

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Safety Relief Valve for LNG/LPG Service**with type designation(s)
PSL-MD

Issued to

Fukui Seisakusho Co., Ltd.
Hirakata-city, Osaka-pref, Japan

is found to comply with

DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV GL rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers
DNV GL class programme DNVGL-CP-0186 – Type approval – Valves**Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****K. factor:** See certificate
Temperature range: -196°C to 125°C
Max. working press.: 2.5 barThis Certificate is valid until **2020-12-31**.Issued at **Høvik** on **2016-08-10**DNV GL local station: **Kobe**for **DNV GL**Approval Engineer: **Zeinab Sharifi**

Marianne Spæren Marveng
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

Angled type safety relief valves operated by pilot valves.

Sizes:

Group I: 2"x3" and 4"x6"
Group II: 3"x4", 6"x8" and 12"x16"
Group III: 8"x10", 10"x12" and 14"x18"
Group IV: 2"x2", 3"x 3", 4"x4", 6"x6", 8"x8" and 10"x10"

Valve types and materials:

Valve type	Material specifications for different parts		
	Body, bonnet	Disc, seat, flange, diaphragm	Seal, gasket
PSL-MD-Pilot	A351-CF8M	SUS 316	Teflon, NBR
PSL-MD()2	A351-CF8M, A216, A352 or equivalent	SUS 316, SUS304 or equivalent	Teflon
PSL-MD()3			
PSL-MD()4			

ASME VIII coefficient of discharge PSL-MD()3 and PSL-MD()4 type:

Group	K_d (sonic flow)	K_d (subsonic flow)
I	0,935	$-0,171 \times (P_2/P_1) + 1,032$
II		$-0,120 \times (P_2/P_1) + 1,011$ when $P_2/P_1 \leq 0,847$ $-0,714 \times (P_2/P_1) + 1,514$ when $P_2/P_1 > 0,847$
III		$-0,200 \times (P_2/P_1) + 1,051$
IV	0,746	0,746

ASME VIII coefficient of discharge PSL-MD()2 type:

Group	K_d (sonic flow)	K_d (subsonic flow)
I	0,843	$-0,167 \times (P_2/P_1) + 0,936$
II	0,843	$-0,255 \times (P_2/P_1) + 0,992$
III	0,843	$-0,255 \times (P_2/P_1) + 0,950$
IV	-	$-0,0925 \times (P_2/P_1) + 0,7574$

P1 – absolute inlet pressure of safety relief valve

P2 – absolute outlet pressure of safety relief valve

Application/Limitation

Maximum pressure relief setting: 2.5 bar.

The minimum design pressure of pressure relief valve discharge lines shall not be less than the lower of 0.5 MPa, or 10 times the relief valve set pressure. (ref. to DNV GL ship rules Pt.5 Ch.7 Sec.5 [4.1.1])

DNV GL Surveyor must be given permission to survey the manufacturing premises, production and inspection routines at any time during the validity period of this certificate.

Production tests

Valves covered by this certificate shall be subject to product tests in presence of a DNV GL surveyor as below (Reference is made to DNV GL ship rules Pt.5 Ch.7 Sec.8 [2.2.2]):

- Hydrostatic test of the valve body at a pressure equal to 1.5 times the design pressure for all valves.
- Test of set pressure at ambient temperature. Surveyor shall ensure that it opens at the prescribed pressure setting, with an allowance not exceeding $\pm 10\%$ for 0 to 0.15 MPa, $\pm 6\%$ for 0.15 to 0.3 MPa, $\pm 3\%$ for 0.3 MPa and above
- Leak test (seat tightness) after reset at 90% of each set pressure at room temperature.
- Sufficient valve capacity is to be approved for each application.

Certification

Each valve is to be certified by a DNV GL surveyor and shall be set and sealed in the presence of a surveyor, and recorded by a sealing certificate, including the valves' set pressure, shall be retained on board the ship. The set pressure shall be sealed by the use of a robust non-corrosive wire. (Ref. DNV GL ship rules Pt.5 Ch.7 Sec.8 [2.2.3])

Material of the body shall have material certificate as below (Reference is made to DNV GL ship rules Pt.5 Ch.7 Sec.1 Table 8)

- Work certificate When the minimum design temperature is greater than -55°C
- Work certificate When the minimum design temperature is less than -55°C
And sizes smaller than DN100.
- VL certificate When the minimum design temperature is less than -55°C
And sizes greater than or equal to DN100.

Material of body shall be made by works approved by the Society.

Type Approval documentation

Updated technical drawings submitted, 2016-07-05

Drawing/doc. no.	Drawing/doc. title	Rev. No.	DNV GL Status
MD-001	PSL-MD-Pilot	-	Type approved
MD-002	PSL-MD ()2	Rev.01	Type approved
MD-003	PSL-MD ()3	Rev.01	Type approved
MD-004	PSL-MD ()4	-	Type approved
MD-005	PSL-MD-Pilot	-	Type approved

Original technical documentation file ref. T-1174 dated March 27, 2001

Prototype Test Report T-00608, August 1991.

Test Report on Safety Valve Discharge Coefficient, December 1991.

Test Report on Safety Valve Discharge Coefficient, Doc. Ref. T-1195, 2001-07-12.

Catalogue No.50E0, ref. no. 202G5C

Tests carried out

Flow capacity test, Burst test, Low temperature leakage test.

Marking of product

For traceability to this Type Approval the products are at least to be marked with:

- Manufacturer's name or trade mark
- Type designation
- Size (pipe size of valve inlet)
- Set pressure and capacity.

Periodical assessment

For retention of the Type Approval, a DNV GL surveyor shall perform periodical assessment every second year and before the expiry date of this certificate. The scope of the periodical assessment survey, is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

The main elements of the certificate retention survey are:

- Review of Type Approval documentation
 - Review of possible changes in design, materials and performance
- Ensure traceability between manufacturer's product type marking and Type Approval Certificate.