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Fire protection — Automatic sprinkler systems —

Part 12: Requirements and test methods for grooved-end components for steel pipe systems

Protection contre l'incendie — Systèmes d'extinction automatiques du type sprinkler —

Partie 12: Exigences et méthodes d'essai pour les raccords de tuyauterie en acier à extrémités rainurées

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6182-12 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 5, *Fixed firefighting systems using water*.

ISO 6182 consists of the following parts, under the general title *Fire protection — Automatic sprinkler systems*:

— *Part 1: Requirements and test methods for sprinklers*

— *Part 2: Requirements and test methods for wet alarm valves, retard chambers and water motor alarms*

— *Part 3: Requirements and test methods for dry pipe valves*

— *Part 4: Requirements and test methods for quick-opening devices*

— *Part 5: Requirements and test methods for deluge valves*

— *Part 6: Requirements and test methods for check valves*

— *Part 7: Requirements and test methods for early suppression fast response (ESFR) sprinklers*

— *Part 8: Requirements and test methods for pre-action dry alarm valves*

— *Part 9: Requirements and test methods for water mist nozzles*

— *Part 10: Requirements and test methods for domestic sprinklers*

— *Part 11: Requirements and test methods for pipe hangers*

— *Part 12: Requirements and test methods for grooved-end components for steel pipe systems*

Introduction

This part of ISO 6182 is one of a number of International Standards prepared by ISO/TC 21 covering components for automatic sprinkler systems.

They are included in a series of International Standards planned to cover the following:

a) carbon dioxide systems (ISO 6183);

b) explosion protection systems (ISO 6184).

Fire protection — Automatic sprinkler systems —

Part 12: Requirements and test methods for grooved-end components for steel pipe systems

1 Scope

This part of ISO 6182 specifies performance requirements, grooving dimensions, test methods and marking requirements for couplings used in the joining of roll and cut grooved steel tube, pipe, grooved-end fittings and other grooved-end components up to 300 mm in nominal diameter.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing or heat resistance tests*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*

ISO 1083:2004, *Spheroidal graphite cast irons — Classification*

ISO 4200:1991, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length*

ASTM A47/A47M-99(2004), *Standard Specification for Ferritic Malleable Iron Castings*

ASTM A153/A153M, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

ASTM A183, *Standard Specification for Carbon Steel Track Bolts and Nuts*

ASTM A536-84(2004), *Standard Specification for Ductile Iron Castings*

ASTM A563-07a, *Standard Specification for Carbons and Alloy Steel Nuts*

ASTM B633-07, *Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel*

ASTM D395-03, *Standard Test Methods for Rubber Property — Compression Set*

EN 12329, *Corrosion protection of metals — Electrodeposited coatings of zinc with supplementary treatment on iron or steel*

VdS 2100-6:2002-5(01), *Guidelines for water extinguishing systems — Pipe joints — Requirements and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
grooved-end components
pipe, tubes, fittings and other components that are used to form grooved mechanical coupling joints

3.2
mechanical coupling
device consisting of two or more housings, fasteners such as bolts and nuts and a pressure-responsive gasket, used to mechanically join grooved pipe, tubing, valves, fittings and other grooved-end components to form a sealed joint

3.2.1
flexible mechanical coupling
mechanical coupling forming a sealed joint in which there is limited angular, axial and rotational movement without overstressing the pipe joint

NOTE See 6.8.

3.2.2
rigid mechanical coupling
mechanical coupling forming a sealed joint in which there is essentially no free angular, axial or rotational movement

3.3
mechanical coupling housing
structural parts of a mechanical coupling that mechanically fit onto grooved pipes, tubes, fittings and other grooved-end components to provide restraint and enclosure of the gasket

3.4
OD
outside diameter

3.5
pressure-responsive gasket
gasket that improves its seal with the application of pressure; that is, additional pressure results in additional force between the gasket and the surface to which it is sealing

3.6
rated working pressure
maximum service pressure at which a grooved piping system is intended to operate

4 Product consistency

It shall be the responsibility of the manufacturer to implement a quality-control programme to ensure that production consistency meets the requirements of this part of ISO 6182 in the same manner as the originally tested samples.

5 Product assembly

Installation instructions shall be provided by the manufacturer and shall include at least the following:

a) assembly procedure for the installation of couplings;

b) grooved-end component specifications, with which the coupling is intended to be used, including minimum pipe wall thickness;

c) bolt torque specification, where required by the manufacturer;

d) maximum allowable movement for flexible couplings;

e) specification for permissible media within the pipe in conjunction with the gasket material (see 8.2 for colour codes).

6 Requirements

6.1 Grooved-end dimensions

6.1.1 Roll grooved-end dimensions

The dimensions of roll grooved ends shall be in accordance with Table 1.

6.1.2 Cut grooved-end dimensions

The dimensions of cut grooved ends shall be in accordance with Table 2.

6.1.3 Cast grooved-end dimensions

The dimensions of cast grooved ends shall be in accordance with Table 3.

6.2 Minimum pipe wall thickness

Grooved-end pipe couplings shall be tested with pipe having the minimum nominal wall thickness specified in the manufacturer's installation instructions.

6.3 Mechanical coupling housing

The casting materials of the housings shall be ductile iron in accordance with ISO 1083:2004, Grade 400-15; ASTM A536-84(2004), Grade 65-45-12 or malleable iron in accordance with ASTM A47/A47M-99(2004), Grade 32510 or 32518; or material having equivalent strength and corrosion resistance. When requested on purchase order, the housing shall be galvanized in accordance with ASTM A153/A153M or EN 12329.

6.4 Pressure-responsive gasket

Materials for the coupling gaskets shall be ethylene-propylene diene m-class rubber (EPDM), nitrile, silicone rubber or other elastomeric materials suitable for the intended service.

6.5 Bolts

Oval neck track head bolts shall be in accordance with ISO 898-1:1999, Class 8.8, heavy hex bolts in accordance with ASTM A183 or other bolts which prevent rotation and have a minimum tensile strength of 800 N/mm^2. Bolts shall be zinc plated in accordance with ASTM B633-07, SC1, or EN 12329, or be of a material that provides at least equivalent corrosion resistance.

Table 1 — Roll grooved-end dimensional specifications

Dimensions in millimetres

Pipe or tube			Dimensional specifications[a]						
Nominal size	Outside diameter (OD)		Gasket seat A ±0,76	Groove width B ±0,76	Groove diameter C		Groove depth D[b]	Wall thickness T Min. allow.	Flare F Max. dia.
	Actual size	Tolerance			Actual size	Tolerance			
25	33,7	+0,41 −0,68	15,88	7,14	30,23	0 −0,38	1,70	1,8	34,5
32	42,4	+0,50 −0,60	15,88	7,14	38,99	0 −0,38	1,70	1,8	43,3
40	48,3	+0,44 −0,52	15,88	7,14	45,09	0 −0,38	1,60	1,8	49,4
50	60,3	±0,61	15,88	8,74	57,15	0 −0,38	1,60	1,8	62,2
65	73,0	±0,74	15,88	8,74	69,09	0 −0,46	1,98	2,3	75,2
65	76,1	±0,76	15,88	8,74	72,26	0 −0,46	1,93	2,3	77,7
80	88,9	+0,89 −0,79	15,88	8,74	84,94	0 −0,46	1,98	2,3	90,6
90	101,6	+1,02 −0,79	15,88	8,74	97,38	0 −0,51	2,11	2,3	103,4
100	108,0	+1,07 −0,79	15,88	8,74	103,73	0 −0,51	2,11	2,3	109,7
100	114,3	+1,14 −0,79	15,88	8,74	110,08	0 −0,51	2,11	2,3	116,2
125	133,0	+1,32 −0,79	15,88	8,74	129,13	0 −0,51	1,93	2,9	134,9
125	139,7	+1,40 −0,79	15,88	8,74	135,48	0 −0,51	2,11	2,9	141,7
125	141,3	+1,42 −0,79	15,88	8,74	137,03	0 −0,56	2,13	2,9	143,5
150	159,0	+1,60 −0,79	15,88	8,74	154,50	0 −0,56	2,20	2,9	161,0
150	165,1	+1,60 −0,79	15,88	8,74	160,90	0 −0,56	2,16	2,9	167,1
150	168,3	+1,60 −0,79	15,88	8,74	163,96	0 −0,56	2,16	2,9	170,7
200	219,1	+1,60 −0,79	19,05	11,91	214,40	0 −0,64	2,34	2,9	221,5
250	273,0	+1,60 −0,79	19,05	11,91	268,28	0 −0,69	2,39	3,6	275,4
300	323,9	+1,60 −0,79	19,05	11,91	318,29	0 −0,76	2,77	4,0	326,2

[a] See Figure 1 for dimensional diagram.

[b] Dimension for reference only, groove diameter is determined by C.

Table 2 — Cut grooved-end dimensional specifications

Dimensions in millimetres

Pipe or tube			Dimensional specifications[a]					
Nominal size	Outside diameter (OD)		Gasket seat A ±0,76	Groove width B ±0,76	Groove diameter C		Groove depth D[b]	Wall thickness T Min. allow.
	Actual size	Tolerance			Actual size	Tolerance		
25	33,7	+0,41 −0,68	15,88	7,54	30,23	0 −0,38	1,70	3,3
32	42,4	+0,50 −0,60	15,88	7,54	38,99	0 −0,38	1,70	3,5
40	48,3	+0,44 −0,52	15,88	7,54	45,09	0 −0,38	1,58	3,6
50	60,3	±0,61	15,88	8,36	57,15	0 −0,38	1,58	3,6
65	73,0	±0,74	15,88	8,36	69,09	0 −0,46	1,98	4,0
65	76,1	±0,76	15,88	8,36	72,26	0 −0,46	1,93	4,0
80	88,9	+0,89 −0,79	15,88	8,36	84,94	0 −0,46	1,98	4,5
90	101,6	+1,02 −0,79	15,88	8,36	97,38	0 −0,51	2,11	5,0
100	108,0	+1,07 −0,79	15,88	9,14	103,73	0 −0,51	2,11	5,0
100	114,3	+1,14 −0,79	15,88	9,14	110,08	0 −0,51	2,11	5,0
125	133,0	+1,32 −0,79	15,88	9,14	129,13	0 −0,51	1,93	5,0
125	139,7	+1,40 −0,79	15,88	9,14	135,48	0 −0,51	2,11	5,0
125	141,3	+1,42 −0,79	15,88	9,14	137,03	0 −0,56	2,13	5,0
150	159,0	+1,60 −0,79	15,88	9,14	154,50	0 −0,56	2,20	5,4
150	165,1	+1,60 −0,79	15,88	9,14	160,90	0 −0,56	2,16	5,4
150	168,3	+1,60 −0,79	15,88	9,14	163,96	0 −0,56	2,16	5,4
200	219,1	+1,60 −0,79	19,05	11,53	214,40	0 −0,64	2,34	5,4
250	273,0	+1,60 −0,79	19,05	12,32	268,28	0 −0,69	2,39	6,3
300	323,9	+1,60 −0,79	19,05	12,32	318,29	0 −0,76	2,77	7,1

[a] See Figure 2 for dimensional diagram.

[b] Dimension for reference only, groove diameter is determined by C.

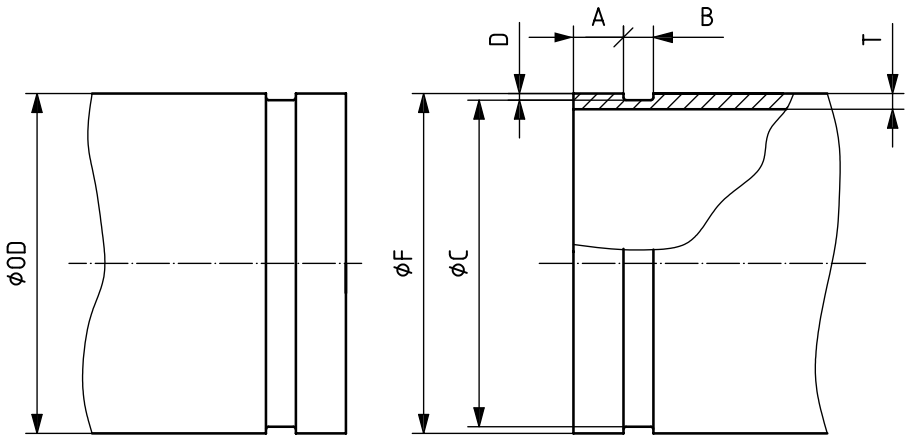


Figure 1 — Roll grooved-end dimensional reference points from Table 1

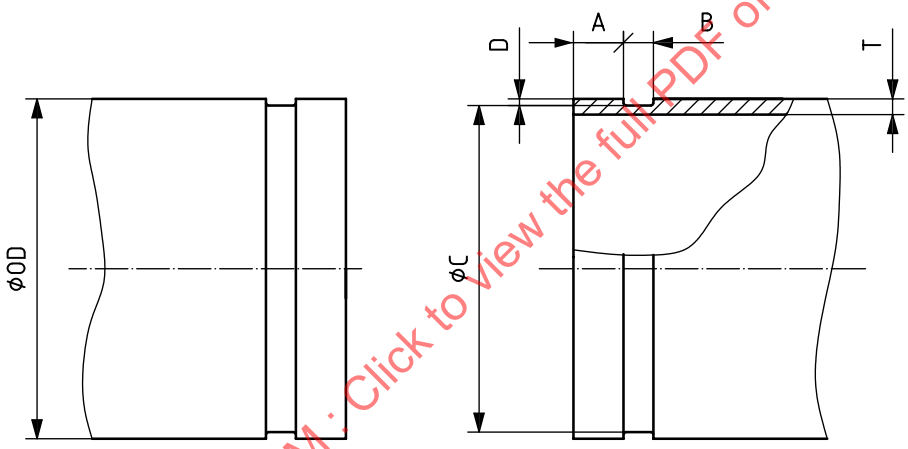


Figure 2 — Cut grooved-end dimensional reference points from Table 2

Table 3 — Cast components grooved-end dimensions

Dimensions in millimetres

Nominal diameter DN	Outside diameter OD	Tolerance	Groove diameter	Tolerance	Gasket seat	Tolerance	Groove width	Tolerance
25	33,4	+0,37 −0,37	30,2	0 −0,89	15,88	+0,76 −0,76	7,54	+1,17 −1,17
32	42,2	+0,37 −0,37	39,0	0 −0,89	15,88	+0,76 −0,76	7,54	+1,17 −1,17
40	48,3	+0,34 −0,34	45,1	0 −0,89	15,88	+0,76 −0,76	7,54	+1,17 −1,17
50	60,3	+0,40 −0,40	57,2	0 −0,89	15,88	+0,76 −0,76	8,36	+1,17 −1,17
65	73,0	+0,49 −0,49	69,1	0 −0,97	15,88	+0,76 −0,76	8,36	+1,17 −1,17
65	76,1	+0,50 −0,50	72,3	0 −0,97	15,88	+0,76 −0,76	8,36	+1,17 −1,17
80	88,9	+0,54 −0,54	84,9	0 −0,97	15,88	+0,76 −0,76	8,36	+1,17 −1,17
90	101,6	+0,58 −0,58	97,4	0 −1,07	15,88	+0,76 −0,76	8,36	+1,17 −1,17
100	108,0	+0,59 −0,59	103,7	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
100	114,3	+0,61 −0,61	110,1	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
125	133,0	+0,66 −0,66	129,1	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
125	139,7	+0,68 −0,68	135,5	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
125	141,3	+0,69 −0,69	137,0	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
150	159,0	+0,74 −0,74	154,5	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
150	165,1	+0,74 −0,74	160,8	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
150	168,3	+0,74 −0,74	164,4	0 −1,07	15,88	+0,76 −0,76	9,14	+1,17 −1,17
200	219,1	+0,76 −0,76	214,4	0 −1,52	19,05	+0,76 −0,76	11,53	+1,17 −1,17
250	273,0	+0,77 −0,77	268,3	0 −1,57	19,05	+0,76 −0,76	12,32	+1,17 −1,17
300	323,9	+0,79 −0,79	318,3	0 −1,65	19,05	+0,76 −0,76	12,32	+1,17 −1,17

6.6 Nuts

Nuts shall be hexagon nuts in accordance with ISO 898-2:1992, minimum Class 8, or heavy (large) hexagon nuts in accordance with ASTM A563-07a, Grade B or equivalent. Nuts shall be zinc plated in accordance with ASTM B633-07, SC1, or be of a material that provides at least the equivalent corrosion resistance.

6.7 Hinge pins

Hinge pins, if provided, shall be zinc plated in accordance with ASTM B633-07, Class FE/ZN5, or EN 12329, or be of a material that provides at least the equivalent corrosion resistance.

6.8 Flexible coupling

A flexible mechanical coupling shall permit axial displacement, rotation and at least 1° of angular movement for pipe diameter sizes less than 200 mm and 0,5° for pipe diameter sizes 200 mm and greater without inducing harm on the pipe when tested in accordance with 7.7.

6.9 Vacuum

The coupling assembly shall maintain a vacuum of 0,08 MPa (0,8 bar) for a period of 5 min without leakage when tested in accordance with 7.2.

6.10 Air leakage

The coupling assembly shall show no evidence of air leakage when tested in accordance with 7.3.

6.11 Low-temperature exposure

The coupling assembly shall show no evidence of air leakage when tested in accordance with 7.4.

6.12 Heat ageing

The coupling assembly shall show no evidence of air leakage or cracking of the gasket when tested in accordance with 7.5.

6.13 Hydrostatic pressure

The coupling assembly shall show no evidence of leakage, fracture or rupture when tested in accordance with 7.6.

6.14 Bending moment

The coupling assembly shall show no evidence of fracture or rupture or evidence of water leakage when tested in accordance with 7.7.

6.15 Gasket material evaluation

6.15.1 Compression set

Compression set shall not exceed 25 % when tested in accordance with ASTM D395-03, method B.

6.15.2 Tensile strength and elongation

6.15.2.1 Gasket materials shall have the following properties when tested in accordance with ISO 37:

a) for silicone rubber (having poly-organo-siloxan as its constituent characteristics), a minimum tensile strength of 3,4 MPa (34 bar) and a minimum ultimate elongation of 100 %; or

b) for natural rubber and a synthetic rubber other than silicon rubber, a minimum tensile strength of 10,3 MPa (103 bar) and a minimum ultimate elongation of 150 %, or a minimum tensile strength of 15,2 MPa (152 bar) and a minimum ultimate elongation of 100 %.

6.15.2.2 When tested in accordance with ISO 188, the physical properties of the gasket material after oven ageing at 100 °C for 70 h shall be at least 60 % of the as-received tensile strength and elongation values. Any change in the hardness shall not exceed 5 % of the as-received value.

6.16 Fire resistance

The design of the coupling system should be such that a joint shall not leak in excess of the discharge from one sprinkler, in accordance with 7.8, during a fire test in accordance with VdS 2100-6; 2002-5(01), Section 5.5. The estimated flow of a single sprinkler operating is 115 l/min. This is based on a sprinkler with a nominal discharge coefficient of 8,0 l/min/(kPa)$^{1/2}$ [80 l/min/(bar)$^{1/2}$] at a pressure of 0,2 MPa (2 bar).

6.17 Rated working pressure

The rated working pressure of a coupling shall not be less than 1,2 MPa (12 bar).

6.18 Nominal sizes

The size of a coupling shall be in accordance with the pipe sizes given in ISO 4200.

7 Test methods

7.1 Test assembly

Unless otherwise specified, the test assembly shall consist of two sections of piping, each 150 mm long fitted with end caps. The test coupling shall be assembled in accordance with the manufacturer's installation instructions. See Figure 3.

7.2 Vacuum

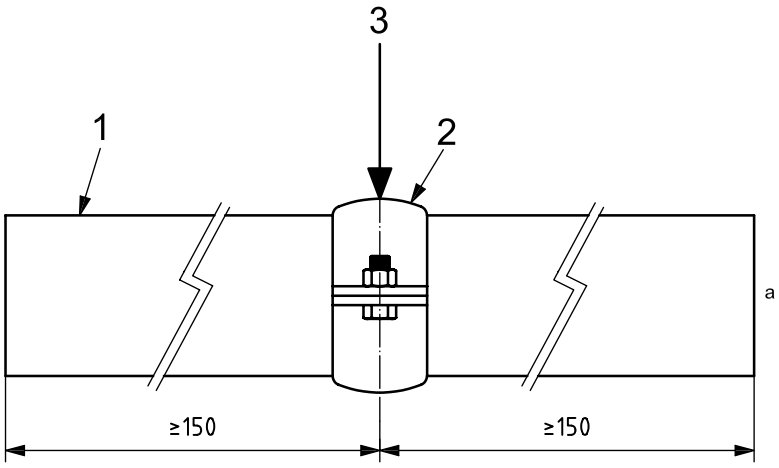
NOTE See 6.9.

7.2.1 The test assembly (see Figure 3) shall be equipped with a vacuum gauge to permit visual verification of the actual vacuum being applied. Vacuum tests shall be performed at an ambient temperature of (24 ± 5) °C.

7.2.2 Using a suitable vacuum pump, the test assembly shall be subjected to an internal vacuum pressure of 0,08 MPa (0,8 bar), and then isolated by closing shut off valves located between the test sample and the vacuum pump. The 0,08 MPa (0,8 bar) vacuum pressure may be re-established, if necessary, following an appropriate stabilization period.

7.2.3 Once the vacuum pressure has been established, there shall be no increase of more than 0,01 MPa (0,1 bar) below relative ambient pressure during the 5 min test period.

Dimensions in millimetres



Key

1 pipe section
2 pipe fitting
3 test load

[a] Pipe tap provided in the end.

Figure 3 — Test assembly

7.3 Air leakage

NOTE See 6.10.

7.3.1 The test assembly (see Figure 3) shall be equipped with pressure measuring equipment to permit visual verification of the internal pressure being applied. Air tests shall be performed at an ambient temperature of (24 ± 5) °C.

7.3.2 The air pressure shall then be increased to 0,3 MPa (3 bar) and held for 5 min and then soapy water or leakage test fluid applied.

CAUTION — Pneumatic pressure testing requires appropriate safety precautions.

7.3.3 There shall be no loss of air pressure observed by pressure measuring equipment or evidence of leakage during a 5 min test period.

7.4 Low-temperature exposure

NOTE See 6.11.

7.4.1 The test assembly (see Figure 3) shall be equipped with a pressure gauge to permit visual verification of the pressure being applied.

7.4.2 Water to the depth of 3 mm shall be added to the horizontal assembly. The assembly and water shall be at an ambient temperature of (24 ± 5) °C. The assembly shall then be pressurized with air to 0,3 MPa (3 bar), sealed and placed in a chamber at –40 °C in the horizontal position for a period of 24 h. Following the exposure, the assembly shall be restored to ambient temperature.

CAUTION — Pneumatic pressure testing requires appropriate safety precautions.

7.4.3 The air pressure in the assembly shall be observed to return to 0,3 MPa (3 bar) within 24 h.

7.5 Heat aging

NOTE See 6.12.

7.5.1 The test assembly (see Figure 3) shall be initially pressurized to 0,3 MPa (3 bar) to check for leakage as specified in 7.3.2, then depressurized and placed in the oven at 135 °C for 45 days.

CAUTION — Pneumatic pressure testing requires appropriate safety precautions.

7.5.2 Following exposure, the assembly shall be conditioned at an ambient temperature of (24 ± 5) °C for a minimum of 24 h. The test assembly shall then be submerged in water and pressurized with air to 0,3 MPa (3 bar) for 5 min.

CAUTION — Pneumatic pressure testing requires appropriate safety precautions.

7.5.3 There shall be no loss of air pressure observed by the formation of air bubbles at the test coupling during the 5 min test period.

7.5.4 The test assembly shall be disassembled and the gasket shall not crack when two diametrically opposite points are squeezed together by hand until they touch. Gaskets intended for use with components 200 mm and larger shall also not crack when opposite sides are twisted by hand into a half turn.

7.6 Hydrostatic pressure test

NOTE See 6.13.

7.6.1 The test assembly (see Figure 3) shall be filled with water and purged of any entrapped air. Hydrostatic tests shall be performed at an ambient temperature of (24 ± 5) °C.

CAUTION — Hydrostatic pressure testing requires appropriate safety precautions.

7.6.2 Hydrostatic pressure shall be increased at a rate not exceeding 2,0 MPa/min (20 bar/min) until an internal pressure level equal to four times the rated working pressure is attained. This pressure shall be maintained for 5 min.

7.6.3 There shall be no leakage, rupture or joint failure throughout the 5 min test period.

7.7 Bending moment

NOTE See 6.14.

7.7.1 The test assembly shall consist of two sections of piping each a minimum of 400 mm long fitted with end caps. The test coupling shall be assembled in accordance with the manufacturer's installation instructions (see Figure 4).