

Stainless Steels

DATA SHEET

B-37

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CRYOGENIC 308LCF CONSUMABLES

Alloy type

Controlled ferrite 308L austenitic stainless steels for joining 304L base materials used in cryogenic applications.

Materials to be welded

ASTM	BS EN & DIN
304L	1.4306
304	1.4301
304LN	1.4311
CF3	1.4308
CF8	

BS	UNS
304S11	S 30403
304S15/16/31	S 30400
304S61	S 30453
304C12	
304C15	

Applications

Used to weld 18/8 stainless steels with service temperatures down to -196°C . The controlled ferrite SMAW electrodes and flux cored wires are specifically designed for cryogenic service; they are not batch selected consumables.

Applications include **pipework** and **vessels** subject to **cryogenic service** (-196°C) eg **LNG**.

Standard 308L consumables for general purpose fabrication can be found in data sheet B-30. The 308L consumables covered here are not suitable for 304/304H in elevated temperature structural applications, see data sheets C-10 and C-12.

Microstructure

Austenite with a controlled level of ferrite, 2-5FN (3-8FN for solid wires).

Welding guidelines

No preheat, maximum interpass temperature 250°C (300°C may be acceptable on thicker section material); no PWHT required.

For optimum impact properties use heat inputs at the higher end of the allowable ranges.

Additional information

There is a Technical Profile covering the use of the controlled ferrite consumables for LNG applications.

G B Holloway et al 'Stainless steel arc welding consumables for cryogenic applications.' Stainless Steel World America 2004 Conference, Houston, 2004.

Related alloy groups

General purpose 308L stainless steel consumables are in data sheet B-30. Stainless steel consumables for high temperature applications on 304H can be found in data sheets C-10 or C-12.

Products available


Process	Product	Specification
MMA	Ultramet 308LCF	AWS E308L-16
	Ultramet B308LCF	AWS E308L-15
TIG	ER308LCF	AWS ER308L
SAW	ER308LCF	AWS ER308L
	LA491	BS EN SA FB255
FCW	Supercore 308LCF	AWS E308LT1-1/4

General Data for all 308L MMA Electrodes

Storage	<p>3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin is satisfactory for longer than a working shift of 8h. Excessive exposure of electrodes to humid conditions will cause some moisture pick-up and increase the risk of porosity.</p> <p>For electrodes that have been exposed: Redry 200 – 300°C/1-2h to restore to as-packed condition. Maximum 400° C, 3 cycles, 10h total. Storage of redried electrodes at 50 – 200°C in holding oven or heated quiver: no limit, but maximum 6 weeks recommended. Recommended ambient storage conditions for opened tins (using plastic lid): < 60% RH, > 18°C.</p>																
Fume data	<p>Fume composition, wt % typical:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Fe</th> <th>Mn</th> <th>Cr</th> <th>Ni</th> <th>Mo</th> <th>Cu</th> <th>F *</th> <th>OES (mg/m³)</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>5</td> <td>5</td> <td>0.8</td> <td>-</td> <td>< 0.2</td> <td>16</td> <td>1</td> </tr> </tbody> </table> <p>* F=28% for basic coated Ultramet B308LCF but this does not affect the OES.</p>	Fe	Mn	Cr	Ni	Mo	Cu	F *	OES (mg/m ³)	8	5	5	0.8	-	< 0.2	16	1
Fe	Mn	Cr	Ni	Mo	Cu	F *	OES (mg/m ³)										
8	5	5	0.8	-	< 0.2	16	1										


ULTRAMET 308LCF

Rutile MMA electrode for cryogenic 304L applications

Product description	<p>MMA electrode – special rutile flux coated 308L electrode on high purity 304L core wire. Versatile downhand and positional capability, Ultramet 308LCF has a controlled composition and ferrite content designed for cryogenic service requiring >0.38mm lateral expansion at minus 130-196°C. Also suitable for unusual occasions when 304L is specified for service up to 550°C and corrosion conditions preclude the use of 308H.</p> <p>Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.</p>												
Specifications	AWS A5.4		E308L-16										
	BS EN 1600		E 19 9 L R 3 2										
	BS 2926		19.9.LR										
	DIN 8556		19 9 L R 2 3										
ASME IX Qualification	QW432 F-No 5, QW442 A-No 8												
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN		
	min	--	0.5	--	--	--	18.0	9.0	--	--	2		
	max	0.04	2.0	0.90	0.025	0.030	21.0	11.0	0.50	0.5	5		
	typ	<0.025	1	0.6	0.01	0.02	18.5	10	0.1	<0.1	3		
All-weld mechanical properties	As welded						min	typical					
	Tensile strength						MPa	520	600				
	0.2% Proof stress						MPa	320	445				
	Elongation on 4d						%	35	50				
	Elongation on 5d						%	30	46				
	Reduction of area						%	--	43				
	Impact energy						-100°C	J	--	45			
							-196°C	J	--	35			
	Lateral expansion *						-196°C	mm	0.38	0.50			
	* Batch tested for Charpy lateral expansion >0.38mm at -196°C.												
Operating parameters	DC +ve or AC (OCV: 50V min)												
													
	∅ mm	2.5		3.2		4.0		5.0					
	min A	60		75		100		130					
	max A	90		120		155		210					
Packaging data	∅ mm	2.5		3.2		4.0		5.0					
	length mm	300		350		350		450					
	kg/carton	11.4		13.5		13.5		16.2					
	pieces/carton	618		396		261		159					

ULTRAMET B308LCF

Basic coated MMA pipe-welding electrode for 304L

Product description	<p>MMA electrode – designed and manufactured to give high moisture resistance using a basic flux system and high purity 304L core wire. Ultramet B308LCF is particularly suited to the most demanding vertical and overhead welding applications including fixed pipework in the ASME 5G/6G position. Under site conditions it is tolerant to adverse wind and drafts.</p> <p>Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.</p>										
Specifications	AWS A5.4	E308L-15									
	BS EN 1600	E 19 9 L B 4 2									
	BS 2926	19.9.LB									
	DIN 8556	E 19 9 L B 20+									
ASME IX Qualification	QW432 F-No 5, QW442 A-No 8										
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN
	min	--	0.5	--	--	--	18.0	9.0	--	--	2
	max	0.04	2.0	0.90	0.025	0.030	21.0	11.0	0.50	0.5	5
	typ	0.03	1.2	0.3	0.01	0.015	18.5	10	0.05	<0.1	3
All-weld mechanical properties	As welded					min		typical			
	Tensile strength					MPa		520 600			
	0.2% Proof stress					MPa		320 440			
	Elongation on 4d					%		35 44			
	Elongation on 5d					%		30 40			
	Reduction of area					%		-- 60			
	Impact energy					+20°C		J -- 80-120			
						-196°C		J -- 35-50			
	Lateral expansion *					-196°C		mm 0.38 0.55			
	* Batch tested for Charpy lateral expansion >0.38mm at -196°C.										
Operating parameters	DC +ve only.										
	∅ mm	2.5		3.2		4.0					
	min A	60		75		100					
	max A	90		120		155					
Packaging data	∅ mm	2.5		3.2		4.0					
	length mm	300		350		350					
	kg/carton	12.0		13.5		13.5					
	pieces/carton	681		396		261					

ER308LCF

308L solid wire for cryogenic 304L applications

Product description	Batch selected solid wire for TIG and sub-arc welding.										
Specifications	AWS A5.9	ER308L									
	BS EN ISO 14343-A	19 9 L									
	BS EN ISO 14343-B	SS308L									
	BS 2901: Pt2	308S92									
	DIN 8556	SG X2CrNi 19 9 (1.4316)									
ASME IX Qualification	QW432 F-No 6, QW442 A-No 8										
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN
	min	--	1.0	0.30	--	--	19.5	9.0	--	--	3
	max	0.025	2.0	0.65	0.020	0.030	21.0	11.0	0.3	0.3	8
	typ	0.01	1.7	0.4	0.01	0.015	20	10	0.1	0.15	7
All-weld mechanical properties	As welded					min	typical				
							TIG	SAW + LA491			
	Tensile strength					MPa	510	605	570		
	0.2% Proof stress					MPa	320	465	450		
	Elongation on 4d					%	30	35	41		
	Elongation on 5d					%	30	33	37		
	Impact energy					-130°C	J	--	110		50
						-196°C	J	--	80		30
	Lateral expansion *					-196°C	mm	0.38	1.0		0.5
* ER308LCF SAW wire batch tested, with LA491 flux, for Charpy lateral expansion >0.38mm at -196°C.											
Typical operating parameters		TIG			SAW						
	Shielding	Argon			LA491						
	Current	DC-			DC+						
	Diameter	2.4mm			2.4mm						
	Parameters	100A, 12V			350A, 30V						
Packaging data	ø mm	TIG			SAW						
	1.6	2.5kg tube			--						
	2.4	2.5kg tube			25kg coil						
	3.2	2.5kg tube			25kg coil						
Fume data	MIG fume composition (wt %) (TIG and SAW fume negligible)										
		Fe	Mn	Cr ³	Ni	Mo	Cu	OES (mg/m ³)			
		32	12	16	8	< 0.5	< 0.5	3.1			

SUPERCORE 308LCF Rutile all positional flux cored wire for cryogenic 304L applications

Product description	<p>Supercore 308LCF has a controlled composition and ferrite content designed for cryogenic service requiring >0.38mm lateral expansion at minus 130-196°C.</p> <p>Supercore 308LCF is designed for all-positional welding including fixed pipework. Metal recovery is about 90% with respect to the wire.</p>											
Specifications	AWS A5.22		E308LT1-1/4									
	BS EN ISO 17633-A		T 19 9 L P C/M 2									
	BS EN ISO 17633-B		TS308L-FB1									
ASME IX Qualification	QW432 F-No 6, QW442 A-No 8											
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN	
	min	--	0.5	0.2	--	--	18.0	9.0	--	--	2	
	max	0.04	2.0	1.0	0.025	0.030	21.0	11.0	0.3	0.3	5	
	typ	0.03	1.4	0.6	0.01	0.02	18.6	10.5	0.1	0.1	3	
All-weld mechanical properties	As welded						min	typical				
	Tensile strength					MPa	520	540				
	0.2% Proof stress					MPa	320	400				
	Elongation on 4d					%	35	50				
	Elongation on 5d					%	30	46				
	Reduction of area					%	--	50				
	Impact energy				+ 20°C	J	--	74				
					-130°C	J	--	40				
					-196°C	J	--	36				
	Lateral expansion *				-196°C	mm	0.38	0.70				
* Batch tested for Charpy lateral expansion >0.38mm at -196°C.												
Operating parameters	Shielding gas: 80%Ar-20%CO ₂ or 100% CO ₂ at 20-25l/min. Proprietary gases may be used but argon should not exceed 85%.											
	Current: DC+ve ranges as below for Ar-20%CO ₂ . Welding with 100%CO ₂ requires approx 3V higher:											
	ø mm	amp-volt range					typical			stickout		
1.2	120 – 280A, 22 – 34V					180A, 29V (downhand) 150A, 25V (positional)			15 – 20mm			
Packaging data	<p>Spools vacuum-sealed in barrier foil with cardboard carton: 15kg (33 lbs)</p> <p>The as-packed shelf life is virtually indefinite.</p> <p>Resistance to moisture absorption is high, but to maintain the high integrity of the wire surface and prevent any possibility of porosity, it is advised that part-used spools are returned to polythene wrappers.</p> <p>Where possible, preferred storage conditions are 60% RH max, 18°C min.</p>											
Fume data	Fume composition (wt %)											
		Fe	Mn	Ni	Cr ³	Cr ⁶	Cu	F	OES (mg/m ³)			
		17	10	1.5	3	5	< 1	5	1			