

TYPE APPROVAL CERTIFICATE**This is to certify:****That the Safety Relief Valve for LNG/LPG Service**

with type designation(s)

Pilot-Operated Safety Relief Valve Type F7000, Pilot-Operated Safety Relief Valve Type F8000

Issued to

Flow Safe Inc.**ORCHARD PARK NY, United States**

is found to comply with

Det Norske Veritas' Rules for Classification of Ships Pt.4, Ch.6 "Piping Systems"**Det Norske Veritas' Rules for Classification of Ships Pt.5, Ch.5 "Liquefied Gas Carriers"****Det Norske Veritas' Standards for Certification 2.9 No. 5-794.40****Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**

Type:	K. factor:	Temperature range:	Max. working press.:
Pilot-Operated Safety Relief Valve Type F7000	0.824	Depending on seat material, see cert.	Depending on type/size/temperature, see cert.
Pilot-Operated Safety Relief Valve Type F8000	0.878	Depending on seat material, see cert.	Depending on type/size/temperature, see cert.

This Certificate is valid until **2018-12-31**.Issued at **Høvik** on **2016-08-03**DNV GL local station: **New York**Approval Engineer: **Adel Samiei**for **DNV GL**

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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

F7000/8000 Series Pilot Operated Safety Relief Valves for LPG and LNG with four types of pilots: F100, F200, F300 or F500

- F7040: Full-bore with plastic seat and piston seal
- F7050: Full-bore with elastomer seat and piston seal. Piston seal has Teflon backup ring.
- F8040: Restricted (API) bore with plastic seat and piston seal
- F8050: Restricted (API) bore with elastomer seat and piston seal. Piston seal has Teflon backup ring.

Sizes: 1"x2", 1.5"x3", 2"x3", 3"x4", 4"x6", 6"x8", 8"x10", 10"x12"

Materials:

- Body: Carbon steel SA-216 WCB/ SA-352 LCC Stainless steel / SA-351 CF8M
- Liner Stainless steel A743 CF8M
- Piston body Stainless steel 351 CF8M
- Seat retainer Stainless steel 316 SS

Application/Limitation

The safety relief valves are approved for use on cargo tanks and in piping systems for ships having class notation "Tanker for Liquefied Gas" considering below limitations.

The maximum allowable working pressures and set pressures of valves are dependent on valve sizes as below:

VALVE SIZE (Inlet x Outlet)	MAWP/Set pressures (psig)	VALVE SIZE (Inlet x Outlet)	MAWP/Set pressures (psig)	VALVE SIZE (Inlet x Outlet)	MAWP/Set pressures (psig)
1 X 2	6000	3 X 4	3705	8 X 10	1480
1½ X 3	6000	4 X 6	3705	10 x 12	740
2 X 3	6000	6 X 8	1480	12 X 16	285

Working temperature range depending on seat material:

Material	Temperature	Material	Temperature
Buna-N	-30 °F to 275 °F (-34 °C to 135 °C)	Vespel	-67 °F to 500 °F (-55 °C to 260 °C)
Viton	-30 °F to 400 °F (-34 °C to 204 °C)	PEEK	0 °F to 525 °F (-18 °C to 274 °C)
Ethylene Propylene	-65 °F to 325 °F (-54 °C to 162 °C)	Perlast G60A	-60 °F to 500 °F (-51 °C to 260 °C)
Polyurethane	-60 °F to 225 °F (-51 °C to 107 °C)	BUNA-N 50/70	-262 °F to 275 °F (-163 °C to 135 °C)
PTFE/Teflon	-67 °F to 400 °F (-55 °C to 204 °C)	Chemraz 504	-262 °F to 446 °F (-163 °C to 230 °C)
PCTFE/Kel-F	-67 °F to 400 °F (-55 °C to 204 °C)		

Only sizes 2x3, 4x6, 6X8 and 8X10 are approved for working temperatures below -67 °F (-55 °C).

The pilot valve is to be protected by arrangements on board or by stiffeners placed between the pilot and main valve

The pilot valve exhaust is to be guided into the vent system.

Each valve is to be equipped with a back flow preventer.

Type Approval documentation

Manufacturer's product catalogue "Bulletin: F78K1105"
 Manufacturer's design analysis dated 2006-07-15 and 2007-08-17

Job Id: **262.1-010544-5**
Certificate No: **TAP00000G4**

Manufacturer's design drawings:

- Body casting 07-1229 dated 1995-11-20
- Body machining 07-4240F dated 2005-09-22
- Body machining 07-4241F dated 2006-03-09
- F7100 dated 2005-05-31
- F7200 dated 2005-06-01
- F7300 dated 2005-06-01
- F7500 dated 2008-06-05
- F8100 dated 2014-11-25
- F8150 dated 2014-04-03
- F8500 dated 2008-06-05

Manufacturer's test reports No: 8752 dated 2006-11-07, witnessed by DNV.

Manufacturer's test reports dated 2010-10-26 and 2010-10-27.

Manufacturers test report dated 2011-08-12 witnessed by GL

Manufacturer's test report dated 2016-05-12 witnessed by DNV GL surveyor.

Tests carried out

Hydraulic pressure and leakage test and cryogenic testing.

Production testing and

All valves shall be tested in presence of DNV GL surveyor as below:

1. Hydrostatic test of the valve body at a pressure equal to 1.5 times the design pressure for all valves.
2. Test of set pressure at ambient temperature.
3. Leak test after reset at 90% of each set pressure at room temperature.
4. Sufficient valve capacity is to be approved for each application.

Documents, signboards etc. which are to accompany each product/delivery:

- Instruction and maintenance manuals
- Surveyors report

Certification

All valves covered by this certificate shall be delivered with a DNV product certificate, if the minimum design temperature is below -55°C or outlet size is not less than 4". Otherwise manufacturer certificate is accepted.

Materials of the valve body are to be delivered with material certificates in accordance with DNV Rules Part 5, Chapter 5 Section 2 Table E1. All of materials with NV or Work certificate have to be supplied from an approved manufacturer of DNV GL for the type and grade of steel being supplied and for the relevant steelmaking and processing route.

Marking of product

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

- Manufacturer's name or trade mark
- Design or 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.