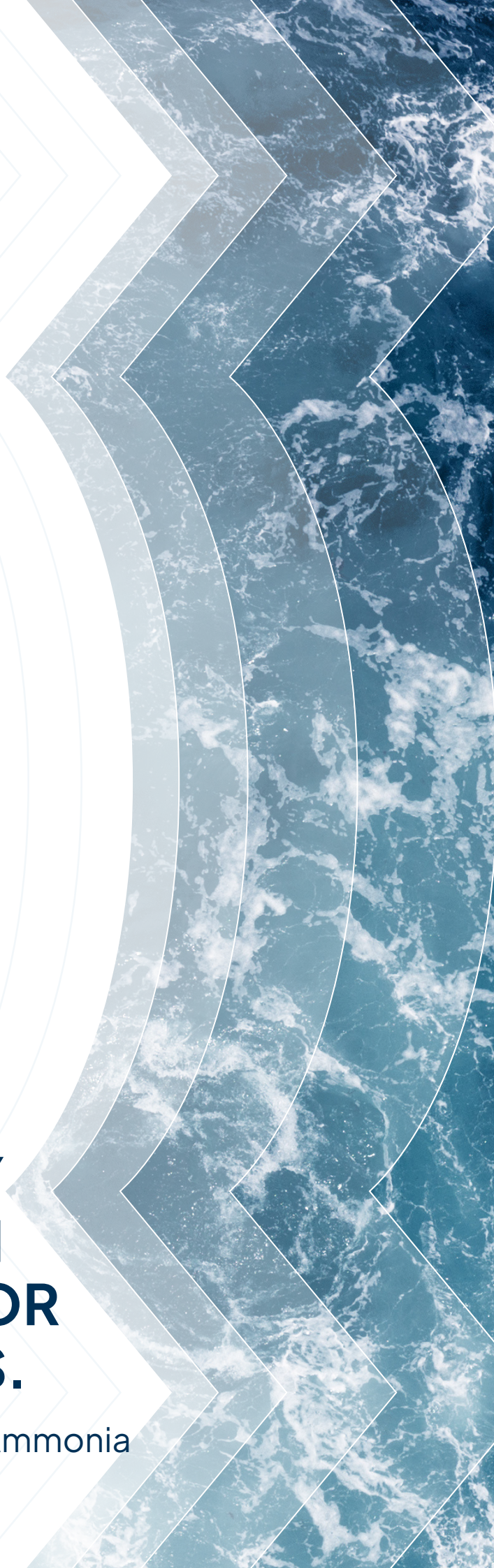
PRES•VAC®

PART OF G&O MARITIME GROUP



THE HIGH VELOCITY PRESSURE VACUUM VALVE DESIGNED FOR DUAL FUELED SHIPS.

PV-ECO / 4100–300 – Methanol /Ammonia



BACKGROUND

The use of methanol or ammonia as fuel presents significant safety and environmental challenges. The PV-ECO/4100–300 pressure-vacuum valve is specifically designed for dual-fuel vessels, particularly where long vent lines are required or where vent outlets are located close to crew and accommodation areas.

The valve provides high-velocity venting, is endurance-burn certified, and complies with IMO, ISO, and ATEX requirements for safe operation in hazardous environments:

IMO/677REV1 - 1009/1324, ISO15364
ISO16852 and ISO 80079–49 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 primary component used in the end-of-line solution is the high-velocity pressure-vacuum valve. Where the valve is installed on a long vent line, it is essential that the high-velocity pressure relief valve located at the outlet of the vent line does not experience any pressure surge above its set opening pressure. This is critical to prevent overpressure within the venting system.

When an end-of-line high-velocity pressure-vacuum valve is installed, no additional protection device is required for the methanol tank.





THE CHALLENGE

The use of methanol and ammonia as fuels presents a number of challenges that must be addressed with safety and environmental protection as the highest priorities.

The pressure-vacuum (PV) valve should be designed to prevent the accumulation of dirt around the seat and disc, while also ensuring that vapour residues do not cause pitting or corrosion of sealing surfaces.

The PV-ECO/4100–300 is designed with a metal-to-metal seat and disc, complemented by a resilient soft seal for enhanced protection and leakage control. This configuration provides an optimum solution for toxic fuels, delivering a high level of safety and protection for both personnel and equipment.

A methanol fuel system typically consists of storage tanks, service tanks and drain tanks, which are generally installed within the engine-room area below deck. In accordance with safety requirements, these tanks are normally surrounded by cofferdams.

The following factors should be carefully considered when determining the appropriate tank venting safety equipment:

The storage temperature of the methanol or ammonia must be established.

Knowledge of the operating temperature is essential for determining the correct vapour pressure and fluid density. In particular, the vapour pressure of methanol increases with temperature. Although ammonia condenses as pressure increases, it behaves in a similar manner to methanol at the temperature and pressure conditions typically encountered on board a vessel.

Consequently, the pressure setting of the valve protecting the methanol or ammonia tank is highly dependent on the temperature at which the fuel is stored.

Due to the toxic nature of both fuels, the safety valve should have a minimum pressure setting of 20 kPa.

Where the vent line is particularly long, typically in excess of 60 metres, the pressure drop within the piping system must be taken into account when selecting the appropriate venting equipment. The PV-ECO/4100–300 is a magnet-controlled, weight-loaded valve that reduces pressure drop by approximately 20% when opening, thereby providing additional allowance for pressure losses within long vent lines. As a result, pressure surges are effectively eliminated during operation.

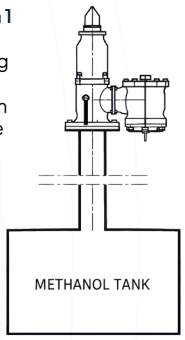
Where the vent line is short, the methanol pressure-vacuum valve is generally installed on a smaller vessel, resulting in the discharge of methanol or ammonia vapours in closer proximity to the crew. In such applications, the valve must be capable of continuously achieving an efflux velocity of at least 60 m/s in order to disperse vapours safely away from crew-occupied areas. The PV-ECO/4100–300 is designed to deliver consistent performance with a continuous efflux velocity exceeding 60 m/s, ensuring that vapours are discharged to a height of approximately 21 metres before the vapour cloud begins to form.

The existing rules, regulations and standards for the venting equipment to be installed on dual fueled venting systems.

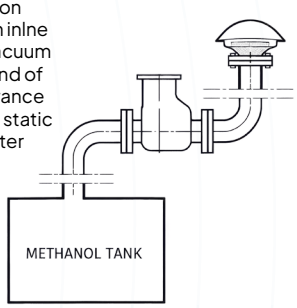
Each Methanol tank whether cargo, service or residual is connected to a vent line where the "Device to prevent the flame" is installed either as an inline configuration or an end of line configuration for complying with IMO/ MSC/ Circular.677 REV01, ISO15364, ISO16852 and IMO/ MSC.1/Circular.1621, dealing with over pressure and under pressure and preventing of flashback. The device installed to protect the tanks needs 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).
6. Oscillation test according to ISO15364:2021.

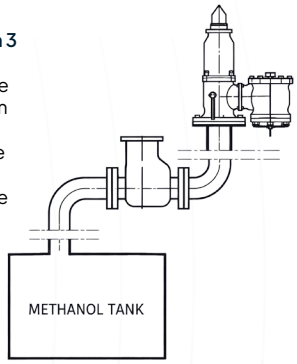
Venting solution 1
End of line solution installing high velocity pressure vaccum valves end of the vent line.



Venting solution 2
Inline solution installing an inlne pressure vacuum valve and end of line a endurance burntested static flame arrester

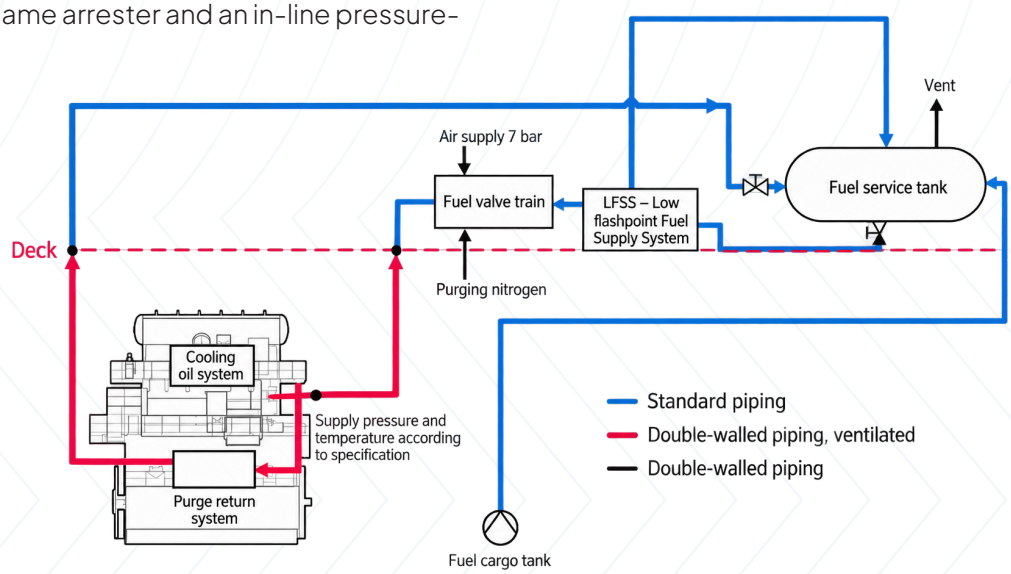


Venting solution 3
Inline solution installing an inline pressure vacuum valve and end of line an enduance burntested high velocity pressure vacuum valves.



The venting system shall, in accordance with the applicable rules and regulations, be equipped with a "Device to prevent the passage of flames". This may comprise either a pressure-vacuum valve or a combination of an endurance-burn-tested deflagration flame arrester and an in-line pressure-vacuum valve.

In addition, gas or cargo vapours covered by IMO MSC/Circ. 677 Rev.1 and having a flash point below 60°C shall be protected by an inert gas system.



MAIN FUNCTIONS & FEATURES

Safety
The PV-ECO/4100–300 valve is designed, tested and manufactured to provide the highest levels of safety for personnel, cargo and the vessel.

The pressure-relief unit is engineered to ensure that the efflux velocity consistently exceeds the minimum requirement of 30 m/s, typically achieving velocities between 60 and 100 m/s. Special variants are available to meet Classification Society requirements for a minimum efflux velocity of 60 m/s, enabling the discharged gas to be projected to a height of up to 21 metres above the valve outlet. This feature is particularly important for methanol or ammonia tank venting systems installed on smaller vessels.

The pressure-unit cone has been optimised to promote vertical vapour dispersion. In combination with the high efflux velocity, this ensures that vapours are safely dispersed away from deck areas and personnel, thereby enhancing operational safety

The PV-ECO/4100–300 valve has been extensively fire tested at the world's leading test laboratory in Germany. Tests which include endurance burn testing and flash-back testing in accordance with all relevant rules.

The resilient seal provides protection against leakage and reduces emissions to virtually zero.



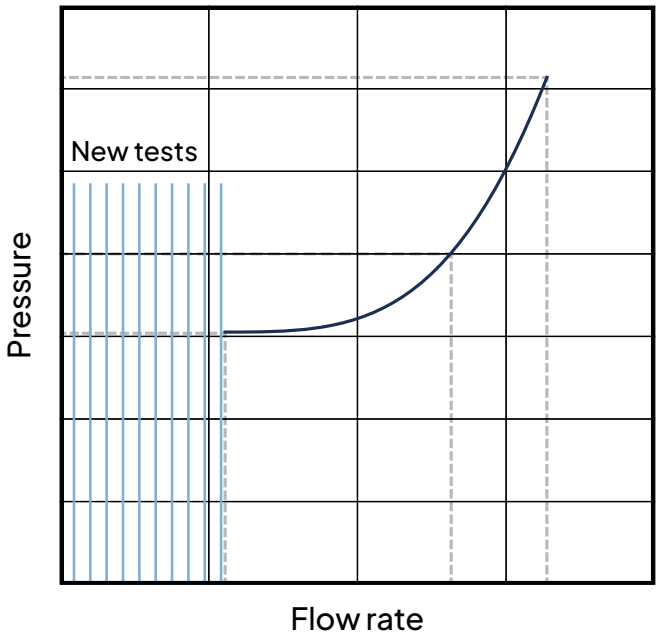




Compliance with rules & regulations

The PV-ECO/4100–300 valve is designed, tested and manufactured in compliance with all current international regulations and is engineered to meet future regulatory requirements wherever applicable.

In 2016, the European Commission adopted EN ISO 16852:2016 as the standard for testing flame arresters installed on board marine vessels. The PV-ECO/4100–300 was the first pressure-vacuum valve on the market to be specifically designed, tested and approved in accordance with this standard.



Pres-Vac is ISO 9001 certified to ensure consistency of the high-quality products that Pres-Vac is known for.

Flashback testing is conducted in accordance with EN ISO 16852:2016. The tests are performed using pipe lengths equal to or greater than the intended installation pipe length, as required by the standard.

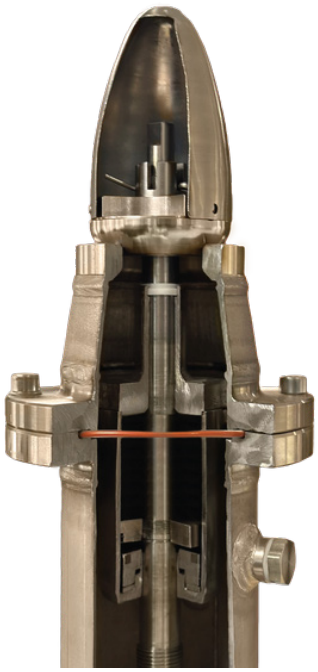
The valve is designed to provide effective vertical vapour dispersion and a high efflux velocity, ensuring the safe discharge of vapours away from personnel and critical vessel areas.

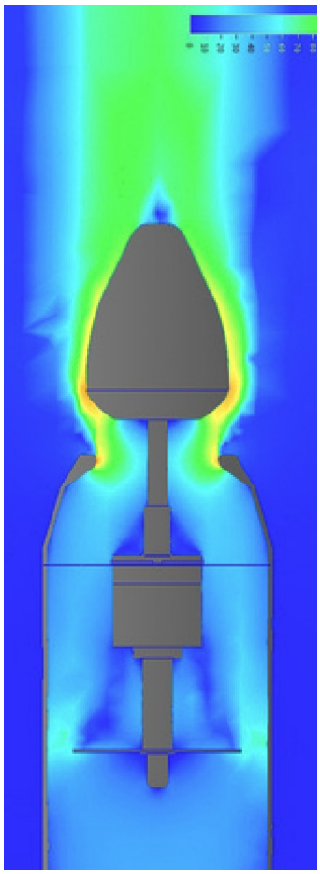
Effective relief of tank pressure
The PV-ECO/4100–300 valve provides effective control and management of tank pressure. If the tank pressure exceeds the specified set pressure, the valve opens immediately to relieve the excess pressure. Similarly, if the pressure falls below the specified vacuum setting during discharge operations, the valve opens to admit air or inert gas and prevent excessive vacuum conditions. The advanced flow-control design of the PV-ECO/4100–300 ensures stable and reliable pressure management under all operating conditions.

The pressure-relief valve is controlled by a combination of magnetic and weight-loaded forces, ensuring that no pressure surge occurs during valve opening.

A patented combination of a booster plate and pressure-control ring provides smooth opening and closing characteristics, ensuring efficient operation even at low flow rates.

An integrated patented damper ensures nonhammering and non-oscillating operation, even when installed on very long vent lines.





Optimised closing pressure
The patented flow-control system incorporated within the PV-ECO/4100–300 valve ensures an optimised closing pressure, thereby reducing blowdown losses resulting from pressure drop within the venting system. This minimises the loss of inert gas and cargo vapours compared with conventional pressure-vacuum valves.

For installations with very long vent lines, a configuration often found on large container vessels, it is essential that the valve is designed to close at the highest possible pressure. This ensures that the inert gas system is activated only after the valve has fully closed, thereby improving operational efficiency and reducing unnecessary consumption of inert gas.

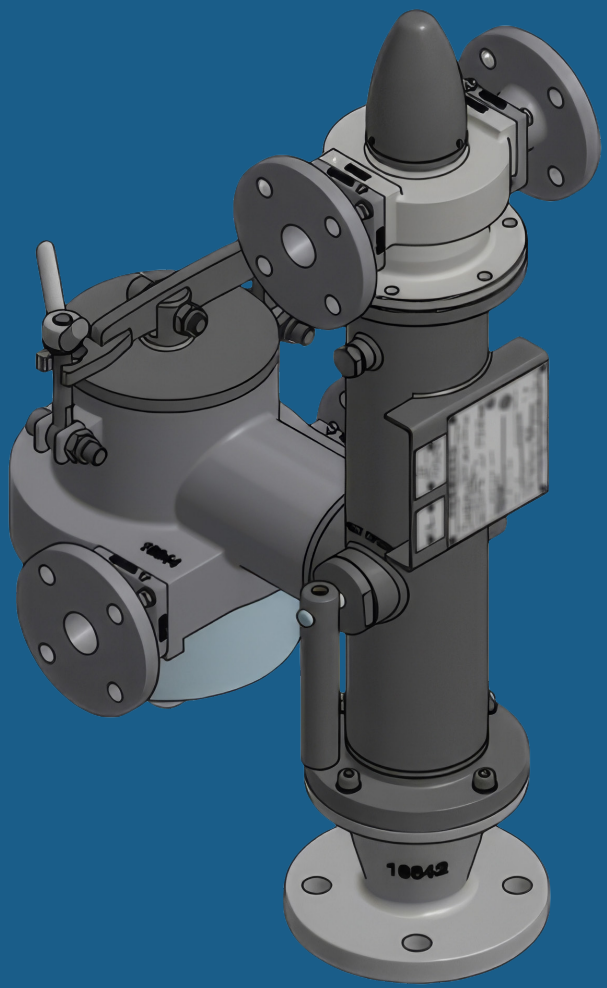
Low noise level
Through optimisation of the nozzle design, the noise level generated by the PV-ECO/4100–300 has been reduced by 10 to 15 dB compared with conventional valve designs. As a result, hearing protection may not be required in many applications, depending on the operating conditions and applicable site regulations.

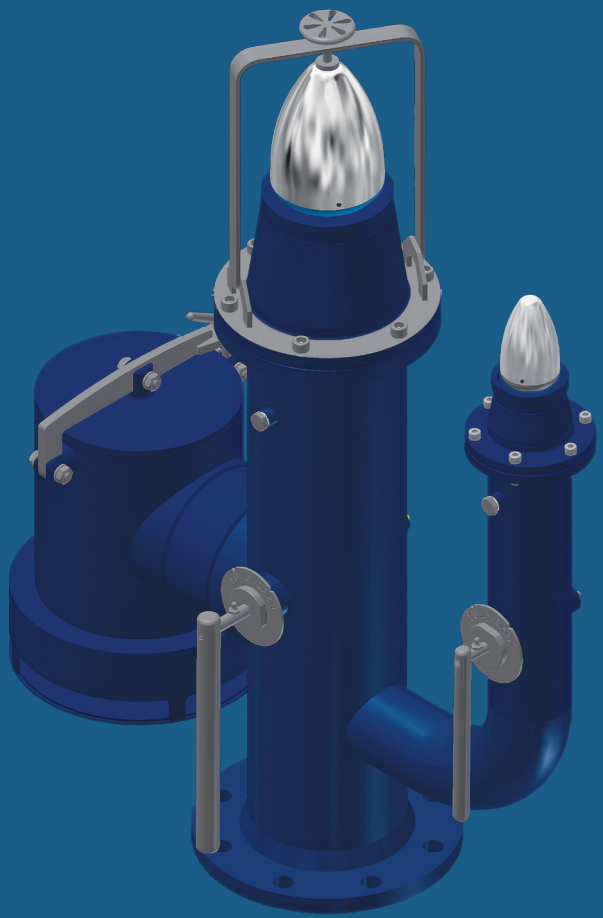
The advanced flow-control technology incorporates a noise-reduced design, enabling the valve to operate at high flow rates without generating the excessive noise typically associated with conventional pressure-vacuum valves.

Additional features

The PV-ECO/4100–300 valve has been designed to simplify maintenance and reduce lifecycle costs through the following features:

- The number of components has been reduced by 30%, resulting in a simpler design that is easy to dismantle, inspect and maintain.
- The valve is engineered to minimise maintenance requirements while ensuring reliable and consistent performance, particularly when installed in locations that are difficult to access.
- The overall weight of the valve is reduced compared with the standard ECO valve, facilitating easier handling and installation.
- The check-lift system can be inspected and maintained without dismantling the valve.
- Valve set pressure can be easily recalibrated following an overhaul, typically required after approximately five years of service.
- Most maintenance activities can be carried out on board by the vessel's crew, with the majority of work being performed in situ.

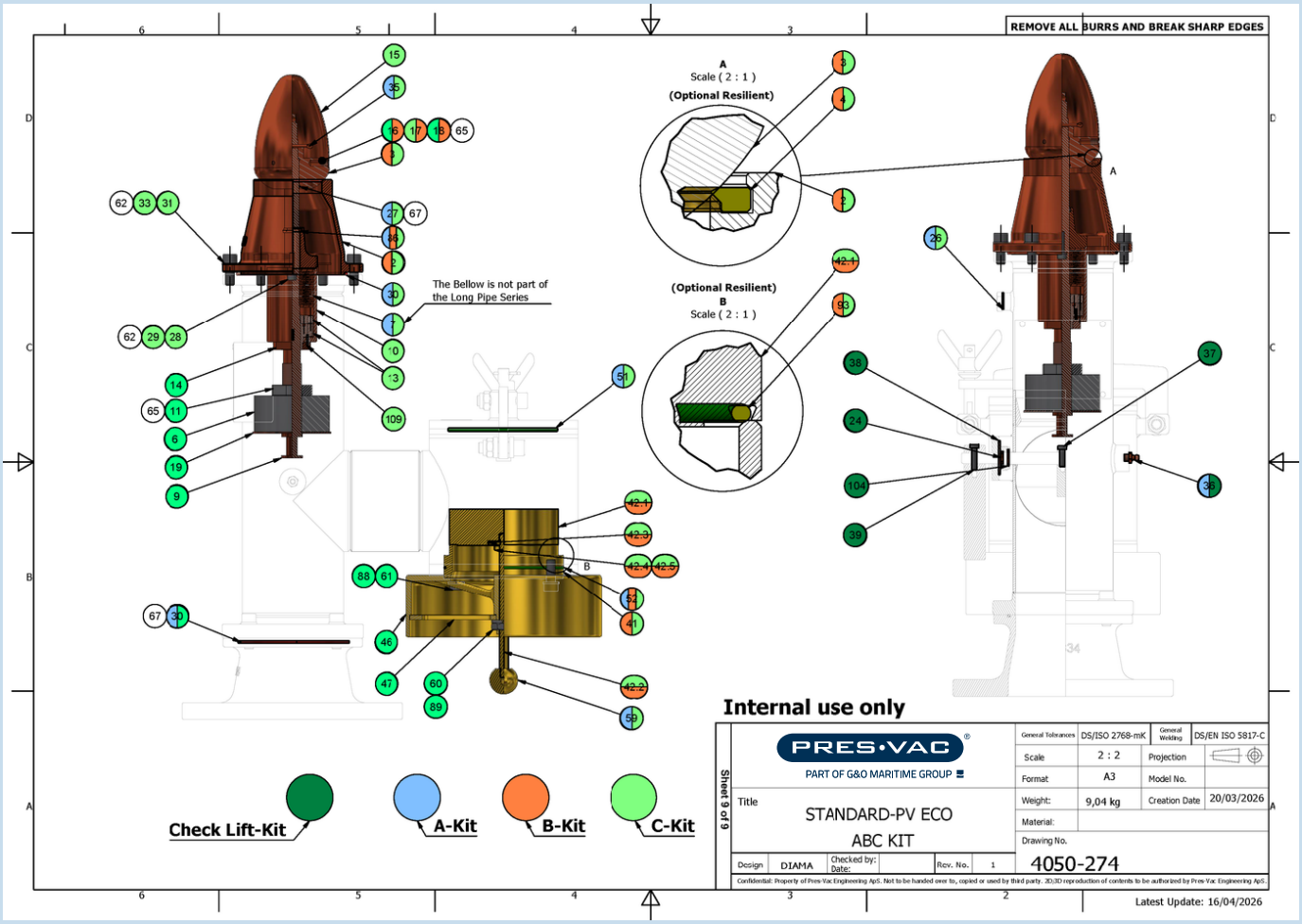




Operations and Mainteance made simple
The PV-ECO/4100–300 valve has been designed to simplify operation and maintenance.

Operations by the crew are made simple by the following features:

- New two-way operating full stroke check lift
- Visual inspection of all moving parts
- Dirt indicator
- Hinged type gas freeing cover



DESIGN

Optimized nozzle design
Reduces noise and provides high gas dispersion.

Stainless steel housing and parts
Simple, chemical-resistant and rigid design.

Integrated resilient seal
Zero leakage with replaceable resilient seal.

Booster plate / pressure control ring
Part of the advanced flow management system.

Setting calibration
Easy calibration of settings after overhaul.

Full open mark
Indicates when the valve is 100% open.

Hinged type gas freeing cover
Ensures quick and safe gas freeing operation.

Enclosure
Protects the magnet and dampener from environmental exposure.

Visual inspection of disc/seat
Allows simple inspection for maintenance.

Dirt indicator
Enables easy checking for valve fouling.

Dampener
Provides stable and reliable valve operation.



Custom Configuration & Options

The PV-ECO/4100–300 valve is individually configured to meet the specific requirements of each customer. When used for methanol or ammonia venting applications, different vessel designs may require different pressure and vacuum valve configurations. Variations in vessel layout and piping arrangements often result in different requirements for valve settings, flange sizes and flange standards.

In some applications, the valve may be installed on vent lines exceeding 100 metres in length, and in certain cases even longer. In others, it may be fitted to smaller vessels, where achieving a high efflux velocity is essential to ensure that vapours are discharged well above the vessel, thereby protecting crew and surrounding areas.

The PV-ECO/4100–300 is specifically designed, tested and certified for methanol and ammonia venting applications, ensuring full compliance with applicable regulatory and classification society requirements.

The pressure and vacuum functions can be freely combined to provide the configuration best suited to the operational requirements of the vessel. All configurations are available with a range of flange sizes and can be supplied in accordance with all major flange standards.

- Integrated gas freeing cover
- Wlectric, steam or thermal heating
- High-set pressure dual valve

Custom solutions and special requirements can be delivered upon request

Option: Integrated gas freeing cover
The integrated gas-freeing cover is mounted on top of the vacuum valve and can be operated easily without the use of tools.

The cover has been designed to maximise the release of vapour, providing the highest possible discharge capacity permitted by the vent pipe dimensions.





Customer benefits

Maximum safety for crew, vessel and cargo
- High vertical gas dispersion
- Low noise
- Extensively tested by independent test laboratory
- Integrated leakage protection

Compliance with all current and foreseen regulations
- No risk of non-compliance
- Complies with the latest European standard for fire testing

Designed for your needs
- The valves can be optimized to effectively meet your venting requirements.

Excellent operational performance
- The combination of weight and magnetic force protects against pressure surges and secures high closing-pressure.
- Leakage protection ensures maximum safety, minimizes loss of inert gas and cargo vapour.

Low maintenance costs
- Modular design of the valve makes replacement of wear parts and spare parts simple.
- Lifetime availability of spare parts and global network of service centers.

Emission Reduction
- High closing pressure



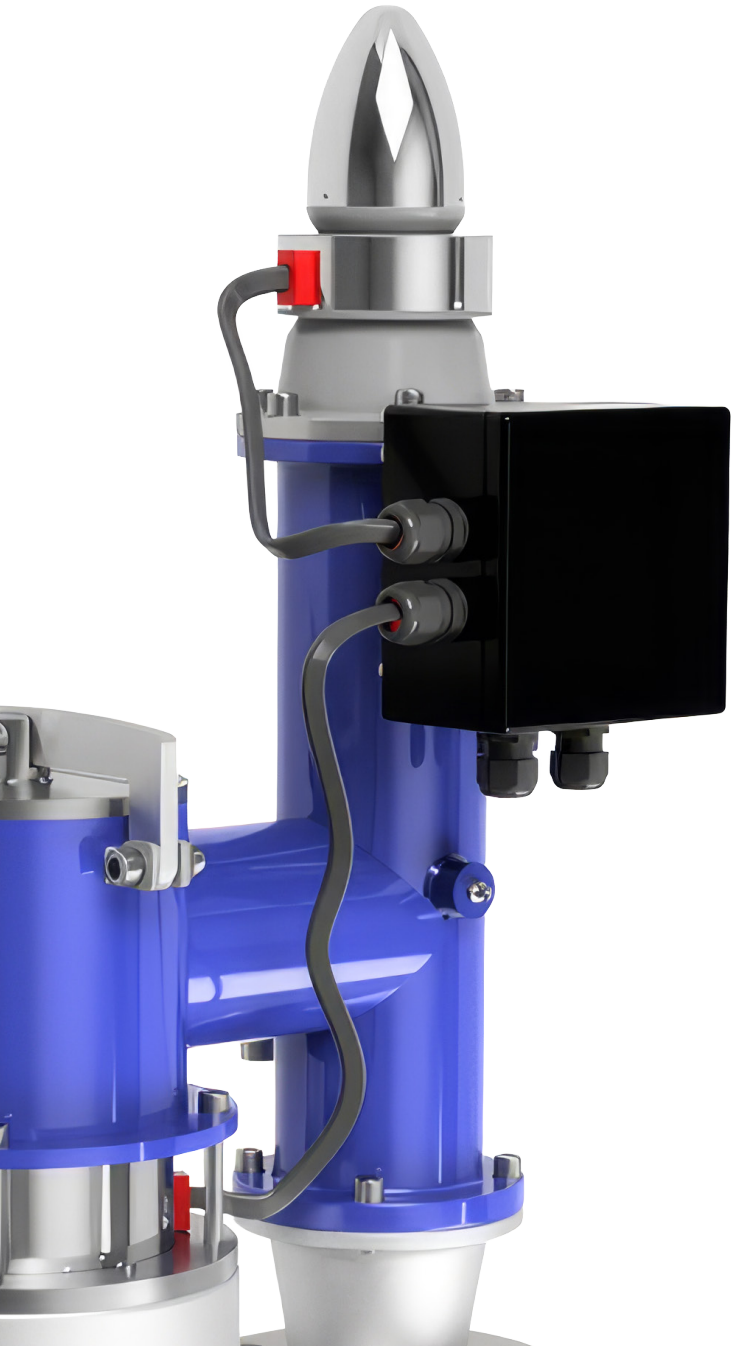


Option:

Compliance with OCIMF 10% statement concerning pressure and vacuum in the vent system

The pressure-relief valve is designed to comply with OCIMF requirements, limiting pressure rise to a maximum of 10% above the set pressure. The valve design prevents additional pressure surges within the venting system during operation.

The vacuum-relief valve is designed to minimise vacuum levels below the set pressure in accordance with OCIMF recommendations. Two configurations are available: one featuring a vacuum-boosting function and another incorporating a magnet-and-weight control system to optimise valve performance.



Optional electric, steam or thermal heating systems:

The pressure and vacuum units can be fitted with heating systems to prevent ice formation and ensure reliable valve operation under adverse environmental conditions.

Heating can also be used when handling cargoes with a high pour point, preventing crystallisation by maintaining the valve and associated components at an appropriate operating temperature. Ice accretion may occur during heavy seas or freezing rain when surface temperatures are at or below freezing. The accumulation of ice can impair valve operation and prevent the device from functioning correctly.

PV-ECO/4100-300: The Ultimate Version

The PV-ECO/4100-300 valve is available in two configurations: PV-ECO/4100-300, designed for installations with extended vent lines, and PV-ECO, designed for shorter vent lines requiring enhanced efflux velocity. The most suitable configuration should be selected based on the vessel's design and operating requirements.

The PV-ECO/4100-300 Ultimate incorporates all key features required for demanding methanol and ammonia venting applications, including:

- Seat with integrated resilient seal
  - ▷ Provides superior leakage protection while significantly reducing wear on both the disc and seat.
- Flame-arrester elements manufactured from AISI 316L stainless steel
  - ▷ Reduces wear from highly corrosive cargoes and extends maintenance intervals through the use of AISI 316L stainless steel flame screens.

SAFETY & COMPLIANCE

Class authorities & Quality Assurance
The equipment supplied is approved by our notified body and recognised by all major classification societies. It also complies with applicable European inland waterway regulations and Russian inland waterway requirements.

Pres-Vac Engineering ApS operates a quality management system certified to ISO 9001:2015 and audited by FORCE. Further details are available upon request.

In addition, the equipment complies with ATEX requirements for onshore installations and offshore applications, including FPSOs, and is designed to meet relevant NORSOK requirements where applicable.

Approval certificates are included within the scope of supply. Test certificates and material certificates can be provided upon request and at additional cost, provided these requirements are specified in the project documentation and purchase specification.

The suitability of a pressure-vacuum valve for a particular application shall be determined by the purchaser based on the Product Review Document, which provides a detailed description of the valve and demonstrates compliance with the requirements of ISO 15364:2021.

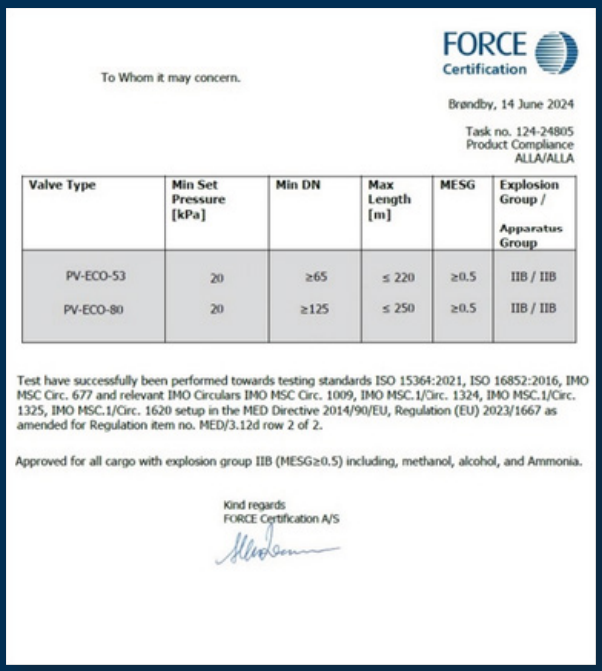
Regulatory Updates
The equipment is designed and manufactured to comply with all applicable mandatory regulations and recognised industry standards relevant to the vessel and its intended service.

Key regulatory developments include:
IMO MEPC.2/Circ.19 (17 December 2013), incorporating the latest provisional categorisation of liquid substances and amendments to Chapter 17 of the IBC Code.

SOLAS Chapter II-1, Regulation 3–12 and the Noise Code (effective 1 July 2014), introducing mandatory noise measurements during sea trials and establishing maximum permissible noise levels.

Marine Equipment Directive (MED) 2014/90/EU and subsequent amendments, including Regulation (EU) 2024/1975.

Adoption of EN ISO 16852, introducing enhanced flame-arrester testing requirements, including mandatory testing at low flow rates. These requirements address previously identified safety gaps and provide a more comprehensive assessment of flame-arresting performance under operational conditions.



FORCE Certification

To Whom it may concern.

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

Patent Protection & Product Reliability
The equipment offered incorporates patented technology and is supplied free from any known third-party intellectual property claims against the shipyard, vessel owner or operator.

The non-hammering and non-oscillating pressure-vacuum valves are protected by patent rights. Furthermore, the equipment is supported by comprehensive worldwide product liability insurance covering both design and manufacturing activities.

International Marine Regulations and Compliance
The marine industry is governed by regulations issued by the International Maritime Organization (IMO), national authorities and the leading classification societies.

To ensure compliance with these requirements, the PV-ECO/4100–300 valve is subjected to extensive testing and verification programmes. The valve is designed, tested and certified to meet the industry's stringent requirements for safety, reliability and operational performance.

PV-ECO/4100–300 complies with all design and test requirements of:

- IMO MSC/Circ. 677–REV01
- IMO MSC.1/Circ.1621
- EN ISO 16852: 2016
- ISO 15364, 2021
- EN 12874:2001
- ISO 28300/API 2000
- ISO 80079–36:2016
- ISO 80079–37:2016
- IMO/Polar Code
- OCIMF
- API 2000
- ADN
- USCG

Adoption of EN ISO 16852, introducing enhanced flame-arrester testing requirements, including mandatory testing at low flow rates. These requirements address previously identified safety gaps and provide a more comprehensive assessment of flame-arresting performance under operational conditions.




NO SMOKING
SAFETY FIRST

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At G&O Maritime Group we enable our customers during the green transition in the maritime industry