

Low Alloy Steels

DATA SHEET

A-12

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1¼Cr-½Mo CREEP RESISTING STEEL

Alloy type

1¼Cr-½Mo alloyed steel consumables for elevated temperature service.

Materials to be welded

ASTM	BS EN & DIN
A387 Gr 11 & 12	13CrMo 4-5 (1.7355)
A182 F11 & F12	13CrMo 4-4 (1.7335)
A217 WC6 & WC11	16CrMo 4-4 (1.7337)
A234 WP11 & WP12	11CrMo 5-5 (1.7339)
A199 T11	GS-25CrMo 4 (1.7128)
A200 T11	GS-17CrMo 5-5 (1.7357)
A213 T11 & T12	
A335 P11 & P12	
	BS
	1501 Gr 620 & 621
	1502 Gr 620
	1503 Gr 620 & 621
	1504 Gr 621
	3100 Gr B2
	3604 Gr 620/440 & 621
	3059 Gr 620/460

Applications

These consumables are designed for prolonged elevated temperature service up to 550°C. Main areas of application are associated with **steam generating power plant**, eg **pipng, turbine castings, steam chests, valve bodies** and **boiler superheaters**. Some of the consumables will also find service in refineries where they are used for **corrosion resistance** to sulphur bearing crude oil at 250-450°C. Some of the consumables will also find applications in the chemical and petro-chemical industries where they are used for **resistance to hydrogen attack** in the fabrication of **hydrocrackers, coal liquefaction plant** and **NH₃ pressure vessels** operating at up to 450°C. In the as-welded condition the consumables also provide a useful source of 300HV hardness weld deposit for build-up or

hardsurfacing to resist metal-to-metal wear and heavy impact.

Microstructure

After PWHT, the microstructure consists of tempered bainite.

Welding guidelines

Preheat and interpass temperature 200°C minimum, up to 300°C for thick sections. Maintain throughout welding cycle and some time after completion of welding.

PWHT

Apart from some special applications, PWHT will always be required. PWHT temperature is typically 690°C with time being dependent on section thickness.

Additional information

There are Technical Profiles available which cover some of the consumables on this data sheet. Additional information is available on Chromet 1X and Cormet 1.

Products available

Process	Product	Specification
MMA	Chromet 1	AWS E8018-B2
	Chromet 1L	AWS E7015-B2L
	Chromet 1X *	AWS E8018-B2
TIG/MIG	1CrMo	BS EN CrMo1Si
	ER80S-B2	AWS ER80S-B2
SAW	SA 1CrMo	AWS EB2
	LA436	BS EN SA AB 1
FCW	Cormet 1	AWS E81T1-B2

* Chromet 1X is the temper embrittlement resistant (TER) version of Chromet 1.

General Data for all 1¼Cr-½Mo Electrodes

Description	Basic flux, metal powder type coatings on low carbon high purity core wire. Recovery is approximately 115% with respect to the core wire and 65% with respect to whole electrode. Moisture resistant coating gives very low metal hydrogen levels.																					
Storage	<p>3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin will give hydrogen < 5ml/100g for longer than a working shift of 8h.</p> <p>For electrodes that have been exposed: Redry 250 – 300°C/1-2h to ensure H₂ < 10ml/100g, 300 – 350°C/1-2h to ensure H₂ < 5ml/100g. Maximum 420°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>																					
Operating parameters	DC +ve or AC (OCV: 70V min)																					
	ø mm	2.5	3.2	4.0	5.0	6.0																
	min A	70	80	100	140	200																
	max A	110	140	180	240	300																
Fume data	<p>Fume composition, wt % typical:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 10%;">Fe</th> <th style="width: 10%;">Mn</th> <th style="width: 10%;">Cr</th> <th style="width: 10%;">Ni</th> <th style="width: 10%;">Cu</th> <th style="width: 10%;">F</th> <th style="width: 10%;">OES (mg/m³)</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">15</td> <td style="text-align: center;">5</td> <td style="text-align: center;">< 0.5</td> <td style="text-align: center;">< 0.1</td> <td style="text-align: center;">< 0.2</td> <td style="text-align: center;">18</td> <td style="text-align: center;">5</td> </tr> </tbody> </table>							Fe	Mn	Cr	Ni	Cu	F	OES (mg/m ³)		15	5	< 0.5	< 0.1	< 0.2	18	5
	Fe	Mn	Cr	Ni	Cu	F	OES (mg/m ³)															
	15	5	< 0.5	< 0.1	< 0.2	18	5															

CHROMET 1

1¼Cr-½Mo MMA electrode

Product description	MMA electrode meeting AWS and BS EN national standards suitable for most power generation applications.									
Specifications	AWS A5.5 E8018-B2 BS EN ISO 3580-A E CrMo1 B 3 2 BS EN ISO 3580-B E 5516-1CM BS 2493 (1CrMo B H) DIN 8575 ECrMo 1 B 2 6									
ASME IX Qualification	QW432 F-No 4, QW442 A-No 3									
Composition (weld metal wt %)		C	Mn*	Si	S	P	Cr	Mo	Cu	
	min	0.05	0.50	--	--	--	1.00	0.45	--	
	max	0.10	0.90	0.80	0.025	0.025	1.40	0.65	0.15	
	typ	0.07	0.8	0.40	0.012	0.015	1.25	0.55	< 0.10	
* Mn may exceed AWS 0.90% max.										
All-weld mechanical properties	PWHT 690°C/1h					min	typical			
	Tensile strength					MPa	550	650		
	0.2% Proof stress					MPa	460	570		
	Elongation on 4d					%	19	25		
	Elongation on 5d					%	20	21		
	Reduction of area					%	--	70		
	Impact energy					J	47	160		
						+ 20°C	--	100		
						-10°C	--	250		
	Hardness					(AW) HV	--	210		
					(PWHT) HV	--	210			
Preheat 150 – 250°C (BS EN), 200 – 300°C (BS), 160 – 190°C (AWS), 200 – 350°C (DIN).										
Packaging data	ø mm	2.5	3.2	4.0	5.0	6.0				
	length mm	350	380	450	450	450				
	kg/carton	12.6	15.0	16.8	17.4	17.4				
	pieces/carton	627	372	243	159	111				

CHROMET 1L

Low carbon 1¼Cr-½Mo MMA electrode

Product description	MMA electrode – 1¼Cr-½Mo deposit with low carbon which produces lower hardness and residual stresses for resistance to sulphide stress corrosion cracking when operating in wet 'sour' environments. Also suitable for thin section joints which are to be left in the as-welded condition.									
Specifications	AWS A5.5	E7015-B2L								
	BS EN ISO 3580-A	E CrMo1L B 3 2								
	BS EN ISO 3580-B	E 5216-1CML								
	BS 2493	(1CrMo L B H)								
	DIN 8575	ECrMo 1 B 2 6								
ASME IX Qualification	QW432 F-No 4, QW442 A-No 3									
Composition (weld metal wt %)		C	Mn*	Si	S	P	Cr	Mo	Cu	
	min	0.03	0.50	--	--	--	1.00	0.45	--	
	max	0.05	0.90	0.80	0.025	0.025	1.40	0.65	0.15	
	typ	0.04	0.8	0.40	0.012	0.015	1.25	0.55	<0.10	
	* Mn may exceed AWS 0.90% max.									
All-weld mechanical properties	PWHT 690°C/1h						min	typical		
	Tensile strength				MPa		520	600		
	0.2% Proof stress				MPa		390	500		
	Elongation on 4d				%		19	26		
	Elongation on 5d				%		20	23		
	Reduction of area				%		--	68		
	Impact energy		+ 20°C		J		--	180		
			-10°C		J		--	120		
Hardness		(AW)		HV		--	220			
		(PWHT)		HV		--	200			
Packaging data	ø mm	2.5		3.2		4.0		5.0		
	length mm	350		380		450		450		
	kg/carton	12.0		15.0		17.7		18.0		
	pieces/carton	612		399		252		168		

CHROMET 1X

1¼Cr-½Mo alloyed MMA electrode for temper embrittlement resistance

Product description	MMA electrode – 1¼Cr-½Mo deposit which meets specific requirements for improved temper embrittlement resistance with prolonged service at 400-600°C. Relevant trace elements (P, Sn, As, Sb) are controlled to ensure low Bruscato (X) and Watanabe (J) factors.												
Specifications	AWS A5.5	E8018-B2											
	BS EN ISO 3580-A	E CrMo1 B											
	BS EN ISO 3580-B	E 5516-1CM											
	BS 2493	1CrMo B H											
	DIN 8575	ECrMo 1 B 2 6											
ASME IX Qualification	QW432 F-No 4, QW442 A-No 3												
Composition (weld metal wt %)		C	Mn*	Si*	S	P	Cr	Mo	Cu	Sn	As	Sb	
	min	0.05	0.50	0.15	--	--	1.00	0.45	--	--	--	--	
	max	0.10	0.90	0.30	0.015	0.012	1.40	0.65	0.15	0.005	0.010	0.005	
	typ	0.06	0.7	0.25	0.012	0.009	1.25	0.55	<0.05	0.002	0.003	<0.002	
	* Mn+Si < 1.10%												
	Bruscato factor (X) :		$\frac{10P + 5Sb + 4Sn + As}{100}$ (ppm)					=	15 max				
	Watanabe factor (J) :		$(Mn+Si) \times (P + Sn) \times 10^4$					=	180 max				

CHROMET 1X (continued)

All-weld mechanical properties	PWHT 690°C/1h ⁽¹⁾ (SC = step cooled)		min	typical	690°C/5h typical	690°C/5h + SC typical
	Tensile strength	MPa	550	610	610	595
0.2% Proof stress	MPa	460	525	515	490	
Elongation on 4d	%	19	25	29	29	
Elongation on 5d	%	20	21	25	25	
Reduction of area	%	--	70	70	70	
Impact energy	+ 20°C	J	47 ⁽²⁾	160	200	200
	- 30°C	J	--	100	160	140
Hardness	(AW)	HV	--	300-320	--	--
	(PWHT)	HV	--	200-210	220	190

⁽¹⁾ BS & AWS PWHT 690°C/1h, DIN 690°C/>30min, BS EN 720°C/1h.
⁽²⁾ DIN & BS EN minimum average.

Packaging data	ø mm	2.5	3.2	4.0	5.0
length mm	350	380	450	450	
kg/carton	12.6	15.0	16.8	17.4	
pieces/carton	627	372	243	159	

1CrMo

Solid welding wire for TIG & MIG.

Product description	Copper coated wire for TIG and MIG welding of 1¼Cr-½Mo steels, conforming to European specifications.										
Specifications	AWS A5.28	ER80S-G									
	BS EN ISO 21952-A	CrMo1Si	(W = TIG, G = MIG)								
	BS 2901: Pt1	(A32)									
	DIN 8575	(SG CrMo 1)									
ASME IX Qualification	QW432 F-No 6, QW442 A-No 3										
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	
	min	0.08	0.80	0.50	--	--	0.90	--	0.45	--	
	max	0.14	1.20	0.80	0.020	0.020	1.30	--	0.65	0.4	
	typ	0.1	1	0.6	0.010	0.015	1.2	<0.1	0.5	0.1	
All-weld mechanical properties	PWHT 690°C/4h (AWS=1h)					min	typical				
	Tensile strength	MPa	550	635	590						
	0.2% Proof stress	MPa	470	520	480						
	Elongation on 4d	%	19	25	26						
	Impact energy	-10°C	J	--	> 200	> 115					
	Hardness		HV(HB)	--	220(215)	195(190)					
Typical operating parameters		TIG				MIG					
	Shielding	Argon				Ar-5%CO ₂					
	Current	DC-				DC+					
	Diameter	2.4mm				1.2mm					
	Parameters	100A, 12V				280A, 26V					
Packaging data	ø mm	TIG				MIG					
	0.8	--				15kg reel					
	1.2	--				15kg reel					
	1.6	5kg tube				--					
	2.4	5kg tube				--					
	3.2	5kg tube				--					
Fume data	MIG fume composition (wt %) (TIG fume negligible)										
		Fe	Mn	Cr ³	Ni	Mo	Cu	OES (mg/m ³)			
		55	5	0.4	< 0.1	< 0.5	1.2	5			

ER80S-B2

Solid welding wire for TIG & MIG.

Product description	Copper coated wire for TIG and MIG welding 1/4Cr-1/2Mo creep resisting steels, conforming to the AWS/ASME specification.									
Specifications	AWS A5.28	ER80S-B2								
	BS EN ISO 21952-B	1CM								
	BS 2901: Pt1	(A32)								
	DIN 8575	--								
ASME IX Qualification	QW432 F-No 6, QW442 A-No 3									
Composition (wire wt %)		C	Mn	Si	S	P	Cr	Ni	Mo	Cu
	min	0.07	0.40	0.40	--	--	1.20	--	0.40	--
	max	0.12	0.70	0.70	0.020	0.020	1.50	0.20	0.65	0.35
	typ	0.1	0.5	0.5	0.010	0.015	1.3	<0.1	0.5	0.1
All-weld mechanical properties	PWHT 690°C/4h (AWS=1h)					min	typical			
	Tensile strength				MPa	550	TIG	MIG		
	0.2% Proof stress				MPa	470	635	590		
	Elongation on 4d				%	19	520	480		
	Hardness				HV(HB)	--	25	26		
	Impact energy	- 10°C			J	--	220(215)	195(190)		
						--	> 200	> 115		
Typical operating parameters		TIG				MIG				
	Shielding	Argon				Ar - 5% CO ₂				
	Current	DC -				DC+				
	Diameter	2.4mm				1.2mm				
	Parameters	100A, 12V				280A, 26V				
Packaging data	ø mm	TIG				MIG				
	0.8	--				15kg reel				
	0.9	--				15kg reel				
	1.0	--				15kg reel				
	1.2	--				15kg reel				
	1.6	5kg tube				--				
	2.4	5kg tube				--				
	3.2	5kg tube				--				
Fume data	MIG fume composition (wt %) (TIG fume negligible)									
		Fe	Mn	Cr ³	Ni	Mo	Cu	OES (mg/m ³)		
		55	5	0.4	<0.1	<0.5	1.2	5		

SA1CrMo

Solid welding wire for SAW.

Product description	Solid wire for Sub Arc Welding of 1¼Cr-½Mo steels.							
Specifications	AWS A5.23		EB2					
	BS EN ISO 24598-A		SCrMo1					
ASME IX Qualification	QW432 F-No 6, QW442 A-No 3							
Composition (typical)		C	Mn	Si	S	P	Cr	Mo
	SA1CrMo wire	0.10	0.8	0.15	0.010	0.012	1.3	0.55
	Deposit with LA436	0.08	1.1	0.4	<0.01	<0.02	1.1	0.5
All-weld mechanical properties (LA436 flux)	PWHT 690°C/1h				min		typical	
	Tensile strength			MPa	550	620		
	0.2% Proof stress			MPa	470	535		
	Elongation on 4d			%	20	25		
	Elongation on 5d			%	20	23		
	Impact energy			+20°C	J	47	>47	
Typical operating parameters	Current: DC or AC; DC+ve is preferred For 2.4mm: 300-500A, 28-36V, 350-700mm/min travel							
Packaging data	ø mm	SAW						
	2.4	25kg coil						
Fume data	SAW fume negligible							

LA436

Sub-arc flux

Product description	LA436 is agglomerated aluminate basic flux (Boniszewski BI ~1.6) with silicon pick-up of ~0.3% and manganese pick-up of ~0.4%.							
Specifications	AWS A5.23		F8 P0-EB2 B2					
	BS EN 760		SA AB 1 67 AC H5					
ASME IX Qualification	QW432 F-No --, QW442 A-No --							
Composition (typical)		C	Mn	Si	S	P	Cr	Mo
	SA 1CrMo wire	0.10	0.8	0.15	0.010	0.012	1.3	0.55
	Deposit with LA436	0.08	1.1	0.4	<0.01	<0.02	1.1	0.5
All-weld mechanical properties with SA 1CrMo wire					Typical PWHT 690-720 °C/1-2h			
	Tensile strength			MPa	620			
	0.2% Proof stress			MPa	535			
	Elongation on 4d			%	25			
	Impact energy			+20°C	J	>47		
Typical operating parameters	Current: DC or AC; DC+ve is preferred 2.4mm: 300-500A, 28-36V, 350-700mm/min travel speed							
Packaging data	Metrode LA436 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 300-350°C/1-2h.							

CORMET 1

All-positional flux cored wire

Product description	Cormet 1 is an all-positional flux cored wire suitable for welding fixed pipework. Made using a high purity steel sheath with a metal recovery of about 90% with respect to the wire.									
Specifications	AWS A5.29		E81T1-B2C/M							
	BS EN ISO 17634-B		T55T1-1C/M-1CM							
ASME IX Qualification	QW432 F-No 6, QW442 A-No 3									
Composition (weld metal wt %)		C	Mn	Si	S	P	Cr	Mo	Cu	
	min	0.05	--	--	--	--	1.00	0.40	--	
	max	0.12	1.25	0.80	0.030	0.030	1.50	0.65	0.30	
	typ	0.06	1.0	0.3	0.01	0.01	1.3	0.55	0.05	
All-weld mechanical properties	PWHT 690°C/1-2h						min	typical		
	Tensile strength					MPa	550	650		
	0.2% Proof stress					MPa	470	550		
	Elongation on 4d					%	19	24		
	Elongation on 4d					%	17	22		
	Impact energy					+ 20°C J	--	> 40		
	Hardness					HV	--	220		
Operating parameters	Shielding gas: 80%Ar-20%CO ₂ at 20-25l/min. Proprietary gases may be used but argon should not exceed 80%. The wire is also suitable for use with 100%CO ₂ . (Note: for 100%CO ₂ shielding gas, voltage should be 1-2V higher.)									
	Current: DC+ve ranges as below:									
	ø mm	amp-volt range				typical	stickout			
	1.2	160 – 260A, 24-30V				190A, 25V	15 – 25mm			
1.6	220 – 350A, 26-32V				260A, 28V	15 – 25mm				
Packaging data	Spools vacuum-sealed in barrier foil with cardboard carton: 15kg. The as-packed shelf life is virtually indefinite. Resistance to moisture absorption is high, but to maintain the high integrity of the wire surface and prevent any possibility of porosity, it is advised that part-used spools are returned to polythene wrappers. Where possible, preferred storage conditions are 60% RH max, 18°C min.									
Fume data	Fume composition (wt %)									
		Fe	Mn	Ni	Cr ³	Cr ⁶	Cu	F	OES (mg/m ³)	
		20	8	< 0.5	1	< 1	< 1	8	5	