

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Check Valve

with type designation(s)
803108

Issued to

Graco High Pressure Equipment Inc
Erie, PA, USA

is found to comply with

DNV rules for classification – Ships Pt.6 Ch.2 Sec.5 Gas fuelled ship installations – Gas fuelled LNG
DNV rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers
DNV rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV class programme DNV-CP-0186 – Type approval – Valves

Application :

Products approved by this certificate are accepted for installation on all vessels classed by DNV.

Temperature range: -165°C to +38°C
Max. working press.: 517 bar (7500 psi)
Sizes: DN 3/4"

Issued at **Hamburg** on **2022-07-15**

This Certificate is valid until **2027-07-14**.

for **DNV**

DNV local station: **Certification & Inspection Services**

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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Product description

Check valve designed with high pressure rating and for cryogenic applications. The check valve is approved for installation in instrumentation and control lines for fluid pressure control in one-way flow direction. The check valve design meets a test temperature of -196°C.

Valve type (GRACO Product Numbers)	Nominal size (DN / inch)	Design Pressure ² Bar (PSI)	Design temperature ² [°C]
Check valve 803108	3/4"	517 (7500)	-165° to +38°

Materials¹

Item	Material type / Material standard
Valve cover	ASTM A276 316 CNDS
Valve body	ASTM A276 316 CNDA
Seal ring	ASTM A276 316 CNDS
Ball, ball support, spring	ASTM A276 316

Note ¹

Materials for fabrication of pressure retaining valve items such as valve body and bonnet shall be supplied by DNV Approved Material Manufacturers. Material properties shall comply with requirements specified in DNV Rules Materials & Welding Pt.2 Ch. 1 to Ch. 4.

Valves scheduled for gas fuelled ship installations subjected to the IGF Code and having a design temperature below 0°C shall be provided with a material certificate issued by DNV. See DNV Rules Pt.6 Ch.5, Section 5 – Table 4 – Certification of material quality and testing.

Application

Check valve approved for installation in instrumentation and control lines, e.g., for control of pressure in one-way flow direction, in ship's machinery piping systems, pressure vessels, fuel systems and cargo piping systems.

Operating media may include:

Air, gaseous and liquid nitrogen, flammable and non-flammable gas, cryogenic liquefied gas (LNG)

Note ²

For maximum allowable working pressure at ambient and elevated temperatures see ASME B31.3 as appropriate.

Limitation

Check valve is not approved for liquid and gaseous hydrogen

Type Approval documentation

Tests carried out

Test standards:

DNV Pt. 5 Ch. 7 Liquefied Gas Tankers
DNV Rules Pt.4 Ch.6 – Piping systems
DNV CP-0186 - Valves

Valve test	Purpose
Pressure test	Minimum test pressure = 1,5 times the design pressure Pressure test at room temperature
Seat tightness test	Ambient temperature, Duration 5 minutes Reverse flow direction Test pressure 569 bar (8250 psi) Leakage rate: 0 leakage
Seat tightness test	Cryogenic test temperature, -196°C, Duration 5 minutes Reverse flow direction Test pressure 569 bar (8250 psi) Leakage rate: 3333 mm3
Valve leakage pressure test	Cryogenic test temperature, -196°C, Duration 5 minutes Normal flow direction Test pressure 569 bar (8250 psi) Leakage rate:0

Production testing and valve certification

I. Application in Gas as fuel systems

For each valve intended to be installed in ship's gas fuel supply systems a Product Certificate (PC) is to be issued based on the following scope of tests and according to
DNV Rules Part 6, Chapter 2, Section 5 – Gas fuelled ship installations – Gas fuelled

Type of test	Test pressure
Shell strength	1,5 times the design pressure
Tightness test of pressure bearing housing	1,1 times the design pressure
Seat tightness test	1,1 times the design pressure
Functional test	Design / work pressure

Valves in LNG / Gas fuel system – Table 3 Certification required

<u>Valve design conditions - Test and certification</u>	<u>Type of certificate / Issued by</u>
Design temperature < 0°C / DNV Rules Pt.5 Ch.7 irrespective of size	VL Certificate / DNV
Design pressure > 10 bar/ DNV Rules Pt.5 Ch.7 irrespective of size	VL Certificate / DNV
Design pressure ≤ 10 bar Design temperature ≥ 0°C	Works certificate / Manufacturer

Material certificates

DNV Rules Pt. 6 Ch.2 Section 5 – Gas fuelled ship installations
Table 4 Certification of material quality and testing

Design temperature	<u>Type of certificate / Issued by</u>
< 0°C	VL Certificate / DNV
≥ 0°C	W Works Certificate / Manufacturer

Production testing and valve certification - continuation

II. 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 (PC) shall be issued by DNV based on the following scope of tests and according to: DNV Rules Part 5, Chapter 7 – Liquefied gas tankers, Section 5, Item 13.1.2

<u>Type of test</u>	<u>Test pressure</u>
Hydrostatic pressure test	1,5 times the design pressure
Tightness test of pressure bearing housing	1,1 times the design pressure
Seat tightness test	1,1 times the design pressure
Functional test	Design / work pressure

DNV Rules 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

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 Rules Part 5, Chapter 7 – Liquefied gas tankers

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

<u>Valve nominal diameter DN $\leq$ 100</u>	<u>Type of Certificate / Issued by</u>
	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 shall be issued based on the tests listed above and according to DNV GL Rules Part 5, Chapter 7 – Liquefied gas tankers, Section 1

<u>Valve nominal size DN $<$ 100 mm</u>	<u>Type of certificate / Issued by</u>
Material certificates (valve bodies)	W Works Certificate / Manufacturer
W Works Certificate, issued by Manufacturer	

III. Application in ship machinery piping systems

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

Valve test: | Hydrostatic pressure test, test pressure in amount of 1,5 times the design pressure

Material certificates (Valve bodies) | In accordance with DNV Rules Pt.4 Ch.6 – Piping systems, Section 2 – Table 3

Valve certification | Valve to be certified with a Product Declaration (PD) issued by manufacturer

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:

- Manufacturer's name or trademark
- Valve type designation
- Size
- Maximum design pressure and temperature
- Arrow to indicate direction of flow on one-way flow valves

Periodical assessment

A condition for retention of the Type Approval Certificate in its validity period is that periodical assessments are successfully carried out.

For retention of the Type Approval, a DNV 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 DNV-CP-0338, Sec.4.

END OF CERTIFICATE