



# **Pres-Vac Solutions**

## **Chemical Tankers**

**PRES•VAC**

## Protecting your cargo

**The Pres-Vac product portfolio includes a range of world class valves, nitrogen plants and venting systems.**

Safe and reliable operations of chemical tankers require owners and ship managers to rely on highly critical components. In order to optimize operation cost and meet requirements from cargo owners Pres-Vac offers a range of products, which prevent accidents and hazardous incidents on board tankers.

Historically the rules applying to chemical tankers have been governed by IMO and local authorities, who apply restrictions and guidelines on how venting systems on chemical tankers should work.

Pres-Vac P/V valves are approved by all classification societies and have for years set the standard for safe and reliable P/V valves.

For more than 60 years Pres-Vac have manufactured products that prevent cargo related accidents on board tankers. Focus has always been on delivering the safest, most reliable products on the market. We have set the standard for this product category.

The Pres-Vac product range has continually expanded over the years and today includes a range of world class valves, nitrogen generators and venting recirculation systems.



## Cargo tank venting valves



**Pres-Vac supply the world's leading P/V valves**

P/V valves are placed on cargo tanks to ensure that the pressure in the cargo tanks does not exceed the allowed limits. Opening a valve to relieve pressure will result in direct access to the cargo and any fire on deck would have catastrophic consequences. Consequently, a pressure vacuum valve must also prevent fire from entering the tank.

## P/V valve applications

When using a Pres-Vac product, there is virtually no limit to the number of different cargo systems that can be designed. In general, common venting systems on chemical carriers are between tanks or individual full flow systems for each cargo tank. For chemical carriers, cargo vapor separation is required, and therefore each tank has a dedicated full flow valve.



P/V valves



Mainline valves



Gas freeing



Void space venting



Inert gas systems



VOC management





**SOLAS and the chemical code dictate the 3 protection levels that must be present:**

1. Normal venting for loading, discharging and ballasting.
2. Thermal variation when the tank is isolated from the inert gas system.
3. Redundancy venting in case of failure, or alternatively an alarm sensor in each tank.

**For chemical carriers, two systems can be utilized:**

1. End-of-line high velocity P/V valves mounted 3 metres above deck.
2. In-line P/V valves and end-of-line flame arresters (long endurance burning certified for some installations) mounted 6 metres above deck (outlet).

For other tanker types, a mast riser system is a possibility (common venting systems) when cargo separation is not an issue.





## The highest tank pressure possible

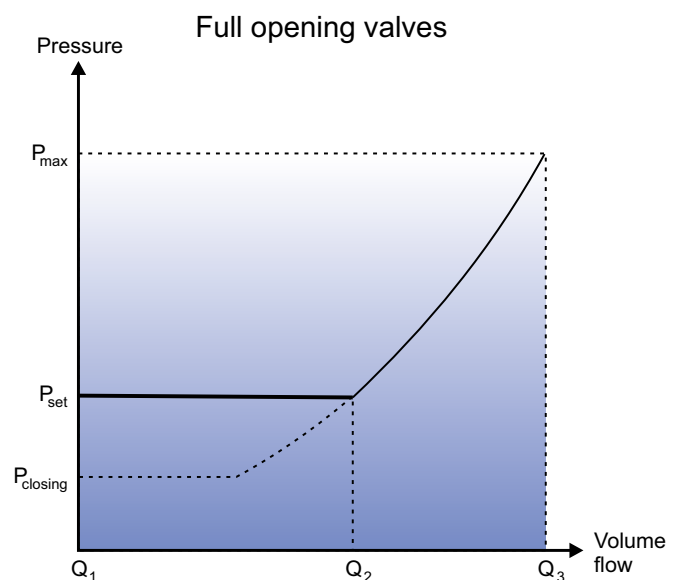
The evaporation of cargo depends on the pressure in the tank. The higher the cargo pressure, the lower the evaporation rate. Therefore, a high positive tank pressure is important to bring down the cargo evaporation rate.

During the last 10 years, the average tank pressure has increased due to the lower cost of high tensile steel and increased global competition in the ship building industry. The trend is that tank pressure will continue to increase in order to minimize evaporation rates.

When tankers apply a higher cargo pressure to minimize cargo emissions, it is important that the venting system is reliable and safe. Repeated alarms due to over pressure are a common feature of many purely weight loaded P/V valves.

These valves produce pressure surges, when the valve is not working at full capacity, and sometimes these surges surpass the limits for the electronic sensors triggering the alarm.

This may result in the crew losing faith in the P/V valves and choosing to manually vent the cargo. A P/V valve should have an opening sequence as illustrated in Full opening valve graph, where  $P_{set}$  is horizontal all the way out to the opening curve.







## Minimizing cargo loss

Another issue affecting cargo emission through the tank venting system is the closing pressure of the P/V valves. By minimizing the difference between the opening ( $P_{set}$ ) and the closing ( $P_{closing}$ ) pressures, it is possible to reduce cargo emissions, resulting from the increased tank pressure when the valve closes. Pres-Vac magnetically controlled P/V valves address this issue, and today the difference can be as low as 4 kPa.

## Better working environment for the crew

By using high velocity Pres-Vac P/V valves it is normally possible to achieve a gas jet velocity of 40-80 m/s above the valve. This ensures that emissions from the P/V valves escape as far away from the deck as possible.

It is important that valves are properly maintained. If the seat and disc of the valve are worn, leakage from the valve to the deck may occur. Leakage to the deck is emission and it may jeopardize the health of the crew.

Vessels fitted with P/V valves **with** built in soft seals in the seat reduces the leakage rate with 80% compared to a P/V valves **without** soft seal.

## Long pipe length from tank to valve

For chemical tankers it is important that the P/V valves can be removed from the deck area and installed as high as possible to reduce the risk of cargo vapors on deck.

By placing the P/V valves in a group above deck in a vent tower, this can be accomplished in a simple and efficient manner. The challenge in doing this is that an additional pressure drop is introduced in the pipe installation from the tank to the P/V valve. Pres-Vac valves are designed to support long pipes.

Chemical tankers require an opening setting as high as possible to avoid toxic fumes on deck. If the pressure from the tank to the P/V valve is high due to the length of the pipes, a pressure drop due to the valve characteristics is unwanted. A P/V valve should be able to maintain the same pressure characteristics on pipes that are up to half the length of the cargo deck.

## Noise levels

When tankers discharge in ports that are in close proximity to populated areas, it is necessary that the tankers do not have excessive noise levels while loading and discharging. Normally noise from the P/V valve is generated because of the speed of air pushed through the valve.

Full lifting of the valve and the design of the seat and disc is very important in avoiding turbulence and lowering the speed of the main jet.

## Pres-Vac P/V products

Pres-Vac supplies the world's leading P/V valves for chemical carriers. Pres-Vac delivers state of the art P/V valves that use a combination of magnetic force and weight to deliver the best possible venting performance.

Our valve delivers superior performance, high capacity and optimal leakage protection ensuring minimal cargo loss and maximum safety.

*A gas freeing cover unit can be installed as an integrated part of a P/V valve or as a separate unit*



## Cargo tank gas products

### Cargo fumes and improper equipment make a dangerous cocktail

Gas freeing is perhaps the most dangerous operation on a tanker, because the most flammable gas mixture emission is always experienced at some point during this operation. When such a gas mixture is emitted, a spark occurring several meters above the outlet can cause a tank explosion, if proper gas freeing equipment is not installed.

### Gas freeing – safely and quickly

Gas freeing needs to be a safe and simple procedure, but it is one of the most dangerous procedures related to cargo handling. Therefore, it is important that gas freeing equipment (blowers, inert gas plant and gas freeing outlets/covers) are dimensioned to make gas freeing a safe, quick and easy operation.

The gas freeing blowers are used to overcome the pressure drop in the piping between the tank and the gas outlet and must be sized to gas free 3 tanks simultaneously, according to the IG code. Based on the available static pressure and associated capacity, proper end-of-line flame screens shall be selected (gas freeing covers) to facilitate an efflux velocity of 20 m/s. Selecting a system yielding 20 m/s allows the fastest possible gas-freeing operation. The already in-place pressure relief valves may be used, but the static pressure is likely to be inadequate.



## IMO Circ. 1324 and 1325

The IMO and a dedicated workgroup have spent several years on redrafting IMO/MS/Circ677 regarding gas groups and the requirement to carry equipment "dedicated" to specific flame groups. On 5 June 2009, an amendment was issued to ensure that the Maximum Experimental Safe Gap (MESG) value for the medium to be used for testing a device is appropriate to the product which the cargo tank is certified to carry, and also complies with the device installed.

Tankers carrying cargoes belonging to gas group IIA are required to have P/V valves installed which on the pressure and vacuum side have been certified using propane, in accordance with IMO/MS/Circ1324.

Tankers carrying cargoes belonging to gas group IIB are required to have P/V valves installed, which on the pressure and vacuum side have been certified using ethylene, in accordance with IMO/MS/Circ1324. If a gas freeing cover is integrated in the P/V valve, this must also comply with IMO/MS/Circ1324.



## Inert gas systems



**Pres-Vac PSA Nitrogen plants provide safe and clean inert gas options for chemical tankers**

The flame suppressive (inert) properties of nitrogen make it widely used in the marine and oil and gas industries.

Nitrogen is odourless, non-polluting and non-reactive in nature, which makes it highly suitable for a wide variety of applications.

The main reason for using inert gas in cargo tanks is to prevent fire or explosion in the cargo tanks. Inert gas has a fire suppressing effect that works by removing one side of the fire triangle: oxygen.

## Pres-Vac gas freeing products

Pres-Vac delivers approved and certified gas freeing equipment including stand-alone units, integrated units and gas freeing covers integrated in detonation arrestors.





## No cargo contamination

The inert properties of nitrogen are widely exploited in the marine industry, because nitrogen is odorless, non-polluting and non-reactive in nature. These properties make nitrogen highly suitable for cargoes with low flash points and which are sensitive towards other, more polluting methods of inerting.

In connection with tank cleaning, using nitrogen also has the advantage that it does not contain any soot or other particles and, therefore, it is only necessary to clean the tanks once.

During a typical discharge operation, the discharged cargo is replaced by inert gas in the tank. Consequently, oxygen accumulation is avoided minimizing the risk of fire or explosion. The inert gas is pumped into the tank at the same rate as the cargo discharge pumping rate.

When a loading operation commences, the tanks are typically filled with inert gas, and this inert gas then slowly leaves the tank through the P/V valves or the vapor return line, when the pressure becomes too high.

Inert gas is also used in connection with stripping of the cargo tanks and the tank cleaning process, as there is a risk of mixing cargo vapors and air during these processes.

## Increased safety



When cargo is discharged or loaded at speeds greater than 7 m/s, or gas flow rates of more than 40 m/s, special care needs to be taken due to the risk of static electricity.

## Energy savings

Pressure Swing Absorption (PSA) systems are the 3rd generation of nitrogen generators, due to the more efficient process compared to membrane systems. Generally, PSA based systems have lower investments than membrane systems, as the latter require expensive compressors. Furthermore it is possible to





achieve energy savings of 30% on nitrogen production if a PSA system is used. Maintenance is the other key area, where potential savings can be found. PSA systems use:

- 20% less fuel compared to Inert Gas Generators;
- 30% less electricity compared to membrane type nitrogen generators.

Some producers of marine nitrogen systems focus specifically on designing solutions to save energy across all plant components. When comparing the working pressures of PSA and membrane plants, cost savings are achieved due to the lower working pressure (8 bar vs. 12 bar).

It is also possible to reduce energy consumption by regulating the number of compressors running, based on the flow and purity levels required by the system at any given time. This requires advanced control systems, which some of Pres-Vac's PSA systems provide.

When a frequency controlled compressor package is installed, compressor idle time is reduced to zero.

## Performance check of capacity

When using inert gas systems, it is important to make sure that the plant delivers the correct amount of inert gas. If the inert gas systems have reduced capacity over time, it is important that the crew is informed in order to reduce the discharge capacity.

## Tankers down to 8,000 DWT must have inert gas systems

A proposed amendment to SOLAS is currently being discussed by IMO, whereby tankers down to 8,000 DWT that carry cargo with a flash point below 60 degrees Centigrade will also be required to have inert gas plants installed on board.

IMO is choosing this path primarily to increase safety at sea by minimizing the risk of fire and explosion, but also because the technological development of inert gas plants allows them to be installed less expensively and more easily on board small tankers.

## Centralized dry air plant

Additionally, it is possible for some inert gas systems to be integrated with the ship's air package, to supply working air and instrument air for daily use. Since the quality and purity of the air that is produced by the PSA system is very high and the humidity is very low, this is an added free benefit of producing nitrogen.

## Pres-Vac Inert gas system

Pres-Vac supplies a range of high performing Inert gas systems for marine use.

These PSA systems deliver high purity nitrogen that keeps the cargo clean while providing the most efficient way of producing nitrogen at sea.



## Venting void spaces



**Pres-Vac provides safe and rugged solutions for venting void spaces**

Venting void spaces is something that has to be done on all types of vessels, not only tankers. There are a large number of different requirements that need to be considered when selecting the right venting valve.

- Should the valve only keep sea water out or also work as overfill protection?
- What kind of non-flammable cargo is contained in the tank?
- Is the tank adjacent to a cargo tank?
- Is it only an air release valve?

Material selection also needs to be considered carefully, as well as requirements regarding arctic operations.

## Redundancy regarding spare P/V valve

IMO MSC/Circ. 677 stipulates that any ballast tanks positioned adjacent to cargo tanks must be equipped with P/V valves in order to release cargo vapour.

The capacity requirements are often very low, and many operators therefore place a valve of the same type as the one installed on their cargo tanks. This is to avoid confusion in the event that the valve is returned for service, or where a spare valve is held in case the tank valve malfunctions.



## Service and support

**Pres-Vac offers maintenance kits, tools and a service organization to make preventive maintenance and repairs as easy and efficient as possible**

Since P/V valves are safety equipment on tankers, there are rules regarding the servicing that needs to be carried out. P/V valves normally require 3 types of inspection:

- Before any cargo operation
- Periodic on board inspection
- Special survey overhaul

If the valves are maintained according to the maker's recommendation, some investigations show that the lowest cost of operating a P/V valve can be achieved. By continuously inspecting and overhauling the valves on board the vessel as part of a planned maintenance schedule, larger and more costly damage is normally avoided and down time is minimized.

## Kits and tools

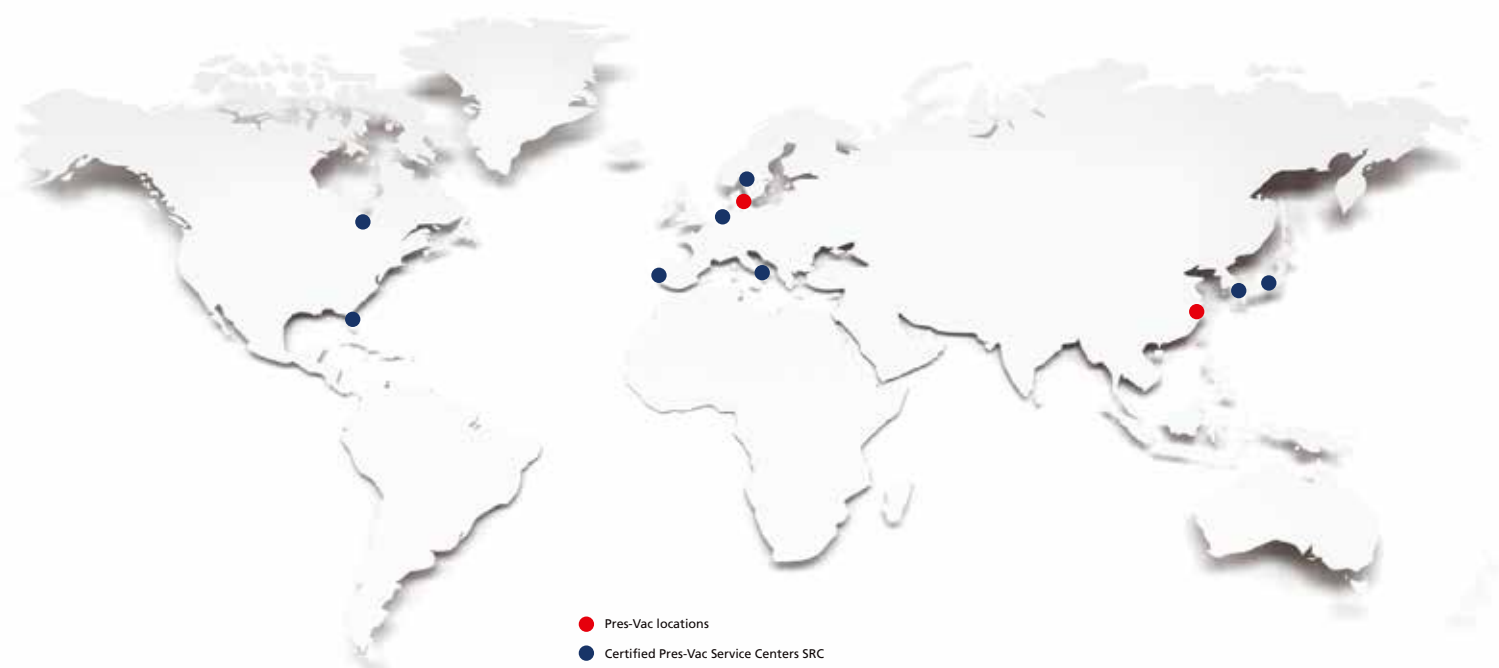
For a ship owner, easy access to spare parts is important to keep a vessel running. Pres-Vac keeps spare parts on stock and readily available.

Supplying spare part kits which include instructions as a complete product is commonplace in the marine industry, because it enables the vessel to carry inexpensive parts in a structured way, and provides cover for the most frequent repairs that may be required.

Pres-Vac offers specialized tools allowing the crew to solve specific tasks. Sometimes the cost of these tools is too high to justify having them installed on a vessel, but occasionally it is both practical and affordable to have these tools on board.

## Service and repair centres

Pres-Vac offers a global network of certified Service and Repair Centres (SRCs) that possess the technical skills and marine experience to resolve service issues.



### **About Pres-Vac Engineering**

For over 60 years, Pres-Vac Engineering has been supplying pressure/vacuum valves and venting equipment to the tanker shipping industry.

Today, we are the worlds' leading supplier of high-velocity pressure/vacuum valves and around 50% of all tanker vessels world-wide use Pres-Vac equipment.

We work with shipyards, naval architects and other partners on all continents. We have a network of highly professional, experienced agents and distributors in all major ship owning and ship building countries.

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