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BSI Standards Publication

Copper and copper alloys

Plumbing fittings – Specification for
press ends of plumbing fittings for use
with metallic tubes

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 December 2010. It was prepared by Technical Committee NFE/34/3, *Copper and copper alloy fittings*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other documents

This standard is related to parts of the BS EN 1254 series of standards for copper and copper alloy fittings for joining metallic tubes or plastics pipes. BS EN 1254 is published in five parts:

Part 1: *Fittings with ends for capillary soldering or capillary brazing to copper tubes;*

Part 2: *Fittings with compression ends for use with copper tubes;*

Part 3: *Fittings with compression ends for use with plastics pipes;*

Part 4: *Fittings combining other end connections with capillary or compression ends;*

Part 5: *Fittings with short ends for capillary brazing to copper tubes.*

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the Water Supply (Water Fittings) (Amendment) Regulations 1999 [1].

1 Scope

This British Standard specifies requirements for materials and design and gives methods of test for copper press end connections of plumbing fittings up to 108 mm in diameter used for the purpose of joining copper tubes conforming to BS EN 1057 and non-copper metallic tubes that are intended for use in water, in heating and cooling systems, and in natural gas and liquefied petroleum gas systems.

NOTE See Clause 4 for plumbing fitting operating temperatures and pressures.

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.

BS 6001-1 (ISO 2859-1), *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

BS EN 549:1995, *Specification for rubber materials for seals and diaphragms for gas appliances and gas equipment*

BS EN 681-1:1996, *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanized rubber*

BS EN 1057, *Copper and copper alloys – Seamless, round copper tubes for water and gas in sanitary and heating applications*

BS EN 1254-2:1998, *Copper and copper alloys – Plumbing fittings – Part 2: Fittings with compression ends for use with copper tubes*

BS EN ISO 6509:1995, *Corrosion of metals and alloys – Determination of dezincification resistance of brass*

BS ISO 9924-1, *Rubber and rubber products – Determination of the composition of vulcanizates and uncured compounds by thermogravimetry – Part 1: Butadiene, ethylene-propylene copolymer and terpolymer, isobutene-isoprene, isoprene and styrene-butadiene rubbers*

ISO 6957:1988, *Copper alloys – Ammonia test for stress corrosion resistance*

3 Terms and definitions

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

3.1 adaptor fitting

plumbing fitting joining two or more different types of tube end

3.2 marking

3.2.1 durable marking

marking that is legible at least up to the time of commissioning of the installation

NOTE An example of this is ink marking.

3.2.2 permanent marking

marking that is legible up to the end of the life of the installation

NOTE This is usually achieved through stamping, etching or engraving.

3.3 maximum operating pressure (MOP)

highest pressure at which pipework can be continuously operated

3.4 nominal diameter

diameter of a plumbing fitting end expressed as the nominal outside diameter of the connecting tube

3.5 plumbing fitting

component used in a plumbing system to connect one tube either to another tube or to an integral part of the system

3.6 press end

plumbing fitting end which incorporates an elastomeric sealing element and to which a pressing tool and jaw are applied to make a mechanical and leaktight joint

3.6.1 Type 1 press end

press end for use in water applications

3.6.2 Type 2 press end

press end for use in gas applications

NOTE 1 Some designs incorporate an additional device to aid retention.

NOTE 2 Compression of the ends of the plumbing fitting and the tube for a Type 2 press end can be achieved directly or indirectly by radial compression.

3.7 pressing tool and jaw

mechanical device which, by closing jaws, causes radial compression of the plumbing fitting end onto the connecting tube

NOTE Jaws also include slings.

3.8 tests**3.8.1 routine test**

test carried out periodically to determine the continued quality and performance of a product

NOTE Routine tests are often repeated type tests and are often used to prove product compliance with relevant requirements of a specification.

3.8.2 type test

one or more tests carried out to determine the performance of a new product

NOTE Type tests can include calculations, for example. Type tests are normally written in the technical specification and are carried out on product samples that are representative of the product type. Type tests are usually used to prove product compliance with the relevant requirements of a specification.

4 Operating temperatures and pressures

4.1 Unless otherwise specified in the manufacturer's instructions, the MOP shall be as given in Table 1.

Table 1 Operating temperatures and pressures for Type 1 and Type 2 press ends

Press end type	Operating temperature °C	MOP for nominal diameters ≤108 mm bar
Type 1 ^{A)}	≥4 to ≤15 >15 to ≤95 ^{B)}	16 16 reducing to 10 ^{B)}
Type 2	≥-20 to ≤70	1 or 5 ^{C)}

^{A)} Certain designs of Type 1 press ends can be used at temperature/pressure ratings outside those given in this table, where specified by the manufacturer. For such applications, the manufacturer's instructions shall be followed.

^{B)} Intermediate MOP, P_{int} , shall be determined by linear interpolation:
 $P_{int} = (T_{int} - 30\text{ °C})(16\text{ bar} - 10\text{ bar})/(95\text{ °C} - 30\text{ °C}) + 10\text{ bar}$.
Where $15\text{ °C} < T_{int} < 95\text{ °C}$

^{C)} This is determined by the MOP of the Type 2 press end.

4.2 Type 1 press ends shall be capable of withstanding temporary excursions of temperatures up to 110 °C at a pressure of 10 bar. ¹⁾

NOTE This is to allow for system malfunctions.

5 Plumbing fitting press end and tube compatibility

5.1 Where copper tubes are used in conjunction with plumbing fitting press ends, they shall conform to BS EN 1057, have wall thicknesses and tempers in accordance with Table 2 of this British Standard and be compatible with plumbing fitting press ends.

5.2 Where non-copper metallic tubes are used in conjunction with plumbing fitting press ends, they shall have tempers, wall thicknesses and dimensions conforming to the press end manufacturer's instructions for compatibility.

Table 2 Minimum wall thicknesses of copper tube with R250/R290 temper conforming to BS EN 1057 that are suitable for press end jointing
Dimensions in millimetres

Nominal diameter	Minimum wall thickness					
	0.6	0.7	0.8	0.9	1.0	1.5
6	X					
8	X					
10	X					
12	X					
15		X				
18			X			
22				X		
28				X		
35					X	
42					X	
54					X	
66.7						X
76.1						X
108						X

¹⁾ 1 bar = 100 kPa.

6 Plumbing fittings

6.1 Materials

6.1.1 General

6.1.1.1 Plumbing fitting bodies shall be made from copper or copper alloys.

NOTE Some of the standardized coppers and copper alloys commonly used for the manufacture of plumbing fittings are given in Annex A.

6.1.1.2 Other components of the plumbing fittings shall be made from materials that do not cause the connected tube to degrade.

NOTE For plumbing fittings intended for use in drinking water applications, attention is drawn to the Water Supply (Water Fittings) (Amendment) Regulations 1999 [1].

6.1.2 Type 1 press end sealing elements

6.1.2.1 General

6.1.2.1.1 Sealing elements for Type 1 press ends shall conform to the requirements for elastomeric materials specified in BS EN 681-1.

6.1.2.1.2 The minimum tear strength for butyl rubber shall be in accordance with BS EN 681-1:1996, Table 3.

6.1.2.2 Thermogravimetric analysis (TGA)

6.1.2.2.1 A TGA shall be carried out for identity testing of elastomeric materials in accordance with BS ISO 9924-1.

6.1.2.2.2 The TGA shall be carried out at the same time as the type tests (see Clause 8). The resulting graph shall be retained as a master graph for comparison with future TGA graphs.

6.1.2.2.3 Routine TGA tests shall be carried out at a frequency of one per year. Result graphs from routine TGA tests shall be compared to the master graph (see 6.1.2.2.2) and differences investigated. The TGA results shall be retained for future comparison.

6.1.2.3 Durability test

A durability test shall be carried out in accordance with BS EN 681-1:1996, Appendix B, using the following parameters.

- a) A test duration of 3 000 h.
- b) A test temperature of 110 °C.
- c) A test medium of distilled water.
- d) A compression set after 3 000 h of $\leq 35\%$.
- e) A compression set increase between 1 000 h and 3 000 h of $\leq 5\%/1\,000\text{ h}$.

6.1.3 Type 2 sealing elements

6.1.3.1 General

Sealing elements for Type 2 press ends shall conform to 6.1.3.2 and BS EN 549.

6.1.3.2 Infrared spectrometric identification

6.1.3.2.1 An infrared spectrometric identification test shall be carried out in accordance with BS 549:1995, Annex B, during type testing. The resulting graph shall be retained as a master graph for comparison with future infrared spectrometric identification graphs.

6.1.3.2.2 Routine infrared spectrometric identification tests shall be carried out at the frequency of one per year. Results from the routine infrared spectrometric identification tests shall be compared to the master graph and differences investigated. The infrared spectrometric identification tests shall be retained for future comparison.

6.2 Dimensions and tolerances

6.2.1 Minimum bore area

6.2.1.1 The minimum cross-sectional area of the bore through each fitting, excluding any internal pipe support, shall be calculated from a minimum bore diameter conforming to Table 3.

Table 3 **Minimum bore diameter**
Dimensions in millimetres

Nominal diameter	Minimum bore diameter
6	4.0
8	6.0
10	7.0
12	9.0
15	11.0
18	14.0
22	18.0
28	23.0
35	29.0
42	36.0
54	47.0
66.7	57.0
76.1	65.0
108	92.0

6.2.1.2 The smallest diameter on an unequal-ended press fitting shall conform to Table 3, and shall not restrict other outlets.

6.2.2 Tolerance for the alignment of the plumbing fitting press ends

The alignment of the press ends of the plumbing fitting shall be within 2° of the specified axis.

6.3 Design and manufacture

6.3.1 Joint assembly tools

Pressing tools and jaws specified by the plumbing fittings manufacturer shall be used to assemble the joint.

NOTE The maintenance frequency for pressing tools and jaws is either automatically indicated by a cycle counter in the press tool (e.g. every 20 000 cycles) or a maintenance frequency is specified by the manufacturer (e.g. every 12 months).

6.3.2 Tube abutment

Unless otherwise specified by the manufacturer, press ends shall have a tube abutment to limit the depth to which a tube can be inserted.

NOTE Plumbing fittings can be produced for special purposes, where the plumbing fitting ends do not incorporate abutments, allowing for the fitting to slide along the tube. This can be particularly useful for pipework repairs.

6.3.3 Plated or coated surfaces

The manufacturer shall agree the requirements for plated or coated surfaces with the purchaser.

7 Evaluation of plumbing fittings

Plumbing fittings shall be evaluated through type tests in accordance with Clause 8 and routine tests in accordance with Clause 9. The type tests and routine tests shall be carried out in accordance with Table 4.

The results of type tests and routine tests shall be recorded and held by the manufacturer for a minimum of five years.

NOTE When carrying out a series of type tests, it is not essential to repeat tests that have already been performed on plumbing fittings, except in those circumstances specified in 8.1.

8 Type tests

8.1 Circumstances in which to carry out type tests

8.1.1 Type tests shall be carried out on new designs before introduction to the market.

8.1.2 The manufacturer shall implement a documented procedure to assess the necessity for carrying out repeat type tests on press ends where a change is proposed to an existing product.

COMMENTARY ON 8.1.2

The performance characteristics of press ends might be affected by the following changes:

- a) alterations to the press end design;*
- b) changes to the raw material;*
- c) changes in the production process; or*
- d) change of the supplier of the components.*

In these instances, it is likely to be necessary to repeat type tests.

8.1.3 Where changes are made to the material or supplier of the sealing element, the press ends shall conform to either **6.1.2** and **8.4.3** (Type 1 press ends) or **6.1.3** and **8.4.4** (Type 2 press ends), as applicable.

Table 4 Tests for plumbing fittings with Type 1 and Type 2 press ends

Description of test	Tests for press end	
	Type 1	Type 2
<i>Type tests</i>		
Leaktightness under internal hydrostatic pressure (Annex B)	Yes	No
Leaktightness under internal pneumatic pressure (Annex C)	No	Yes
Resistance to pull-out (Annex D)	Yes	Yes
Resistance to temperature cycling (Annex E)	Yes	No
Resistance to temperature cycling (Annex F)	No	Yes
Resistance to pressure cycling (Annex G)	Yes	No
Leaktightness under vacuum (Annex H)	Yes	Yes
Resistance to vibration (Annex I)	Yes	Yes
Resistance to static flexural strength (Annex J)	No	Yes
Resistance to high temperature (Annex K)	No	Yes
Resistance to stress corrosion (copper-zinc alloys) (8.4.10; ISO 6957:1988, Clause 8)	Yes	Yes
<i>Routine tests</i>		
Pressure test for plumbing fitting bodies with as-cast microstructure or fabricated by welding or brazing (Annex L)	Yes ^{A)}	Yes ^{A)}
Resistance to dezincification (Annex M)	Yes ^{A)}	Yes ^{A)}
^{A)} These tests shall only be applicable where the plumbing fitting material or method of construction allows for testing to take place.		

8.2 Type 1 and Type 2 press ends

8.2.1 Plumbing fittings intended for joining tubes and having Type 1 press ends shall be subjected to the applicable type tests, in accordance with Table 4.

8.2.2 Plumbing fittings intended for joining tubes and having Type 2 press ends shall be subjected to the applicable type tests, in accordance with Table 4.