

Stainless Steels

DATA SHEET

B-59

METRODE PRODUCTS LTD
 HANWORTH LANE, CHERTSEY
 SURREY, KT16 9LL
 Tel: +44(0)1932 566721
 Fax: +44(0)1932 565168 Sales
 Fax: +44(0)1932 569449 Technical
 Fax: +44(0)1932 566199 Export
 Email: info@metrode.com
 Internet: http://www.metrode.com

LEAN DUPLEX STAINLESS STEELS

Alloy type

Lean duplex ferritic-austenitic stainless steels.

Materials to be welded

BS EN & DIN

X2CrNiN23L
 1.4362

ASTM/UNS

S32304, S32101, S32001

Proprietary alloys include:

Sandvik	SAF 2304
Usinor Industeel	Uranus 35N
Avesta Polarit	LDX 2101
AK Steel	Nitronic 19D

Applications

Lean duplex stainless steels (LDSS) provide cost savings compared to 22%Cr duplex stainless steels because of the reductions in Ni and Mo. The LDSS also provide a strength advantage compared to austenitic stainless steels and generally have comparable corrosion resistance to austenitic stainless steels.

The LDSS are finding more widespread use in today's economic climate, particularly in structural applications. Uses include: **bridges** and **structural work** generally replacing austenitic stainless steels and carbon steels rather than replacing standard duplex alloys.

Microstructure

Multipass welds in the as-welded condition contain about 25–50% ferrite depending on dilution and heat input/cooling rate conditions.

Welding guidelines

Preheat not generally required. Interpass temperature 150°C max, although for many applications this could be relaxed to 250°C. Heat input in the range 1.0–2.5 kJ/mm (depending on material thickness) should be acceptable. Welds are left in the as-welded condition.

Related alloy groups

The 22%Cr duplex consumables (data sheet B-60) are related and can also be used for welding the lean duplex stainless steels.


There is no matching solid wire available. The ER329N (AWS ER2209) wire should be used for MIG/TIG/SAW applications, data sheet B-60.

Products available

Process	Product	Specification
MMA	Ultramet 2304	--
FCW	Supercore 2304P	--

ULTRAMET 2304

Rutile electrode for lean duplex

Product description	<p>MMA electrode made on high quality stainless steel core wire with rutile flux system optimised for all welding positions except vertical down.</p> <p>Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.</p>												
Specifications	NONE												
ASME IX Qualification	QW432 F-No -, QW442 A-No -												
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	N	PRE _N	
	min	--	0.5	--	--	--	22.5	8.0	0.1	--	0.08	24	
	max	0.04	2.0	1.0	0.02	0.03	25.5	10.0	0.8	0.75	0.20	31	
	typ	0.03	0.7	0.7	0.015	0.025	24.5	9.1	0.2	0.3	0.13	27	
	PRE _N = Cr + 3.3Mo + 16N												
All-weld mechanical properties	As welded						min	typical					
	Tensile strength						MPa	690	790				
	0.2% Proof stress						MPa	480	640				
	Elongation on 4d						%	20	31				
	Reduction of area						%	--	42				
	Impact energy						J	--	55				
							J	--	50				
					J	--	37						
Operating parameters	DC +ve or AC (OCV 55V min)												
	ø mm					2.5	3.2	4.0					
	min A					50	65	100					
	max A					90	120	160					
Packaging data	ø mm					2.5	3.2	4.0					
	length mm					300	350	450					
	kg/carton					12	13.5	17.4					
	pieces/carton					229	130	86					
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:</p> <p>Redry 200 – 300°C/1-2h to restore to as-packed condition. Maximum 380° C, 3 cycles, 10h total.</p> <p>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	Fume composition, wt % typical:												
		Fe	Mn	Cr	Ni	Mo	Cu	F	OES (mg/m ³)				
		7	6	6	1	0.2	<0.2	16	0.8				

SUPERCORE 2304P

Flat and positional FCAW for lean duplex

Product description	<p>High performance rutile all positional flux cored wire produced in the most versatile size of 1.2mm.</p> <p>Made with an austenitic stainless steel sheath and rutile flux system. Weld metal carbon content is typically <0.04% when using either 80%Ar-20%CO₂ or 100% CO₂ shielding gas.</p> <p>Metal recovery about 90% with respect to the wire.</p>												
Specifications	NONE												
ASME IX Qualification	QW432 F-No -, QW442 A-No -												
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	N	PRE _N	
	min	--	0.5	--	--	--	22.5	8.0	0.1	--	0.08	24	
	max	0.04	2.0	1.00	0.02	0.03	25.5	10.0	0.8	0.75	0.20	31	
	typ	0.03	1.0	0.6	0.01	0.02	24.5	9.2	0.2	0.2	0.14	27	
	PRE _N (pitting resistance equivalent) = Cr + 3.3Mo + 16N												
All-weld mechanical properties	As welded						min	typical					
	Tensile strength						MPa	690	760				
	0.2% Proof stress						MPa	480	610				
	Elongation on 4d						%	20	35				
	Elongation on 5d						%	20	32				
	Reduction of area						%	--	50				
	Impact energy			- 20°C			J	--	70				
				- 50°C			J	--	55				
Hardness						HV	--	240					
Operating parameters	<p>Shielding gas: Either 80%Ar-20%CO₂ or 100% CO₂ shielding gas at 20-25l/min. Proprietary gases may be used but argon should not exceed 85%.</p> <p>Current: DC+ve ranges as below for Ar-20%CO₂. Welding with 100%CO₂ requires approx 3V higher:</p>												
	ø mm	amp-volt range					typical			stickout			
	1.2 P	120A-22V to 250A-34V					150A-25V			15-20mm			
Packaging data	<p>Spools vacuum-sealed in barrier foil with cardboard carton: 15kg</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)				
		10	12	2	4	5.5	<0.5	9	0.9				