

Stainless Steels

DATA SHEET

B-61

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25%Cr SUPERDUPLEX - ZERON[®] 100

Alloy type

25%Cr superduplex ferritic-austenitic stainless steels matching the proprietary Zeron[®] 100 alloy.

Materials to be welded

Matching

wrought:	cast:
UNS S32760	UNS J93380, DIN 1.4508
DIN 1.4501	ASTM A890 6A,
ASTM A182 F55	ACI CD3MWCuN

Other superduplex, including

wrought:
 UNS S32750, 2507 (Sandvik/Avesta), UR47N (CLI)
 UNS S32550, S32520, UR52N+ (CLI), Ferralium SD40 (Meighs)
 UNS S39274, DP3W (Sumitomo), UNS S32950, 7-Mo Plus (Carpenter)

cast:
 UNS J93404, DIN 1.4469
 ASTM A890 5A, ACI CE3MN

Applications

Zeron[®] 100 has an exceptional combination of strength and resistance to corrosion and erosion in a wide range of aggressive media. The presence of Cu+W provides superior resistance to sulphuric and hydrochloric acids when compared to similar alloys without these additions. Offshore applications exploit the high resistance to pitting and stress-corrosion cracking in seawater. It is also highly resistant to caustic alkalis and phosphoric acid. Service temperature range is usually limited to -50°C to 280°C, the upper limit owing to thermal instability ("450°C" and sigma embrittlement).

It is widely used in **oil and gas production** and **process pipework, risers, manifolds, pressure vessels, valves, pumps, desalination plant**, systems for **flue-gas desulphurisation (FGD)** and also in the **mining, chemical and pharmaceutical** industries. Zeron[®] 100 wires are also used for joining supermartensitic stainless steels.

Microstructure

Multipass welds in the as-welded condition consist of a duplex austenite-ferrite microstructure with an approximate 30-60% ferrite level, depending on heat input/cooling conditions.

Welding guidelines

Preheat not generally required. Interpass temperature 150°C max. Heat input in the range 1.0–2.0 kJ/mm (depending on material thickness) should be acceptable but most codes restrict the max to 1.5 or 1.75kJ/mm.

PWHT

Although welds in wrought duplex stainless steels are almost always left in the as-welded condition, major repairs to castings are generally specified in the solution treated condition. Experience has indicated good properties following 1120°C/3-6h + water quench.

Additional information

Further information on the welding of Zeron[®] 100 is available in the Metrode Technical Profile on duplex and superduplex.

Related alloy groups

2507 superduplex (data sheet B-62) and matching consumables for casting repair (solution annealed) applications.

Products available

Process	Product	Specification
MMA	Zeron[®] 100XKS	BS EN E25 9 4 NLB
TIG/MIG/SAW	Zeron[®] 100X	BS EN 25 9 4 NL
SAW flux	SSB LA491	BS EN SA AF 2 BS EN SA FB 2
FCW	Supercore Z100XP	AWS E2594T1-4

General Data for all Zeron[®] 100 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 style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="border-bottom: 1px solid black;">Fe</th> <th style="border-bottom: 1px solid black;">Mn</th> <th style="border-bottom: 1px solid black;">Ni</th> <th style="border-bottom: 1px solid black;">Cr</th> <th style="border-bottom: 1px solid black;">Cu</th> <th style="border-bottom: 1px solid black;">Mo</th> <th style="border-bottom: 1px solid black;">V</th> <th style="border-bottom: 1px solid black;">F</th> <th style="border-bottom: 1px solid black;">OES (mg/m³)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">6</td> <td style="text-align: center;">1</td> <td style="text-align: center;">7</td> <td style="text-align: center;">0.5</td> <td style="text-align: center;">0.2</td> <td style="text-align: center;"><0.1</td> <td style="text-align: center;">28</td> <td style="text-align: center;">0.7</td> </tr> </tbody> </table>	Fe	Mn	Ni	Cr	Cu	Mo	V	F	OES (mg/m ³)	7	6	1	7	0.5	0.2	<0.1	28	0.7
Fe	Mn	Ni	Cr	Cu	Mo	V	F	OES (mg/m ³)											
7	6	1	7	0.5	0.2	<0.1	28	0.7											

ZERON[®] 100XKS

Basic pipe-welding electrode for superduplex

Product description	<p>Basic coated all-positional MMA electrode for welding Zeron[®] 100 and other superduplex alloys for service in the as-welded condition. This electrode is overmatching with respect to nickel content to achieve correct austenite-ferrite microstructural phase balance. It is designed for the most demanding vertical and overhead welding positions such as fixed pipework qualified in the ASME 6G position.</p> <p>Fully alloyed matching Zeron[®] 100 core wire including W and Cu. Moisture resistant flux technology.</p> <p>Recovery is about 105% with respect to core wire, 65% with respect to whole electrode.</p>														
Specifications	AWS A5.4 E2595-15 BS EN 1600 E 25 9 4 N L B 4 2 Weir Materials Approvals MDS 12809/08 ABS, DNV														
ASME IX Qualification	QW432 F-No 5, QW442 A-No 8														
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	W	Cu	N	PRE _N	PRE _W	
	min	--	--	--	--	--	24.0	9.0	3.5	0.5	0.5	0.2	40	40	
	max	0.03	1.0	1.0	0.01	0.03	26.0	10.0	4.0	1.0	1.0	0.3	--	--	
	typ	0.025	0.9	0.5	0.005	0.02	25	9.3	3.6	0.7	0.7	0.23	41	42	
	Pitting resistance equivalent PRE _N = Cr + 3.3Mo + 16N Pitting resistance equivalent PRE _W = Cr + 3.3Mo + 1.65W + 16N														
All-weld mechanical properties	As welded						min	typical							
	Tensile strength						MPa	760	800-950						
	0.2% Proof stress						MPa	550	650-750						
	Elongation on 4d						%	15	30						
	Elongation on 5d						%	20	22-27						
	Reduction of area						%	--	40-45						
	Impact energy														
Hardness						HV	--	270-320							
Operating parameters	DC +ve														
	∅ mm						2.5	3.2	4.0	5.0					
	min A						50	70	100	130					
	max A						75	95	155	210					
Packaging data	∅ mm						2.5	3.2	4.0	5.0					
	length mm						300	350	350	350					
	kg/carton						12.0	14.1	13.5	13.5					
	pieces/carton						696	360	270	172					

ZERON[®] 100X

Solid welding wire for superduplex

Product description	Solid wire for TIG, MIG and SAW. For applications where Zeron [®] 100X wire is to be used for welding supermartensitic stainless steels it is possible for wire to be supplied with a total hydrogen content of 3ppm maximum.															
Specifications	AWS A5.9		ER2594													
	BS EN ISO 14343-A		25 9 4 N L (prefix W=TIG, G=MIG, S=SAW)													
	Weir Materials		MDS 12809/07													
	Approvals		ABS, DNV (TIG and SAW in conjunction with SSB flux)													
ASME IX Qualification	QW432 F-No 6, QW442 A-No 8															
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	W	Cu	N	PRE _N	PRE _W		
	min	--	--	--	--	--	24.0	9.0	3.5	0.5	0.5	0.2	40	40		
	max	0.03	1.0	1.0	0.01	0.03	26.0	10.0	4.0	1.0	1.0	0.3	--	--		
	typ	0.015	0.7	0.4	0.002	0.02	25	9.3	3.7	0.6	0.7	0.23	41	42		
All-weld mechanical properties	Typical values as welded					min	TIG	MIG	SAW	TIG +160°C						
	Tensile strength					MPa	760	870	860	885	769					
	0.2% Proof stress					MPa	550	695	645	700	523					
	Elongation on 4d					%	15	36	25	26	39					
	Elongation on 5d					%	20	32	23	24	34					
	Reduction of area					%	--	68	28	48	72					
	Impact energy					-50°C	J	--	130	60	40	--				
						-75°C	J	--	>100	--	--	--				
	Hardness cap/mid					HV	--	290	290	290	--					
Typical operating parameters		TIG			MIG			SAW								
	Shielding	Argon			Ar/He/CO ₂			SSB flux								
	Current	DC-			pulsed			DC+								
	Diameter	1.6/2.4mm			1.2mm			1.6mm								
	Voltage	100A, 12V			180A, 28V			350A, 30V								
Packaging data	ø mm	TIG			MIG			SAW								
	0.8	--			To order			--								
	1.0	--			To order			--								
	1.2	--			To order			--								
	1.6	2.5kg tube			--			25kg coil								
	2.0	2.5kg tube			--			--								
	2.4	2.5kg tube			--			25kg coil								
	3.2	2.5kg tube			--			--								
Fume data	MIG fume composition (wt %) (TIG and SAW fume negligible)															
		Fe	Mn	Cr ³	Ni	Mo	Cu	OES (mg/m ³)								
		28	10	22	8	2	1.3	2.3								

SSB FLUX

Sub-arc flux

Product description	Agglomerated basic non-alloying flux for submerged arc welding.											
Specifications	DIN 32522 BS EN 760	BFB6 63353 DC8M SA AF2 DC										
ASME IX Qualification	QW432 F-No -, QW442 A-No -											
Composition (typical)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	W	N
	Zeron® 100X wire	0.015	0.7	0.4	0.002	0.023	25	9.3	3.7	0.7	0.7	0.23
	Deposit	0.02	0.6	0.4	0.002	0.02	24.5	9.3	3.6	0.7	0.7	0.21
All-weld mechanical properties with Zeron® 100X wire	Typical values as welded				min		SAW					
	Tensile strength				MPa	750	890					
	0.2% Proof stress				MPa	550	700					
	Elongation on 4d				%	--	25					
	Elongation on 5d				%	20	24					
	Reduction of area				%	--	>40					
	Impact energy	- 50°C			J	--	40					
Hardness				HV	--	290						
Operating parameters	Current: DC +ve ranges as below:											
	∅ mm	amp-volt range				typical			stickout			
	1.6	200-350A, 27-31V				300A, 28V			20-25mm			
	2.4	250-450A, 28-32V				350A, 29V			20-25mm			
Packaging data	Metrode SSB Flux is supplied in sealed moisture resistant 20kg metal drums. Preferred storage conditions for opened drums: < 60%RH, > 18°C. If the flux has become damp or has been stored for a long period, it should be redried in the range 250-400°C/1-3h.											

LA491 FLUX

Sub-arc flux

Product description	Agglomerated fluoride-basic non-alloying flux for submerged arc welding.											
Specifications	DIN 32522 BS EN 760	B FB 6 55455 AC 8 SA FB 255 AC										
ASME IX Qualification	QW432 F-No -, QW442 A-No -											
Composition (typical)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	W	N
	Zeron® 100X wire	0.015	0.7	0.4	0.002	0.02	25	9.3	3.7	0.7	0.7	0.23
	Deposit	0.02	0.6	0.4	0.002	0.02	24.5	9.3	3.6	0.7	0.7	0.21
All-weld mechanical properties with Zeron® 100X wire	Typical values as welded				min		SAW					
	Tensile strength				MPa	750	890					
	0.2% Proof stress				MPa	550	700					
	Elongation on 4d				%	--	25					
	Elongation on 5d				%	20	24					
	Reduction of area				%	--	>40					
	Impact energy	- 50°C			J	--	40					
Hardness				HV	--	290						
Operating parameters	Current: DC +ve ranges as below:											
	∅ mm	amp-volt range				typical			stickout			
	1.6	200-350A, 27-31V				300A, 28V			20-25mm			
	2.4	250-450A, 28-32V				350A, 29V			20-25mm			
Packaging data	Metrode LA491 Flux is supplied in sealed moisture resistant 20kg metal drums. Preferred storage conditions for opened drums: < 60%RH, > 18°C. If the flux has become damp or has been stored for a long period, it should be redried in the range 300-350°C/1-3h.											

SUPERCORE Z100XP

Rutile flux cored wire for superduplex stainless steel

Product description	Flux cored wire made with an alloyed stainless steel sheath and rutile flux system. Supercore Z100XP combines easy operability, high deposit quality for both positional pipework and downhand welding. Metal recovery is about 90% with respect to the wire.															
Specifications	AWS A5.22		E2594T1-4													
	BS EN ISO 17633-B		TS 2594-F M21 1													
ASME IX Qualification	QW432 F-No --, QW442 A-No --															
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	W	N	PRE _N	PRE _W		
	min	--	0.5	--	--	--	24.0	8.5	3.5	0.5	0.5	0.2	40	40		
	max	0.04	1.5	1.0	0.02	0.03	26.0	10.0	4.0	1.0	1.0	0.3	--	--		
	typ	0.03	1.0	0.5	0.005	0.02	24.5	9.1	3.7	0.6	0.6	0.22	41	42		
	Pitting resistance equivalent PRE _N = Cr + 3.3Mo + 16N Pitting resistance equivalent PRE _W = Cr + 3.3Mo + 1.65W + 16N															
All-weld mechanical properties	As welded						min	typical								
	Tensile strength						MPa	760	880							
	0.2% Proof stress						MPa	550	690							
	Elongation on 4d						%	15	27							
	Elongation on 5d						%	18	25							
	Reduction of area						%	--	33							
	Impact energy						-20°C	J	--	40						
							-50°C	J	--	32						
	Hardness						HV	--	280							
							HRC	--	26							
Operating parameters	Shielding gas: 80%Ar-20%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 :															
	ø mm	amp-volt range						typical	stickout							
1.2	120 – 250A, 22 – 34V						180A, 29V	15 – 20mm								
Packaging data	Spools vacuum-sealed in barrier foil with cardboard carton: 15kg The as-packed shelf life is virtually indefinite. 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. Where possible, preferred storage conditions are 60% RH max, 18°C min.															
Fume data	Fume composition (wt %)															
		Fe	Mn	Ni	Cr ³	Cr ⁶	Cu	F	OES (mg/m ³)							
		14	10	1.5	5	5	< 1	5	1.0							