

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 safety and environmental challenges that require meticulous attention.

In this White Paper, our team of technical experts examines the complexities of storing methanol on ships. Emphasising 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 industries and livelihoods across the world, but it can leave a significant environmental footprint. To reduce and prevent the emission of greenhouse gases, the ship engines can be designed to run on alternative fuels like methanol and ammonia.

If vented appropriately, both fuels leave very little footprints - especially methanol, which dissolves quickly and does not harm any species.

According to the IBC Code, methanol is

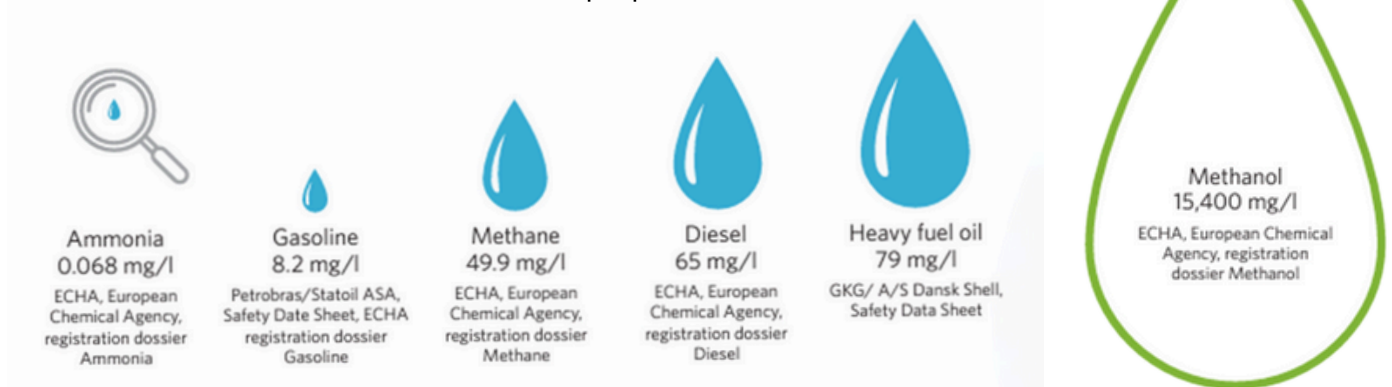
- Flammable
- Toxic
- Explosion group IIA

According to the IBC Code, ammonia is:

- 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

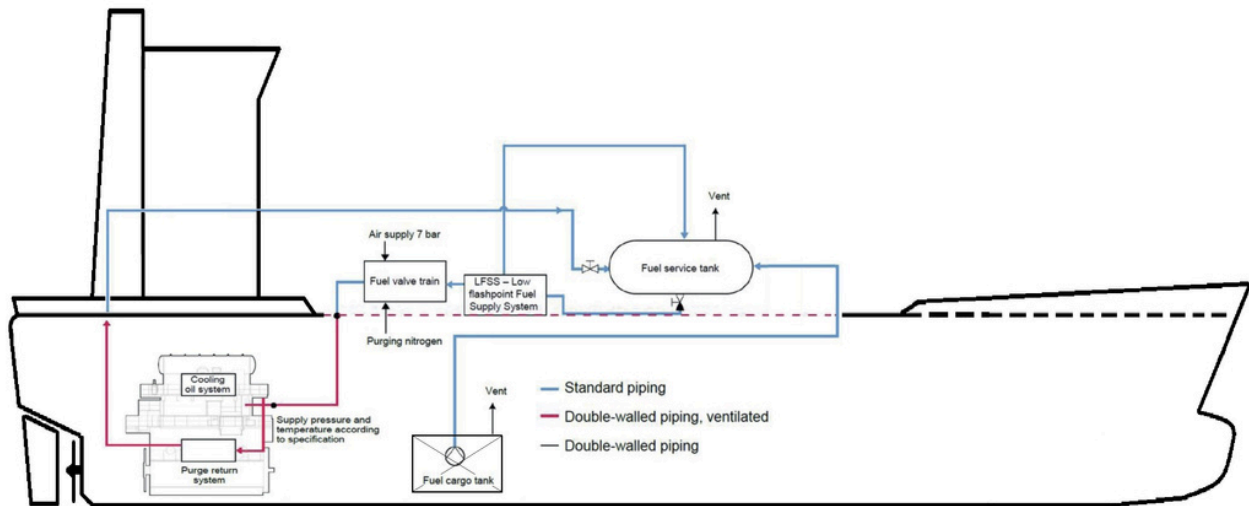
CHALLENGE

The dual fuel vent system layout:

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

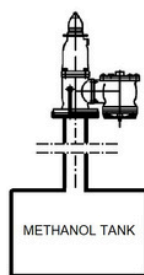
There are several challenges with dual fuel vent system installations:

- 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 to make it safe and acceptable to vent the gases from the over-pressure 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 reaching the crew areas or accommodation areas.
- Venting requirements for end of line high velocity pressure vacuum valves are also a challenge, not only on the performance side, but also when it comes to certification.
- According to ISO15364 and ISO16852, the valve must perform without any oscillation and be endurance burn tested on the pipe length which it is intended to be installed on.
- Due to the position at which the valves are installed, they must perform flawlessly and be maintenance-free for a long period of time (5 years).
- For very long vent pipes, pressure drop when loading can be a challenge, according to SOLAS and USCG, VECS must be investigated.



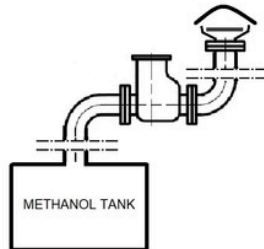
Venting solution 1

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



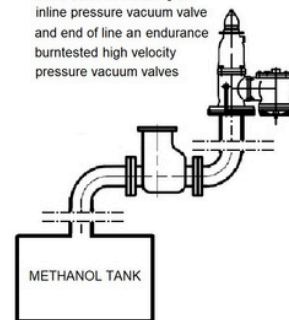
Venting solution 2

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:

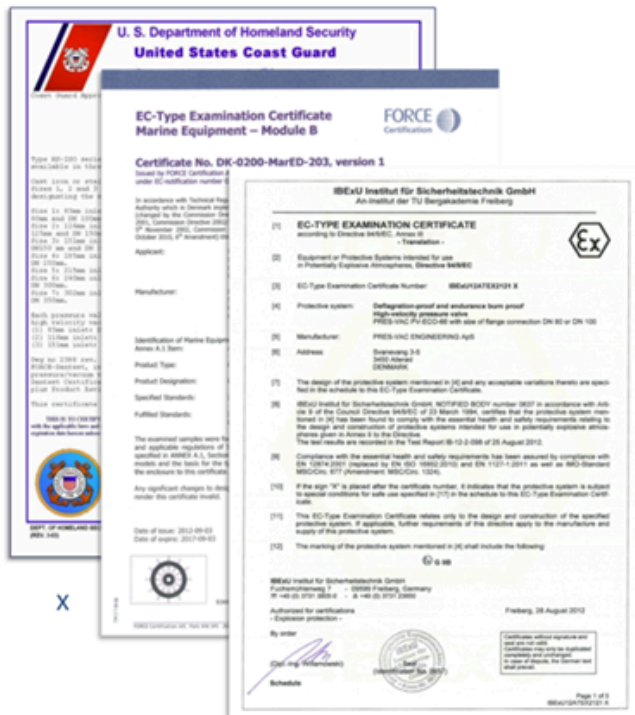
In the specification for a dual fuel venting system, the following equipment requirements should be mentioned. The specification should ensure full compliance with latest rules and regulations, including IMO/MSC/1621, ISO15364:2021, ISO16852:2016, and EU-MED (if EU flag), and should cover all the rules and standards for which the equipment should be tested.[SC1]

- 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.
- If a vapour return system (VECS) is 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.
- Special conditions should be addressed on the vacuum side of the process, assuring that the pressure drop is controlled. 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 must be presented for technical/compliance clarification

Mastering regulations and intensive testing are key competencies in obtaining approvals and becoming a 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		X		
Documentation requirement	X			
Free clearances				
Pressure fluctuations				
Maintenance in-site	X	X		



The high velocity pressure vacuum valves on the market today.

1) A Conventional weight-loaded p/v valve

This type of valve uses the weight of the moving parts, to control the velocity of the gases coming out of the valve at a minimum of 30m/s, as rules require. 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 maximum allowable pressure, with the consequence that the tank will suffer a blow up.

For an oil carrier, this will trigger an alarm every time the ship is loading, alerting security staff at the refinery to decide whether or not to stop the process.

In terms of maintenance, this type of valve can 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, made by 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 gases emitting 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 that allows for the minimum size of piping, a fast blow down releasing very little gas into the atmosphere, and a long-lasting and steady non-oscillating operation.

In terms of maintenance, this can be done by one crew member using the interchangeable pressure/vacuum head.

3) Pure magnet controlled p/v valve

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

In terms of maintenance, this type of valve requires two or three crew members removing the entire valve.

The Type Approval Certificate:


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

- Certification of 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.
- Compliance with methanol/ammonia/alcohol.
- The maximum length and opening setting.
- Methanol belongs to the explosion group IIA, which should be the minimum the valve should be tested for.
- A minimum setting of 20kpa due to the toxicity of methanol and ammonia.
- Compliance with explosion group IIB, MESG = 0,65.
- Certification of the soft/hard seal solution (if required).

The installation also requires the following tests and compliance

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

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


SOLUTION

The ideal solution:

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 reduce 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 suitable for long vent pipe applications, even up to 220 meters.

The valves are designed to perform flawlessly on extra-long vent pipes, due to the combination of weight and magnet, enabling us to adjust the behaviour. Because there is no hammering or oscillation, the weight/magnet combination allows us to optimise the performance to each project (vent-pipe size and length).

In addition:

- The valves have a dual seat arrangement, metal, and soft seal. The soft seal protects the seat and disk and prevents wear and tear. It also makes the valve 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 carry out a FAT (Factory Approval Test), the valves on our test stand before shipping, almost all valves perform without any leakage (please note: we know per experience that small leaks can occur with prolonged use at sea).
- 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.
- With appropriate cleaning, the valve will work flawlessly for a long period of time. This is very important because the valve positions can be difficult to access.

Fully compliant:

- 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

It is also possible to add our Resilient Seal to any of our high velocity valves, to lower the leak rate compared to a metal-to-metal solution.

The seal is made from an NBR, Kalrez or Viton composite material (depending on the purpose and cargo), and is placed in the seat of the pressure unit. The material is non-flammable and suitable for both chemical and oil products.



Why choose our Resilient Seal for your high velocity valves?

- Reduces vapour emissions to almost zero
- Reduces wear and tear on the disk and seat
- Easily replaceable

Getting the vacuum situation under control:

The vacuum valve, designed to compensate for any under-pressure occurring in the venting system, is as important as the pressure valve.

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



The vacuum valve must be able to handle any situation that could bring the venting system in an unwanted under-pressure situation; it should be noted that a conventional vacuum valve of the modulation type can increase the pressure drop when the valve starts opening - this must 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 consisting of a weight as a disk and controlled with a magnet could be the answer. This combination mitigates pressure drop when the valve opens and ensures the valve works flawlessly.

RECOMMENDATIONS

when choosing an end of line solution, it is advisable to look at the environment the cargo is stored under, especially the temperature - this is because the methanol vapour pressure increases with the increase in cargo temperature. This will affect the setting of the valve.

It is also important that the high velocity pressure vacuum valve you choose is suitable for use with alcohol (methanol/ammonia). The Type Approval Certificate should clearly state its compliance.

Additionally, we recommend that the maker confirms its longevity and need for maintenance. This is important as it can be difficult to access the valve once installed.-

The PV-valve should be endurance burn tested and-certified, eventhough the cargo is protected by nitrogen. A resilient seal will also ensure minimum or no leakage.

The Pres-Vac Green ECO-Methanol High Velocity Pressure Vacuum Valve is a suitable solution for meeting these requirements.



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