

Nickel Base Alloys

DATA SHEET

D-10

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

NICKEL BASE 182 CONSUMABLES

Alloy type

Inconel™ type consumables with manganese and niobium additions.

Materials to be welded

Nickel alloys such as Inconel™ 600, Nimonic 75. Nickel base alloys to themselves and to mild, low alloy and stainless steels. High temperature transition joints. Cryogenic 3% and 5% Ni steels.

Applications

These weld metals have no directly equivalent parent material, although the composition is related to Inconel™ 600. Mn and Nb are added to give high resistance to hot cracking, tolerance to dilution by many combinations of nickel-base and ferrous alloys, with stable properties over a wide range of service temperatures from -269°C to above 900°C.

Applications include heat-resisting nickel-base alloys to themselves for use in **furnace equipment** up to about 900°C. Other applications include:

Mixed welds between most nickel-base alloys, including Monel 400 and stainless, low alloy or CMn steels without need to preheat.

Transition welds between creep-resisting ferritic and austenitic steels, such as 2CrMo and 316H for long term service at elevated temperature in petrochemical and power generation plants.

Low temperature applications such as 3% or 5% Ni steels used for cryogenic vessels and pipework in service at or below -100°C.

Stress relief may be carried out if required.

Microstructure

High nickel austenite with some carbides.

Welding guidelines

Requirements for preheat and PWHT will be dependent on the base material being welded. For most nickel-base materials, no preheat is required.

Related alloy groups

The AB alloys (data sheet D-11) cover similar applications.

Products available


Process	Product	Specification
MMA	Nimrod 182KS	AWS ENiCrFe-3
	Nimrod 182	AWS ENiCrFe-3
	Nimax 182	AWS ENiCrFe-3
TIG/MIG/ SAW	20.70.Nb	AWS ERNiCr-3
SAW flux	NiCr	SA FB2

General Data for all 182 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:</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	<p>Fume composition, wt % typical:</p> <table border="1" style="width: 100%; text-align: center;"> <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>2</td> <td>13</td> <td>5</td> <td>10</td> <td>0.2</td> <td>0.1</td> <td>15</td> <td>1</td> </tr> </tbody> </table>	Fe	Mn	Cr	Ni	Mo	Cu	F	OES (mg/m ³)	2	13	5	10	0.2	0.1	15	1
Fe	Mn	Cr	Ni	Mo	Cu	F	OES (mg/m ³)										
2	13	5	10	0.2	0.1	15	1										

NIMROD 182KS

All-positional Inconel™ type MMA electrode


Product description	MMA electrode – This electrode is made on a nearly matching core wire with a basic flux system designed to produce optimum operability and radiographically sound weld metal. Nimrod 182KS is optimised for DC+ welding in all positions including pipework qualified in the ASME 6G position. Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.															
Specifications	AWS A5.11		ENiCrFe-3													
	BS EN 14172		ENi6182													
	DIN 1736 (Werkstoff No)		EL-NiCr15FeMn (2.4807)													
ASME IX Qualification	QW432 F-No 43															
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Cu	Ti	Co *	Ta *		
	min	--	5.0	--	--	--	13.0	61	1.0	2.0	--	--	--	--		
	max	0.10	9.5	1.0	0.015	0.02	17.0	bal	2.5	9.0	0.50	1.0	0.12	0.30		
	typ	0.05	7	0.5	0.01	0.01	16	~ 65	1.5	< 8	0.1	0.1	< 0.05	0.05		
* Co and Ta maximums only when specified at time of order.																
All-weld mechanical properties	As-welded						min		typical							
	Tensile strength						MPa		550		640					
	0.2% Proof stress						MPa		360		385					
	Elongation on 4d						%		30		40					
	Elongation on 5d						%		27		37					
	Reduction of area						%		--		38					
	Impact energy						-196°C		J		--		100			
	Hardness						HV		--		190					
Operating parameters	DC +ve only															
																
	ø mm	2.5		3.2		4.0		5.0								
	min A	60		70		100		130								
	max A	80		110		155		210								
Packaging data	ø mm	2.5		3.2		4.0		5.0								
	length mm	280		300		350		350								
	kg/carton	12.0		12.3		15.0		15.0								
	pieces/carton	705		450		300		198								

NIMROD 182

Inconel™ type MMA electrode for downhand welding and surfacing


Product description	MMA electrode – This electrode is made on a nearly matching core wire with a basic slag system designed to produce optimum operability and weld metal soundness for downhand/HV welding. Optimised for DC+ operability primarily for surfacing and cladding applications. Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.													
Specifications	AWS A5.11		ENiCrFe-3 (3.2mm will not necessarily satisfy 3G usability criteria)											
	BS EN 14172		ENi6182											
	DIN 1736 (Werkstoff No)		EL-NiCr15FeMn (2.4807)											
ASME IX Qualification	QW432 F-No 43													
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Cu	Ti	Co *	Ta *
	min	--	5.0	--	--	--	13.0	61	1.0	2.0	--	--	--	--
	max	0.10	9.5	1.0	0.015	0.02	17.0	bal	2.5	9.0	0.50	1.0	0.12	0.30
	typ	0.05	6	0.5	0.01	0.01	16	~ 65	1.5	< 8	0.1	0.1	< 0.05	0.05
* Co and Ta maximums only when specified at time of order.														

NIMROD 182 (continued)

All-weld mechanical properties	As-welded		min	typical
	Tensile strength	MPa	550	660
	0.2% Proof stress	MPa	360	420
	Elongation on 4d	%	30	40
	Elongation on 5d	%	27	37
	Reduction of area	%	--	38
	Impact energy	-196°C	J	--
Hardness		HV	--	190
Operating parameters	DC +ve			
				
	∅ mm	3.2	4.0	5.0
	min A	70	100	130
max A	110	155	210	
Packaging data	∅ mm	3.2	4.0	5.0
	length mm	280	330	330
	kg/carton	12.0	14.1	14.1
	pieces/carton	375	249	165

NIMAX 182

High recovery electrode for cladding & surfacing

Product description	MMA electrode – high efficiency metal powder type with basic flux covering on high conductivity pure nickel core wire. Nimax 182 is a high efficiency version of Nimrod 182KS, with versatile features for fabrication, repair and maintenance. Recovery is about 140% with respect to core wire, 65% with respect to whole electrode.											
Specifications	AWS A5.11		ENiCrFe-3									
	BS EN 14172		ENi6182									
	DIN 1736 (Werkstoff No)		EL-NiCr15FeMn (2.4807)									
ASME IX Qualification	QW432 F-No 43											
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Cu	Ti
	min	--	5.0	--	--	--	13.0	61	1.0	2.0	--	--
	max	0.10	9.5	1.0	0.015	0.02	17.0	bal	2.5	9.0	0.50	1.0
typ	0.06	6	0.4	0.008	0.01	15	~ 69	1.5	7	0.05	0.07	
All-weld mechanical properties	As-welded		min	typical								
	Tensile strength	MPa	550	660								
	0.2% Proof stress	MPa	360	390								
	Elongation on 4d	%	30	40								
	Elongation on 5d	%	27	38								
	Reduction of area	%	--	40								
	Impact energy	-196°C	J	--	> 80							
Hardness		HV	--	190								
Operating parameters	DC +ve only											
												
	∅ mm	2.0	2.5	3.2	4.0	5.0						
	min A	40	70	90	130	160						
max A	60	115	155	210	260							
Packaging data	∅ mm	2.0	2.5	3.2	4.0	5.0						
	length mm	255	300	350	350	450						
	kg/carton	9.9	12.0	13.5	13.5	17.1						
	pieces/carton	807	468	291	192	129						

20.70.Nb

Solid welding wire for TIG, MIG and SAW

Product description	Solid wire – wires for TIG, MIG and sub-arc welding of nickel base alloys and dissimilar joints between nickel alloys, ferritic and austenitic stainless steels.												
Specifications	AWS A5.14			ERNiCr-3									
	BS EN ISO 18274			SNi6082									
	BS2901:PT5			NA35									
	DIN 1736 (Werkstoff No)			SG-NiCr20Nb (2.4806)									
	UNS			N06082									
	Also known generically as filler metal 82 (FM82)												
ASME IX Qualification	QW432 F-No 43												
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Nb	Cu	Ti	Fe	
	min	--	2.5	--	--	--	18.0	67.0	2.0	--	--	--	
	max	0.05	3.5	0.50	0.015	0.020	22.0	bal	3.0	0.50	0.7	3.0	
	typ	0.02	3	0.1	0.005	0.01	20	73	2.5	0.01	0.4	1	
All-weld mechanical properties	Typical values as welded						typical						
	Tensile strength						MPa	640					
	0.2% Proof stress						MPa	360					
	Elongation on 4d						%	40					
	Impact energy						-196°C	J	> 100				
Typical operating parameters		TIG			MIG			SAW					
	Shielding	Ar			Ar			NiCr flux					
	Current	DC-			Pulsed			DC+					
	Diameter	2.4mm			1.2mm			1.6mm					
	Parameters	100A, 12V			180A, 26V			300A, 26V					
Packaging data	ø mm	TIG			MIG			SAW					
	1.0	--			15kg			--					
	1.2	--			15kg			--					
	1.6	2.5kg			--			--					
	2.0	2.5kg			--			--					
	2.4	2.5kg			--			25kg					
	3.2	2.5kg			--			--					
Fume data	MIG fume composition (wt %) (TIG fume negligible)												
		Fe	Mn	Cr ³	Ni	Mo	Cu	OES (mg/m ³)					
		1	6	15	56	< 0.1	< 0.5	0.9					

NiCr FLUX

Sub-arc flux

Product description	Sub-arc flux – Agglomerated, fluoride basic flux of high basicity (Boniczewski B1~3). The high basicity ensures low loss of critical alloying elements in the transfer from wire to weld deposit; the low silica content ensures a low silicon content of the weld metal and reduces the risk of hot cracking. NiCr flux can be used DC+, DC- and AC, although DC+ operation is preferred. Flux:wire ratio is 1-2:1 depending on operating conditions; recycled flux should be limited to about 10% to avoid build-up of fines.										
Specifications	DIN 32522		BFB7 6534 AC5								
	BS EN 760		SA FB2								
Composition (typical)		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Ti
	20.70.Nb wire	0.02	3	0.1	0.005	0.01	20	bal	2.5	1	0.4
	deposit	0.01	3	0.2	0.006	0.006	20.5	bal	2.3	1	0.08
All-weld mechanical properties with 20.70.Nb wire	As welded				typical						
	Tensile strength				MPa	640					
	0.2% Proof stress				MPa	360					
	Elongation				%	40					
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 NiCr Flux is supplied in sealed moisture resistant 25kg 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.										