

# Low Alloy Steels

## DATA SHEET

## A-41

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## 2%Ni FOR IMPROVED TOUGHNESS

### Alloy type

Nominally 2.5%Ni low alloy steels.

### Materials to be welded

CMn and low alloy steel plate, pipe, forgings and castings used extensively for service at low temperature eg. LT50.

<b>ASTM</b>	A203 Grade A & B plate. A333 Grade 6 pipe. A350 Grade LF1 & LF2 forgings. A352 Grade LC2 casting.
<b>BS</b>	1501-224 Grade 490B plate.

Also proprietary medium tensile steels eg. Hyplus 29 (Corus) and Corten weathering steel (Corus, US Steels).

### Applications

Fabrication of **storage tanks**, **process plant** and associated **pipework** where good fracture toughness from as-welded joints is demanded down to temperatures in the region of -60°C.

The addition of about 2.5%Ni improves microstructural refinement and tolerance to procedural variations compared to plain CMn weld metal. It also promotes the formation of a stable patina as required for matching the

characteristics of weathering steels, and is an alternative to using matching consumables (data sheet A-70).

### Microstructure

In the as-welded condition the microstructure is ferritic with a component of acicular ferrite for optimum toughness.

### Welding guidelines

Preheat according to base material and thickness. Although AWS consumable specifications require PWHT many fabrications will be left as-welded. The need for PWHT will generally be determined by applicable design codes.

### Related alloy groups






The 1%Ni low alloy consumables (data sheet A-40) and 3%Ni types (data sheet A-42) are also designed for applications requiring low temperature toughness.

### Products available

Process	Product	Specification
MMA	<b>Tufmet 2Ni.B</b>	AWS E8018-C1
TIG/MIG	<b>2Ni</b>	AWS ER80S-Ni2

# TUFMET 2Ni.B

2.5%Ni MMA electrode for good low temperature toughness

<b>Product description</b>	MMA electrode with a basic flux, metal powder type coating on low carbon core wire. Moisture resistant coating giving very low weld metal hydrogen levels. Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.											
<b>Specifications</b>	<b>AWS A5.5</b>	E8018-C1										
	<b>BS EN ISO 2560-A</b>	(E 46 6 2Ni B 42)										
	<b>BS EN ISO 2560-B</b>	E5518-N5 P U										
	<b>BS 2493</b>	(2Ni.BH)										
	<b>DIN 8529</b>	(EY 4675 2NiB)										
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 4, <b>QW442</b> A-No 10											
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Ni	Cr	Mo	Cu	V	Nb
	min	--	0.50	--	--	--	2.00	--	--	--	--	--
	max	0.10	1.25	0.80	0.030	0.030	2.75	0.2	0.2	0.3	0.05	0.05
	typ	0.05	0.75	0.3	0.015	0.010	2.4	0.05	0.05	0.05	0.01	<0.01
<b>All-weld mechanical properties</b>	As welded or PWHT 605°C/1h *											
							min	typical				
	Tensile strength					MPa	550-680 **	600				
	0.2% Proof stress					MPa	460	520				
	Elongation on 4d					%	19	25				
	Elongation on 5d					%	20	23				
	Reduction of area					%	--	70				
	Impact energy					J	47	100				
						J	-- ***	65				
	* BS & BS EN ISO-A properties are as-welded, AWS & BS EN ISO-B after PWHT.											
	** Maximum according to DIN 8529 is optional.											
	*** Typically >30J as-welded, meeting BS 2Ni.LB/AWS E7018-C1L properties.											
<b>Operating parameters</b>	DC +ve or AC (OCV: 70V min)											
												
	ø mm		2.5	3.2	4.0							
	min A		70	80	100							
	max A		110	140	180							
<b>Packaging data</b>	ø mm		2.5	3.2	4.0							
	length mm		350	380	450							
	kg/carton		12.0	13.8	16.8							
	pieces/carton		609	405	270							
<b>Storage</b>	<b>3 hermetically sealed ring-pull metal tins</b> per carton, with unlimited shelf life. Direct use from tin will give hydrogen < 5ml/100g weld metal during 8h working shift. For electrodes that have been exposed: <b>Redry</b> 250 – 300°C/1-2h to ensure H <sub>2</sub> <10ml/100g, 300-350°C/1-2h to ensure H <sub>2</sub> <5ml/100g.. Maximum 420°C, 3 cycles, 10h total. <b>Storage</b> of redried electrodes at 100– 200°C in holding ovens, or 50-150°C in heated quivers: 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	Cu	Pb	F	OES (mg/m <sup>3</sup> )			
		14	5	<0.5	<0.1	0.2	<0.1	18	5			

## 2Ni

Solid wire for TIG and MIG welding

<b>Product description</b>	Solid copper coated wire for TIG and MIG.											
<b>Specifications</b>	<b>AWS A5.28</b>					ER80S-Ni2						
	<b>BS EN 440 and BS EN ISO 636-A</b>					(G 2Ni2 - MIG: W 2Ni2 - TIG)						
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 6, <b>QW442</b> A-No 10											
<b>Composition (wire wt %)</b>		C	Mn	Si	S	P	Ni	Cu				
	min	0.06	0.8	0.40	--	--	2.00	--				
	max	0.12	1.25	0.80	0.025	0.025	2.75	0.35				
	typ	0.08	1	0.5	0.010	0.010	2.5	0.10				
<b>All-weld mechanical properties</b>	Typical values as welded (AW) and PWHT 605°C/1h:											
							TIG		MAG: Ar + 5%CO <sub>2</sub>		MAG: Ar + 20%CO <sub>2</sub>	
					min*		AW	PWHT	AW	PWHT	AW	PWHT
	Tensile strength			MPa	550		580	556	650	585	580	555
	0.2% Proof stress			MPa	470		470	452	540	460	470	425
	Elongation on 4d			%	24		32	35	28	32	28	32
	Impact energy			J	27		175	200	45	140	40	100
				J	--		--	34	--	50	--	30
	Hardness cap/mid			HV	--		220/190	185/220	240/230	195/185	220/195	185/175
	* Minimum properties after PWHT 620°C/1h according to AWS. Actual tests show conformance as-welded, as required for most fabrications. Proof stress values below AWS are found after PWHT at 605°C/1h (=typical practice and PWHT for AWS E8018-C1/Tufmet 2Ni.B).											
Note that superior as-welded toughness may be obtained with Metrode 1Ni.												
<b>Typical operating parameters</b>		TIG					MIG					
	Shielding	Argon					Ar + 5-20%CO <sub>2</sub> *					
	Current	DC-					DC+					
	Diameter	2.4mm					1.2mm					
	Parameters	120A, 14V					280A, 26V					
* Ar + 1-5%O <sub>2</sub> and proprietary mixtures also suitable. Less oxidising shielding gas such as Ar + 5%CO <sub>2</sub> produced the best mechanical properties, see above.												
<b>Packaging data</b>	ø mm	TIG					MIG					
	1.2	--					15kg spool					
	1.6	5kg tube					--					
	2.0	To order					--					
	2.4	5kg tube					--					
	3.2	To order					--					
<b>Fume data</b>	MIG fume composition (wt %) (TIG fume negligible)											
		Fe	Mn	Cr <sup>3</sup>	Ni	Mo	Cu	OES (mg/m <sup>3</sup> )				
		54	6	<0.1	1.5	<0.1	1.2	5				