

ISO 5817 guide for the assessment of discontinuities and imperfections in fusion-welded joints in steel, nickel and titanium

Acceptance limits	Limits for discontinuities and imperfections			Note:
	D	C	B	
Crack (100)/Crater crack (104)/Lack of fusion (401)/Burn through (510)				
$t \geq 0,5$ mm	Not permitted			
Surface pore (2017)				
$t = 0,5$ to 3 mm	$d \leq 0,3 \times s$ or a_A 0,6 mm*	Not permitted	Not permitted	Maximum dimension for a single pore for s = nominal butt weld thickness a_A = nominal throat thickness of the fillet weld
$t > 3$ mm	$d \leq 0,3 \times s$ or a_A max 3 mm	$d \leq 0,2 \times s$ or a_A max 2 mm		
s or $a_A = 3$ mm	0,9 mm	0,6 mm		
s or $a_A = 5$ mm	1,5 mm	1,0 mm		
s or $a_A = 8$ mm	2,4 mm	1,6 mm		
s or $a_A \geq 10$ mm	3,0 mm	2,0 mm		
End crater pipe (2025)				
$t = 0,5$ to 3 mm	$h \leq 0,2 \times s$ or a_A $d \leq 0,3 \times s$ or a_A	Not permitted	Not permitted	
$t = 2$ mm	$h \leq 0,4$ mm $d \leq 0,6$ mm			
$t > 3$ mm	$h \leq 0,2 \times s$ or a_A max 2 mm $d \leq 0,3 \times s$ or a_A max 3 mm	$h \leq 0,1 \times s$ or a_A max 1 mm $d \leq 0,2 \times s$ or a_A max 2 mm		
s or $a_A = 3,1$ mm	$h \leq 0,6$ mm $d \leq 0,9$ mm	$h \leq 0,3$ mm $d \leq 0,6$ mm		
s or $a_A = 5$ mm	$h \leq 1,0$ mm $d \leq 1,5$ mm	$h \leq 0,5$ mm $d \leq 1$ mm		
s or $a_A \geq 10$ mm	$h \leq 2,0$ mm $d \leq 3,0$ mm	$h \leq 1,0$ mm $d \leq 2,0$ mm		
Lack of fusion (401)				
$t = 0,5$ mm	Not permitted	Not permitted	Not permitted	
Micro lack of fusion (4014) (Can only be detected by microscopic examination $\geq 50 \times$)				
$t = 0,5$ mm	Not permitted	Not permitted	Not permitted	
Incomplete root penetration (4021)				
$t \geq 0,5$ mm	$h^* \leq 0,2 \times t$ max 2 mm	Not permitted	Not permitted	
$t = 2$ mm	0,4 mm*			
$t = 4$ mm	0,8 mm*			
$t = 6$ mm	1,2 mm*			
$t = 8$ mm	1,6 mm*			
$t \geq 10$ mm	2,0 mm*			
Undercut (5011/5012)				
$t = 0,5$ to 3 mm	$h^* \leq 0,2 \times t$ max 1 mm	$h^* \leq 0,1 \times t$ max 0,5 mm	Not permitted	
$t = 2$ mm	0,4 mm*	0,2 mm*		
$t > 3$ mm	$h \leq 0,2 \times t$ max 1 mm	$h \leq 0,1 \times t$ max 0,5 mm	$h \leq 0,05 \times t$ max 0,5 mm	
$t = 3,1$ mm	0,6 mm	0,3 mm	0,16 mm	
$t = 5$ mm	1,0 mm	0,5 mm	0,25 mm	
$t \geq 10$ mm	1,0 mm	0,5 mm	0,5 mm	
Shrinkage groove (5013)				
$t = 0,5$ to 3 mm	$h^* \leq 0,2 \times t$ max 1 mm	$h^* \leq 0,1 \times t$ max 0,5 mm	Not permitted	
$t = 2$ mm	0,4 mm*	0,2 mm*		
$t > 3$ mm	$h^* \leq 0,2 \times t$ max 2 mm	$h^* \leq 0,1 \times t$ max 1 mm	$h^* \leq 0,05 \times t$ max 0,5 mm	
$t = 3,1$ mm	0,6 mm*	0,3 mm*	0,16 mm*	
$t = 5$ mm	1,0 mm*	0,5 mm*	0,25 mm*	
$t \geq 10$ mm	2,0 mm*	1,0 mm*	0,5 mm*	
Excess weld metal (buttweld) (502)				
$t \geq 0,5$ mm	$h \leq 1,0+0,25 \times b$ max 10 mm	$h \leq 1,0+0,15 \times b$ max 7 mm	$h \leq 1,0+0,1 \times b$ max 5 mm	
$b = 5$ mm	2,25 mm	1,75 mm	1,5 mm	
$b = 10$ mm	3,5 mm	2,5 mm	2,0 mm	
$b = 15$ mm	4,75 mm	3,25 mm	2,5 mm	
Excess convexity (fillet weld) (503)				
$t \geq 0,5$ mm	$h \leq 1,0+0,25 \times b$ max 5 mm	$h \leq 1,0+0,15 \times b$ max 4 mm	$h \leq 1,0+0,1 \times b$ max 3 mm	
$b = 5$ mm	2,25 mm	1,75 mm	1,5 mm	
$b = 10$ mm	3,5 mm	2,5 mm	2,0 mm	
$b = 15$ mm	4,75 mm	3,25 mm	2,5 mm	
Excess penetration (504)				
$t = 0,5$ to 3 mm	$h \leq 1,0+0,6 \times b$	$h \leq 1,0+0,3 \times b$	$h \leq 1,0+0,1 \times b$	
$b = 2$ mm	2,2 mm	1,6 mm	1,2 mm	
$t > 3$ mm	$h \leq 1,0+1,0 \times b$ max 5 mm	$h \leq 1,0+0,45 \times b$ max 4 mm	$h \leq 1,0+0,2 \times b$ max 3 mm	
$b = 3$ mm	4,0 mm	2,8 mm	1,6 mm	
$b = 5$ mm	5,0 mm	4,0 mm	2,0 mm	
$b = 10$ mm	5,0 mm	4,0 mm	3,0 mm	
Incorrect weld toe (buttweld) (505)				
$t \geq 0,5$ mm	$\alpha \geq 90^\circ$	$\alpha \geq 110^\circ$	$\alpha \geq 150^\circ$	

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Overlap (506)				
$t \geq 0,5$ mm	$h \leq 0,2 \times b$	Not permitted	Not permitted	
$b = 10$ mm	2,0 mm			
$b = 20$ mm	4,0 mm			
Sagging (509)-Incompletely filled groove (511)				
$t = 0,5$ to 3 mm	$h^* \leq 0,25 \times t$	$h^* \leq 0,1 \times t$	Not permitted	
$t = 2$ mm	0,5 mm*	0,2 mm*		
$t > 3$ mm	$h^* \leq 0,25 \times t$ max 2 mm	$h^* \leq 0,1 \times t$ max 1 mm	$h^* \leq 0,05 \times t$ max 0,5 mm	
$t = 3,1$ mm	0,8 mm*	0,3 mm*	0,16 mm*	
$t = 5$ mm	1,25 mm*	0,5 mm*	0,25 mm*	
$t \geq 10$ mm	2,0 mm*	1,0 mm*	0,5 mm*	
Excessive asymmetry of fillet weld (512)				
$t \geq 0,5$ mm	$h \leq 2,0+0,2 \times a_A$	$h \leq 2,0+0,15 \times a_A$	$h \leq 1,5+0,15 \times a_A$	
$a = 3$ mm	2,6 mm	2,5 mm	3,0 mm	
$a = 4$ mm	2,8 mm	2,6 mm	2,1 mm	
$a = 5$ mm	3,0 mm	2,75 mm	2,25 mm	
$a = 7$ mm	3,4 mm	3,1 mm	2,6 mm	
$a = 10$ mm	4,0 mm	3,5 mm	3,0 mm	
Root concavity (515)				
$t = 0,5$ to 3 mm	$h \leq 0,2+0,1 \times t$	$h \leq 0,1 \times t^*$	Not permitted	
$t = 2$ mm	0,4 mm	0,2 mm*		
$t > 3$ mm	$h \leq 0,2 \times t^*$ max 2 mm	$h \leq 0,1 \times t^*$ max 1 mm	$h \leq 0,05 \times t^*$ max 0,5 mm	
$t = 3,1$ mm	0,6 mm*	0,3 mm*	0,16 mm*	
$t = 5$ mm	1,0 mm*	0,5 mm*	0,25 mm*	
$t \geq 10$ mm	2,0 mm*	1,0 mm*	0,5 mm*	
Insufficient throat thickness (5213)				
$t = 0,5$ to 3 mm	$h^* \leq 0,2+0,1 \times a$	$h^* \leq 0,2$	Not permitted	
$a = 2$ mm	0,4 mm*	0,2 mm*		
$t > 3$ mm	$h^* \leq 0,3+0,1 \times a$ max 2 mm	$h^* \leq 0,3+0,1 \times a$ max 1 mm		
$a = 3$ mm	0,6 mm*	0,6 mm*		
$a = 5$ mm	0,8 mm*	0,8 mm*		
$a = 10$ mm	1,3 mm*	1,0 mm*		
Excessive throat thickness (5214)				
$t \geq 0,5$ mm	Unlimited	$h \leq 1,0+0,2 \times a$ max 4 mm	$h \leq 1,0+0,15 \times a$ max 3 mm	
$a = 3$ mm		1,6 mm	1,45 mm	
$a = 5$ mm		2,0 mm	1,75 mm	
$a = 10$ mm		3,0 mm	2,5 mm	
Stray arc (601)				
$t \geq 0,5$ mm	Permitted, if the properties of the parent metal are not affected.	Not permitted	Not permitted	
Spatter (602)/Temper colour (610)				
$t \geq 0,5$ mm	Acceptance depends on application, e.g. material, corrosion, protection.			
Linear misalignment between plates (5071)				
$t = 0,5$ to 3 mm	$h \leq 0,2+0,25 \times t$	$h \leq 0,2+0,15 \times t$	$h \leq 0,2+0,1 \times t$	
$t = 2$ mm	0,7 mm	0,5 mm	0,4 mm	
$t > 3$ mm	$h \leq 0,25 \times t$ max 5 mm	$h \leq 0,15 \times t$ max 4 mm	$h \leq 0,1 \times t$ max 3 mm	
$t = 3,1$ mm	0,8 mm	0,5 mm	0,3 mm	
$t = 10$ mm	2,5 mm	1,5 mm	1,0 mm	
$t = 15$ mm	3,8 mm	2,3 mm	1,5 mm	
Circumferential misalignment (5072)				
$t \geq 0,5$ mm	$h \leq 0,5 \times t$ max 4 mm	$h \leq 0,5 \times t$ max 3 mm	$h \leq 0,5 \times t$ max 2 mm	
$t = 3$ mm	1,5 mm	1,5 mm	1,5 mm	
$t = 6$ mm	3,0 mm	3,0 mm	2,0 mm	
$t \geq 10$ mm	4,0 mm	3,0 mm	2,0 mm	
Incorrect root gap for fillet welds (617)				
$t = 0,5$ to 3 mm	$h \leq 0,5+0,1 \times a_A$	$h \leq 0,3+0,1 \times a_A$	$h \leq 0,2+0,1 \times a_A$	
$a_A = 2$ mm	0,7 mm	0,5 mm	0,4 mm	
$t \geq 3$ mm	$h \leq 1+0,3 \times a$ max 4 mm	$h \leq 0,5+0,2 \times a$ max 3 mm	$h \leq 0,5+0,1 \times a$ max 2 mm	
$a_A = 4$ mm	2,2 mm	1,3 mm	0,9 mm	
$a_A = 6$ mm	2,8 mm	1,7 mm	1,1 mm	
$a_A = 10$ mm	4,0 mm	2,5 mm	1,5 mm	
Incorrect weld toe (fillet weld) (505)				
$t \geq 0,5$ mm	$\alpha \geq 90^\circ$	$\alpha \geq 100^\circ$	$\alpha \geq 110^\circ$	

*** Short discontinuities and imperfections**

Where the weld is 100 mm or more in length, discontinuities and imperfections shall be considered as short if their total length does not exceed 25 mm in the 100 mm containing the largest number of discontinuities and imperfections.

Where the weld is less than 100 mm in length, discontinuities and imperfections shall be considered as short if their total length does not exceed 25 % of the weld length.

Kiwa is not responsible for any errors.