

STANDARD FOR CERTIFICATION

No. 2.9

Type Approval Programme No. 5-794.40

TYPE APPROVAL OF VALVES

APRIL 2008

DET NORSKE VERITAS

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FOREWORD

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A list of Standards for Certification is found in the latest edition of Pt.0 Ch.1 of the "Rules for Classification of Ships" and the "Rules for Classification of High Speed, Light Craft and Naval Surface Craft".

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CONTENTS

1. GENERAL REQUIREMENTS.....	5	8. REQUIREMENTS TO VALVES FOR	
1.1 Scope.....	5	SPECIAL APPLICATIONS	7
1.2 Guidance note	5	8.1 General	7
2. TYPE APPROVAL	5	8.2 Safety valves for steam	7
2.1 Procedure	5	8.3 Valves for LNG/LPG	7
3. DOCUMENTATION TO BE SUBMITTED	5	8.4 Safety valves for chemicals.....	7
4. MATERIALS	5	8.5 Valves for fire water hydrants	7
4.1 General requirements.....	5	8.6 Valves for refrigerants.....	7
4.2 Material certificates	5	9. TESTING	8
4.3 Rubber materials.....	5	9.1 Type testing.....	8
4.4 Steel for elevated temperatures.....	6	9.2 Production testing	9
5. DESIGN	6	10. INSTALLATION	9
5.1 General requirements to a valve design.....	6	10.1 General	9
5.2 Strength evaluation	6	11. CERTIFICATION CONDITIONS	9
6. FABRICATION.....	6	11.1 Type Approval Certificate.....	9
7. CERTIFICATION.....	6	11.2 Certificate retention	9
7.1 General.....	6	11.3 Marking	10
7.2 Design.....	6	12. STANDARDS REFERRED TO IN THIS	
7.3 Materials	6	DOCUMENT	10
7.4 Type testing	7	APPENDIX A.....	11
7.5 Production testing.....	7		
7.6 Product certificate.....	7		

Main changes

- Changes in the type approval programme are extensive and re-arranged - thus only given as new, clean text.
- In essence there are no new requirements, but outdated requirements have been removed, and some requirements previously only stated in the type approval programme have been shifted to the Rules (updating of the latter, in a separate proposal). Also, a new table giving test requirements for valves in all different ship systems, is part of the new updated programme.

1. General requirements

1.1 Scope

This Certification Note gives the requirements on which Det Norske Veritas base their type approval of valves. The following valve designs are covered:

- ball valves
- butterfly valves
- check valves
- diaphragm valves
- gate valves
- globe valves
- safety valves for steam/chemicals.

Requirements related to special valve applications, such as valves for fire water systems, valves on gas bottles, in quick closing systems on fuel oil tanks, for ship's side or bottom and valves for refrigerants are also included in this document. The following valve designs are not covered:

- pressure/vacuum relief valves
- pressure reducing valves.

Type approval of valves is based upon the requirements in this Standard for Certification and relevant parts of the following DNV documents:

- Det Norske Veritas Rules for Classification of Ships
- Det Norske Veritas Rules for High Speed, Light Craft and Naval Surface Craft
- Det Norske Veritas Offshore Standards.

1.2 Guidance note

Requirements to valves can be found in the following parts of the Rules:

- for valves in ship piping and machinery piping systems Pt.4 Ch.6 Sec.4, 5 and 6
- for valves intended for piping systems in the cargo area of Liquefied Gas Carriers Pt.5 Ch.5 Sec.6
- for valves intended for piping systems in the cargo area of Chemical Carriers Pt.5 Ch.4 Sec.6
- for valves intended for piping systems in the cargo area of Oil Carriers Pt.5 Ch.3 Sec.4.

2. Type Approval

2.1 Procedure

The type approval procedure consists of the following elements:

- design assessment
- type testing
- certificate retention survey.

See Det Norske Veritas Certification Note no. 1.2 for the general procedures for type approval. Documentation of design

and initial testing (see paragraph 3 Documentation) shall be submitted to Det Norske Veritas, and a type approval certificate will be issued when the documents are examined and found in order.

3. Documentation to be submitted

Three copies of the following documents and information shall be submitted together with the application for type approval of valves:

- manufacturer's catalogue for the products
- sectional drawing(s) with all dimensions necessary for strength control of the pressure exposed parts of the different valve sizes
- material specifications with exact material designation and reference to recognized national or international material standards for all parts of the valve
- data for possible artificial material and rubber
- desired field of application and necessary data for the media for which type approval is wanted
- operational limitations
- maximum working pressure (nominal pressure) for all valve types and sizes
- desired operating temperature range
- fabrication procedure specifications
- welding procedure specification with qualification in case any part of the valve is welded
- extent of Non-destructive testing (NDT) and acceptance criteria
- detailed description of how the product is marked. This information shall be sufficient to trace a valve to the type approval certificate. It shall as a minimum consist of the manufacturer's name or trade mark and valve type designation
- description of the manufacturer's quality control procedures for the production
- documentation of test results from type testing or documentation of strength evaluation as required by this Standard for Certification
- reference to national or international codes and/or standards as applicable.

4. Materials

4.1 General requirements

The materials used in the valve parts shall comply with the requirements in this Standard for Certification and/or to Det Norske Veritas Rules for Classification of Ships. Material may also be specified to comply with recognized national/international material standards such as ASTM, BS, DIN, EN, ISO etc., when due regard is taken to possible limitations or additional requirements given in the Rules. When valves are designed in accordance with a standard recognized for marine application the materials as specified in the design standard will be accepted.

4.2 Material certificates

Valve bodies and bonnets are to be furnished with material certificates as given in Det Norske Veritas Rules for Classification of Ships Pt.4 Ch.6 Sec.2 Table A2.

4.3 Rubber materials

Temperature ranges exceeding those tabulated below require a test report from the rubber manufacturer proving a satisfactory lifetime of the rubber at maximum design temperature in continuous service or at minimum design temperature when relevant.

Table 4-1 Generally acceptable temperature range for rubber used for some media

Type of rubber	Minimum temperature, °C	Maximum temperature, °C		
		Dry air	Seawater steam	Hydrocarbons
EPDM	-40 to -70	130	100 - 130	N/A
Hypalon	-20 to -55	120	80 - 90	N/A
Perbunan (Nitrile)	-10 to -30	100	80 - 90	60 - 90
Viton	-20 to -45	150 - 200	100 - 150	150 - 170
Neoprene	-30 to -50	100	80 - 90	0 - 50
Silicone rubber	-50 to -100	150 - 200	80 - 100	50 - 150

NOTE: The above table is for guiding purposes only. Temperatures outside these limits have to be documented. The sealing materials are to be compatible with the fluids inside the piping system.

4.4 Steel for elevated temperatures

The maximum pressure for which the valves are type approved is defined as maximum allowable pressure in continuous service at +20°C. For elevated temperatures the maximum allowable pressure may have to be reduced dependant on the material quality. When no documentation of the mechanical properties at elevated temperatures is available, the pressure will have to be reduced according to Table 4-2.

Table 4-2 Pressure reduction factors at elevated temperatures

Temperature, °C	Carbon steels, unalloyed	Low alloyed steels	Stainless steels
20	1,00	1,00	1,00
50	1,00	1,00	0,95
100	1,00	1,00	0,85
150	0,89	0,93	0,77
200	0,81	0,87	0,71
250	0,72	0,81	0,67
300	0,65	0,75	0,63
350	0,59	0,69	0,60
400	0,54	0,63	0,58
450	0,50	0,57	0,57
500	N/A	0,52	0,56
550	N/A	N/A	0,55
600	N/A	N/A	0,50

Generally the following maximum metal temperatures will be accepted in connection with type approval:

- Carbon steels, unalloyed: +450°C
- Low alloyed Mo-steels: +500°C
- Low alloyed CrMo-steels: +550°C
- Stainless steels 304L and 316L: +400°C
- Stainless steels 304, 316 and 321: +600°C.

If higher utilisation of the material is wanted, the mechanical properties of the material at the desired temperature have to be documented.

5. Design

5.1 General requirements to a valve design

The valves shall be designed in compliance with the requirements given in Pt.4 Ch.6 Sec.6 and 1.2 Guidance Note in this Standard for Certification.

All valves larger than DN 50 to be type approved for hydrocarbon service shall be equipped with an anti-static device that will ensure electrical conductivity between the ball, disc, gate or plug etc. and the valve body. For valve sizes DN 50 and smaller only electrical conductivity between the ball, disc, gate or plug and the valve stem is required.

5.2 Strength evaluation

5.2.1 When the valves are designed in accordance with a standard recognized for marine application the following will be compared to the requirements of the standard and evaluated in connection with the type approval:

- valve composition
- dimensions
- mechanical properties of the material and it's suitability for the desired applications
- fabrication procedure
- the valve manufacturer's quality control procedures
- strength calculation.

5.2.2 When the valves are not designed in accordance with a standard recognised for marine application the strength of the valve body may be evaluated based one or more of the following alternatives:

- experimental stress analysis
- finite element analysis
- burst testing
- Examples of recognised standards:
 - EN 12516 1/2/3 Industrial valves- Shell design strength
 - EN 593 Industrial valves-Metallic butterfly valves
 - EN 12334 Industrial valves-Cast iron check valves
 - EN 1171 Industrial valves-Cast iron gate valves
 - EN 12284 Refrigerating systems and heat pumps-Valves-Requirements, testing and marking
 - API 6D
 - ASME 1634.

6. Fabrication

The dimensions of the forging or casting in areas subject to machining shall be so designed that it will be possible to machine off sufficient amount of material to remove all surface defects and decarbonised material. Reduction of the thickness in any place to less than 93% of the nominal thickness is not permitted. In no case more than 3 mm shall be removed. The transitions between grinded and unaffected areas shall be smoothly rounded. Surface defects may be removed by chipping or gouging provided that the surfaces of the resulting depression are subsequent ground smooth to unaffected material. Complete elimination of defective material is to be demonstrated by non-destructive examination.

Welding repair may be accepted on defect casting made of weldable material based on the requirements given in Pt.2 Ch.2 Sec.7.

7. Certification

7.1 General

The following certification requirements are applicable for all type of valves if not stated otherwise in requirements to valves for special applications.

7.2 Design

The valves shall be designed in accordance with paragraph 5.1. Strength evaluation of the valve is to be in accordance with paragraph 5.2. Fabrication of valves is to be in accordance with paragraph 6.

7.3 Materials

Materials are to be delivered with materials certificates as given in Det Norske Veritas Rules for Classification of Ships Pt.4 Ch.6 Sec.2 Table A2.

7.4 Type testing

Type testing is to be performed in accordance with paragraph 9.1 and Table A-1 in Appendix A.

7.5 Production testing

Production testing is to be performed in accordance with paragraph 9.2 and Table A-1 in Appendix A.

7.6 Product certificate

DNV product certificates are required for valves with $D_N > 100$ mm having a design pressure, $p > 16$ bar and for ship side valves with $D_N > 100$ mm regardless of pressure rating. For other valves manufacturer's certificate is accepted.

8. Requirements to valves for special applications

8.1 General

In addition to the requirements given in paragraph 8 the valves have to comply with the requirements given in paragraph 1 to 7 in this Standard for Certification.

8.2 Safety valves for steam

8.2.1 General

Determination of discharge coefficient and verification of capacity.

This is to be performed according to a recognised standard. For valves manufactured in a number of sizes exceeding 6, 3 samples are to be selected for testing. For valves manufactured in less sizes, 2 samples are to be selected for testing. The tests shall be carried out using 3 significantly different settings of each size of the valve. Each test shall be carried out minimum 3 times. The accuracy of flow measurement equipment shall be within $\pm 2\%$. A recognised test laboratory may be accepted for performing the tests. Alternatively DNV can witness the test at the manufacturer's premises.

8.2.2 Check of set pressure and reset pressure

Each test shall be carried out minimum 3 times at ambient temperature. The set pressure shall be sealed by the use of a robust non-corrosive wire. The surveyor will issue a declaration regarding set pressure and date of testing according to the DNV Ship Rules.

The set pressure deviation is not to exceed:

0 up to 1.5 bar:	$\pm 10\%$
1.5 up to 3.0 bar:	$\pm 6\%$
3.0 up to 20 bar:	$\pm 3\%$
20 up to 100 bar:	$\pm 2\%$
> 100 bar:	$\pm 1.5\%$

A DNV product certificate is required from production testing of safety valves. A leakage test of the valve body according to the requirements in paragraph 9.2.1 shall be performed. The test pressure shall be 1, 5 times the design pressure. Seat leakage test according to the requirements of paragraph 9.2.2 to 1.1 times the design pressure shall be performed.

The seat leakage test shall be performed after reset usually at 90% of the set pressure. Test to be performed at minimum design temperature.

8.2.3 Certification requirements

DNV product certificates are required for valves with $D_N > 40$ mm. For other valves manufacturer's certificate is accepted.

8.3 Valves for LNG/LPG

8.3.1 General

The design pressure shall be minimum 5 bar.

8.3.2 Certification requirements

Materials are to be delivered with materials certificates as given in DNV Rules Pt.5 Ch.5 Sec.2.

DNV product certificate is required for valves with $D_N > 100$ mm. For other valves manufacturer's certificate is accepted.

8.4 Safety valves for chemicals

8.4.1 Certification requirements

Materials are to be delivered with materials certificates as given in Det Norske Veritas Rules for Classification of Ships Pt.5 Ch.4 Sec.2 Table D1.

DNV product certificates are required for valves with $D_N > 100$ mm. For other valves manufacturer's certificate is accepted.

8.5 Valves for fire water hydrants

8.5.1 General

Valves made of, or equipped with, material that may disintegrate, be destroyed or in other ways render ineffective by heat, shall be fire tested in accordance with paragraph 9.1.5.

8.5.2 Certification requirements

DNV product certificates are required for valves with $D_N > 100$ mm having a design pressure, $p > 16$ bar. For other valves manufacturer's certificate is accepted.

8.6 Valves for refrigerants

8.6.1 General

In addition to the requirements of section 3 the following information shall be given:

- type of refrigerant
- description of valve function
- working range for possible automatic pressure/temperature regulating mechanism.

8.6.2 Design

The strength of the valve body and other pressurized parts shall be evaluated according to one or more of the alternatives described in section 5 Design. Strength calculations shall be based on the material design stress at ambient temperature (about 20°C). Using a material with higher design stress than allowed by DIN 3158 will not qualify for a corresponding reduction in wall thickness. An increase in wall thickness may, however be required in case the maximum design temperature is above +100°C. Screws, bolts and nuts joining the different pressure exposed parts shall be designed to absorb all the forces they may be exposed to due to variations in pressure and temperature. It shall be possible to exchange and re-tighten the stem packing while the valve is pressurized. Screwed-on valve bonnets are not permitted on valves with DN40 or bigger.

When the design temperature is below -40°C care shall be taken that the stem packing does not restrict the operational ability of the valve. Valves with extended stem or heated stem packing or equivalent shall therefore be used if the minimum design temperature is below -40°C. Adjustments of the stem packing shall be possible without big encroachments in the insulation.

Non-integral seats or linings and stuffing boxes shall be locked in such a manner that they cannot become loose in service.

Every pressure exposed part, including the packings, of the valve that is physically in contact with the refrigerant during normal service shall be made from a material that remains unaffected by the refrigerant, and all other material, including bolt-, screw- and nut material, shall be suitable for the pressure/temperature rates specified. Metallic material that may be subject to ageing shall not be used. Castings shall be stress relieved or given another suitable heat treatment with controlled cooling. The purpose of this is to remove possible residual

stresses from the casting.

The correlation between the material used and the pressure/temperature rating will be evaluated as outlined in DIN 3158 "Valves for use in refrigerating systems; safety requirements, testing and marking". Equivalent material qualities to those mentioned in DIN 3158 may be accepted. Materials not corresponding to the qualities allowed by DIN 3158 table 1A, B, C, D, E, F, G, H, I, K and L are subject to special consideration.

8.6.3 Certification requirements

DNV product certificates are required for valves with $D_N > 100$ mm having a design pressure, $p > 16$ bar. For other valves manufacturer's certificate is accepted.

9. Testing

9.1 Type testing

9.1.1 For valves intended for special application, see Table A-1 in Appendix A for test requirements

9.1.2 Burst test of the valve body

Valve bodies shall be selected at random from stock. For a number of valve body sizes of the same or close comparable design, one size tested will qualify the next upper and the next lower size. The burst test shall be performed on minimum one sample of each testing size. When the minimum nominal thickness of the pressure exposed parts is changed in steps (two or more nominal valve sizes have the same thickness) the largest size shall be selected for testing. The valve body shall be connected to a hydraulic pressure source that is able to raise the pressure in steps of 5 bar up to the calculated minimum burst pressure.

The test rig shall have sufficient range of recording, and shall be equipped with calibrated pressure/time recording instruments for permanent recording of the pressure/time curve.

All openings of the valve body shall be blinded. The valve body shall be filled with the hydraulic fluid. One of the blinds shall be equipped with nipples for venting, and have the necessary connection(s) to the pressure source.

Care shall be taken that all air is purged before the valve body is pressurized. The pressure shall be raised in steps of about 1/10 of calculated burst pressure. The test specimens shall be checked for external leakage between each pressure step, up to the calculated burst pressure. When the calculated burst pressure is reached, the pressure shall be kept constant for at least 5 minutes. The pressure may then at the manufacturer's option be raised further until burst occurs. Minimum required burst pressure shall be calculated according to the following formula:

$$P_{burst} = P_w \times \frac{\sigma_b}{\sigma_{bt}} \times \frac{f}{\alpha}$$

where:

- P_{burst} = minimum required burst pressure, N/mm²
- P_w = maximum design pressure, N/mm²
- f = reduction factor according to Fig. 9-1. It may be calculated as:
 $f = 4 - 0.002 \times (\text{Max. working pressure} - 200)$
- α = material and welding factor:
 = 1.0 for forged material
 = 0.8 for cast material
 = 0.8 for valve bodies built up by welding.
- σ_b = actual minimum tensile strength of the material specified for the valve body at ambient temperature, N/mm²
- σ_{bt} = actual minimum tensile strength of the material specified for the valve body at maximum design temperature, N/mm².

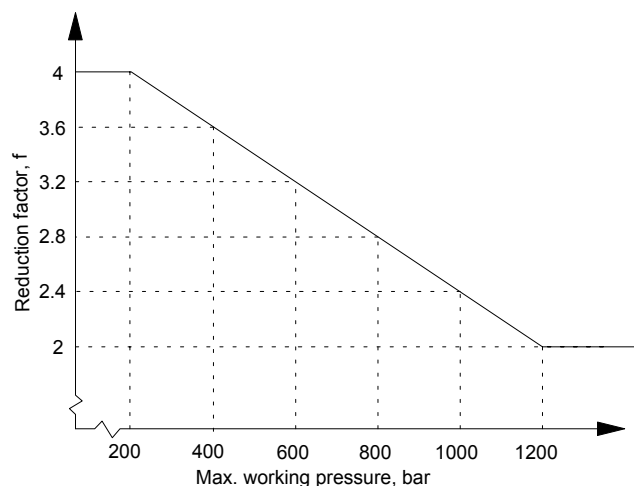


Figure 9-1
 Reduction factor f when calculating the minimum burst pressure for nominal working pressures above 200 bar

No external leakage or permanent, visible deformation is permitted in any part of the valve body at any time before the minimum calculated burst pressure is obtained.

9.1.3 Fire test

Valves made of, or equipped with, material that may disintegrate, be destroyed or in other ways render ineffective by heat and that are wanted type approved for systems where fire resistance is required shall be fire tested according to the procedures outlined in API STD 607 or equivalent. Valves used for regulating purposes or other purposes where tightness is not required may be accepted for hydrocarbon process systems without a fire test.

9.1.4 Fire testing of valves for fire hydrants

Valves made of, or equipped with, material that may disintegrate, be destroyed or in other ways render ineffective by heat, shall be tested as follows:

Fill the valves with water and apply a static pressure of 8,3 bar (120 psi). This pressure shall be maintained during the test. Place the valves in a suitable furnace or oven where a temperature of 540°C (1000°F) shall be maintained for 20 minutes. The valves shall be tested in closed position with the pressure applied to one side of the valve seat. The other end shall be open to the atmosphere through a pipe leading to the outside of the furnace or oven. At the end of the test the maximum external leakage rate shall not exceed that given in Table 9-1. The valves shall be operable after completion of this test.

Nominal valve size, DN	Maximum leakage rate, Litres/minute
40	1.25
50	2.00
65	4.00
80	6.25
100	9.75
125	14.25
150	22.25
200	25.00
250	25.00
300	25.00

9.1.5 Testing of valves for LNG/LPG

All types of valves for LNG/LPG are to be type tested according to paragraph 9.1. If the valves are intended to be used in

systems with design temperature below -55°C the valves are to be subjected to a prototype test in accordance with requirements given in Pt.5 Ch.5 Sec.6 C801. Testing according to BS 6364 or equivalent will be accepted.

9.2 Production testing

9.2.1 Leakage test of the valve body

Each valve to be delivered as "type approved by DNV" shall be subject to a hydraulic pressure test of the valve housing. This test shall be performed while the valve is in open position. The valve shall be ready assembled before the test commences. All openings shall be blinded. Fill the valve with the testing fluid, purge all possible air, and connect the valve to a hydraulic pressure source able to deliver sufficient pressure. Pressurise the valve assembly to 1, 5 times the maximum allowable working pressure.

However, valves for regulating purposes that are equipped with details sensible to over-pressure, such as bellows, membranes, anchor tubes for magnetic valves etc., may be pressurized to 1,1 times the maximum allowable working pressure.

Keep the test pressure constant for at least one minute and inspect the valve for external leakage. No external leakage is permitted at any time during this test.

Duration and acceptance criterion is given in Table 9-2.

9.2.2 Seat leakage test

All possible air shall be purged. The test shall be performed after closing the valve with normal closing torque without application of external forces. The test pressure shall be at least equal to the maximum design pressure. Test liquid shall be water or other suitable medium subject to consideration.

For valves intended for LNG or LPG the valves are to be subjected to a seat and stem leakage test at a pressure equal to 1.1 times the maximum design pressure.

Duration and acceptance criterion is given in Table 9-2.

Ball valves: The pressure shall be applied to each end successfully. The other end shall be open to the atmosphere.

Butterfly valves: The pressure shall be applied to the inlet end of the valve. In case the valve is designed for flow in both directions, the pressure shall be applied to each end successfully. The other end shall be open to the atmosphere.

Check valves: The pressure shall be applied to the disc from the outlet end. The inlet shall be open to the atmosphere.

Diaphragm valves: The pressure shall be applied to each end successfully. The other end shall be open to the atmosphere.

Gate valves: Each seat shall be tested by applying the test pressure successfully on each side of the closed valve. The other end shall be open to the atmosphere. Alternatively, both seats may be tested at the same time by applying the test pressure to the space between the seats through the body or bonnet. Both ends shall then be open to the atmosphere.

Globe valves: The pressure shall be applied to the disc from the inlet end. The outlet end shall be open to the atmosphere.

Needle valves: The pressure shall be applied to the disc from the inlet end. The outlet end shall be open to the atmosphere.

Plug valves: The pressure shall be applied to each end successfully. The other end shall be open to the atmosphere. For the body test and the seat leakage test table applies.

The pressure tests shall be witnessed by a DNV surveyor when the valves are to be delivered for ship applications, and

- are to be fitted on ship side or bottom, or
- have a nominal diameter of more than 25 mm in Class I and Class II systems onboard.

The witnessing by a DNV surveyor may be waived dependant

on a special agreement called Manufacturing Survey Arrangement, MSA. For other valves a pressure test certificate from the manufacturer signed by a responsible Quality Assurance person will be accepted.

9.2.3 Pneumatic pressure test

The hydraulic pressure test may be substituted by a pneumatic pressure test up to the maximum design pressure when necessary.

Size	Shell, minutes	Seat, minutes
≤ 100 mm (≤ 4 ")	2	5
125 - 250 mm (5" - 10")	5	5
275 mm - 450 mm (11" - 18")	10	5
≥ 475 mm (≥ 19 ")	15	5
Acceptance criterion	No leakage	Drop tight

9.2.4 Test report

The result of the tests shall be documented by test certificates or test reports.

The test report shall at least contain the following information:

- name of the testing laboratory, and testing date
- description of the product(s) tested
- a short description of the testing procedure
- test results and possible test events
- maximum design pressure
- temperature range (maximum and minimum temperature)
- reference to applicable design rules, codes, standards, or other regulations
- marking of product.

A responsible person shall sign the report. Responsible person in this relation can be a surveyor from DNV or superior person at an independent testing laboratory. In some cases the Q.A.-Manager at manufacturer may sign the reports when his Q.A.-system is approved by DNV. The burst test report is to be signed by a DNV surveyor if this test is performed at the manufacturer's premises.

10. Installation

10.1 General

No specific requirements regarding the installation are given in this document. The installation of the different valves has to comply with the requirements given in Det Norske Veritas Rules for Classification of Ships Pt.4 Ch.6 Sec.4, 5 and 6.

11. Certification Conditions

11.1 Type Approval Certificate

When the design assessment and type testing are successfully completed and the documentation has been examined a type approval certificate will be issued and normally given a validity period of 4 years.

11.2 Certificate retention

The manufacturer/holder of the certificate has to apply in writing for renewal of his certificate(s). For retention and renewal of the type approval, a DNV Surveyor shall perform a survey every second year and before the expiry date of the certificate to verify that the conditions for the type approval are complied with and to witness testing as described in the type approval certificate.

11.3 Marking

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 trade mark
- valve type designation
- size
- maximum design pressure or pressure class
- arrow to indicate direction of flow on one way flow valves.

Additional marking may be required by the applicable standard. Information of the content of the marking and layout shall be submitted together with the application.

12. Standards referred to in this document

- API STD 607 Fire test for soft-seated quarter-turn valves
- BS 6364 Specification for valves for cryogenic service
- DIN 3158 Valves for use in refrigerating systems; safety requirements, testing and marking
- EN 10204 Metallic products - Types of inspection documents
- NS-EN 738-1 Pressure regulators for use with medical gases - Pressure regulators and pressure regulators with flow metering devices.
- NS-EN 849 Transportable gas cylinders - Cylinder valves - Specification and type testing
- ISO 10729 Transportable gas cylinders - Cylinder valves - Specification and type testing
- EN 12516 1/2/3 Industrial valves- Shell design strength
- EN 593 Industrial valves-Metallic butterfly valves
- EN 12334 Industrial valves-Cast iron check valves
- EN 1171 Industrial valves-Cast iron gate valves
- EN 12284 Refrigerating systems and heat pumps-Valves-Requirements, testing and marking.

Appendix A

Table A-1 Test requirements for valves intended for special application				
<i>System</i>		<i>Type test acc. to paragraph 9.1</i>		<i>Production test acc. to paragraph 9.2</i>
		<i>Closing valves</i>	<i>Regulation valves</i>	
Flammable fluids (Flash point ≤ 60°C)				
1	Cargo oil	2 ¹⁾ and 3 ²⁾	2 ¹⁾	1 and 2
2	Crude oil washing	2 ¹⁾	2 ¹⁾	1 and 2
3	Vent	2 ¹⁾	2 ¹⁾	1 and 2
Flammable fluids (Flash point > 60°C)				
4	Cargo oil lines	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
5	Fuel oil	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
6	Lubrication oil	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
7	Hydraulic oil	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
8	Thermal oil	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
Inert gas				
9	Water seal effluent lines	2 ¹⁾	2 ¹⁾	1 and 2
10	Scrubber effluent lines	2 ¹⁾	2 ¹⁾	1 and 2
11	Main lines	2 ¹⁾	2 ¹⁾	1 and 2
12	Distribution lines	2 ¹⁾	2 ¹⁾	1 and 2
Sea water				
13	Bilge lines	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
14	Fire main and water spray	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 4)	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 4)	1 and 2
15	Foam	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 4)	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 4)	1 and 2
16	Sprinkler	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 3)	2 ¹⁾ and 3 ²⁾ or 2 ¹⁾ and 4 ²⁾ , 4)	1 and 2
17	Ballast	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
18	Cooling water	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
19	Tank cleaning	2 ¹⁾	2 ¹⁾	1 and 2
20	Non-essential	2 ¹⁾	2 ¹⁾	1 and 2
Fresh water				
21	Cooling water	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
22	Condensate return	2 ¹⁾ and 3 ²⁾ , 3)	2 ¹⁾	1 and 2
23	Non-essential	2 ¹⁾	2 ¹⁾	1 and 2
LNG				
24	Liquefied gas, working temperature $t < -55$ °C	2 ¹⁾ , 3 ²⁾ and 5	2 ¹⁾ and 5	1 and 2
25	Liquefied gas, working temperature $t \geq -55$ °C	2 ¹⁾ , 3 ²⁾ and 5	2 ¹⁾ and 5	1 and 2
26	LPG	2 ¹⁾ , 3 ²⁾ and 5	2 ¹⁾ and 5	1 and 2
Miscellaneous				
29	Starting/control air	2 ¹⁾	2 ¹⁾	1 and 2
30	Service air (non-essential)	2 ¹⁾	2 ¹⁾	1 and 2
31	Brine	2 ¹⁾ and 4 ²⁾ , 3)	2 ¹⁾	1 and 2
32	CO2	2 ¹⁾	2 ¹⁾	1 and 2
33	Steam	2 ¹⁾ and section 8.2.2	2 ¹⁾ and section 8.2.2	1 and 2
34	Sanitary	2 ¹⁾	2 ¹⁾	1 and 2
35	Refrigerants	2 ¹⁾	2 ¹⁾	1 and 2
1) Burst test of the valve body is to be performed if required by part 5.2 in this type approval programme 2) Fire tested in accordance with 9.1.4 is required, if the valves contain elements that may disintegrate or in other ways be rendered ineffective by heat 3) Valves that are wanted type approved for systems where fire resistance is required either by the DNV Rules, Pt.4 Ch.1 Sec.3 B500 or by the purchaser is to be fire tested in accordance with part 9.1.4 4) Valves tested in accordance with the requirements given in part 9.1.5 can only be used as valves for fire hydrants.				