



**MWA
Product Guide
2nd Edition**



TOOL & DIE

CONTENTS

MAC TOOL E3042	4
MAC TOOL E3044	5
MAC TOOL E3053	6
MAC TOOL E3060	7
MAC HSS E3062	8
MAC TOOL E3064	9
MAC TOOL E3065	10
MAC TOOL E3066	11
MAC TOOL E3067	12
MAC TOOL E3068	13
MAC TOOL E3069	14
MAC HICA E3071	15
MAC HICA E3072	16
MAC HICA E3073	17
MAC HICA E3074	18
MAC HICA E3075	19
MAC HICA E3076	20-21

MAC TOOL E3042

Manufactured on a high purity ferritic core wire with an alloy bearing concentrically extruded basic flux. It is used for both the maintenance and manufacture of components and tools subjected to impact and abrasion at temperatures up to 550°C. Such applications include dies, hot & cold shear blades, hammers, sewage and guillotine blades.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Fe	Mn	Mo	P	S	Si
0.35	7.0	BAL	1.30	2.50	0.015	0.01	0.50

Typical All Weld Deposit Hardness

As Deposited	Rockwell C
55	

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
50-70	80-110	140-170	170-210

Current:
DC (+) AC (80 amps OCV)

Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

MAC TOOL E3044

Manufactured on a high purity ferritic core wire with an alloy bearing chemically basic concentrically extruded flux. All positional welding characteristics with excellent control of the molten welding pool. Used to special advantage for the repair of hot working dies by single or multi layer build ups, or surfacing rollers or hot shear blades. When machining tungsten carbide tools are used to obtain the best profile. Excellent resistance to impact and abrasion up to 550°C and this is combined with the ability of the deposit to be machined making it an exceptionally versatile alloy. Pre- Heat 200°C to 300°C. Slow cool after welding. Readily machinable with carbide tools

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Fe	Mn	Mo	P	S	Si
0.15	5.0	BAL	0.17	4.20	0.015	0.010	0.60

Typical All Weld Deposit Hardness

As Deposited	Rockwell C
40	

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
50-70	80-110	140-170	170-210

Current:
AC/DC (+)(80 amps OCV)

Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

MAC TOOL E3053

Manufactured on a high purity mild steel core wire with a concentrically extruded chemically basic flux that contains the alloying elements and deoxidants. The metal recovery rate is some 130% with respect to the core wire, the electrode is suited for all positional work and the slag is easily controlled and resists control when building up edges. Mac Tool E3053 is essentially a modified high speed steel alloy to enlarge it's range of welding applications on cutting tools, reamers and similar no PWHT is needed and hot hardness up to 600°C is excellent. When toughness as well as hot hardness is needed or when machining is required the alloy should be annealed and slow cooled, followed by H.T at 1200°C followed by air cooling or quenching.

Typical All Weld Metal Chemical Analysis (%)

Co	Cr	Fe	Mn	Mo	P	S	Si	Ti&Nb	W
2.8	1.9	BAL	0.5	0.55	0.01	0.009	0.4	0.8	8.0

Typical All Weld Deposit Hardness

	Typical RC
As Deposited	63
Annealed @ 800°C	25
Slow Cooled 1200°C-600°C	64

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
70-90	90-140	130-190	160-220

Current:
AC/DC (+) - DC electrode positive (+)

Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

MAC TOOL E3060

Manufactured using a high purity, low silicon wire with a chemically basic, alloy bearing flux. May be used in all positions except vertically down, strong stable arc, fillet welds are convex, weld metal of bright appearance. Very low levels of hydrogen. Used to best advantage for downhand welding for critical repairs to die blocks when the weld metal must combine good toughness, high strength and resistance to oxidation at high temperatures, plus resistance to thermal shock.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Mn	Mo	Ni	Si
0.13	9.5	1.0	3.0	1.75	0.9

Typical All Weld Metal Mechanical Properties

After PWHT at 520°C

Tensile Strength	840-920 N/mm ²
0.2% Proof Stress	735-810 N/mm ²
Elongation	8-12%
Hardness	38-45 HRC

Sizes Available and Recommended Amperages

3.2mm	4.0mm	5.0mm	6.0mm
90-140	150-190	190-220	250-300

Related Specification:

10% Chrome (Generic)

Current:

AC/DC (+)

Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 180°C before use.

MAC HSS E3062

Hard facing electrode, designed to deposit high quality high speed steel on mild or low alloy steels, having a metal recovery rate of 115%. Tough and highly crack resistant deposits, retaining hardness at temperatures up to 620°C. Deposits can be annealed and re-hardened by oil quenching. Highly recommended for the fabrication of blanking and piercing dies, knife blade edges, shear blades, lathe tools, boring tools, milling cutters, broaching tools, drills, hot working dies etc., ideal for the building up of edges on small components.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Mn	Mo	Si	V	W
0.52	4.79	0.42	8.33	0.27	0.84	2.59

Typical All Weld Deposit Hardness

As Deposited	59-62 Rockwell C
Annealed @ 865°C	35-37 Rockwell C
Oil Quenched at 1200°C	59-62 Rockwell C

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
50-80	90-120	130-150	150-220

Current:
AC/DC (+)
Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

MAC TOOL E3064

A low hydrogen, iron powder basic flux coated electrode. Designed for special hardfacing applications involving heavy impact loading combined with abrasion. This electrode is ideally suited for forging dies because of its very tough deposit. It is an H13 type product. Pre-heat and dilution may effect hardness on first two layers but not on subsequent layers. On heavy build-ups use Mac Trode E6718 as buffer layer on carbon steels and Mac Trode E630 on 13% manganese steels

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Mn	Mo	Si	V
0.45	6.50	0.70	0.60	0.50	0.80

Typical All Weld Metal Mechanical Properties

	1st Layer	2nd Layer	3rd Layer
Rockwell HRC	53-55	56-59	57-60

Sizes Available and Recommended Amperages

3.2mm	4.0mm	5.0mm
80-140	100-180	140-240

Related Specification:
H13 Tool Steel
Current:
AC (OCV 70 amps) DC+
Storage:

If allowed to become damp, the electrodes should be re-dried for one hour at 180°C before use.

MAC TOOL E3065

A low hydrogen, iron powder basic flux coated electrode for hard facing applications involving a combination of both impact and abrasion. Easy to use, giving sound porosity free welds. Ideally suited for use in the forging industry.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Mn	Mo	Si	V	W
0.80	7.50	1.4	0.80	0.70	0.15	1.2

Typical Hardness Values (On Mild Steel Plate)

	1st Layer	2nd Layer	3rd Layer
Rockwell HRC	55-60	60-62	60-63

Sizes Available and Recommended Amperages

3.2mm	4.0mm	5.0mm
90-150	110-190	150-250

Current:

AC (OCV 70 amps) DC+

Storage:

Electrodes should be kept in a dry store. If allowed to become damp electrodes should be re-dried for one hour at 150°C before use.

MAC TOOL E3066

A low hydrogen electrode manufactured on a high purity mild steel core wire with an extruded chemically basic coating which ensures low S-P-O and N levels and also alloys the weld with the appropriate levels of alloying elements. Weld alloying is by means of appropriate levels of C-Mn-Cr-Ni and Mo, which harden by matrix reinforcing, so combining hardness with toughness. Mac Tool E3066 is specifically designed for the repair of low alloy steel die blocks in the forging industry. The weld metal combines hardness with exceptional toughness and resistance to oxidation, plus resistance to thermal cycling. Specifically the nickel ensures toughness, the chrome resistance to oxidation, the molybdenum towards retaining hardness at high temperatures.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Mn	Mo	Ni	P	S	Si
0.15	2.2	1.2	1.1	3.9	0.010	0.008	0.4

Typical All Weld Metal Mechanical Properties

HV 420 – 430 (43 Rockwell hardness)
 (SR 570°C) HV 320 – 400 (30 Rockwell hardness)

Sizes Available and Recommended Amperages

3.2mm	4.0mm	5.0mm	6.00mm
100-120	140-180	200-260	250-320

Current:

DC (+) or AC (min OCV 70 amps)

Storage:

Electrodes should be kept in a dry store. If allowed to become damp electrodes should be re-dried for two hours at 250°C before use.

MAC TOOL E3067

Extruded flux coated MMA electrode manufactured on a high purity nickel core wire with a complex alloyed chemically neutral flux coating. Metal recovery is some 150% with respect to the core wire. The alloy may be described as a nickel based Cr Co Mo Al and Ti alloyed material that exhibits excellent (precipitation) hardening characteristics. Mac Tool E3067 deposits weld metal with excellent high temperature strength and toughness stability while retaining excellent resistance to oxidation and creep. The alloy is exceptionally valuable on hot working tools, in the drop forging industry, notably the repair of GFM hammers. As with all complex nickel based alloys, welding procedures and post weld cooling rates within the 200°C min and 400°C max interpass temperatures, should be adhered to. The weld procedure should be designed to favour a maximum fineness of dendritic structure to reduce micro fissuring and liquation cracking. The use of minimum amperages consistent with good weldability is one criteria that greatly assists this objective.

Typical All Weld Metal Chemical Analysis (%)

C	Co	Cr	Fe	Mn	Mo	Si	Ti+Al	W
0.04	8.4	18.0	6.5	0.2	7.2	1.2	3.5	1.4

Typical All Weld Metal Mechanical Properties

In the aged condition 240HV

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
50-80	80-110	140-180	160-220

Related Specification:

Udimet 520 Material

Current:

AC/DC (+)

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 250°C before use

MAC TOOL E3068

Extruded flux coated MMA electrode manufactured on a ferritic core wire with a complex alloyed chemically neutral flux coating. The alloy bearing chemically basic flux ensures excellent welding characteristics and metal recovery is some 125% with respect to the core wire. As the weld is a modified stainless it has excellent resistance to oxidation up to 1000°C and good wear resistance up to 600°C even under certain corrosive conditions. As welded the hardness of 52 – 56 HRC results, if the weld has to be machined it may be so annealed at 830°C and then rehardened by air or oil cooling from 960°C to 1000°C. Although it may be used to weld medium carbon variants of AISI 410 it is intended to be used as a surfacing alloy as it attains a high hardness even under conditions of slow cooling, when welding large dies and tools, it is mainly air hardening.

Nominal Analysis (%)

C	Cr	Mo	Ni
0.2	12.50	2.50	2.20

Physical Properties

As Welded

52 – 56 HRC

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
70-110	100-160	140-200	190-260	240-300

Related Specification:

Typical H11 Tool Steel

Current:

DC+ or AC (OCV 80 amps)

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 250°C before use

MAC TOOL E3069

Extruded flux coated MMA electrode manufactured on a high purity nickel core wire with a complex alloyed chemically neutral flux coating. Metal recovery is some 150% with respect to the core wire.

Mac Tool E3069 is a nickel based Cr Co Mo alloyed precipitation hardening alloy for welding to similarly alloyed based materials used for high temperature applications. e.g. to weld AMS 5706, 5707, 5708, 5709, 5544, 5586 or ASTM 637

Typical All Weld Metal Chemical Analysis (%)

Co	Cr	Mo	Ti+Al
14.0	20.0	4.5	4.5

Typical All Weld Metal Mechanical Properties

Air Aged Rockwell C 35-45

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
50-80	80-110	140-180	160-220

Related Specification:

Waspalloy (Type)

Current:

AC/DC (+)

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 250°C before use

MAC HICA E3071

Cobalt based electrode designed on a fully alloyed core wire to combat all four elements of wear, i.e. heat, impact, corrosion and abrasion. Most suitable of cobalt range where abrasion is the most predominant of the four elements of wear. Excellent for rebuilding corners with minimum base metal dilution. Has ability to overlay extensive areas without cracking. Will retain hardness at high temperatures. Welds are non-machinable. Recommended for use in the iron and steel industries or any industry where heat, corrosion and abrasion occur concurrently.

Nominal Analysis (%)

C	Co	Cr	Fe	W
2.5	BAL	30.0	3.0	12.0

Typical All Weld Deposit Hardness

	HRC	HV
+20°C	56	600
+400°C	48	480
+800°C	26	270

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
70-90	90-115	100-150	170-220

Related Specification:

AWS E Co Cr-C (Cobalt Grade 1)

Current:

AC/DC (+).

Storage:

If allowed to become damp the electrodes should be re-dried for one hour at 150°C before use

MAC HICA E3072

Cobalt based electrode designed on a fully alloyed core wire to combat all four elements of wear, i.e. heat, impact, corrosion and abrasion. High impact properties. Most suitable of cobalt range where impact is the most predominant of the four elements of wear. Excellent for rebuilding corners with minimum base metal dilution. Has ability to overlay extensive areas without cracking. Will retain hardness at high temperatures. The welds are machinable. Recommended for use in iron and steel industries. Suitable for use on shear blades, dies, punches and all applications where good resistance to heat, impact, corrosion and abrasion is required.

Typical All Weld Metal Chemical Analysis (%)

C	Cr	Co	Fe	W
1.0	31.0	BAL	2.0	5.5

Typical All Weld Deposit Hardness

	HRC	HV
+20°C	45	440
+400°C	32	320
+800°C	22	230

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm	6.4mm
60-75	90-115	100-150	150-220	220-275

Related Specification:
AWS E Co Cr-A. (Cobalt Grade 6)

Current:
AC/DC (+)

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 150°C before use

MAC HICA E3073

Cobalt based electrode made on a fully alloyed core wire designed to combat all four elements of wear, i.e. heat, impact, corrosion and abrasion. The electrode provides optimum impact and abrasion resistant properties while retaining hardness at elevated temperatures. Excellent for rebuilding corners with minimum base metal dilution. Has ability to overlay extensive areas without cracking. Will retain hardness at high temperatures. Welds are non-machinable. Suitable for use in industries where severe impact and abrasion occurs.

Typical All Weld Metal Chemical Analysis %

C	Co	Cr	Fe	W
1.9	BAL	30.0	3.0	8.4

Typical All Weld Deposit Hardness

	HRC	HV
+ 20°C	51	546
+ 200°C	42	418
+400°C	39	380
+600°C	37	362

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm
60-75	90-115	100-150	170-220

Related Specification:
AWS E Co Cr-B. (Cobalt Grade 12)

Current:
AC/DC (+)

Storage:

If allowed to become damp the electrodes should be re-dried for one hour at 150°C before use

MAC HICA E3074

High recovery chrome / cobalt / iron based electrode designed to combat all four elements of wear, i.e. heat, impact, corrosion and abrasion, but with the emphasis on impact properties. The addition of molybdenum refines the grain structure and produces good hot hardness. Excellent for rebuilding corners with minimum base metal dilution. Has ability to overlay extensive areas without cracking. Will retain hardness at high temperatures. The welds are machinable and will work harden under impact. Recommended for use in the iron and steel industries. Designed initially as a forging material for either repairs or sinking. Suitable for use on shear blades and dies, and all applications where good resistance to heat, impact, corrosion and abrasion is required. Due to its excellent impact properties and refined grain structure it is ideally suited to clipping tools and forging punches.

Typical All Weld Metal Chemical Analysis (%)

C	Co	Cr	Fe	Mo	Ni	Si
0.11	56.32	22.01	14.34	5.5	1.32	1.12

Typical All Weld Deposit Hardness

25-30 HRC as deposited (will work harden up to 50 HRC under impact).

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm	5.0mm	6.4mm
70-90	90-115	110-150	140-190	220-275

Related Specification:

AWS E Co Cr Fe-special

Current:

AC/DC (+)

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 150°C before use

MAC HICA E3075

This electrode is also known as alloy 21. The flux is a rutile type made on a fully alloyed core wire. Cobalt based electrode designed on a fully alloyed core wire to combat all four elements of wear, i.e. heat, impact, corrosion and abrasion. Most suitable of cobalt range where toughness is the most predominant of the four elements of wear. Excellent for rebuilding corners with minimum base metal dilution. Has ability to overlay extensive areas without cracking. Designed specifically for use as a forging die material. Because of its low carbon content, the electrode has excellent resistance to thermal and mechanical shock. The electrode deposits a high alloyed cobalt base weld metal with 0.3% carbon. Welds are machinable. The suggested usages are in iron and steel industries or any industry where heat, corrosion and abrasion occur concurrently, for such items as steel mill rolls, valves seat inlays, hot working dies and tools, hot shearing blades, tongs etc

The electrode main advantages are: - High temperature strength and ductile, resists thermal shock. Tough – impact resistant. Highly ductile – resists weld cracking (without any preheat). High resistance to corrosion, oxidation, sulphidation. Hardness 30 HRC as deposited, increases with work hardening. High resistance to cavitation-erosion.

Typical All Weld Metal Chemical Analysis %

C	Co	Cr	Fe	Mo	Ni
0.30	BAL	26.0	3.0	5.5	3.0

Typical All Weld Deposit Hardness

As Deposited	30 HRC
Work Hardened	50 HRC

Sizes Available and Recommended Amperages

3.2mm	4.0mm	5.0mm	6.4mm
90-115	100-150	170-220	220-275

Related Specification:

AWS E Co Cr - E. (Cobalt Grade 21)

Current:

AC/DC (+) (min 70 OCV).

Storage:

If allowed to become damp the electrodes should be re-dried for one hour at 150°C before use

MAC HICA E3076

Cobalt based electrode designed on a fully alloyed core wire. It is resistant to wear, galling and corrosion, retaining these properties at high temperatures. This electrode has exceptional fatigue resistance. Useful for tools working hot steel. Also resistant to thermal cracking, hot metal on metal wear, and surface fatigue. The welds are machinable. Recommended for use in iron and steel industries. Suitable for use on piercing points, forming tools, extrusion dies, and furnace hardware, and all applications where a combination of metal-on-metal wear, thermal fatigue and hot corrosion resistance is required.

Related Specification:

Cobalt G25

Current:

AC/DC (+) DC Positive

Storage:

If allowed to become damp electrodes should be re-dried for one hour at 150°C before use

Typical All Weld Metal Chemical Analysis (%)

C	Co	Cr	Fe	Mn	Ni	S	Si	W
0.1	BAL	20	2	1.5	0	0.02	1.12	15

Sizes Available and Recommended Amperages

2.5mm	3.2mm	4.0mm
60-75	90-115	100-150

Typical All Weld Deposit Hardness

Hardness **340-380 HB**