

# Low Alloy Steels

DATA SHEET

A-19

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## 12CrMoV CREEP RESISTING STEEL

### Alloy type

12%Cr creep resisting steel also with nominally 1%Mo-0.5%W-0.3%V. The matching base material is generically called X20.

### Materials to be welded

**AISI** Type 422.  
**DIN** X20CrMoV 12 1 (1.4935)  
 G-X22CrMoV 12 1 (1.4931) cast.  
**BS** 3604 grade 762.

### Applications

Chromet 12MV deposits high strength martensitic weld metal of nominally 0.2%C-12%Cr-1%Mo modified with vanadium and tungsten. The alloying is balanced with a small addition of nickel to ensure a fully martensitic microstructure.

12%CrMoV steels are used for critical heat and creep resisting service up to at least 550°C. The high chromium level confers superior steam and fireside corrosion performance compared with 2-9%CrMo creep-resisting steels.

Used in cast and wrought form for **high pressure steam piping** and **headers, heat exchangers** and **turbine components**, particularly in the **power generation industry** and sometimes in **petrochemical** applications.

### Microstructure

In the PWHT condition the microstructure consists of tempered martensite.

### Welding guidelines

The room temperature hardness of as-deposited weld metal exceeds 500HV over a wide range of cooling

conditions. Preheat of 400°C with maximum interpass temperature of 500°C is specified by DIN 8575. These temperatures are above the austenite-martensite transformation range (Ms-Mf about 350-150°C) and more recent procedures have benefited from welding in the 200-350°C preheat range to reduce grain-coarsening and promote some tempering of partially transformed multipass weld metal.

After welding, the joint must be cooled slowly to 120C (100-150°C) and held for 1-2 hours, to allow transformation before post-weld heat treatment. If immediate heat treatment is not possible, the transformation step must be followed by a post-heat of about 350°C for 1-4 hours for hydrogen release, before cooling below 60°C is allowed. In this condition, the hard weld zone is potentially sensitive to stress corrosion cracking (SCC) and must be kept dry, with minimum delay before PWHT.

### PWHT

For production welds typical PWHT is in the temperature range 730-770°C. Normally this would be required for a minimum of three hours but will vary according to thickness, see appropriate application code for details.

### Related alloy groups






The newer P91 materials have replaced many of the original applications for this alloy (data sheet A-17).

### Products available

Process	Product	Specification
MMA	<b>Chromet 12MV</b>	BS EN E CrMoWV 12 B
TIG	<b>12CrMoV</b>	BS EN W CrMoWV 12 Si

# CHROMET 12MV

Basic all-positional MMA electrode for 12%Cr creep resisting steel

<b>Product description</b>	Basic low hydrogen metal powder type made on high purity core wire. Moisture resistant coating giving very low weld metal hydrogen levels. Recovery is about 130% with respect to core wire, 65% with respect to whole electrode.														
<b>Specifications</b>	<b>BS EN ISO 3580-A</b>		E CrMoWV12 B 3 2												
	<b>DIN 8575</b>		E CrMoWV 12 B 26												
<b>ASME IX Qualification</b>	<b>QW432</b> F-No --, <b>QW442</b> A-No --														
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	W	V				
	min	0.15	0.40	--	--	--	10.0	--	0.80	0.40	0.20				
	max	0.22	1.30	0.80	0.025	0.025	12.0	0.8	1.20	0.60	0.40				
	typ	0.20	0.8	0.25	0.010	0.017	11	0.5	1	0.5	0.3				
<b>All-weld mechanical properties</b>	PWHT 760°C / 3 hrs					Room temperature		Elevated temperature							
						min *	typical	350°C		400°C		450°C			
								min	typ	min	typ	min	typ		
	Tensile strength				MPa	690	750	--	590	--	560	--	520		
	0.2% Proof stress				MPa	550	550	370	450	355	420	325	410		
	Elongation on 4d				%	--	24	--	18	--	20	--	17		
	Elongation on 5d				%	15	21	--	16	--	16	--	14		
	Reduction of area				%	--	55	--	50	--	48	--	48		
	Impact energy			+ 20°C	J	34	40	--	--	--	--	--	--		
				0°C	J	--	33	--	--	--	--	--	--		
Hardness				HV	--	235	--	--	--	--	--	--			
	* Minimum requirements after PWHT of 740-780°C/2 hours.														
<b>Operating parameters</b>	DC +ve or AC (OCV: 70V min)														
	ø mm		2.5		3.2		4.0		5.0						
	min A		70		80		100		140						
	max A		110		140		180		240						
<b>Packaging data</b>	ø mm		2.5		3.2		4.0		5.0						
	length mm		350		380		450		450						
	kg/carton		12.6		13.8		16.8		16.8						
	pieces/carton		600		339		234		150						
<b>Storage</b>	<p><b>3 hermetically sealed ring-pull metal tins</b> per carton, with unlimited shelf life. Direct use from tin will give hydrogen &lt;5ml/100g for longer than a working shift of 8h.</p> <p>For electrodes that have been exposed:  <b>Redry</b> 250 – 300°C/1-2h to ensure H<sub>2</sub>&lt;10ml/100g, 300 - 350°C/1-2h to ensure H<sub>2</sub>&lt;5ml/100g. Maximum 420° 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>	Fume composition, wt % typical:														
		Fe	Mn	Ni	Cr	Cu	Mo	V	F	OES (mg/m <sup>3</sup> )					
		20	4	0.1	3	<0.2	0.1	0.1	16	1.7					

# 12CrMoV

Solid TIG wire for 12%Cr creep resisting steel

<b>Product description</b>	Solid wire for TIG.											
<b>Specifications</b>	<b>BS EN ISO 21952-A</b> W CrMoWV 12 Si <b>DIN 8575</b> SG CrMoWV12											
<b>ASME IX Qualification</b>	<b>QW432</b> F-No --, <b>QW442</b> A-No --											
<b>Composition (wire wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	V	W	
	min	0.17	0.40	0.20	--	--	10.5	--	0.80	0.20	0.35	
	max	0.24	1.00	0.60	0.020	0.025	12.0	0.80	1.20	0.40	0.80	
	typ	0.2	0.6	0.4	0.005	0.01	11	0.6	1	0.3	0.5	
<b>All-weld mechanical properties</b>	Typical values after PWHT 760°C/2h:						min	typical				
	Tensile strength					MPa	690	750				
	0.2% Proof stress					MPa	550	600				
	Elongation on 5d					%	15	20				
	Impact energy				+ 20°C	J	34	50				
<b>Operating parameters</b>	TIG											
	Shielding	Argon *										
	Current	DC-										
	Diameter	2.4										
	Voltage	100A, 12V										
<b>Packaging data</b>	ø mm	TIG										
	2.4	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> )				
		55	4	8	<0.5	<0.5	<0.5	5				