

**VSG**

**VSG Quality Inspection Standard**

**For**

**Manual and Robotic Welding**

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**Certified Welding Inspector**

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**DISTRIBUTION**

Distribution via company intranet

**REVISION LOG**

<b>ISSUE</b>	<b>DATE</b>	<b>REASON</b>
1	10/24/2019	Original Issue
2	2/2/2021	Changed record retention, clarified scope/ responsibility

## **2.0 Scope**

This standard applies to and robotic or manual welds produced at VSG facilities or received on externally supplied products that will be sold by VSG.

## **3.0 Responsibility**

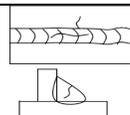
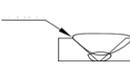
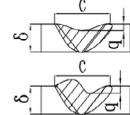
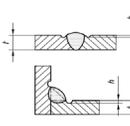
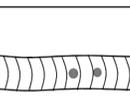
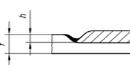
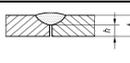
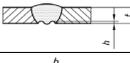
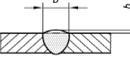
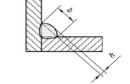
The VSG Certified Welding Inspector is responsible for oversight of this standard.

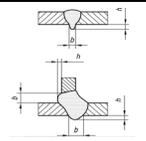
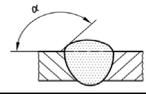
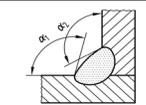
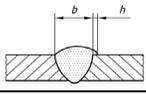
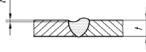
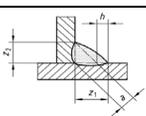
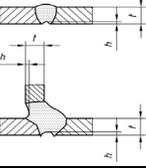
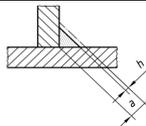
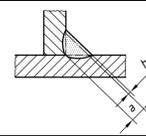
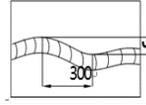
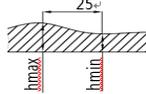
## **4.0 Reference Documents**

AWS D1.1/D1.1M:2015  
Structural Welding Code Steel

ISO 5817:2014  
Welding-Fusion-welded joints in steel, nickel, titanium and  
their alloys (beam welding excluded)- Quality levels for imperfections

5.0 Inspection Criteria

ITEM	Weld Defective	Graphic	Structural Acceptance Criteria	Related Standard	Cosmetic Criteria
1	Crack Prohibition		Any crack shall be unacceptable, regardless of size or location.	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	
2	Weld/Base Metal Fusion		Complete fusion shall exist between adjacent layers of weld metal and between weld metal and base metal.	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	
3	Crater Cross Section		All craters shall be filled to provide the specified weld size, except for the ends of intermittent fillet welds outside of their effective length.	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	
4	Undersized Welds		The size of a fillet weld in any continuous weld may be less than the specified nominal size (L) without correction by the following amounts (U): $L$ specified nominal weld size, in [mm] $\leq 3/16 [5]$ $1/4 [6]$ $\geq 5/16 [8]$ $U,$ allowable decrease from L, in [mm] $\leq 1/16 [2]$ $\leq 3/32 [2.5]$ $\leq 1/8 [3]$ In all cases, the undersize portion of the weld shall not exceed 10% of the weld length. On web-to-flange welds on girders, underrun shall be prohibited at the	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	
5	Undercut		In primary members, undercut shall be no more than 0.01 in [0.25 mm] deep when the weld is transverse to tensile stress under any design loading condition. Undercut shall be no more than 1/32 in [1 mm] deep for all other cases.	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	For cosmetic reasons, VSG will limit undercut on all welds visible to the customer to 0.01 in [0.25mm]
6	Porosity		The frequency of piping porosity in fillet welds shall not exceed one in each 4 in [100 mm] of weld length and the maximum diameter shall not exceed 3/32 in [2.5 mm]. <b>Exception:</b> for fillet welds connecting stiffeners to web, the sum of the diameters of piping porosity shall not exceed 3/8 in [10 mm] in any linear inch of weld and shall not exceed 3/4 in [20 mm] in any 12 in [300 mm] length of weld.  CJP groove welds in butt joints transverse to the direction of computed tensile stress shall have no piping porosity. For all other groove welds, the frequency of piping porosity shall not exceed one in 4 in [100 mm] of length and the maximum diameter shall not exceed 3/32 in [2.5 mm].	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	For cosmetic reasons, VSG will reject any porosity in welds visible to the customer.
7	End crater		All craters shall be filled to provide the specified weld size, except for the ends of intermittent fillet welds outside of their effective length.	AWS D1.1/D1.1M:2015 (Cyclically Loaded Nontubular Connections)	
8	Incomplete root penetration		Only for single side butt welds, Not permitted	ISO 5817:2014 (E) Grade C	
9	Shrinkage groove		Smooth transition is required, Short imperfections: $h \leq 0,1 t$ , but max.1 mm	ISO 5817:2014 (E) Grade C	
10	Excess weld metal (butt weld)		Smooth transition is required. $h \leq 1 \text{ mm} + 0,15 b$ , but max. 7 mm.	ISO 5817:2014 (E) Grade C	
11	Excessive convexity (fillet weld)		$h \leq 1 \text{ mm} + 0,15 b$ , but max. 4 mm	ISO 5817:2014 (E) Grade C	

ITEM	Weld Defective	Graphic	Structural Acceptance Criteria	Related Standard	Cosmetic Criteria
12	Excess penetration		$h \leq 1 \text{ mm} + 0,6 b$ , but max. 4 mm	ISO 5817:2014 (E) Grade C	
13	Incorrect weld toe		butt welds, $\alpha \geq 110^\circ$	ISO 5817:2014 (E) Grade C	
			fillet welds, $\alpha \geq 100^\circ$	ISO 5817:2014 (E) Grade C	
14	Overlap		Not permitted	ISO 5817:2014 (E) Grade C	
15	Incompletely filled groove		Smooth transition is required, Short imperfections: $h \leq 0,1 t$ , but max. 1 mm	ISO 5817:2014 (E) Grade C	
16	Burn through		Not permitted	ISO 5817:2014 (E) Grade C	
17	Excessive asymmetry of fillet weld (excessive unequal leg length)		In cases where an asymmetric fillet weld has not been prescribed. $h \leq 2 \text{ mm} + 0,15 a$	ISO 5817:2014 (E) Grade C	
18	Root concavity		Smooth transition is required. Short imperfections: $h \leq 0,1 t$ , but max. 1 mm	ISO 5817:2014 (E) Grade C	
19	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)	Not permitted	ISO 5817:2014 (E) Grade C	
20	Poor restart		Not permitted	ISO 5817:2014 (E) Grade C	
21	Insufficient throat thickness		Not applicable to processes with proof of greater depth of penetration. Short imperfections: $h \leq 0,3 \text{ mm} + 0,1 a$ , but max. 1 mm	ISO 5817:2014 (E) Grade C	
22	Excessive throat thickness		The actual throat thickness of the fillet weld is too large. $h \leq 1 \text{ mm} + 0,2 a$ , but max. 4 mm	ISO 5817:2014 (E) Grade C	
23	Stray arc		Not permitted	ISO 5817:2014 (E) Grade C	
24	Spatter		Acceptance depends on application, e.g. material, corrosion protection	ISO 5817:2014 (E) Grade C	
25	Temper colour (Discolouration)		Acceptance depends on application, e.g. material, corrosion protection	ISO 5817:2014 (E) Grade C	
26	Weld straightness		Weld straightness f shall not more than 2mm in 300 mm of length.	-----	
27	Weld Size Variation		$h_{\text{max}} - h_{\text{min}} \leq 1,5$ in 25 mm of length.	-----	

## **6.0 Records**

Any records deemed necessary and generated in reference to this standard will be retained for at least five years.