

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Valve for Liquefied Gas

with type designation(s)
FLOWTOP, FLOWPRO and Mark One

Issued to

Flowserve Control Valves GmbH
Villach Kärnten, Austria

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.6 Ch.2 Sec.5 Gas fuelled ship installations – Gas fuelled

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.

Issued at **Hamburg** on **2017-09-29**

This Certificate is valid until **2022-09-28**.

DNV GL local station: **Augsburg**

Approval Engineer: **Guido Friederich**

for **DNV GL**

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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

Globe valves intended for the use in LNG/LPG and gas fuel systems. The valves are controlled by a pneumatic actuator.

The type approval does not include actuator and/or other equipment for remote control of the valves. FLOWTOP /FLOWPRO and MK1 valve types provide a design with pressure ratings according to ASME B16.34 / EN 12516-1.

Flange connections acc. to ASME B16.5 or EN1092-1

Socket weld ends acc. to ASME B 16.11, Butt weld ends acc. to ASME B 16.25

Valve type series	Nominal size in inch	Pressure rating
FLOWTOP		
V738	½" to 12"	ANSI Class 150
V740	½" to 12"	ANSI Class 300
FLOWPRO		
V760	½"; 2"; 3"	ANSI Class 600
Mark One (MK1)	1"; 2"; 3"; 4"; 6"; 8"; 10"; 12" 8" 3" 6" 3" 1"; 2"	ANSI Class 150 to ANSI Class 1500 ANSI Class 300 ANSI Class 600 ANSI Class 600 ANSI Class 1500 ANSI Class 2500

Remark

Socket welded joints / ends may be used for valves with an outer diameter of 88.9 mm and less. (See DNV GL Rules Pt. 4 Ch. 6 – Piping systems, Section 9 – Socket welded joints.)

Materials

Valve series	V738	V740	V760	MK1
Body / Bonnet	ASTM SA351 CF8, CF3M, CF8M ASTM SA216 WCB, WCC ASTM SA352 LCB, LCC		ASTM SA216 WCB, WCC ASTM SA352 LCB, LCC	ASTM SA351 CF8, CF3M, CF8M ASTM SA352 LCB, LCC

Material properties for valve bodies and bonnet to be installed in LPG/LNG and ship's gas fuel systems shall comply with DNV GL Rules Pt.5 Ch.7 – Liquefied gas tankers, Section 6 – Materials of construction, quality control and marking.

Additional material certificates shall provide material properties for the relevant minimum design temperature, in particular charpy impact test results according to DNV GL Rules Pt. 5 Ch. 7, Table 4.

Materials to be used fabrication of valve bodies shall be supplied by DNV GL Approved Material Manufacturers.

All material properties shall comply with requirements specified in DNV GL Rules Materials & Welding Pt.2 Ch. 1 to Ch. 4.

Application/Limitation

MK1 VALVE TYPE SERIES

Design pressures and temperatures

Flange	Min. allowable temperature	Max. allowable temperature	Max. allowable pressure
3" Class 1500	-46°C	150 °C	❖
6" Class 600	-196 °C	150 °C	70 barg
8" Class 300	-196 °C	150°C	25 barg

- ❖ Maximum allowable working pressure at ambient and elevated temperature shall be according to the design standards, ASME B16.34 or EN 12516-1 as appropriate.

FLOWTOP / FLOWPRO and MK1 VALVE TYPE SERIES

Design pressures and temperatures

	V738	V740	V760	Mark One
1"	18,7 bar	19 bar	-	150 bar
1 1/2"	16 bar	16 bar	Class 600	-
2"	16 bar	16 bar	Class 600	150 bar
3"	16 bar	16 bar	Class 600	-
4"	19,6 bar	19,6 bar	-	Class 300
6"	19,6 bar	19,6 bar	-	Class 300
8"	6 bar	6 bar	-	130 bar
10"	19 bar	19 bar	-	19 bar
12"	6 bar	6 bar	-	110 bar

At elevated temperatures the design pressure shall be reduced according to the following factors:
Standard/Grade: **A 351 CF8**

Temperature		Class	Class	Class	Class
		150	300	900	1500
°C	°F	bar	bar	bar	bar
-196	-321	1	1	1	1
-29	-20	1	1	1	1
38	100	1	1	1	1
50	122	0,96	0,96	0,96	0,96
100	212	0,82	0,82	0,82	0,82
150	302	0,74	0,74	0,74	0,74
200	392	0,69	0,69	0,69	0,69
250	482	0,65	0,65	0,65	0,65
300	572	0,54	0,62	0,62	0,62
325	617	0,49	0,61	0,61	0,61
350	662	0,44	0,60	0,60	0,60
375	707	0,39	0,58	0,58	0,58
400	752	0,34	0,57	0,57	0,57
425	797	0,29	0,56	0,56	0,56
427	800	0,29	0,56	0,56	0,56

ASME B16.34-2004: Material Group No. 2.1, Standard Class
Standard/Grade: **A351 CF8M**

Temperature	Class	Class	Class	Class
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Job Id: **262.1-006562-9**
 Certificate No: **TAP0000104**

		150	300	900	1500
°C	°F	bar	bar	bar	bar
-196	-321	1	1	1	1
-29	-20	1	1	1	1
38	100	1	1	1	1
50	122	0,96	0,97	0,97	0,97
100	212	0,82	0,85	0,85	0,85
150	302	0,74	0,77	0,77	0,77
200	392	0,69	0,72	0,72	0,72
250	482	0,65	0,67	0,67	0,67
300	572	0,54	0,64	0,64	0,64
325	617	0,49	0,62	0,62	0,62
350	662	0,44	0,61	0,61	0,61
375	707	0,39	0,60	0,60	0,60
400	752	0,34	0,59	0,59	0,59
425	797	0,29	0,59	0,59	0,59
427	800	0,29	0,59	0,59	0,59

ASME B16.34-2004: Material Group No. 2.2, Standard Class
 Standard/Grade: **A216 WCB/WCC**

Temperature		Class	Class	Class	Class	Class
		150	300	600	900	1500
°C	°F	bar	bar	bar	bar	bar
-29 to 38	-29 to 100	1	1	1	1	1
50	122	0,98	0,98	0,98	0,98	0,98
100	212	0,90	0,91	0,91	0,91	0,91
150	302	0,81	0,88	0,88	0,88	0,88
200	392	0,70	0,86	0,86	0,86	0,86
250	482	0,62	0,82	0,82	0,82	0,82
300	572	0,52	0,78	0,78	0,78	0,78
325	617	0,47	0,76	0,76	0,76	0,76
350	662	0,43	0,74	0,74	0,74	0,74
375	707	0,38	0,71	0,71	0,71	0,71
400	752	0,33	0,68	0,68	0,68	0,68
425	797	0,28	0,56	0,56	0,56	0,56
450	842	0,23	0,45	0,45	0,45	0,45
475	887	0,19	0,34	0,34	0,34	0,34
500	932	0,14	0,23	0,23	0,23	0,23
538	1000	0,07	0,12	0,12	0,12	0,12

Job Id: **262.1-006562-9**
Certificate No: **TAP0000104**

Type Approval documentation

Tests carried out

Test standards

DNV GL Pt.5 Ch. 7 – Liquefied gas tankers
EN 12266-1 /-2; ASME B16.34
DNV GL CP 0186

Test pressure
[bar g]

Type of test

Shell strength
Tightness test of pressure bearing housing
Seat tightness test
Using helium in liquid nitrogen at -196 °C
(not applicable to Mark One class 2500 valves)
Functional test EN 12266-2

1,5 times the design pressure
1,1 times the design pressure
1,1 times the design pressure

Design / working pressure

Production testing

- I. 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 13.2

<u>Type of test</u>	<u>Test pressure</u>
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

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

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

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

Material certificates (valve bodies)
W Works Certificate, issued by
Manufacturer

Remark

For valves intended to be installed in ship's gas fuel systems certification requirements according to DNV GL Rules Pt. 6 Ch.2 Section 5 – "Gas fuelled ship installations " are to be observed where as for application on liquefied gas tankers DNV GL Rules Pt. 5 Ch. 7 – Liquefied gas tankers applies.

Production testing - continuation

II. Ships gas as fuel systems

For each valve intended to be installed in ship's gas fuel supply systems a product certificate is to be issued based on the following scope of tests and according to DNV GL 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 GL Pt.5 Ch.7 irrespective of size	VL Certificate / DNV GL
Design pressure > 10 bar/ DNV GL Pt.5 Ch.7 irrespective of size	VL Certificate / DNV GL
Design pressure ≤ 10 bar Design temperature ≥ 0°C	Works certificate / Manufacturer

Material certificates

DNV GL 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 GL
≥ 0°C	W Works Certificate / Manufacturer

III. General valve service conditions

[Other than covered by requirements for liquefied gas tankers and ship's gas fuel systems]
Certification of valves for general service conditions and applications
Valves to be used for general applications other than covered by requirements for liquefied gas tankers and gas fuelled ship installations shall be certified according to DNV GL Rules Pt.4 Ch.6 – Piping systems, Section 9

<u>Valve nominal size / Pressure rating</u>	<u>Type of certificate / Issued by</u>
DN > 100 mm / PN > 16 bar	VL Certificate / DNV GL
DN ≤ 100 mm / PN ≤ 16 bar	W Works Certificate / Manufacturer
Ship side valves DN > 100 mm regardless of pressure rating	VL Certificate / DNV GL

Material certificates (valve bodies)

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

Note:

Valves having a nominal diameter DN >100 and to be fabricated with a design temperature > 400°C shall provide VL material certificates for valve body and bolts.

Marking of product

For traceability to this type approval the products are to be marked with:

- 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

Periodical assessment

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

The objective of the periodical assessment is to verify that the conditions for the type approval have not been altered. The main scope of the periodical assessment will normally include:

- Verification of the TA applicant's production and quality system w.r.t ensuring continued consistent production of the type approved products at the TA applicant's own premises and at other companies that are given the responsibility for manufacturing of the products.
- Review of the TA documentation and that this is still used as a basis for the production
- Review of possible changes to the design, the material and the performance of the product
- Verification of the product marking

END OF CERTIFICATE