

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Safety Relief Valve for LNG/LPG Service

with type designation(s)
REC, REB, RECL and REBL

Issued to

Fukui Seisakusho Co., Ltd.
Hirakata-city 27, 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:	Depending on material (see cert.)
Max. working press.:	According to manufacture's instructions

This Certificate is valid until **2020-12-31**.

Issued at **Høvik** on **2016-07-01**

DNV GL local station: **Kobe**

Approval Engineer: **Zeinab Sharifi**

for **DNV GL**

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

Design:

1. REC/RECL: Conventional, full lift, spring loaded safety relief valve, closed bonnet venting to valve discharge
2. REB/REBL: Balanced, full lift, spring loaded safety relief valve, bonnet venting to atmosphere.

End connections:

- Inlet, flanged or tapered threads
- Outlet, flanged

Discharge coefficient:

- RECL and REBL type: 0.717
- REC and REB type: 2.24 (for boilers acc. to DNV GL requirements) and 0.869 (for sonic flow acc. to ASME requirements)

Sizes, REC and REBL:

3/4" x 1"	1" x 1"	1" x 2"	1 1/2" x 2"
1 1/2" x 2 1/2"	1 1/2" x 3"	2" x 3"	2 1/2" x 4"
3" x 4"	4" x 6"	6" x 8"	6 x 10"
8" x 10"			

Sizes, RECL and REBL:

1" x 1"	3/4" x 1"	1" x 2"
1 1/2" x 2"	1 1/2" x 2 1/2"	1 1/2" x 3"
2" x 3"	3" x 4"	4" x 6"
6" x 8"	6 x 10"	8" x 10"

Further details about product designation, type and size are described in manufacturer document no. T-1592 rev.1 page14, dated 2015-12-15.

Valve body materials:

Austenitic Stainless Steel: A182- F304/F304L/F316/F316L or equivalent
Stainless steel: A 351 – CF8/CF8M or equivalent
Carbon steel : A350-LF2, A 216 – WCB or equivalent
Alloy steel : A 352 – LC3, A 217 – WC6 or equivalent

Further details are given in manufacturer document no. T-1592 rev.1 Table 6, dated 2015-12-15.

Application/Limitation

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

Maximum allowable relief valve setting is to be according to approved table PT1 (carbon-manganese, 2.25% nickel steel and 3.5% nickel steel) or PT2 (austenitic 304) of document no. T-00574-sup.1 dated Apr.-3. 1992.

Minimum allowable design temperature:

- Carbon-manganese steel body: -55°C
- 2.25% nickel steel body: -65°C
- 3.5% nickel steel body: -90°C
- Austenitic 304 body: -165°C

Maximum allowable design temperature: +350°C.

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 shall 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 (just size 2"x3")
- VL certificate When the minimum design temperature is less than -55°C
And sizes greater than or equal to DN100 (sizes except 2"x3")

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

The valve body material shall be impact tested according to applicable tables in DNV GL Rules Pt.2 Ch.2. Minimum average Charpy-V energy values:

Carbon-manganese steel:	27 Joule at a test temp. 5°C below min. design temp.
2.25% nickel steel:	34 Joule at a test temp. of -70°C
3.5% nickel steel:	34 Joule at a test temp. of -95°C
Austenitic steel:	a) Min. design temp. $> -105^{\circ}\text{C}$: No Charpy testing required. b) Min. design temp. $\leq -105^{\circ}\text{C}$: 41 Joule at -196°C .

Type Approval documentation

Manufacturer's drawings:

2007X-001	2007X-002	2007X-003	2007X-004	2007X-005
2007X-006	2007X-007	2007X-008	2007X-009	2007X-010
2007X-011	2007X-012	2007X-013	2007X-014	2007X-015
2007X-016	2007X-017	2007X-018	2007X-019	2007X-020
2007X-021	2007X-022	2007X-023	2007X-024	2007X-025
2007X-026	2007X-027	2007X-028	2007X-029	2007X-030
2007X-031	2007X-032	2007X-033	2007X-034	2007X-035
2007X-036	2007X-037	2007X-038	2007X-039	2007X-040
2007X-041	2007X-042	2007X-043	2007X-044	2007X-045
2007X-046	2007X-047	2007X-048	2007X-049	2007X-050
2007X-051	2007X-052	2007X-053	2007X-054	2007X-055
2007X-056	2007X-057	2007X-058	2007X-059	2007X-060
2007X-061	2007X-062	2007X-063	2007X-064	2007X-065
2007X-066	2007X-067	2007X-068	2007X-069	2007X-070
2007X-071	2007X-072	2007X-073	2007X-074	2007X-075
2007X-076	2007X-077	2007X-078	2007X-079	2007X-080
2007X-081	2007X-082	2007X-083	2007X-084	2007X-085

Job Id: **262.1-002556-3**
Certificate No: **TAP00000BW**

2007X-086	2007X-087	2007X-088	2007X-089	2007X-090
REBL-200701	200702			

Drawings:

RE-00811, RE-00821, RE-00831, RE-00841, RE-00851, RE-00861
RE-00871, RE-00812, RE-00822, RE-00832, RE-00842, RE-00852
RE-00862, RE-00872, RE-00911, RE-00921, RE-00931, RE-00941
RE-00951, RE-00961, RE-00971, RE-00912, RE-00922, RE-00932
RE-00942, RE-00952, RE-00962, RE-00972, RE-200612-01, RE-200612-02
RE-01 and RE02

Manufacturer's test report Doc. No. T-1437 dated 2006-10-19
Manufacturer's document T-00574-sup.1 revision 7.

Booklets:

T-1592 rev.1 dated 2015-12-15
T-1310 dated 2003-08-11
Test report: T-00586
Test report: T-00616

Tests carried out

Cryogenic tests, flow capacity testing

Marking of product

For traceability to this type approval each device has to be permanently marked with:

- Manufacturer's name or trade mark
- Type designation
- Size of inlet and outlet
- Pressure and vacuum setting

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.