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«Український науково-дослідний і навчальний центр
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(ДП «УкрНДНЦ»)

Наказ від 04.10.2019 № 308

EN 1708-2:2018

Welding — Basic weld joint details in steel —
Part 2: Non internal pressurized components

прийнято як національний стандарт
методом підтвердження за позначенням

ДСТУ EN 1708-2:2019
(EN 1708-2:2018, IDT)

Зварювання. Зварні з'єднання сталевих елементів.
Частина 2. Зварні з'єднання конструкційних елементів,
на які не діє внутрішній тиск

З наданням чинності від 2019–11–01

EUROPEAN STANDARD

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Welding - Basic weld joint details in steel - Part 2: Non internal pressurized components

Soudage - Descriptif de base des assemblages soudés en acier - Partie 2 : Composants non soumis à une pression interne

Schweißen - Verbindungselemente beim Schweißen von Stahl - Teil 2: Nicht innendruckbeanspruchte Bauteile

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European foreword

This document (EN 1708-2:2018) has been prepared by Technical Committee CEN/TC 121 "Welding and allied processes", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by June 2019 and conflicting national standards shall be withdrawn at the latest by June 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1708-2:2000.

The main changes compared to the previous edition are as follows:

a) the normative references and bibliography have been updated;

b) process numbers have been updated according to EN ISO 4063;

c) reference to EN ISO 9692-2 in Tables 2, 3, 4 und 5 has been deleted.

EN 1708, *Welding — Basic welded joint details in steel* is composed of the following parts:

— *Part 1: Pressurized components*;

— *Part 2: Non internal pressurized components.*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

The purpose of this document is to exemplify sound and accepted welded connections applicable to welded not internal pressurized steel components. It does not promote the standardization of connections that may be regarded as mandatory or restrict development in any way. The requirements of carrying capacity, fitness for purposes, fatigue and corrosion stress will be considered if necessary.

This document contains examples of connections welded by the following processes (process numbers according to EN ISO 4063):

— Manual metal arc welding (111);

— Self-shielded tubular-cored arc welding (114);

— Submerged arc welding (12);

— MIG welding; Metal inert gas welding with solid wire electrode (131);

— MAG welding; Metal active gas welding with solid wire electrode (135);

— Tubular cored metal arc welding with active gas shield (136);

— MAG welding; Metal active gas welding with metal cored electrode (138);

— MIG welding; Metal inert gas welding with flux cored electrode (132);

— MIG welding; Metal inert gas welding with metal cored electrode (133);

— TIG welding; Tungsten inert gas arc welding (14).

Other processes by agreement.

Further requirements will be considered in accordance with existing application standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 1792, *Welding - Multilingual list of terms for welding and related processes*

EN ISO 2553, *Welding and allied processes - Symbolic representation on drawings - Welded joints (ISO 2553)*

EN ISO 9692-1, *Welding and allied processes - Types of joint preparation - Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels (ISO 9692-1)*

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

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1)*

EN ISO 17659, *Welding - Multilingual terms for welded joints with illustrations (ISO 17659)*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

WPQR	=	welding procedure qualification record
a	=	weld design throat thickness
b	=	root gap
B	=	width of profile or plate
c	=	distance to auxiliary attachment
d	=	size of bevel or diameter
D	=	distance of the stiffener and size of opening
F	=	load strength
g	=	width of weld in two flange plate
h	=	difference of thickness
i	=	distance of the opening and weld to the web
k	=	penetration depth and corner distance
l	=	length
m	=	size of mechanical beveling
R	=	radius
t	=	plate thickness
t_R	=	thickness of stacked flange end
z	=	leg length of the weld
α	=	included angle (i.e. angle of the slope)
δ	=	angle of T-joint

NOTE All dimensions in the following tables are guide values.

5 Requirements

5.1 Selection for detail

The connections recommended 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 the existing fabrication and service conditions that pertain.

5.2 Joint preparation

5.2.1 General

The limitations quoted in weld profiles and sizes are based on commonly accepted sound practice, but they can be subjected to modifications if required by special welding techniques or design conditions.

The terminology and symbolization used in this standard follow EN 1792, EN ISO 17659 and EN ISO 2553.

5.2.2 Joint preparation geometry

The recommended joint preparation geometry (e.g. included angles, root gaps, root radius and depth of root faces) are given in EN ISO 9692-1 and in EN ISO 9692-2.

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 and effective root penetration.

5.2.3 Butt joints with significant difference of thickness

Depending on the type of load (type of action effect) and the difference of thickness, adjustment with the weld or bevelling is necessary (see Table 1 and Figure 1) when the direction of strength is perpendicular to the weld.

Table 1 — Guidelines for weld preparation on butt joints with significant difference of thickness

Type of load (type of action effect)	Difference of thickness, *h*, mm	Adjustment with the weld		Angle of the slope [a]	Figures
		suggested	not permitted		
Members with predominantly static loads	≤ 10	X	–	–	1 a) and 1 b)
	> 10	–	X	$20° \leq \alpha \leq 45°$	1 c) and 1 d)
Members significantly susceptible to fatigue or to risk of brittle fracture	≤ 3	X	–	–	1 b)
	> 3	–	X	$10° \leq \alpha \leq 30°$ [b]	1 c) and 1 d)

Key: X = permitted; – = not permitted or not necessary

[a] The angle of the slope depends on the actual acceptable notch case.

[b] In case of low loaded components, α can be raised up to 45°.

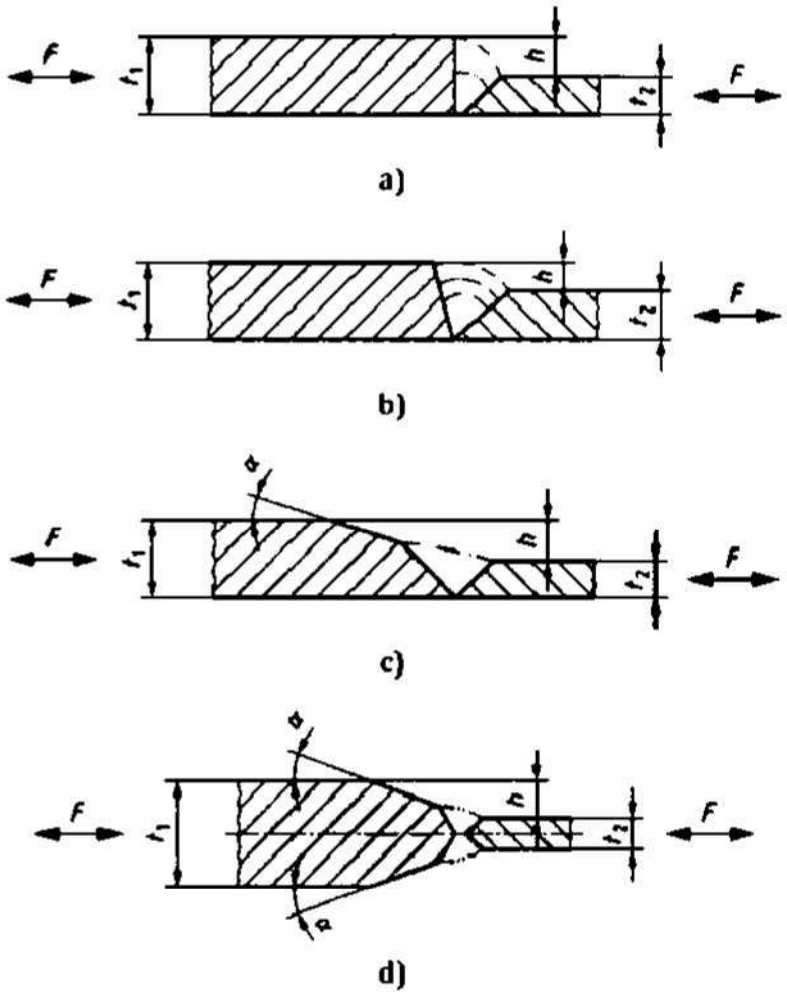


Figure 1 — Sketches of adjustment on difference of thickness

5.2.4 Weld size

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

Fillet welds for T-joints (see Figure 2) should respect the following condition (see Formulae (1) and (2)):

$$3\,mm \leq a \leq 0{,}7 \times t_2 \qquad (1)$$

NOTE 1 In special cases, the above limit of $0{,}7 \times t_2$ can be exceeded.

$$a \geq \sqrt{t_{max.}} - 0{,}5\,mm \qquad (2)$$

NOTE 2 Only up to 30 mm plate thickness except for process 12 (submerged arc welding).

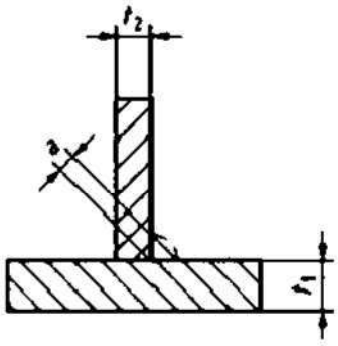
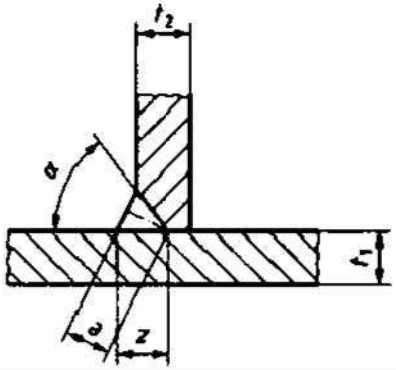
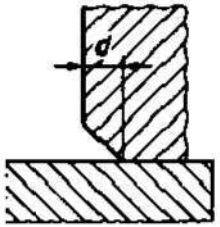
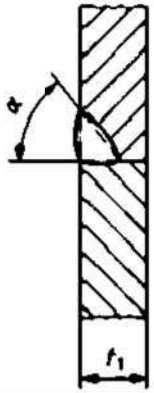
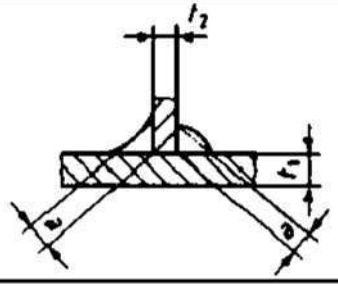


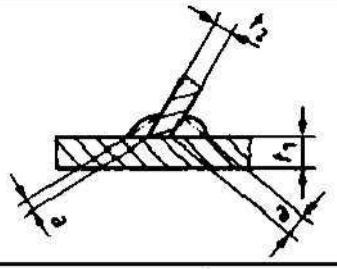
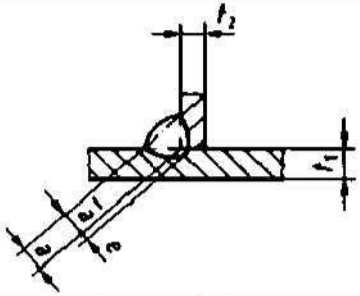
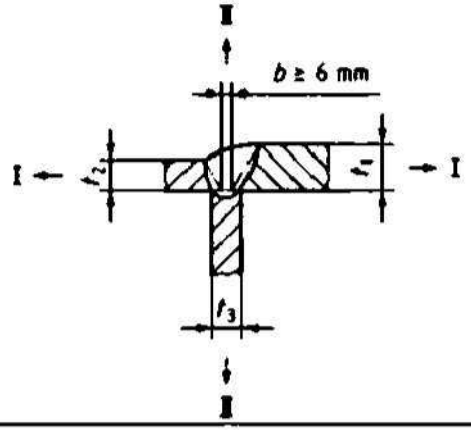
Figure 2 — Sketch of a T-joint

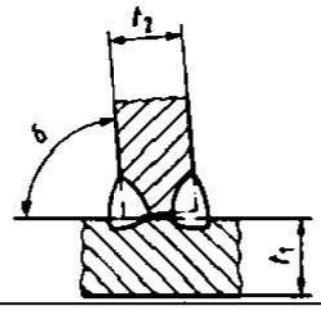
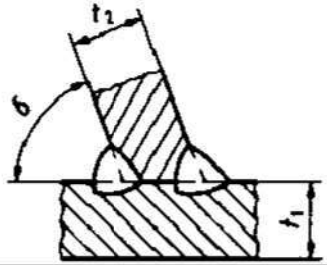
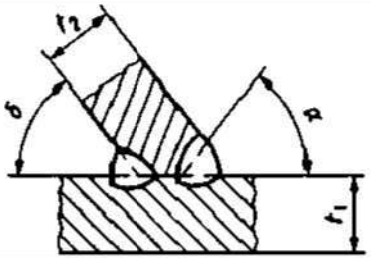
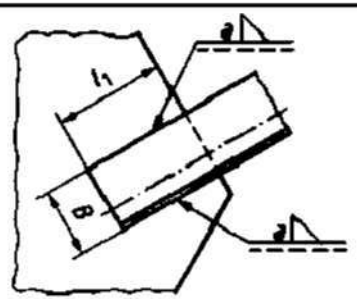
5.3 Typical connections

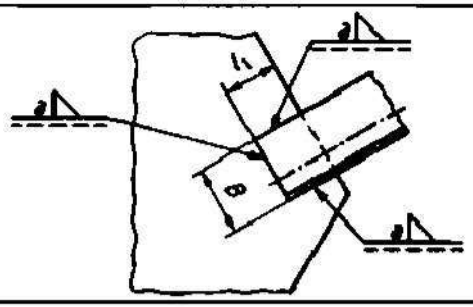
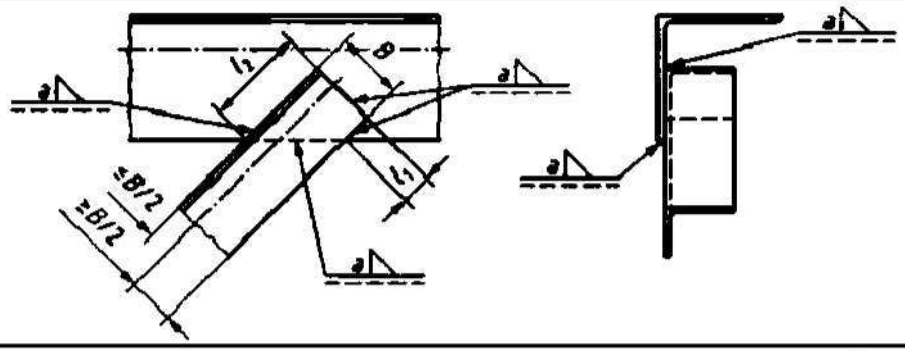
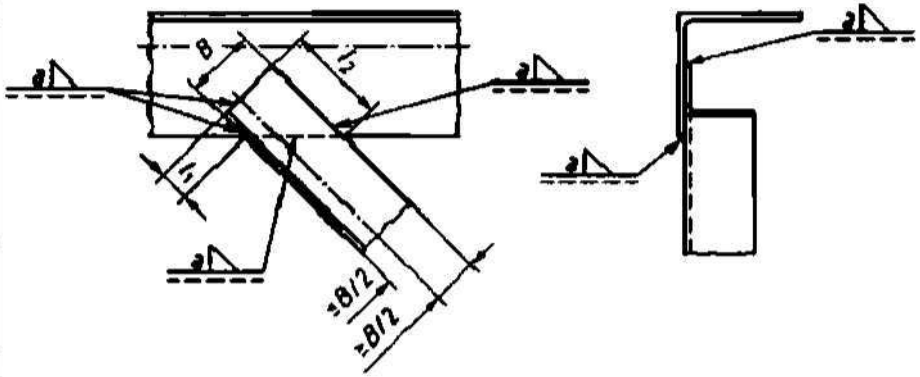
Typical connections are given in Table 2. For connections that not are mentioned (e.g. full penetration joint), reference shall be made to EN ISO 9692-1 and EN ISO 9692-2.

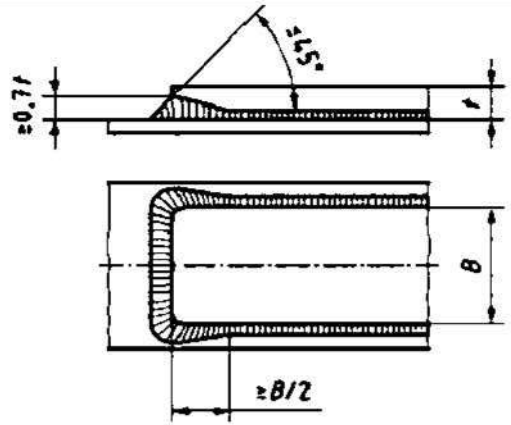
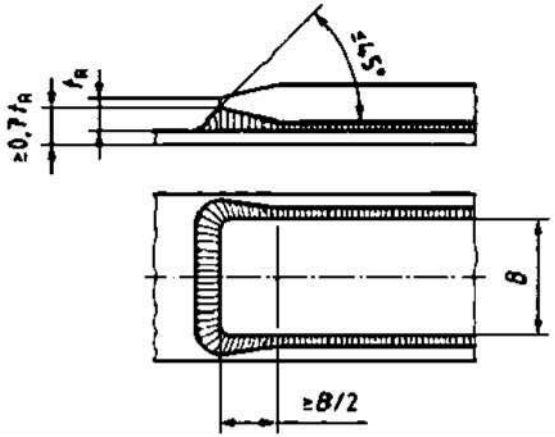
Table 2 — Typical joint preparation

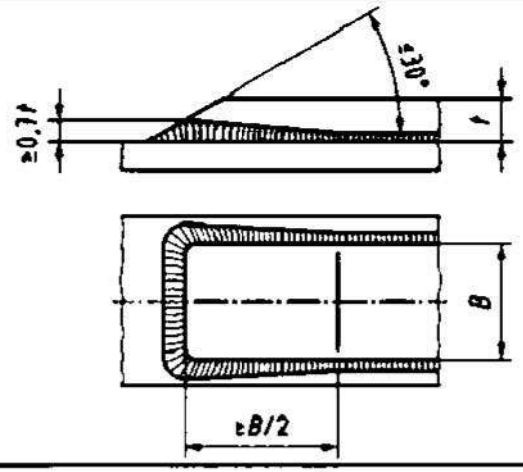
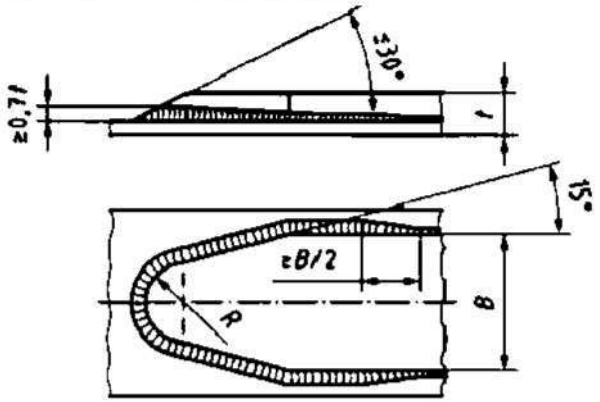
No.	Figure [a]	Application/Condition	Note
2.1 Weld thickness evaluation			
2.1.1		Partial penetration welds $\alpha \leq 60°$	If the leg length of the weld z is specified, the weld throat can be assumed equal to a without any other indication: $a = d$ applicable to double side weld, too 
2.1.2			
2.1.3		Design throat of fillet welds	Measured from the theoretical root point

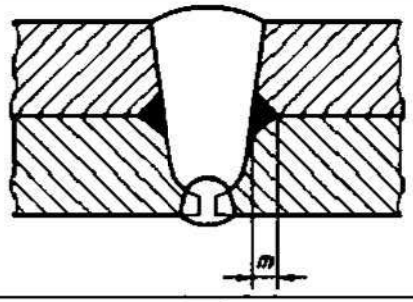
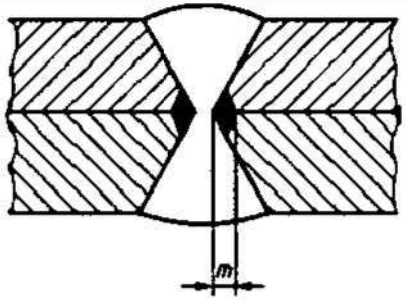
No.	Figure •	Application/Condition	Note
2.1.4			
2.1.5			Applicable only for fully mechanized and automatic processes and $a = \bar{a} + e$ e to be settled by WPQR according to EN ISO 15614-1
2.1.6		Multiple joint of three components $t_3 \geq b + 4$ mm	For I – I direction stress: $a = t_2$ (for $t_2 < t_1$); for II – II direction stress: $a = b$; This type of joint is very sensitive to lack of fusion, which, due to the geometry, is difficult to detect with non-destructive testing of weld metal.

No.	Figure [a]	Application/Condition	Note
2.1.7		$t_2 \leq 10$ mm $80° \leq \delta \leq 90°$	Fillet welds without joint preparation of the web
2.1.8		$60° \leq \delta \leq 80°$ Fillet welds (the web with diagonal cut, no joint preparation)	
2.1.9		$45° \leq \delta \leq 60°$ $45° \leq \alpha \leq 60°$ Fillet welds (the web with diagonal cut and one side joint preparation)	
2.2 Weld length evaluation			
2.2.1		Side fillet weld	$\Sigma l = 2 l_1$ $l_1 \geq 6\,a$, but min. 40 mm

No.	Figure [a]	Application/Condition	Note
2.2.2		Side and edge fillet weld	$\Sigma l = B + 2 l_1$ $l_1 \geq 6 a$, but min. 40 mm
2.2.3		Allround fillet weld	$\Sigma l = l_1 + l_2 + 2 B$ Centre of mass nearer to the fillet weld l_2
2.2.4		Allround fillet weld	$\Sigma l = 2 l_1 + 2 B$ Centre of mass nearer to the fillet weld l_1

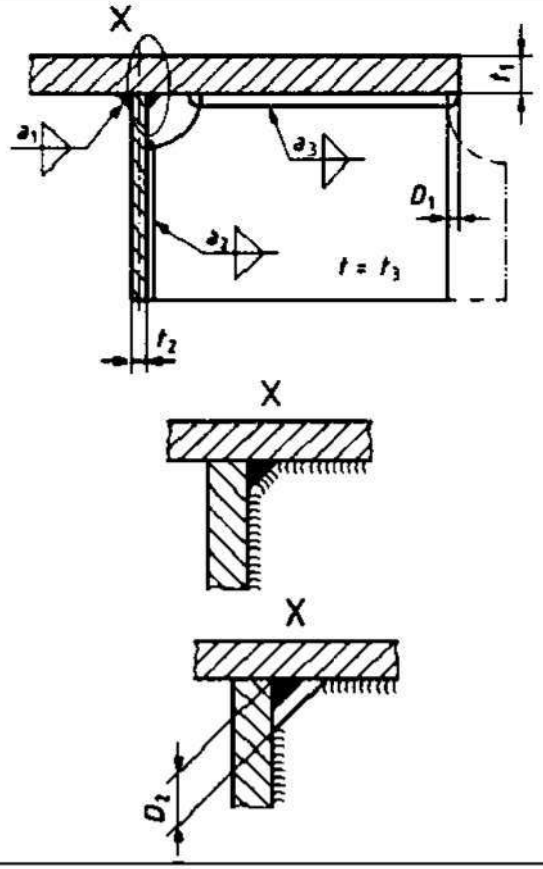
No.	Figure a	Application/Condition	Note
2.3 Weld connection at stacked flange ends			
2.3.1			For predominate statically load and low dynamical load
2.3.2		$t_R \geq 20$ mm	

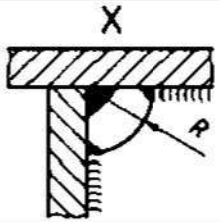
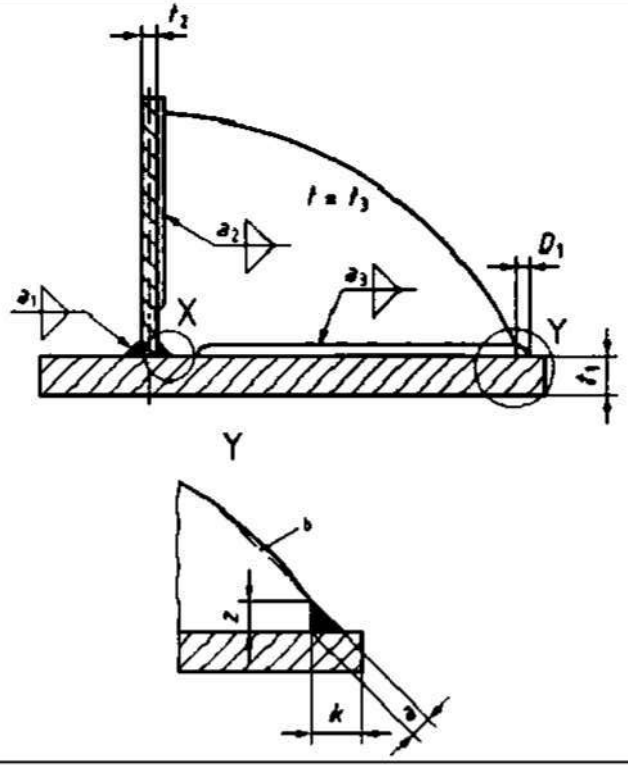
No.	Figure a	Application/Condition	Note
2.3.3			For dynamical loads weld transition to be ground notch-free
2.3.4		$R = B/3$	For severe fatigue conditions weld interface to be ground notch-free

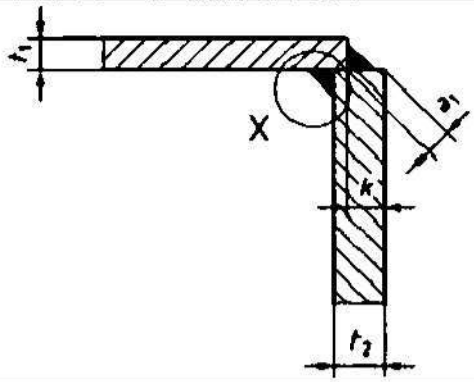
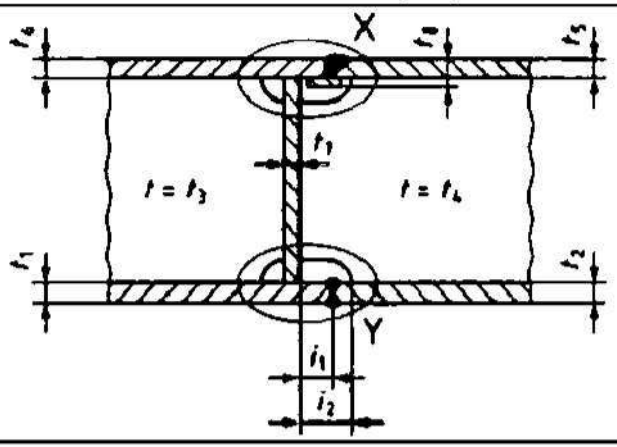
No.	Figure [a]	Application/Condition	Note
	2.4 Butt joints of stacked flange plates		
2.4.1		Two flange plate connection	Flange plate joints shall be at right angles to the direction of force.
2.4.2		Joint difficult to be tested; it is not suitable for through thickness loading $m \geq 7$ mm	Back gouging to be performed without deleting the assembling runs.

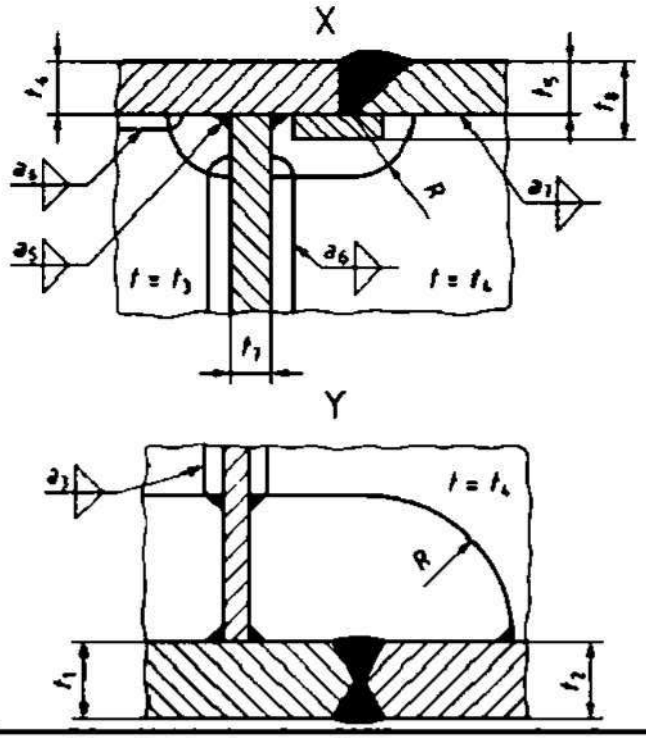
[a] The used symbolic representation in the sketches of Table 2 are based on system A of EN ISO 2553. This system A is used in Europe. System B of EN ISO 2553 is based on standards used in the pacific area.

Table 3 — Welded plates and beams (by dynamic stress)

No.	Figure a	Application/Condition	Note
	3.1 Stiffeners for weld beams		
3.1.1	X_1 X_2 	$D_1 \geq 3\,a_3$	For detail X_1 No opening only for stiffener thicknesses $t \leq 16$ mm the risk of brittle fracture shall be considered for detail X_2 Only for predominantly static load $D_2 \geq 25$ mm and $\geq t_3$

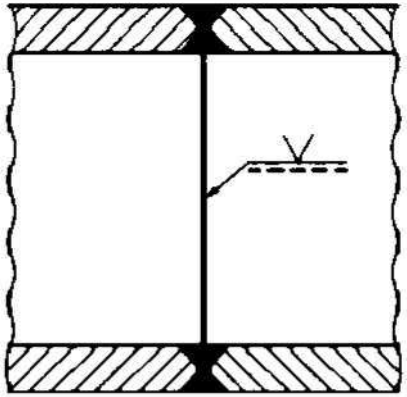
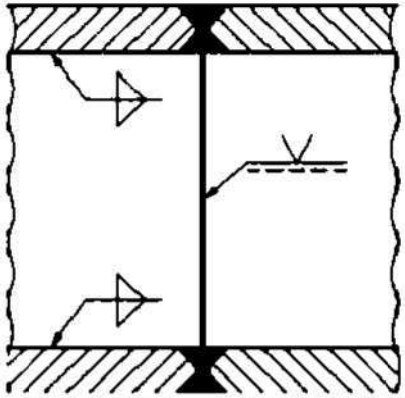
No.	Figure [a]	Application/Condition	Note
3.1.1	X_3 		For detail X_3 For fatigue load or for members with a high corrosion risk or brittle fracture $R \geq 25\ mm + t$
3.1.2		$D_1 \geq 3\,a_3$	Details X_1, X_2 and X_3 see 3.1.1 For Y For predominantly static load $z = \sqrt{2} \times a$ $k \geq \sqrt{2} \times a + 2\,mm$ For dynamic loads (b) further more weld and edge of the stiffener shall be ground smoothly.

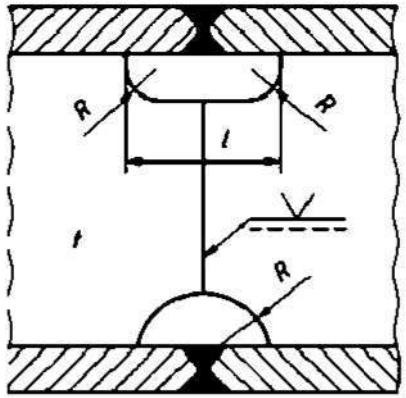
No.	Figure [a]	Application/Condition	Note
3.1.3			Details X_1, X_2 and X_3 see 3.1.1 $k \geq \sqrt{2} \times a_1 + 2\,mm$ $t_2 - k \geq 2\,mm$
3.1.4		$l_1 \geq 100\,mm$ $l_2 \geq 200\,mm$ $l_1 = l_2 = l_5 = l_6$	Flange butt welds to be radiographed

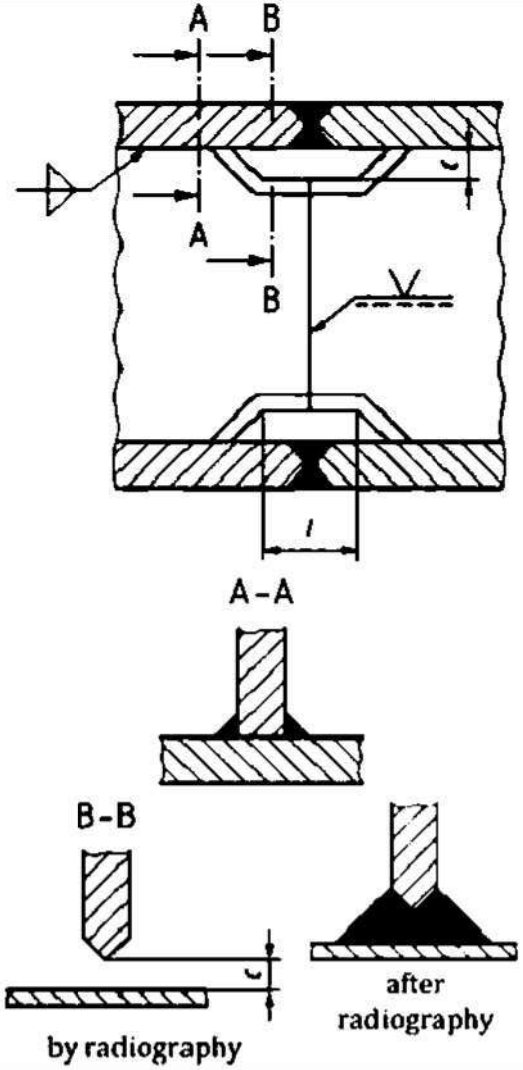
No.	Figure [a]	Application/Condition	Note
3.1.4		$R \geq t_3 + 25$ mm	In case of permanent backing, a fillet weld is necessary.

[a] The used symbolic representation in the sketches of Table 3 are based on system A of EN ISO 2553. This system A is used in Europe. System B of EN ISO 2553 is based on standards used in the pacific area.

Table 4 — Beam to beam connections

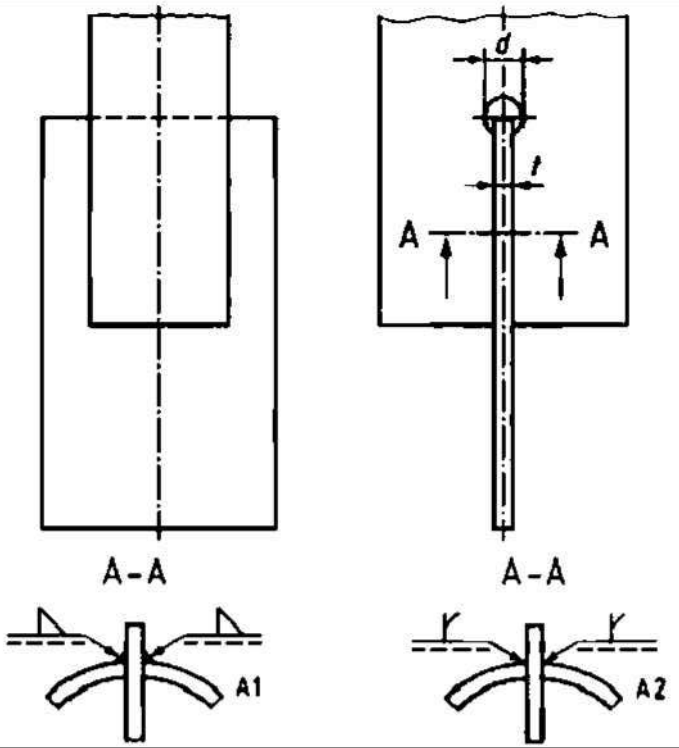
No.	Figure [a]	Application/Condition	Note
4.1 Beam to beam connections			
4.1.1		Butt weld of a section without radiography for normal application (no fatigue, no risk of corrosion)	Depending on the present web thickness, other joint preparation can be used.
4.1.2		Butt weld without radiography for normal application (no fatigue, no risk of corrosion)	Depending on the present web thickness, other joint preparation can be used.

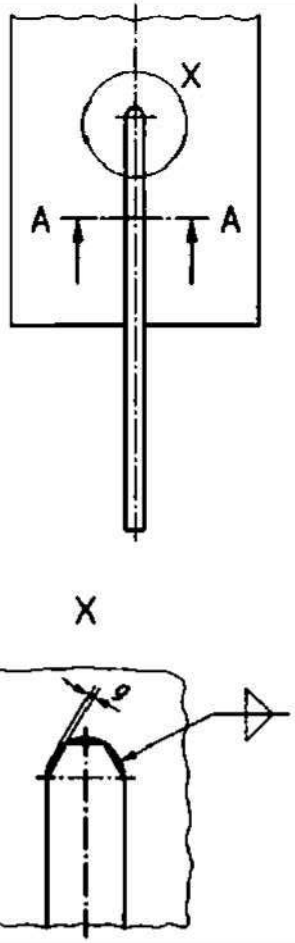
No.	Figure [a]	Application/Condition	Note
4.1.3		Butt weld of sections or welded beams with radiography $R \geq t + 25$ mm	Depending on the present web thickness, other joint preparation can be used. The minimum length of l should be 120 mm, when radiographic examination is foreseen. In case of high risk of corrosion or by dynamic loads, the openings in the web should be closed after radiographic examination. Special care shall be taken to avoid imperfections at the end of the web welds; in the most severe cases, in order to switch off the arc on run-off plates, the distance between web and flange can be raised.

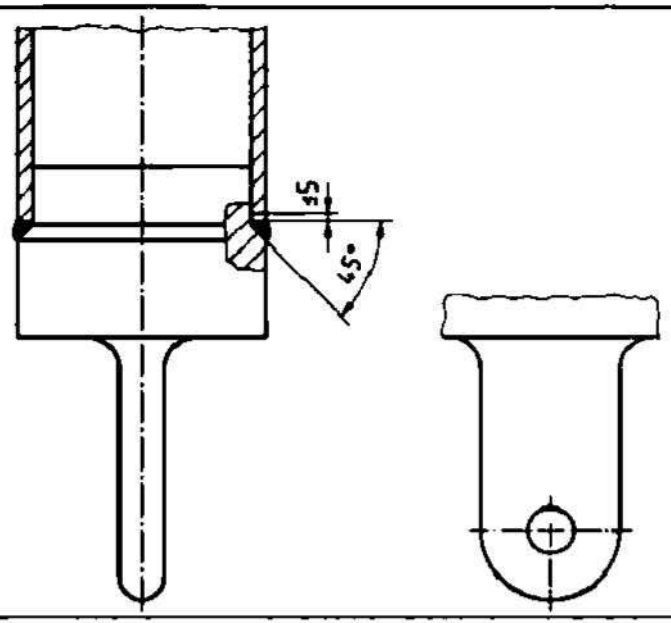
No.	Figure [a]	Application/Condition	Note
4.1.4		Butt welds of welded beams with radiography (for cases of severe fatigue or high risk of corrosion and brittle fracture) $l \geq 120$ mm $c \geq 5$ mm	Depending on the present web thickness other joint preparation can be used. Special care shall be taken to avoid imperfections at the end of the web welds; in the most severe cases, in order to switch off the arc on run-off plates, the distance between web and flange can be raised up to 10 mm. After radiography the slot between flange and web shall be filled by several welding runs.

[a] The used symbolic representation in the sketches of Table 4 are based on system A of EN ISO 2553. This system A is used in Europe. System B of EN ISO 2553 is based on standards used in the pacific area.

Table 5 — Hollow section connections

No.	Figure [a]	Application/Condition	Note
	5.1 Special plate bar / tube		
5.1.1		Only for tubes $d \geq t + 20$ mm	Execution with rat hole Fillet welds (A1) or partial penetration welds (A2)

No.	Figure [a]	Application/Condition	Note
5.1.2		$g \geq 2$ mm cut A – A, see 5.1.1	Execution with continuous weld

No.	Figure [a]	Application/Condition	Note
	5.2 Special tube to forging/casting		
5.2.1			

[a] The used symbolic representation in the sketches of Table 5 are based on system A of EN ISO 2553. This system A is used in Europe. System B of EN ISO 2553 is based on standards used in the pacific area.

Bibliography

[1] EN ISO 4063, *Welding and allied processes - Nomenclature of processes and reference numbers (ISO 4063)*