INTERNATIONAL STANDARD

ISO 4144

Second edition
2003-03-15

Pipework — Stainless steel fittings threaded in accordance with ISO 7-1

Tuyauteries — Raccords en acier inoxydable, filetés conformément à l'ISO 7-1

Reference number
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Contents

Page

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 4144 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 5, *Threaded or plain end butt-welding fittings, threads, gauging of threads*.

This second edition cancels and replaces the first edition (ISO 4144:1979), which has been technically revised.

Introduction

ISO 4144 has been used worldwide since its publication in 1979. Precision casting technologies have begun to be applied to the production of stainless steel castings.

Dimensions of stainless steel fittings are considerably reduced by the introduction of the new casting technologies, which offer economical advantage and high profitability of the industry.

Another important issue to be considered in ISO standardization is the requirement of pressure-temperature ratings.

Furthermore, six new types of stainless steel fittings, such as 45° elbows, male and female elbows, crosses, etc., have been added to the ten conventional types of fittings specified in ISO 4144:1979.

Pipework — Stainless steel fittings threaded in accordance with ISO 7-1

1 Scope

This International Standard specifies the types, pressure-temperature ratings, minimum dimensions and materials of stainless steel fittings for threaded connections in accordance with ISO 7-1, used for ordinary piping for steam, air, gas, water, oil, etc.

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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 7-2, *Pipe threads where pressure-tight joints are made on the threads — Part 2: Verification by means of limit gauges*

ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 261, *ISO general-purpose metric screw threads — General plan*

ISO 262, *ISO general-purpose metric screw threads — Selected sizes for screws, bolts and nuts*

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

ISO 4990:—[1)], *Steel castings — General technical delivery requirements*

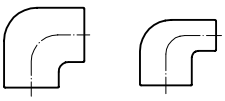
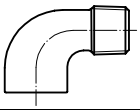
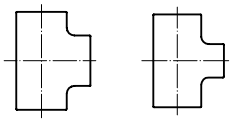
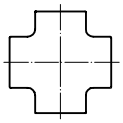
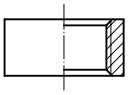
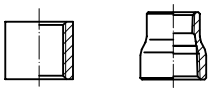
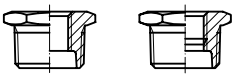
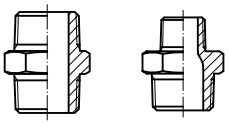
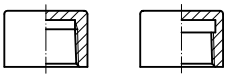
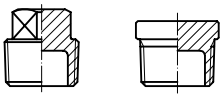
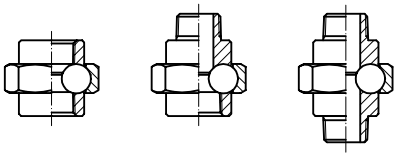
ISO 4991:1994, *Steel castings for pressure purposes*

1) To be published. (Revision of ISO 4990:1986)

3 Types of fittings and their symbols

Table 1 shows 12 types of fittings and their symbols.

Table 1 — Types of fittings and their symbols

Diagram	Type	Symbol	Figure
	Elbows, equal and reducing	E1 and E2	2 and 3
	45° elbows	E3	4
	Male and female elbows	E4	5
	Tees, equal and reducing	T1 and T2	2 and 3
	Crosses	X1	2
	Half sockets	S1	6
	Sockets, equal and reducing	S2 and S3	7 and 8
	Reducing bushes	B1	9
	Hexagon nipples, equal and reducing	N1 and N2	10 and 11
	Caps	C1	12
	Plugs	P1 and P2	13
	Unions	U1, U2, U3 U4, U5, U6	14

4 Pressure-temperature ratings

Pressure-temperature ratings are indicated in Table 2.

Table 2 — Pressure-temperature ratings

Temperature °C	Non-shock maximum working pressure bar
− 20 to 40	20
100	16,5
150	15
200	14
220	13,5

NOTE 1 Pressure for intermediate temperatures may be determined by the interpolation method.

NOTE 2 Temperatures indicated are those of internal fluid.

NOTE 3 Piping loads, stresses and moments are not taken into account.

5 Manufacturing and materials

Fittings shall be manufactured from castings, rolling, forging, etc. Material shall be austenitic stainless steel having the proof stress at least equal to that of steel TS 47 specified in ISO 2604-2. Fittings shall be made from materials that have been properly heat treated by the solution-annealing method specified in ISO 4991:1994, 5.2, Table 1.

6 Threads

6.1 Choice of thread

Threads in fittings shall be in accordance with ISO 7-1. External and internal threads are tapered 1:16, but internal threads may be parallel.

Exceptions: Union-nuts and their mating threads shall be in accordance with ISO 68-1, ISO 228-1, ISO 261, ISO 262 or ISO 724.

6.2 Chamfering

Thread ends should be chamfered.

7 Dimensions

7.1 General

Dimensions are shown in Figures 1 to 14 and specified in Tables 3 to 16. Unspecified dimensions are at the discretion of the manufacturer.

7.2 Dimensions of joints

See Figure 1 and Table 3.

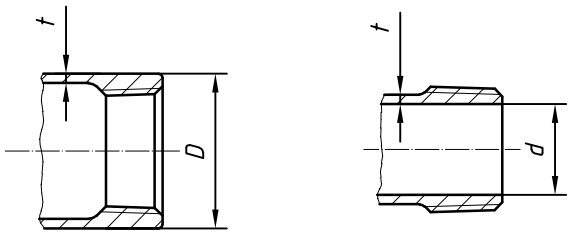


Figure 1 — Dimensions of joints

Table 3 — Dimensions of joints

Thread size	Nominal diameter DN	Minimum outside diameter of internal threads [a] D mm	Maximum inside diameter of external threads [b] d mm	Minimum wall thickness [c] t mm
1/8	6	13,0	5,5	1,5
1/4	8	16,5	8,0	1,5
3/8	10	20,0	11,5	1,5
1/2	15	24,5	15,0	1,6
3/4	20	30,0	20,5	1,7
1	25	37,5	26,0	1,9
1 1/4	32	46,5	34,5	2,2
1 1/2	40	53,0	40,0	2,4
2	50	65,5	51,0	2,7
2 1/2	65	82,0	65,5	3,2
3	80	95,5	77,5	3,6
4	100	121,5	101,5	4,1

[a] D is equal to the major diameter of the internal thread at the gauge plane plus $2t$ and rounded up to 0,5 mm.

[b] d is equal to the minor diameter of the external thread at the gauge plane minus $2t$ and rounded down to 0,5 mm.

[c] The wall thickness of fittings made of a material other than casting material may be reduced to $0{,}8t$.

7.3 Elbows E1, tees T1 and crosses X1

See Figure 2 and Table 4.

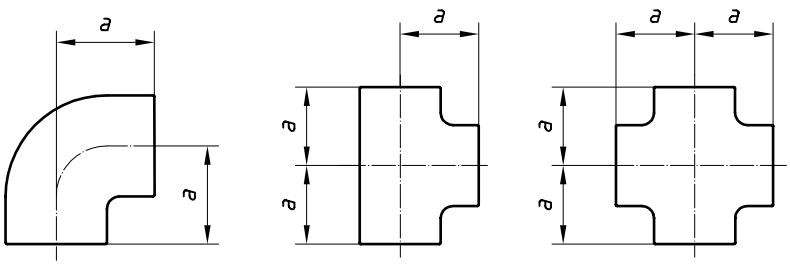


Figure 2 — Elbow E1, tee T1 and cross X1

Table 4 — Dimensions of elbows E1, tees T1 and crosses X1

Thread diameter	Nominal diameter DN	a_{min} mm
1/8	6	17
1/4	8	19
3/8	10	23
1/2	15	27
3/4	20	32
1	25	38
1 1/4	32	45
1 1/2	40	48
2	50	57
2 1/2	65	69
3	80	78
4	100	96

7.4 Reducing elbows E2 and reducing tees T2

See Figure 3 and Table 5.

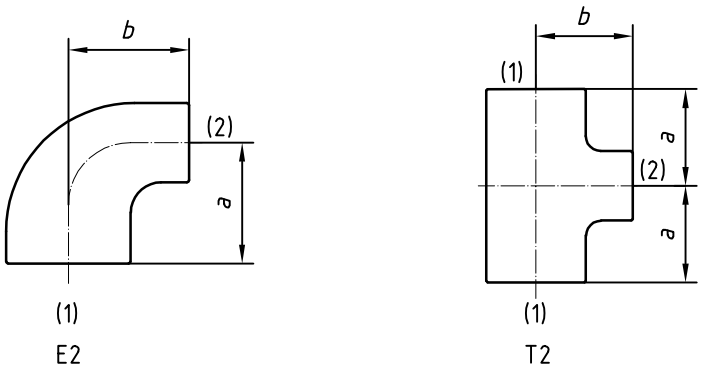


Figure 3 — Reducing elbow E2 and reducing tee T2

Table 5 — Reducing elbows E2 and reducing tees T2

Thread size		Nominal diameters [a]		a_{min}	b_{min}
		DN_1	DN_2		
(1)	(2)			mm	mm
1/4	**1/8**	8	6	18	18
3/8	**1/4**	10	8	20	22
1/2	**1/4**	15	8	24	24
	3/8		10	26	25
3/4	**3/8**	20	10	28	28
	1/2		15	29	30
1	**1/2**	25	15	32	33
	3/4		20	34	35
1 1/4	**3/4**	32	20	38	40
	1		25	40	42
1 1/2	**1**	40	25	41	45
	1 1/4		32	45	48
2	**1 1/4**	50	32	48	54
	1 1/2		40	52	55
2 1/2	**1 1/2**	65	40	55	62
	2		50	60	65
3	**2**	80	50	62	72
	2 1/2		65	72	75
4	**2 1/2**	100	65	78	90
	3		80	83	91

[a] DN_1 shows nominal diameter of larger side and DN_2 shows nominal diameter of smaller side.

7.5 45° elbows E3

See Figure 4 and Table 6.

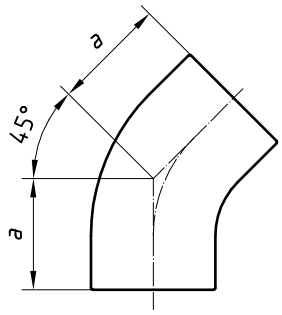


Figure 4 — 45° elbow E3

Table 6 — Dimensions of 45° elbows E3

Thread size	Nominal diameter DN	a_{min} mm
1/8	6	16
1/4	8	17
3/8	10	19
1/2	15	21
3/4	20	25
1	25	29
1 1/4	32	33
1 1/2	40	37
2	50	42
2 1/2	65	49
3	80	54
4	100	64

7.6 Male and female elbows E4

See Figure 5 and Table 7.

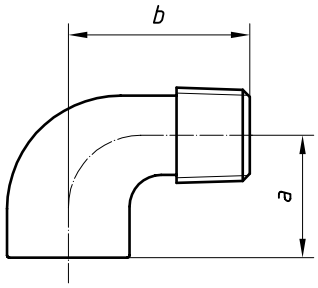


Figure 5 — Male and female elbow E4

Table 7 — Dimensions of male and female elbows E4

Thread size	Nominal diameter DN	a_{min} mm	b_{min} mm
1/8	6	17	26
1/4	8	19	27
3/8	10	23	29
1/2	15	27	35
3/4	20	32	40
1	25	38	46
1 1/4	32	45	54
1 1/2	40	48	57
2	50	57	70
2 1/2	65	69	83
3	80	78	94
4	100	97	115

7.7 Half sockets S1

See Figure 6 and Table 8.

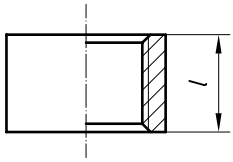


Figure 6 — Half socket S1

Table 8 — Dimensions of half sockets S1

Thread size	Nominal diameter DN	l_{min} mm
1/8	6	7,5
1/4	8	11
3/8	10	11,5
1/2	15	15
3/4	20	16,5
1	25	19,5
1 1/4	32	21,5
1 1/2	40	21,5
2	50	26
2 1/2	65	30,5
3	80	33,5
4	100	39,5

7.8 Sockets S2

See Figure 7 and Table 9.

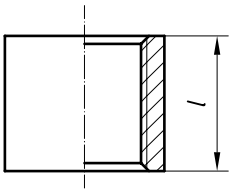


Figure 7 — Socket S2

Table 9 — Dimensions of sockets S2

Thread size	Nominal diameter DN	l_{min} mm
1/8	6	17
1/4	8	24
3/8	10	25
1/2	15	32
3/4	20	35
1	25	41
1 1/4	32	45
1 1/2	40	45
2	50	54
2 1/2	65	63
3	80	69
4	100	81

7.9 Reducing sockets S3

See Figure 8 and Table 10.

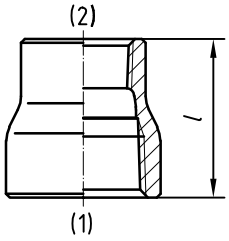


Figure 8 — Reducing socket S3

Table 10 — Dimensions for reducing sockets S3

Thread size		Nominal diameters [a]		l_{min}
		DN_1	DN_2	
(1)	(2)			mm
1/4	**1/8**	8	6	25
3/8	**1/8**	10	6	26
	1/4		8	
1/2	**1/4**	15	8	34
	3/8		10	
3/4	**3/8**	20	10	36
	1/2		15	
1	**1/2**	25	15	42
	3/4		20	
1 1/4	**3/4**	32	20	48
	1		25	
1 1/2	**1**	40	25	52
	1 1/4		32	
2	**1 1/4**	50	32	58
	1 1/2		40	
2 1/2	**1 1/2**	65	40	65
	2		50	
3	**2**	80	50	72
	2 1/2		65	
4	**2 1/2**	100	65	94
	3		80	

[a] DN_1 shows nominal diameter of larger side and DN_2 shows nominal diameter of smaller side.

7.10 Reducing bushes B1

See Figure 9 and Table 11.

Reducing bushes B1 can have a hexagonal shape up to size 1/2, hexagonal or octagonal shape for size 3/4 through 2, hexagonal, octagonal or decagonal shape for size 2 1/2 through 4.

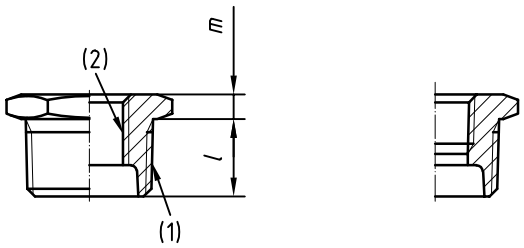


Figure 9 — Reducing bush B1

Table 11 — Dimensions of reducing bushes B1

Thread size		Nominal diameters [a]		l_{min}	m_{min}
		DN_1	DN_2		
(1)	(2)			mm	mm
1/4	**1/8**	8	6	10,5	4
3/8	**1/8**	10	6	11	5
	1/4		8		
1/2	**1/4**	15	8	14,5	5
	3/8		10		
3/4	**3/8**	20	10	15,5	5,5
	1/2		15		
1	**1/2**	25	15	18	6
	3/4		20		
1 1/4	**3/4**	32	20	20,5	6,5
	1		25		
1 1/2	**1**	40	25	20,5	6,5
	1 1/4		32		
2	**1 1/4**	50	32	25	7
	1 1/2		40		
2 1/2	**1 1/2**	65	40	27	7
	2		50		
3	**2**	80	50	30	7,5
	2 1/2		65		
4	**2 1/2**	100	65	36	8
	3		80		

[a] DN_1 shows nominal diameter of larger side and DN_2 shows nominal diameter of smaller side.

7.11 Hexagon nipples N1

See Figure 10 and Table 12.

Nipples can have a hexagonal shape up to size 1/2, hexagonal or octagonal shape for size 3/4 through 2, hexagonal, octagonal or decagonal shape for size 2 1/2 through 4.

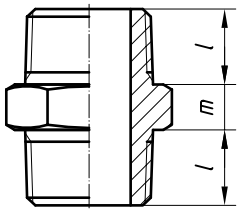


Figure 10 — Hexagon nipple N1

Table 12 — Dimensions of hexagon nipples N1

Thread size	Nominal diameter DN	l_{min} mm	m_{min} mm
1/8	6	8	4
1/4	8	10,5	4
3/8	10	11	5
1/2	15	14,5	5
3/4	20	15,5	5,5
1	25	18	6
1 1/4	32	20,5	6,5
1 1/2	40	20,5	6,5
2	50	25	7
2 1/2	65	27	7
3	80	30	7,5
4	100	36	8

7.12 Reducing nipples N2

See Figure 11 and Table 13.

Reducing nipples N2 can have a hexagonal shape up to size 1/2, hexagonal or octagonal shape for size 3/4 through 2, hexagonal, octagonal or decagonal shape for size 2 1/2 through 4.

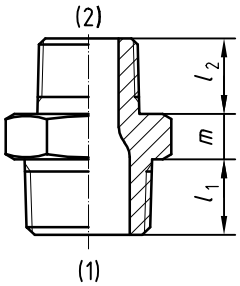


Figure 11 — Reducing nipple N2

Table 13 — Dimensions of reducing nipples N2

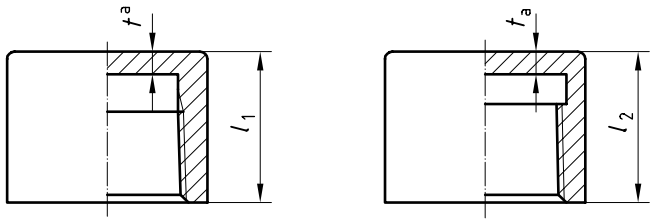
Thread size		Nominal diameters [a]		$l_{1\,min}$	$l_{2\,min}$	m_{min}
		DN_1	DN_2			
(1)	(2)			mm	mm	mm
1/4	**1/8**	8	6	10,5	8	4
3/8	**1/8**	10	6	11	8	5
	1/4		8		10,5	
1/2	**1/4**	15	8	14,5	10,5	5
	3/8		10		11	
3/4	**3/8**	20	10	15,5	11	5,5
	1/2		15		14,5	
1	**1/2**	25	15	18	14,5	6
	3/4		20		15,5	
1 1/4	**3/4**	32	20	20,5	15,5	6,5
	1		25		18	
1 1/2	**1**	40	25	20,5	18	6,5
	1 1/4		32		20,5	
2	**1 1/4**	50	32	25	20,5	7
	1 1/2		40		20,5	
2 1/2	**1 1/2**	65	40	27	20,5	7
	2		50		25	
3	**2**	80	50	30	25	7,5
	2 1/2		65		27	
4	**2 1/2**	100	65	36	27	8
	3		80		30	

[a] DN_1 shows nominal diameter of larger side and DN_2 shows nominal diameter of smaller side.

7.13 Caps C1

See Figure 12 and Table 14.

Caps may be round, hexagonal, octagonal or decagonal at the discretion of the manufacturer.



[a] The minimum wall thickness, t, of caps shall be no less than the minimum wall thickness requirements of Table 3.

Figure 12 — Caps C1

Table 14 — Dimensions of caps C1

Thread size	Nominal diameter DN	$l_{1\,min}$ mm	$l_{2\,min}$ mm
1/8	6	12,5	10,5
1/4	8	16	14
3/8	10	16,5	14,5
1/2	15	21	18,5
3/4	20	22,5	19,5
1	25	26	22,5
1 1/4	32	29	25,5
1 1/2	40	29	25,5
2	50	33,5	30
2 1/2	65	38,5	35
3	80	42	38,5
4	100	48,5	45

7.14 Plugs P1 and P2

See Figure 13 and Table 15.

Plugs may be solid or hollow at the discretion of the manufacturer. P2 may be hexagonal shape up to size 1/2, hexagonal or octagonal shape for size 3/4 through 2, hexagonal, octagonal or decagonal shape for size 2 1/2 through 4.

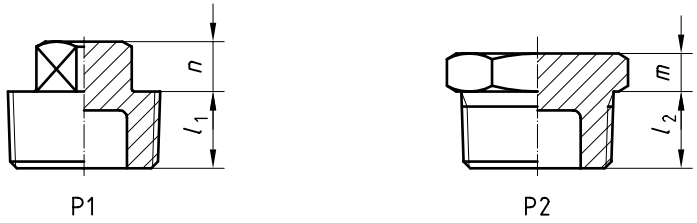


Figure 13 — Plugs P1 and P2

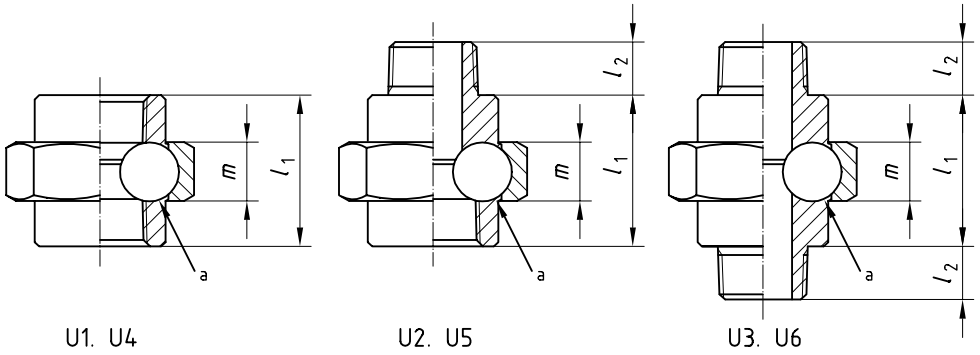
Table 15 — Dimensions of plugs P1 and P2

Thread size	Nominal diameter DN	$l_{1\,min}$ mm	n_{min} mm	$l_{2\,min}$ mm	m_{min} mm
1/8	6	6	5	8	4
1/4	8	8,5	5	10,5	4
3/8	10	9	6	11	5
1/2	15	11,5	7	14,5	5
3/4	20	13	8	15,5	5,5
1	25	14,5	11	18	6
1 1/4	32	17	11	20,5	6,5
1 1/2	40	17	12	20,5	6,5
2	50	21,5	13	25	7
2 1/2	65	23,5	15	27	7
3	80	26,5	15	30	7,5
4	100	32,5	19	36	8

7.15 Unions with flat seat U1, U2 and U3 and unions with taper seat U4, U5 and U6

See Figure 14 and Table 16.

Union nuts may be hexagonal, octagonal or decagonal at the discretion of the manufacturer.



The minimum wall thickness of the union nut at any point shall be no less than the minimum wall thickness requirements of Table 3.

[a] The type of joint (flat or taper) is at the discretion of the manufacturer.

Figure 14 — Unions with flat seat U1, U2 and U3 and unions with taper seat U4, U5 and U6

Table 16 — Dimensions of unions with flat seat U1, U2 and U3 and unions with taper seat U4, U5 and U6

Thread size	Nominal diameter DN	$l_{1\ min}$ mm	$l_{2\ min}$ mm	m_{min} mm
1/8	6	30	8	13
1/4	8	33,5	10,5	13,5
3/8	10	36,5	11	15
1/2	15	39,5	14,5	16
3/4	20	42,5	15,5	17
1	25	50	18	20
1 1/4	32	54	20,5	22
1 1/2	40	58	20,5	24
2	50	65	25	27
2 1/2	65	75	27	29,5
3	80	83	30	31
4	100	110	36	34

8 Tests and inspections

8.1 The following inspections shall be performed visually:

a) inner and outer surfaces of fitting are smooth, with no cracks, harmful scratches, burrs, sand marks or other defects;

b) fully threaded parts of fittings are sound, with no thinned and nicked or other defects.

8.2 Inspections of threads of fittings shall be in accordance with ISO 7-2 or shall be carried out by other suitable means.

8.3 The axes of screw threads shall be accurate within ± 0,5° of the specified angle.

8.4 When inspecting the fittings in production, the following test shall be performed on each fitting to ensure that no leakage occurs. To test fittings, threaded ends are sealed and, after pressurizing the inside of the fittings to air pressure of 6 bar, the fittings shall be observed for the time indicated in Table 17 while maintaining the pressure.

Table 17 — Minimum test duration

Thread size	Minimum test duration s
⩽ **2**	15
⩾ **2 1/2**	60

8.5 A hydraulic test may be performed at 30 bar, instead of an air pressure test. The test method and test duration should be in accordance with 8.4.

8.6 A leakage inspection is not required for fittings made from materials such as forgings, rolled bars or extruded tubes.

8.7 Fittings shall be capable of passing an intergranular corrosion test performed in accordance with ISO 4990:—, B.9.1. When testing is performed, one fitting from each heat treatment charge shall be tested.

9 Marking

Fittings shall be marked with the trademark, material symbol or abbreviation and thread designation. However, marking may be omitted when there is insufficient space.

10 Designation

The fittings complying with this International Standard shall be designated by the following particulars, in the sequence shown:

a) type of fitting;

b) reference to this International Standard, i.e. ISO 4144;

c) designation of thread size;

d) symbol (see Table 1);

e) material.

EXAMPLE 1 An equal female elbow E1, with Rc 2 internal conical thread of grade TS 47 is designated as follows:

Elbow ISO 4144-Rc 2 E1 TS 47

EXAMPLE 2 A reduced tee with run T2, with Rc 2 internal conical thread and branch 1 1/4 of grade TS 61 is designated as follows:

Reduced tee ISO 4144-Rc 2 × 1 1/4 T2 TS 61

ICS 23.040.40

Price based on 19 pages