EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 5817

March 2023

ICS 25.160.40

Supersedes EN ISO 5817:2014

English Version

Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2023)

Soudage - Assemblages en acier, nickel, titane et leurs alliages soudés par fusion (soudage par faisceau exclu) - Niveaux de qualité par rapport aux défauts (ISO 5817:2023)

Schweißen - Schmelzschweißverbindungen an Stahl, Nickel, Titan und deren Legierungen (ohne Strahlschweißen) - Bewertungsgruppen von Unregelmäßigkeiten (ISO 5817:2023)

This European Standard was approved by CEN on 10 February 2023.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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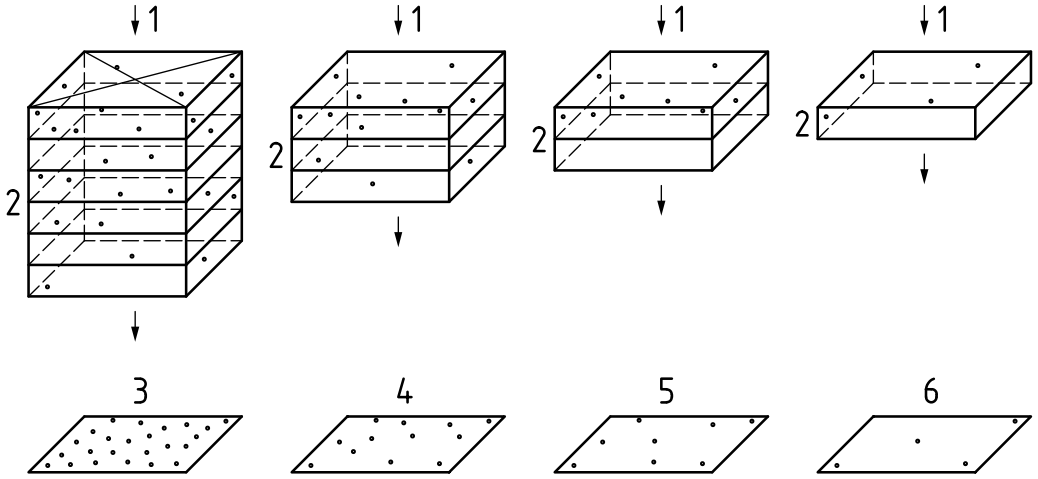


Key

1	direction of rays	3	sixfold thickness	5	twofold thickness
2	four pores per volume unit	4	threefold thickness	6	onefold thickness

Figure 1 — Radiographic films of specimens with identical occurrence of pores per volume unit

3.6
cross-sectional area
area to be considered after fracture or sectioning

3.7
smooth transition
even surface with no irregularities or sharpness at the transition between the weld bead and the parent material and/or the adjacent welding bead(s)

3.8
fatigue class
FATx
classification reference to S-N curve

Note 1 to entry: x is the stress range in MPa at $2 \cdot 10^6$ cycles.

Note 2 to entry: Fatigue properties are described by S-N curves (stress-number of cycle-curves).

Note 3 to entry: See Annex B.

4 Symbols

a	nominal throat thickness of the fillet weld (see also ISO 2553)
a_A	actual throat thickness (throat thickness of the finalized weld) (see ISO/TR 25901-1)
A	area surrounding the gas pores
b	width of weld reinforcement
d	diameter of gas pore
d_A	diameter of area surrounding the gas pores
h	height or width of imperfection

i	penetration in fillet welds
l	length of imperfection in longitudinal direction of the weld
l_p	length of projected or cross-sectional area
r	radius of weld toe
s	nominal butt weld thickness
t	wall or plate thickness (nominal size)
w_p	width of the weld or width or height of the cross-sectional area
z	leg length of a fillet weld (see also ISO 2553)
α	angle of weld toe
β	angle of angular misalignment

5 Assessment of imperfections

Limits for imperfections in accordance with ISO 6520-1 are given in Table 1.

If, for the detection of imperfections, macro-examination is used, only those imperfections shall be considered which can be detected with a maximum of tenfold magnification. Excluded from this are micro lack of fusion (see Table 1, 1.5) and microcracks (see Table 1, 2.2).

Systematic imperfections are only permitted in quality level D, provided the other requirements of Table 1 are fulfilled.

A welded joint should usually be assessed separately for each individual type of imperfection (see Table 1, 1.1 to 3.2).

Different types of imperfection occurring at any cross-section of the joint need special consideration (see multiple imperfections in Table 1, 4.1).

The limits for multiple imperfections (see Table 1) are only applicable for cases where the requirements for a single imperfection are not exceeded.

Any two adjacent imperfections separated by a distance smaller than the major dimension of the smaller imperfection shall be considered as a single imperfection.

Table 1 — Limits for imperfections

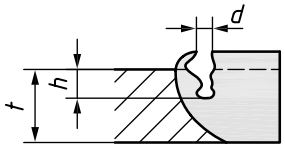
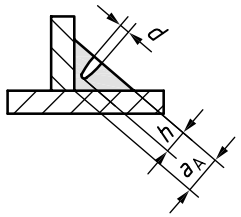
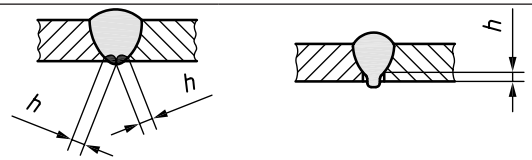
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
1 Surface imperfections							
1.1	100	Crack		≥ 0,5	Not permitted	Not permitted	Not permitted
1.2	104	Crater crack		≥ 0,5	Not permitted	Not permitted	Not permitted
1.3	2017	Surface pore	On the weld face or the weld root Maximum dimension of a single pore	0,5 to 3	Butt welds $d \leq 0{,}3\ s$ fillet welds $d \leq 0{,}3\ a_A$	Not permitted	Not permitted
				> 3	Butt welds $d \leq 0{,}3\ s$, but max. 3 mm fillet welds $d \leq 0{,}3\ a_A$, but max. 3 mm	butt welds $d \leq 0{,}2\ s$, but max. 2 mm fillet welds $d \leq 0{,}2\ a_A$, but max. 2 mm	Not permitted
1.4	2025	End crater pipe	— butt welds  — fillet welds 	0,5 to 3	Butt welds $h \leq 0{,}2$ s $d \leq 0{,}3\ s$ fillet welds $h \leq 0{,}2\ a_A$, $d \leq 0{,}3\ a_A$	Not permitted	Not permitted
				> 3	Butt welds $h \leq 0{,}2$ s, but max. 2 mm $d \leq 0{,}3\ s$, but max. 3 mm fillet welds $h \leq 0{,}2\ a_A$, but max. 2 mm $d \leq 0{,}3\ a_A$, but max. 3 mm	Butt welds $h \leq 0{,}1\ s$, but max. 1 mm $d \leq 0{,}2\ s$, but max. 2 mm fillet welds $h \leq 0{,}1\ a_A$, but max. 1 mm $d \leq 0{,}2\ a_A$, but max. 2 mm	Not permitted
1.5	401	Lack of fusion (incomplete fusion)		≥ 0,5	Not permitted	Not permitted	Not permitted
	4014	Micro lack of fusion	Only detectable by micro examination (≥50 ×)	≥ 0,5	Permitted	Permitted	Not permitted

Table 1 *(continued)*

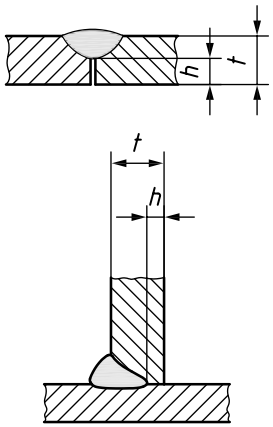
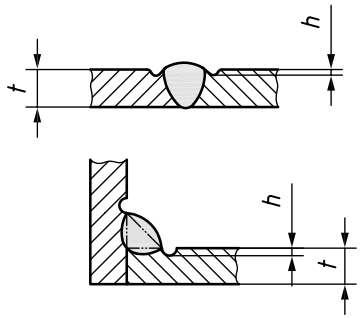
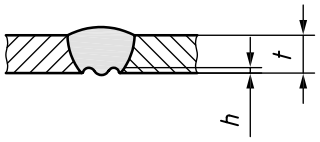
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	*t* mm	Limits for imperfections for quality levels		
					D	C	B
1.6	4021	Incomplete root penetration	Only for single side butt welds (full penetration) 	≥ 0,5	Short imperfections: $h \leq 0{,}2\ t$ but max. 2 mm	Not permitted	Not permitted
1.7	5011	Continuous undercut	Smooth transition is required. This is not regarded as a systematic imperfection.	0,5 to 3	Short imperfections: $h \leq 0{,}2\ t$	Short imperfections: $h \leq 0{,}1\ t$	Not permitted
	5012	Intermittent undercut (short imperfection)		> 3	$h \leq 0{,}2\ t$, but max. 1 mm	$h \leq 0{,}1\ t$, but max. 0,5 mm	$h \leq 0{,}05\ t$, but max. 0,5 mm
1.8	5013	Shrinkage grooves	Smooth transition is required. 	0,5 to 3	Short imperfections: $h \leq 0{,}1\ t + 0{,}2$ mm	Short imperfections: $h \leq 0{,}1\ t$	Not permitted
				> 3	Short imperfections: $h \leq 0{,}2\ t$, but max. 2 mm	Short imperfections: $h \leq 0{,}1\ t$, but max.1 mm	Short imperfections: $h \leq 0{,}05\ t$, but max. 0,5 mm

Table 1 *(continued)*

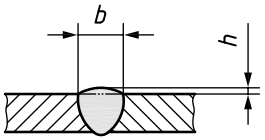
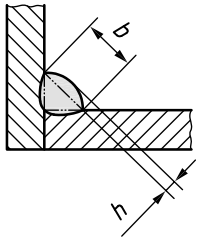
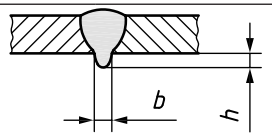
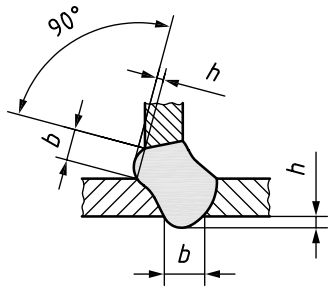
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
1.9	502	Excess weld metal (butt weld)	Smooth transition is required between the capping run(s) and the plate surface and/or the adjacent welding bead(s) 	≥ 0,5	$h \leq 0{,}25\ b + 1$ mm, but max. 10 mm	$h \leq 0{,}15\ b + 1$ mm, but max. max. 7 mm	$h \leq 0{,}1\ b + 1$ mm, but max. 5 mm
1.10	503	Excessive convexity (fillet weld)	Smooth transition is required between the cap of the weld and the plate surface and/or the adjacent welding bead(s) 	≥ 0,5	$h \leq 0{,}25\ b + 1$ mm, but max. 5 mm	$h \leq 0{,}15\ b + 1$ mm, but max. 4 mm	$h \leq 0{,}1\ b + 1$ mm, but max. 3 mm
1.11	504	Excessive penetration	 	0,5 to 3	$h \leq 0{,}6\ b + 1$ mm	$h \leq 0{,}3\ b + 1$ mm	$h \leq 0{,}1\ b + 1$ mm
				> 3	$h \leq 1{,}0\ b + 1$ mm, but max. 5 mm	$h \leq 0{,}45\ b + 1$ mm, but max. 4 mm	$h \leq 0{,}2\ b + 1$ mm, but max. 3 mm

Table 1 *(continued)*

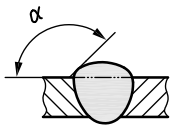
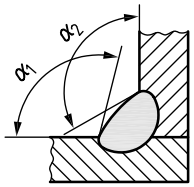
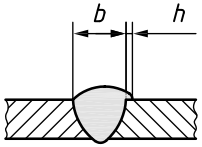
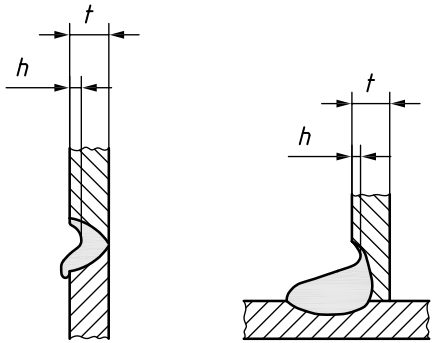
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
1.12	505	Incorrect weld toe	— butt welds  Not applicable for the root	≥ 0,5	$\alpha \geq 90°$	$\alpha \geq 110°$	$\alpha \geq 150°$
			— fillet welds  $\alpha_1 \geq \alpha$ and $\alpha_2 \geq \alpha$	≥ 0,5	$\alpha \geq 90°$	$\alpha \geq 100°$	$\alpha \geq 110°$
1.13	506	Overlap	 	≥ 0,5	$h \leq 0{,}2\ b$	Not permitted	Not permitted
1.14	509	Sagging	Smooth transition is required  	0,5 to 3	Short imperfections: $h \leq 0{,}25\ t$	Short imperfections: $h \leq 0{,}1\ t$	Not permitted
				> 3	Short imperfections: $h \leq 0{,}25\ t$, but max. 2 mm	Short imperfections: $h \leq 0{,}1\ t$, but max. 1 mm	Short imperfections: $h \leq 0{,}05\ t$, but max. 0,5 mm

Table 1 *(continued)*

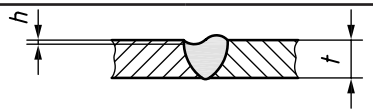
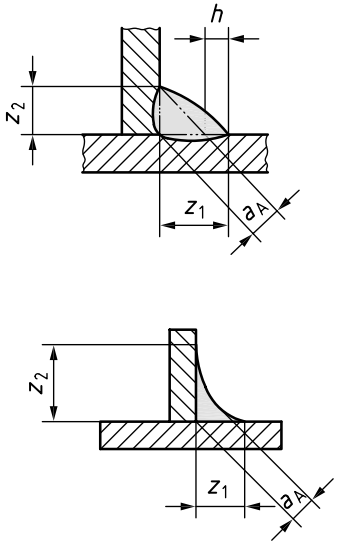
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
	511	Incompletely filled groove					
1.15	510	Burn through	—	≥ 0,5	Not permitted	Not permitted	Not permitted
1.16	512	Excessive asymmetry of fillet weld (excessive unequal leg length)	In cases where an asymmetric fillet weld has not been prescribed.  $h = \lvert Z_1 - Z_2 \rvert$	≥ 0,5	$h \le 0{,}2\ a_A + 2$ mm	$h \le 0{,}15\ a_A + 2$ mm	$h \le 0{,}15\ a_A + 1{,}5$ mm

Table 1 *(continued)*

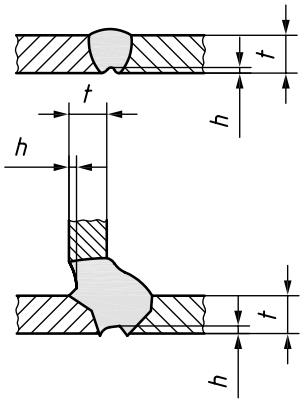
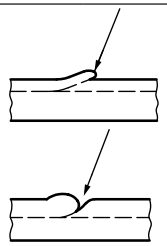
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	*t* mm	Limits for imperfections for quality levels		
					D	C	B
1.17	515	Root concavity	Smooth transition is required. 	0,5 to 3	$h \leq 0{,}1\ t + 0{,}2$ mm	Short imperfections: $h \leq 0{,}1\ t$	Not permitted
				> 3	Short imperfections: $h \leq 0{,}2\ t$, but max. 2 mm	Short imperfections: $h \leq 0{,}1\ t$, but max. 1 mm	Short imperfections: $h \leq 0{,}05\ t$, but max. 0,5 mm
1.18	516	Root porosity	Spongy formation at the root of a weld due to bubbling of the weld metal at the moment of solidification (e.g. lack of gas backing)	≥ 0,5	Acceptance depends on application, e.g. material, corrosion protection	Not permitted	Not permitted
1.19	517	Poor restart		≥ 0,5	Permitted The limit depends on the type of imperfection which occurred due to the restart	Not permitted	Not permitted

Table 1 *(continued)*

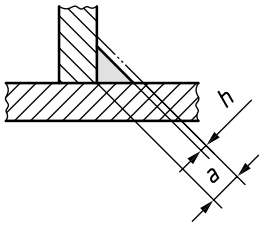
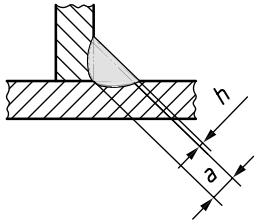
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
1.20	5213	Insufficient throat thickness	Not applicable to processes with proof of greater depth of penetration 	0,5 to 3	Short imperfections: $h \leq 0{,}1\ a + 0{,}2$ mm	Short imperfections: $h \leq 0{,}2$ mm	Not permitted
				> 3	Short imperfections: $h \leq 0{,}1\ a + 0{,}3$ mm, but max. 2 mm	Short imperfections: $h \leq 0{,}1\ a + 0{,}3$ mm, but max. 1 mm	Not permitted
1.21	5214	Excessive throat thickness	The actual throat thickness of the fillet weld is too large. 	≥ 0,5	Permitted	$h \leq 0{,}2\ a + 1$ mm, but max. 4 mm	$h \leq 0{,}15\ a + 1$ mm, but max. 3 mm
1.22	601	Stray arc	—	≥ 0,5	Permitted, if the properties of the parent metal are not affected	Not permitted	Not permitted
1.23	602	Spatter	—	≥ 0,5	Acceptance depends on application, e.g. material, corrosion protection	Acceptance depends on application, e.g. material, corrosion protection	Acceptance depends on application, e.g. material, corrosion protection
1.24	610	Temper colours (visible oxide film)	—	≥ 0,5	Acceptance depends on application, e.g. material, corrosion protection	Acceptance depends on application, e.g. material, corrosion protection	Acceptance depends on application, e.g. material, corrosion protection
2 Internal imperfections							
2.1	100	Crack	All types of cracks except microcracks and crater cracks	≥ 0,5	Not permitted	Not permitted	Not permitted

Table 1 *(continued)*

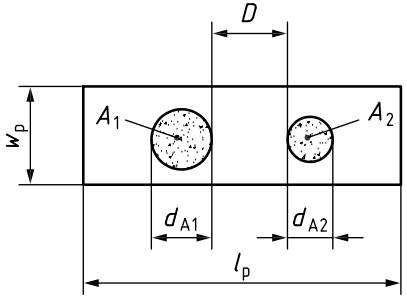
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
2.2	1001	Microcrack	A crack usually only visible under the microscope (≥50 ×)	≥ 0,5	Permitted	Acceptance depends on type of parent metal with particular reference to crack sensitivity	Acceptance depends on type of parent metal with particular reference to crack sensitivity
2.3	2011 2012	Gas pore Uniformly distributed porosity	The following conditions and limits for imperfections shall be fulfilled. See also Annex A for information.				
			a1) Maximum dimension of the area of the imperfections (inclusive of systematic imperfection) related to the projected area. The porosity in the project area depends on the numbers of layers (volume of the weld).	≥ 0,5	For single layer: ≤ 2,5 % For multi-layer: ≤ 5 %	For single layer: ≤ 1,5 % For multi-layer: ≤ 3 %	For single layer: ≤ 1 % For multi-layer: ≤ 2 %
			a2) Maximum dimension of the cross-sectional area of the imperfections (inclusive of systematic imperfection) related to the fracture area (only applicable to test pieces: production test, welder or procedure qualification tests)	≥ 0,5	≤ 2,5 %	≤ 1,5 %	≤ 1 %
			b) Maximum dimension for a single pore for	≥ 0,5			
			— butt welds		$d \leq 0{,}4\ s$, but max. 5 mm	$d \leq 0{,}3\ s$, but max. 4 mm	$d \leq 0{,}2\ s$, but max. 3 mm
			— fillet welds		$d \leq 0{,}4\ a_A$, but max. 5 mm	$d \leq 0{,}3\ a_A$, but max. 4 mm	$d \leq 0{,}2\ a_A$, but max. 3 mm
2.4	2013	Clustered (localized) porosity		≥ 0,5	$d_A \leq 25$ mm or $d_{A,\max} \leq w_p$	$d_A \leq 20$ mm or $d_{A,\max} \leq w_p$	$d_A \leq 15$ mm or $d_{A,\max} \leq w_p/2$

Table 1 *(continued)*

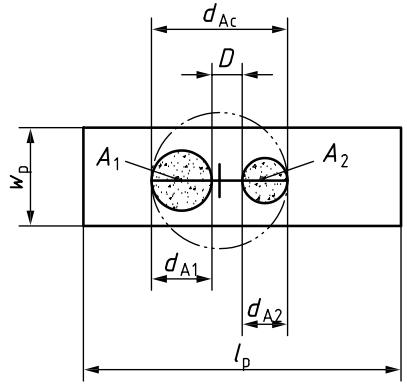
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
			 Reference length for l_p is 100 mm. The total gas pore area within the cluster is represented by a circle of diameter d_A surrounding all the gas pores. The requirement for a single gas pore shall be met by all the gas pores within this circle. A permitted porous area shall be local. The possibility of the pore cluster masking other imperfections shall be taken into consideration. If D is less than d_{A1} or d_{A2}, whichever is smaller, then the total gas pore area is represented by a circle of diameter d_{AC}, where $d_{AC} = d_{A1} + d_{A2} + D$. Systematic cluster porosity is not permitted. d_A corresponds to d_{A1}, d_{A2} or d_{AC}, whichever is applicable.				
2.5	2014	Linear porosity	— butt welds	≥ 0,5	$h \leq 0{,}4\ s$, but max. 4 mm $l \leq s$, but max. 75 mm	$h \leq 0{,}3\ s$, but max. 3 mm $l \leq s$, but max. 50 mm	$h \leq 0{,}2\ s$, but max. 2 mm $l \leq s$, but max. 25 mm
			— fillet welds	≥ 0,5	$h \leq 0{,}4\ a$, but max. 4 mm $l \leq a$, but max. 75 mm	$h \leq 0{,}3\ a$, but max. 3 mm $l \leq a$, but max. 50 mm	$h \leq 0{,}2\ a$, but max. 2 mm $l \leq a$, but max. 25 mm

Table 1 *(continued)*

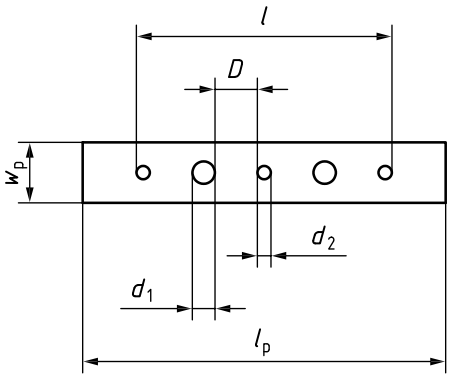
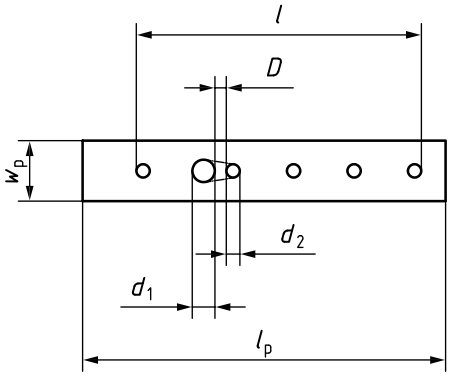
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
			Case 1 ($D > d_2$)  Case 2 ($D < d_2$)  Reference length for l_p is 100 mm. For case 1: $d_1 = h$ For case 2: $d_1 + d_2 + D = h$				

Table 1 *(continued)*

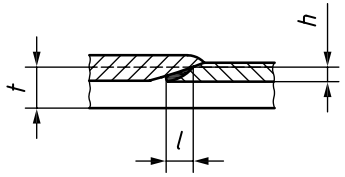
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
2.6	2015 2016	Elongated cavity Worm hole	— butt welds	≥ 0,5	$h \leq 0{,}4\ s$, but max. 4 mm $l \leq s$, but max. 75 mm	$h \leq 0{,}3\ s$, but max. 3 mm $l \leq s$, but max. 50 mm	$h \leq 0{,}2\ s$, but max. 2 mm $l \leq s$, but max. 25 mm
			— fillet welds	≥ 0,5	$h \leq 0{,}4\ a$, but max. 4 mm $l \leq a$, but max. 75 mm	$h \leq 0{,}3\ a$, but max. 3 mm $l \leq a$, but max. 50 mm	$h \leq 0{,}2\ a$, but max. 2 mm $l \leq a$, but max. 25 mm
2.7	202	Shrinkage cavity	—	≥ 0,5	Short imperfections permitted, but not breaking of the surfaces: butt welds: $h \leq 0{,}4\ s$, but max. 4 mm fillet welds: $h \leq 0{,}4\ a$, but max. 4 mm	Not permitted	Not permitted
2.8	2024	Crater pipe	 The larger value of h or l will be measured	0,5 to 3	h or $l \leq 0{,}2\ t$	Not permitted	Not permitted
				> 3	h or $l \leq 0{,}2\ t$, but max. 2 mm	Not permitted	Not permitted
2.9	300 301	Solid inclusion Slag inclusion	— butt welds	≥ 0,5	$h \leq 0{,}4\ s$, but max. 4 mm $l \leq s$, but max. 75 mm	$h \leq 0{,}3\ s$, but max. 3 mm $l \leq s$, but max. 50 mm	$h \leq 0{,}2\ s$, but max. 2 mm $l \leq s$, but max. 25 mm
	302 303	Flux inclusion Oxide inclusion	— fillet welds	≥ 0,5	$h \leq 0{,}4\ a$, but max. 4 mm $l \leq a$, but max. 75 mm	$h \leq 0{,}3\ a$, but max. 3 mm $l \leq a$, but max. 50 mm	$h \leq 0{,}2\ a$, but max. 2 mm $l \leq a$, but max. 25 mm

Table 1 *(continued)*

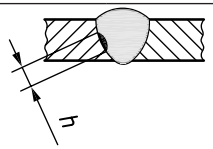
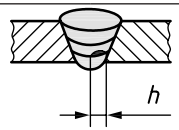
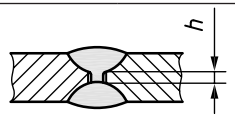
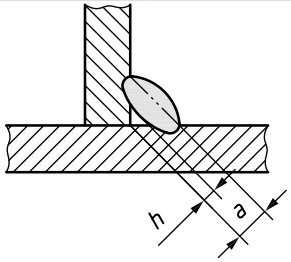
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
2.10	304	Metallic inclusion other than copper	— butt welds	≥ 0,5	$h \leq 0{,}4\ s$, but max. 4 mm	$h \leq 0{,}3\ s$, but max. 3 mm	$h \leq 0{,}2\ s$, but max. 2 mm
			— fillet welds	≥ 0,5	$h \leq 0{,}4\ a$, but max. 4 mm	$h \leq 0{,}3\ a$, but max. 3 mm	$h \leq 0{,}2\ a$, but max. 2 mm
2.11	3042	Copper inclusion	—	≥ 0,5	Not permitted	Not permitted	Not permitted
2.12	401	Lack of fusion (incomplete fusion)		≥ 0,5	Short imperfections permitted: butt welds: $h \leq 0{,}4\ s$, but max. 4 mm fillet welds: $h \leq 0{,}4\ a$ but max. 4 mm	Not permitted	Not permitted
	4011	Lack of side-wall fusion					
	4012	Lack of inter-run fusion					
	4013	Lack of root fusion					
2.13	4021	Incomplete root penetration	 T-joint (fillet weld)	> 0,5	Short imperfections: $h \leq 0{,}2\ a$, but max. 2 mm	Not permitted	Not permitted

Table 1 *(continued)*

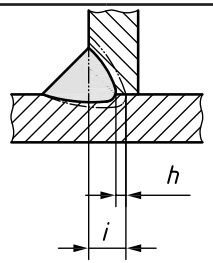
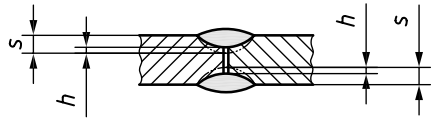
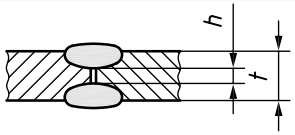
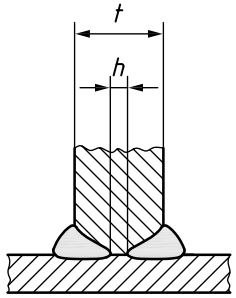
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
	402	Lack of penetration	 T-joint (partial penetration)  Butt joint (partial penetration)	≥ 0,5	Short imperfections: $h \leq 0{,}2\ s$ or $h \leq 0{,}2\ i$, but max. 2 mm	Short imperfections: $h \leq 0{,}1\ s$ or $h \leq 0{,}1\ i$, but max. 1,5 mm	Not permitted
			 Butt joint (full penetration)  T-joint (full penetration)	≥ 0,5	Short imperfections: $h \leq 0{,}2\ t$, but max. 2 mm	Not permitted	Not permitted

Table 1 *(continued)*

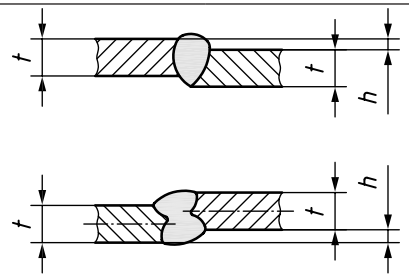
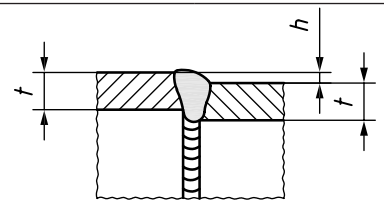
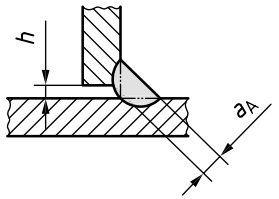
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
3 Imperfections in joint geometry							
3.1	507	Linear misalignment	The limits relate to deviations from the correct position. Unless otherwise specified, the correct position is that when the centrelines coincide (see also Clause 1). t refers to the smaller thickness.				
	5071	Linear misalignment between plates		0,5 to 3	$h \leq 0{,}25\ t + 0{,}2$ mm	$h \leq 0{,}15\ t + 0{,}2$ mm	$h \leq 0{,}1\ t + 0{,}2$ mm
				> 3	$h \leq 0{,}25\ t$ but max. 5 mm	$h \leq 0{,}15\ t$, but max. 4 mm	$h \leq 0{,}1\ t$, but max. 3 mm
			This applies for longitudinal welds in plates and hollow sections				
	5072	Linear misalignment between tubes		≥ 0,5	$h \leq 0{,}5\ t$, but max. 4 mm	$h \leq 0{,}5\ t$, but max. 3 mm	$h \leq 0{,}5\ t$, but max. 2 mm
			This applies for circumferential welds in tubes and hollow sections				
3.2	617	Incorrect root gap for fillet welds	Gap between the parts to be joined. Gaps exceeding the appropriate limit may, in certain cases, be compensated for by a corresponding increase in the throat thickness. 	0,5 to 3	$h \leq 0{,}1\ a_A + 0{,}5$ mm	$h \leq 0{,}1\ a_A + 0{,}3$ mm	$h \leq 0{,}1\ a_A + 0{,}2$ mm
				> 3	$h \leq 0{,}3\ a_A + 1$ mm, but max. 4 mm	$h \leq 0{,}2\ a_A + 0{,}5$ mm, but max. 3 mm	$h \leq 0{,}1\ a_A + 0{,}5$ mm, but max. 2 mm

Table 1 *(continued)*

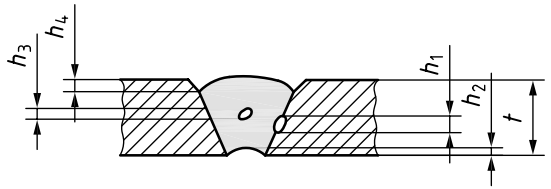
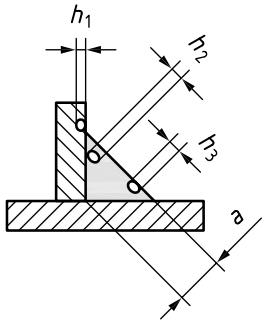
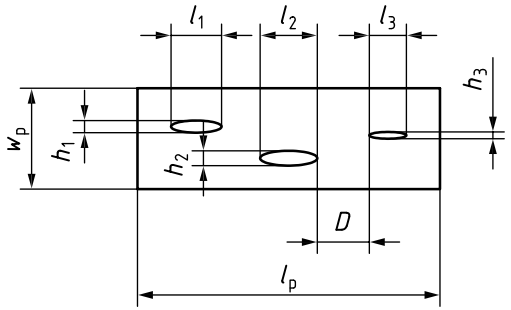
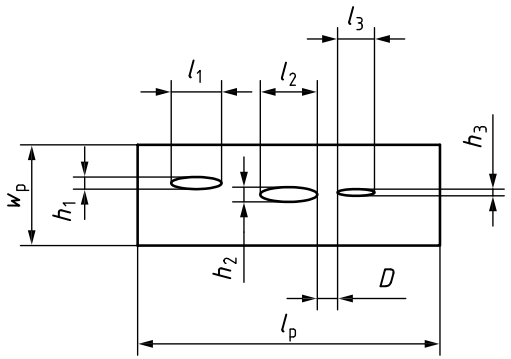
No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
4 Multiple imperfections							
4.1	None	Multiple imperfections in any cross-section which reduce the cross-section	502 Excess weld metal 503 Excessive convexity 504 Excessive penetration, 505 Incorrect weld toe, 506 Overlap, 512 Excessive asymmetry of fillet weld (excessive unequal leg length) and 5214 Excessive throat thickness are excluded  $h_1 + h_2 + h_3 + h_4 = \sum h$  $h_1 + h_2 + h_3 = \sum h$	0,5 to 3 > 3	Not permitted Maximum total height of imperfections: $\Sigma h \leq 0{,}4\ t$ or $\leq 0{,}4\ a$	Not permitted Maximum total height of imperfections: $\Sigma h \leq 0{,}3\ t$ or $\leq 0{,}3\ a$	Not permitted Maximum total height of imperfections: $\Sigma h \leq 0{,}2\ t$ or $\leq 0{,}2\ a$

Table 1 *(continued)*

No.	Reference to ISO 6520-1	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
4.2	None	Projected or cross-sectional area in longitudinal direction	Case 1 ($D > l_3$)  $h_1 \times l_1 + h_2 \times l_2 + h_3 \times l_3 = \Sigma h \times l$ Case 2 ($D < l_3$)  $h_1 \times l_1 + h_2 \times l_2 + \left(\frac{h_2 + h_3}{2}\right) \times D + h_3 \times l_3 = \Sigma h \times l$	≥ 0,5	$\Sigma h \times l \leq 16\ \%$	$\Sigma h \times l \leq 8\ \%$	$\Sigma h \times l \leq 4\ \%$
			The sum of the areas $\Sigma h \times l$ shall be calculated as a percentage to the evaluation area $l_p \times w_p$ (case 1). If D is smaller than the shorter length of one of the neighbouring imperfections, the full connection of the two imperfections shall be applied to the sum of imperfections (case 2). See also Annex A for information.				