

# Nickel Base Alloys

## DATA SHEET

## D-80

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## NICKEL-MOLYBDENUM ALLOY B2

### Alloy type

Ni-28%Mo consumables to match alloy B2.

### Materials to be welded

#### wrought:

**ASTM** B333, B335, B619, B626:  
 UNS N10001 (alloy B)  
 UNS N10665 (alloy B2)  
**DIN** 2.4617  
**Proprietary** Hastelloy alloy B-2 (Haynes)  
 Nimofer 6928 (VDM)

#### cast:

**ASTM** A494: N-7M  
 A743: N-12M  
 A744: N-12M  
**BS** 3146: ANC 15  
**DIN** 2.4685, 2.4882  
**Proprietary** NB (Paralloy)  
 Langalloy B (Meighs)  
 AR5 (LaBour/Darwins)

#### Similar alloys:

UNS N10675, Hastelloy Alloy B-3 (Haynes).  
 UNS N10629, DIN 2.4600, Nimofer 6629 (VDM), alloy B-4.

### Applications

These consumables deposit nickel-molybdenum weld metal with very low carbon and silicon levels appropriate for alloy B-2, although it is equally suitable for the original alloy B, now obsolete in wrought form. In addition, specially controlled levels of iron and chromium ensure good as-welded ductility in multipass deposits.

These modifications bring the composition close to the more recent alloys B-3 and B-4 which have better microstructural stability and weldability than alloy B-2. There are no electrode specifications for these alloys at present, and these consumables are therefore offered as an acceptable candidate within current specification limits. These alloys are designed to resist hydrochloric acid at all concentrations and temperatures up to boiling point under non-oxidising conditions. They are also resistant to hydrogen chloride gas, sulphuric and acetic acids under certain conditions. The newer alloys B-3 and B-4 with additional Fe and Cr have

improved SCC resistance in chloride media. Contamination of acid media with oxidising ferric or cupric salts must be avoided. Alloys with much higher chromium (C-4 or C-276 etc.) are superior under oxidising conditions.

Applications include **pumps, valves and process equipment** operating in **aggressive environments in chemical plant**.

### Microstructure

Solid solution alloy, high nickel austenite with some microsegregation typical of as-deposited weld metal (homogenised by solution treatment around 1150°C and rapidly cooled for casting repairs).

### Welding guidelines

No preheat and maximum interpass of 150°C for wrought alloys.

For castings of low ductility a preheat-interpass of up to 200-300°C may be required on sections above 15mm. In this case a post-weld solution treatment must be applied to restore satisfactory weld area properties.

### Additional information

Alloy B-2 was introduced to suppress the formation of carbides and silicon-rich intermetallic phases which occur in the original alloy B during processing and welding. However, experience has revealed that elimination of Fe promoted sensitivity to another intermetallic, beta phase Ni<sub>4</sub>Mo. This can be limited significantly by controlled Fe (and Cr) additions within the B-2 specification, and this modification is extended in the new alloys B-3 (1.5%Fe, 1.5%Cr) and B-4 (3%Fe, 1.3%Cr). Intermetallics reduce ductility and corrosion resistance.


If PWHT is required to restore maximum corrosion resistance of casting repairs, castings should be solution treated at about 1150°C followed by a rapid cool.

### Products available

Process	Product	Specification
MMA	<b>Nimax B2L</b>	AWS ENiMo-7
TIG	<b>HAS B2</b>	AWS ERNiMo-7

# NIMAX B2L

High molybdenum nickel base MMA electrode to match alloy B-2

<b>Product description</b>	MMA electrode made on pure nickel core wire with a special basic flux coating to give low levels of impurities. Sizes above 3.2mm are not suitable for positional welding. Recovery is about 130% with respect to core wire, 65% with respect to whole electrode.														
<b>Specifications</b>	<b>AWS A5.11</b>		ENiMo-7												
	<b>BS EN 14172</b>		E Ni1066												
	<b>DIN 1736</b>		EL-NiMo29												
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 44														
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	W	Cu	Fe	Co	V	
	min	--	--	--	--	--	0.3	64.5	26	--	--	1.0	--	--	
	max	0.02	1.75	0.2	0.015	0.02	1.0	bal	30	1.0	0.50	2.0	1.0	0.4	
	typ	0.018	1.3	0.1	0.005	0.01	0.7	68	28	0.1	0.01	1.5	0.04	0.1	
<b>All-weld mechanical properties</b>	As welded						min	typical							
	Tensile strength						MPa	760	775						
	0.2% Proof stress						MPa	400	525						
	Elongation on 4d						%	25	31						
	Elongation on 5d						%	22	30						
	Reduction of area						%	--	25						
	Hardness						HV	--	260						
	ASTM A494 castings require elongation >6% (N-12MV) or >20% (N-7M) after solution treatment.														
<b>Operating parameters</b>	DC +ve 														
	∅ mm	2.5			3.2			4.0							
	min A	70			90			130							
	max A	115			155			210							
<b>Packaging data</b>	∅ mm	2.5			3.2			4.0							
	length mm	300			350			350							
	kg/carton	12.6			15.0			14.1							
	pieces/carton	447			300			174							
<b>Storage</b>	<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. For electrodes that have been exposed: <b>Redry</b> 250 – 300°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): < 60% RH, > 18°C.														
<b>Fume data</b>	Fume composition, wt % typical:														
		Fe	Mn	Ni	Cr	Mo	Cu	F	OES (mg/m <sup>3</sup> )						
		1	2	10	0.2	15	0.2	16	5						

# HAS B2

Solid TIG wire to match alloy B-2

<b>Product description</b>	Solid wire for TIG.												
<b>Specifications</b>	<b>AWS A5.14</b>		ERNiMo-7										
	<b>BS EN ISO 18274</b>		SNi1066										
	<b>BS 2901: Pt5</b>		NA44										
	<b>DIN 1736</b>		SG-NiMo27 (2.4615)										
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 44												
<b>Composition (wire wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	W	Cu	Fe	Co
	min	--	--	--	--	--	--	64.0	26.0	--	--	--	--
	max	0.02	1.0	0.10	0.015	0.020	1.0	bal	30.0	1.0	0.50	2.0	1.0
	typ	0.01	0.7	0.05	0.005	0.005	0.5	70	27	0.5	0.02	1.5	0.05
<b>All-weld mechanical properties</b>	Typical values as welded						TIG						
	Tensile strength						MPa	815					
	0.2% Proof stress						MPa	510					
	Elongation on 4d						%	48					
	Elongation on 5d						%	47					
	Reduction of area						%	40					
	Impact energy						+ 20°C	J	220				
	Hardness cap/mid						HV	230/245					
<b>Typical operating parameters</b>	TIG												
	Shielding Argon												
	Current DC-												
	Diameter 2.4mm												
	Parameters 100A, 12V												
<b>Packaging data</b>	TIG												
	ø mm 2.4												
	2.5kg tube												
<b>Fume data</b>	Fume composition (wt %) (TIG fume negligible)												
	Fe	Mn	Cr <sup>3</sup>	Ni	Mo	Cu	OES (mg/m <sup>3</sup> )						
	2	2	<0.5	50	25	<0.5	1						