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Fire protection — Automatic sprinkler systems —

Part 11: Requirements and test methods for pipe hangers

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

Partie 11: Exigences et méthodes d'essai relatives aux dispositifs de fixation des conduites

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 6182-11:2003), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The seismic requirements and testing have been removed from this document and will be addressed in a separate standard.

A list of all the parts in the ISO 6182 series, can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Fire protection — Automatic sprinkler systems —

Part 11: Requirements and test methods for pipe hangers

1 Scope

This document specifies construction requirements, performance requirements, test methods and marking requirements for typical types of pipe hangers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 2064, *Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3575:2016, *Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of commercial and drawing qualities*

ISO 4998:2014, *Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of structural quality*

ASTM B568, *Standard test method for measurement of coating thickness by X-ray spectrometry*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
band (loop) hanger
type of pipe hanger where the distance from the structure to the pipe is adjustable and usually utilizes a metallic strip looped around the pipe for support of a load

Note 1 to entry: See Figure 1 j).

3.1.1
adjustable swivel band (loop) hanger
type of pipe hanger that is intended to accommodate support of piping at various directions in the same plane

Note 1 to entry: See Figure 1 e).

3.2
bracket
cantilever-type pipe hanger that is attached directly to a vertical surface of the building structure

Note 1 to entry: See Figure 1 l).

3.3
building attachment component
support fixing
pipe hanger component set into the wall, such as driven fastener, expansion anchor, undercut anchor, or cast-in insert, intended to support the pipe hanger

3.4
cast-in insert
type of building attachment component cast into the concrete at the time of pouring

Note 1 to entry: See Figure 1 m).

Note 2 to entry: Cast-in inserts can be channels, which take special threaded bolts, or internally threaded sockets, which accept conventional bolts or rods.

3.5
ceiling flange
type of building attachment component pipe hanger that is attached directly to an overhead surface of a building structure

Note 1 to entry: See Figure 1 k).

3.6
beam clamp
type of building attachment that is rigidly attached to both edges of the bottom flange of a structural member

Note 1 to entry: See Figure 1 a).

3.7
C-clamp
building attachment component that grips a flange by means of a jaw and setscrew combination

Note 1 to entry: See Figure 1 q).

3.8
riser clamp
pipe attachment component intended to support vertical piping (risers) at various levels

Note 1 to entry: See Figure 1 b).

3.9
top/bottom clamp
building attachment intended to rigidly grip one edge of a top or bottom flange of a steel structural member

Note 1 to entry: See Figure 1 d).

3.10
clevis hanger
type of split-ring pipe-attachment component

Note 1 to entry: See Figure 1 i).

3.11
clip
pipe-attachment component, usually a one piece and nonadjustable "U" shaped device that partially embraces a pipe intended to be attached directly to a building structure

Note 1 to entry: See Figure 1 c).

3.12
coupler
threaded rod coupling
threaded element used to connect the building attachment component (support fixing) to the rod

Note 1 to entry: See Figure 1 p).

Note 2 to entry: Couplers can have male or female threads (usually female) and can be the same thread throughout or two different thread diameters to link fixings and rods of different sizes (increaser coupler).

3.13
driven fastener
type of building attachment component driven into solid concrete or structural steelwork by means of a special tool, usually powder actuated, and can have female or, usually, male thread linked to the rod by means of a coupler

3.14
expansion anchor
type of building attachment component set into the concrete ceiling or wall of the building structure in self-drilled or pre-drilled cylindrical holes

Note 1 to entry: See Figure 1 n) and Figure 1 o).

Note 2 to entry: Ceiling fixings are usually “deformation-controlled” internally threaded socket anchors, which are expanded by driving an expander plug to the base of the shell or by driving the shell over the expander plug.

Note 3 to entry: Fixings for walls can be socket anchors or can be “torque-controlled” anchors, either through-bolts (where an expander clip is expanded by the tightening of the bolt) or sleeve anchors (where the sleeve is expanded by the tightening of the bolt).

3.15
pipe hanger
assembly of components used singly or in combination with other assemblies for supporting gravity loads of a piping system

Note 1 to entry: A pipe hanger can comprise a building attachment component (support fixing), coupler, rod or equivalent and pipe attachment component as shown in Figure 2, or a simple bracket and building attachment component (support fixing) as indicated in Figure 3.

3.16
non-heat sensitive material
material whose measured tensile strength at (540 ± 10) °C is at least 90 % of the value measured at (20 ± 5) °C

3.17
pipe attachment component
pipe hanger component that is attached directly to the pipe

Note 1 to entry: See Figures 2 and 3.

3.18
retaining strap
building attachment component, usually made from steel strip, intended for use in combination with a beam clamp, C-clamp or a top/bottom clamp to hold the clamp in place on the beam

Note 1 to entry: See Figure 1 q).

3.19
solid ring
pipe hanger that completely encircles a pipe without a positive gripping action that has to be slipped onto the end of the pipe and cannot be opened in any way for attachment to the pipe after the piping is fabricated

Note 1 to entry: See Figure 1 f).

3.19.1
split ring
pipe hanger that completely encircles a pipe without a positive gripping action that can be opened in some way to allow it to be installed on the pipe after the pipeline is fabricated

Note 1 to entry: See Figure 1 g).

3.19.2
swivel ring
solid or split ring pipe hanger, equipped with a top swivel allowing the pipe hanger to be connected to a rod after it has been installed onto the pipe

Note 1 to entry: See Figure 1 f).

3.20
undercut anchor
type of building attachment component installed in a concrete ceiling or wall of the building structure in self-drilled or pre-drilled undercut holes

Note 1 to entry: The setting of the anchor, usually by hammering a sleeve over an outwardly tapered element, forces the sleeve out into the undercut shape forming a mechanical interlock with the base material. These anchors are intended for tension zones of concrete, i.e. cracked concrete.

3.21
welded studs
type of building attachment, usually fabricated from threaded material equal to the rod size that is intended to be welded to the steel building structure

4 Product consistency

It shall be the responsibility of the manufacturer to implement a quality control programme to ensure that production continuously meets the requirements of this document in the same manner as the originally tested samples.

5 Materials and rod sizes

5.1 Materials

Pipe hangers and their components shall be made of ferrous or other non-heat-sensitive materials.

5.2 Rod sizes

5.2.1 Pipe hangers and their components shall be provided with rod sizes in accordance with Table 1 unless otherwise stated in 5.2.2.

5.2.2 Pipe hanger rod sizes designated in Table 1 are the nominal diameters associated with machined threads. The diameter of a rod provided with a rolled thread shall be not less than the root diameter of the thread.

5.2.3 Some pipe hanger assemblies, such as powder-driven (pyrotechnic) fasteners and 6-mm and 8-mm size expansion shells require the use of an increaser coupling to attach to nominal 10-mm size rod. The increaser couplings provided by the manufacturer shall have sufficient strength to support the test loads applicable to the maximum permitted pipe size.

5.3 Ceiling flanges

Ceiling flanges for pipe sizes up to DN 50 shall have at least two supporting screw holes. For pipe sizes of up to DN 200, no less than three supporting screw holes shall be provided.

6 Material thickness

6.1 Uncoated material thickness

6.1.1 Unprotected flat steel, no less than 3 mm thick, is acceptable for use as a clevis-type hanger, band hanger, adjustable swivel band hanger and for other flat iron hangers, if the pipe hanger is at least 25 mm wide and if the pipe hanger exhibits strength values of at least 150 % of the required test load specified in Table 1.

6.1.2 A C-clamp formed of a double thickness, no less than 3 mm thick, unprotected steel so as to form a 6 mm thick section is acceptable if the clamp exhibits strength value of at least 150 % of the required test load specified in Table 1.

6.1.3 A pressed-steel concrete insert formed from unprotected steel, no less than 3 mm thick, is acceptable if it complies with all other requirements.

6.1.4 Except as noted in 6.1.1, if a pipe hanger or part of a pipe hanger is made of flat iron or steel, the thickness of the metal shall be at least 4,8 mm.

6.2 Coated material thickness

6.2.1 A pipe hanger or part of a pipe hanger shall have a minimum thickness of 3 mm provided it has an acceptable protective coating. Acceptable coatings are as follows:

a) a zinc coating having a minimum thickness of 12,7 µm on all outside surfaces and 7,6 µm on all inside surfaces; or

b) a Z180 continuous hot-dip zinc-coated steel sheet coating as specified in ISO 4998:2014, Table 3, or ISO 3575:2016, Table 2; or

c) any other metallic or non-metallic finish or combination of the two which, when subjected to comparative tests, provides corrosion protection equivalent to a) or b).

The coating thickness shall be determined in accordance with 8.1.

6.2.2 Coated flat steel material, no less than 1,5 mm thick, is acceptable for use as a clevis-type hanger, band hanger, adjustable swivel loop hanger and as part of other flat iron hangers for pipes DN 50 or

less in size provided the pipe hanger exhibits a strength value of at least 150 % of the required test load specified in Table 1.

Coated flat steel material, no less than 2,5 mm thick, is acceptable for use as a clevis-type hanger, band hanger, adjustable swivel loop hanger and as part of other flat iron hangers for pipes greater than DN 50 in size provided the pipe hanger exhibits a strength value of at least 150 % of the required test load specified in Table 1.

7 Performance requirements

7.1 General

A pipe hanger or building attachment component shall be tested to the pull test load requirements in Table 1 using the values for the largest size of nominal piping that the pipe hanger can accommodate or for the maximum load of the largest rod size to which it can be attached, whichever load is larger. Unless otherwise stated, the tolerances given in Annex A shall apply.

7.2 Elongation and pull requirements

7.2.1 When tested in accordance with 8.2, a pipe hanger, after initially being preloaded, shall support the elongation test load selected from Table 1 for 1 min without exceeding an elongation of 5 mm.

Exception — No elongation is permitted for building attachment components that are not provided with a clip or retaining strap to maintain securement to the building member.

Table 1 — Pull test load requirements

Nominal pipe size DN	Pipe outside diameter mm	Minimum threaded rod size[c] mm	Pre-load N	Elongation test load[a] N	Required test load[b] N
20	26,7	10 or 8	100	1 700	3 400
25	33,4	10 or 8	150	1 700	3 400
32	42,4	10 or 8	200	1 700	3 400
40	48,3	10 or 8	250	1 700	3 400
50	60,3	10 or 8	350	1 700	3 400
65	76,1	10	539	2 084	4 168
80	88,9	10	785	2 354	4 707
90	101,6	10	883	2 795	5 590
100	114,3	10	1 128	3 334	6 669
125	139,7	12	1 569	4 462	8 924
150	168,3	12	2 109	5 884	11 768
200	219,1	12	3 334	9 022	18 044
250	273,0	16	5 002	13 019	26 038
300	323,9	16	6 816	17 579	35 158

[a] Equivalent to 50 % of 5 times the weight of a 4,6 m span of water-filled Schedule 40 steel pipe plus a fixed mass of 115 kg.

[b] Equivalent to 5 times the weight of a 4,6 m span of water-filled Schedule 40 steel pipe plus a fixed mass of 115 kg.

[c] The threads should be in accordance with ISO 1502.

NOTE For hangers with pipe outside diameters not listed above use load values in accordance with those defined in notes a and b.

7.2.2 Following the elongation test, the pipe hanger shall then be subjected to the required test load specified in Table 1 for 1 min without rupture, pull out, or complete release.

7.3 Concrete inserts

When tested in accordance with 8.3, pipe hangers and building attachments intended for installation in concrete are to be installed in a manner representing their intended field installation in concrete blocks. They shall then be capable of supporting the required test load specified in Table 1 for 1 min without rupture, pull out, or complete release of load.

7.4 Vibration requirements

When tested in accordance with 8.4, expansion shells (cases, shields, or bases), powder-driven fasteners, welded studs, C-clamps not provided with a locknut or retaining strap, and any other pipe hangers that may be subject to change in their ability to retain their installation holding power, are to be vibrated for a period of 100 h at a frequency of 35 Hz and an amplitude of (0,825 ± 0,05) mm and shall then comply with the elongation and pull requirements specified in 7.2.

8 Test methods

8.1 Metallic coating thickness test (see 6.2)

8.1.1 General

The conventions and definitions concerning the measurement of coating thickness given in ISO 2064 shall apply. The coating thickness may be determined by one of the methods given in 8.1.2 to 8.1.4. The method used shall be agreed by all parties; in cases of dispute the method given in 8.1.2 shall be used.

8.1.2 Gravimetric determination of the mass per area

The mass per unit area of the zinc coating shall be determined in accordance with the method described in ISO 1460.

8.1.3 Measurement of coating thickness by X-ray spectrometry

The coating thickness shall be determined in accordance with the method described in ASTM B568 or another equivalent method.

8.1.4 Magnetic determination of coating thickness

The coating thickness shall be determined in accordance with the methods described in ISO 2178. The instruments shall be handled and calibrated according to manufacturer's instructions.

8.1.5 Other methods

Other methods may be used providing they meet the general requirements given in 8.1.1.

8.2 Tests for rods and pipe attachments (see 7.2)

8.2.1 Sample rods and pipe attachments are to be installed in a tension-compression test apparatus in a manner duplicating their intended field installation.

8.2.2 The test machine is to be operated at a speed sufficient to produce an elongation of the test samples at the rate of 1,27 mm/min ± 10 %.

8.2.3 A pipe hanger other than a riser clamp, whose holding power is dependent on the tightness of a bolt, nut, cap screw, lock nut, setscrew, or other machine or roll-threaded part, is to be installed in the

test setup and subjected to test with the threaded members tightened to the values specified in Table 2 or as specified by the manufacturer.

8.2.4 A riser clamp shall be tightened to the torque as specified by the manufacturer.

Table 2 — Applied torques for threaded parts

Thread size		Applied torque	
mm	in	N·m	lbf·in
8	1/4	4,52	40
8	5/16	5,65	50
10	3/8	6,78	60
12	7/16	10,2	90
12	1/2	14,1	125
16	9/16	20,3	180
16	5/8	28,2	250
20	3/4	45,2	400
20	7/8	75,1	665
24	1	111,9	990

8.3 Tests for building attachment components (support fixings) (see 7.3)

8.3.1 The concrete blocks specified in 7.3 shall be at least 350 mm × 350 mm × 200 mm in size, made from a mixture of one part Portland cement, two parts torpedo sand, and four parts crushed limestone or gravel, or of a mixture of these proportioned so that the 28-day compressive strength will be from 17,2 MPa to 20,7 MPa, and reinforced such as with the use of eight 6,4-mm steel rods. Four of the rods are to be placed in the concrete-block form in a plane 38 mm from and parallel with the top of the form. Each set of four rods is to be arranged in the form so that each of the four sides of the form has a rod placed 75 mm in from the side. (See 7.3).

8.3.2 Sample inserts shall be cast in the concrete blocks (one insert per block), and the blocks allowed to cure for at least 28 days. After this period, the concrete blocks with concrete inserts in place are to be assembled in the test machine and the inserts subjected to an increasing load until the required loading as specified in Table 1 is achieved. The test machine supports are to be no closer to the centreline of an anchor point than approximately ten diameters of the anchor rod.

8.3.3 Expansion shells (cases, shields, or bases) shall be installed for performance tests in the concrete blocks (one expansion shell per block), after the blocks have cured for at least 28 days. Each sample expansion shell is to be installed in the manner and at the depth specified by the manufacturer.

8.3.4 Following installation of test samples in the concrete blocks, each test setup shall be secured in place in the test machine and subjected to an increasing load until the required loading as specified in Table 1 is achieved.

8.3.5 Samples of fasteners, including powder-driven fasteners, designed for use in concrete are to be driven into concrete blocks, as previously described in 8.3.1, in accordance with the manufacturer's installation instructions.

8.3.6 Each test fastener for use in concrete is to be driven into the concrete to the full depth of the shank. The fastener is then to be subjected to an increasing tensile load until the required loading as specified in Table 1 is achieved.

8.3.7 Samples of fasteners intended for use in steel are to be driven into steel strips of suitable width, having thicknesses of 8 mm, 10 mm, 12 mm, 16 mm and 20 mm, and having hardness values (Brinnell) of no less than 140, nor greater than 240. Each sample shall penetrate the full depth of the shank until the point protrudes approximately 3,2 mm beyond the surface of the underside of the steel plate. The fastener shall then be subjected to an increasing load until the required loading as specified in Table 1 is achieved.

8.3.8 Welding studs shall be attached to steel plates that are not less than 4,8 mm thick and having other dimensions suitable to installation in the strength-test machine. The samples shall be attached to the steel plate using the tools and methods recommended by the manufacturer. The test arrangement shall then be subjected to an increasing load until the required loading as specified in Table 1 is achieved.

8.4 Vibration tests (see 7.4)

8.4.1 In a vibration test, the amplitude is defined as the maximum displacement of sinusoidal motion from the position of rest or one-half of the total table displacement.

8.4.2 The test pipe hanger shall consist of the smallest size of each type or series.

8.4.3 A pipe hanger normally installed in concrete, such as an expansion case or a powder-driven fastener, is to be installed in a concrete block, such as that specified in 8.3.1, weighing approximately 60 kg. The pipe hanger and block are to be mounted in the test fixture in a manner that will cause the concrete block to be the test load supported by the pipe hanger.

8.4.4 A pipe hanger normally driven into, welded, or otherwise attached to steel is to be installed on the vibration test fixture in its intended manner. A pipe hanger rod supporting the 60 kg test load is to be attached to the pipe hanger.

8.4.5 The test fixture, together with the pipe hanger and its load, is to be mounted in a vertical position on a vibration-test apparatus and vibrated in a vertical direction.

9 Marking

9.1 Hangers

9.1.1 Pipe hanger rods need not be marked.

9.1.2 Pipe hangers shall be marked with the maximum pipe size with which they are intended to be used. Pipe hanger parts that are tested with the maximum size pipe they can accommodate need not be marked with the maximum pipe size.

9.1.3 Pipe hanger parts other than those identified above shall be plainly marked with the name or trademark and model number designation of the manufacturer.

9.1.4 The name, trademark, or model number for a product that cannot be adequately marked due to product size, material, or the like, shall be placed on the shipping carton or other type container if the product is packaged for shipment.

9.2 Factory marking

If a manufacturer produces pipe hanger equipment at more than one factory, each pipe hanger shall have a distinctive marking to identify it as the product of a particular factory.

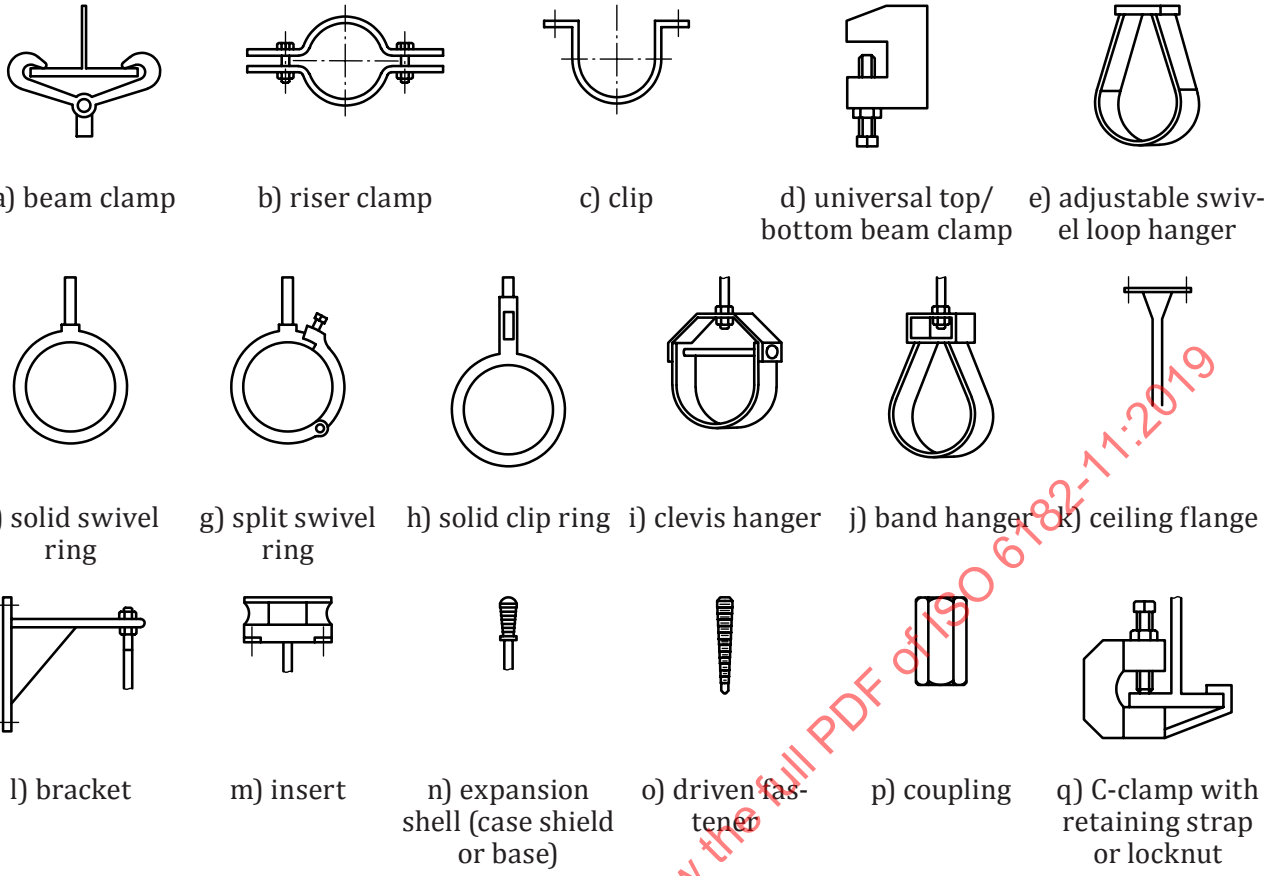
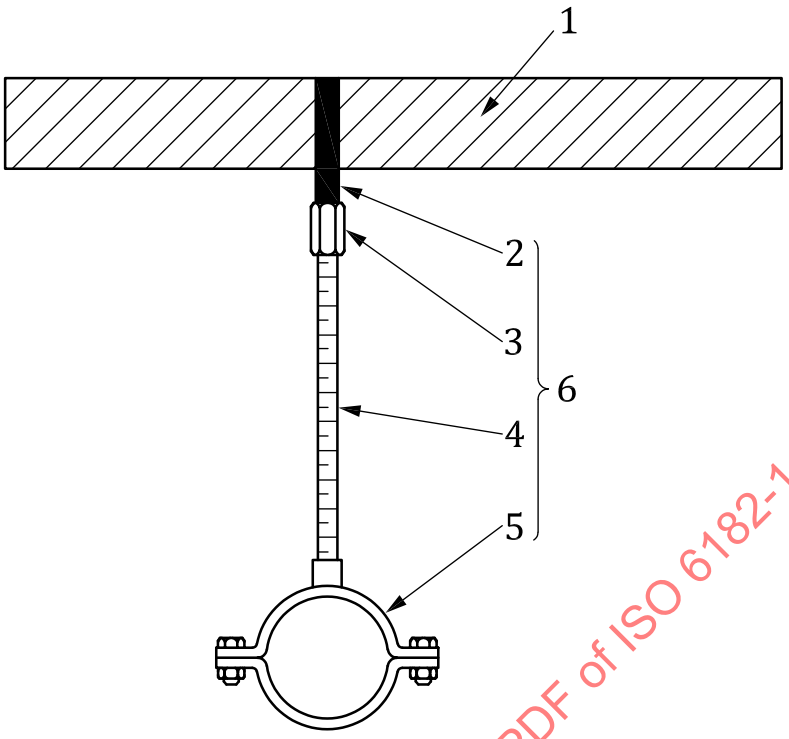


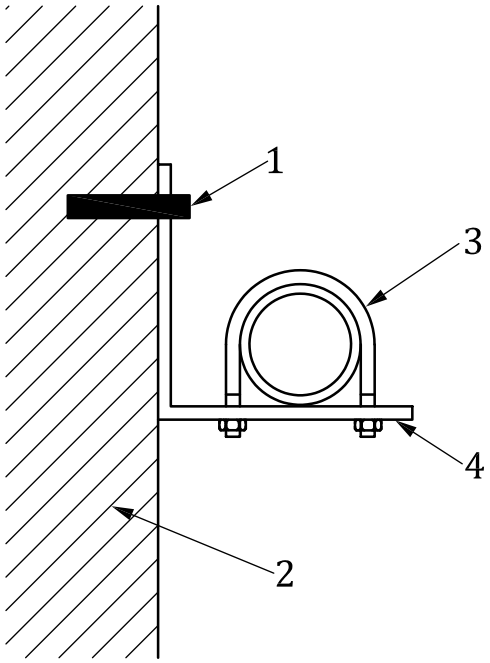
Figure 1 — Typical types of pipe hanger equipment



Key

1 ceiling
2 building attachment component (support fixing)
3 coupler
4 rod
5 pipe attachment component
6 hanger

Figure 2 — Pipe hanger attachments — Floor/wall attachment



Key

1 bracket-type pipe attachment (support fixing)
2 wall
3 pipe attachment component
4 bracket

Figure 3 — Pipe hanger attachments — Wall attachment