properly to provide tight seal.

Reduce Emission and Product Loss by upgrading to AGCO 93000 with Zero Leakage design.

Emerson AGCO is the best PVRV upgrade to meet safety, cost saving, productivity and reliability of PVRV requirements

- Zero leakage
- Low differential gap
- Short blowdown.
- Field Service and test capability
- High flow capacity with integrated Flame arrestor
- Real time monitoring

Improve Plant safety with Anderson Greenwood™ 5910C ‘Combo’ PVRV and Flame Arrester

This integrated solution combines decades of proven AMAL™ flame arrester performance and VAREC™ tank venting technology into one combined unit that is light weight and easy to maintain.

Tested in-house at the new El Campo Flame Test Laboratory, the 5910C is a Pressure and Vacuum relief valve, with integrated Flame Arrester, designed to protect above ground storage tanks containing potentially flammable liquids and vapors from rupture or explosion by overpressure and from external heat and ignition sources.

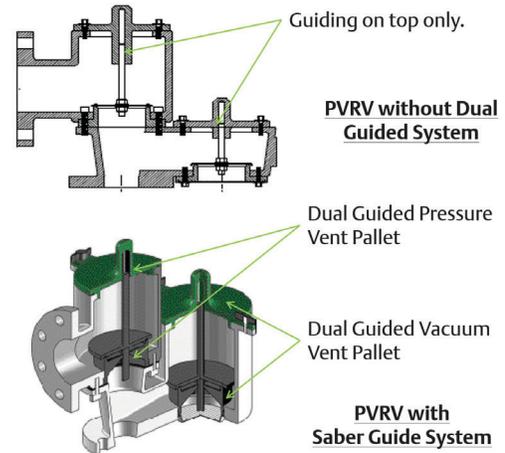


Figure 12. Improved vent sealing tightness

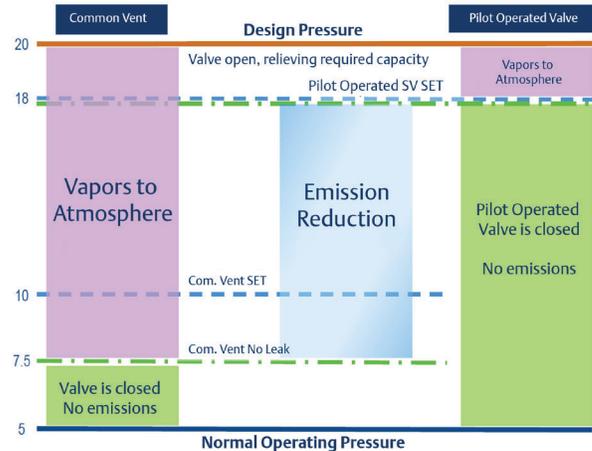


Figure 13. Improving vent sealing tightness with zero leakage design



Figure 14. 'Combo' PVRV and Flame Arrester

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