Fittings

Requirements and test methods

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VdS Guidelines for water extinguishing systems

Fittings

Requirements and test methods

Content

1 Scope

These guidelines specify requirements and test methods for grooved-end fittings, made of ductile cast iron. They are applicable to fittings of nominal sizes DN 25 to DN 300 for use in pipework of water extinguishing systems according to VdS CEA 4001, VdS 2109 and VdS 2395-1 with a maximum allowable pressure upto 16 bar.

These guidelines are not applicable to special fittings such as for example quick tees.

Note 1: The manufacturer is free to specify a value > 16 bar for the maximum allowable pressure. In this case the tests are conducted and documented for the specified pressure value. The approval certificate will, however, limit the application to 16 bar. The suitability for use at higher pressures will be assessed on a case to case basis. It will be decided in each individual case whether additional tests and/or measures are necessary.

Note 2: The use of fittings – that are equipped with machined grooves in compliance with Annex B and tested in accordance with these guidelines – in combination with approved pipe couplings is released based on a corresponding declaration of the fitting manufacturer.

Note 3: The use of fittings - that are equipped with cast grooves and tested in accordance with these guidelines – in combination with approved pipe couplings may be released based on a declaration of the coupling manufacturer covering the combination in question and – where appropriate – tests with test samples.

2 Normative references

These Guidelines incorporate, by dated or undated references, provisions from other publications (e.g. European Standards EN or International Standards IEC), which are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these Guidelines only when incorporated in them by amendment or revision. For undated references the latest edition of the publication referred to applies.

VdS CEA 4001	Guidelines for sprinkler systems – Planning and installation
VdS 2109	Guidelines for water spray systems – Planning and installation
VdS 2395-1	Guidelines for semi-stationary extinguishing systems – Planning and installation Part 1: Semi-stationary water spray extinguishing systems

3 Definitions

Allowable pressure: Pressure specified by the manufacturer for which the test shall be conducted. The test pressures are calculated on the basis of this value.

Cast groove: Groove of the fitting which is used after the casting process without further finishing

Mechanically machined groove: Groove of the fitting which is defined by cutting machined finishing after the casting process

4 Requirements

4.1 Specifications and performance characteristics

4.1.1 The applicant shall specify the allowable pressure. The allowable pressure shall be at least 10 bar.

Note: See also clause 1.1, note 1.

4.1.2 The surfaces of the components (inward and outward) shall be protected against corrosion.

4.1.3 The applicant shall specify the couplings which he plans to combine with the fittings.

If this refers also to couplings of other manufacturers the applicant shall

- in case of fittings with cast grooves, submit a declaration of the coupling manufacturer regarding the combination fitting-coupling.
- in case of fittings with mechanically machined grooves according to Annex B, submit a corresponding manufacturer declaration of his own.

Note: See also clause 1, notes 2 and 3.

4.2 Technical documentation

The following documents are necessary:

a) List of documents (with own designation, drawing number, revision state, date) stating all required documents below (each with their designation, drawing number, revision state and date)

b) Manufacturing documents:
   - Component drawing

     The marking shall be documented in the drawings according to 4.3.

     The definition of coded marking on the fittings shall be documented in the drawings.

c) Installation instruction for the use of the fittings in stationary water extinguishing systems where all information relevant for the user is summarized and which specifies at least the details below:
   - description and dimensions of the fittings
   - description of groove dimensions
   - usable pipe couplings

4.3 Marking

Fittings shall be marked with following details:

- Name or trade mark of the manufacturer/supplier
- Nominal size
- Type/model designation
- Date or period or batch of manufacture

- Manufacturing site, if the fitting is produced parallel in several manufacturing sites or if the manufacturing site is changed
- Manufacturing process, if the fitting is produced parallel in several manufacturing processes/techniques or if the manufacturing process/technique is changed
- Marking according to VdS 2344 as VdS-approved

4.4 Nominal sizes and connections

The nominal sizes (DN) 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250 and 300 are allowable in the nominal size range of DN 25 to DN 300.

5 Tests

5.1 Test conditions and test samples

5.1.1 Test conditions

The tests are conducted at a temperature of (25 ± 10) °C unless specified otherwise for a specific test.

The tolerance of all test parameters is ± 5 % unless specified otherwise.

5.1.2 Test modules and test samples

5.1.2.1 Pipe fittings of different geometry (among others T-piece, cross piece, bend, end cap, flange adapter, reducing fitting) and nominal size can be treated as one component series provided that all fittings consist of the same material and have got equivalent wall thickness within one nominal size.

5.1.2.2 For the testing of fittings the test modules (tests and test sequence for one test sample each) are determined according to table 5.1.

Test module	**A**	**B**	**C**
5.2.1 Compliance	1	1	1
5.4.1 Pressure test		2	2
5.4.2 Pressure test at bending		3	3
5.4.3 Water hammer test		4	
5.4.4 Leakage test		5	

Table 5.1: Test modules and test sequence

5.1.2.3 Fittings with mechanically machined grooves according to Annex B are tested according to 5.1.2.4.

Fittings with cast grooves are tested according to 5.1.2.4 in combination with one of the specified couplings. For combinations with other specified couplings, additional tests according test module C (see table 5.1) are agreed with the manufacturer.

5.1.2.4 For testing a series of fittings a test schedule is determined with at least the following test modules and test samples (design of the test samples see 5.1.4.4 and 5.1.4.5):

a) 1 test sample of each component for test module A

b) 1 test sample assembly with bend and/or T-piece of the maximum nominal size for test module B,
   - if the series only comprises bends according figure A.2;
   - if the series also comprises T-pieces according figure A.1;

c) 1 test sample assembly with bend and/or T-piece of minimum nominal size for test module B,
   - if the series only comprises bends according figure A.2;
   - if the series also comprises T-pieces according figure A.1;

d) 1 test sample assembly with bend and/or T-piece of medium nominal size (selection in agreement with the manufacturer) for test module B,
   - if the series only comprises bends according figure A.2;
   - if the series also comprises T-pieces according figure A.1.

In addition, if the series also comprises flange adapter:

e) 1 test sample assembly of maximum nominal size for test module B according figure A.3.

f) 1 test sample assembly of minimum nominal size for test module B according figure A.3

g) 1 test sample assembly of medium nominal size (selection in agreement with the manufacturer) for test module B according figure A.3.

In addition, if the series also comprises reducing fitting:

h) 1 test sample assembly of maximum nominal size (reducing stage in agreement with the manufacturer) for test module B according figure A.4.

i) 1 test sample assembly of minimum nominal size (reducing stage in agreement with the manufacturer) for test module B according figure A.4.

j) 1 test sample assembly of medium nominal size (selection of nominal size and reducing stage in agreement with the manufacturer) for test module B according figure A.4.

5.1.2.5 The test pipes and couplings shall be suitable for the pressures and bending moments subjected during the tests.

The pipe couplings used for a test sample assembly shall be VdS-approved for an allowable pressure ≥ the allowable pressure of the fittings.

5.2 Pre-testing and identification

5.2.1 Compliance test

A visual and dimensional check is made to determine whether the test samples correspond to the description in the technical documentation (drawings, parts list and instructions for installation) and comply with the verifiable requirements of these guidelines.

5.2.2 Resistance to corrosion and ageing test

On the basis of the drawings, the parts lists and the test samples it is assessed, whether corrosion and ageing may have a detrimental effect on the performance characteristics of the fitting. In case of doubt, corresponding tests have to be conducted.

5.3 Assembling of the test sample assembly

The test sample assembly consisting of fitting(s), pipe couplings and test pipes is mounted according to the installation instructions of the manufacturer.

5.4 Test of the mechanical strength (test module B)

5.4.1 Pressure test

The test sample assembly is mounted on the test device according to Annex A, figure A.1, A.2, A.3 or A.4, dependent on the component to be tested.

Subsequently the test sample assembly is completely filled with water and subjected to a test pressure of 4 times the allowable pressure. The test pressure is maintained for 10 min. Then the test sample assembly is pressure-relieved.

The test sample assembly shall hold safely together. There shall be no signs of:

- leakage,
- plastic deformation or rupture of the material,
- sliding of the couplings on the pipe or on the fitting or
- a projecting sealing element.

5.4.2 Pressure test under bending stress

The couplings of the test sample assembly are retightened while the test sample assembly is pressureless and still filled with water. Then the test sample assembly is subjected to a test pressure of 4 times the allowable pressure.

Subsequently, according to Annex A, figure A.5, the test force F is applied by ascending a hydraulic piston to generate the bending moment according to table 5.2.

The test sample assembly shall hold safely together. There shall be no signs of:

- leakage,
- plastic deformation or rupture of the material,
- sliding of the couplings on the pipe or on the fitting or
- a projecting sealing element.

Nominal size [DN]	Bending moment [Nm]
20	213
25	350
32	644
40	858
50	1.000
65	1.280
80	1.950
100	2.940
125	6.130
150	8.830
200	19.080
250	31.800
300	52.560

Note: For reducing fittings the dimension of the smaller nominal size does apply to determine the bending moment.

Table 5.2: Bending moments

5.4.3 Water hammer test

The test sample assembly filled with water, as left after the test according to clause 5.4.2, is shock-pressurised as follows (test medium water)

- Number of cycles: 3000
- Test pressure: 25 bar above the allowable pressure

The pressure in the test sample assembly shall be maximum 3.5 bar before each cycle. The test sample assembly shall hold safely together. There shall be no signs of

- leakage,
- plastic deformation or rupture of the material,
- a projecting sealing element.

5.4.4 Leakage test

The test sample assembly is completely drained of water.

Subsequently the test sample assembly is pressurised with air for 10 min with a test pressure of 10 bar and is examined for leakage using a leak detection spray. Then the test sample assembly is pressure relieved. The test sample assembly shall be tight.

5.5 Other tests

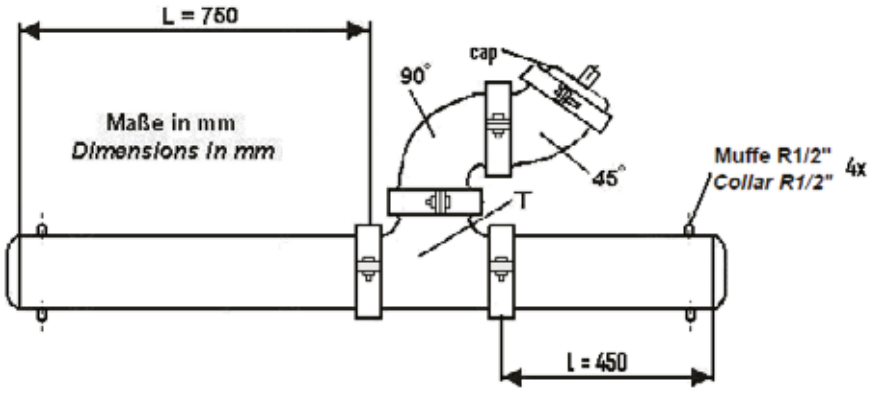
Where necessary due to special designs or new manufacturing methods, additional tests will be conducted in agreement with the manufacturer

Annex A – Test sample assembly and test device for fittings

Figure A.5 shows an example for a test device. Other test devices can be used as far as the dimensions in figure A.5 are observed.

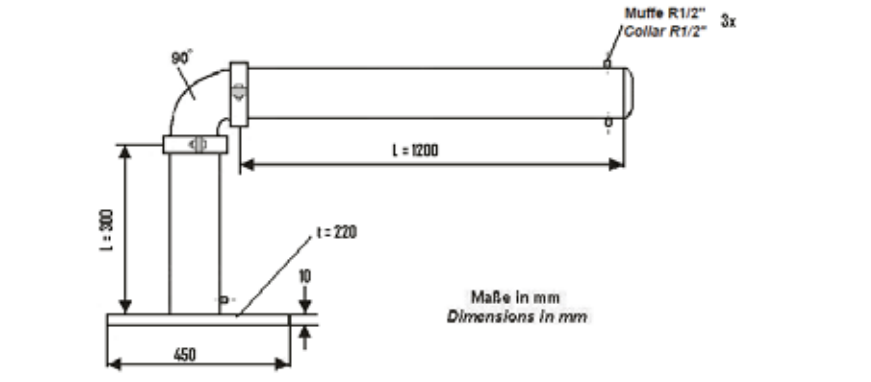
In case of component series which do not include all fittings or which do include additional fittings it can be necessary to adapt the test sample assembly. The dimensions in diagram figure A.5 shall be observed.

The force F can also be applied from below to the test sample in case the test sample is firmly clamped on the counter bearing (dimension 180 mm in figure A.5).



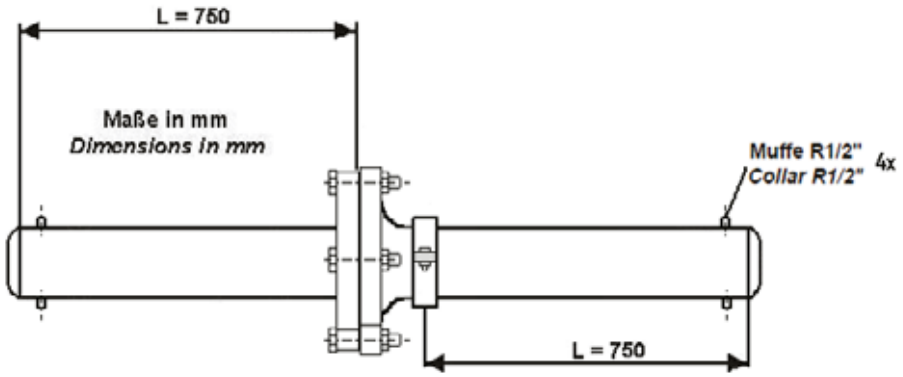
bushing with female whitworth pipe thread (BSP) R ½“ (DN 15), cylindric (!not conic!)

Figure A.1: Test sample assembly for pipe fittings – series (T-piece)



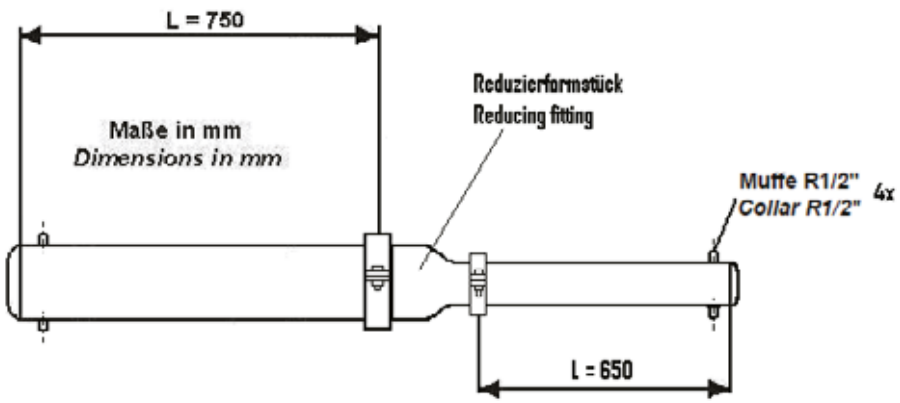
bushing with female whitworth pipe thread (BSP) R ½“ (DN 15), cylindric (!not conic!)

Figure A.2: Test sample assembly for pipe fittings – 90° bend



bushing with female whitworth pipe thread (BSP) R ½“ (DN 15), cylindric (!not conic!)

Figure A.3: Test sample assembly for pipe fittings – flange adapter



bushing with female whitworth pipe thread (BSP) R ½“ (DN 15), cylindric (!not conic!)

Figure A.4: Test sample assembly for pipe fittings – reducing fitting

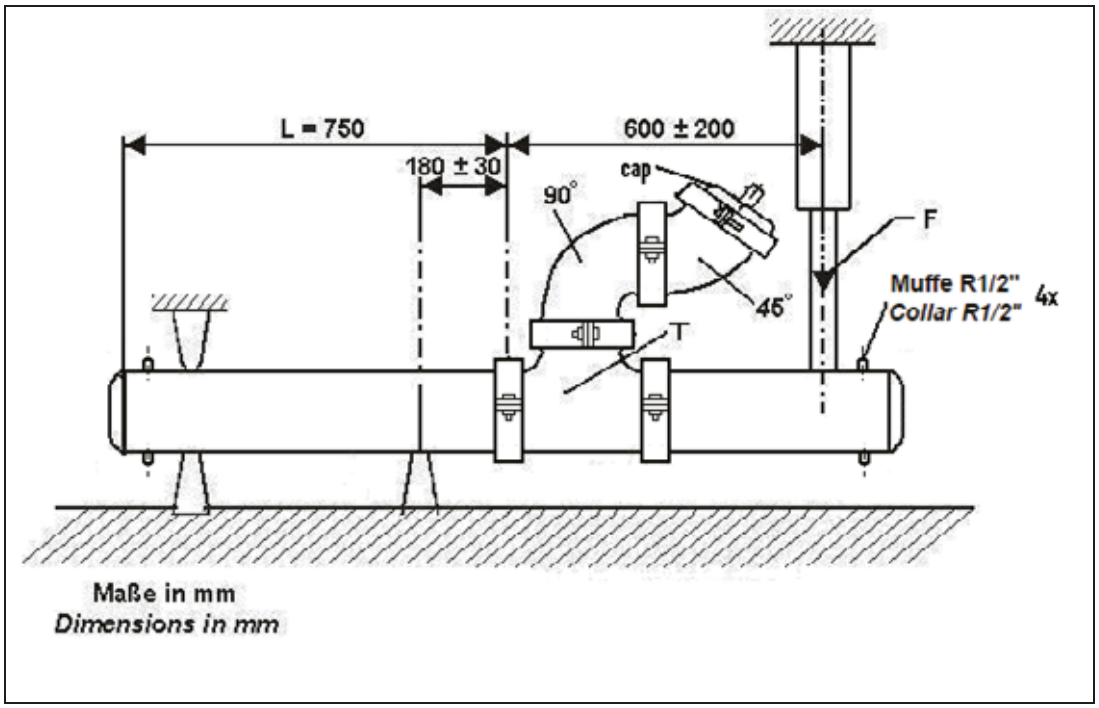


Figure A.5: Test device (dimensions/lever arm/tie points)

Annex B – Dimensions for grooved connections

This annex specifies the dimensions for grooved connections for use with pipe couplings for grooved pipe ends.

Valid for cutting machined connections.

Nominal siz		Nominal outer diameter in mm	Outer diameter in mm		Pipe length up to groove in mm	Groove breadth in mm	Diameter at ground of the groove in mm	
			max.	min.	± 0,76	± 0,76	max.	min.
DN	25	33.7	33.73	33.07	15.87	7.92	30.23	29.85
DN	32	42.4	42.57	41.76	15.87	7.92	38.99	38.61
DN	40	48.3	48.74	47.78	15.87	7.92	45.09	44.70
DN	50	60.3	60.94	59.72	15.87	7.92	57.15	56.77
DN	65	76.1	76.85	75.35	15.87	7.92	72.26	71.80
DN	80	88.9	89.79	88.11	15.87	7.92	84.94	84.48
DN	100	114.3	115.44	113.51	15.87	9.52	110.08	109.58
DN	125	139.7	141.10	138.91	15.87	9.52	135.48	134.97
DN	150	168.3	169.85	167.49	15.87	9.52	163.95	163.40
DN	200	219.1	220.65	218.29	19.05	11.13	214.40	213.77
DN	250	273	274.62	272.26	19.05	12.70	268.27	267.59
DN	300	323.9	325.42	323.06	19.05	12.70	318.29	317.53

Note 1: Groove shoulder free of burs metal removed up to max. 0.3 mm x 45°.
Note 2: Groove ground with radius up to max. 0.8 mm.

Table B.1: Dimensions for grooved connections