Nickel Base Alloys

DATA SHEET **D-32**

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CORROSION RESISTANT ALLOY C22

Alloy type

Nickel base 22%Cr-13.5%Mo-3%W, alloy C22.

Materials to be welded

Matching Alloy C22:

ASTM
A494 CX2MW (cast)
UNS N06022
DIN
2.4602 (NiCr21Mo14W)
2.4811, 2.4836 (NiCr20Mo15)
2.4697 (G-NiCr20Mo15) (cast)
Proprietary Alloys
Hastelloy™ Alloy C-22™ (Haynes International Inc)
Nicrofer™ 5621hMoW (VDM)
Inconel™ 622 (Special Metals)

Other Alloys:

Alloy C4
ASTM UNS N06455
DIN 2.4610 (NiMo16Cr16Ti)
Hastelloy™ Alloy C-4 (Haynes International Inc)
Superaustenitics
UNS S31254, S31266, S32654, S34565, N08367, N08925, N08926.
1.4529, 1.4565, 1.4575, 1.4652.
254SMO and 654SMO (Outokumpu)
Uranus B66 (Usinor Industeel)

Applications

The weld deposit composition of Ni-22Cr-13.5Mo-3W is designed to match the nickel base alloy commonly known as alloy C22. The high level of molybdenum is similar to alloys C276 and C4 but performance in a wide range of more oxidising media is significantly enhanced in alloy C22 by increasing chromium to 22%.

Alloy C22 also provides a tough Nb-free weld metal for dissimilar welds in superaustenitic and superduplex stainless steels or combinations of these with nickel base alloys. Some authorities do not allow or have discontinued using alloy 625 consumables for such applications, where deleterious Nb-rich precipitates may form in diluted or partially mixed regions around the fusion boundary.

Applications of alloy C22 in aggressively corrosive media include **scrubbers** for **flue gas desulphurisation (FGD), digesters** and **papermaking equipment, chemical process plant, corrosion resistant overlays** and in severe **offshore** and **petrochemical** environments.

Microstructure

Solid solution strengthened high nickel austenite, with some microsegregation typical of as-deposited weld metal.

Welding procedure

Preheat not normally required, interpass temperature restricted to 100°C and heat inputs below 1kJ/mm are desirable.

Related alloy groups

Alloy 59 is similar but with slightly higher Cr and Mo for similar or more severe applications – see data sheet D-31.

Products available

Process	Product	Specification
MMA	**Nimrod C22KS**	AWS ENiCrMo-10
TIG/MIG	**HAS C22**	AWS ERNiCrMo-10

NIMROD C22KS

All-positional MMA electrode for alloy C22

Description

Basic flux covered electrode with exceptional operability optimised for DC+ welding in all positions including fixed pipework qualified in the ASME 5G/6G positions. It is equally suitable for general fabrication welds.

Special basic flux covering on matching high purity nickel alloy core wire to give clean and homogenous weld metal. Very low levels of carbon and silicon minimise the occurrence of deleterious precipitates in the as-welded condition.

Recovery is approx 110% with respect to core wire, 65% with respect to whole electrode.

Specifications

AWS A5.11 ENiCrMo-10
BS EN 14172 E Ni6022

ASME IX Qualification

QW422 P-No 43, **QW432** F-No 43

Composition (weld metal wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	W	V	Co	Cu	Fe
min	--	--	--	--	--	20.0	49.0	12.5	2.5	--	--	--	2.0
max	0.02	1.0	0.2	0.015	0.02	22.5	--	14.5	3.5	0.35	2.5	0.50	6.0
typ	0.01	0.5	0.15	0.008	0.008	21	58	14	3	0.05	0.05	0.05	4

All-weld mechanical properties

Typical as-welded			min	typical
Tensile strength		MPa	690	760
0.2% Proof stress		MPa	350	510
Elongation on 4d		%	25	36
Elongation on 5d		%	22	35
Reduction of area		%	--	33
Impact energy	-196°C	J	--	45
Hardness, cap/mid		HV	--	245/275

Operating parameters

DC +ve

ø mm	2.5	3.2	4.0
min A	60	75	100
max A	80	120	155

Packaging data

ø mm	2.5	3.2	4.0
length mm	250	300	350
kg/carton	10.5	13.5	15.6
pieces/carton	711	486	306

Storage

3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin is satisfactory for much longer than an 8h working shift. Excessive exposure of electrodes to humid conditions will cause some moisture pick-up and increase risk of porosity.
For electrodes that have been exposed:
Redry 250 – 300°C/1-2h to restore to as-packed condition. Maximum 350°C, 3 cycles, 10h total.
Storage of redried electrodes at 100 – 200°C in holding oven, or 50 – 150°C in heated quivers: 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 %)

Fe	Mn	Ni	Cr	Mo	Cu	F	OES (mg/m^3)
1	4	10	5	6	0.2	16	1

HAS C22

Solid wire for nickel base alloy C22

Product description

Solid wire for TIG and MIG.

Specifications

AWS A5.14 ERNiCrMo-10
BS EN ISO 18274 SNi6022

ASME IX Qualification

QW432 F-No 43

Composition (wire wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	W	V	Co	Cu	Fe
min	--	--	--	--	--	20.0	49.0	12.5	2.5	--	--	--	2.0
max	0.01	0.50	0.08	0.010	0.02	22.5	--	14.5	3.5	0.3	2.5	0.50	6.0
typ	0.003	0.2	0.03	0.002	0.01	21	56	13.5	3	0.15	1.5	0.1	4

All-weld mechanical properties

Typical values as welded			TIG
Tensile strength		MPa	740
0.2% Proof stress		MPa	500
Elongation on 4d		%	44
Elongation on 5d		%	42
Impact energy	- 196°C	J	130
Hardness		HV	220

Typical operating parameters

	TIG	MIG
Shielding	Argon *	Argon or Ar-He
Current	DC-	Pulsed
Diameter	2.4mm	1.2mm
Parameters	100A, 12V	160A, 28V (mean)

* Also required as a purge for root runs.

Packaging data

ø mm	TIG	MIG
1.0	--	To order
1.2	--	To order
1.6	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	Ni	Mo	Cu	OES (mg/m^3)
14	1	17	30	10	<0.5	1.7