Repair & Maintenance

DATA SHEET **E-10**

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PURE NICKEL FOR CAST IRON

Alloy type

Pure nickel type for welding cast iron.

Materials to be welded

ASTM	BS
A159, A319, A126, A48.	1452 – Grey iron

Applications

Pure nickel consumables are used for welding and repair of standard grades of **grey cast irons** and **malleable cast irons** to give low strength deposits which can be readily machined even in thin layers. The resistance to hardening of diluted weld metal can be useful for buttering prior to filling with more economic NiFe consumables (data sheet E-11).

They are also suitable for joining these cast irons to steels, monels, copper etc where high strength is not required.

Typical components are **general engineering castings**, including **machine bases**, **engine blocks**, **gear housings** etc operating under low stresses.

Microstructure

MMA electrode deposits austenitic nickel with finely distributed graphite; the solid wire deposits almost pure nickel refined with Ti.

Welding guidelines

Welding is often carried out without preheat but heavy multipass deposits or highly restrained joints may require preheat up to 150°C.

Prior to welding surfaces should be prepared by careful gouging and/or grinding using limited amounts of heat to avoid propagating cracks. The area to be welded should be cleaned as far as practicable from sand, oil, grease, paint or rust. Preheating can help to remove impregnated oil on used castings which are being repaired.

If welding is carried out without preheat it is desirable to minimise the width of the HAZ by using a low heat input and low interpass temperature. A skip welding technique can be beneficial in helping to achieve this.

For thicker section welds and highly restrained welds preheat up to150°C may be necessary. Light peening to reduce contraction stresses can also be beneficial but care should be taken not to exhaust the ductility of the weld metal.

Buttering the joint faces, or sides of the repair cavity, prior to filling can also be desirable whether a preheat is used or not.

On completion of welding the workpiece should be allowed to cool slowly, using insulation if necessary.

Related alloy groups

The NiFe alloy (data sheet E-11) is also used for welding cast iron and covers many similar applications.

Products available

Process	Product	Specification
MMA	**CI Soft Flow Ni**	AWS ENi-CI
TIG/MIG	**Nickel 2Ti**	AWS ERNi-1

CI SOFT FLOW Ni

Pure nickel MMA electrode for cast iron

Product description

MMA electrode with special basic-graphite flux (no barium compounds) on pure nickel core wire. Good refining action provides maximum resistance to cracking and freedom from porosity. Sound welds can be produced even with oil impregnated and contaminated surfaces. The stable arc characteristics also provide uniform low penetration and minimum dilution. The smallest diameters can be used in all positions including vertical down.

Recovery is about 95% with respect to core wire, 70% with respect to whole electrode.

Specifications

AWS A5.15	ENi-CI
BS EN 1071	E C Ni-CI 1
DIN 8573	(ENi BG 1)

ASME IX Qualification

QW432 F-No --

Composition (weld metal wt %)

	C	Mn	Si	S	P	Cu	Ni	Fe	Al
min	--	--	--	--	--	--	92	--	--
max	2.0	2.5	2.0	0.03	0.03	2.5	bal	5.0	1.0
typ	0.5	2	0.1	0.01	0.01	0.1	96	2	0.1

All-weld mechanical properties

As welded		typical
Tensile strength	MPa	275
0.2% Proof stress	MPa	190
Elongation	%	5-10
Hardness	HV	140-160

Mechanical properties will depend upon amount of dilution, and variations in welding procedure and run sequence.

Operating parameters

DC +ve or AC (OCV: 50V min)

ø mm	2.5	3.2	4.0	5.0 *
min A	60	70	90	120
max A	80	110	150	190

Packaging data

ø mm	2.5	3.2	4.0	5.0 *
length mm	300	350	350	375
kg/carton	15.0	16.5	16.8	18.6
pieces/carton	903	480	309	234

* 5.0mm diameter made to order, minimum order quantity.

Storage

3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin is satisfactory.
For electrodes that have been exposed:
Redry 100 – 150°C/1-2h to restore to as-packed condition. Maximum 150° C, 3 cycles, 10h total.
Storage: Recommended ambient storage conditions for opened tins (using plastic lid): < 60% RH, > 18°C.

Fume data

Fume composition, wt % typical:

Fe	Mn	Ni	Cu	F	Ba	OES (mg/m^3)
0.5	1	10	<0.5	12	<0.5	5

NICKEL 2Ti

Solid pure nickel wire for cast iron

Product description

Solid wire for TIG and MIG. This is the same wire that is used for alloy 200 pure nickel base materials (data sheet D-50) but it is also useful for welding cast irons as a match for the CI Soft Flow Ni electrode.

Specifications

AWS A5.14	ERNi-1
BS 2901: Pt5	NA32
BS EN proposed	Ni2061
DIN 1736	(SG-NiTi4 (2.4155))

Also known generically as filler metal 61 (FM61)

ASME IX Qualification

QW432 F-No 41

Composition (wire wt %)

	C	Mn	Si	S	P	Ni	Ti	Al	Cu	Fe
min	--	--	--	--	--	93.0	2.0	--	--	--
max	0.15	1.0	0.75	0.015	0.03	bal	3.5	1.5	0.25	1.0
typ	<0.02	0.4	<0.3	0.005	0.005	96	3	0.1	<0.02	0.1

All-weld mechanical properties

Typical values as welded		TIG
Tensile strength	MPa	585
0.2% Proof stress	MPa	335
Elongation on 4d	%	35
Elongation on 5d	%	31
Reduction of area	%	65
Hardness cap/mid	HV	155/185

Typical operating parameters

	TIG	MIG
Shielding	Argon	Ar or Ar-He
Current	DC-	Pulsed
Diameter	2.4mm	1.2mm
Parameters	100A, 12V	150A, 29V (mean)

Packaging data

ø mm	TIG	MIG
1.2	--	15kg spool
1.6	2.5kg tube	--
2.4	2.5kg tube	--

Fume data

MIG fume composition (wt %) (TIG fume negligible)

Fe	Mn	Cr^3	Ni	Mo	Cu	OES (mg/m^3)
2	2	<0.1	68	0.1	<0.5	0.7