



Malleable cast iron fittings threaded to ISO 7/1

Raccords en fonte malléable filetés selon l'ISO 7/1

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Descriptors : pipe fittings, cast iron products, malleable cast iron, symbols, definitions, dimensions, dimensional tolerances, designation tests, acceptance testing, specifications.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 49 was developed by Technical Committee ISO/TC 6, *Ferrous metal pipes and metallic fittings*, and was circulated to the member bodies in February 1981.

It has been approved by the member bodies of the following countries:

Austria	Hungary	Norway
Belgium	India	Poland
Brazil	Israel	Romania
China	Italy	South Africa, Rep. of
Czechoslovakia	Korea, Dem. P. Rep. of	Sweden
Finland	Korea, Rep. of	Switzerland
France	Netherlands	Thailand
Germany, F.R.	New Zealand	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds:

Australia
Canada
Japan
United Kingdom
USA

This International Standard cancels and replaces ISO Recommendation R 49-1957, of which it constitutes a technical revision.

Malleable cast iron fittings threaded to ISO 7/1

1 Scope and field of application

This International Standard specifies requirements for design and performance for malleable cast iron threaded pipe fittings.

These fittings are for general purposes for the transmission of fluids and gases up to the limits of pressure and temperature specified in this International Standard. They are intended for the connection of elements threaded in accordance with ISO 7/1, sizes 1/8 to 6.

For use in conditions outside the pressure and temperature limits specified, reference shall be made to the manufacturer.

2 References

ISO 7, *Pipe threads where pressure tight joints are made on the threads*

Part 1 : *Designation, dimensions and tolerances.*
Part 2 : *Verification by means of limit gauges.*

ISO 228, *Pipe threads where pressure tight joints are not made on the threads*

Part 1 : *Designation, dimensions and tolerances.*
Part 2 : *Verification by means of limit gauges.*

ISO 272, *Fasteners — Hexagon products — Widths across flats.*

ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Determination of the mass per unit area — Gravimetric method.*

ISO 2859, *Sampling procedures and tables for inspection by attributes.*

ISO 4759/1, *Tolerances for fasteners — Part 1: Bolts, screws and nuts with thread diameters $\geq 1,6$ and ≤ 150 mm and product grades A, B and C.*

ISO 5922, *Malleable cast iron.*

ISO 6708, *Pipe components — Definition of nominal size.*

3 Symbols

Table 1 — Index of types and symbols

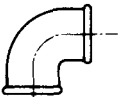
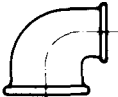
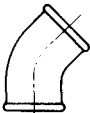
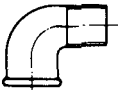
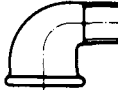
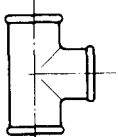
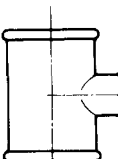
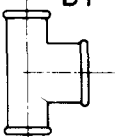
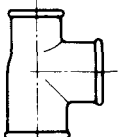
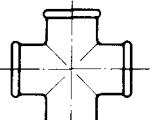
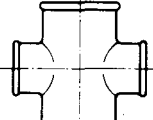
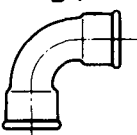
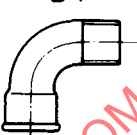
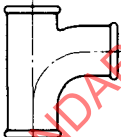
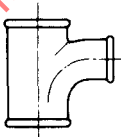
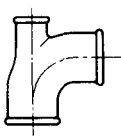
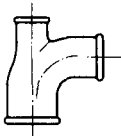
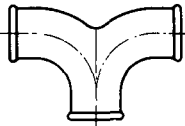
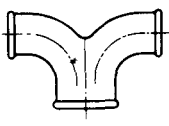
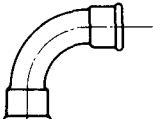
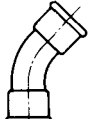
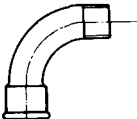
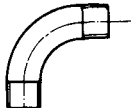
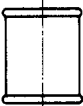
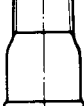
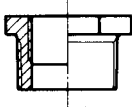
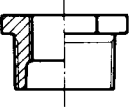
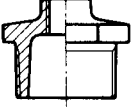
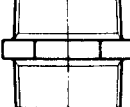
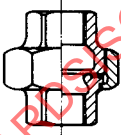
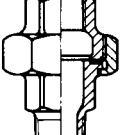
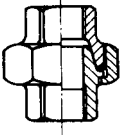
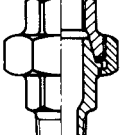
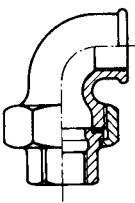
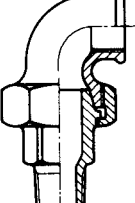
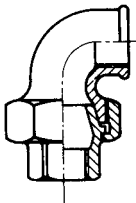
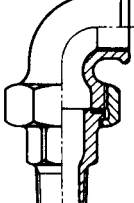
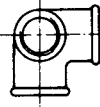
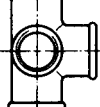
Types	Symbols					
A Elbows	A1		A1/45°	A4		A4/45°
	 Page 10	 Page 11	 Page 12	 Page 11	 Page 11	 Page 12
B Tees			B1			
	 Page 10	 Page 13		 Page 13	 Page 14	 Page 14
C Crosses	C1					
	 Page 16	 Page 16				
D Short bends	D1	D4				
	 Page 17	 Page 17				
E Pitcher tees Twin elbows	E1				E2	
	 Page 17	 Page 18	 Page 18	 Page 18	 Page 17	 Page 19
G Long sweep bends	G1	G1/45°	G4	G4/45°	G8	
	 Page 20	 Page 21	 Page 20	 Page 21	 Page 20	

Table 1 (concluded)

Types	Symbols			
M Sockets	M2		M4	
	 Page 22	 Page 22	 Page 23	 Page 23
N Bushings Hexagon nipples	N4			N8
	 Page 24	 Page 24	 Page 24	 Page 25
P Backnuts	P4			
	 Page 26			
T Caps Plugs	T1	T8	T9	T11
	 Page 27	 Page 27	 Page 27	 Page 27
U Union	U1	U2	U11	U12
	 Page 28	 Page 28	 Page 28	 Page 28
UA Union elbows	UA1	UA2	UA11	UA12
	 Page 29	 Page 29	 Page 29	 Page 29
Za Side outlet elbows and tees	Za1	Za2		
	 Page 10	 Page 10		

4 Terminology

For this International Standard, the following terms apply :

4.1 fitting : Connecting piece, of one or more parts.

4.2 jointing thread : Thread complying with ISO 7/1.

4.3 fastening thread : Thread complying with ISO 228/1.

4.4 designation of thread; fitting size : Size designation of the threads of the threaded outlets as derived from ISO 7/1 (see also clause 12).

4.5 nominal size; DN : Numerical designation of size which is common to all components in a piping system other than components designated by outside diameters. It is a convenient round number for reference purposes and it is only loosely related to manufacturing dimensions.

NOTE — The relationship between fitting size and nominal size is given for reference purposes in clause 14.

4.6 reinforcement : Additional material on the outside diameter of an internally threaded fitting in the form of a band or bead.

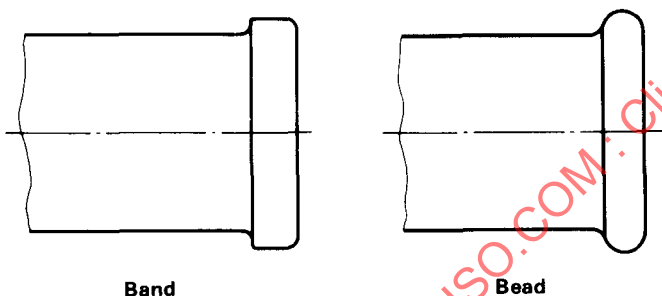


Figure 1 — Forms of reinforcements

4.7 rib : Local and axially aligned additional material on the outside or inside of a fitting for assistance in assembly or manufacturing.

4.8 outlet : Internally or externally threaded end of a fitting, which connects with a tube, fitting or other component, which is threaded in accordance with ISO 7/1.

4.9 run : Two principal axially aligned outlets of a tee or cross.

4.10 branch : Side outlet(s) of a tee or cross.

4.11 chamfer : Removal of a conical portion at the entrance of a thread to assist assembly and prevent damage to the start of the thread.

4.12 face-to-face dimension : Distance between the two parallel faces of axially aligned outlets of a fitting.

4.13 face-to-centre dimension : Distance from the face of an outlet to the central axis of an angularly disposed outlet.

4.14 laying length : Average distance from the assembled pipe end to the axis of the fitting, or between the ends of two assembled pipes. (See 7.2.)

5 Materials

5.1 Material of the fitting

5.1.1 Malleable cast iron

The material used shall be malleable cast iron meeting the requirements of ISO 5922. The grade of material used shall be equal to or better than W 35-04 for whiteheart fittings and B 30-06 for blackheart fittings.

5.1.2 Other iron materials

Notwithstanding this requirement, any other ferrous materials which give mechanical properties at least equivalent to those malleable cast irons specified above will be allowed.

5.2 Galvanizing

Where a galvanized protection is required, the zinc coating shall be applied by the hot dip process and shall meet the following requirements.

- The molten metal in the galvanizing bath shall contain not less than 98,5 % by mass of zinc.
- The mass of the galvanized coating on an average of four fittings shall be not less than 500 g/m², which corresponds to an average thickness of 70 µm.
- The coating mass on an individual sample shall be not less than 450 g/m².

6 Design

6.1 The drawings are diagrammatic, without prejudice to the manufactured form.

6.2 The types and sizes dimensionally standardized are shown in tables 6 to 24.

6.3 Fittings shall be reinforced at the internally threaded ends by a bead or band, except where they are polygonal in shape to allow for spanner flats, or where fittings have side outlets (type Za1 and Za2).

6.4 Manufacturers may incorporate ribs at their discretion. Ribs should not project higher than the reinforcing bead or band.

7 Dimensions and tolerances

7.1 Where maximum or minimum dimensions are not specified, the tolerances for face-to-face and face-to-centre dimensions shall be as follows (see table 2).

NOTE — The face-to-face and face-to-centre dimensions of unions may not always comply with the tolerance given due to the compound effect of piece tolerances and design upon the final assembly.

Table 2 — Tolerance on length

Values in millimetres

Dimension	Tolerance
< 30	± 1,5
> 30 < 50	± 2,0
> 50 < 75	± 2,5
> 75 < 100	± 3,0
> 100 < 150	± 3,5
> 150 < 200	± 4,0
> 200	± 5,0

7.2 Laying lengths are given for assistance and guidance during installation. Their accuracy is dependent upon the tolerances given in 7.1 and on the tolerance of the threads specified in ISO 7/1. The dimensions given in the tables (z_1 , z_2 and z_3) are the average distance from the pipe end to the axis of the fitting (see figure 2) or the distance from pipe end to pipe end (see figure 3).

These assembly dimensions are calculated by deducting average lengths of engagement from the face-to-face or face-to-centre dimensions given in the tables. The average lengths of engagement are rounded from the dimensions given in ISO 7/1 and are given in table 3.

Table 3 — Lengths of engagement

Designation of thread size	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Length of engagement mm	7	10	10	13	15	17	19	19	24	27	30	36	40	40

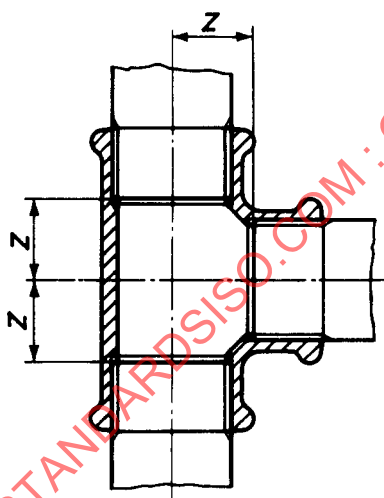


Figure 2 — Laying lengths z in the case of an angularly disposed fitting

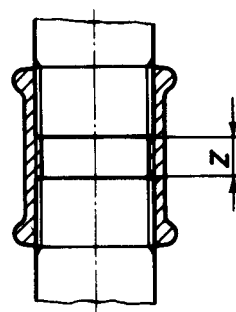


Figure 3 — Laying length z in the case of an axially aligned fitting

7.3 Dimensions of widths across flats should be in accordance with ISO 272 where practicable and should not be exceeded even if galvanized.

7.3.2 The minimum width of the spanner flat (i.e. width at its corners) should correspond to those given in table 4.

7.3.1 Flats on plugs shall be square. Flats on other fittings up to and including 3/4 should be hexagonal. Flats on fittings above 3/4 may be hexagonal or octagonal.

Table 4 — Width of spanner flats

Designation of thread size	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Width of spanner flats mm	4	4	5	5	5,5	6	6,5	6,5	7	7	7,5	8

8 Threads

8.1 Choice of thread

8.1.1 Jointing thread

Fittings shall be threaded in accordance with ISO 7/1. External threads are taper, internal threads may be parallel, or taper.

8.1.2 Fastening threads

The threads of union nuts and their mating threads should be in accordance with ISO 228/1. Backnuts shall be in accordance with ISO 228/1.

8.2 Alignment of threads

The axes of the screw threads shall be accurate to within $\pm 1/2^\circ$ of the specified angle.

8.3 Chamfering

The outlets of the fittings shall have a chamfer.

On internal threads, the chamfer should have an included angle of 90° , and the diameter at the face should exceed the major diameter of the thread.

On external threads, the chamfer should be a minimum included angle of 60° and the diameter at the face should not exceed the minor diameter of the thread at that face.

9 Manufacture

Fittings shall not contain material detrimental to their usage. They should be smooth, free from sand, blow holes, cracks and other injurious defects. They shall not be impregnated to cover such defects.

10 Required characteristics

10.1 Permissible working pressure and temperature

The fittings of all sizes shall be suitable for a maximum permissible working pressure of 25 bar at temperatures up to 120°C and for a maximum permissible working pressure of 20 bar for temperatures between 120 and 300°C .

10.2 Design strength

The fittings shall be designed to withstand a pressure of 100 bar at ambient temperature on sizes 4 and smaller and a pressure of 64 bar at ambient temperature on sizes above 4.

10.3 Assembly

The fittings shall be capable of withstanding the forces normally involved during assembly when correctly assembled with threads in accordance with ISO 7/1.

11 Quality assurance

11.1 Routine production control

11.1.1 Malleable cast iron

The manufacturer shall ensure by adequate controls that the malleable cast iron meets the requirements of the appropriate grade of ISO 5922.

In addition to the test requirements of ISO 5922, the manufacturer shall conduct appropriate tests on sample fittings after annealing and before leaving the annealing department, to ensure that they are satisfactorily malleabilized.

11.1.2 Galvanizing

Where a galvanized protection is specified, the manufacturer shall ensure that the galvanized coat meets the requirements of 5.2. The method of determination of the coating mass should be taken from ISO 1460. The thickness of the coating may be checked by using calibrated electronic or magnetic instruments.

Galvanized fittings shall be visually inspected for compactness and continuity of the zinc coating in accordance with sampling plans (for example ISO 2859).

11.1.3 Threads

11.1.3.1 Jointing

The manufacturer shall ensure by adequate control that the jointing threads meet the requirements of ISO 7/1 and the gauging requirements of ISO 7/2.

11.1.3.2 Fastening

Fastening threads should meet the requirements of ISO 228/1 and the gauging requirements of ISO 228/2.

11.1.3.3 Alignment

The alignment of the threads shall meet the requirements specified in 8.2.

11.1.4 Leak tightness test

All pressure containing fittings shall be tested after machining, but before protective coating other than galvanizing, by one of the following methods. Each fitting, when so tested, shall show no sign of leakage.

- a) by the application of an internal hydraulic pressure of not less than 20 bar, or
- b) by the application of an internal pneumatic pressure of not less than 5 bar, whilst the fitting is completely immersed in water or light oil, or
- c) by other tests which ensure an equivalent quality.

Fittings which do not satisfy the chosen test shall be rejected.

11.1.5 Final inspection

The manufacturer shall ensure by adequate visual inspection that the fittings meet the requirements of clauses 8.3 and 9.

11.2 Certification

If specifically requested by the customer, manufacturers shall issue a certificate of compliance with this standard.

11.3 Acceptance tests

11.3.1 If the customer requires acceptance tests, these shall be stipulated and agreed at the enquiry or order stage. The purchaser shall bear the costs of acceptance tests. Acceptance tests should be carried out with suitable equipment and manpower of the manufacturer.

11.3.2 One or more of the following tests may be specified :

a) Malleability of the material

The cylindrical portion of a fitting shall without showing cracks visible to the naked eye, withstand a deformation of 10 % on its outside diameter (measured behind the bead or band) on sizes up to 2, and 5 % deformation on sizes larger than 2.

b) Galvanizing

Test requirements for the zinc coating shall be agreed between the purchaser and the hot dip galvanizer.

c) Leak tightness tests

Acceptance leak tightness tests shall be carried out on 5 % or 50 pieces of not more than 3 different types or sizes of the fittings comprising the order (the smaller of the two numbers). If one fitting shows any leakage, a repeat test with another 5 % or 50 pieces of the defective item shall be made. If one of these additionally tested fittings shows any leakage, the whole order shall be deemed not to comply with this International Standard and may be rejected.

12 Designation of fittings

12.1 Elements of the designation

The fittings complying with this International Standard shall be designated as follows :

- a) the type of fitting, see table 1
- b) ISO 49
- c) the symbol, see table 1
- d) fitting size, see tables 6 to 24 and clause 12.2
- e) whether black (ungalvanized) or galvanized.

12.2 Additional notes on designation of size

Equal fittings, where all outlets are of the same size, are referred to by that one size, irrespective of the number of outlets.

Unequal fittings having two outlets are specified by their outlets in decreasing order (large outlet-small outlet).

Unequal fittings having more than two outlets but not reducing on the run are specified as follows :

- a) tees B1 and E1 with equal outlets on the run and an increasing or decreasing outlet on the branch are specified by stating the size of the run followed by the size of the branch, for example, 1 × 3/4 (see tables 9 and 13).
- b) Twin elbows reducing E2. The size of the large outlet is specified followed by the size of the two smaller outlets, for example, 1 1/2 × 1 1/4 (see table 14).
- c) Reducing crosses C1. The size of the largest run is specified followed by the size of the two smaller (but equal) branches, for example, 1 1/2 × 1 (see table 11).

Unequal fittings with reducing run (or generally with three or more different outlets) may be specified by either method "a" or method "b" according to national practice as follows :

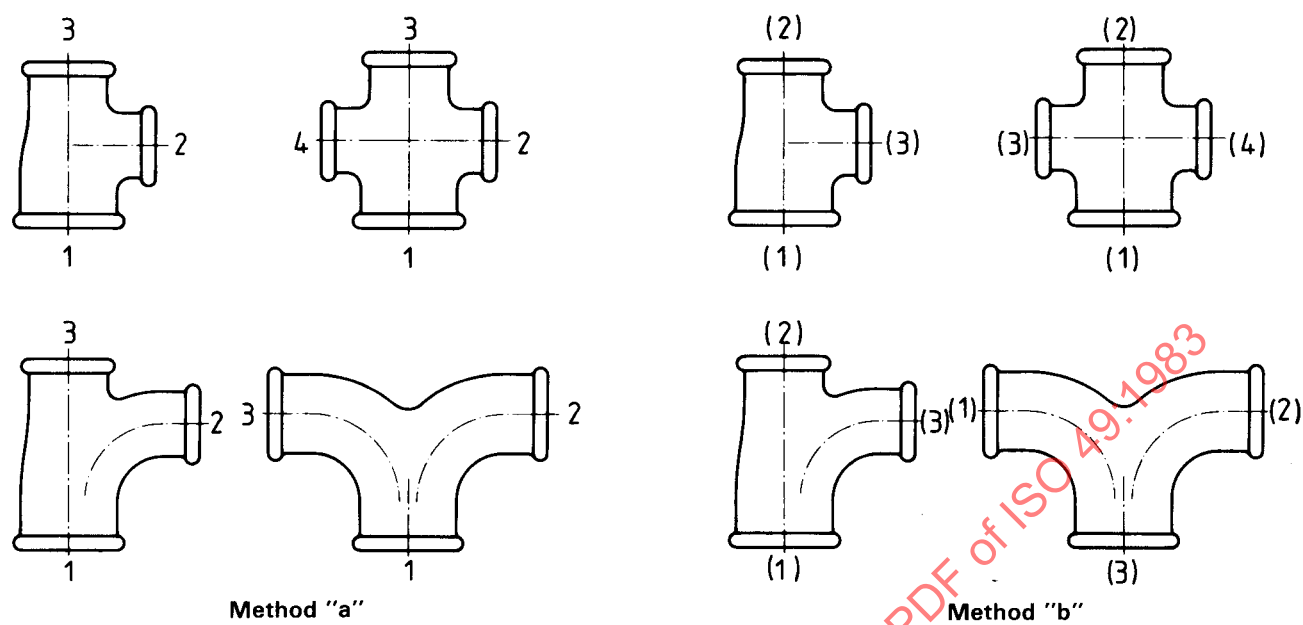


Figure 4 — Sequence of specifying outlets when the above mentioned abbreviated method does not apply

12.3 Examples of designation

- I Equal female elbow size 2, black finish :
Elbow ISO 49-A1-2-black
- II Reduced tee with run 2 and branch 1, galvanized :
Tee ISO 49-B1-2 × 1-galvanized
- III Reduced tee with run 1 and 3/4 and branch 1/2 black finish :
"a" Tee ISO 49-B1-1 × 1/2 × 3/4 black
"b" Tee ISO 49-B1-1 × 3/4 × 1/2 black

13 Marking of fittings

Fittings shall be marked wherever practical with the manufacturer's name or trade mark and with the fitting size.

14 Relationship between thread designation and nominal size

The relationship between thread designation and nominal size is given in table 5.

Table 5 — Thread designation and nominal size

Designation of thread size	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Nominal size DN	6	8	10	15	20	25	32	40	50	65	80	100	125	150

15 Tables for dimensionally standardized types and sizes

The programme of types and sizes, their dimensions and laying lengths are shown in the following tables.

However, because the use of fittings differs widely between countries, these tables could not be fixed in one binding form. Three cases had to be left open for choice in national standards according to usage :

- Items shown in brackets are "non-preferred sizes" in the

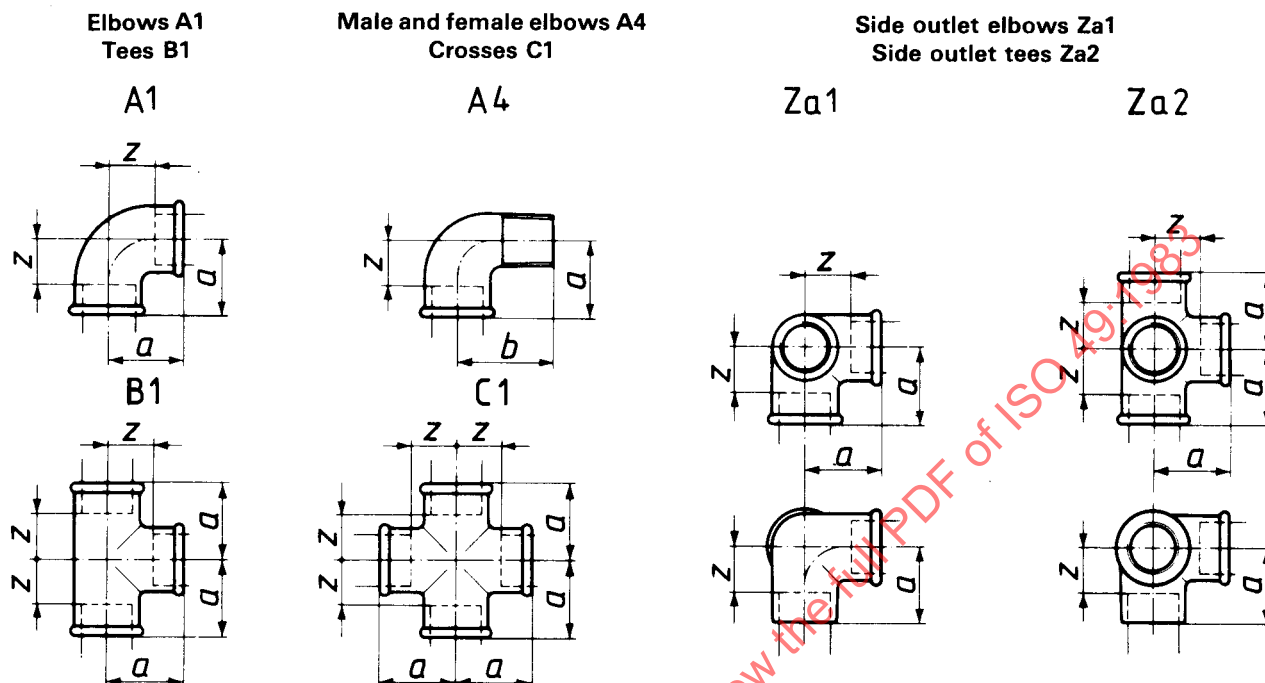
sense that they may be included or not included in national standards.

- One of the types T8 and T9 plugs may be omitted from national standards.

- Tables 23 and 24 show two typical types of seats of unions and their designation. Other types of seat design and seat materials shall be considered as standard, providing dimensions in tables 23 and 24 and other requirements of this International Standard are observed. Such unions do not carry a formal designation.

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Table 6



Fitting sizes						Dimensions mm		Laying lengths mm
A1	A4	B1	C1	Za1	Za2	a	b	z
1/8	1/8	1/8	—	—	—	19	25	12
1/4	1/4	1/4	(1/4)	—	—	21	28	11
3/8	3/8	3/8	3/8	(3/8)	(3/8)	25	32	15
1/2	1/2	1/2	1/2	1/2	(1/2)	28	37	15
3/4	3/4	3/4	3/4	3/4	(3/4)	33	43	18
1	1	1	1	(1)	(1)	38	52	21
1 1/4	1 1/4	1 1/4	1 1/4	—	—	45	60	26
1 1/2	1 1/2	1 1/2	1 1/2	—	—	50	65	31
2	2	2	2	—	—	58	74	34
2 1/2	2 1/2	2 1/2	(2 1/2)	—	—	69	88	42
3	3	3	(3)	—	—	78	98	48
4	4	4	(4)	—	—	96	118	60
(5)	—	(5)	—	—	—	115	—	75
(6)	—	(6)	—	—	—	131	—	91

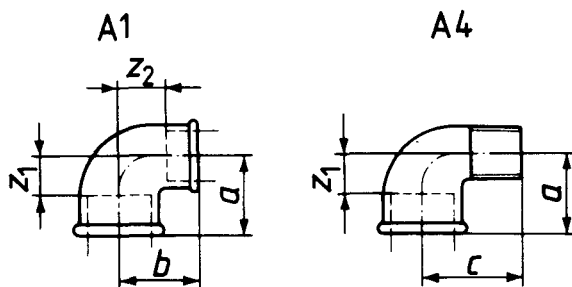
Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 7

Elbows, reducing A1
Male and female elbows, reducing A4



Fitting sizes		Dimensions mm			Laying lengths mm	
A1	A4	a	b	c	z_1	z_2
(3/8 × 1/4)	—	23	23	—	13	13
1/2 × 3/8	1/2 × 3/8	26	26	33	13	16
(3/4 × 3/8)	—	28	28	—	13	18
3/4 × 1/2	3/4 × 1/2	30	31	40	15	18
1 × 1/2	—	32	34	—	15	21
1 × 3/4	1 × 3/4	35	36	46	18	21
1 1/4 × 3/4	—	36	41	—	17	26
1 1/4 × 1	1 1/4 × 1	40	42	56	21	25
(1 1/2 × 1)	—	42	46	—	23	29
1 1/2 × 1 1/4	—	46	48	—	27	29
2 × 1 1/2	—	52	55	—	28	36
(2 1/2 × 2)	—	61	66	—	34	42

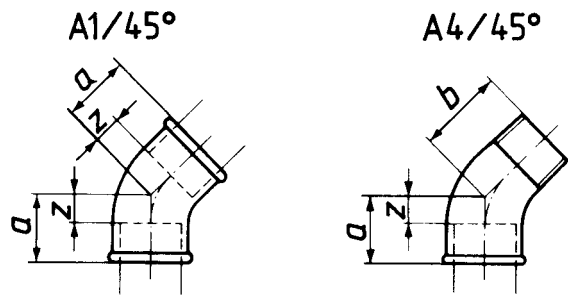
Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 8

45° elbows A1/45°
45° male and female elbows A4/45°



Fitting sizes		Dimensions mm		Laying lengths mm
A1/45°	A4/45°	a	b	Z
3/8	3/8	20	25	10
1/2	1/2	22	28	9
3/4	3/4	25	32	10
1	1	28	37	11
1 1/4	1 1/4	33	43	14
1 1/2	1 1/2	36	46	17
2	2	43	55	19

Dimensions which are not specified are left to the discretion of the manufacturer.

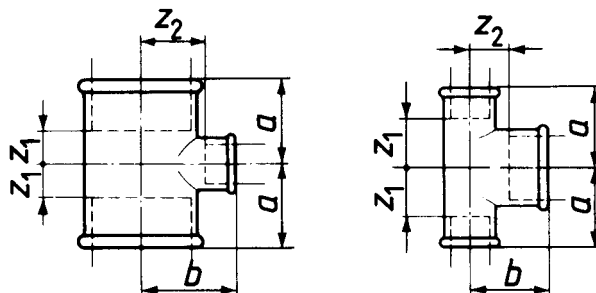
Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 9

Tees reducing on the branch B1
Tees increasing on the branch B1

B1



Fitting sizes	Dimensions mm		Laying lengths mm	
	a	b	z ₁	z ₂
3/8 × 1/4	23	23	13	13
3/8 × 1/2	26	26	16	13
1/2 × 1/4	24	24	11	14
1/2 × 3/8	26	26	13	16
1/2 × 3/4	31	30	18	15
(1/2 × 1)	34	32	21	15
(3/4 × 1/4)	26	27	11	17
3/4 × 3/8	28	28	13	18
3/4 × 1/2	30	31	15	18
3/4 × 1	36	35	21	18
(3/4 × 1 1/4)	41	36	26	17
(1 × 1/4)	28	31	11	21
1 × 3/8	30	32	13	22
1 × 1/2	32	34	15	21
1 × 3/4	35	36	18	21
1 × 1 1/4	42	40	25	21
(1 × 1 1/2)	46	42	29	23
(1 1/4 × 3/8)	32	36	13	26
1 1/4 × 1/2	34	38	15	25
1 1/4 × 3/4	36	41	17	26
1 1/4 × 1	40	42	21	25
1 1/4 × 1 1/2	48	46	29	27
(1 1/4 × 2)	54	48	35	24

Fitting sizes	Dimensions mm		Laying lengths mm	
	a	b	z ₁	z ₂
1 1/2 × 1/2	36	42	17	29
1 1/2 × 3/4	38	44	19	29
1 1/2 × 1	42	46	23	29
1 1/2 × 1 1/4	46	48	27	29
1 1/2 × 2	55	52	36	28
2 × 1/2	38	48	14	35
2 × 3/4	40	50	16	35
2 × 1	44	52	20	35
2 × 1 1/4	48	54	24	35
2 × 1 1/2	52	55	28	36
2 1/2 × 1	47	60	20	43
2 1/2 × 1 1/4	52	62	25	43
2 1/2 × 1 1/2	55	63	28	44
2 1/2 × 2	61	66	34	42
3 × 1	51	67	21	50
(3 × 1 1/4)	55	70	25	51
3 × 1 1/2	58	71	28	52
3 × 2	64	73	34	49
3 × 2 1/2	72	76	42	49
4 × 2	70	86	34	62
4 × 3	84	92	48	62

Dimensions which are not specified are left to the discretion of the manufacturer.

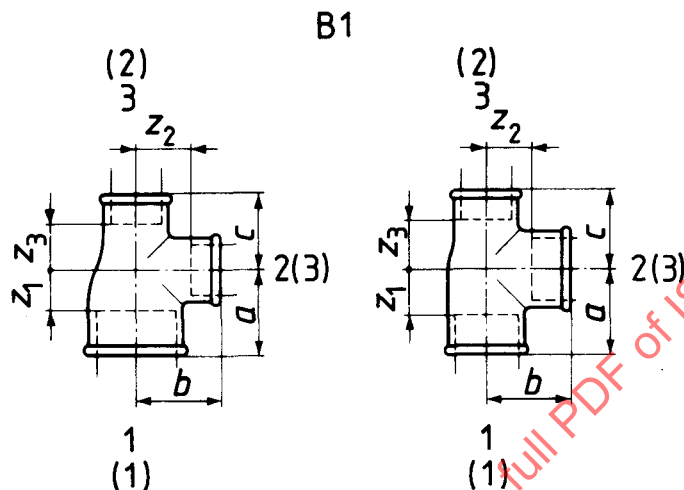
Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Method of designation of fitting sizes : see 12.2.a).

Table 10

Tees reducing on the run and the branch B1
 Tees reducing on the run and equal on the branch B1



Fitting sizes						Dimensions mm			Laying lengths mm			
1	Method "a" 2 3		(1)	Method "b" (2) (3)		a	b	c	z ₁	z ₂	z ₃	
1/2	×	3/8	×	3/8	×	3/8	26	26	25	13	16	15
1/2	×	1/2	×	3/8	×	1/2	28	28	26	15	15	16
3/4	×	3/8	×	1/2	×	3/8	28	28	26	13	18	13
3/4	×	1/2	×	3/8	×	1/2	30	31	26	15	18	16
3/4	×	1/2	×	1/2	×	1/2	30	31	28	15	18	15
3/4	×	3/4	×	3/8	×	3/4	33	33	28	18	18	18
3/4	×	3/4	×	1/2	×	3/4	33	33	31	18	18	18
1	×	1/2	×	1/2	×	1/2	32	34	28	15	21	15
1	×	1/2	×	3/4	×	1/2	32	34	30	15	21	15
1	×	3/4	×	1/2	×	3/4	35	36	31	18	21	18
1	×	3/4	×	3/4	×	3/4	35	36	33	18	21	18
(1	×	1	×	3/8	×	1)	38	38	32	21	21	22
1	×	1	×	1/2	×	1	38	38	34	21	21	21
1	×	1	×	3/4	×	1	38	38	36	21	21	21
1 1/4	×	1/2	×	1	×	1/2	34	38	32	15	25	15
1 1/4	×	3/4	×	3/4	×	3/4	36	41	33	17	26	18
1 1/4	×	3/4	×	1	×	3/4	36	41	35	17	26	18
1 1/4	×	1	×	3/4	×	1	40	42	36	21	25	21
1 1/4	×	1	×	1	×	1	40	42	38	21	25	21
1 1/4	×	1 1/4	×	1/2	×	1 1/4	45	45	38	26	26	25
1 1/4	×	1 1/4	×	3/4	×	1 1/4	45	45	41	26	26	26
1 1/4	×	1 1/4	×	1	×	1 1/4	45	45	42	26	26	25

Fitting sizes						Dimensions			Laying lengths		
						mm			mm		
1	Method "a"		Method "b"			a	b	c	z ₁	z ₂	z ₃
	2	3	(1)	(2)	(3)						
1 1/2	× 1/2	× 1 1/4	1 1/2	× 1 1/4	× 1/2	36	42	34	17	29	15
1 1/2	× 3/4	× 1 1/4	1 1/2	× 1 1/4	× 3/4	38	44	36	19	29	17
1 1/2	× 1	× 1	1 1/2	× 1	× 1	42	46	38	23	29	21
1 1/2	× 1	× 1 1/4	1 1/2	× 1 1/4	× 1	42	46	40	23	29	21
(1 1/2	× 1 1/4	× 1)	(1 1/2	× 1	× 1 1/4)	46	48	42	27	29	25
1 1/2	× 1 1/4	× 1 1/4	1 1/2	× 1 1/4	× 1 1/4	46	48	45	27	29	26
1 1/2	× 1 1/2	× 1/2	1 1/2	× 1/2	× 1 1/2	50	50	42	31	31	29
1 1/2	× 1 1/2	× 3/4	1 1/2	× 3/4	× 1 1/2	50	50	44	31	31	29
1 1/2	× 1 1/2	× 1	1 1/2	× 1	× 1 1/2	50	50	46	31	31	29
1 1/2	× 1 1/2	× 1 1/4	1 1/2	× 1 1/4	× 1 1/2	50	50	48	31	31	29
2	× 3/4	× 1 1/2	2	× 1 1/2	× 3/4	40	50	38	16	35	19
2	× 1	× 1 1/2	2	× 1 1/2	× 1	44	52	42	20	35	23
2	× 1 1/4	× 1 1/4	2	× 1 1/4	× 1 1/4	48	54	45	24	35	26
2	× 1 1/4	× 1 1/2	2	× 1 1/2	× 1 1/4	48	54	46	24	35	27
(2	× 1 1/2	× 1 1/4)	(2	× 1 1/4	× 1 1/2)	52	55	48	28	36	29
2	× 1 1/2	× 1 1/2	2	× 1 1/2	× 1 1/2	52	55	50	28	36	31
2	× 2	× 3/4	2	× 3/4	× 2	58	58	50	34	34	35
2	× 2	× 1	2	× 1	× 2	58	58	52	34	34	35
2	× 2	× 1 1/4	2	× 1 1/4	× 2	58	58	54	34	34	35
2	× 2	× 1 1/2	2	× 1 1/2	× 2	58	58	55	34	34	36

Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2.

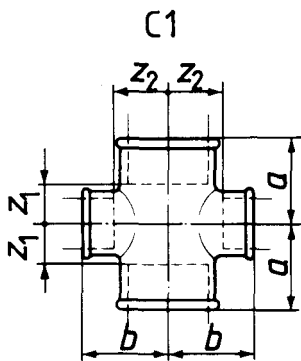
Threads : in accordance with ISO 7/1.

Method of designation of fittings : see 12.2.

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Table 11

Crosses, reducing C1

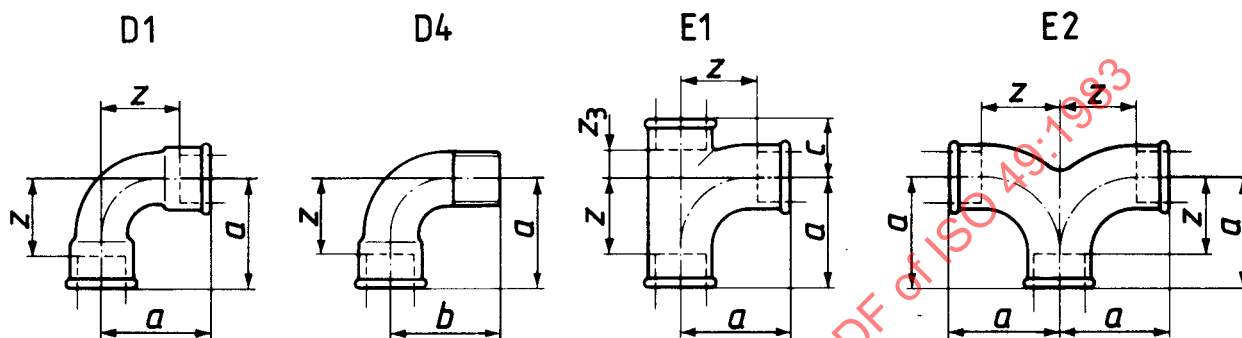


Fitting sizes	Dimensions mm		Laying lengths mm	
	<i>a</i>	<i>b</i>	<i>z</i> ₁	<i>z</i> ₂
(1/2 × 3/8)	26	26	13	16
3/4 × 1/2	30	31	15	18
1 × 1/2	32	34	15	21
1 × 3/4	35	36	18	21
(1 1/4 × 3/4)	36	41	17	26
1 1/4 × 1	40	42	21	25
(1 1/2 × 1)	42	46	23	29

Dimensions which are not specified are left to the discretion of the manufacturer.
Tolerances : see table 2.
Threads : in accordance with ISO 7/1.
Method of designation of fitting sizes : see 12.2 c).

Table 12

Short bends D1
 Male and female short bends D4
 Pitcher tees E1
 Twin elbows E2



Fitting sizes				Dimensions mm		Laying lengths mm	
D1	D4	E1	E2	a = b	c	z	z ₃
1/4	1/4	—	—	30	—	20	—
3/8	3/8	3/8	3/8	36	19	26	9
1/2	1/2	1/2	1/2	45	24	32	11
3/4	3/4	3/4	3/4	50	28	35	13
1	1	1	1	63	33	46	16
1 1/4	1 1/4	1 1/4	1 1/4	76	40	57	21
1 1/2	1 1/2	1 1/2	1 1/2	85	43	66	24
2	2	2	2	102	53	78	29

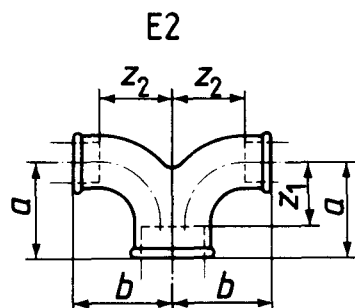
Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 14

Twin elbows, reducing E2



Fitting sizes	Dimensions mm		Laying lengths mm	
	<i>a</i>	<i>b</i>	<i>z</i> ₁	<i>z</i> ₂
(3/4 × 1/2)	47	48	32	35
(1 × 3/4)	53	54	36	39
(1 1/4 × 1)	66	68	47	51
(1 1/2 × 1 1/4)	77	79	58	60
(2 × 1 1/2)	91	94	67	75

Dimensions which are not specified are left to the discretion of the manufacturer.

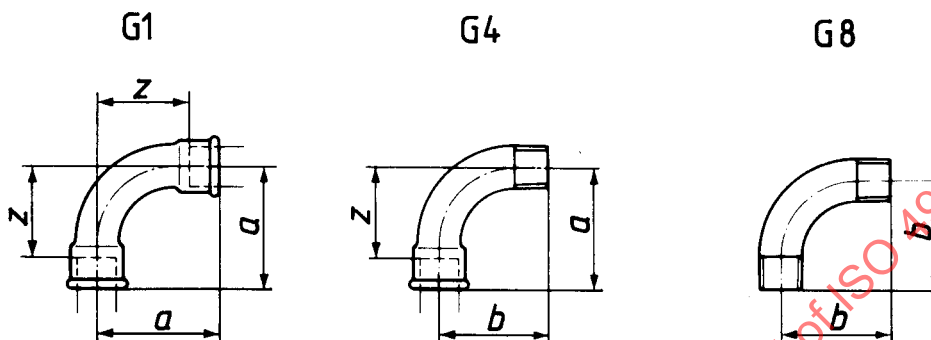
Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Method of designation of fitting sizes : see 12.2 b).

Table 15

Long sweep bends G1
 Male and female long sweep bends G4
 Male long sweep bends G8



Fitting sizes			Dimensions mm		Laying lengths mm
G1	G4	G8	a	b	z
—	(1/8)	—	35	32	28
1/4	1/4	—	40	36	30
3/8	3/8	(3/8)	48	42	38
1/2	1/2	1/2	55	48	42
3/4	3/4	3/4	69	60	54
1	1	1	85	75	68
1 1/4	1 1/4	(1 1/4)	105	95	86
1 1/2	1 1/2	(1 1/2)	116	105	97
2	2	(2)	140	130	116
2 1/2	(2 1/2)	—	176	165	149
3	(3)	—	205	190	175
4	(4)	—	260	245	224

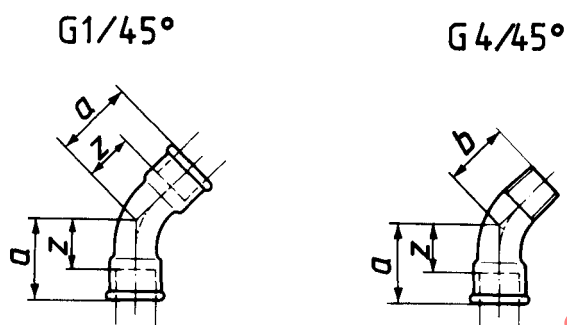
Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 16

45° long sweep bends G1/45°
45° male and female long sweep bends G4/45°



Fitting sizes		Dimensions mm		Laying lengths mm
G1/45°	G4/45°	a	b	z
—	(1/4)	26	21	16
(3/8)	3/8	30	24	20
1/2	1/2	36	30	23
3/4	3/4	43	36	28
1	1	51	42	34
1 1/4	1 1/4	64	54	45
1 1/2	1 1/2	68	58	49
2	2	81	70	57
(2 1/2)	(2 1/2)	99	86	72
(3)	(3)	113	100	83

Dimensions which are not specified are left to the discretion of the manufacturer.

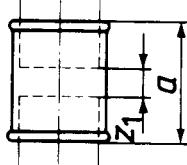
Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

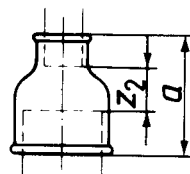
Table 17

Sockets M2
Sockets, right- and left-hand thread M2 R-L
Sockets, reducing M2

M2
M2 R-L



M2



Fitting sizes			Dimensions mm	Laying lengths mm	
M2	M2 R-L	M2 reducing	a	z ₁	z ₂
1/8	—	—	25	11	—
1/4	—	1/4 × 1/8	27	7	10
3/8	3/8	(3/8 × 1/8) 3/8 × 1/4	30	10	13 10
1/2	1/2	1/2 × 1/4 1/2 × 3/8	36	10	13 13
3/4	3/4	(3/4 × 1/4) 3/4 × 3/8 3/4 × 1/2	39	9	14 14 11
1	1	1 × 3/8 1 × 1/2 1 × 3/4	45	11	18 15 13
1 1/4	1 1/4	1 1/4 × 1/2 1 1/4 × 3/4 1 1/4 × 1	50	12	18 16 14
1 1/2	1 1/2	(1 1/2 × 1/2) 1 1/2 × 3/4 1 1/2 × 1 1 1/2 × 1 1/4	55	17	23 21 19 17

Fitting sizes			Dimensions mm	Laying lengths mm	
M2	M2 R-L	M2 reducing	a	z ₁	z ₂
2	2	(2 × 1/2) (2 × 3/4) 2 × 1 2 × 1 1/4 2 × 1 1/2	65	17	28 26 24 22 22
2 1/2	—	(2 1/2 × 1 1/4) (2 1/2 × 1 1/2) (2 1/2 × 2)	74	20	28 28 23
3	—	(3 × 1 1/2) (3 × 2) (3 × 2 1/2)	80	20	31 26 23
4	—	(4 × 2) (4 × 2 1/2) (4 × 3)	94	22	34 31 28
(5)	—	—	109	29	—
(6)	—	—	120	40	—

Dimensions which are not specified are left to the discretion of the manufacturer.

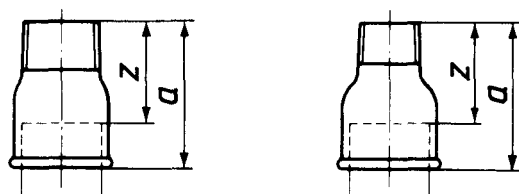
Tolerances : see table 2.

Threads : in accordance with ISO 7/1.

Table 18

Male and female sockets M4
Male and female sockets, reducing M4

M4



Fitting sizes		Dimensions mm	Laying lengths mm
M4	M4 reducing	a	z
3/8	3/8 × 1/4	35	25
1/2	1/2 × 1/4 1/2 × 3/8	43	30
3/4	(3/4 × 3/8) 3/4 × 1/2	48	33
1	1 × 1/2 1 × 3/4	55	38
1 1/4	1 1/4 × 3/4 1 1/4 × 1	60	41
—	1 1/2 × 1 1 1/2 × 1 1/4	63	44
—	(2 × 1 1/4) (2 × 1 1/2)	70	46

Dimensions which are not specified are left to the discretion of the manufacturer.

Tolerances : see table 2

Threads : in accordance with ISO 7/1.