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ISO 2853

Second edition
1993-06-15

Stainless steel threaded couplings for the food industry

Raccords filetés en acier inoxydable pour l'industrie alimentaire

Reference number
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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.

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.

International Standard ISO 2853 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Sub-Committee SC 1, *Steel tubes*.

This second edition cancels and replaces the first edition (ISO 2853:1976), all the tables of which have been technically revised.

Annexes A, B, C, D and E form an integral part of this International Standard. Annexes F and G are for information only.

Stainless steel threaded couplings for the food industry

1 Scope

This International Standard specifies the dimensions, tolerances, surface roughness, materials, assembling and hygienic requirements for

a) welded- and expanded-type male parts and liners, and

b) nuts and gaskets,

in stainless steel threaded pipe couplings for the food industry.

Male parts and liners in stainless steel threaded couplings for the food industry are intended to be used with stainless steel tubes specified in ISO 2037.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 48:1979, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

ISO 2037:1992, *Stainless steel tubes for the food industry.*

ISO 2604-1:1975, *Steel products for pressure purposes — Quality requirements — Part 1: Forgings.*

ISO 6506:1981, *Metallic materials — Hardness test — Brinell test.*

ISO 6507-1:1982, *Metallic materials — Hardness test — Vickers test — Part 1: HV 5 to HV 100.*

ISO 6508:1986, *Metallic materials — Hardness test — Rockwell test (scales A - B - C - D - E - F - G - H - K).*

3 Symbols

A	allowance of male part thread
B_1	inside diameter of support ring
B_2	outside diameter of support ring
C_1	spigot diameter of expanded-type male part and liner
C_2	spigot diameter of welded-type male part and liner
C_3	inside diameter of hexagon or round nut
C_4	inside diameter of gasket
C_5	inside diameter of expanded-type male part and liner
C_6	inside diameter of welded-type male part and liner
C_7	outside diameter of expanded- or welded-type liner
C_8	outside diameter of round nut
C_9	centring inside diameter of nut
C_{10}	outside diameter of neck of welded-type male part and liner
d	major diameter of male part thread
d_1	minor diameter of male part thread

d_2 pitch diameter of male part thread

D major diameter of nut thread

D_1 minor diameter of nut thread

D_2 pitch diameter of nut thread

E inside diameter of gasket lip

F_1 total length of expanded-type male part

F_2 total length of welded-type male part and liner

F_3 total length of expanded-type liner

F_4 total length of hexagon or round nut

F_5 inside width of support ring

G_1 length of external thread of expanded- and welded-type male part

G_2 length of internal thread of hexagon or round nut

H height of fundamental triangle of thread

J chamfer diameter of round nut

K length of spigot of expanded- and welded-type male part and liner

L_1 flange thickness of expanded- and welded-type liner

L_2 inside flange thickness of hexagon or round nut

M_1 outside diameter of lip of gasket to be used with support ring

M_2 outside diameter of lip of gasket to be used without support ring

N_1 width across slots of round nut

N_2 width across flats of hexagon nut

O width of slot of round nut

p pitch of thread

R_1 fillet radius of welded-type male part

R_2 fillet radius of welded-type liner

S outside diameter of gasket (lip excluded) to be used with support ring

T_2 length of lip of gasket to be used with support ring

T_3 wall thickness of support ring

U total thickness of gasket

V compression thickness of gasket

w root width of male part threads on GO side profile

W root width of nut threads on GO side profile

X_1 lock ring groove diameter

X_2 lock ring outside diameter

α_1 angle of chamfer of round nut

α_2 angle of neck of support ring

4 Dimensions and tolerances

4.1 Expanded-type male part

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 1 and table 1.

4.2 Expanded-type liner

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 2 and table 2.

4.3 Welded-type male part

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 3 and table 3.

4.4 Welded-type liner

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 4 and table 4.

4.5 Hexagon nut

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 5 and table 5.

4.6 Round nut

The dimensions and tolerances, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure 6 and table 6.

4.7 Gasket

The dimensions and tolerances, in millimetres, are given in figure 7 and table 7.

For the specifications of the gasket, see annex C.

4.8 Support ring

The dimensions and tolerances, in millimetres, are given in figure 8 and table 8.

5 Assembling

5.1 Welding

Welded-type male parts and liners shall be attached to the pipe ends by butt welding.

5.2 Expanding

Expanded-type male parts and liners shall be attached to the pipe ends by expanding. A method for carrying out the expansion is described in annex F. This method can be applied to nominal sizes up to and including 101,6 mm.

6 Hygienic requirements

6.1 All surfaces of the coupling in contact with the foodstuff shall be easily accessible for cleaning, either by cleaning in place methods or by manual cleaning when disassembled. Removable parts shall be readily demountable.

6.2 The interior surface of welded-type male parts and liners shall be clean and smooth. It shall be free from surface defects and inclusions.

6.3 The gasket shall be made of a material compatible with the material of the fitting, with the foodstuffs and with the cleaning fluids utilized. It shall not, for example, impart an odour or taste to the foodstuff.

7 Surface roughness

The surface roughness of expanded- and welded-type male parts and liners, nuts and support rings, in accordance with the specifications of ISO 468, shall be, for finely finished surfaces, $R_a \leqslant 1$ µm.

8 Materials

8.1 Male parts, liners, nuts and support rings.

Austenitic stainless steel shall be selected from ISO 2604-1.

Generally the steel types F47 and F62 are suitable (similar to the types recommended for tubes in ISO 2037).

8.2 Gaskets

The gaskets shall be of natural or synthetic rubber with a hardness from 75 IRHD to 85 IRHD in accordance with ISO 48. The material shall meet the hygienic requirements and have a reasonable life expectancy.

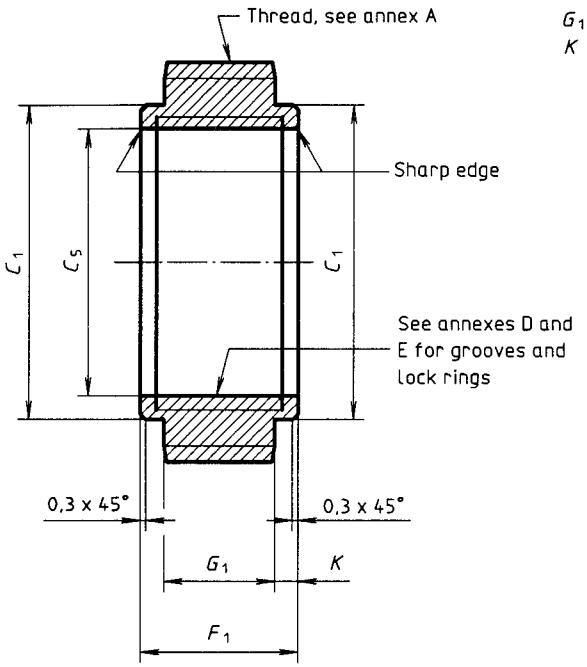


Figure 1

Table 1

Nominal size	C_1 h10	C_5 A10	F_1 ± 0,2
12	15	12	17
12,7	15	12,7	17
17,2	21,2	17,2	17
21,3	25,4	21,3	17
25	29	25	17
33,7	38	33,7	20
38	42,5	38	20
40	44,5	40	20
51	56	51	20
63,5	69,7	63,5	25
70	76,2	70	25
76,1	82,3	76,1	30

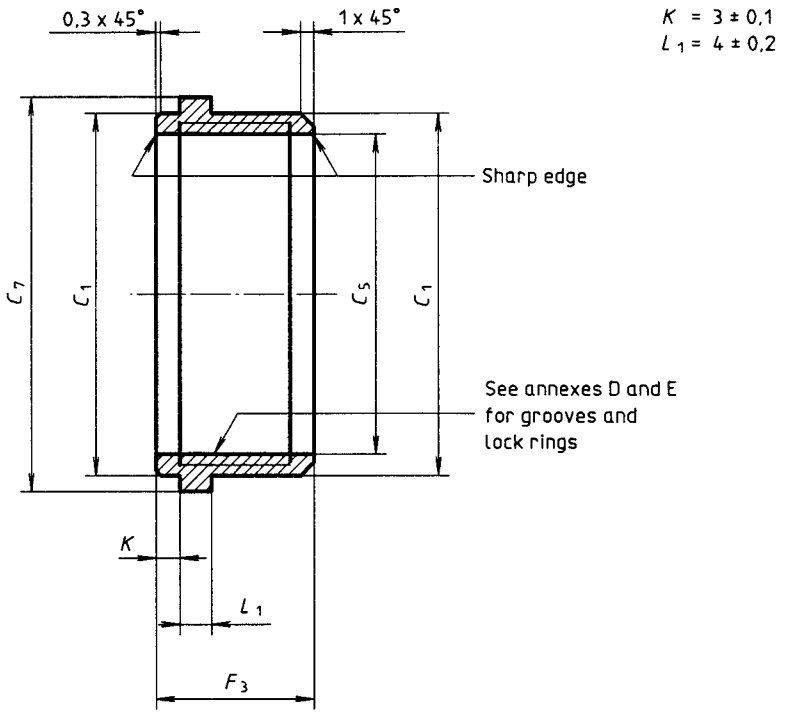


Figure 2

Table 2

Nominal size	C_1 h10	C_5 A10	C_7 h10	F_3 ± 0,2
12	15	12	19,6	16
12,7	15	12,7	19,6	16
17,2	21,2	17,2	25,8	18
21,3	25,4	21,3	30	20
25	29	25	33,8	20
33,7	38	33,7	42,5	20
38	42,5	38	47	20
40	44,5	40	49	20
51	56	51	60,5	25
63,5	69,7	63,5	74	30
70	76,2	70	80,9	30
76,1	82,3	76,1	87,5	30

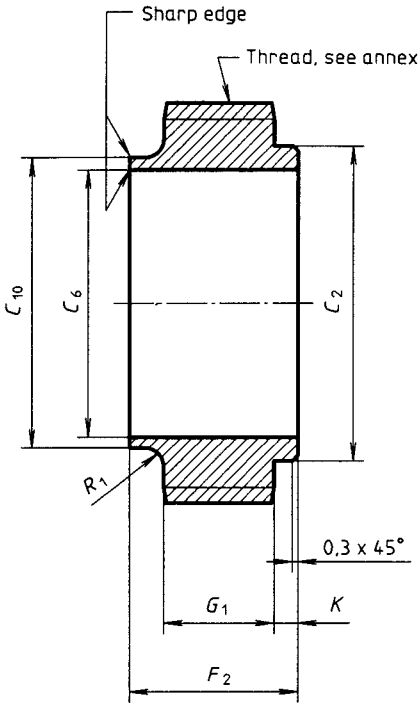


Figure 3

Table 3

Nominal size	C_2 h10	C_6 N11	C_{10} h11
25	29,2	22,6	25,6
33,7	38,2	31,3	34,3
38	42,7	35,6	38,6
40	44,7	37,6	40,6
51	56,2	48,6	51,6
63,5	69,9	60,3	64,1
70	76,4	66,8	70,6
76,1	82,6	72,9	76,7

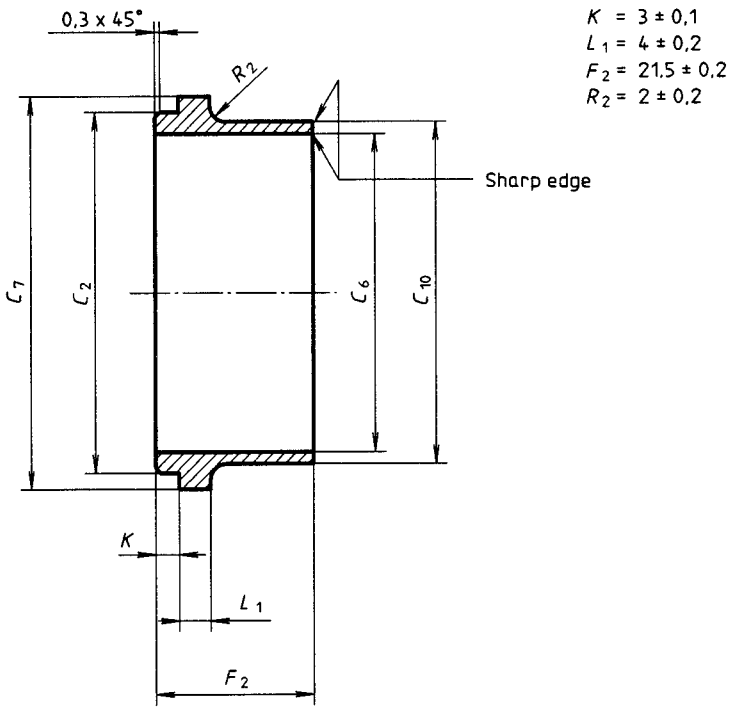


Figure 4

Table 4

Nominal size	C_2 h10	C_6 N11	C_7 h10	C_{10} h11
25	29,2	22,6	33,8	25,6
33,7	38,2	31,3	42,5	34,3
38	42,7	35,6	47	38,6
40	44,7	37,6	49	40,6
51	56,2	48,6	60,5	51,6
63,5	69,9	60,3	74	64,1
70	76,4	66,8	80,9	70,6
76,1	82,6	72,9	87,5	76,7
88,9	95,7	84,9	101	89,8
101,6	108,7	97,6	114,1	102,5

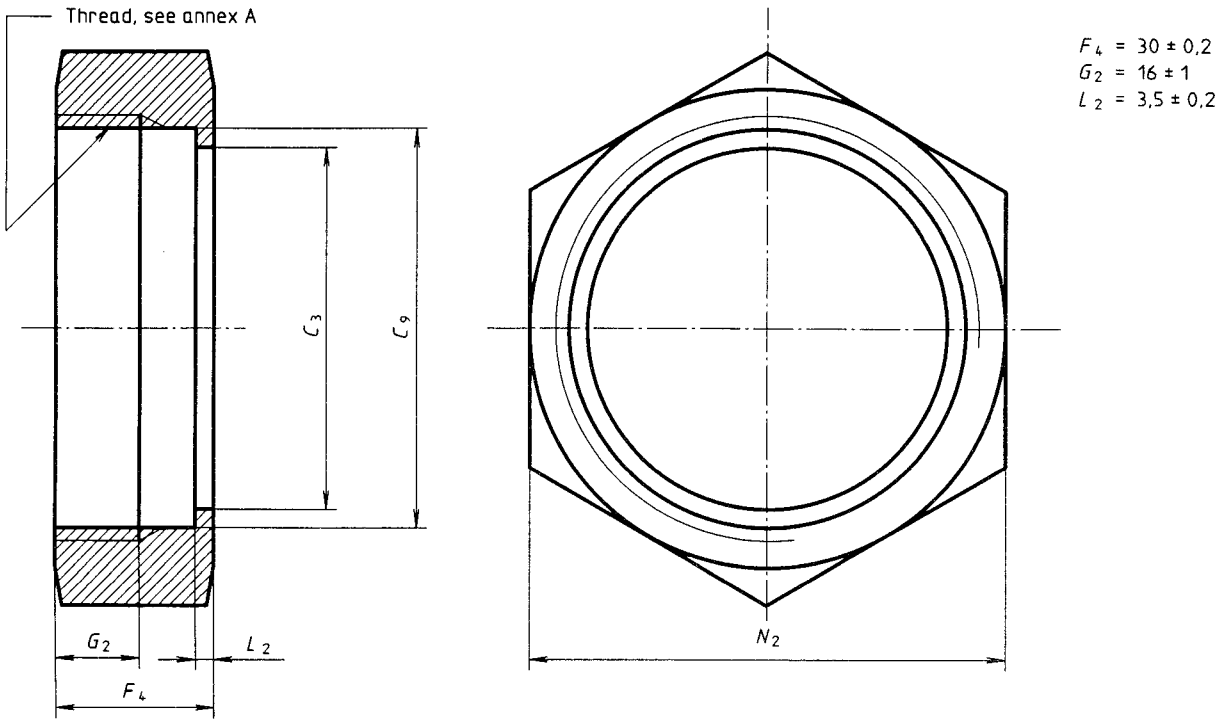


Figure 5

Table 5

Nominal size	C_3 H11	C_9 $^{+0,16}_{0}$	N_2 h15
12	16	20,1	32
12,7	16	20,1	32
17,2	22,2	26,47	41
21,3	26,4	30,74	46
25	30,5	34,34	46
33,7	39	43,18	60
38	43,5	47,86	60
40	45,5	49,89	65
51	57	61,37	75
63,5	70,7	74,88	90
70	77,2	81,79	100
76,1	83,3	88,4	105
88,9	97	101,91	115
101,6	110	115,42	135

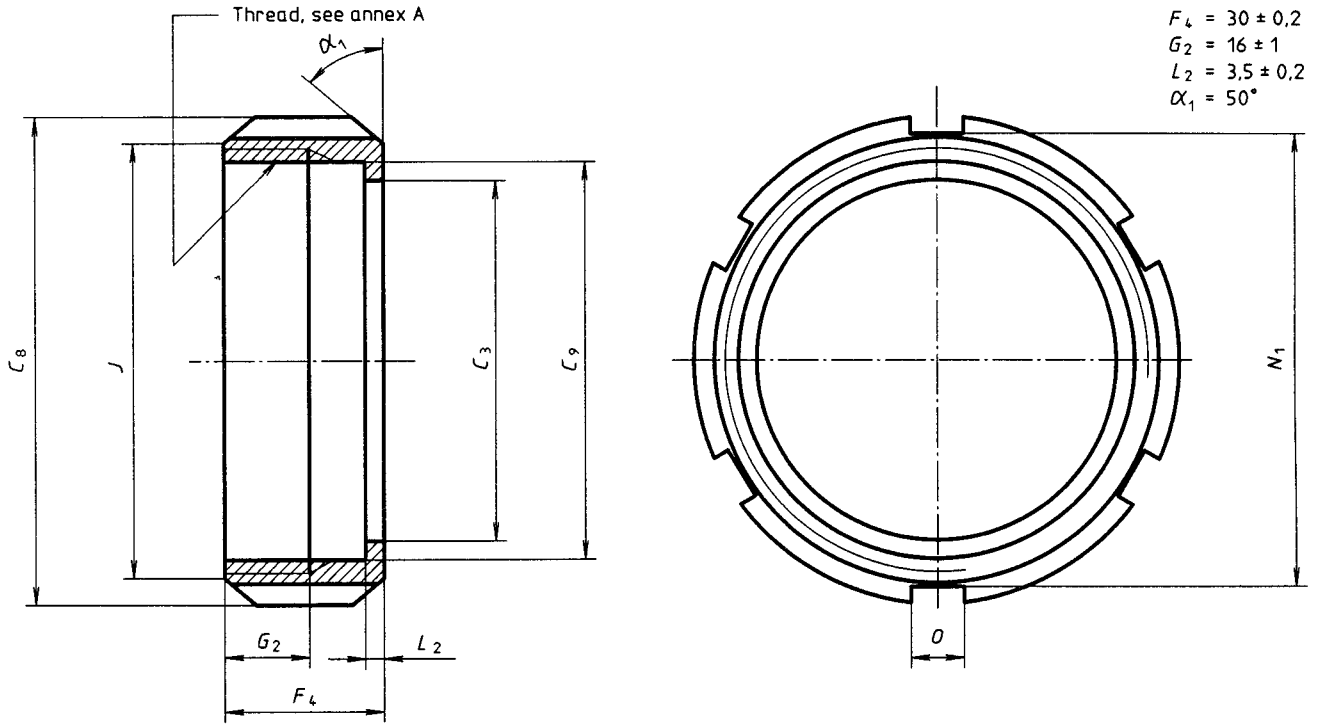
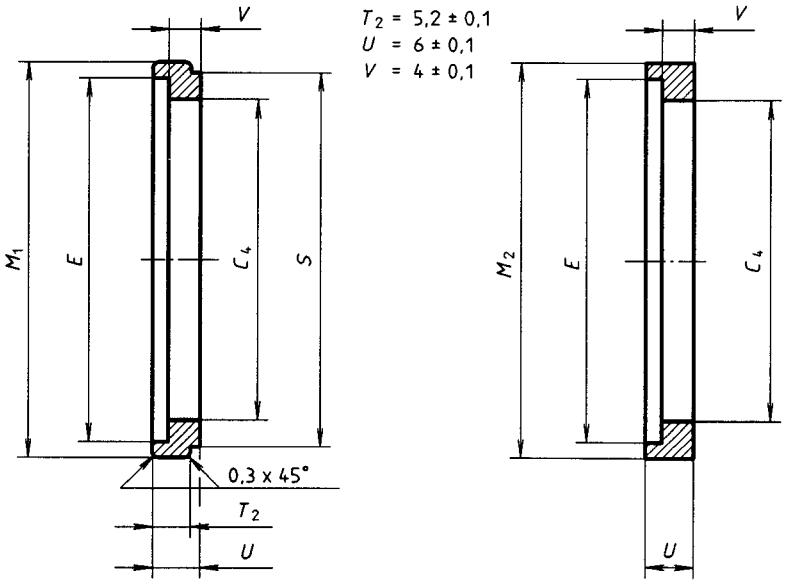


Figure 6

Table 6

Nominal size	C_3 H11	C_8 h13	C_9 $^{+0,16}_{0}$	J ± 1	N_1 h15	O H13
12	16	33	20,1	26	27	6
12,7	16	33	20,1	26	27	6
17,2	22,2	40	26,47	35	36	6
21,3	26,4	44	30,74	37	38	6
25	30,5	48	34,34	41	42	6
33,7	39	58	43,18	49	50	8
38	43,5	64	47,86	55	56	8
40	45,5	65	49,89	57	58	8
51	57	77	61,37	68	69	8
63,5	70,7	91	74,88	82	83	10
70	77,2	98	81,79	89	90	10
76,1	83,3	106	88,4	97	98	10
88,9	97	122	101,91	112	113	12
101,6	110	135	115,42	125	126	12



a) Gasket to be used with the support ring shown in 4.8

b) Gasket to be used without the support ring

Figure 7

Table 7

Nominal size	C_4 $^{+0,5}_{0}$	E ±0,25	M_1 ±0,25	M_2 ±0,25	S $^{0}_{+0,5}$
12	11	14,8	18,2	18,5	15,5
12,7	11,7	14,8	18,2	18,5	15,5
17,2	16,2	21	24,4	24,7	21,7
21,3	20,3	25,2	28,6	28,9	25,9
25	23,6	28,8	32,2	32,5	29,5
33,7	32,3	37,8	41,2	41,5	38,5
38	36,6	42,3	45,7	46	43
40	38,6	44,3	47,7	48	45
51	49,6	55,8	59,2	59,5	56,5
63,5	61,3	69,5	72,9	73,2	70,2
70	67,8	76	79,4	80	76,7
76,1	73,9	82,2	85,6	86,5	82,9
88,9	85,9	95,3	98,7	99,5	96
101,6	98,6	108,3	111,7	112,5	109

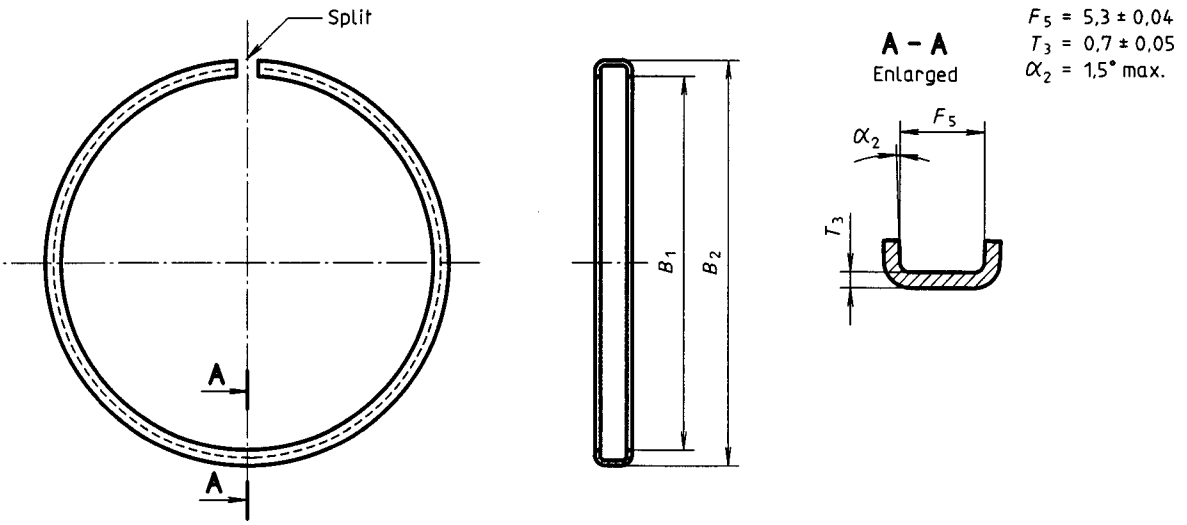


Figure 8

Table 8

Nominal size	B_1 ± 0,13	B_2 ± 0,13
12	15,8	19,6
12,7	15,8	19,6
17,2	22	25,8
21,3	26,2	30
25	29,8	33,6
33,7	38,8	42,6
38	43,3	47,1
40	45,3	49,1
51	56,8	60,6
63,5	70,5	74,3
70	77	80,8
76,1	83,2	87
88,9	96,3	100,1
101,6	109,3	113,1

Annex A
(normative)

Trapezoidal threads intended for threaded couplings

A.1 Definitions

For the purposes of this annex, the following definitions apply.

A.1.1 basic profile: Joint profile to which tolerances are referred for male part and nut threads. (See figure A.1.)

A.1.2 pitch, P: Axial lead per turn of the screw thread. The nominal value adopted for the pitch is 8 threads per inch (or 8 threads per 25,4 mm).

P = 3,175 mm

A.1.3 major diameter: Diameter over crests of the male part thread and over roots of the nut thread. (See figure A.1).

A.1.4 pitch diameter: See figure A.1.

A.1.5 minor diameter: See figure A.1.

A.1.6 GO side profile: Profile forming the limiting thread profile of the "GO" side. See figure A.2.

A.2 Determination of thread limiting dimensions

A.2.1 Thread diameters

The limiting dimensions of thread diameters of male parts and nuts have been determined from the limits, in millimetres, and expressions given in tables A.1 and A.2 respectively.

A.2.2 Root width of threads (w, W) on GO side profile

The root widths of threads on the GO side profile of male parts and nuts have been determined from the expressions given in A.2.2.1 and A.2.2.2 respectively.

A.2.2.1 Male parts

$$w = 0{,}370\ 7P - 0{,}127 + 0{,}008\ 064\sqrt{d}$$

A.2.2.2 Nuts

$$W = 0{,}370\ 7P - 0{,}135$$

A.3 Thread dimensions

A.3.1 Male part

The thread dimensions, in millimetres, of the male part are given in figure A.3 and table A.3.

A.3.2 Nut

The thread dimensions, in millimetres, of the nut are given in figure A.4 and table A.4.

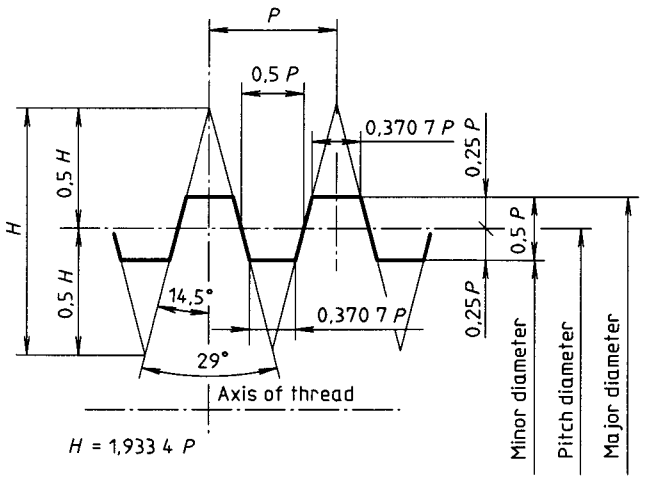
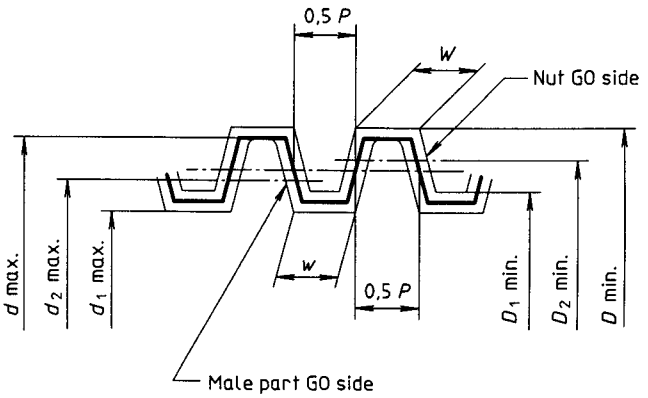


Figure A.1



The thick line indicates the basic profile.

Figure A.2

Table A.1 — Male parts

Major diameter d		Pitch diameter $d_2 = d - 0{,}5P$		Minor diameter $d_1 = d - P$	
GO side limit	**Lower limit**	**GO side limit**	**Lower limit**	**GO side limit**	**Lower limit**
0	$-0{,}05\,P$	$-A$	$-(A+T)$	$-0{,}508$	$-(0{,}508+1{,}5T)$
Tolerances T : $T = 0{,}070\,56\sqrt{P} + 0{,}014\,11\sqrt{d}$		Allowances A : $A = 0{,}030\,24\sqrt{d}$			

Table A.2 — Nuts

Major diameter $D(=d)$		Pitch diameter $D_2 = D - 0{,}5P$		Minor diameter $D_1 = D - P$	
GO side limit	**Upper limit**	**GO side limit**	**Upper limit**	**GO side limit**	**Upper limit**
+ 0,889	+ 1,397	+ 0,368	+ (0,368 + T)	+ 0,381	+ (0,381 + 0,05P)
Tolerances T : $T = 0{,}070\,56\sqrt{P} + 0{,}014\,11\sqrt{d}$		Allowances A : $A = 0{,}030\,24\sqrt{d}$			

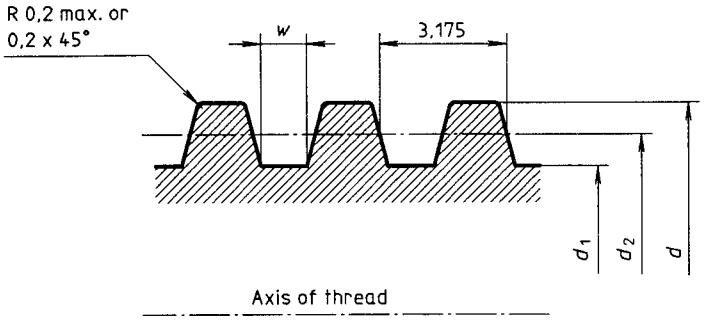


Figure A.3

Table A.3

Nominal size	d		d_2		d_1		w
	max.	min.	max.	min.	max.	min.	
12	22,89	22,73	21,16	20,96	19,21	18,92	1,089
12,7	22,89	22,73	21,16	20,96	19,21	18,92	1,089
17,2	29,26	29,10	27,51	27,31	25,58	25,27	1,094
21,3	33,53	33,37	31,77	31,56	29,85	29,54	1,097
25	37,13	36,97	35,36	35,15	33,45	33,13	1,097
33,7	45,97	45,81	44,18	43,96	42,29	41,95	1,105
38	50,65	50,49	48,85	48,62	46,97	46,63	1,107
40	52,68	52,52	50,87	50,64	49,00	48,65	1,109
51	64,16	64,00	62,33	62,09	60,48	60,12	1,115
63,5	77,67	77,51	75,82	75,57	73,99	73,61	1,121
70	84,58	84,42	82,71	82,45	80,90	80,51	1,124
76,1	91,19	91,03	89,31	89,05	87,51	87,12	1,127
88,9	104,70	104,54	102,80	102,53	101,02	100,61	1,132
101,6	118,21	118,06	116,29	116,01	114,53	114,11	1,138

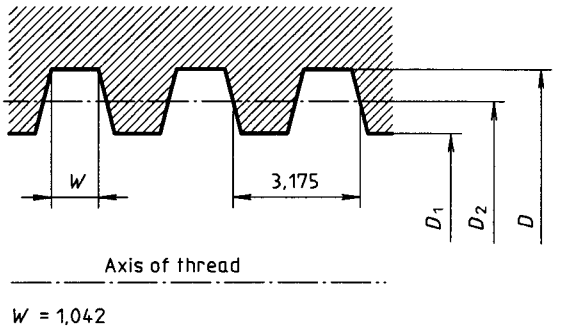


Figure A.4

Table A.4

Nominal size	D		D_2		D_1	
	max.	min.	max.	min.	max.	min.
12	24,28	23,78	21,86	21,67	20,25	20,10
12,7	24,28	23,78	21,86	21,67	20,25	20,10
17,2	30,66	30,15	28,24	28,04	26,62	26,47
21,3	34,93	34,42	32,52	32,31	30,89	30,74
25	38,53	38,02	36,12	35,91	34,49	34,34
33,7	47,37	46,86	44,97	44,75	43,33	43,18
38	52,05	51,54	49,66	49,43	48,01	47,86
40	54,08	53,57	51,69	51,46	50,04	49,89
51	65,56	65,05	63,18	62,94	61,52	61,37
63,5	79,07	78,56	76,70	76,45	75,03	74,88
70	85,98	85,47	83,62	83,36	81,94	81,79
76,1	92,59	92,08	90,23	89,97	88,55	88,40
88,9	106,10	105,59	103,75	103,48	102,06	101,91
101,6	119,61	119,10	117,27	116,99	115,57	115,42

Annex B
(normative)

Cross-section of threaded coupling assembly

B.1 Scope

This annex illustrates the assembling of welded- and expanded-type couplings.

B.2 Expanded-type couplings

See figure B.1.

B.3 Welded-type couplings

See figure B.2.

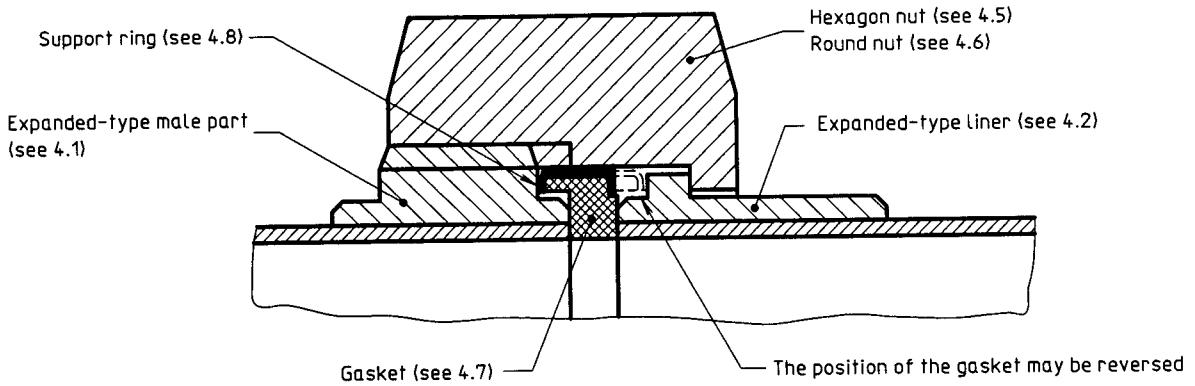


Figure B.1 — Expanded-type coupling

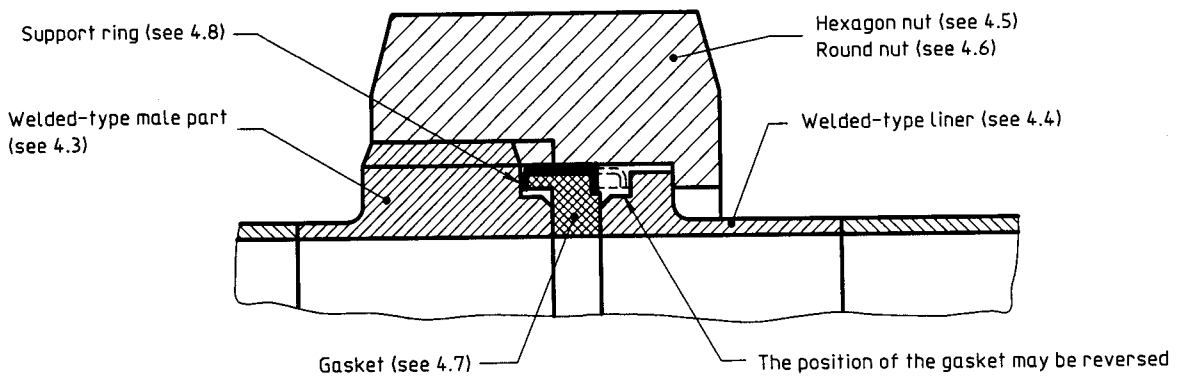


Figure B.2 — Welded-type coupling

Annex C
(normative)

Specifications of the gasket

Various designs of gasket may be used for specific purposes. The following list gives the basic requirements that the gasket shall satisfy.

a) The gasket shall be easy to place on and remove from the coupling part.

b) It shall not be possible to fit the gasket in an incorrect position.

c) The gasket shall permit sideways movement of the liner and the male part, to enable assembly to be carried out.

d) Irrespective of pressure or vacuum in the pipe, the gasket shall be held on by the tightened coupling.

e) The gasket shall have a minimum of surface in contact with the liquid.

f) When tightening the coupling, the part of the gasket closest to the pipe shall be tightened first.

g) Materials shall be chosen in accordance with 8.2.

h) It is desirable that the gasket should not be easily displaced when the coupling is undone.

Annex D
(normative)

Grooving for expanded-type male parts and liners

D.1 Scope

This annex is applicable to nominal sizes 25 mm up to and including 76,1 mm. The use of the lock ring is optional for expanded-type male parts and liners.

D.2 Design

Expanded-type male parts and liners shall be provided internally with some form of grooving to give adequate strength to the joint between male part or liner and pipe end. Figures D.1 and D.2 show the positioning of the grooves.

D.3 Dimensions

The dimensions, in millimetres, and the tolerance classes (see ISO 286-2) are given in figures D.1 and D.2 and table D.1.

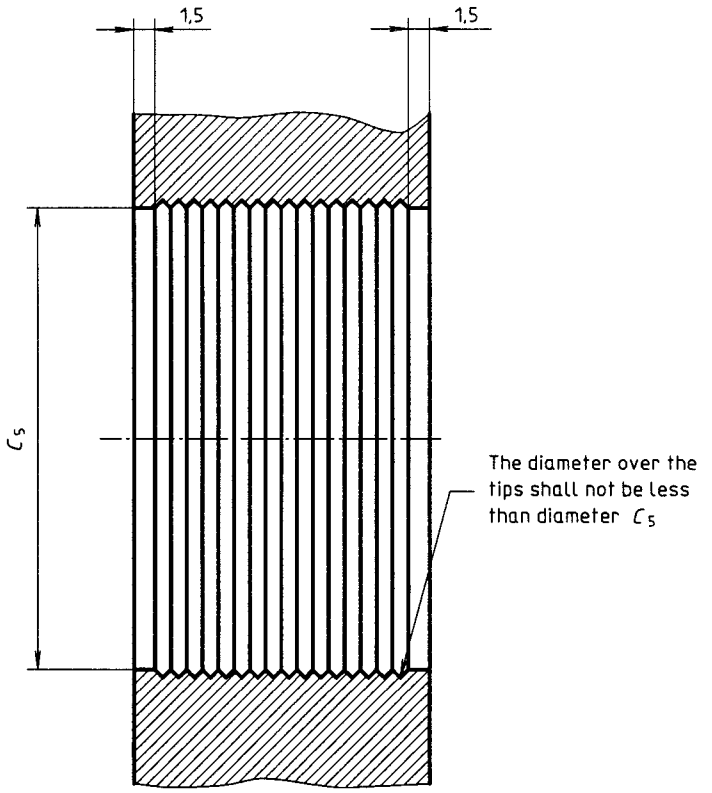


Figure D.1 — Grooving for expanded-type male parts and liners without lock ring

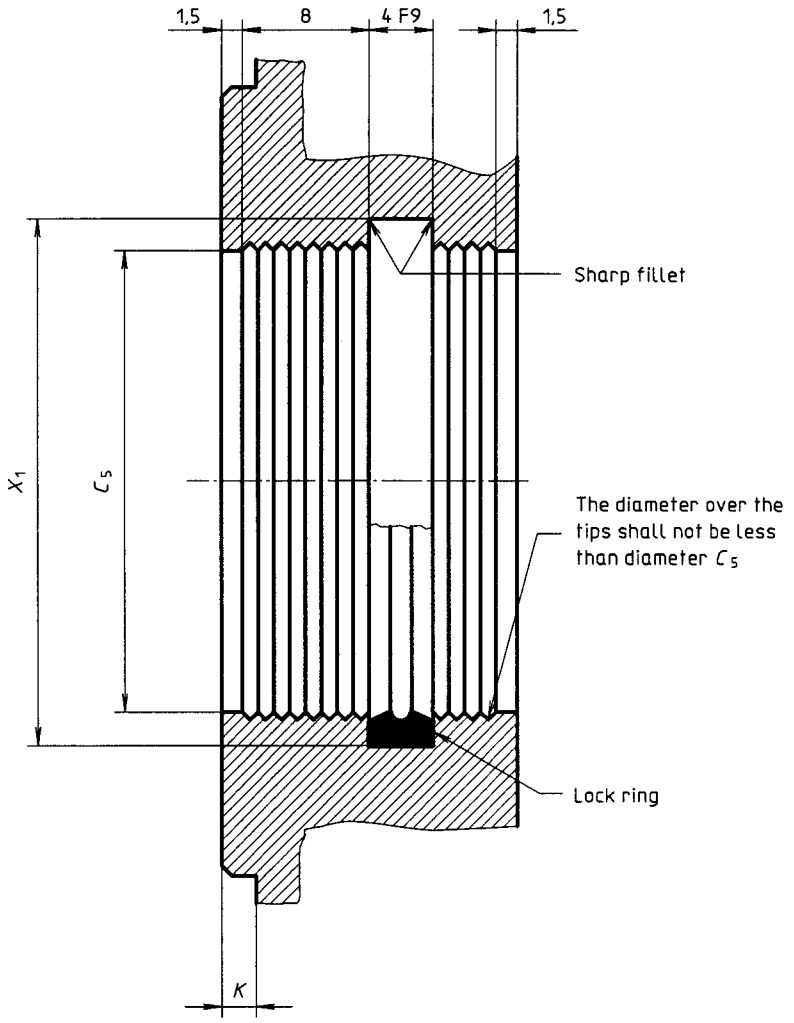


Figure D.2 — Grooving for expanded-type male parts and liners with lock ring

Table D.1

Nominal size	Lock ring groove diameter X_1 N12
25	27,25
33,7	35,95
38	40,25
40	42,25
51	53,25
63,5	65,65
70	72,15
76,1	78,25

Annex E
(normative)

Lock rings for expanded-type male parts and liners

E.1 Scope

This annex is applicable to lock rings for expanded-type male parts and liners.

E.2 Conditions of use

The use of a lock ring is particularly recommended in special cases (for instance under conditions of high pressure, high temperatures, or large thermal expansion with long lengths of piping), for nominal sizes 25 mm up to and including 76,1 mm. The lock ring gives extra safety in the case of poor expansion.

E.3 Dimensions

The dimensions, in millimetres, and the tolerance classes (see ISO 286-2) are given in figure E.1 and table E.1.

E.4 Material

A steel having a hardness given in table E.2 shall be used.

Table E.1

Nominal size	Lock ring outside diameter X_2
25	27,25
33,7	35,95
38	40,25
40	42,25
51	53,25
63,5	65,65
70	72,15
76,1	78,25

Table E.2

Hardness		Reference standard
Symbol	Value	
HV	450 to 480	ISO 6507-1
HB	425 to 450	ISO 6506
HRC	45,5 to 48	ISO 6508

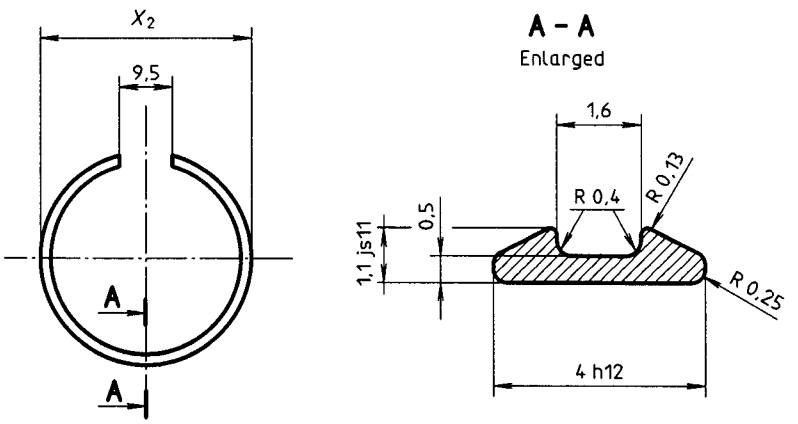


Figure E.1

Annex F
(informative)

Method of expansion with straight pipe

F.1 Scope

This annex specifies a method of expansion for assembling expanded-type male parts and liners of nominal sizes 12 mm up to and including 101,6 mm on straight tubes of the dimensions given in ISO 2037.

F.2 Tools

The tools shown in figures F.1, F.2 and F.3 are suitable for male parts and liners with or without lock ring. The set of tools consists of the following:

a base plate (see figure F.1)

b clamp block (see figure F.1)

c split cutting ring (see figure F.1)

d assembly punch (see figure F.1)

e flange locating ring (see figure F.2)

f expander (see figure F.2)

g facing cutter holder (see figure F.3)

h facing cutter (see figure F.3)

i facing ring (see figure F.3)

j centring pilot (see figure F.3)

The following tools are also required: torque wrench and sockets, levers, hacksaw, spanners for clamp block nuts, file, mallet.

F.3 Procedure

F.3.1 Preparation

Fasten the base plate **a** to the bench. Put a clamp block **b** of the required size on to the base plate with the location for the split cutting ring towards the front (see figure F.1). If long lengths of tubes are to be used, an additional support is required to keep the tube level.

F.3.2 Cutting the tube

When assembling a male part and liner on a tube, the length required is the distance between the mating surfaces of the male part and liner less 8 mm, i.e. twice the compression thickness of the gasket.

F.3.2.1 Mark the tube to the length required. Push the tube through the centre hole of the clamp block. Fit the split cutting ring **c** in the clamp block. Place the cutting mark on the tube in line with the face of the cutting ring. Tighten the clamp block (see figure F.1).

NOTE 1 The end of polished tube tends to be tapered. Cut off the tapered portion before marking off the length of the tube.

F.3.2.2 Cut the tube with a hacksaw. File the tube end square against the split cutting ring.

F.3.3 Expansion

F.3.3.1 Release the clamp block, push the tube forward and re-clamp. Place the liner or male part on the end of the tube, the flange facing outwards, and use the assembly punch **d** to drive the male part or liner onto the tube (see figure F.1).

F.3.3.2 Release the clamp block and remove the split cutting ring. Position the male part or liner in the location for the male part or for the liner in the clamp block and re-clamp (see figure F.2).

F.3.3.3 Place the flange locating ring **e** over the male part or liner and insert the expander **f** through the ring into the tube (see figure F.2).

NOTE 2 The expander rollers should be slightly oiled.

F.3.3.4 Set the torque wrench in accordance with the manufacturer's instructions. Apply the wrench and rotate the expander in a clockwise direction until the wrench releases.

F.3.3.5 Release the expander by an anti-clockwise rotation.

F.3.3.6 Use the levers to remove the expander and the flange locating ring.

F.3.4 Facing off

F.3.4.1 To face-off the expanded tube, fit the correct size facing cutter **h** and centring pilot **j** to the facing cutter holder **g**. Put the facing ring **i** over the flange of the male part or liner, then insert the pilot of the facing tool into the tube about 10 mm beyond its end. Lock the pilot tight in the core of the tube, bring up the cutter, and adjust the spring pressure to keep the cutter against the edge of the tube. Rotate the cutter and remove the surplus metal. If, for any reason, the cutter is out of square, the facing ring will correct this.

F.3.4.2 Release the centring pilot and withdraw the cutter, holder and attachment as one unit, and remove the facing ring.

F.3.4.3 Release the clamp block and remove the tube-liner assembly.

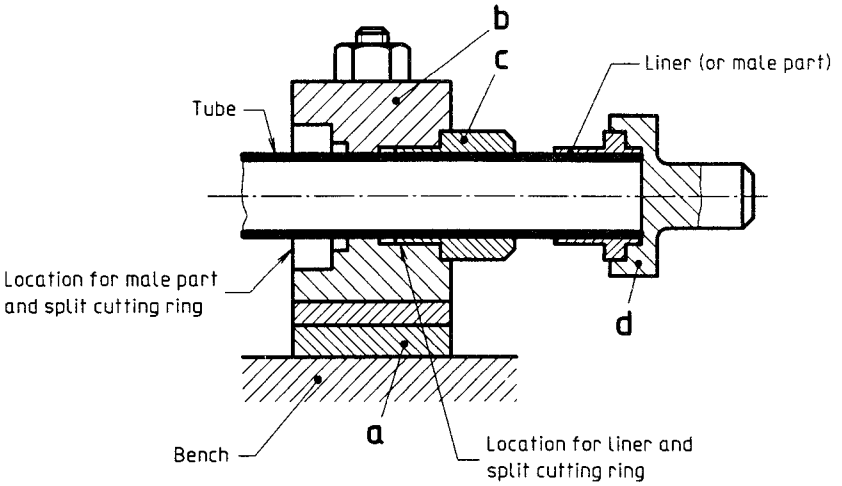


Figure F.1

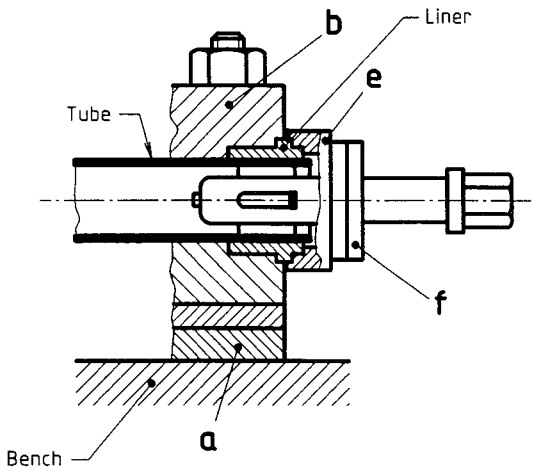


Figure F.2

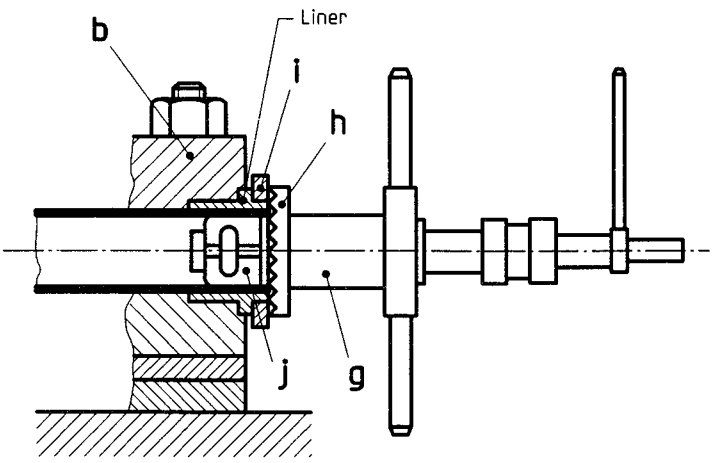


Figure F.3

Annex G
(informative)

Bibliography

[1] ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*

UDC 621.643.066-034.14

Descriptors: food industry, stainless steels, steel products, steel tubes, pipe fittings, couplings, specifications, dimensions.

Price based on 23 pages