

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Ball Valve**

with type designation(s)

Cryogenic Ball Valves -CP Series, Cryogenic Ball Valves - CN Series

Issued to

**PBM, Inc.
Irwin, PA, USA**

is found to comply with

DNV GL rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers**DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems****DNV GL class programme DNVGL-CP-0186 – Type approval – Valves****Application :****Products approved by this certificate are accepted for installation on all vessels classed by DNV GL.**

Type:	Temperature range:	Max. working press.:	Sizes:
Cryogenic Ball Valves -CP Series	-165°C to +80°C	15 bar	DN 1/2" - 2"
Cryogenic Ball Valves - CN Series	-165°C to +80°C	15 bar	DN 1/2" - 3"

Issued at **Hamburg** on **2019-10-14**This Certificate is valid until **2024-10-13**.for **DNV GL**DNV GL local station: **Houston**Approval Engineer: **Guido Friederich**

Olaf Drews
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.



Product description

Stainless steel ball valves approved for the use in ships machinery piping, fuel systems and cargo handling piping systems.

Valves actuators including additional accessories and mounting parts (positioner, limit switches) are not covered within this type approval.

Ball valve design

Valve end connections according to ANSI Class 150 / ASME B16.34

- Flanges
- Butt welded ends
- Female NPT/BSPT ¹

Minimum design temperature: -165°C (-196 °C) ²

Maximum design temperature: + 80°C

Materials

Valve item	Material	Additional description
Valve body	ASTM A 479 316	Stainless steel
Bonnet	ASTM A 479 316	Stainless steel
Ball	ASTM A 276 316L	Stainless steel
Seat	V-TEF	Modified PTFE, testing acc. USP 88 Class VI
Stem	ASTM A 564 S17400	Stainless steel

Material certification

Material certificates for cryogenic valves shall provide material properties for the relevant minimum design and test temperature, in particular charpy impact test results according to

DNV GL Rules Pt. 5 Ch. 7 – Liquefied gas tankers, Section 6 – Materials of construction, quality control and marking.

Materials for fabrication of pressure retaining valve items such as valve body and bonnet shall be supplied by DNV GL Approved Material Manufacturers.

Application

Operating media include flammable gases, nitrogen and cryogenic liquefied gases including LNG.

Limitation

Note 1

Ball valve type series with threaded connections are NOT permitted for installation in LNG/LPG systems on board of DNV GL classed liquefied gas tankers and in ship's LNG and gas fuel systems.

For valves to be installed on board of ships the following limitations apply:

Valves for installation in systems operating with flammable gases are to be classed within Pipe Class I, see DNV GL Rules Pt. 4 Ch. 6 - Piping systems.

Threaded joints may be used for outside diameters as stated below except for piping systems conveying toxic or flammable media or services where fatigue, severe erosion or crevice corrosion is expected to occur.

- Threaded joints in CO₂ systems shall be allowed only inside protected spaces and in CO₂ cylinder rooms
- Threaded joints with tapered thread shall be allowed for pipe class I, outside diameter not more than 33,7 mm.
- Pipe Class II and Class III outside diameter not more than 60,3 mm.
- Threaded joints with parallel thread shall be allowed for Pipe class III, outside diameter not more than 60.3 mm.

See DNV GL Rules Pt. 5 Ch.7 – Liquefied gas tankers, Section 5- Process pressure vessels and liquids, vapour and pressure piping systems, Item 8 – Piping fabrication and joining details.

See also requirements provided in the IGC Code, Chapter 5 - Item [5.8] and IGF Code [7.3.6]

Note 2

If the type approved ball valves are intended for use and installation on board of a vessel with a cargo and/or media temperature below -165°C, the requirements for design temperatures below -165°C shall be specially agreed with the flag state administration.

Tests carried out

Test standards	DNV GL Pt.5 Ch. 7 – Liquefied gas tankers ASME B16.34 DNV GL CP 0186 - Valves	Test pressure [bar g]
Type of test		
Hydrostatic pressure test		1,5 times the design pressure
Seat and stem tightness test		1,1 times the design pressure
Cryogenic tightness tests using liquid nitrogen at -196 °C		
Cryogenic functional test		Design / working pressure

Production testing

- I. Application for Liquefied gas tankers
1. Certification of valves [DN $\geq$ 100 or Working temperature $< -55^{\circ}\text{C}$]
For all valves having a nominal Diameter DN $\geq$ 100 or a working temperature below -55°C a product certificate has to be issued by DNV GL based on the following scope of tests and according to:
DNV GL Rules Part 5, Chapter 7 – Liquefied gas tankers, Section 5, Item 13.1

<u>Type of test</u>	<u>Test pressure</u>
Shell strength	1,5 times the design pressure
Seat and stem tightness test	1,1 times the design pressure
Functional test	Design / work pressure

Pt. 5 Ch. 7, Section 1, Table 7 – Certification of components

<u>DN $\geq$ 100 or Working temperature $< -55^{\circ}\text{C}$</u>	<u>Type of certificate / Issued by</u> VL Certificate / DNV GL
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2. Additional cryogenic testing – 10 % of the batch
In addition, cryogenic testing consisting of valve operation and leakage verification for a minimum of 10% of each type and size of valve intended to be used at a working temperature below -55°C shall be carried out.
3. Material certification of valves working temperature $< -55^{\circ}\text{C}$
DNV GL Rules Part 5, Chapter 7 – Liquefied gas tankers

Pt. 5 Ch. 7, Section 1, Table 8 – Certification of material quality and testing Material certificates of valve bodies

<u>Valve nominal diameter</u>	<u>Type of Certificate / Issued by</u>
DN $>$ 100	VL Certificate / DNV GL
DN $\leq$ 100	W Works Certificate / Manufacturer

4. Certification of valves [Working temperature $\geq -55^{\circ}\text{C}$]
For all valves intended for use at a working temperature $\geq -55^{\circ}\text{C}$ a works certificate has to be issued based on the tests listed above and according to
DNV GL Rules Part 5, Chapter 7 – Liquefied gas tankers, Section 1 – Table 7

<u>Valve nominal size</u>	<u>Type of certificate / Issued by</u>
DN $<$ 100 mm	W Works Certificate / Manufacturer

Production testing - continuation

II Application in machinery piping systems

For valves intended to be installed in piping system listed in DNVGL Rules Pt.4, Ch.6 – Section 1 shall be certified according to DNV GL Rules Pt.4 Ch.6 – Piping systems, Section 9

Valve nominal size / Pressure rating

DN > 100 mm / PN > 16 bar

DN ≤ 100 mm / PN ≤ 16 bar

Ship side valves DN > 100 mm
regardless of pressure rating

Type of certificate / Issued by

VL Certificate / DNV GL

W Works Certificate / Manufacturer

VL Certificate / DNV GL

Material certificates (valve bodies)

In accordance with DNV GL Rules Pt.4 Ch.6 – Piping systems, Section 2 – Table 3

Marking of product

Each valve shall be clearly marked for identification. The identification marking may be performed on the body or on a plate of non-corrosive material. When a metallic plate is used, the plate shall be permanently fixed to the body.

Identification marking on the body shall be located to non stressed areas and shall be clearly legible.

The identification marking shall as a minimum include the following:

- Manufacturers name or trade mark
- Valve type designation
- Size
- Maximum design pressure and temperature
- Arrow to indicate direction of flow on one way flow valves

Type Approval documentation

Periodical assessment

For retention of the Type Approval, a DNV GL Surveyor shall perform periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the Type Approval are complied with. Refer to DNVGL-CP-0338, Sec.4.

This certificate is only valid if required periodical assessments are carried out with satisfactory results. To check the validity of this certificate, please look it up in <https://approvalfinder.dnvgl.com>

End of Certificate