

PRES·VAC

PART OF G&O MARITIME GROUP

THE DUAL-FUEL SOLUTION

And why you should choose Pres-Vac PV-ECO-Methanol high velocity pressure vacuum valves for the venting solution.

A GOMG WHITE PAPER

www.presvac.gomaritimegroup.com



SUMMARY

Using methanol as a fuel comes with several challenges that require meticulous attention to safety and environmental concerns.

In this White Paper, our team of technical experts examines the complexities of storing methanol on ships. Emphasizing our dedication to safety and climate considerations, we address relevant questions and offer valuable insights into proposed solutions, particularly focusing on straightforward end-of-line solutions.

This White Paper is the updated version of White Paper “The Pres-Vac solution for methanol venting system” published December 2023.

BACKGROUND

Shipment by sea is vital for the world to go around but also leaves footprints which influence the environment. To reduce/stop emission of greenhouse gases the ships engines can be designed to run on alternative fuels like methanol and ammonia.

Both fuels leave very little footprints and especially methanol let out in the environment, dissolves quickly and does not harm any species.

Methanol is according to the IBC Code:

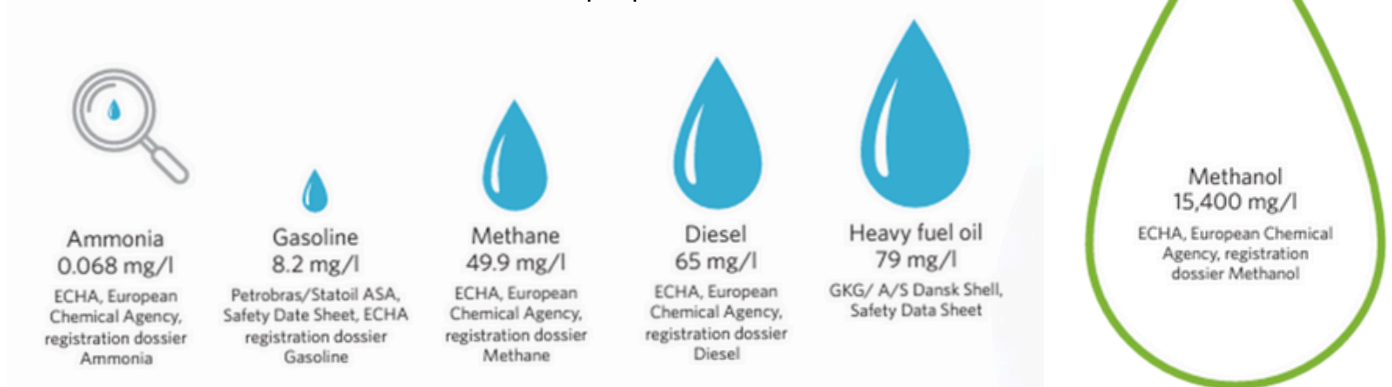
- Flammable
- Toxic
- Explosion group IIA

Ammonia is according to the IBC Code:

- Flammable
- Highly Toxic
- Explosion group (IIA)



Lethal dose to 50% (LC50) of a fish population:



Source: "Interim guidelines for the safety of ships using Methyl/Ethyl Alcohol as fuel", IMO 2020

CHALLENGE

The dual fuel vent system layout:

The venting of the gases emitting from the methanol/ammonia cargo in the tanks needs to be addressed according to IMO/MSC15364 and ISO16852 and IMO/2020 and 1621.

What are the challenges with such an installation:

Methanol/ammonia tanks are often placed under the engine in the double bottom construction, this requires a double wall venting line below deck and long venting pipes until it is safe and acceptable to vent the gases from the overpressure into free air.

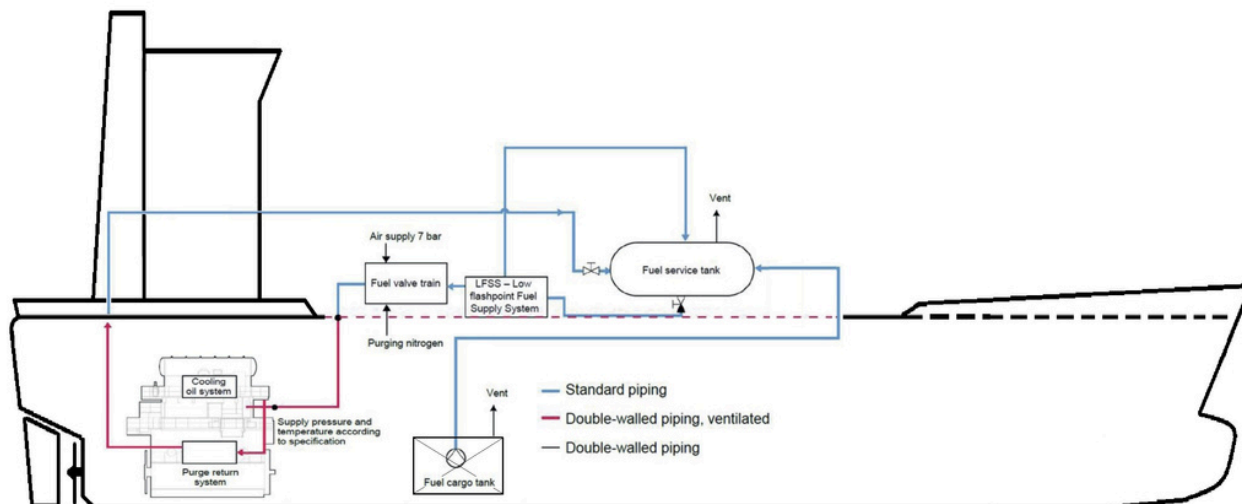
Venting to free air is a challenge because the efflux velocity of the devices installed must be as high as possible to avoid any gases from hitting the crew areas or accommodations air intake.

Venting requirements for the end of line high velocity pressure vacuum valve is also a challenge, not only on the performance side, but also when comes to the certification requirements.

On the certification side the valve must, according to ISO15364 and ISO16852, perform without any oscillation and be endurance burn tested on the pipe length which it is intended to be installed on.

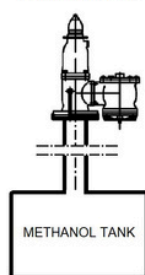
Further and due to the position that the valve is installed on, it must be flawless and maintenance free for a quite long period of time (5 years).

The total pressure drops in the system when loading, according to SOLAS and USCG-VESC must be investigated. For very long vent pipes the pressure drop might be a challenge.



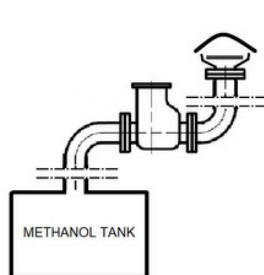
Venting solution 1

End of line solution installing high velocity pressure vacuum valves end of the vent line.



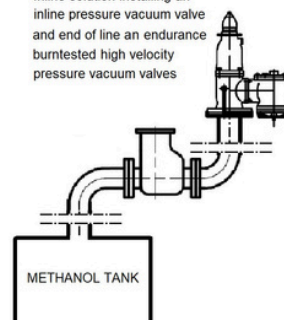
Venting solution 2

Inline solution installing an inline pressure vacuum valve and end of line an endurance burnttested static flame arrester



Venting solution 3

Inline solution installing an inline pressure vacuum valve and end of line an endurance burnttested high velocity pressure vacuum valves



The dual fuel venting equipment specification:

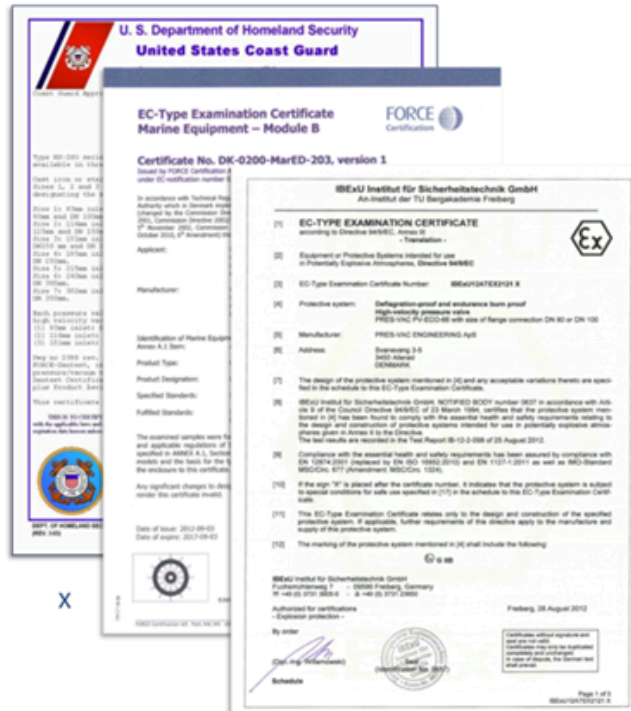
In the specification for a dual fuel venting system, it should clearly be mentioned that the requirement of the equipment to be installed protecting the methanol/ammonia system shall at least be the following:

- The specification shall require full compliance with latest rules and regulations including IMO/MSC/1621, ISO15364:2021, ISO16852:2016, and EU-MED - (if EU flag).
- The specification should in fact mention all the rules and standards for which the equipment should be tested.
- If the methanol is heated in the process, then consideration to the methanol vapour pressure, which for 45°C is 45kpa (7PSI) should be taken into consideration when determining the setting of the pressure relief valves.
- Is a vapour return system (VECS) according to USCG installed the pressure drop calculation must contain the calculation according to SOLAS and USCG CFR.

- The specification should clearly mention the length of the venting pipe, to evaluate the equipment to be installed.
- Due to very long vent pipes, special conditions should be addressed to the vacuum side of the process, assuring that the pressure drop is in control. Should there be challenges in this connection, the vacuum side valve can be of the magnet-controlled type eliminating the pressure drop.
- Due to the toxicity of Methanol and Ammonia the specification should require soft seal in addition to the metal-to-metal contact.
- The Type Approval Certificate shall be presented for technical/compliance clarification

Mastering regulations and intensive testing are key competences to obtain approvals and to be preferred supplier in the marine industry.

Tests Required	IMO MSG/ Circ. 677	U.S.C.G. CFR 46	ADN	CEN/ ISO
Vapour flammability consideration	X		X	X
Tested blocked open	X		X	X
Corrosion test	X			
Ice cap test (20 mm)	X			
Atmospheric explosion test	X			
2-hour constant burning test	X			
Mechanical design standards	X			
Automatic function	X			
Self-closing check lifts	X			
Material requirements	X			
Hydrostatic test	X			
Constant high velocity function	X			
Each model and each size to be tested, save detonation arresters	X			
Installation, system design and opening frequency requirement	X			
Flow measurement test	X			
Capacity vs. pressure drop requirement				
Documentation requirement	X			
Free clearances				
Pressure fluctuations				
Maintenance in-site	X	X		



The high velocity pressure vacuum valves which are on the market today.

1) A conventional weight-loaded p/v valve

This type of valve uses the moving parts, being the weight, to control the velocity of the gasses coming out of the valve at a minimum of 30m/s as rules requires. During the opening phase the valve generates an over pressure on top of the opening setting of 25 to 50%.

For a chemical tanker this is not acceptable because the pressure in the tank will exceed the max allowable with the consequence that the tank will suffer a blow up.

For an oil carrier it will have the effect that the alarm will trick every time the ship is loading, including the security people at the refinery in the decision whether to continue or stop the process.

When maintenance is performed, this type of valve shall be handled by two or three crew members removing the entire valve for cleaning in the workshop.

2) A magnet-controlled weight loaded p/v valve

Makers: Pres-Vac

This type of valve uses the magnet to control the opening setting, and the weight to close the valve. The valve does not create an over pressure and it closes approx. 300mmWG below the opening setting preventing unnecessary gasses into the air.

The magnet can be adjusted to increase the working span for the pressure drop in the pipes. The result is a performance enabling a minimum size of piping, a fast blow down releasing very little gasses into the atmosphere and a long lasting steady non-oscillating operation.

When maintenance is performed, it can be done by one crew member using the interchangeable pressure/vacuum head.

3) Pure magnet-controlled p/v valve

This type of valve uses the magnet to control the opening setting and the small weight to close the valve. The valve does not create an overpressure; however, it has a very low blow down value around 700mmWG due to the small weight of the moving parts. This result in a huge outlet of gasses into the atmosphere, emptying the inert system completely.


When maintenance is performed, nearly all of the types available needs to be done using two or three crew members removing the entire valve.

The Type Approval Certificate:

To be sure that the equipment installed is suitable, optimizes and fully certified in performance and with regards to safety, it is vital that the below is also present on the Type Approval Certificate.

- Be certified on the venting pipe length required by the dual fuel design in accordance with IMO/677 and its amendments, EU-MED, ISO15364 and ISO16852 latest edition.
- The certificate should clearly mention compliance with Methanol/Ammonia/Alcohol.
- The max length and opening setting should be visible on the Type Approval Certificate.
- Methanol belongs to the explosion group IIA, which should be the minimum the valve should be tested for.
- Due to the toxicity of methanol and ammonia, a minimum setting of 20kpa should be used.
- Methanol and ammonia belong to explosion group IIA, however for maximum safety it is highly recommended that the valve is certified for compliance with explosion group IIB, MESG = 0,65.
- If the recommended soft/hard seal solution is chosen, it should be certified and visible on the Type Approval Certificate.

To Whom it may concern.

FORCE
Certification 


Brøndby, 14 June 2024

Task no. 124-24805
Product Compliance
ALLA/ALLA

Valve Type	Min Set Pressure [kPa]	Min DN	Max Length [m]	MESG	Explosion Group / Apparatus Group
PV-ECO-53	20	≥65	≤ 220	≥0.5	IIB / IIB
PV-ECO-80	20	≥125	≤ 250	≥0.5	IIB / IIB

Test have successfully been performed towards testing standards ISO 15364:2021, ISO 16852:2016, IMO MSC Circ. 677 and relevant IMO Circulars IMO MSC Circ. 1009, IMO MSC.1/Circ. 1324, IMO MSC.1/Circ. 1325, IMO MSC.1/Circ. 1620 setup in the MED Directive 2014/90/EU, Regulation (EU) 2023/1667 as amended for Regulation item no. MED/3.12d row 2 of 2.

Approved for all cargo with explosion group IIB (MESG≥0.5) including, methanol, alcohol, and Ammonia.

Kind regards
FORCE Certification A/S


The installation requires compliance with:

- Long vent pipes.
- Leakage tightness.
- Flame transmission test.
- Endurance burn test.
- Non-oscillation performance on long pipes.
- Breather function.
- Green marked valves cutting the emission.
- IIB for highest safety.
- ATEX for non-spark compliance.

SOLUTION

The best solution will be:

- Pres-Vac green ECO Methanol high velocity pressure vacuum valve.
- Certified for flawless performance to over 220 meters of length.
- Certified for Explosion group IIB.
- Certified for use with methanol and ammonia.
- Designed to cut emissions to a minimum and keep the pressure on the cargo.
- Soft seal assures further reduction of leakage/emissions/wear and tear, to near nil level.
- Practically maintenance free for a long period of time.

Detailed methanol PV valve description.

We have designed a high velocity pressure vacuum valve highly suitable for long vent pipe applications sometimes exceeding 140meters.

- The valves are designed to perform flawless on extra-long vent pipes, due to the combination of weight and magnet, enabling us to adjust the behavior. Because no hammering nor oscillation is allowed the weight/magnet is a perfect combination for optimizing the performance to each project (vent-pipe size and length).
- The valves have a dual seat arrangement, metal, and soft seal. The soft seal protects the seat and disk and prevents wear and tear. Further it makes the valve being close to gas tight.
- Whether the resilient seal is installed or not the valve is certified to protect the cargo tank in any cases.
- When we test the valves on our test stand before shipping it (FAT – Factory Approval Test) almost all valves perform without any leakage. However, we know per experience that after a while on sea dirt etc. can cause a valve to have a small leak.
- The excellent thing with this cargo is that it is in real life also a cleaning cargo giving the valves the best conditions to work under.
- The valve will under the conditions above mentioned be able to work flawlessly for a long period of time. This is very important because the position of installation might be difficult to access.

- The valves are all endurance burn tested with Ethylene, gas group IIB, even though the requirement is only IIA. This increases the safety factor to maximum.
- The valves are tested according to ATEX for “Spark” (self-ignition) and are proved not to for not having any “Spark”.
- Overall performance and installation IMO/1621
- Endurance burning test (ISO 16852 and IMO 677)
- Deflagration Test (ISO 16852 and IMO 677)
- Short burning test (IMO 677)
- Flow test after flame (ISO 16852)
- Atex non-spark test

Resilient Seal

An extra feature possible to add to any of our high velocity valves is the Resilient Seal. The seal is made from an NBR, Kalrez or Viton composite material depending on the purpose and cargo, and it is placed in the seat of the pressure unit. The material is non-flammable and suitable for both chemical and oil products. The Resilient Seal will secure a lower leak rate compared to a metal-to-metal solution.

Our solution is a combination between the resilient soft seal and the metal-to-metal seat/disk.



The advantages of choosing the Resilient Seal on your high velocity valve are:

- Reduction of vapour emissions to almost zero.
- Reduction of wear and tear on the disk and seat.
- Easy replacement

Is the vacuum situation in control:

An extra feature possible to add to any of our vacuum valves is the Resilient Seal. The seal is made from an NBR, Kalrez or Viton composite material depending on the purpose and cargo, and it is placed in the seat of the pressure unit. The material is non-flammable and suitable for both chemical and oil products. The Resilient Seal will secure a lower leak rate compared to a metal-to-metal solution.

Our solution is a combination between the resilient soft seal and the metal-to-metal seat/disk.



The vacuum valve, which task is to compensate for any under pressure occurring in the venting system, is in real life as important as the pressure valve.

Even though the vacuum situation often is avoided by letting nitrogen into the venting system to keep the system on a pressure side, we always must consider the worst-case scenario which could happen.

The vacuum valve must be able to handle any situation which could bring the venting system in an unwanted under pressure situation. The valve shall be able to handle the required flow capacity at a correct pressure drop, it should be noted that a conventional vacuum valve is of the modulation type which result in an increased pressure drop when the valve starts opening, this shall be taken into consideration in the pressure drop calculation.

According to IMO/677 a further 30% oversize must be calculated to compensate for any clogging of the flame screen protecting the valve.

If a vapour return system is installed complying with USCG-VECS-46CFR-39 then the vacuum valve must be able to handle the loading situation, the pressure drop calculation should take this into consideration as well and use whichever is the biggest of the two methods.

A vacuum valve design consisting of a weight as disk but controlled with a magnet could be the answer. This combination removes the increasing pressure drop when the valve opens and makes sure the valve works flawlessly.

RECOMMENDATIONS

Choosing the end of line solution which we recommend, it is advisable to look into the environment the cargo are stored under, especially the temperature is important because the methanol vapour pressure increases with the increase of cargo temperature. This will have an effect on the setting of the valve.

Further it is important that the high velocity pressure vacuum valve you choose shall be suitable for complying with alcohol (Methanol/Ammonia), the type approval certificate should clearly state this ability.

We also recommend that the maker confirms long performance time without maintenance. This is important due to the position where the valve is to be installed.

The PV-valve should be endurance burn tested/certified eventhough the cargo is protected by nitrogen.

Last but not least a resilient seal must be mandatory to ensure that there are no/minimum of leakage.



Contact Us



Jens Reimer

**General Manager Sales & After Sales
Head of Regulatory Affairs**

Email: jr@pres-vac.com



René Dalgaard Kristensen

Head of Sales

Email: rdk@pres-vac.com

G&O MARITIME GROUP 

GERTSEN & OLUFSEN



ATLAS
INCINERATORS 

Hans Jensen
Lubricators 



PRES·VAC
