

# Nickel Base Alloys

DATA SHEET

D-11

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## NICKEL BASE AB CONSUMABLES

### Alloy type

Inconel™ type consumables similar to the 182 but with lower Mn and a Mo addition.

### Materials to be welded

Inconel 600, Incoloy 800, Incoloy DS, Nilo, Brightray and other nickel base or high nickel alloys to themselves and to mild, low alloy, and stainless steels. Cryogenic 3-5%Ni steels.

### Applications

The weld metal deposited by these consumables has no directly equivalent parent material, although its composition is related to Inconel 600 (0.05C-75Ni- 16Cr-8Fe). Mo and Nb are added to give high resistance to hot cracking, tolerance to dilution by many combinations of nickel base and ferrous alloys, and stable properties over a wide range of service temperatures from -269°C to above 900°C. The presence of Mo improves elevated temperature properties above about 600°C, compared to the 182 alloys (data sheet D-10).

These consumables are used for welding Inconel 600, Incoloy 800/800H and similar heat resisting or high nickel alloys to themselves for use in **furnace equipment** and **petrochemical plants** up to about 900°C.

In addition they are suitable for **dissimilar** combinations of the above alloys and others such as Monel 400, Incoloy 825 to stainless, low alloy CMn steels without the need to preheat. Stress relief may be carried out if necessary, and

transition welds for high temperature service have good structural stability.

They can also be used for low temperature applications such as 3%Ni or 5%Ni steels used for **cryogenic vessels** and **pipework** in service at or below -100°C.

### Microstructure

In the as-welded condition this nickel base weld metal consists of austenite with a few carbides.

### Welding guidelines

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

### Related alloy groups

The 182 alloys (data sheet D-10) cover similar applications.

### Products available

Process	Product	Specification
MMA	<b>Nimrod AKS</b>	AWS ENiCrFe-2
	<b>Nimrod AB</b>	AWS ENiCrFe-2/4
TIG/MIG/ SAW	<b>20.70.Nb</b>	AWS ERNiCr-3
SAW flux	<b>NiCr</b>	BS EN SA FB2

## General Data for all MMA Electrodes

<b>Storage</b>	<p><b>3 hermetically sealed ring-pull metal tins</b> 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:  <b>Redry</b> 200 – 250°C/1-2h to restore to as-packed condition. Maximum 350° C, 3 cycles, 10h total.  <b>Storage</b> 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): &lt; 60% RH, &gt; 18°C.</p>																
<b>Fume data</b>	<p>Fume composition, wt % typical:</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Fe</th> <th>Mn</th> <th>Ni</th> <th>Cr</th> <th>Mo</th> <th>Cu</th> <th>F</th> <th>OES (mg/m<sup>3</sup>)</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>13</td> <td>10</td> <td>5</td> <td>0.2</td> <td>0.1</td> <td>15</td> <td>1</td> </tr> </tbody> </table>	Fe	Mn	Ni	Cr	Mo	Cu	F	OES (mg/m <sup>3</sup> )	2	13	10	5	0.2	0.1	15	1
Fe	Mn	Ni	Cr	Mo	Cu	F	OES (mg/m <sup>3</sup> )										
2	13	10	5	0.2	0.1	15	1										

## NIMROD AKS

All-positional Inconel™ type MMA electrode




<b>Product description</b>	MMA electrode with a basic flux system on a nearly matching core wire designed to give radiographically sound weld metal. It is optimised for DC+ welding in all positions including pipework in the ASME 5G/6G positions. Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.														
<b>Specifications</b>	<b>AWS A5.11</b>	ENiCrFe-2													
	<b>BS EN 14172</b>	E Ni6133													
	<b>DIN 1736</b>	EL-NiCr15MoNb (2.4625)													
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 43														
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Mo	Cu	Co *	Ta *	
	min	--	1.0	--	--	--	13.0	62	1.5	--	1.0	--	--	--	
	max	0.10	3.5	0.75	0.015	0.02	17.0	Bal	3.0	12.0	2.5	0.50	0.12	0.30	
	typ	0.05	2.8	0.5	0.01	0.01	16	69	2	8	1.5	0.05	0.05	0.05	
	* Co and Ta maximums only when specified at time of order.														
<b>All-weld mechanical properties</b>	As welded						min	typical							
	Tensile strength						MPa	550	700						
	0.2% Proof stress						MPa	360	420						
	Elongation on 4d						%	30	42						
	Elongation on 5d						%	27	39						
	Reduction of area						%	--	50						
	Impact energy	- 196°C					J	--	110						
	Hardness cap/mid						HV	--	200/215						
<b>Operating parameters</b>	DC +ve														
	∅ mm	2.5			3.2			4.0			5.0				
	min A	60			70			100			130				
	max A	80			110			155			210				
<b>Packaging data</b>	∅ mm	2.5			3.2			4.0			5.0				
	length mm	280			300			350			350				
	kg/carton	12.0			12.0			14.4			13.5				
	pieces/carton	762			441			300			186				

## NIMROD AB

Inconel™ type MMA electrode for downhand welding and surfacing

<b>Product description</b>	MMA electrode with a basic flux system on a nearly matching core wire. It is designed for DC or AC (DC+ preferred) welding in the flat/downhand and HV positions; the 3.2mm diameter will not necessarily satisfy the 3G usability criterion in AWS A5.11. Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.													
<b>Specifications</b>	<b>AWS A5.11</b>	ENiCrFe-2/4												
	<b>BS EN 14172</b>	E Ni6133												
	<b>DIN 1736</b>	EL-NiCr15MoNb (2.4625)												
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 43													
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Nb	Fe	Mo	Cu		
	min	--	1.0	--	--	--	13.0	62	1.5	--	1.0	--		
	max	0.10	3.5	0.75	0.015	0.02	17.0	bal	3.0	12.0	2.5	0.50		
	typ	0.05	2.5	0.7	0.01	0.01	16	69	2	7	1.5	0.05		

## NIMROD AB (continued)

<b>All-weld mechanical properties</b>	As welded		min	typical
	Tensile strength	MPa	550	700
	0.2% Proof stress	MPa	360	410
	Elongation on 4d	%	30	36
	Elongation on 5d	%	27	35
	Reduction of area	%	--	43
	Impact energy	- 196°C	J	--
	Hardness	HV	--	200/215
<b>Operating parameters</b>	DC +ve or AC (OCV: 70V min)			  
	∅ mm	3.2	4.0	5.0
	min A	75	100	130
	max A	120	155	210
<b>Packaging data</b>	∅ mm	3.2	4.0	5.0
	length mm	280	330	330
	kg/carton	12.0	14.4	13.8
	pieces/carton	387	249	162

## 20.70Nb

Solid wire for TIG, MIG and SAW

<b>Product description</b>	Solid wire for TIG, MIG and SAW.											
<b>Specifications</b>	<b>AWS A5.14</b>	ERNiCr-3										
	<b>BS EN ISO 18274</b>	SNi6082										
	<b>BS 2901: Pt5</b>	NA35										
	<b>DIN 1736</b>	SG-NiCr20Nb (2.4806)										
	<b>UNS</b>	N06082										
	Also known generically as filler metal 82 (FM82)											
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 43											
<b>Composition (wire wt %)</b>		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
<b>All-weld mechanical properties</b>	Typical values as welded						TIG					
	Tensile strength						MPa	640				
	0.2% Proof stress						MPa	360				
	Elongation on 4d						%	40				
	Impact energy	- 196°C					J	>100				
<b>Typical operating parameters</b>		TIG			MIG			SAW				
	Shielding	Argon *			Argon **			NiCr flux				
	Current	DC-			DC+ ***			DC+				
	Diameter	2.4mm			1.2mm			2.4mm				
	Parameters	100A, 12V			220A, 30V			300A, 31V				
	* Also required as a purge for root runs.											
	** Proprietary Ar/He mixtures also suitable.											
	*** Pulsed current may provide benefits with respect to operability and arc transfer characteristics.											

## 20.70Nb (continued)

Packaging data	ø mm	TIG	MIG	SAW
	1.0	--	--	15kg spool
1.2	--	--	15kg spool	--
1.6		2.5kg tube	--	--
2.0		2.5kg tube	--	--
2.4		2.5kg tube	--	25kg coil
3.2		2.5kg tube	--	--

Fume data	MIG fume composition (wt %) (TIG & SAW fume negligible)						
	Fe	Mn	Cr <sup>3</sup>	Ni	Mo	Cu	OES (mg/m <sup>3</sup> )
	1	6	15	56	<0.1	<0.5	0.9