

# High Temperature Alloys

## DATA SHEET

## C-21

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## CONTROLLED FERRITE 309

### Alloy type

23%Cr-12%Ni (309) alloy with a controlled ferrite and carbon content to match similar heat resistant alloys.

### Materials to be welded

	wrought	cast
<b>ASTM/UNS</b>	S30900 (309) S30908 (309S) S30909 (309H)	A351 Grades CH8, CH10, CH20.
<b>DIN</b>	1.4829 (X12CrNi 22 12)	1.4832 (G-X25CrNiSi20 14)
<b>BS</b>	309S24	309C30
<b>EN</b>	1.4833 (X12CrNi23-12)	

### Applications

These consumables deposit 309 type weld metal with a controlled carbon of about 0.08% and low ferrite content. These controls are designed to increase the high temperature strength and microstructural stability for service applications above 400°C. The widely used 309L dissimilar weld metal has lower hot strength and is more prone to embrittlement during long term high temperature service for which it is not intended.

The main application for this electrode is for welding steels of similar composition although some high temperature steels of dissimilar composition, such as ferritic CrAl and CrSiAl alloys are applicable. It is also a candidate for welding 'utility ferritic' stainless steels

for elevated temperature service.

309 steels have useful oxidation resistance up to about 1000°C and the lower nickel content gives better sulphidation resistance than 310 types.

They are normally used in **furnace** or **flue-gas systems** and **ducting** where the structural creep requirements are modest.

### Microstructure

Austenite with up to 8% ferrite and some carbides.

### Welding guidelines

Preheat not required for most applications.

### Related alloy groups


The 309L consumables (data sheet B-50) typically used for dissimilar joints are related but are not used for the same high temperature applications. The 309H alloy (data sheet C-22) is also related but is generally used for the higher carbon (0.35% C) cast alloys.

### Products available

Process	Product	Specification
MMA	<b>Thermet 309CF</b>	AWS E309H-16
TIG/MIG	<b>309S94</b>	AWS ER309

# THERMET 309CF

309 electrode with controlled carbon and ferrite content

<b>Product description</b>	MMA electrode with a rutile flux coating on high purity 304L core wire. Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.										
<b>Specifications</b>	<b>AWS A5.4</b>	E309H-16									
	<b>BS EN 1600</b>	(E 22 12 R 32)									Cr 20.0-23.0%
	<b>BS 2926</b>	23.12.R									
	<b>DIN 8556</b>	(E 22 12 R 26)									
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 5, <b>QW442</b> A-No 8										
<b>Composition (weld metal wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN
	min	0.06	0.5	0.2	--	--	22.0	12.0	--	--	2
	max	0.15	2.0	0.8	0.025	0.030	24.0	14.0	0.5	0.50	8
	typ	0.08	1.5	0.3	0.01	0.02	22.7	12.8	0.1	0.1	5
<b>All-weld mechanical properties</b>	As welded					min		typical			
	Tensile strength				MPa	560	605				
	0.2% Proof stress				MPa	350	460				
	Elongation on 4d				%	30	34				
	Elongation on 5d				%	25	31				
	Reduction of area				%	--	30				
	Hardness				HV	--	210				
<b>Operating parameters</b>	DC +ve or AC (OCV: 70V min)										
	∅ mm	2.5		3.2		4.0		5.0			
	min A	60		75		100		130			
	max A	90		120		155		210			
<b>Packaging data</b>	∅ mm	2.5		3.2		4.0		5.0			
	length mm	300		350		350		350			
	kg/carton	13.5		15.0		16.5		15.9			
	pieces/carton	899		432		285		183			
<b>Storage</b>	<p><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.</p> <p>For electrodes that have been exposed:  <b>Redry</b> 200 – 250°C/1-2h to restore to as-packed condition. Maximum 250° 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	Cr	Ni	Cu	F	OES (mg/m <sup>3</sup> )			
		9	6	7	1	<0.2	17	0.7			

# 309S94

309 solid wire with controlled carbon and ferrite

<b>Product description</b>	Solid wire for TIG and MIG.										
<b>Specifications</b>	<b>AWS A5.9</b>		ER309								
	<b>BS EN ISO 14343-A</b>		22 12 H								
	<b>BS EN ISO 14343-B</b>		SS309								
	<b>BS 2901: Pt2</b>		309S94								
	<b>UNS</b>		S30980								
<b>ASME IX Qualification</b>	<b>QW432</b> F-No 6, <b>QW442</b> A-No 8										
<b>Composition (wire wt %)</b>		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	FN
	min	0.04	1.0	0.30	--	--	23.0	12.0	--	--	3
	max	0.12	2.5	0.65	0.02	0.030	24.0	14.0	0.3	0.3	12
	typ	0.07	1.7	0.5	0.01	0.02	23.5	13	0.1	0.1	6
<b>All-weld mechanical properties</b>	Typical values as welded						TIG				
	Tensile strength					MPa	580				
	0.2% Proof stress					MPa	415				
	Elongation on 4d					%	42				
	Elongation on 4d					%	39				
	Reduction of area					%	56				
	Hardness cap/mid					HV	175/215				
<b>Typical operating parameters</b>		TIG					MIG				
	Shielding	Argon *					Ar+2%O <sub>2</sub> **				
	Current	DC-					DC+				
	Diameter	2.4mm					1.2mm				
	Parameters	120A, 14V					260A, 26V				
	* Also required as a purge for root runs.										
	** Proprietary Ar, and Ar-He mixtures with <3%CO <sub>2</sub> are also suitable.										
<b>Packaging data</b>	ø mm	TIG					MIG				
	1.0	--					15kg spool				
	1.2	--					15kg spool				
	1.6	2.5kg tube					--				
	2.4	2.5kg tube					--				
<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> )			
		32	12	20	11	<0.5	<0.5	2.5			