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French standard

NF EN 10253-1
December 1999

Classification index: **A 49-170-1**

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Butt-welding pipe fittings

Part 1: Wrought carbon steel for general use and without specific inspection requirements

F : Raccords à souder bout à bout — Partie 1 : Acier au carbone pour usages généraux et sans contrôle spécifique
D : Formstücke zum Einschweißen — Teil 1: Unlegierter Stahl für allgemeine Anwendungen und ohne besondere Prüfanforderungen

French standard approved

by decision of the Director General of AFNOR on November 20, 1999 taking effect on December 20, 1999.

Replaces the approved standard NF A 49-186 dated August 1987.

Correspondence

The European standard EN 10253-1:1999 has the status of French standard.

Analysis

This document defines butt-welding pipe fittings (elbows — reducers — T-fittings — convex bottoms — caps) made up of carbon steel delivered without specific examination.

These pipe fittings can not be considered as meeting the essential requirements of the Directive Equipment under Pressure (Directive 97/23 dated 29/05/1997).

Descriptors

Technical International Thesaurus: connections for welding, steels, information, manufacturing, chemical composition, grades: quality, dimensions, dimensional tolerances, appearance, tests, inspection, marking.

Modifications

With respect to document replaced, complete revision of the document.

Corrections

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National foreword

References to French standards

The correspondence between the standards figuring in the clause "Normative references" and the identical French standards is as follows:

EN 287-1	*: NF EN 287-1 (classification index: A 88-110-1)*
EN 288-1	*: NF EN 288-1 (classification index: A 89-010-1)*
EN 10002-1	*: NF EN 10002-1 (classification index: A 03-001)*
EN 10003-1	*: NF EN 10003-1 (classification index: A 03-031)*
EN 10020	*: NF EN 10020 (classification index: A 02-025)*
EN 10021	*: NF EN 10021 (classification index: A 00-100)*
EN 10052	*: NF EN 10052 (classification index: A 02-010)*
EN 10079	*: NF EN 10079 (classification index: A 40-001)*
EN 10204	*: NF EN 10204 (classification index: A 00-001)*
EN 10246-7	*: NF EN 10246-7 (classification index: A 49-875-7)*
prEN 10246-8	*: NF EN 10246-8 (classification index: A 49-875-8)*
EN ISO 6708	*: NF EN ISO 6708 (classification index: E 29-001)*
ISO 3166	*: NF EN ISO 3166 (classification index: Z 44-000)*

1) Currently being prepared.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10253-1

September 1999

ICS 23.040.40

English version

Butt-welding pipe fittings - Part 1: Wrought carbon steel for general use and without specific inspection requirements

Raccords à souder bout à bout - Partie 1: Acier au carbone pour usages généraux et sans contrôle spécifique

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This European Standard was approved by CEN on 2 July 1999.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 29 "Steel tubes and fittings for steel tubes", the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

In writing the European Standard EN 10253, the competent committee recognized that there are two broad types of products commonly used and decided to reflect these in the standard by the differentiation between two parts.

Firstly the committee recognized the need to provide a basic type in which the minimum wall thickness of the fitting is guaranteed without formal reference to the pressure resistance. This type is considered in Part 1 ; it consists of fittings which are not intended to be used in applications covered by the European Pressure Equipment Directive.

Secondly the equipment standards under the Pressure Equipment Directive will impose that the fitting has a defined resistance to internal pressure. This approach imposes enhanced requirements that are considered in Part 2.

Part 1 : fittings are not designed to fulfil specific design requirements in regard of pressure resistance and are only defined by their chemical composition, mechanical characteristics and dimensions (outside diameter, wall thickness, radius …).

Part 2 : fittings are designed to fulfil specific design requirements.

It is the ultimate responsibility of the user to select the appropriate part for the intended application.

NOTE This European Standard intends to reflect the needs of various national markets ; consequently it offers in a normative annex an alternative solution for an associated combination of steel grade and dimensions (see clause 1).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

1.1 Scope

This European Standard specifies requirements for steel butt-welding fittings (elbows and return bends, concentric and eccentric reducers, equal and reducing tees, dished ends and caps) made of wrought carbon steel and delivered without specific inspection.

The fittings described in this European Standard do not fulfil specific design requirements ; consequently they cannot be considered as conforming to the Essential Requirements of the Pressure Equipment Directive (Directive 97/23/EC of 29.05.1997).

It specifies :

— the steel grade and its chemical composition ;

— the mechanical characteristics ;

— the dimensions and tolerances ;

— the technical conditions for inspection and testing ;

— the marking, packaging and inspection documents.

When steel grade S265 is specified in 4.1.2, the normative annex A applies and takes preference over conflicting requirements in the relevant areas of the main text.

Another part of this European Standard (describing fittings intented to fulfil the Essential Requirements of the PED) is :

— Butt-welding pipe fittings - Part 2 : Wrought carbon and ferritic alloy steels with specific inspection requirements.

1.2 Limitation of use

The allowed pressures and temperatures are the responsibility of the customer according to the state of the art and in application of the safety coefficients specified in the applicable regulations, codes or standards.

1.3 Technical delivery conditions

Unless otherwise specified in this European Standard the general technical delivery conditions specified in EN 10021 apply.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 287-1, *Approval testing of welders - Fusion welding - Part 1 : Steels.*

EN 288-1, *Specification and qualification of welding procedures for metallic materials - Part 1 : General rules for fusion welding.*

EN 10002-1, *Metallic materials - tensile testing - Part 1 : Method of test (at ambient temperature).*

EN 10003-1, *Metallic materials - Brinell hardness testing - Part 1 : Method of test.*

EN 10020, *Definitions and classification of grades of steel.*

EN 10021, *General technical delivery requirements for iron and steel.*

EN 10052, *Vocabulary of heat treatment terms for ferrous products.*

EN 10079, *Definition of steel products.*

EN 10204, *Metallic products - Types of inspection documents.*

EN ISO 6708, *Pipework components - Definition and selection of DN (nominal size*).

EN 10246-7, *Non destructive testing of steel tubes - Part 7 : Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of longitudinal imperfections.*

prEN 10246-8[1)], *Non destructive testing of steel tubes - Part 8 : Automatic ultrasonic testing of the weld seam of electric welded tubes for the detection of longitudinal imperfections*.

ISO 3166, *Codes for the representation of names of countries*.

3 Definitions and symbols

3.1 Definitions

For the purpose of this European Standard the definitions in EN 10020, EN 10021, EN 10052 and EN 10079 shall apply. In addition following definitions apply :

type
For elbows and return bends the type defines the bending radius of the piece. Possible types are :

— type 2D : R ≈ 1D ;

— type 3D : R ≈ 1,5D ;

— type 5D : R ≈ 2,5D.

welded fitting
Fitting made from a welded tube or fitting where welding is part of the fabrication of the fitting.

3.2 Symbols

DN Conventional dimension used in piping ; non measurable value (See EN ISO 6708)

D Specified outside diameter for elbows, return bends, equal tees and large diameter for reducers and reducing tees, in millimetres

D_1 Specified small outside diameter for reducers and reducing tees, in millimetres

T Specified wall thickness at the welding ends, in millimetres

T_1 Specified wall thickness at the welding end of the D_1 face of reducers and reducing tees, in millimetres

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1) In preparation. Until this document is published as a European Standard, the corresponding national standard should be agreed at the time of enquiry and order.

R Radius of elbows and return bends, in millimetres

C Centre to centre distance for return bends (C=2F), in millimetres

B Face to top distance for return bends, in millimetres

F Distance from the axis of the branch outlet to the face of the centre body of tees, in millimetres

G Distance from the axis of the centre line to the face of the branch outlet of reducingtees, in millimetres

h Height of the straight part of dished ends, in millimetres

H Face to centre distance for 45° elbows, in millimetres

K_1 Internal height for dished ends, in millimetres

K_2 Total height for caps, in millimetres

L Face to face distance for reducers, in millimetres

Q Tolerance on the form for fittings

R_m Tensile strength at room temperature, in Newton per square millimetre

R_{eH} Upper yield limit at room temperature, in Newton per square millimetre

A Percentage of elongation at rupture, with reference to a gauge length of $5{,}65\sqrt{S_0}$

HB Brinell hardness

4 Information to be supplied by the purchaser

4.1 Mandatory information

4.1.1 Designation of fittings

The fittings are designated by their name, reference to this European Standard and the following :

— elbows, return bends :

  — for elbows : The type (2D, 3D or 5D), the angle (45° or 90°), the outside diameter D and the wall thickness T ;

  — for return bends : The type (2D, 3D or 5D), the outside diameter D and the wall thickness T ;

— reducers :

  — the form (1 or 2), the large diameter D and the wall thickness T, the small diameter D_1 and the wall thickness T_1.

  — The form does not apply for eccentric reducers ;

— tees :

  — for equal tees : The outside diameter D and the wall thickness T ;

  — for reducing tees : The large diameter D and the wall thickness T, the small diameter D_1 and the wall thickness T_1 ;

— dished ends :

  — the outside diameter D and the wall thickness T ;

— caps :

  — the outside diameter D and the wall thickness T.

4.1.2 The enquiry and order shall include following information :

— quantity ;

— designation of fittings ;

— steel grade (see clause 6 and annex A) ;

— reference to this European Standard.

4.2 Options

A number of options are specified in this European Standard and these are listed below. In the event that the purchaser does not indicate his wish to implement any of these options at the time of enquiry and order, the supplier shall supply in accordance with the basic specification :

— type of tube as starting product (seamless or welded). See 5.2.1 ;

— definition of coating. See clause 11.

4.3 Examples

EXAMPLE 1 :

1000 elbows in accordance with this European Standard of type 3D with angle 90° and dimensions 60,3 X 2,9 made of steel grade S235.

1 000 elbows - EN 10253-1 - type 3D - 90° - 60,3 X 2,9 - S235.

EXAMPLE 2 :

50 elbows in accordance with this European Standard of type 3D with angle 90° and dimensions 273 X 9,5 made of steel grade S265.

50 elbows - EN 10253-1 - type 3D - 90° - 273 X 9,5 - S265.

EXAMPLE 3 :

2 000 concentric reducers in accordance with this European Standard of form 2 with dimensions 219,1 X 6,3 - 139,7 X 4,0 made of steel grade S235.

2 000 concentric reducers - EN 10253-1 - form 2 - 219,1 X 6,3 - 139,7 X 4,0 - S235.

5 Manufacturing process

5.1 Steelmaking process

The steelmaking process of the base material is at the discretion of the manufacturer. The steels shall be fully killed.

5.2 Fitting making-process and heat treatment

5.2.1 Fitting-making processes

The allowed processes and the relevant starting products are given in Table 1.

Table 1 — Fitting-making processes - Starting products [a]

Process for fittings	Hot Deformation		Cold Deformation		
	Bending	Stamping or Forming followed by machining [b]	Bending	Stamping [b]	Forming [b]
Elbows Return Bends	1-2	1-2-3	1-2	1-2-3	1-2-3
Reducers	-	1-2-3	-	1-2-3	1-2-3
Tees	-	1-2-3-4-5	-	1-2-3	1-2-3
Dished ends and caps	-	3-5	1-2-3	-	3

[a] Starting products.

1 Seamless Tube 2 Welded Tube 3 Plate 4 Forgings 5 Bars

[b] For these processes welding may additionally be used.

The process is at the discretion of the manufacturer.

Where tubes are used as starting material, the following conditions apply :

— the choice of the type of tubes (seamless or welded) is left at the discretion of the manufacturer ;

— helical submerged arc welded (SAW) tubes are not permitted ;

— for welded tubes, the full length of the weld seam shall be nondestructively tested in the tube condition in accordance with EN 10246-7 or prEN 10246-8, to acceptance level L4.

Option 1

The type of starting product shall be as defined in the order.

5.2.2 Fusion welding

In the case of the fusion welding process the weld seam shall include at least one external bead and one internal bead, as far as the internal face is accessible.

The welding process, the welders and/or the welding operators shall be qualified in accordance with EN 288-1 or EN 287-1.

Any weld made during the fitting-making process shall be tested in accordance with 9.4.6.

5.2.3 Heat treatment

Fittings produced by cold deformation shall be subsequently normalized.

Fittings produced by hot deformation may be delivered without heat treatment if hot deformation produces a technically equivalent metallurgical structure with the mechanical characteristics according to Table 3.

This condition is regarded as satisfied when the final forming operation is completed between 750 °C and 980 °C.

Dished ends produced by cold deformation need not be heat treated.

6 Metallurgical properties

6.1 Chemical composition

The cast analysis as reported by the steel manufacturer shall comply with the requirements given in Table 2.

Table 2 — Chemical composition

Steel grade	C max. %	Si max. %	Mn max. %	S max. %	P max. %
S235	0,16	0,35	1,2	0,025	0,030
NOTE 1 Elements not included in this table shall not be intentionally added to the steel without agreement of the purchaser, with the exception of elements used for deoxidation. However, residual elements may be tolerated provided that the mechanical properties and applicability of the product are not adversely affected. NOTE 2 See Annex A for details of alternative grade S265.					

6.2 Mechanical characteristics

The mechanical characteristics (at room temperature) shall comply with the requirements given in Table 3.

Table 3 — Mechanical characteristics

Steel Grade	R_{eH} min. N/mm²	R_m N/mm²	A min. %	HB max.
S235	235	360-500	25	170

The mechanical properties may be determined on the finished product or on the base material provided it is in the same heat treatment condition as the fitting it represents.

6.3 Weldability

Fittings covered by this European Standard are weldable. Moreover account should be taken of the fact that the behaviour of the steel during and after welding is dependant not only on the steel, but also essentially on the conditions of preparing and carrying out the welding and on the final use of the fitting.

7 Dimensions and tolerances

7.1 Dimensions

For reducers and tees it is not mandatory that the produced pieces correspond to the exact representation in the figures. Only the dimensions given in the relevant tables shall be respected.

7.1.1 Elbows and return bends

Elbows type 3D and type 5D shall be produced according to Figures 1 and 2, elbows type 2D according to Figure 2. Return bends shall be produced according to Figure 3. Dimensions shall be in accordance with Tables 4, 5 and 6.

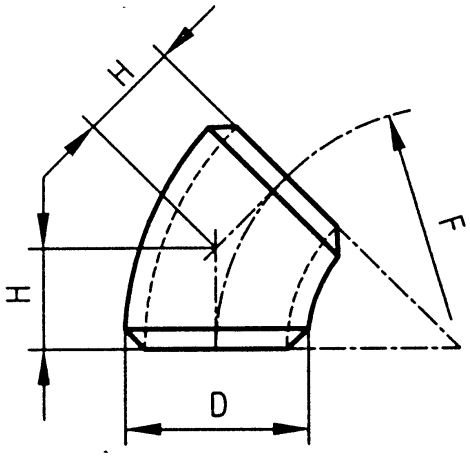

Figure 1 — 45° Elbow

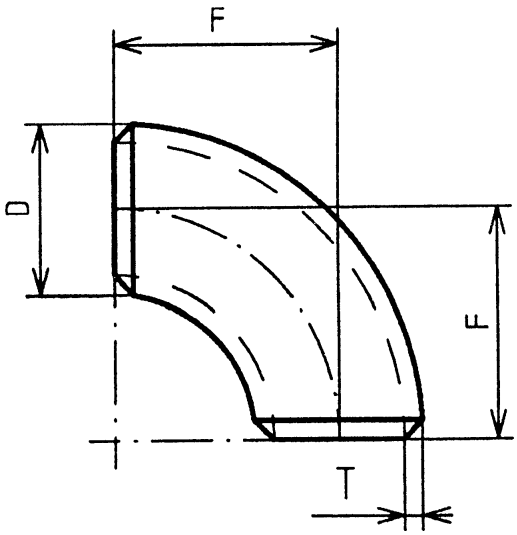

Figure 2 — 90° Elbow

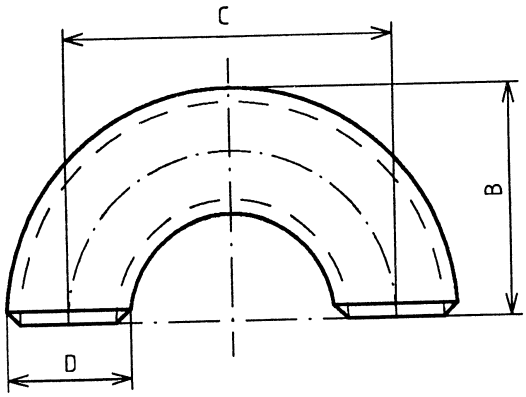

Figure 3 — Return bend

7.1.2 Reducers

Concentric reducers shall be produced according to Figures 4 and 5 (resp. form 1 and 2). Eccentric reducers shall be produced according to Figure 6. Dimensions shall be in accordance with Tables 7 and 8.

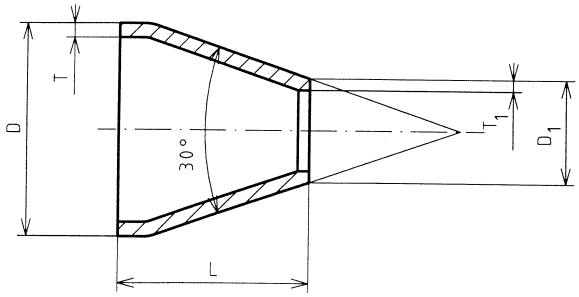

Figure 4 — Concentric reducer - Form 1

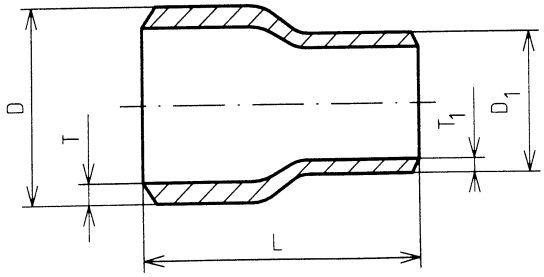

Figure 5 — Concentric reducer - Form 2

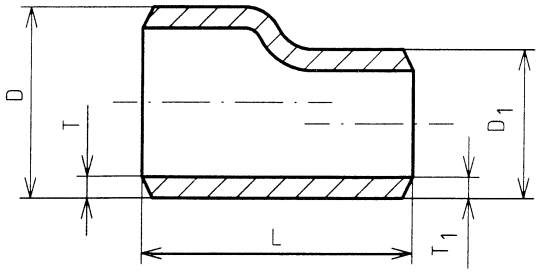

Figure 6 — Eccentric reducer

7.1.3 Equal tees

Equal tees shall be produced according to Figure 7. Dimensions shall be in accordance with Table 9.

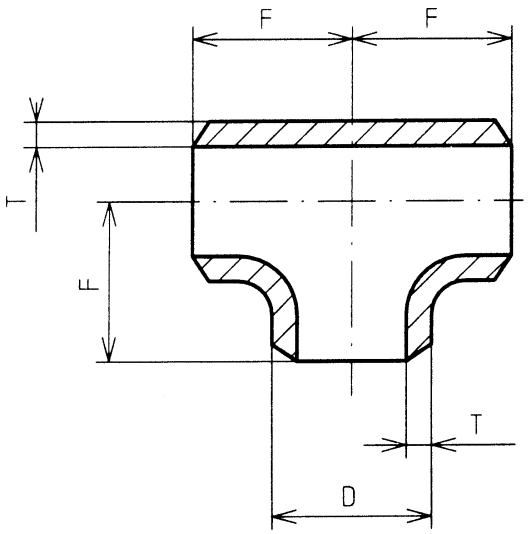

Figure 7 — Equal tee

7.1.4 Reducing tees

Reducing tees shall be produced according to Figure 8. Dimensions shall be in accordance with Table 10.

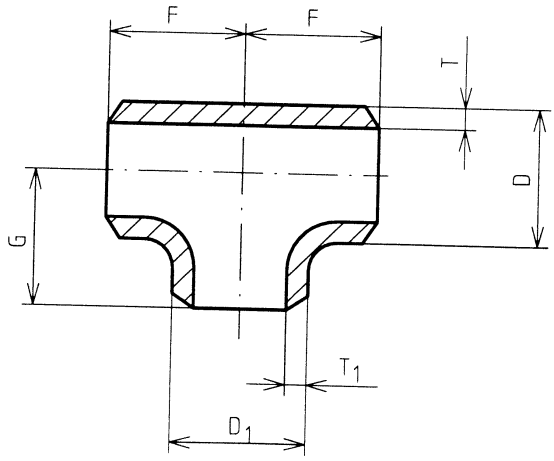

Figure 8 — Reducing tee

7.1.5 Dished ends

Dished ends shall be produced according to Figure 9. Dimensions shall be in accordance with Table 11. Furthermore, the following indications apply :

R : approximately equal to D ;

r : approximately equal to 0,1D.

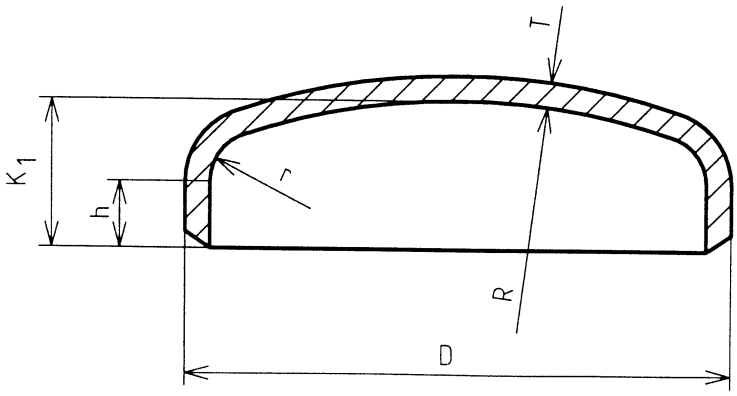

Figure 9 — Dished end

7.1.6 Caps

Caps shall be produced according to Figure 10. Dimensions shall be in accordance with Table 12. Furthermore, the following indications apply :

R : approximately equal to 0,8D ;

r : approximately equal to 0,15D.

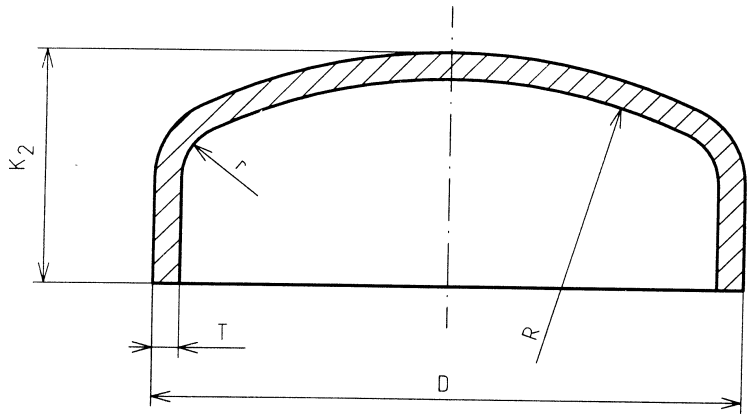

Figure 10 — Cap

Table 4 — Elbows type 2D - Dimensions in millimetres

DN	D	T	F	C	B
20	26,9	2,3	25	50	39
25	33,7	2,6	25	50	42
32	42,4	2,6	32	64	53
40	48,3	2,6	38	76	62
50	60,3	2,9	51	102	81
65	76,1	2,9	63	127	102
80	88,9	3,2	76	152	121
100	114,3	3,6	102	203	159
125	139,7	4,0	127	254	197
150	168,3	4,5	152	305	237
200	219,1	6,3	203	406	313
250	273,0	6,3	254	508	391
300	323,9	7,1	305	610	467
350	355,6	8,0	356	711	533
400	406,4	8,8	406	813	610

Table 5 — Elbows type 3D - Dimensions in millimetres

DN	D	T	H	F	C	B
15	21,3	2,0	12	29	56	38
20	26,9	2,3	12	29	57	43
25	33,7	2,6	16	38	76	56
	38,0	2,6	19	45	90	64
32	42,4	2,6	20	48	95	70
	44,5	2,6	22	51	102	73
40	48,3	2,6	24	57	114	83
	54,0	2,6	28	68,5	137	95
	57,0	2,9	29	72	144	100
50	60,3	2,9	35	76	152	106
	70,0	2,9	38	92	184	127
65	76,1	2,9	44	95	191	132
80	88,9	3,2	47	114	229	159
	101,6	3,6	55	133	267	184
	108,0	3,6	58	142,5	285	196
100	114,3	3,6	63	152	305	210
	133,0	4,0	75	181	362	247
125	139,7	4,0	79	190	381	262
	159,0	4,5	90	216	432	295
150	168,3	4,5	95	229	457	313
175	193,7	5,6	112	270	540	367
200	219,1	6,3	127	305	610	414
	244,5	6,3	141	340	680	462
250	273,0	6,3	159	381	762	518
300	323,9	7,1	190	457	914	619
350	355,6	8,0	222	533	1067	711
400	406,4	8,8	254	610	1219	813

Table 6 — Elbows 5D - Dimensions in millimetres

DN	D	T	H	F	C	B
15	21,3	2,0	18	42,5	85	53
20	26,9	2,3	24	57,5	115	71
25	33,7	2,6	30	72,5	145	89
	38,0	2,6	34	82,5	165	101
32	42,4	2,6	38	92,5	185	114
	44,5	2,6	40	97,5	195	120
40	48,3	2,6	45	107,5	215	132
	54,0	2,6	51	122,5	245	149
	57,0	2,9	53	130	260	158
50	60,3	2,9	56	135,0	270	165
	70,0	2,9	66	160	320	195
65	76,1	2,9	73	175	350	213
80	88,9	3,2	86	205,0	410	250
90	101,6	3,6	98	235	470	286
	108,0	3,6	105	253	506	306
100	114,3	3,6	112	270	540	327
	133,0	4,0	129	311,5	623	378
125	139,7	4,0	137	330	660	400
	159,0	4,5	155	375	750	454
150	168,3	4,5	162	390	780	474
200	219,1	6,3	211	510	1020	620
	244,5	6,3	240	580	1160	702
250	273,0	6,3	269	650	1300	786
300	323,9	7,1	321	775	1550	937
350	355,6	8,0	352	850	1700	1026
400	406,4	8,8	402	970	1940	1173

Table 7 — Reducers form 1 - Dimensions in millimetres

Side D			Side D_1			Length
DN	D	T	DN	D_1	T_1	L
25	33,7	2,6	20	26,9	2,3	35
32	42,4	2,6	20	26,9	2,3	51
			25	33,7	2,6	39
40	48,3	2,6	20	26,9	2,3	67
			25	33,7	2,6	55
			32	42,4	2,6	38
50	60,3	2,9	25	33,7	2,6	77
			32	42,4	2,6	61
			40	48,3	2,6	50
65	76,1	2,9	32	42,4	2,6	95
			40	48,3	2,6	84
			50	60,3	2,9	63
80	88,9	3,2	40	48,3	2,6	108
			50	60,3	2,9	86
			65	76,1	2,9	56
100	114,3	3,6	50	60,3	2,9	143
			60	76,1	2,9	114
			80	88,9	3,2	90
125	139,7	4,0	65	76,1	2,9	159
			80	88,9	3,2	135
			100	114,3	3,6	88
150	168,3	4,5	80	88,9	3,2	189
			100	114,3	3,6	141
			125	139,7	4,0	94
200	219,1	6,3	100	114,3	3,6	210
			125	139,7	4,0	170
			150	168,3	4,5	130
250	273,0	6,3	125	139,7	4,0	250
			150	168,3	4,5	220
			200	219,1	6,3	130
300	323,9	7,1	150	168,3	4,5	290
			200	219,1	6,3	215
			250	273,1	6,3	130
350	355,6	8,0	150	168,3	4,5	335
			200	219,1	6,3	255
			250	273,1	6,3	125
			300	323,9	7,1	100
400	406,4	8,8	200	219,1	6,3	330
			250	273,1	6,3	250
			300	323,9	7,1	175
			350	355,6	8	130

Table 8 — Reducers form 2 - Dimensions in millimetres

Side D			Side D_1			Length
DN	D	T	DN	D_1	T_1	L
20	26,9	2,3	15	21,3	2,0	38
25	33,7	2,6	15	21,3	2,0	51
			20	26,9	2,3	51
32	42,4	2,6	15	21,3	2,0	51
			20	26,9	2,3	51
			25	33,7	2,6	51
40	48,3	2,6	20	26,9	2,3	64
			25	33,7	2,6	64
			32	42,4	2,6	64
50	60,3	2,9	25	33,7	2,6	76
			32	42,4	2,6	76
			40	48,3	2,6	76
65	76,1	2,9	32	42,4	2,6	89
			40	48,3	2,6	89
			50	60,3	2,9	89
80	88,9	3,2	40	48,3	2,6	89
			50	60,3	2,9	89
			65	76,1	2,9	89
100	114,3	3,6	50	60,3	2,9	102
			65	76,1	2,9	102
			80	88,9	3,2	102
125	139,7	4,0	65	76,1	2,9	127
			80	88,9	3,2	127
			100	114,3	3,6	127
150	168,3	4,5	80	88,9	3,2	140
			100	114,3	3,6	140
			125	139,7	4,0	140
200	219,1	6,3	100	114,3	3,6	152
			125	139,7	4,0	152
			150	168,3	4,5	152
250	273,0	6,3	125	139,7	4,0	178
			150	168,3	4,5	178
			200	219,1	6,3	178
300	323,9	7,1	150	168,3	4,5	203
			200	219,1	6,3	203
			250	273	6,3	203
350	355,6	8,0	200	219,1	6,3	330
			250	273	6,3	330
			300	323,9	7,1	330
400	406,4	8,8	250	273	6,3	356
			300	323,9	7,1	356
			350	355,6	8,0	356

Table 9 — Equal Tees - Dimensions in millimetres

DN	D	T	F
20	26,9	2,3	29
25	33,7	2,6	38
32	42,4	2,6	48
40	48,3	2,6	57
50	60,3	2,9	64
65	76,1	2,9	76
80	88,9	3,2	86
90	101,6	3,6	95
100	114,3	3,6	105
125	139,7	4,0	124
150	168,3	4,5	143
200	219,1	6,3	178
250	273,0	6,3	216
300	323,9	7,1	254
350	355,6	8,0	279
400	406,4	8,8	305

Table 10 — Reducing Tees - Dimensions in millimetres

Side D			Side D_1				
DN	D	T	DN	D_1	T_1	F	G
25	33,7	2,6	15	21,3	2,0		38
			20	26,9	2,3	38	38
			25	33,7	2,6		38
40	48,3	2,6	15	21,3	2,0	57	57
			20	26,9	2,3		57
			25	33,7	2,6		57
			32	42,4	2,6		57
50	60,3	2,9	20	26,9	2,3	64	44
			25	33,7	2,6		51
			32	42,4	2,6		57
			40	48,3	2,6		60
65	76,1	2,9	25	33,7	2,6	76	57
			32	42,4	2,6		64
			40	48,3	2,6		67
			50	60,3	2,9		70
80	88,9	3,2	25	33,7	2,6	86	67
			32	42,4	2,6		70
			40	48,4	2,6		73
			50	60,3	2,9		76
			65	76,1	2,9		83
100	114,3	3,6	40	48,3	2,6	105	86
			50	60,3	2,9		89
			65	76,1	2,9		95
			80	88,9	3,2		98
125	139,7	4,0	50	60,3	2,9	124	105
			65	76,1	2,9		108
			80	88,9	3,2		111
			100	114,3	3,6		117
150	168,3	4,5	50	60,3	2,9	143	117
			65	76,1	2,9		121
			80	88,9	3,2		124
			100	114,3	3,6		130
			125	139,7	4,0		137
200	219,1	6,3	80	88,9	3,2	178	152
			100	114,3	3,6		156
			125	139,7	4,0		162
			150	168,3	4,5		168
250	273,0	6,3	100	114,3	3,6	216	184
			125	139,7	4,0		191
			150	168,3	4,5		194
			200	219,1	6,3		203
300	323,9	7,1	150	168,3	4,5	254	219
			200	219,1	6,3		229
			250	273,1	6,3		241
350	355,6	8,0	150	168,3	4,5	279	238
			200	219,1	6,3		248
			250	273,1	6,3		257
			300	323,9	7,1		270
400	406,4	8,8	150	168,3	4,5	305	264
			200	219,1	6,3		273
			250	273,1	6,3		283
			300	323,9	7,1		295
			350	355,6	8,0		305

Table 11 — Dished ends - Dimensions in millimetres

D	T	h	K_1
33,7	2,6	4	11
38,0	2,6	4	11
42,4	2,6	4	11
44,5	2,6	4	11
48,3	2,6	4	11,5
54,0	2,6	4	12,5
57,0	2,9	4	13
60,3	2,9	6	16,5
70,0	2,9	6	17,5
76,1	2,9	6	18,5
88,9	3,2	8	23
101,6	3,6	8	24,5
108,0	3,6	8	25,5
114,3	3,6	8	26
133,0	4,0	10	32
139,7	4,0	12	35,5
159,0	4,5	15	43
168,3	4,5	15	44,5
193,7	5,6	20	56
219,1	6,3	30	68,5
244,5	6,3	30	75
273,0	6,3	40	90
323,9	7,1	40	99
355,6	8,0	40	106
406,4	8,8	50	125

Table 12 — Caps - Dimensions in millimetres

DN	D	T	K_2
20	26,9	2,3	25
25	33,7	2,6	25
32	42,4	2,6	25
40	48,3	2,6	38
50	60,3	2,9	38
65	76,1	2,9	38
80	88,9	3,2	51
90	101,6	4,0	64
100	114,3	3,6	64
125	139,7	4,5	76
150	168,3	4,5	89
200	219,1	6,3	102
250	273,0	6,3	127
300	323,9	7,1	152
350	355,6	8,0	165
400	406,4	8,8	178

7.2 Tolerances on dimensions

7.2.1 Diameter tolerances (D and D_1)

7.2.1.1 The relevant diameters shall be measured at the welding ends of the fittings. The tolerance is :

± 1 % or ± 0,5 mm, whichever is the greater

7.2.1.2 In order to ensure the flow-way area through the fitting is not excessively reduced, the internal diameter (not applicable to dished ends and caps) shall be greater than 80 % of the theoretical internal diameter (ID), as calculated by :

ID = D - 2T

7.2.1.3 Tolerances for ovality are :

at the welding ends : 2 % ;

on the body for elbows and return bends : 4 %.

The ovality (Ov) shall be calculated by :

Ov = 200 * (Dmax - Dmin) / (Dmax + Dmin) in %.

Where :

Dmax : maximum measured diameter in one section ;

Dmin : minimum measured diameter in the same section.

7.2.2 Wall thickness tolerances

Wall thickness tolerances shall comply with the requirements given in Table 13.

Table 13 — Wall thickness tolerances at the welding ends

D	T	Tolerance	
mm	mm	Minus	Plus
≤ 406,4	≤ 4	- 12,5 %	+ 20 %
	> 4		+ 15 %

The minus tolerance applies also for the body of the fitting.

7.2.3 Tolerances on specific dimensions

For the dimensions specific to fittings, the tolerances shall comply with the requirements given in Table 14.

Table 14 — Tolerances on specific dimensions in millimetres

D	F-G-H	B	C	K	L
≤ 114,3	± 2	± 7	± 7	± 4	± 2
114,3 < D ≤ 219,1	± 2	± 7	± 7	± 7	± 3
219,1 < D ≤ 406,4	± 3	± 7	± 10	± 7	± 5

7.2.4 Tolerances on the form of fittings

The tolerance on the form of each type of fitting (out-of-squareness, alignment) is :

Q = 1 % of the diameter D at the point measured or 1 mm, whichever is the greater.

See Figure 11.

7.3 End finishing

7.3.1 At the manufacturer's option, for specified wall thicknesses below 3 mm, the ends may be slightly chamfered. For wall thicknesses equal to or above 3 mm, the ends shall be bevelled with an angle of 30° - 0 + 5° with a face of 1,6 mm ± 0,8 mm. Where necessary the dimensions at the welding ends may be achieved by taper boring of the inside surface with an angle of 18° and/or of the outside surface with an angle of 30°, the angles being related to the axis of the fitting. See Figure 12.

Fitting ends shall be free from harmful burrs.

7.3.2 The ends of dished ends with diameter equal or above 159 mm shall be bevelled with an angle of 30° - 0 + 5° with a face of 1,6 mm ± 0,8 mm.

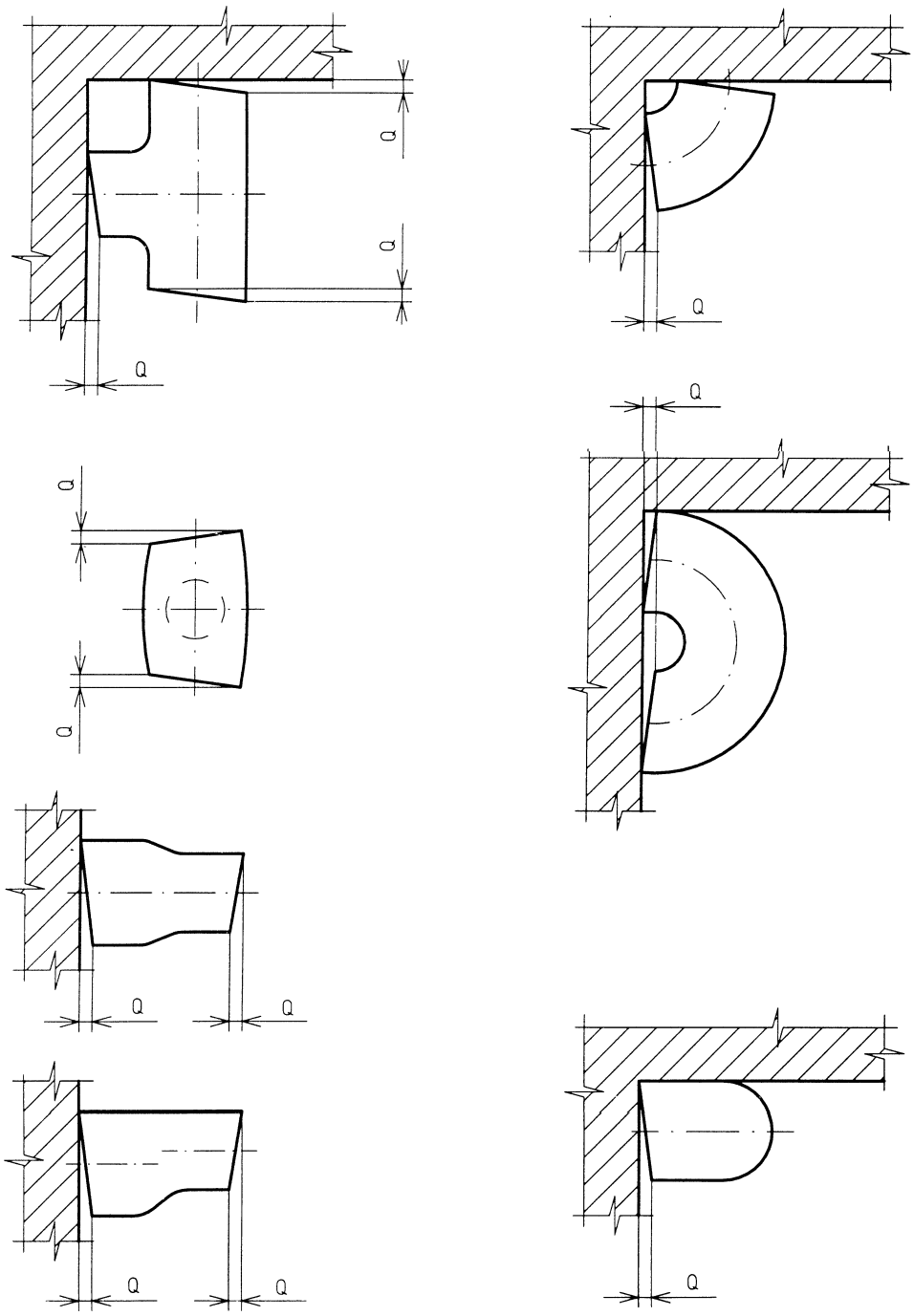

Figure 11 — Tolerance on the form of fittings

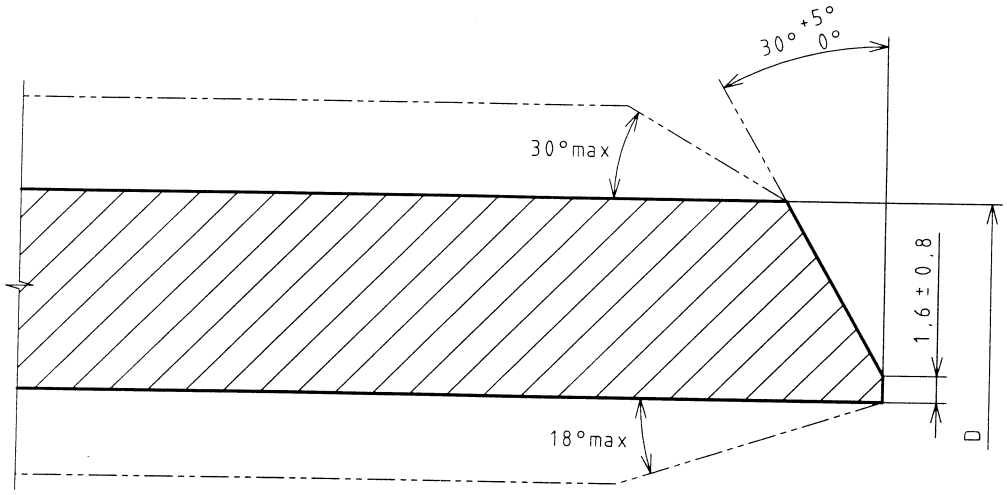

Figure 12 — End finishing

8 Appearance, imperfections and repair

8.1 Appearance

The fittings shall be visually inspected after final deformation and, where applicable, after heat treatment and without being protected with any coating.

The fittings shall have smooth external and internal surfaces, the degree of smoothness depending on the method of manufacture.

8.2 Imperfections

The fittings shall have a workmanlike finish but small imperfections are permissible, provided that the wall thickness remains within the tolerance limits.

Score marks (linear mechanical scratches caused by the deformation process) shall not have a depth greater than 1,6 mm or 12,5 % of the wall thickness, whichever is greater. The bottom of the marks shall be rounded and not sharp.

8.3 Repair

Surface imperfections may be dressed provided that the wall thickness after dressing remains within the tolerance limits.

After dressing, the outside diameter may locally fall below the specified minimum (see 7.2.1.1) provided the wall thickness remains within the tolerance limits.

Repair by hammering is not permitted. Repair by welding may be permitted by agreement on welds made with filler metal and according to a procedure agreed by the purchaser.

9 Inspection and testing

9.1 General

Fittings shall be delivered with non specific inspection (see EN 10021).

9.2 Inspection documents

9.2.1 Fittings shall be delivered with a test report 2.2 in accordance with EN 10204. The approval reference of the quality system shall be indicated on the inspection document.

9.3 Summary of inspection and testing

The type of inspections and tests to be performed is given in Table 15.

Table 15 — Inspection and tests

Inspection and testing	Paragraph in the standard	Number of tests
Chemical analysis	9.4.1	Base material
Tensile test (D > 114,3 mm)	9.4.2	R
Hardness test (D ≤ 114,3 mm)	9.4.3	R
Dimensional inspection	9.4.4	S
Visual examination	9.4.5	S
NDT of the weld when welding is part of the fitting manufacturing process	9.4.6	I
R : Statistical result representative of the manufacturing process ; S : Statistical inspection at the option of the manufacturer ; I : Individual. The representativity of the statistical results (indicated by R) shall be documented in a written procedure.		

9.4 Inspection and test methods

9.4.1 Chemical analysis

The chemical analysis of each cast shall be carried out by the steel manufacturer.

9.4.2 Tensile test at room temperature

The test shall be carried out according to EN 10002-1. The test piece shall be taken in the longitudinal direction and shall not be flattened.

The test may be carried out on a finished product, an intermediary piece or an overlength provided that the metallurgical condition corresponds to the delivery condition.

9.4.3 Hardness test

For fittings with D ≤ 114,3 mm a Brinell hardness test may be carried out in lieu of a tensile test. It shall be carried out in accordance with EN 10003-1 on the outside surface of the fittings or in accordance with any other suitable method where the results can be converted to Brinell hardness numbers.

9.4.4 Dimensional inspection

The actual method for measuring fittings includes calculation from theoretical values. A written procedure for this calculation and measurement shall be produced by the manufacturer and held in his quality system.

9.4.5 Visual examination

Fittings shall be visually examined under normal conditions with adapted lighting to detect imperfections on the inside and outside surfaces.

9.4.6 NDT of the weld

Where welding is part of the fitting manufacturing process, the weld shall be nondestructively tested for the detection of imperfections.

The NDT method is at the discretion of the manufacturer and shall be reported.

10 Marking

Each fitting shall be legibly marked. The marking shall include the information given in Table 16 as a minimum.

Table 16 — Marking

	Fitting diameter mm	
	≤ 88,9	> 88,9
Symbol for the country where deformation is carried out [a]	Yes	Yes
Manufacturer's mark	Yes	Yes
Steel grade	Yes	Yes
Letter W (for welded fittings)	Yes	Yes
Outside diameter D [b]	Yes	Yes
Reference to this European Standard [b]	No	Yes
For reducers and reducing tees the marking shall include D_1 and T_1		
[a] For the meaning of deformation, see Table 1. For symbols, see ISO 3166. [b] For fittings with D ≤ 88,9 mm, these markings may be reported on the packaging or the attached tag.		

Unless otherwise agreed, marking shall be carried out by die-stamping.

11 Protection and packaging

Fittings shall be delivered in the bare condition or coated, at the discretion of the manufacturer.

For D ≤ 60,3 mm, the fittings shall be delivered packaged.

Option 2

The coating shall be as defined in the order.

Annex A (normative)

Alternative specification for all types of fittings

As an alternative to certain requirements defined in this European Standard this annex specifies another steel grade and other dimensions D and T applicable to all types of fittings, with all possible reducing combinations being extrapolated in the same manner as the tables in the main text.

The steel grade defined in this annex shall exclusively be used in combination with the dimensions defined in this annex.

A.1 Steel grade

A.1.1 Chemical composition

The cast analysis as reported by the steel manufacturer shall comply with the requirements given in Table A.1.

Table A.1 — Chemical composition

Steel grade	C max. %	Si max. %	Mn max. %	S max. %	P max. %
S 265	0,20	0,40	1,40	0,025	0,030
NOTE Elements not included in this table shall not be intentionally added to the steel without agreement of the purchaser, with the exception of elements used for deoxidation. However, residual elements may be tolerated provided that the mechanical properties and applicability of the product are not adversely affected.					

A.1.2 Mechanical characteristics

The mechanical characteristics (at room temperature) shall comply with the requirements given in Table A.2.

Table A.2 — Guaranteed mechanical characteristics

Steel Grade	R_{eH} min. N/mm²	R_m N/mm²	A min. %	HB max.
S 265	265	410-570	21	180

A.2 Dimensions

The outside diameter and wall thickness to be specified are listed in Table A.3.

All other relevant dimensions and tolerances shall be in accordance with this European Standard.

In this case the marking shall include (under the conditions defined in clause 10) the wall thickness T.

Table A.3 — Outside diameter and wall thickness, in millimetres

DN	D	T
15	21,3	2,6 4,0
20	26,9	2,6 4,0
25	33,7	3,2 4,0
32	42,4	3,2 4,0
40	48,3	3,2 4,0
50	60,3	3,6 4,5
65	76,1	3,6 4,5
80	88,9	4,0 4,8
90	101,6	4,0 4,8
100	114,3	4,0 5,4
125	139,7	4,8 5,4
150	165,1	4,8 5,4
150	168,3	5,4 6,3 7,1
175	193,7	5,4 6,3 7,1
200	219,1	5,4 6,3 7,9
225	244,5	5,9 7,1
250	273,0	6,3 7,9 9,5
300	323,9	7,1 7,9 9,5
350	355,6	9,5 11,1
400	406,4	9,5 12,7

Annex B (informative)

A-deviation

A-deviation : National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.

This European Standard does not fall under any Directive of the EC.

In the relevant CEN/CENELEC countries, these A-deviations are valid instead of the provisions of this European Standard until they have been removed.

Sweden (Ordinance AFS 1994:39)

According to Chapter 3, Section 1, in the Ordinance AFS 1994:39, it is stated that the materials of a pressure-retaining device shall be such as to offer adequate safety.

In the comments on Section 1 above, it is stated that it is important that, in the case of steels, each steel grade is correctly specified with its specific properties and that it has a sufficient impact energy and is sufficiently ductile at the minimum working temperature.

As none of the two mentioned steel grades in EN 10253-1 has a specified impact energy, this draft European Standard is in conflict with the Ordinance AFS 1994:39.