High Temperature Alloys

DATA SHEET **C-50**

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CONSUMABLES TO MATCH HP40Nb

Alloy type

Consumables to match 0.4%C-25%Cr-35%Ni-Nb heat resistant cast alloys.

Materials to be welded

Matching alloys

ASTM-ASME	DIN
A297 'HP40Cb'	1.4852 (G-X40NiCrNb 35 25)
	1.4853 (wrought)

Proprietary alloys
Paralloy H39W (Doncasters Paralloy)
Lloyds T64 (LBA)
MORE 10 & 10-MA (Duraloy)
Thermalloy 64 (Duraloy)
Manaurite 36X & 36XM (Manoir)
Pyrotherm G25/35Nb & NbTZ (Pose Marre)
Centralloy 4852 & 4852 Micro (Schmidt + Clemens - Centracero)

Nb-free alloys

ASTM-ASME	DIN
A297 HP or HP40	1.4857 (G-X40NiCrSi 35 25)
	1.4853 (wrought)

Proprietary alloys
Paralloy H39 (Doncasters Paralloy)
Lloyds T63 (LBA)
HR33 (Cronite)

Also suitable for high carbon 18%Cr-37%Ni-Nb alloys eg. DIN 1.4849.

Applications

These consumables are designed to match heat resistant cast alloys with 0.4%C-25%Cr-35%Ni-Nb, including those micro-alloyed with Ti to increase creep resistance. They are also suitable for the Nb free alloys and leaner high carbon Cr-Ni alloys such as HK40, HT40 and IN519 where overmatching weld metal will normally be acceptable.

Alloy HP40Nb is not prone to sigma phase embrittlement and the presence of eutectic and secondary carbides provide excellent hot strength and creep resistance in the typical service temperature range 900-1100°C. High levels of Cr and Ni provide good resistance to oxidation and carburisation.

The principal applications are **pyrolysis coils** and **reformer tubes** for **ethylene production** in the **petrochemical industry**.

Microstructure

In the as-welded condition the weld metal consists of austenite with eutectic and secondary carbide.

Welding guidelines

Generally preheat is not required.

Related alloy groups

There are a number of related high carbon Cr-Ni alloys which are used in the same type of applications, see other alloys in the Hot Zone. There is also a lower carbon version of the 25%Cr-35%Ni alloy (data sheet C-40) which provides better thermal shock and fatigue, with some reduction in creep strength.

Products available

Process	Product	Specification
MMA	**Thermet HP40Nb**	BS 25.35.H.Nb.B
TIG/MIG	**25.35.4CNb**	--

THERMET HP40Nb

Basic electrode matching HP40Nb alloys

Product description

Basic moisture resistant MMA electrode made on high purity alloy core wire, giving high resistance to microfissuring and porosity in large multi-run deposits.

Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.

Specifications

BS 2926 25.35.H.Nb.B

ASME IX Qualification

QW432 F-No -

Composition (weld metal wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	Nb	Ti
min	0.35	0.5	0.2	--	--	23.0	32.0	--	0.75	0.02
max	0.50	2.0	1.3	0.030	0.040	27.0	36.0	0.5	1.50	0.20
typ	0.43	1.7	0.9	0.010	0.010	25	35	0.1	1.1	0.08

All-weld mechanical properties

As welded		min *	typical
Tensile strength	MPa	600 (450)	740
0.2% Proof stress	MPa	-- (250)	560
Elongation on 4d	%	-- (5)	15
Elongation on 5d	%	--	15
Reduction of area	%	--	17
Hardness	HV	--	240

* Minimum tensile strength of 600MPa is from BS2926; the values in brackets are minimum values for base material static castings.

Room temperature elongation has little significance for weld metal designed for high temperature service and creep resistance. Values down to 4.5% (on 4d) are allowed in ASTM HP40 castings and the ductility of multipass welds may approach this value due to carbide precipitation in successive runs.

Stress rupture/creep data:

Temperature		Stress		Life	Elongation
°C	°F	MPa	ksi	Hours	%
871	1600	48.2	7	1431	6
927	1700	27.6	4	2398	3
982	1800	17.3	2.5	2414	3

Operating parameters

DC +ve

ø mm	2.5	3.2	4.0	5.0
min A	60	75	100	130
max A	90	120	155	210

Packaging data

ø mm	2.5	3.2	4.0	5.0
length mm	265	320	320	320
kg/carton	11.1	12.3	12.0	12.3
pieces/carton	519	348	228	153

Storage

3 hermetically sealed ring-pull metal tins 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.
For electrodes that have been exposed:
Redry 200 – 300°C/1-2h to restore to as-packed condition. Maximum 400° C, 3 cycles, 10h total.
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.

Fume data

Fume composition, wt % typical:

Fe	Mn	Ni	Cr	Cu	Mo	V	F	OES (mg/m^3)
4	6	7	7	< 0.5	< 0.1	< 0.1	18	0.7

25.35.4CNb

Solid TIG and MIG wire for matching HP40Nb alloys

Product description

Solid wire for TIG, auto-TIG and MIG.

Specifications

There are no national specifications for this wire

ASME IX Qualification

QW432 F-No -

Composition (wire wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	Nb	Ti	Zr	Cu	Sn	Pb
min	0.40	1.0	0.5	--	--	23.0	32.0	--	0.75	0.05	0.01	--	--	--
max	0.50	2.5	1.6	0.02	0.02	27.0	36.0	0.50	1.50	0.25	0.15	0.5	--	--
typ	0.43	1.7	1.1	0.005	0.01	26	35	<0.3	1.1	0.1	0.03	0.1	<0.01	<0.01

All-weld mechanical properties

Typical values as welded		min *	TIG
Tensile strength	MPa	450	809
0.2% Proof stress	MPa	250	593
Elongation on 4d	%	5	9
Elongation on 5d	%	--	11
Reduction of area	%	--	15
Hardness cap/mid	HV	--	211/263

* Parent material minimum values (static castings).

Room temperature elongation has little significance for weld metal designed for high temperature service and creep resistance. Values down to 4.5% (on 4d) are allowed in ASTM HP40 castings and the ductility of multipass welds may approach this value due to carbide precipitation in successive runs.

Typical operating parameters

	TIG
Shielding	Argon
Current	DC-
Diameter	2.4mm
Parameters	100A,12V

Packaging data

ø mm	TIG	Spooled wire normally used for automatic TIG
1.2	--	12.5kg reel
1.6	2.5kg tube	--
2.0	2.5kg tube	--
2.4	2.5kg tube	--
3.2	2.5kg tube	--

Fume data

Fume composition (wt %) (TIG fume negligible)

Fe	Mn	Cr^3	Mo	Cu	OES (mg/m^3)
35	13	26	< 0.5	< 0.5	2