PART OF G&O MARITIME GROUP

THE PRES-VAC SOLUTION FOR METHANOL VENTING SYSTEM

A GOMG WHITE PAPER

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SUMMARY

Utilizing Methanol as a fuel presents several challenges that necessitate careful attention to safety and climate concerns.

In this White Paper, our team of technical experts delves into the details surrounding the storage of methanol aboard ships. Underlining our commitment to prioritizing safety and climate considerations, we explore relevant questions and provide valuable insights into proposed solutions, with focus on the more simple end-of-line solution.

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BACKGROUND

The wish for a greener world is more important now than ever.
Since the middle of the 19th century, HFO has been used in the maritime world, primarily by the shipping industry as fuel due to its low cost compared to all other fuel oils.

HFO consists of the remnants or residual of petroleum sources once the hydrocarbons of higher quality are extracted.

Given HFO elevated sulfur contamination (maximum of 5% by mass), the combustion reaction results in the formation of sulfur dioxide SO2 which will eventually lead to the formation of acid rain (sulfuric acid or H2SO4) in the atmosphere.

The International Maritime Organization (IMO), a specialized arm of the UN, adopted into force on 1 January 2017 the International Code for Ships Operating in Polar Waters named the Polar Code.
The use and carriage of HFO in the Arctic is a commonplace marine industry practice. In 2015, over 200 ships entered Arctic waters carrying a total of 1.1 million tons of fuel with 57% of fuel consumed during Arctic voyages being HFO.

The carriage and use of HFO in the Arctic is discouraged by the Polar Code while being banned completely from the Antarctic under MARPOL Annex I regulation 43.

These regulations ask for alternative fuel products and the development of different fuel systems to replace oil products as fuel, like Ammonia and Methyl Alcohol are among those which are highly efficient and much cleaner to use.

In 2020, the IMO adopted MSC.1/Circular.1621 codifying the proper usage and provisions for methanol as a fuel, in response to its growing usage in the maritime and shipping industries.

As of 2023, roughly 100 methanol-burning ships have been ordered by key players in the industry including Maersk, COSCO Shipping, CMA/CGM and others. The majority of these ships contain dual-fuel engines, meaning they are capable of burning both bunker fuel and methanol.

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CHALLENGE

The use of Methanol as fuel creates challenges which need to be taken care of in such a way that safety and the climate are the top priorities.

The Methanol fuel tank system typically consists of storage tanks, service tanks and drain tanks and is typically installed below in the engine room area. Around these methanol tanks are cofferdams as per safety requirements.

Venting lines are connected to each methanol tank for complying with IMO/ MSC/Circular.677 ISO15364, ISO16852 and IMO/MSC.1/Circular.1621, dealing with over pressure and under pressure.

The device installed to protect the tanks from over pressure and under pressure and flashback need to comply with below tests:

1. Flame transmission test (ISO 16852 9.2- Annex 4, and IMO 677 3.3.3.1
2. Endurance burning test (ISO 16852 9.3 and IMO 677 3.3.3.2)
3. Deflagration Test (ISO 16852 7.3.2.1 and IMO 677 3.2.2)
4. Short burning test (IMO 677 3.3.1)
5. Flow test after flame (ISO 16852-6.7)

The vent system shall, according to the applicable rules and regulations each have a “Device to prevent the passage of flame”. This can be a pressure/vacuum valve installed or/and a deflagration arrester. The required pressure relief device to be installed can either be the end of line type or the inline type.

Further the vent system should be prepared for purging and gas-freeing. This can be done through a common gas-freeing line/device.

Gas/Cargo Vapour which falls under the IMO/677 having a flashpoint below 60°C shall further be protected by an inert gas.

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If we look at the vent systems being designed, the vent lines can be longer than 100 meters and this creates a challenge when calculating the overall pressure drop in the vent system.

Pressure in the tank is equal to the pressure drop across the valve in operation plus the pressure drop in the vent lines and if the inline version is used the pressure drop across the deflagration arrester should be added in the calculation.

If the vent line ends on top of the accommodation and a deflagration arrester is installed, measures should be taken into consideration of the requirement of SOLAS 5.3.4.1.4 requiring a distance from the outlet of the valve from the air intake.

The IMO/MSC.1/Circular.1621 which is made to cover the limitations concerning the use of alternative fuels is not in its final edition only presented as an interim guideline.
The further development of this guidance "AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR ALTERNATIVE FUELS AND RELATED TECHNOLOGIES" is discussed by the working group under IMO/MSC-WP.3.

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SOLUTIONS

Two solutions seem to fit the purpose and can be suitable for the application.

These solutions require that the vent lines are of a size which can cope with the pressure drop through the line plus the pressure drop across the venting device when it is in operation.

This is a challenge when the vent lines can be over 100 meters long.
The two solutions at hand can be configured as follows.

The end of line solution featuring a high velocity PRV (Pressure Relief Valve), includes the requirement that the PRV shall be endurance burn certified and tested according to IMO/677-1009/1324, ISO15364 and ISO16852 latest edition. Due to the position of the valve onboard it is of the utmost importance that the valve installed is ATEX certified for non-spark performance.

The device involved in the end of line solution is:

Due to the long vent pipes, it is vital that the high velocity pressure relief valves installed at the end of the vent line do not have any pressure surge above its opening setting, this is crucial to avoid any overpressure in the vent system. If the end of line high velocity pressure vacuum valve is installed, no further device needs to be installed for protecting the methanol tanks.

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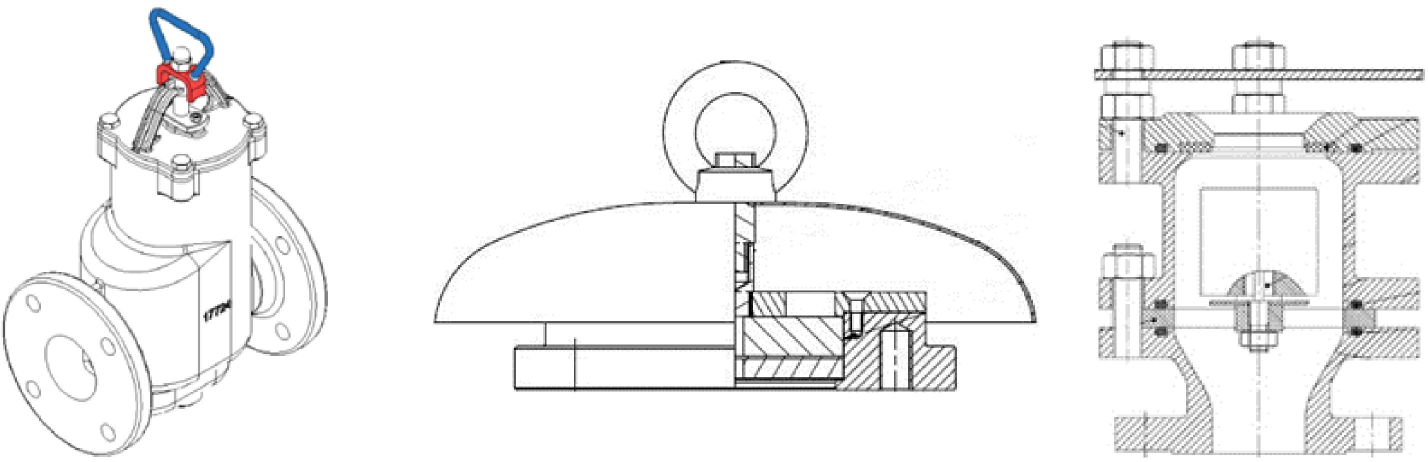
The second solution is fitting an inline pressure vacuum valve class approved and an end of line deflagration arrester to protect the vent system. This end of line deflagration arrester needs to be endurance burn tested and tested according to IMO/677-1009/1324, ISO15364 and ISO16852 latest edition.

The devices involved in the inline solution are:



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RECOMMENDATIONS

The end-of-line solution seems simpler and contains fewer devices. One high velocity pressure vacuum valve will do the job. However, this high velocity pressure vacuum valve needs to be of a type which does not have any pressure surge in the opening phase. The valve should in addition be nearly maintenance free over a period due to the position onboard. Further it will improve significantly if the valve has a resilient seal alongside the metal-to-metal contact, this will make the leakage very low.

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