

Welding — Basic weld joint details in steel —

Part 1: Pressurized components

The European Standard EN 1708-1:1999, with the incorporation of amendment A1:2003, has the status of a British Standard

ICS 25.160.40

National foreword

This British Standard is the official English language version of EN 1708-1:1999, including amendment A1:2003.

The UK participation in its preparation was entrusted to Technical Committee WEE/-/1, Briefing committee for welding, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 September 1999

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soudés en acier — Partie 1: Composants soumis à
la pression
(inclut l'amendement A1:2003)

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 121, Welding, the Secretariat of which is held by DS.

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of an identical text or by endorsement, at the latest by September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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.

This European Standard is composed of the two following parts:

- *Part 1: Pressurized components;*
- *Part 2: Non-internal pressurized components.*

Foreword to amendment A1:2003

This document EN 1708-1:1999/A1:2003 has been prepared by Technical Committee CEN/TC 121, Welding, the Secretariat of which is held by DS.

This Amendment to the European Standard EN 1708-1:1999 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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1 Scope

The purpose of this standard is to exemplify commonly accepted welded connections in pressure systems. It does not promote the standardization of connections that may be regarded as mandatory or restrict development in any way. Stress analysis rules are to be considered if necessary.

This standard contains examples of connections welded by:

- metal-arc welding with covered electrode (111);
- submerged arc welding with wire electrode (121);
- metal-arc inert gas welding: MIG-welding (131);
- metal-arc active gas welding: MAG-welding (135);
- flux-cored wire metal-arc welding with active gas shield (136);
- flux-cored wire metal-arc welding with inert gas shield (137);
- tungsten inert gas arc welding: TIG-welding (141)

processes (process numbers according to EN 24063) in steel pressure systems. Other processes by agreement.

The estimation of the suitability of welded connections for special service conditions, for example corrosion, creep, low temperature and fatigue are not specially considered.

2 Normative references

This European Standard incorporates by dated or undated reference, 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 revision 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 24063, *Welding, brazing, soldering and braze welding of metals — Nomenclature of processes and reference numbers for symbolic representation on drawings.*
(ISO 4063:1990)

EN 25817, *Arc-welded joints in steels — Guidance on quality levels for imperfections.*
(ISO 5817:1992)

EN 29692, *Metal-arc welding with covered electrode, gas shielded metal-arc welding and gas welding — Suggested joint preparations for steel.*
(ISO 9692:1992)

EN ISO 9692-2, *Welding and allied processes — Joint preparation — Part 2: Submerged arc welding of steel.*
(ISO 9692-2:1998)

3 Requirements

3.1 Selection of detail

Connections are not considered to be equally suitable for all service conditions, nor is the order in which they are shown indicative of their relative characteristics. In selecting the appropriate detail to use from the several alternatives shown for each type of connection, consideration shall be given to existing fabrication and service conditions that pertain.

3.2 Joint preparation (geometry and size)

3.2.1 General

The limitations quoted in weld profiles and sizes are based on commonly accepted practice, but they may be subjected to modifications if required by special welding techniques or design conditions, which should be included in the design documents and in the welding procedure specifications (WPS).

3.2.2 Joint preparation geometry

Examples of recommended joint preparation geometry (e.g. bevel angles, root radius, presence of backing strips, root faces) are referred to EN 29692 when applicable and to EN ISO 9692-2 relative to submerged arc welding process. Missing dimensions of preparations are in accordance with EN 29692.

In cases where full penetration butt joints are indicated, it is intended that they shall be back chipped or gouged and back welded, or alternatively that the welding procedure shall be such as to ensure sound, effective root penetration.

For relevant difference of thickness [generally a difference of about 3 mm (see Table 1, no. 1.1.1 to 1.1.6) could be considered relevant; in any case the thickness of material has to be taken into account, as well as the shape of the joint] of parts to be butt welded, the thickest element shall be shaped with a slope of 1:5 up to 1:2.

The smaller values are applicable in severe service conditions.

3.2.3 Weld sizes

The thickness of welds (in particular of fillet welds), which are not determined by their profile, are based on the assumption that the connection need not be stronger than the connected parts.

3.3 Presentation

The drawings of the nozzle and branch connections (see Table 2 and Table 3) show a transversal section of the connection (see Figure 1) and a longitudinal section of the connection (see Figure 2).

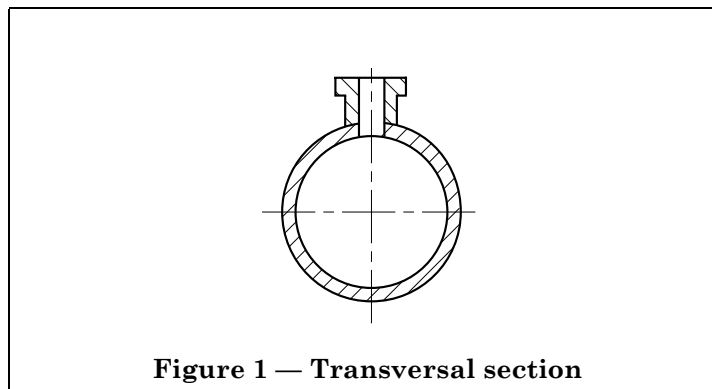


Figure 1 — Transversal section

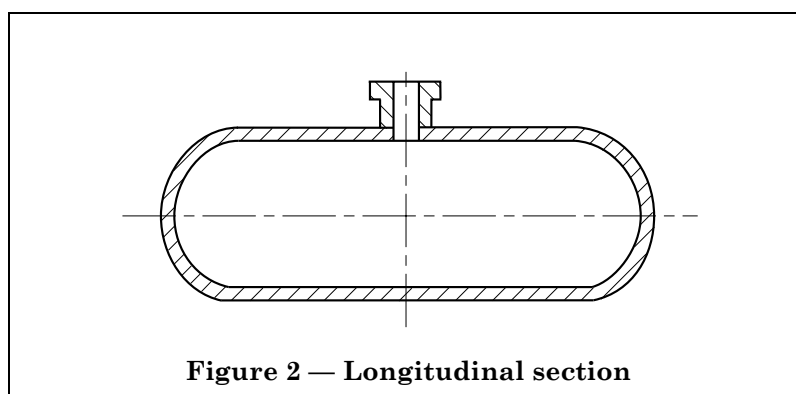


Figure 2 — Longitudinal section

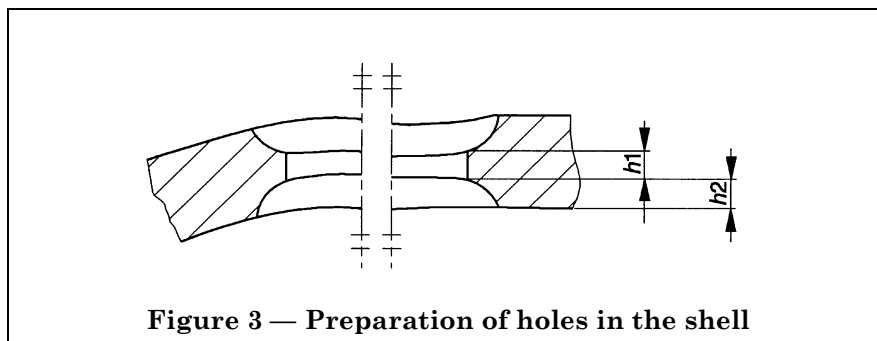
3.4 Removal of internal sharp edges in branch bores

It will be noted that the internal edges on the bores of branches are shown partially radiused (for example see Table 2, no. 2.1.6) because a stress concentration occurs at this point. This precaution (grinding away the sharp edge) is recommended when the branch connection is subjected to severe service conditions like fatigue, creep, and stress corrosion.

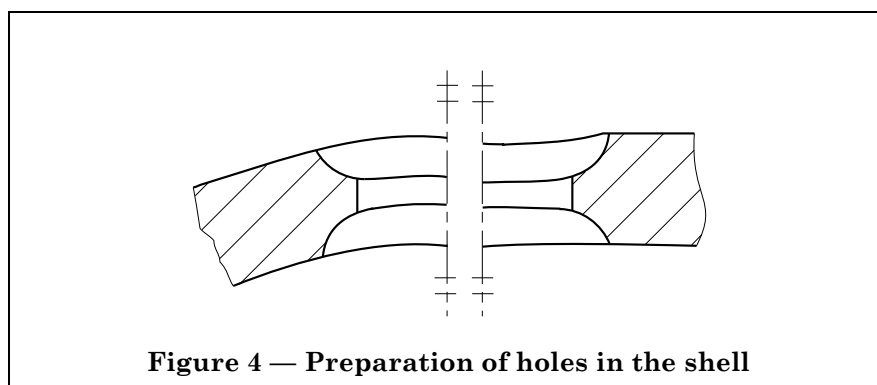
3.5 Preparation of holes in shell for set-in and set-through branches

In cases of set-in and set-through branches (according to Table 2, no. 2.2 and no. 2.3) holes in the shell may be cut and profiled in two ways as follows.

- The depth of the grooves h_1 and h_2 may be constant around the hole as shown in Figure 3.



- The roots of the joint preparations may be in one plane, as for example when they are machine drilled, in which case the depths of the grooves will vary around the hole as shown in Figure 4.



3.6 Welds for smooth transition

In some cases it is convenient to foresee a fillet weld providing smooth geometric transition from the surface of one welded part to the surface of the other, e.g. from branch to shell. Its purpose is to soften the notch effect in the branch-shell edge and therefore the throat thickness is not presented on the figure concerned.

3.7 Oblique and tangential branches

The welded connections are contained in Table 1 to Table 13. Regarding branches, the oblique and tangential ones are not specially considered as their preparation is similar to that reported in Table 2 and Table 3 for radial branches. Only some significant cases are therefore considered (see Table 2, no. 2.2).

NOTE 1 The welds are only blackened in the following tables when the figures do not give information about the dimension of the values for the preparation.

NOTE 2 It is not intended that the values of the dimension given in the tables should be measured precisely but rather the general philosophy should be applied.

Table 1 — Butt joints in plates of different thickness

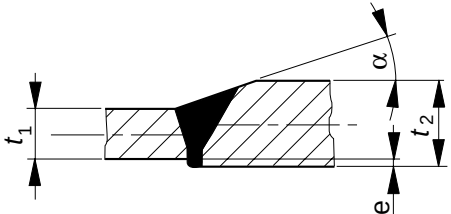
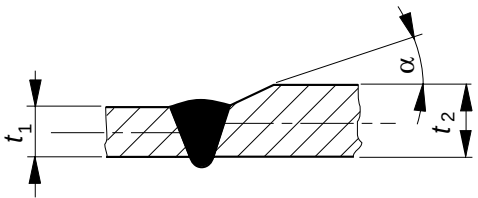
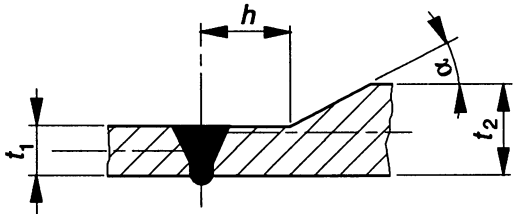
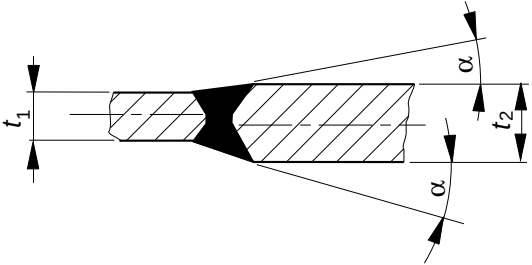
No.	Figure	Application/condition	Note	Reference to EN 29692 and EN ISO 9692-2
1.1 Butt joints in plates of different thickness				
1.1.1		$\alpha \leq 30^\circ$ $t_1 < t_2$	In case of severe service conditions the design shall be in accordance with Figure 1.1.2 and Figure 1.1.3. $e \leq 0,1t_1$ max. 2 mm (for one side welding)	1.5 and 2.5.9
1.1.2		$\alpha \leq 30^\circ$ $t_1 < t_2$		1.5, 2.5.9 and 2.3.3
1.1.3		$\alpha \leq 30^\circ$ $t_1 < t_2$	for ultrasonic test $h \geq 2t_1$, but min. 30 mm for radiographic test $h \geq t_1$	1.5, 2.5.9 and 2.3.3
1.1.4		$\alpha_1 \leq 30^\circ$	see 1.1.1	2.3.3

Table 1 — Butt joints in plates of different thickness (continued)

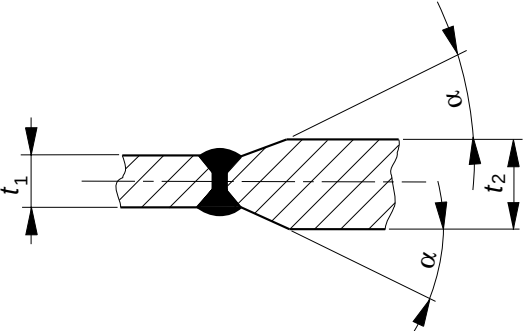
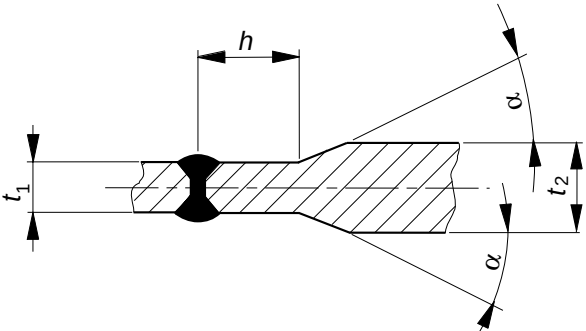
No.	Figure	Application/condition	Note	Reference to EN 29692 and EN ISO 9692-2
1.1.5		$\alpha \leq 30^\circ$		2.3.3
1.1.6		$\alpha \leq 30^\circ$	for ultrasonic test $h \geq 2t_1$, but min. 30 mm for radiographic test $h \geq t_1$	2.3.3

Table 2 — Branches without compensation rings

No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
These connections include the provision of compensation by thickening of the branch and/or shell.				
2.1 Set-on branches (for special branch connections see 13.2)				
2.1.1		$t_2 \leq 3t_1$		1.4 or 1.8 one side welding
2.1.2			These details are recommended only where the bore of the branch is readily accessible for welding. The joint should be back-gouged from the side most accessible and suitable for this purpose, generally from the outside.	2.4.4 or 2.8.8
2.1.3		$\alpha_1 = 30^\circ$ $\alpha_2 = 45^\circ$	see 2.1.2	

Table 2 — Branches without compensation rings (continued)

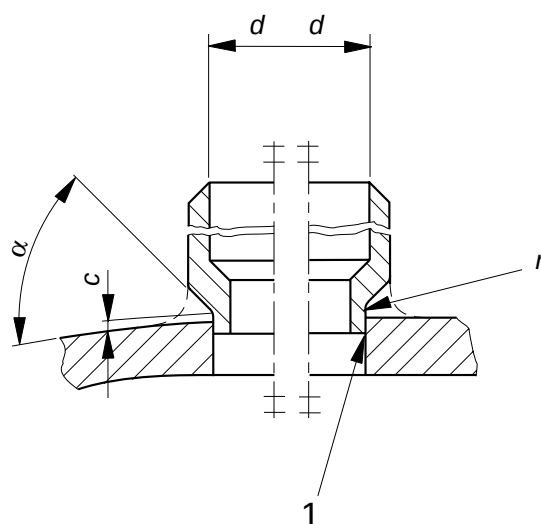
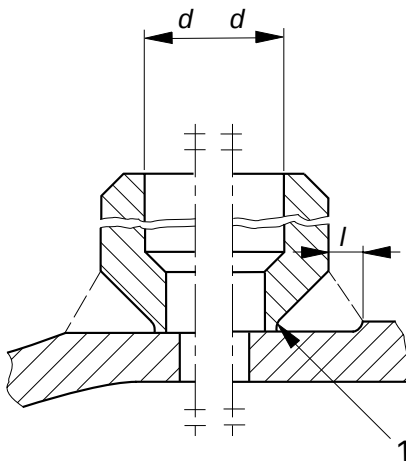
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.1.4		1) no gap $c \geq 1,5 \text{ mm}$ $r \geq 5 \text{ mm}$ $\alpha = 30^\circ$	— Joints generally used for small branch to shell diameter ratios. — Diameter d to be bored out after welding to remove the weld root, in order to ensure sound weld.	
2.1.5		$l = 10 \text{ mm to } 15 \text{ mm}$ 1) no gap	— Joints generally used for small branch to shell diameter ratios. — Diameter d to be bored out after welding to remove weld root, in order to ensure sound weld.	1.4 or 1.8 one side welding

Table 2 — Branches without compensation rings (continued)

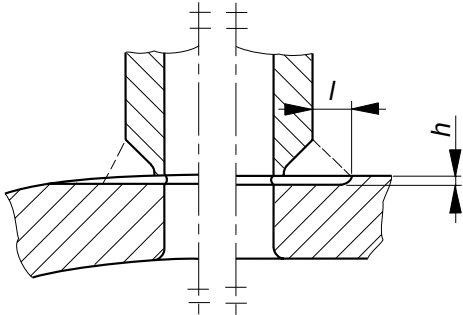
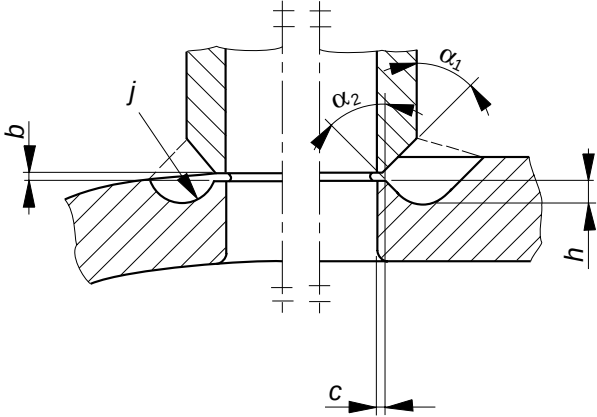
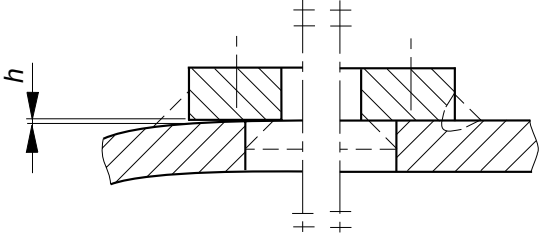
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.1.6		$l = 10 \text{ mm to } 15 \text{ mm}$ $h \geq 3 \text{ mm}$	Joints generally used for small branch to shell diameter ratios.	1.8 one side welding
2.1.7		For branches up to approximately 100 mm bore. $b = 1 \text{ mm to } 3 \text{ mm}$ $h \leq 5 \text{ mm}$ $c = 1 \text{ mm}$ $r = 7 \text{ mm}$ $\alpha_1 \leq 45^\circ$ $\alpha_2 \leq 45^\circ$	Generally used for the attachment of branches to thick-walled shells.	
2.1.8		$h \leq 3 \text{ mm}$	The sizes of the fillet welds should be based on the loads transmitted, paying due regard to other fabrication and service requirements.	

Table 2 — Branches without compensation rings (*continued*)

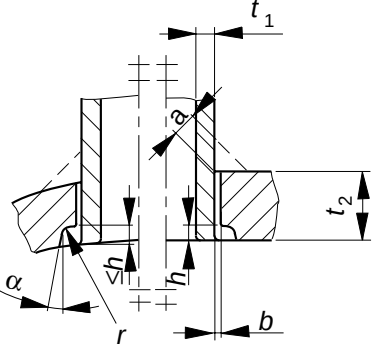
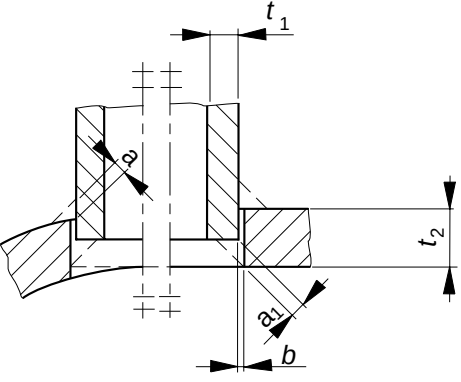
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.2 Set-in branches (for special branch connection see 13.2)				
As a general recommendation all set-in branches should be welded on the inside of the shell as shown, e.g. in Figure 2.2.1 and Figure 2.2.2, if they are accessible for the purpose, otherwise preference should be given to set-on branch connections as shown, e.g. in Figure 2.1.1.				
2.2.1		$\alpha = 0,5t_1$ $h = t_1$ $r \geq 8 \text{ mm}$ $b \leq 1 \text{ mm}$ $\alpha = 10^\circ \text{ to } 20^\circ$	For partial penetration welded connection. Generally used when t_1 is less than $t_2/2$. For small diameter branches attention is drawn to the details shown in Table 3, which may provide a preferable solution.	1.8 and 3.10 A
2.2.2		$\alpha = 0,5t_1$, but $\geq 3 \text{ mm}$ $\alpha_1 < 0,7t_1$ $b \leq 1 \text{ mm}$	For partial penetration welded connection. Limited application: — internal diameter of shell $\leq 200 \text{ mm}$; — wall thickness of branch $t_1 \leq 5 \text{ mm}$.	3.10 A and 3.10 B

Table 2 — Branches without compensation rings (continued)

No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.2.3		$a \geq 5 \text{ mm}$ $a_1 \leq 0,7t_1$ $b \leq 1 \text{ mm}$ $\alpha = 10^\circ \text{ to } 20^\circ$ $r \geq 8 \text{ mm}$	For partial penetration welded connection.	3.10 B and 1.8
2.2.4		$a = 0,5t_1$, but $\geq 3 \text{ mm}$ $a_1 \leq 0,7t_1$ $b \leq 1 \text{ mm}$	For full penetration welded connection.	3.10 B and 1.8

Table 2 — Branches without compensation rings (*continued*)

No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.2.5		$h_1 = 0,6t_1$ $h_2 = t_1$ $b \leq 1 \text{ mm}$ $r \geq 8 \text{ mm}$	For partial penetration welded connection.	2.8.8
2.2.6		$t_1 \geq 3 \text{ mm}$ $t_2 \leq 3t_1$ $\alpha = 40^\circ \text{ to } 60^\circ$	For full penetration welded connection.	1.4 and 1.8
2.2.7		$t_2 \leq 3t_1$	For full penetration welded connection.	2.4.4 and 2.8.8

Table 2 — Branches without compensation rings (continued)

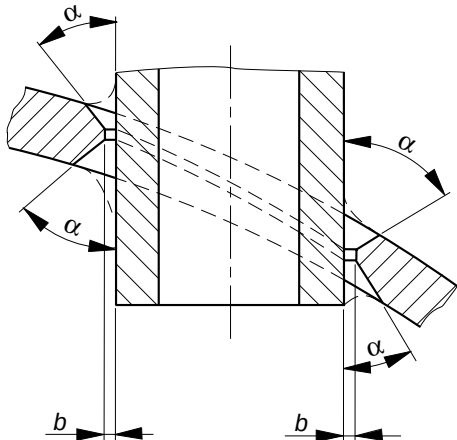
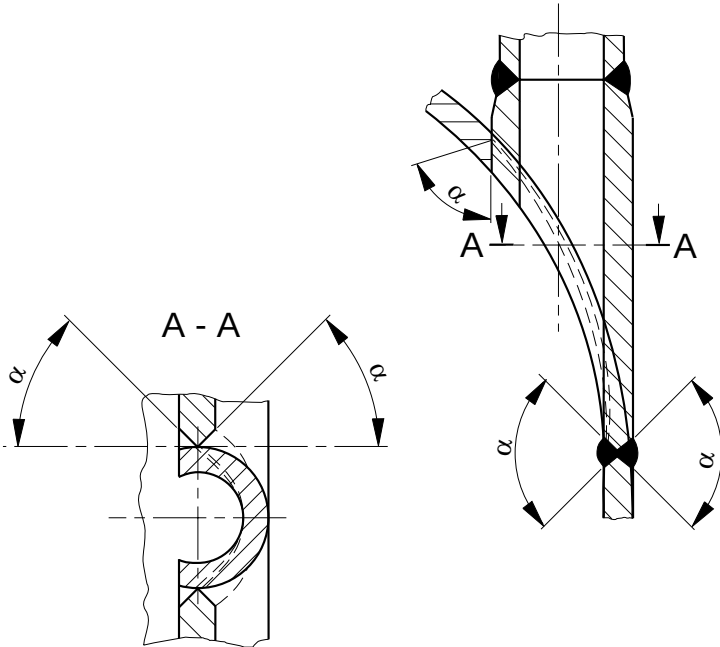
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.2.8		$\alpha = 45^\circ \text{ to } 50^\circ$ $b = 2 \text{ mm to } 3 \text{ mm}$		
2.2.9		$\alpha = 45^\circ \text{ to } 50^\circ$	To be welded from both sides.	

Table 2 — Branches without compensation rings (continued)

No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.3 Set-through branch				
2.3.1		$\alpha = 0,5t_1$ $b \leq 1 \text{ mm}$	Generally used when t_1 is less than $t_2/2$. For small diameter branches, attention is paid to the details shown on Table 3, which may provide a preferable solution.	4.10.10 C
2.3.2		$h = 0,6t_1$ $m \geq t_1$	For partial penetration welded connection.	2.8.8

Table 2 — Branches without compensation rings (continued)

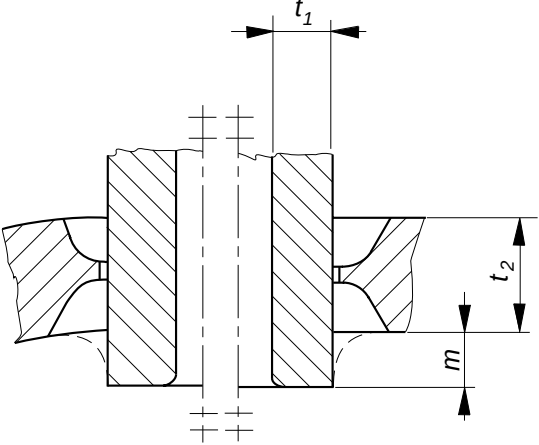
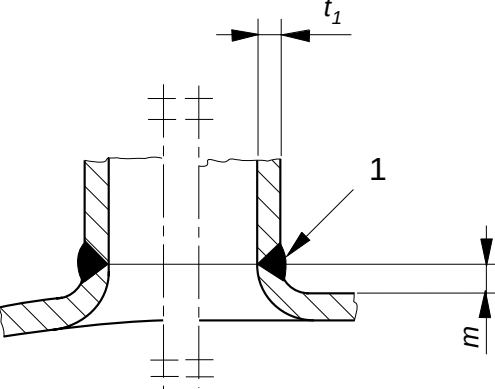
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.3.3		$m \geq t_1$	For full penetration welded connection.	2.4.4 and 2.8.8
2.4 Extruded branch connections (for special branch connections see 13.2)				
2.4.1		$m \geq t_1$ 1) conventional butt joint	Conventional butt joint will be used to weld the branch connection to the shell, and may not necessarily have the form shown.	1.5

Table 2 — Branches without compensation rings (continued)

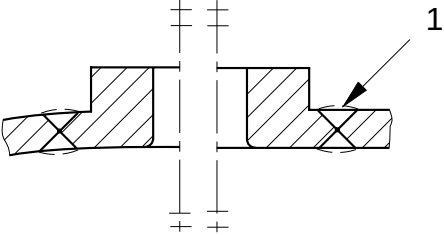
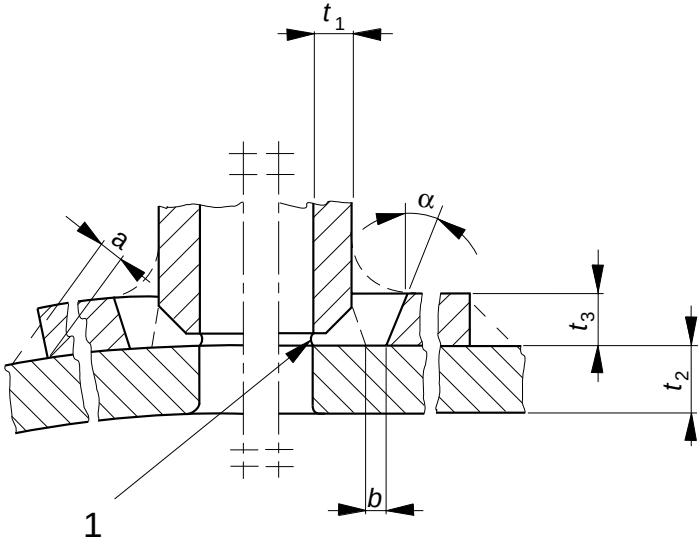
No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
2.5 Butt welded branches				
2.5.1		1) conventional butt joint		2.3.3

Table 3 — Branches with compensation rings

No.	Figure	Application/conditions	Note	Reference to EN 29692 and EN ISO 9692-2
Compensation rings should be closely fitted to the shell and vent holes should be provided in them. The thickness of the compensation ring should preferably not exceed the thickness of the shell.				
3.1 Set-on branches				
3.1.1		$\alpha = 0,5t_3$, but $\geq 5 \text{ mm}$ $b \geq 7 \text{ mm}$ $\alpha \geq 15^\circ$ 1) for shell to branch joints, see Table 2		1.4 or 1.8 and 1.15