

Low Alloy Steels

DATA SHEET

A-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

0.5%Mo CREEP RESISTING STEEL

Alloy type

Ferritic creep resisting 0.5%Mo steels for elevated temperature service.

Materials to be welded

pipe/tube:

ASTM A335 grade P1
 A209 & A 250 grade T1
BS 3059 grade 243
 3606 grades 243, 245, 261

forged:

ASTM A336 grade F1
 A204 grades A, B, C
BS EN 10028-2 grade 16Mo3 (1.5415)
DIN 15Mo3 (1.5415)
 16Mo5 (1.5423)
 10MnMo 4 5 (1.5424)
 11MnMo 4 5 (1.5425)

cast:

ASTM A217 grade WC1
 A352 grade LC1
BS 1504 grade 245
 3100 grade B1
DIN GS-22Mo 4 (1.5419)

Applications

Nominal 0.5% Mo alloying results in improved elevated temperature performance over that of CMn steels. Used for the **fabrication of vessels** and associated **pipework** demanding creep rupture strength and ductility at temperatures up to about 450°C.

The Mo content also enhances resistance to hydrogen attack in chemical process plant operation.

Favourable mechanical properties of both as-welded and stress-relieved weld metal are also useful in welding structural and general engineering steels for ambient or sub-zero temperature service. In this respect these consumables are related to the higher strength manganese-molybdenum alloyed steel consumables.

Microstructure

In the stress-relieved condition the microstructure consists of acicular ferrite with some tempered bainite.

Welding guidelines

Preheat and interpass temperatures are normally in the range 100-250°C depending upon thickness being welded and restraint.

Related alloy groups

For high strength structural welding applications the MnMo alloys (A-50) are related.

PWHT

PWHT to temper the weldment varies according to the code; the extremes range from 550°C up to 720°C but the most common range is 630-670°C. For material up to 20mm thick some codes allow the PWHT to be omitted.

Products available

Process	Product	Specification
MMA	Mo.B	AWS E7018-A1
TIG/MIG	CMo	AWS ER70S-A1

Mo.B

Molybdenum alloyed MMA electrode for elevated temperature service

Product description	Basic flux, metal powder type coating on high purity mild steel 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.											
Specifications	AWS A5.5		E7018-A1									
	BS EN ISO 3580-A		E Mo B 3 2									
	BS 2493		MoBH									
	DIN 8575		E Mo B 26									
	BS and AWS Mn ranges overlap, but required specification should be stated on order.											
ASME IX Qualification	QW432 F-No 4, QW442 A-No 2											
Composition (weld metal wt %)		C	Mn*	Si	S	P	Cr	Ni	Mo	Cu		
	min	--	0.75	--	--	--	--	--	0.40	--		
	max	0.10	1.20	0.60	0.025	0.030	0.20	--	0.65	--		
	typ	0.05	0.8	0.3	0.01	0.015	0.05	0.05	0.55	0.05		
	* BS2493 Mn:Si ≥2:1, AWS A5.5 Mn 0.90% max.											
All-weld mechanical properties	PWHT 600-650°C/h *					min	typical	As-welded typical				
	Tensile strength					MPa	510	550-610	590			
	0.2% Proof stress					MPa	400	460-525	480			
	Elongation on 4d					%	22	27-32	27			
	Elongation on 5d					%	22	23-29	23			
	Reduction of area					%	--	65-72	68			
	Impact energy					- 20°C	J	--	130	100		
						- 30°C	J	--	115	--		
	Hardness					HV	--	200	200			
	* BS and DIN: 600°C/1h; AWS: 620°C/1h. Satisfactory properties are also obtained in the as-welded condition.											
Operating parameters	DC +ve or AC (OCV: 70V min)											
	∅ mm	2.5		3.2		4.0		5.0				
	min A	70		80		100		140				
	max A	110		140		180		240				
Packaging data	∅ mm	2.5		3.2		4.0		5.0				
	length mm	350		380		450		450				
	kg/carton	12.0		15.0		16.5		16.5				
	pieces/carton	552		390		237		153				
Storage	3 hermetically sealed ring-pull metal tins 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: Redry 250 – 300°C/1-2h to ensure H ₂ < 10ml/100g, 300-350°C/1-2h to ensure H ₂ < 5ml/100g. Maximum 420°C, 3 cycles, 10h total. Storage of redried electrodes at 100 – 200°C in holding ovens, or 50-150°C in heated quivers: no limit, but maximum 6 weeks recommended.											
Fume data	Fume composition, wt % typical:											
		Fe	Mn	Ni	Cr	Cu	Pb	F	OES (mg/m ³)			
		16	7	<0.1	<0.1	<0.2	<0.1	17	5			

CMo

0.5%Mo solid TIG and MIG wire for creep resisting steels

Product description	Copper coated solid wire for TIG and MIG.										
Specifications	AWS A5.28		ER70S-A1		(Previous classification was ER70S-G)						
	BS EN ISO 21952-A		Mo Si								
	BS 2901: Pt1		A30								
	DIN 8575		SG Mo								
ASME IX Qualification	QW432 F-No 6, QW442 A-No 2										
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	V
	min	0.08	0.90	0.50	--	--	--	--	0.45	--	--
	max	0.12	1.30	0.70	0.020	0.020	0.2	0.20	0.60	0.3	0.03
	typ	0.1	1.2	0.6	0.01	0.01	0.03	0.02	0.5	0.05	0.01
All-weld mechanical properties	Properties as-welded (AW) or PWHT:		min. *		typical: TIG			MAG: Ar + 5% CO ₂			
					AW		620°C/1h		AW		620°C/1h
	Tensile strength		MPa		515		662 640		650		620
	0.2% Proof stress		MPa		400		540 520		530		505
	Elongation on 4d		%		19		29 25		29		25
	Elongation on 5d		%		22		26 24		25		24
	Impact energy		- 30°C J		--		52 170		42		96
	Hardness cap/mid		HV		--		210/245 205/230		215/235		200/220
	* Minimum values are after PWHT 620°C/1h (AWS) or 595°C/0.5h (DIN) and as-welded for BS EN. MAG welds using more oxidising shielding gas (higher CO ₂ + O ₂) will have lower strength than shown.										
Typical operating parameters			TIG			MIG					
	Shielding		Argon			Argon + 2-20%CO ₂ Argon + 1.5% O ₂ or proprietary					
	Current		DC-			DC+					
	Diameter		2.4mm			1.2mm					
	Parameters		100A, 12V			260A, 26V					
Packaging data	ø mm		TIG			MIG					
	1.2		--			15kg spool					
	1.6		5kg tube			--					
	2.4		5kg tube			--					
Fume data	MIG fume composition (wt %) (TIG fume negligible)										
	Fe		Mn		Cr ³		Ni		Mo		Cu
	55		5		<0.1		<0.1		<0.5		1.2
	OES (mg/m ³)										
	5										