



**McKAY**



**McKAY**

*Since 1881 McKay® has built a strong reputation for quality, consistency and reliability in the manufacture of various filler metal products.*

*Starting in 1935 we pioneered the development of modern welding consumable products, leading the U.S. in the development of low hydrogen and stainless electrodes. By the onset of World War II, we were firmly established in the welding industry, supplying millions of pounds of mild and stainless steel stick electrodes for use in the construction of warships, tanks and other defense-related hardware.*

*During the war, our extensive research led us into the business of producing wear-resistant welding products. Since then, nearly 60 years of research, development and service to thousands of customers have given us a wealth of practical hard surfacing knowledge.*

*Today, as a world leader in hard surfacing products, stainless steel products, low alloy electrodes, and mild steel electrodes, our commitment is to make our people and facilities available to help solve your application problems.*

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(Rev. 11-10)

### Mild Steel Stick Electrode Product Line Overview

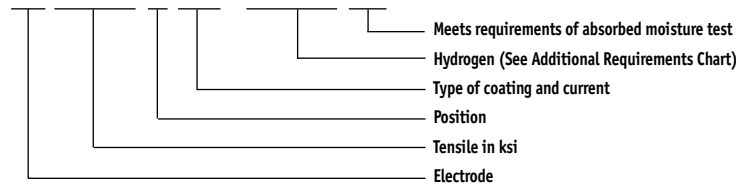
McKay® premium mild steel electrodes are formulated to the same exacting standards as the industry-leading alloy products. The McKay name on the box of mild steel electrodes is an assurance of superior operation, tight deposit chemistries & properties, and consistent overall quality.



## STICK ELECTRODES AWS SECTION

### AWS Classification of Mild Steel Stick Electrodes

# E7018-1 H4R



### Positions

- 1 Flat, Horizontal, Vertical, Overhead
- 2 Flat and Horizontal only



Flat—Usually groove welds, fillet welds only if welded like a “V”



Horizontal—Fillet welds, welds on walls (travel is from side to side).



Vertical—Welds on walls (travel is either up or down).



Overhead—Weld that needs to be done upside down.

### Chemical Symbols

<b>C</b>	Carbon	Most effective hardening element in steel.
<b>Mn</b>	Manganese	Hardening element second to carbon.
<b>Si</b>	Silicon	Deoxidizer, moderate strengthener.
<b>P</b>	Phosphorus	Causes cracking if too high.
<b>S</b>	Sulfur	Aids in machining. Cracking problems like P.
<b>Cr</b>	Chromium	Hardness (low)—corrosion resistance (high).
<b>Ni</b>	Nickel	Hardening element—better cold toughness.
<b>Mo</b>	Molybdenum	Hardenability—high temp tensile—creep strength.
<b>B</b>	Boron	Very small amounts increase hardness.
<b>Cu</b>	Copper	Corrosion resistance (low)—cracking (high).
<b>Al</b>	Aluminum	Deoxidizer—improves mechanical properties.
<b>Ti</b>	Titanium	Removes Oxygen, S, N and C.
<b>N</b>	Nitrogen	Improves strength—lowers toughness.
<b>Cb</b>	Columbium	Hardness—improves mechanical properties.
<b>V</b>	Vanadium	Hardness—improves mechanical properties.

### Additional Requirements

Suffix	Additional Requirement
-1	Increased toughness (impact strength) for E7018 electrodes. Also increased ductility in E7024 electrodes.
H4	Indicates the maximum diffusible hydrogen limit measured in millimeters per 100 grams (mL/100 g). The 4 indicates what the limit is. Example: H4 = 4 mL per 100 grams
R	Meets the requirements of absorbed moisture test.

### AWS Tension Test Requirements

Class	Min. Tensile Strength	Min. Yield Strength
E60xx	62,000 psi	50,000 psi
E70xx	70,000 psi	57,000 psi
E80xx	80,000 psi	67,000 psi
E90xx	90,000 psi	77,000 psi
E100xx	100,000 psi	87,000 psi
E110xx	110,000 psi	95,000 psi
E120xx	120,000 psi	107,000 psi

### Types of Coating and Current

Digit	Type of Coating	Welding Current
0	cellulose sodium	DCEP
1	cellulose potassium	AC or DCEP
2	titania sodium	AC or DCEN
3	titania potassium	AC or DCEP or DCEN
4	iron powder titania	AC or DCEP or DCEN
5	low hydrogen sodium	DCEP
6	low hydrogen potassium	AC or DCEP
7	iron powder iron oxide	AC or DCEP or DCEN
8	iron powder low hydrogen	AC or DCEN

DCEP—Direct Current Electrode Positive  
DCEN—Direct Current Electrode Negative  
AC—Alternating Current

### Mild Steel Stick Electrode Pallet Information

Length	McKay Type	Pallet Weight (lb)		Pallet Dimensions			Number of Units Per Pallet
		Net	Gross (est.)	Depth	Width	Height	
14"	7018XLM	1320	1420	38"	45"	39"	132 (10 lb cans)
14"	6011, 6013, 7014, 7024	3000	3080	32"	40"	32"	60 (50 lb cartons)
14"	6010 PM, 7018 XLM, Soft-Arc 7018-1	3000	3080	32"	40"	38"	60 (50 lb cans)
18"	7024, 7018 XLM	3000	3115	38"	40"	32"	60 (50 lb cartons)
18"	7018 XLM	2450	2539	38"	40"	24"	49 (50 lb cans)

### Mild Steel Low Hydrogen Suggested Operating Ranges

Electrode Diameter inches	mm	Current Range (amperage)
3/32"	2.4	70–110
1/8"	3.2	90–160
5/32"	4.0	120–210
3/16"	4.8	150–300
7/32"	5.6	240–340
1/4"	6.4	270–380

# Mild Steel Stick Electrodes

## Mild Steel Stick Electrodes

McKay Product	AWS Class	ABS	Type of Coating	Welding Characteristics		Positions	Welding Current
				Arc Penetration	Deposition		
<b>6010 PM</b>	E6010	E6010	High-cellulose sodium	Deep	Medium	All	DCEP
<b>6011</b>	E6011	E6011	High-cellulose potassium	Deep (DCEP gives reduced penetration)	Medium	All	AC DCEP
<b>6013</b>	E6013	E6013	High-titania potassium	Light	Medium	All	AC DCEP DCEN
<b>7014</b>	E7014	E7014	Iron powder titania	Light	High	All	AC DCEP DCEN
<b>7024</b>	E7024 & E7024-1	E7024-1;3	Iron powder titania	Light	High	Flat Horizontal	AC DCEN

## Mild Steel Low Hydrogen Stick Electrodes

McKay Product	AWS Class	ABS	Type of Coating	Welding Characteristics		Positions	Welding Current
				Arc Penetration	Deposition		
<b>7018 XLM</b>	E7018-1 H4 R	E7018-1	Low hydrogen iron powder	Medium	High/ Medium	All	AC DCEP
<b>Soft-Arc 7018-1</b>	E7018-1 H4	E7018-1	Low hydrogen iron powder	Medium	High/ Medium	All	AC DCEP

# Mild Steel Stick Electrodes

## 6010 PM

### AWS E6010

An iron powder E6010 electrode. Smooth arc action. Strong operator appeal. X-ray quality weld deposits. Deep arc penetration. Excellent welding characteristics. Vertical down operation is particularly outstanding. Approvals and conformances: AWS Spec A5.1, ASME SFA5.1(FE, A-1), ABS E6010, Lloyd's Grade 3M

### Typical Weld Metal Properties (Chem Pad):

Carbon	.0.13
Manganese	.0.40
Silicon	.0.20
Chromium	.0.05
Nickel	.0.04
Molybdenum	.0.01
Vanadium	<.0.01

### Typical Properties as Welded

Tensile Strength, psi	.75,000
Yield Strength, psi	.62,000
Elongation in 2"	.26%
Reduction in Area	.64%
Impact Strength, ft•lbs (Charpy V Notch) .-20°F	.34 ft•lbs

### Suggested Operating Ranges Dia.

	DC+	Amps
3/32 (2.4 mm)		.40-70
1/8 (3.2 mm)		.65-130
5/32 (4.0 mm)		.90-175
3/16 (4.8 mm)		.140-225

### Typical Applications

- Construction and shipbuilding
- General all-purpose electrode
- Maintenance welding
- Out-of-position X-ray welds
- Pipe welding
- Vertical and overhead plate welding

## 6011

### AWS E6011

An iron powder E6011 electrode. Low spatter, smooth arc. Deep arc penetration. X-ray quality weld metal. Excellent welding characteristics. Vertical down operation is particularly outstanding. The AC counterpart of McKay 6010 PM. Approvals and conformances: AWS Spec A5.1, ASME SFA5.1 (F-3, A-1), ABS E6011, Lloyd's 2M, 2YM

### Typical Weld Metal Properties (Chem Pad):

Carbon	.0.14
Manganese	.0.61
Silicon	.0.30
Chromium	.0.07
Nickel	.0.08
Molybdenum	.0.01
Vanadium	.0.01

### Typical Properties as Welded

Tensile Strength, psi	.77,700
Yield Strength, psi	.63,200
Elongation in 2"	.25%
Reduction in Area	.22-63%
Impact Strength, ft•lbs (Charpy V Notch) .-20°F	.30 ft•lbs

### Suggested Operating Ranges Dia.

	AC, DC±	Amps
3/32 (2.4 mm)		.60-90
1/8 (3.2 mm)		.80-125
5/32 (4.0 mm)		.130-160
3/16 (4.8 mm)		.160-190

### Typical Applications

- Construction and shipbuilding
- Galvanized steel
- General all-purpose electrode
- Light sheet metal fabrication
- Maintenance welding
- Welding through paint, mill scale or rust

## 6013

### AWS E6013

Exceptionally smooth deposit and stable arc. Designed for general purpose use, especially with low-voltage AC welders. Good all-purpose electrode for welding with alternating or direct current. Originally developed for light gage metal, but with sufficient penetration for use on heavier assemblies. Approvals and conformances: AWS Spec A6.1, ASME SFA5.1 (F-2, A-1), ABS E6013

### Typical Weld Metal Properties (Chem Pad):

Carbon	.0.10
Manganese	.0.37
Silicon	.0.27
Chromium	.0.06
Nickel	.0.06
Molybdenum	.0.01
Vanadium	.0.01

### Typical Properties as Welded

Tensile Strength, psi	.72,600
Yield Strength, psi	.61,300
Elongation in 2"	.26.5%
Reduction in Area	.25-55%

### Suggested Operating Ranges Dia.

	AC, DC±	Amps
3/32 (2.4 mm)		.40-80
1/8 (3.2 mm)		.70-120
5/32 (4.0 mm)		.130-160
3/16 (4.8 mm)		.140-220

### Typical Applications

- Excellent for bridging joints with poor fit-up
- General all-purpose electrode
- Metal buildings and structures
- Shaft build-up
- Welding machine parts

# Mild Steel Stick Electrodes

## 7014

### AWS E7014

A high speed general purpose iron powder electrode with greater range of usability than an E7024 electrode. Arc is extremely stable. Deposits are very flat and smooth. Slag removes freely and clearly. Approvals and conformance: AWS Spec A5.1, ASME SFA5.1 (F-2, A-1), ABS E7014

### Typical Weld Metal Properties (Chem Pad):

Carbon	.06
Manganese	.054
Silicon	.035
Phosphorus	.0026
Sulphur	.0013
Nickel	.09
Chromium	.06
Molybdenum	.01
Vanadium	.01

### Typical Properties as Welded

Tensile Strength, psi	.79,000
Yield Strength, psi	.68,100
Elongation in 2"	.27.5%
Reduction in Area	.33-55%

### Suggested Operating Ranges

Dia.	Amps
	AC, DC±
3/32 (2.4 mm)	.70-90
1/8 (3.2 mm)	.120-145
5/32 (4.0 mm)	.140-210
3/16 (4.8 mm)	.180-280

### Typical Applications

- Excellent for bridging joints with poor fit-up
- General all -purpose electrode
- Heavy sheet metal
- Iron powder increases deposition rate and efficiency
- Welding machine bases and frames

## 7024

### AWS E7024 & E7024-1

A high speed production electrode of the iron powder or contact type. Has optimum arc stability, smoothness of deposit and ease of slag removal. Used for high speed horizontal or flat fillet welds. Approvals and conformance: AWS Spec A5.1, ASME SFA5.1 (F-1, A-1), ABS 3

### Typical Weld Metal Properties (Chem Pad):

Carbon	.06
Manganese	.081
Silicon	.043
Phosphorus	.0008
Sulphur	.0019
Nickel	.07
Chromium	.05
Molybdenum	.02
Vanadium	.02

### Typical Properties as Welded

Tensile Strength, psi	.82,000
Yield Strength, psi	.72,000
Elongation in 2"	.25%
Reduction in Area	.20-40%
(Charpy V Notch) . . . .0°F	.42 ft •lbs

### Suggested Operating Ranges

Dia.	Amps
	AC, DC-
1/8 (3.2 mm)	.130-150
5/32 (4.0 mm)	.180-225
3/16 (4.8 mm)	.200-280
7/32 (5.6 mm)	.250-320
1/4 (6.4 mm)	.300-360

### Typical Applications

- Earthmoving equipment and mining machinery
- General all-purpose electrode
- High speed/high deposition
- Plate fabrication
- Railroad cars and shipbuilding



## 7018 XLM

### AWS E7018-1 H4R

A high deposition rate iron powder electrode for use with either AC or DC reverse polarity. Ease of welding in vertical or overhead positions is outstanding. For mild steel and joining mild to low alloy steels. Approvals and conformance: AWS Spec A5.1, ASME SFA5.1 (F-4, A-1), ABS E7018-1

### Typical Weld Metal Properties

(Chem Pad):

Carbon	.007
Manganese	1.10
Silicon	0.30
Phosphorus	0.01
Sulphur	0.01
Nickel	0.08
Chromium	0.08
Molybdenum	0.01
Vanadium	0.01
Mn + Ni + Cr + Mo + V	1.28

### Typical Properties of Welded Deposit

#### As Welded

Tensile Strength, psi	78,000
Yield Strength, psi	68,000
Elongation in 2"	31%
Reduction in Area	77%
Impact Strength, ft • lbs (Charpy V Notch) . . . -20°F	.90 ft • lbs

### Suggested Operating Ranges

#### Dia.

#### Amps

– AC, DC+

3/32" (2.4 mm)	.70-110
1/8" (3.2 mm)	.90-100
5/32" (4.0 mm)	110-230
3/16" (4.8 mm)	190-300
7/32" (5.6 mm)	240-340
1/4" (6.4 mm)	310-390

### Typical Applications

- Excellent for out-of-position tacking
- Iron powder increases deposition rate
- Low alloy structurals
- Offshore rigs and power plants
- Steel structures and field erections

## Soft-Arc™ 7018-1

### AWS E7018-1 H4

An electrode designed to give outstanding operator appeal in all positions when welding steels that require low hydrogen X-ray quality welds. Very good low temperature impacts are also found along with a smooth, stable arc with low spatter and good slag removal. Approvals and conformance: AWS Spec A5.1, ASME SFA5.1 (F-4, A-1), ABS E7018-1

### Typical Weld Metal Properties

(Chem Pad):

Carbon	0.04
Manganese	1.00
Silicon	0.40
Phosphorus	0.012
Sulphur	0.009
Nickel	0.06
Chromium	0.05
Molybdenum	0.02
Vanadium	0.01
Mn + Ni + Cr + Mo + V	1.14

### Typical Properties of Welded Deposit

#### As Welded

Tensile Strength, psi	81,000
Yield Strength, psi	69,000
Elongation in 2"	29%
Reduction in Area	77%
Impact Strength, ft • lbs . . . -20F..100 ft • lbs (Charpy V Notch) . . . . -50F ...75 ft • lbs	

### Suggested Operating Ranges

#### Dia.

#### Amps

– AC, DC+

3/32" (2.4 mm)	.80-110
1/8" (3.2 mm)	.90-150
5/32" (4.0 mm)	110-230
3/16" (4.8 mm)	150-300

### Typical Applications

- Welding of enameling steels; free machining steels; low alloy structurals; and low, medium or high carbon steels
- Weldments in low temperature environments where low temperature impacts are important

# Stick Electrode Technical Section

## Comparative Index of Mild Steel Electrodes

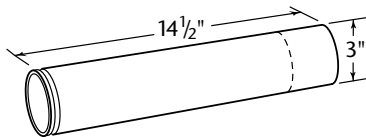
AWS Class	McKay	ESAB	Lincoln	Hobart
E6010	<b>6010 PM</b>	SW-10P, SW-10P Plus	Fleetweld 5P, 5P+	Pipemaster 60
E6011	<b>6011</b>	SW-14	Fleetweld 35, 180	335A, 335C
E6013	<b>6013</b>	SW-15	Fleetweld 37	447A, 447C
E7014	<b>7014</b>	SW-15IP	Fleetweld 47	14A
E7024, E7024-1	<b>7024</b>	7024	Jetweld 1	24
E7018-1	<b>7018 XLM Soft-Arc 7018-1</b>	Atom Arc 7018 Atom Arc 7018-1	LH-70, Excalibur 7018-1 LH-78 MR Excalibur 7018 MR	418 718 MC

## Mild Steel Electrodes Per Pound

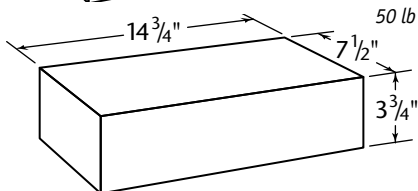
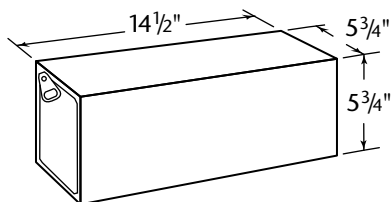
McKay Type	Diameter: Length:	3/32" (2.4 mm) 14"	1/8" (3.2 mm) 14"	5/32" (4.0 mm) 14"	3/16" (4.8 mm) 14"	3/16" (4.8 mm) 18"	1/4" (6.4 mm) 18"
6010 PM		30	17	12	8	—	—
6011		29	16	11	7	—	—
6013		30	15	10	7	—	—
7014		23	13	9	6	—	—
7024		—	10	7	—	4	2
7018 XLM, Soft-Arc 7018-1		21	12	9	7	—	3

## Packaging Options

### 14-Inch Electrodes



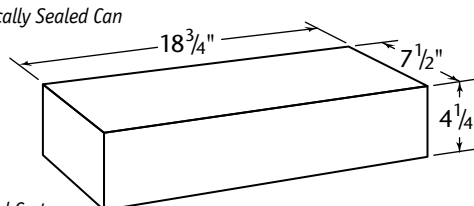
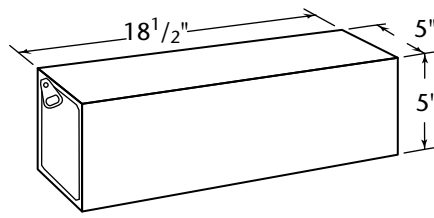
10 lb Hermetically Sealed Can



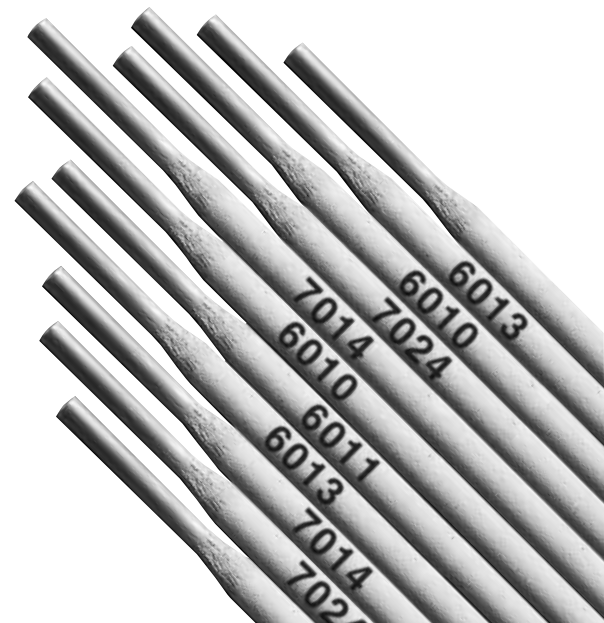
50 lb Hermetically Sealed Can

50 lb Corrugated Carton

### 18-Inch Electrodes



All the McKay mild steel electrodes are stamped with AWS class or product name.

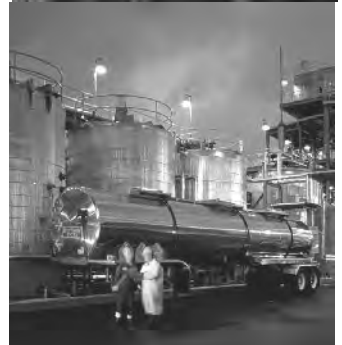


# Stainless Steel Stick Electrodes

For over a half a century, McKay® has been the acknowledged leader in stainless steel welding technology. Exceptionally tight internal specifications and controls in all phases of the manufacturing operation assure the end user the utmost consistency in chemistry, ferrite, welder appeal, and overall quality.

McKay stainless electrode coatings are custom formulated for each electrode diameter, grade and coating type, and for each individual heat of selected core wire. Each electrode has complete traceability and is imprinted with both AWS grade and lot number. For most of the popular grades, McKay stainless electrodes are available in three coating types: AC-DC, DC Lime and Sterling® coating. In addition, actual chemistries are available upon request for McKay stainless steel covered electrodes at no additional charge.

From formulation through raw material selection and each stage of production, McKay stainless electrodes are made to be the industry standard.

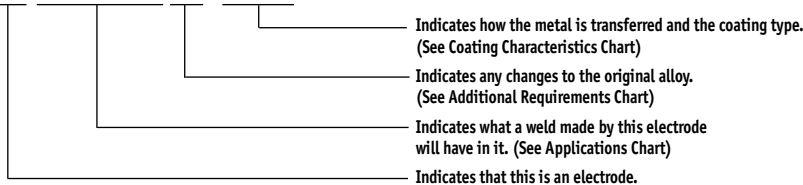


# Stainless Steel Stick Electrodes AWS Section

## STICK ELECTRODES AWS SECTION

### AWS Classification of Stainless Steel Coated Electrodes

# E308L-16



### Positions

1 Flat, Horizontal, Vertical, Overhead

Flat—Usually groove welds, fillet welds only if welded like a “V.”

Vertical—Welds on walls (travel is either up or down).

Horizontal—Fillet welds, welds on walls (travel is from side to side).

Overhead—Weld that needs to be done upside down.

### Coating Characteristics

Coating	Dash Number	Out of Position	Bead Ripple	Slag Removal	Spatter Level	Crack Resistance	Transfer Type	Operating Current	Bead Profile
DC Lime	-15	1	3	3	3	1	Globular	DCEP	Convex
AC-DC	-16	2	2	2	2	2	Globular	AC/DCEP	Flat
Sterling	-17	3	1	1	1	3	Spray	AC/DCEP	Concave

Ratings: 1 = the best      3 = the least

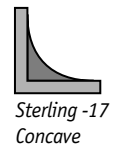
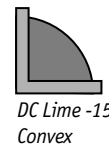
### Additional Requirements

Suffix	Additional Requirements
L	Has a lower carbon content
H	Limited to the upper range on the carbon content
Mo	Molybdenum added—pitting resistance, creep strength, ferrite increased
Ni	Nickel added—high temperature strength, corrosion resistance, added toughness

### AWS Class and Applications

Class	Brief Description
A E308	Used for welding many dissimilar 300 series stainless steels
A E309	Used for welding many dissimilar metals—mild steel to stainless steel
A E310	Used to join similar alloys—some dissimilar metals
A E312	Excellent for welding dissimilar metals
A E316	Mo added to help prevent pitting and increase creep resistance
A E317	Even more Mo than E316
A E330	For heat and scale resistance above 1800F on similar base metal
A E347	Cb added to prevent corrosion just outside of the weld bead
M E410	For welding martensitic stainless steels and used for surfacing carbon steels
PH E630	For welding ASTM A564 Type 630 (17-4 PH and 15-5 PH)
D E2209	For welding similar duplex stainless steels

A—Austenitic      M—Martensitic      D—Duplex



### AWS (A5.4) Stainless Steel Stick Electrode Chemical Composition of Weld Metal Deposit, %

AWS Class	Carbon C	Chromium Cr	Nickel Ni	Molybdenum Mo	Manganese Mn	Silicon Si	Phosphorous P	Copper Cu
E308-XX	0.08 Max.	18.0–21.0	9.0–11.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E308H-XX	0.04–0.08	18.0–21.0	9.0–11.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E308L-XX	0.04 Max.	18.0–21.0	9.0–11.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E309-XX	0.15 Max.	22.0–25.0	12.0–14.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E309L-XX	0.04 Max.	22.0–25.0	12.0–14.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E309Mo	0.08 Max.	22.0–25.0	12.0–14.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E309MoL	0.08 Max.	22.0–25.0	12.0–14.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E310-XX	0.08–0.20	25.0–28.0	20.0–22.5	0.75 Max.	1.0–2.5	0.75 Max.	0.03 Max.	0.75 Max.
E312-XX	0.15 Max.	28.0–32.0	8.0–10.5	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E316-XX	0.08 Max.	17.0–20.0	11.0–14.0	2.0–3.0	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E316H-XX	0.04–0.08	17.0–20.0	11.0–14.0	2.0–3.0	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E316L-XX	0.04 Max.	17.0–20.0	11.0–14.0	2.0–3.0	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E317L-XX	0.04 Max.	18.0–21.0	12.0–14.0	2.0–3.0	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E330-XX	0.18–0.25	14.0–17.0	33.0–37.0	0.75 Max.	1.0–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E347-XX	0.08 Max.	18.0–21.0	9.0–11.0	0.75 Max.	0.5–2.5	0.90 Max.	0.04 Max.	0.75 Max.
E410-XX	0.12 Max.	11.0–13.5	0.7 Max.	0.75 Max.	1.0 Max.	0.90 Max.	0.04 Max.	0.75 Max.
E410NiMo-XX	0.06 Max.	11.0–12.5	4.0–5.0	0.40–0.70	1.0 Max.	0.90 Max.	0.04 Max.	0.75 Max.
E2209-XX**	0.04 Max.	21.5–23.5	8.5–10.5	2.5–3.5	0.5–2.0	0.90 Max.	0.04 Max.	0.75 Max.

# Stainless Steel Stick Electrodes

## Stainless Steel Stick Electrodes

**DC Lime (-15)** Excellent for all-position operation, McKay DC Lime stick electrodes provide low spatter and good weld bead appearance. The best choice for maximum impact and crack resistance at high temperatures or for welding highly restrained joints, DC Lime electrodes are the preferred choice for pipe welding and cryogenic applications.

**AC-DC/Sterling AP/Smootharc Plus (-16)** Ideal multipurpose stainless electrodes provide smooth, uniform and finely rippled weld beads that require minimal finishing. AC-DC/Sterling AP electrodes perform well on AC or DCEP and possess outstanding out-of-position capabilities and good strike and restrike characteristics.

**Sterling® (-17)** A superb family of spray transfer electrodes that produces attractive, finely rippled concave weld beads. Sterling electrodes operate well in all positions, on AC or DCEP, with self-peeling slag and excellent restrike characteristics. The direct spray arc transfer is extremely stable and exhibits higher deposition rates with little spatter.

McKay Product	AWS Class	Smootharc Plus/ AC-DC/Sterling AP -16	DC Lime -15	Sterling -17
308/308H	E308 & E308H	●	●	●
308L	E308L	●	●	●
309	E309	●	●	●
309L	E309L	●	●	●
310	E310	●	○	○
312	E312	●	○	○
316/316H	E316 & E316H	●	○	●
316L	E316L	●	●	●
317L	E317L	●	○	●
330	E330	●	○	○
347	E347	●	○	●
410	E410	●	○	○
410NiMo	E410NiMo	●	○	○
2209	E2209	●	○	○

● Offered      ○ Not Offered

NOTE: Actual certs are included in every master carton of stainless stick electrodes at no charge.

# Stainless Steel Stick Electrodes

## 308/308H Sterling AP 308/308H DC Lime 308/308H Sterling®

**AWS E308-16 & E308H-16**  
**AWS E308-15 & E308H-15**  
**AWS E308-17 & E308H-17**

For applications where service conditions are not severe. Intermediate layer prior to deposition of hard-facing material. Use on Types 301, 302, 304, 305, and 308 base metals. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

### Typical Deposit Analysis %

C - 0.06  
Mn - 0.14  
Si - 0.44  
Cr - 19.88  
Ni - 9.78  
Fe - Bal.

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .86,000 psi  
Yield Strength . . . . .65,000 psi  
Elongation in 2" . . . . .45%  
DeLong Ferrite Number . . . . .7

## 308/308L Sterling AP 308/308L DC Lime 308/308L Sterling® 308L Smootharc Plus

**AWS 308/E308L-16**  
**AWS 308/E308L-15**  
**AWS 308/E308L-17**

For welding Type 308L. Properties similar to Type 308 with low C to avert carbide precipitation and inhibit subsequent carbide precipitation. Approvals and conformance: AWS Spec A5.4, ASME SF5.4 (F-5, A-8)

### Typical Deposit Analysis %

C - 0.03  
Mn - 1.14  
Si - 0.43  
Cr - 19.68  
Ni - 9.89  
Fe - Bal.

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .83,000 psi  
Yield Strength . . . . .64,000 psi  
Elongation in 2" . . . . .37%  
DeLong Ferrite Number . . . . .9

## 309 H Sterling AP

**AWS E309-16**

The moisture resistant, all-position 309 (H) Sterling® AP electrode is primarily designed for welding Type 309 metal but can also be used for 18-8 clad steels or dissimilar materials if the alloy content is sufficiently high for a sound, ductile deposit. It yields a uniform weld bead that is flat to slightly convex:

AWS Spec A5.4, ASME SF5.4 (F-5, A-8)

### Typical Deposit Analysis %

C - 0.08  
Cr - 23.50  
Ni - 13.00  
Mo - 0.10  
Mn - 1.05  
P - 0.020  
S - 0.016  
Cu - 0.10

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .88,000 psi  
Yield Strength . . . . .67,000 psi  
Elongation in 2" . . . . .37%  
DeLong Ferrite Number . . . . .6-15

## 309/309L Sterling AP 309/309L DC Lime 309/309L Sterling® 309L Smootharc Plus

**AWS 309/E309L-16**  
**AWS 309/E309L-15**  
**AWS 309/E309L-17**

Low C modification of standard Type 309 analysis used for weld overlay or welding stainless to mild or low alloy steels. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

### Typical Deposit Analysis %

C - 0.03  
Mn - 1.32  
Si - 0.41  
Cr - 23.00  
Ni - 13.50  
Fe - Bal.

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .79,000 psi  
Yield Strength . . . . .64,000 psi  
Elongation in 2" . . . . .41%  
DeLong Ferrite Number . . . . .13

## 309Mo 309MoL AC-DC

**AWS E309Mo-16**  
**AWS E309MoL-16**

Addition of Molybdenum to 309 for improved tensile strength and resistance. Used for 316 clad steels and joining Mo-containing steels to carbon steels:

AWS Spec A5.4, ASME SF5.4 (F-5, A-8)

### Typical Deposit Analysis %

C - 0.03  
Mn - 1.23  
Si - 0.44  
Cr - 22.70  
Ni - 13.60  
Mo - 2.40  
Fe - Bal.

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .90,000 psi  
Yield Strength . . . . .70,000 psi  
Elongation in 2" . . . . .35%  
DeLong Ferrite Number . . . . .13

## 310 AC-DC

**AWS E310-16**

For welding base metal of similar composition, when the stainless base metal is of unknown composition, and for dissimilar metals. Used as a transition layer for high restrained joints of high carbon steels.

Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-9)

### Typical Deposit Analysis %

C - 0.14  
Mn - 2.02  
Si - 0.46  
Cr - 26.12  
Ni - 21.00  
Fe - Bal.

### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .86,000 psi  
Yield Strength . . . . .63,000 psi  
Elongation in 2" . . . . .40%  
DeLong Ferrite Number . . . . .0

## 312 AC-DC

### AWS E312-16

Welding Type 312 base metals. Excellent for dissimilar metal joining due to high ferrite potentials. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, 4-8)

#### Typical Deposit Analysis %

C – 0.07  
Mn – 0.80  
Si – 0.40  
Cr – 28.50  
Ni – 9.10  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .115,000 psi  
Yield Strength . . . . .95,000 psi  
Elongation in 2" . . . . .25%  
DeLong Ferrite Number . . . . .45

## 316/316L Sterling AP

### 316/316L DC Lime

### 316/316L Sterling®

### 316L Smootharc Plus

#### AWS 316/E316L-16

#### AWS 316/E316L-15

#### AWS 316/E316L-17

Welding Type 316L material. Properties similar to Type 316. Suited for urea environments. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Mn – 1.55  
Si – 0.48  
Cr – 18.20  
Ni – 13.00  
Mo – 2.27  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .82,000 psi  
Yield Strength . . . . .61,000 psi  
Elongation in 2" . . . . .42%  
DeLong Ferrite Number . . . . .2

## 330 AC-DC

### AWS E330-16

Used to weld Type 330 base metal for heat and creep resisting applications. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-9)

#### Typical Deposit Analysis %

C – 0.20  
Mn – 1.84  
Si – 0.34  
Cr – 15.30  
Ni – 34.19  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .86,000 psi  
Yield Strength . . . . .58,000 psi  
Elongation in 2" . . . . .40%  
DeLong Ferrite Number . . . . .0

## 316/316H Sterling AP

### 316/316H Sterling®

#### AWS E316-16 & E316H-16

#### AWS E316-17 & E316H-17

For welding Type 316 steel. Applies where increased high temperature corrosion resistance of molybdenum-bearing steels are necessary. Low FN version. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.07  
Mn – 1.63  
Si – 0.40  
Cr – 18.50  
Ni – 12.40  
Mo – 2.21  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .85,000 psi  
Yield Strength . . . . .68,000 psi  
Elongation in 2" . . . . .45%  
DeLong Ferrite Number . . . . .4

## 317L AC-DC

### AWS E317L-16

### AWS E317L-17

Increased molybdenum content results in higher tensile strength, better corrosion resistance, and improved high temperature creep strength when compared with 316L. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.03  
Mn – 1.21  
Si – 0.51  
Cr – 18.80  
Ni – 13.70  
Mo – 3.40  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .92,000 psi  
Yield Strength . . . . .69,000 psi  
Elongation in 2" . . . . .35%  
DeLong Ferrite Number . . . . .4

## 347 AC-DC

### AWS E347-16

### AWS E347-17

Metal stabilized with columbium prevents carbide precipitation. Better corrosion resistance than Type 308. For welding Types 347 and 321 steels. Good corrosion resistance in steam or utility applications up to 1400°F. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.06  
Mn – 1.19  
Si – 0.46  
Cr – 20.24  
Ni – 10.00  
Cb – 0.60  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .80,000 psi  
Yield Strength . . . . .64,000 psi  
Elongation in 2" . . . . .36%  
DeLong Ferrite Number . . . . .10

# Stainless Steel Stick Electrodes

## 410 AC-DC

### AWS E410-16

Air-hardening stainless for welding 12 Cr material. Requires pre and post-weld heat treatments. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.09  
Mn – 0.55  
Si – 0.29  
Cr – 12.30  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Heat Treated for 1 hr. @ 1375°F  
Tensile Strength . . . . .80,000 psi  
Yield Strength . . . . .44,000 psi  
Elongation in 2" . . . . .24%

## 2209 AC-DC

### AWS E2209-16

Specially formulated for welding the 22 Cr-5 Ni-3 Mo (Type 2205) duplex stainless steels. The deposited duplex weld metal offers combined high strength with improved pitting and SSC resistance. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.03  
Mn – 1.01  
Si – 0.38  
Cr – 22.90  
Ni – 10.10  
Mo – 03.00  
N – 0.093  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength . . . . .115,000 psi  
Yield Strength . . . . .90,000 psi  
Elongation in 2" . . . . .27%  
DeLong Ferrite Number (Extended) . . . .34  
Impact Strength ... -50°F . . . . .23 ft•lbf  
(Charpy v Notch)

## 410NiMo AC-DC

### AWS E410NiMo-16

Used extensively for welding ASTM CA6NM castings as well as 410, 410S and 405 base metals. Better as-welded toughness than 410. Approvals and conformance: AWS Spec A5.4, ASME SFA5.4 (F-5, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Mn – 0.68  
Si – 0.35  
Cr – 12.48  
Ni – 04.30  
Mo – 0.55  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Stress Relieved for 1 hr. @ 1125°F  
Tensile Strength . . . . .134,000 psi  
Yield Strength . . . . .123,000 psi  
Elongation in 2" . . . . .18%





# Stainless Steel Stick Electrodes Technical Section

## Comparative Index of Stainless Steel Electrodes

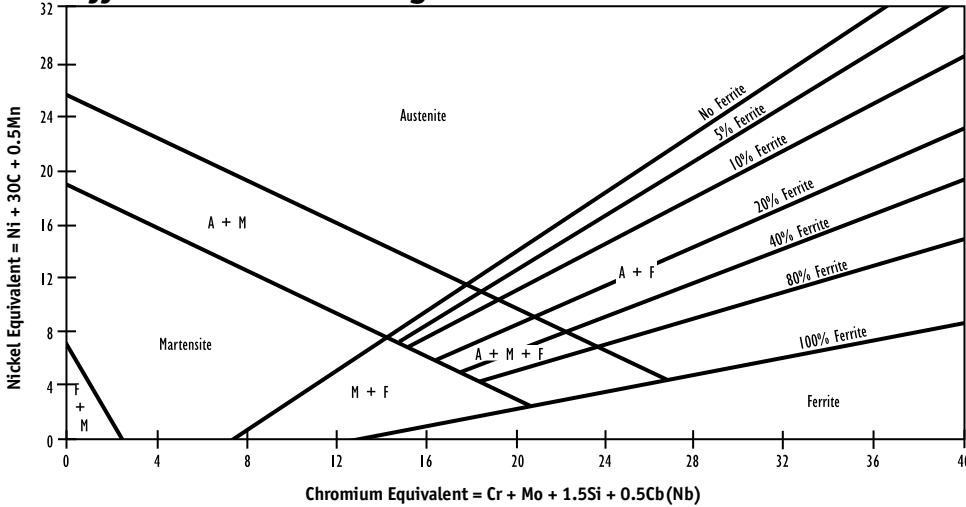
AWS Class	McKay	Techalloy	Sandvik	Lincoln
E308L-16	308/308L Sterling AP	Tech Rod 308L-16	–	Red Baron 308L MR
E308L-17	308L-17 Sterling	Tech Rod 308L-17	19.9. LR	Blue Max 308/308L AC/DC
E308H-16	308/308H Sterling AP	Tech Rod 308-16	–	Red Baron 308/308H MR
E308H-17	308/308H Sterling	Tech Rod 308-17	–	–
E309L-16	309/309L Sterling AP	Tech Rod 309L-16	–	Red Baron 309/309L MR
E3096L-17	309L Sterling	Tech Rod 309L-17	24.3. LR	Blue Max 309/309L AC/DC
E309-17	309-17 Sterling	Tech Rod 309-17	–	–
E309Mo-17	309 Mo/309MoL	–	23.12.2. LR	–
E310-16	310 AC-DC	Tech Rod 310-16	–	Red Baron 310 MR
E312-16	312 AC-DC	Tech Rod 312-16	29.9 R	–
E316L-16	316/316L Sterling AP	Tech Rod 316L-16	19.12.3. LRV	Red Baron 316/316L MR
E316L-17	316L-17 Sterling	Tech Rod 316L-17	19.12.3. LR	Blue Max 316/316L AC/DC
E316H-16	316/316H Sterling AP	Tech Rod 316-16	–	–
E316H-17	316/316H-17 Sterling	Tech Rod 316-17	–	–
E317L-16	317L AC-DC	Tech Rod 317-16	19.13.4. LR	–
E330-16	330 AC-DC	Tech Rod 330-16	–	–
E347-16	347 AC-DC	Tech Rod 347-16	–	–
E410-16	410 AC-DC	Tech Rod 410-16	–	–
E410NiMo-16	410NiMo AC-DC	Tech Rod 410NiMo-16	–	–
E2209-16	2209 AC-DC	Tech Rod 2209	22.9.3. LR (B)	–

# Stainless Steel Stick Electrodes

## Technical Section

### TECHNICAL SECTION

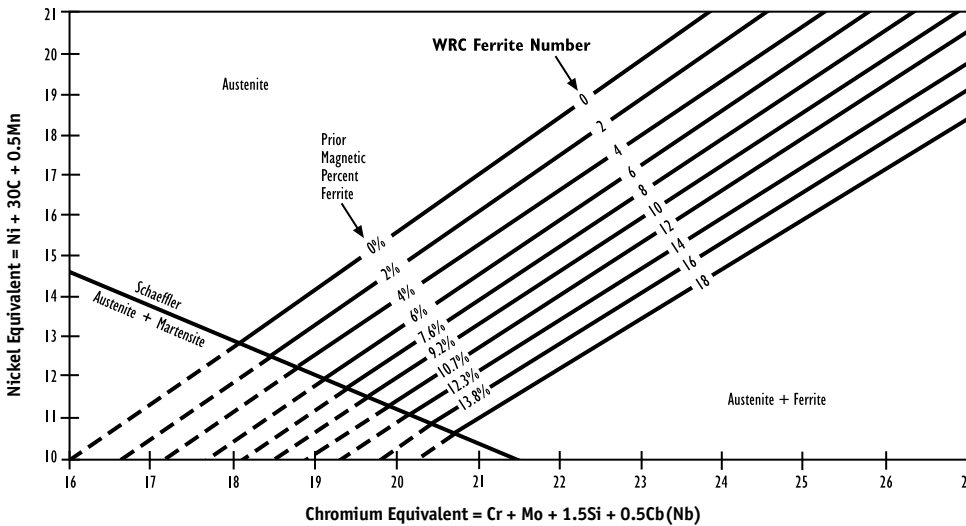
#### Schaeffler Constitution Diagram



Calculate the nickel and chromium equivalents from the weld metal analysis. If nitrogen analysis of the weld metal is not available, assume 0.06% for GTAW and covered electrodes or 0.08% for GMAW weld metals.

If the chemistry is accurate, the diagram predicts the WRC Ferrite Number within  $\pm 3$  in approximately 90% of the tests for the 308, 309, 316, and 317 families.

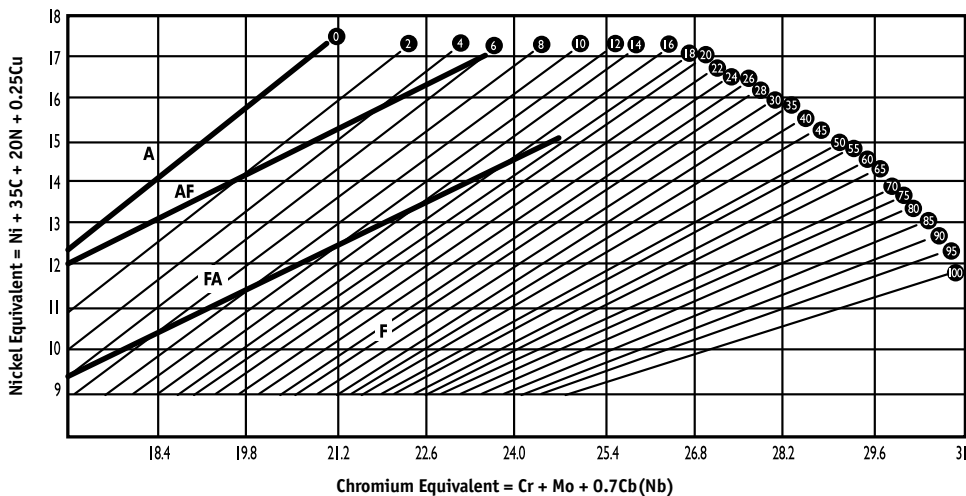
#### DeLong Constitution Diagram



Comparison with Schaeffler Diagram:

1. The Nickel Equivalent allows for a nitrogen pick-up of 30N.
2. Ferrite Numbers for 308, 308L, and 347 covered electrodes are similar. The higher alloy 309, 316, and 317 families have about 2 to 4 higher FN on this diagram.
3. Generally, this diagram correlates better with GTAW and GMAW weld metals because it allows for nitrogen pick-up.
4. The Schaeffler austenite-martensite boundary has been included here for reference.

#### 1992 WRC Constitution Diagram



Comparison with Schaeffler and DeLong Diagrams:

1. Considered more accurate for predicting ferrite in higher-alloyed stainless steels.
2. Copper (Cu) has been added to help determine the FN of duplex stainless steel welds.
3. This diagram should be limited to welds that contain less than 3Mo, less than 1Si, less than 10Mn and less than 0.2N.
4. A = Entirely austenite  
AF = Austenite with some ferrite  
FA = Ferrite with islands of austenite  
F = Ferrite alone

# Stainless Steel Stick Electrodes Technical Section

## Stainless Steel Stick Electrode Suggested Operating Ranges

Electrode Diameter		AC-DC/Sterling AP and DC Lime		Sterling	
inches	mm	Flat and Horizontal Welding	Vertical Up Welding	Flat and Horizontal Welding	Vertical Up Welding
3/32"	2.4	65-80	45-65	50-80	45-65
1/8"	3.2	90-110	60-80	85-120	55-80
5/32"	4.0	125-150	65-85	130-170	65-85
3/16"	4.8	140-190	NR	160-205	NR
1/4"	6.4	210-300	NR	—	—

NR = Not Recommended

## Stainless Steel Electrodes Per Pound

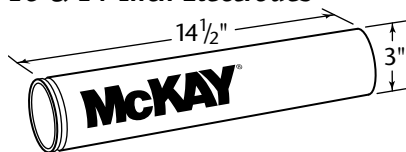
McKay Type	Diameter: Length:	3/32" (2.4 mm) 10"	1/8" (3.2 mm) 14"	5/32" (4.0 mm) 14"	3/16" (4.8 mm) 14"	1/4" (6.4 mm) 14"
DC Lime (-15)		37	15	10	7	—
AC-DC/Sterling AP (-16) Smootharc Plus		34	13	9	6	3
Sterling (-17)		34	13	9	6	—

## Stainless Steel Stick Electrode Pallet Information

Length	McKay Type	Pallet Weight (lb)		Depth	Pallet Dimensions		Number of Units Per Pallet
		Net	Gross (est.)		Width	Height	
3/32"-10"	DC Lime	792	892	38"	45"	39"	132 (6 lb Cans)
1/8"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/32"-10"	AC-DC/Sterling AP Smootharc Plus	792	892	38"	45"	39"	132 (6 lb Cans)
1/8"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
1/4"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/32"-10"	Sterling	792	892	38"	45"	39"	132 (6 lb Cans)
1/8"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)

## Packaging Options

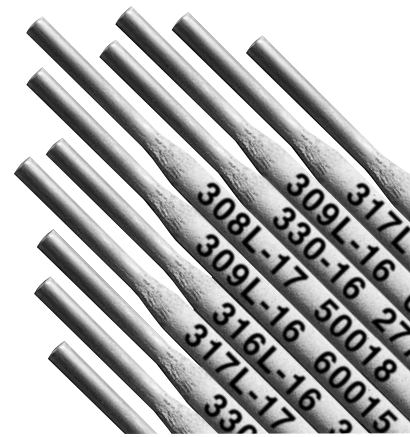
### 10 & 14-Inch Electrodes



6 & 10 lb Hermetically Sealed Can

Note: The same can is used for the 10" and 14" electrodes.  
(A spacer is used for 10" electrodes.)

All McKay stainless steel electrodes are stamped with product name and lot number for complete traceability.



## STAINLESS STEEL WIRE PRODUCT LINE OVERVIEW

For over a half century, McKay® has been the acknowledged leader in stainless steel welding technology. Exceptionally tight internal specifications and controls in all phases of the manufacturing operation assure the end user the utmost consistency in chemistry, ferrite, welder appeal, and overall quality.

The McKay reputation for having the highest-quality stainless tubular and solid wires in the market is a reflection of our dedication to perfection. Industries including food processing, medical equipment, pulp & paper, petroleum refineries, chemical, nuclear, brewery & distillery, and water systems have all benefited from using McKay high-quality products.



60 lb Coil  
(Flux-Cored)  
(In-Flux 410 NiMoT1 only)



60 lb Coil  
(Solid Wire)



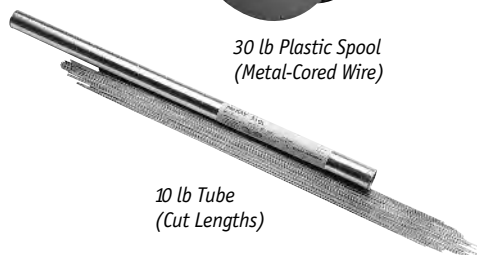
25 or 28 lb Plastic Spool  
(Flux-Cored)



30 lb Plastic Spool  
(Solid Wire)



30 lb Plastic Spool  
(Metal-Cored Wire)



10 lb Tube  
(Cut Lengths)



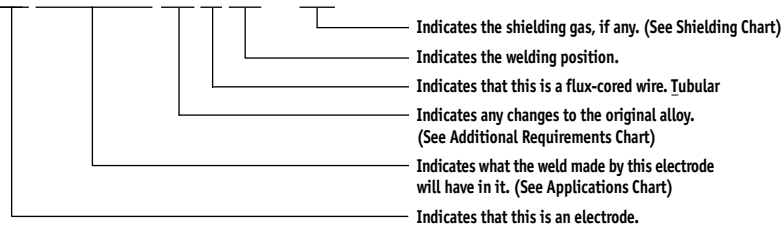
# Stainless Steel Tubular Wires

## AWS Section

### STAINLESS STEEL TUBULAR WIRE AWS SECTION

#### AWS Classification of Stainless Steel Tubular Wires

## E308LT1-1



#### Positions

**1** Flat, Horizontal, Vertical, Overhead

**0** Flat and Horizontal only



Flat—Usually groove welds, fillet welds only if welded like a “V”



Horizontal—Fillet welds, welds on walls (travel is from side to side).



Vertical—Welds on walls (travel is either up or down).



Overhead—Weld that needs to be done upside down.

#### Chemical Symbols

<b>C</b>	Carbon	Increases strength and hardness—reduces corrosion resistance.
<b>Mn</b>	Manganese	Improves crack resistance in fully austenitic welds.
<b>Si</b>	Silicon	Increased corrosion and scaling resistance.
<b>P</b>	Phosphorus	Causes cracking if too high.
<b>S</b>	Sulfur	Aids in machining. Cracking problems like P.
<b>Cr</b>	Chromium	Main corrosion and scaling resistance element.
<b>Ni</b>	Nickel	Better cold toughness—corrosion resistance.
<b>Mo</b>	Molybdenum	High temperature tensile/creep strength—pitting corrosion resistance.
<b>Ti</b>	Titanium	High temperature stabilizer—age hardening.
<b>N</b>	Nitrogen	Raises strength—minimize grain growth.
<b>Cb</b>	Columbium	High temperature stabilizer—hardening—strengthening.

#### Additional Requirements

Suffix	Additional Requirements
L	Has a Lower carbon content
H	Limited to the upper range on the carbon content
Mo	Molybdenum added—pitting resistance, creep strength, ferrite increased
Ni	Nickel added—high temperature strength, corrosion resistance, + ductility

#### AWS Class and Applications

Class	Brief Description
A E308	Used for welding many dissimilar 300 series stainless steels
A E309	Used for welding many dissimilar metals—mild steel to stainless steel
A E316	Mo added to help prevent pitting and increase creep resistance
A E317	Even more Mo than E316
A E347	Cb added to prevent corrosion just outside of the weld bead
M E410	For welding martensitic stainless steels and used for surfacing carbon steels
F E430	For welding similar alloys and corrosion-resistant surfacing
D E2209	For welding similar duplex stainless steels
E2553	For welding Ferralium 255 and other similar alloys

A—Austenitic M—Martensitic F—Ferritic D—Duplex

#### Shielding Gas and Current

Dash Number	Shielding Gas	Welding Current
-1	CO <sub>2</sub>	DCEP
-3	None (Self-Shielded)	DCEP
-4	75–80% Ar/Remainder CO <sub>2</sub>	DCEP

#### AWS (A5.22) Stainless Steel Tubular Wire Chemical Composition of Weld Metal Deposit, %

AWS Class	Carbon C	Chromium Cr	Nickel Ni	Molybdenum Mo	Manganese Mn	Silicon Si
<b>Open-Arc</b>						
E308LT0-3	0.03 Max.	19.5–22.0	9.0–11.0	0.5 Max.	0.5–2.5	1.0
E309LT0-3	0.03 Max.	23.0–25.5	12.0–14.0	0.5 Max.	0.5–2.5	1.0
E316LT0-3	0.03 Max.	18.0–20.5	11.0–14.0	2.0–3.0	0.5–2.5	1.0
E410NiMoT0-3	0.06 Max.	11.0–12.5	4.0–5.0	0.40–0.70	1.0 Max.	1.0
<b>Gas-Shielded</b>						
E308T1-4/-1	0.08 Max.	18.0–21.0	9.0–11.0	0.5 Max.	0.5–2.5	1.0
E308LT1-4/-1	0.04 Max.	18.0–21.0	9.0–11.0	0.5 Max.	0.5–2.5	1.0
E308LT0-4/-1						
E309LT1-4/-1	0.04 Max.	22.0–25.0	12.0–14.0	0.5 Max.	0.5–2.5	1.0
E309LT0-4/-1						
E316LT1-4/-1	0.04 Max.	17.0–20.0	11.0–14.0	2.0–3.0	0.5–2.5	1.0
E316LT0-4/-1						
E317LT1-4/-1	0.04 Max.	18.0–21.0	12.0–14.0	3.0–4.0	0.5–2.5	1.0
E347T1-4/-1	0.08 Max.	18.0–21.0	9.0–11.0	0.5 Max.	0.5–2.5	1.0 Max.
E410NiMoT1-4/-1	0.06 Max.	11.0–12.5	4.0–5.0	0.40–0.70	1.0 Max.	1.0
E2209T1-4/-1*	0.04 Max.	21.0–24.0	7.5–10.0	2.5–4.0	.05–2.0	1.0
E2553T1-4/1						

Note: All products listed above also require the following: 0.04 Max. Phosphorus, 0.5 Max. Copper, 0.03 Max. Sulfur \*Requires 0.08–0.2 of Nitrogen

## Stainless Steel Open-Arc Tubular Wires

McKay® In-Flux® 0 Wires are designed for joining and cladding in the flat and horizontal positions. These products perform well in field fabrication or in drafty shop conditions, because they do not require external shielding gas.

McKay Product	AWS Class	Positions	McKay Product	AWS Class	Positions
<b>In-Flux 308L-0</b>	E308LT0-3	Flat, Horizontal	<b>In-Flux 316L-0</b>	E316LT0-3	Flat, Horizontal
<b>In-Flux 309L-0</b>	E309LT0-3	Flat, Horizontal	<b>In-Flux 410NiMo-0</b>	E410NiMoT0-3	Flat, Horizontal

## Stainless Steel Gas-Shielded Flux-cored Tubular Wires

McKay ChromaWeld™ LT0 and LT1 Stainless wires are truly a premium stainless gas shielded flux-cored product. ChromaWeld™ features a bright, flat bead profile, clean easy slag release, minimal spatter, higher moisture resistance, and excellent overall weld bead appearance combined with excellent welder appeal.

McKay Product	AWS Class	Positions	McKay Product	AWS Class	Positions
<b>ChromaWeld 308LT1</b>	E308LT1-4/-1	All	<b>ChromaWeld 316LT1</b>	E316LT1-4/-1	All
<b>ChromaWeld 309LT1</b>	E309LT1-4/-1	All	<b>In-Flux 410NiMoT1</b>	E410NiMoT1-4/-1	All

## Stainless Steel Gas-Shielded Metal-Cored Tubular Wires

McKay Goldcor wires are designed to meet the needs of chemical/food service/automotive exhaust fabricators that have poor to fair fit up and desire a metal-cored wire that can produce a soft arc at superior welding speeds.

McKay Product	AWS Class	Positions
<b>Goldcor 308LSi</b>	EC308LSi	Flat, Horizontal
<b>Goldcor 309LSi</b>	EC309LSi	Flat, Horizontal
<b>Goldcor 316LSi</b>	EC316LSi	Flat, Horizontal

# Stainless Steel Wires

## In-Flux® O Stainless Steel Open-Arc Flux-Cored Wires

### In-Flux 308L-0

#### AWS E308LTO-3 flat & horizontal

An austenitic stainless steel deposit that can be used for joining common austenitic stainless steels such as Types 304, 304L, 321, CF-8, and CF-3. It provides good resistance to intergranular corrosion. It can also be used as an intermediate layer for hard surfacing. Approvals and conformance: AWS Spec A5.22, ASME SFA5.22 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.03  
Mn – 1.10  
Si – 0.44  
Cr – 20.20  
Ni – 9.80  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength . . . . .94,000 psi  
Yield Strength . . . . .70,000 psi  
Elongation in 2" . . . . .40%  
DeLong Ferrite Number . . . . .8

#### Diameters

1/16", 3/32"

### In-Flux 309L-0

#### AWS E309LTO-3 flat & horizontal

An austenitic stainless steel deposit used for joining common austenitic stainless steels such as Types 304, 304L, 309, and 309L. It is often used for overlaying carbon steel and low alloy steel, as well as for joining stainless steel to carbon or low alloy steel. Approvals and conformance: AWS Spec A5.22, ASME SFA5.22 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.03  
Mn – 1.73  
Si – 0.58  
Cr – 23.10  
Ni – 12.90  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength . . . . .91,000 psi  
Yield Strength . . . . .70,000 psi  
Elongation in 2" . . . . .40%  
DeLong Ferrite Number . . . . .11

#### Diameters

1/16", 3/32"

### In-Flux 316L-0

#### AWS E316LTO-3 flat & horizontal

An austenitic stainless steel deposit used for joining Types 316, 316L, CF-8M, and CF-3M stainless steels. It provides high resistance to intergranular corrosion with lower carbon. Approvals and conformance: AWS Spec A5.22, ASME SFA5.22 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Mn – 2.12  
Si – 0.44  
Cr – 19.10  
Ni – 11.90  
Mo – 2.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength . . . . .89,000 psi  
Yield Strength . . . . .68,000 psi  
Elongation in 2" . . . . .40%  
DeLong Ferrite Number . . . . .5

#### Diameters

1/16", 3/32"

## In-Flux® Gas Shielded Stainless Steel

### In-Flux 410NiMoT1

#### AWS E410NiMoT1-4/-1 all-position

A low carbon martensitic stainless steel deposit used for joining Type CA-6NM stainless steel castings as well as for joining Types 409, 410, 410S, and 405 stainless steels. The 410NiMoT1 has been tested to and has met hardness requirements set forth by NACE MR0175-95, with a PWHT procedure. Approvals and conformance: AWS Spec A5.22, ASME SFA5.22 (F-6)

#### Typical Deposit Analysis %

C – 0.03      Ni – 4.30  
Mn – 0.30      Mo – 0.59  
Si – 0.38      Fe – Bal.  
Cr – 11.50

#### Typical Properties as Welded

Heat Treated for 1 hr. @ 1150°F:  
Tensile Strength . . . . .131,000 psi  
Yield Strength . . . . .111,000 psi  
Elongation in 2" . . . . .21%  
As Welded:  
Tensile Strength . . . . .161,900 psi  
Yield Strength . . . . .144,900 psi  
Elongation in 2" . . . . .20%  
75/25 (Ar/CO<sub>2</sub>) or 100% CO<sub>2</sub>

#### Diameters

.045", 1/16", 3/32"



## ChromaWeld Stainless Steel Gas-Shielded Flux-Cored Wires

### ChromaWeld 308LT1

#### AWS E308LT1-4/-1

An austenitic stainless steel all-position gas shielded flux-cored wire with low carbon used for joining common austenitic stainless steels such as Types 301, 302, 304 and 304L, CF-8, and CF-3.

#### Typical Deposit Analysis %

C – 0.025  
Mn – 1.40  
Si – 0.52  
Cr – 19.22  
Ni – 10.05  
Fe – Bal.

#### Typical Weld Metal Properties

Tensile Strength . . . . .80,000 psi  
Yield Strength . . . . .59,000 psi  
Elongation in 2" . . . . .42%  
DeLong Ferrite Number . . . . .10  
75% Ar-25% CO<sub>2</sub> or 100% CO<sub>2</sub>

#### Features

- All position
- Self-detaching slag
- Spray-like arc transfer
- High moisture resistance

#### Benefits

- Welds well in vertical (up) position, as well as flat & horizontal
- Excellent welder appeal
- Low spatter and less clean-up
- Good weld soundness & extended shelf-life

**Diameters** .045", 1/16"

### ChromaWeld 309LT1

#### AWS E309LT1-4/-1

An austenitic stainless steel all-position gas-shielded flux-cored wire with low carbon used for joining common austenitic stainless steels such as Types 304, 304L, 309 and 309L. It is often used for joining stainless steel to carbon and low alloy steel, as well as for overlying carbon steel and low alloy steel.

#### Typical Deposit Analysis %

C – 0.027  
Mn – 1.23  
Si – 0.53  
Cr – 23.95  
Ni – 12.65  
Fe – Bal.

#### Typical Weld Metal Properties

Tensile Strength . . . . .83,000 psi  
Yield Strength . . . . .61,000 psi  
Elongation in 2" . . . . .38%  
DeLong Ferrite Number . . . . .17  
75% Ar/25% CO<sub>2</sub> or 100% CO<sub>2</sub>

#### Features

- All-position
- Self-detaching slag
- Spray-like arc transfer
- High moisture resistance

#### Benefits

- Welds extremely well in vertical (up) position, as well as flat and horizontal
- Excellent welder appeal
- Low spatter and less clean-up
- Good weld soundness & extended shelf-life

**Diameters** .045", 1/16"

### ChromaWeld 316LT1

#### AWS E316T1-4/1

An austenitic stainless steel all-purpose gas-shielded flux-cored wire with low carbon used for joining Types 316, 316L, CF-8M and CF-3M stainless steels.

#### Typical Deposit Analysis %

C – 0.028  
Mn – 1.25  
Si – 0.55  
Cr – 18.80  
Ni – 12.60  
Mo – 2.65  
Fe – Bal.

#### Typical Weld Metal Properties

Tensile Strength . . . . .82,000 psi  
Yield Strength . . . . .60,000 psi  
Elongation in 2" . . . . .39%  
DeLong Ferrite Number . . . . .9  
75% Ar/25% CO<sub>2</sub> or 100% CO<sub>2</sub>

#### Features

- All-position
- Self-detaching slag
- Spray-like arc transfer
- High moisture resistance

#### Benefits

- Welds extremely well in vertical (up) position, as well as flat & horizontal
- Excellent welder appeal
- Low spatter and less clean-up
- Good weld soundness & extended shelf-life

**Diameters** .045", 1/16"

# Stainless Steel Tubular Wires Technical Section

## Comparative Index of Stainless Steel Open-Arc Tubular Wires

AWS Class	McKay	ESAB	Stoody
E308LT0-3	In-Flux 308L-0	Core-Bright 308L	SOS 308L
E309LT0-3	In-Flux 309L-0	Core-Bright 309L	SOS 309L
E316LT0-3	In-Flux 316L-0	Core-Bright 316L	SOS 316L

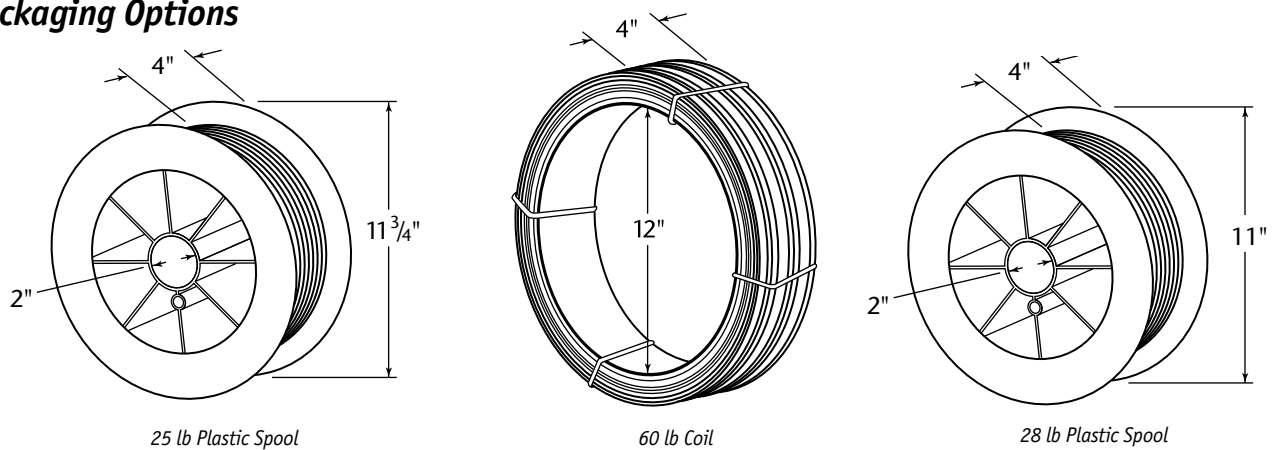
## Comparative Index of Stainless Steel Gas-Shielded Tubular Wires

AWS Class	McKay	ESAB	Kobelco	Lincoln	Sandvik
E308LT1-4/-1	ChromaWeld 308LT1	Shield-Bright 308L	DW-308LP	—	308LT-1AP
E309LT1-4/-1	ChromaWeld 309LT1	Shield-Bright 309L	DW-309LP	—	309LT-1AP
E316LT1-4/-1	ChromaWeld 316LT1	Shield-Bright 316L	DW-316LP	—	316LT-1AP
E410NiMoT1-4/-1	In-Flux 410NiMoT1	—	—	—	—

## Stainless Steel Tubular Wire Pallet Information

McKay Type	Pallet Weight (lb)		Depth	Pallet Dimensions			Number of Items Per Pallet
	Net	Gross (est.)		Width	Height		
25 lb Spool	500	605	24"	24"	27"	20 (25 lb Spools)	
28 lb Spool	1568	1650	31"	47"	32"	56 (28 lb Spools)	
60 lb Coil	1680	1743	36"	36"	35"	28 (60 lb Coils)	

## Packaging Options



25 lb Plastic Spool

60 lb Coil

28 lb Plastic Spool

## TECHNICAL SECTION

### Stainless Steel Dissimilar Welding Chart

Base Metals	201	202	301	302	302B	303	304	304L	305	308	309	309S	310	310S	314	316	316L	317	317L	321	330	347	348	403	405	410	414	416	420	430	430F	431	440A	440B	440C	446	Base Metals		
308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	201	
	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	202	
		308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	301	
			308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	302
				308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	302B
					308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	312	303
						308	308	308	308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	304
							308L	308	308	308	308	308	308	308	308	308	308	308L	308	308L	312	308L	308L	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	304L
								308	308	308	308	308	310	310	312	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	305
									308	308	308	308	308	308	308	308	308	308	308	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	308
										309	309	309	309	309	309	309	309	309	309	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	309	
											309	309	309	309	309	309	309	316	316	316	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	310	309S	
												310	310	310	310	310	310	316	316	317	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	310
													310	310	310	310	310	316	316	317	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	310S
														310	310	310	310	316	316	317	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	314
															310	310	310	316	316	317	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	310	316
																316	316	316	316	308	312	308	308	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	316L
																	316L	316L	316L	308L	312	308L	308L	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	317
																		317	317	308	312	308L	308L	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	317L
																			317L	308L	312	308L	308L	309	309	309	309	309	309	309	309	309	309	309	309	309	309	310	321
																				347	312	308	312	308	312	312	312	312	312	312	312	312	312	312	312	312	312	312	330
																					347	312	308	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	327
																						347	312	308	312	312	312	312	312	312	312	312	312	312	312	312	312	312	348
																							347	312	308	312	312	312	312	312	312	312	312	312	312	312	312	312	403
																								347	312	308	312	312	312	312	312	312	312	312	312	312	312	312	405
																									347	312	308	312	312	312	312	312	312	312	312	312	312	312	410
																										347	312	308	312	312	312	312	312	312	312	312	312	312	414
																											347	312	308	312	312	312	312	312	312	312	312	312	416
																												347	312	308	312	312	312	312	312	312	312	312	420
																													347	312	308	312	312	312	312	312	312	312	430
																														347	312	308	312	312	312	312	312	312	430F
																														347	312	308	312	312	312	312	312	312	431
																														347	312	308	312	312	312	312	312	312	440A
																														347	312	308	312	312	312	312	312	312	440B
																														347	312	308	312	312	312	312	312	312	440C
																														347	312	308	312	312	312	312	312	312	446
																														347	312	308	312	312	312	312	312	312	310

This chart is only a suggestion of which filler metals should be adequate for the joining of the stainless steels. This does not mean that other filler metal alloys are not recommended or of less quality. In all instances the chart should be used as a reference only. Actual application should dictate the proper alloy choice.

The gray sections of the chart indicate "free-matching" alloys, which are considered not weldable. This is due to the high percentage of sulfur or other low melting point elements that cause hot cracking. If high-quality joints are required welding is not generally recommended.

This chart does not indicate welding procedure. Some stainless steels require preheat while others should not have a preheat. Some welds require a buttering layer or other more rigid procedure. Suppliers may be contacted regarding procedure recommendations.

# Stainless Steel Tubular Wires

## Technical Section

### TECHNICAL SECTION

#### Suggested Parameters and Typical Deposition Data for In-Flux-0 Wires

Diameter	Electrical Stick-Out*	Voltage † Range	Current Range † amps	Deposition Rate lb/hr	Deposition Efficiency%
.045"	3/8" – 5/8"	26–32	100–180	4–7	85–88
1/16"	1/2"–1"	26–32	150–275	9–15	85–88
5/64"	3/4"–1-1/4"	26–32	200–300	12–16	85–88
3/32"	1"–1-1/2"	26–32	225–350	13–17	85–88

\*For 410-0 and 410 NiMo-0, stick-out should be 1-1/2" for all diameters (these martensitic grades, being lower in Cr, have less tolerance for N).  
 †Note: Voltage and current should be in phase. If voltage is at the low end of the range, current also should be at the low end. Same way for high-side settings.

#### Operating Ranges and Deposition Rates for ChromaWeld Wires

Diameter Electric Stickout Pos.	Arc Voltage (Volts)	Current DCEP (+) (Amps)	Approx. Wire Feed Speed (In/Min)	Deposition Rates (lbs/hr)
.045" (1.2 mm)	24	140	210	5.0
5/8" – 3/4" (16 mm – 19 mm)	<b>25 – 29</b>	<b>160 – 200</b>	<b>275 – 380</b>	<b>6.0 – 8.0</b>
Flat, Horizontal & Vertical Up	33	300	680	15.0
1/16" (1.6 mm)	28	200	155	6.5
3/4" – 1" (19 – 25.4 mm)	<b>29 – 33</b>	<b>240 – 280</b>	<b>230 – 290</b>	<b>8.5 – 11.0</b>
Flat, Horizontal & Vertical Up	35	350	420	16.0

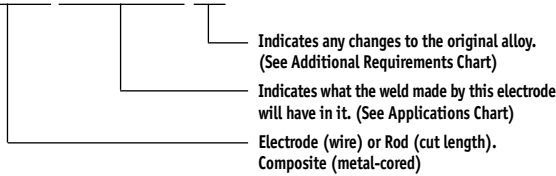
\*When using CO2 shielding gas, add 1–2 volts.  
**BOLD**– Optimum parameters for welder appeal.



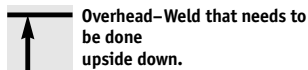
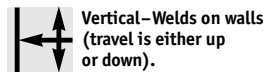
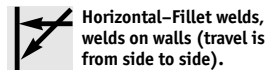
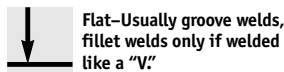
# Stainless Steel Wires AWS Section

## METAL-CORE/SOLID WIRE AWS SECTION

### AWS Classification of Stainless Steel Solid Wires ER308L



#### Positions



#### Chemical Symbols

<b>C</b>	Carbon	Increases strength and hardness—reduces corrosion resistance.
<b>Mn</b>	Manganese	Improves crack resistance in fully austenitic welds.
<b>Si</b>	Silicon	Increased corrosion and scaling resistance.
<b>P</b>	Phosphorus	Causes cracking if too high.
<b>S</b>	Sulfur	Aids in machining. Cracking problems like P.
<b>Cr</b>	Chromium	Main corrosion and scaling resistance element.
<b>Ni</b>	Nickel	Better cold toughness—corrosion resistance.
<b>Mo</b>	Molybdenum	High temperature tensile/creep strength—pitting corrosion resistance.
<b>Ti</b>	Titanium	High temperature stabilizer—age hardening.
<b>N</b>	Nitrogen	Raises strength—minimize grain growth.
<b>Cb</b>	Columbium	High temperature stabilizer—hardening—strengthening.

#### Additional Requirements

Suffix	Additional Requirements
L	Has a Lower carbon content
H	Limited to the upper range on the carbon content
Mo	Molybdenum added—pitting resistance, creep strength, ferrite increased
Ni	Nickel added—high temperature strength, corrosion resistance, + ductility

#### AWS Class and Applications

Class	Brief Description
A E308	Used for welding many dissimilar 300 series stainless steels
A E309	Used for welding many dissimilar metals—mild steel to stainless steel
A E310	Can be used for welding base metals of similar composition.
A E316	Mo added to help prevent pitting and increase creep resistance
A E317	Even more Mo than E316
A E347	Cb added to prevent corrosion just outside of the weld bead
M E410	For welding martensitic stainless steels and used for surfacing carbon steels
F E430	For welding similar alloys and corrosion-resistant surfacing
D E2209	For welding similar duplex stainless steels

A—Austenitic M—Martensitic F—Ferritic D—Duplex

#### Stainless Steel Cut Lengths Per Pound

Dia.	1/16" (1.6 mm)	3/32" (2.4 mm)	1/8" (3.2 mm)	.035"	.045	5/32
Length:	36"	36"	36"			
	31	14	8			

#### AWS (A5.9) Stainless Steel Solid Wire Chemical Composition Requirements, %

AWS Class	Carbon C	Chromium Cr	Nickel Ni	Molybdenum Mo	Manganese Mn	Silicon Si	Phosphorus P	Copper Cu
ER308	0.08 Max.	19.5–22.0	9.0–11.0	0.75 Max.	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER308H	0.04–0.08	19.5–22.0	9.0–11.0	0.50 Max.	1.0–2.5	0.20–0.65	0.03 Max.	0.75 Max.
ER308L	0.03 Max.	19.5–22.0	9.0–11.0	0.75 Max.	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER308LSi	0.03 Max.	19.5–22.0	9.0–11.0	0.75 Max.	1.0–2.5	0.65–1.00	0.03 Max.	0.75 Max.
ER309	0.12 Max.	23.0–25.0	12.0–14.0	0.75 Max.	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER309L	0.03 Max.	23.0–25.0	12.0–14.0	0.75 Max.	1.0–2.5	0.20–0.65	0.03 Max.	0.75 Max.
ER309LSi	0.03 Max.	23.0–25.0	12.0–14.0	0.75 Max.	1.0–2.5	0.65–1.00	0.03 Max.	0.75 Max.
ER310								
ER316	0.08 Max.	18.0–20.0	11.0–14.0	2.0–3.0	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER316H	0.04–0.08	18.0–20.0	11.0–14.0	2.0–2.0	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER316L	0.03 Max.	18.0–20.0	11.0–14.0	2.0–3.0	1.0–2.5	0.30–0.6	0.03 Max.	0.75 Max.
ER316LSi	0.08 Max.	18.0–20.0	11.0–14.0	2.0–3.0	1.0–2.5	0.65–1.00	0.03 Max.	0.75 Max.
ER347*	0.08 Max.	19.0–21.5	9.0–11.0	0.75 Max.	1.0–2.5	0.30–0.65	0.03 Max.	0.75 Max.
ER410	0.12 Max.	11.5–13.5	0.6 Max.	0.75 Max.	0.6 Max.	0.5 Max.	0.03 Max.	0.75 Max.

\* Also requires 10 x C min./1.0 max. of Cb      \*\* Also requires 0.08–0.20 of N

## Stainless Steel Solid Wires — Spooled/Coiled/Cut Lengths

### 308/308L

#### AWS ER308 & ER308L

Lower range carbon 308 to help prevent intergranular corrosion. Used to weld Types 201, 302, 304, and 308 stainless steels. Also used for joining some dissimilar 300 series stainless steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 20.50  
Ni – 10.50  
Mo – 0.30  
Mn – 1.70  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....85,000 psi  
Yield Strength, psi .....58,000 psi  
Elongation in 2" .....36%  
Impact Resistance .....RT ...96 ft•lbs  
(Charpy V Notch).....-320°F...43 ft•lbs  
DeLong Ferrite Number.....11

Cut lengths available.

### 308/308H

#### AWS ER308 & ER308H

Use on Types 301, 302, 305, and 308 base metals. Carbon is restricted to the higher range (0.04-0.08%) to give increased strength for applications where high mechanical properties are required. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.05  
Cr – 20.00  
Ni – 10.00  
Mo – 0.20  
Mn – 1.70  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....88,000 psi  
Yield Strength, psi .....60,000 psi  
Elongation in 2" .....40%  
Impact Resistance .....RT ...92 ft•lbs  
(Charpy V Notch)  
DeLong Ferrite Number.....10

Cut lengths available.

### 308L HiSil

#### AWS ER308LSi

A 308L chemistry which has been modified with a higher silicon level to increase weld puddle fluidity, ensuring better tie-ins and potentially higher welding speeds. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 20.00  
Ni – 10.00  
Mo – 0.30  
Mn – 1.60  
Si – 0.80  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....86,000 psi  
Yield Strength, psi .....57,000 psi  
Elongation in 2" .....42%  
Impact Resistance .....RT ...92 ft•lbs  
(Charpy V Notch).....-320°F...33 ft•lbs  
DeLong Ferrite Number.....12

### 309 (H)

#### AWS ER309

This product is produced in the upper range of carbon content to give increased high temperature strength. For welding Type 309 stainless steels, 18-8 clad steel, or dissimilar metals. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.06  
Cr – 24.00  
Ni – 12.50  
Mo – 0.20  
Mn – 1.70  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....92,000 psi  
Yield Strength, psi .....60,000 psi  
Elongation in 2" .....38%  
Impact Resistance .....RT ...85 ft•lbs  
(Charpy V Notch)  
DeLong Ferrite Number.....9

Cut lengths available.

### 309L HiSil

### 309/309L

#### AWS ER309/ER309L

Used to join similar 309L alloys or join 300 series stainless steels to carbon or low alloy steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 24.00  
Ni – 13.50  
Mo – 0.20  
Mn – 2.10  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....87,000 psi  
Yield Strength, psi .....59,000 psi  
Elongation in 2" .....40%  
Impact Resistance .....RT ..100 ft•lbs  
(Charpy V Notch)  
DeLong Ferrite Number.....12

Cut lengths available.

#### AWS ER309LSi

A modified 309L deposit. The higher silicon levels help to overcome the typical sluggish nature of 300 series stainless steel welding puddles. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 24.00  
Ni – 13.00  
Mo – 0.20  
Mn – 1.70  
Si – 0.85  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....87,000 psi  
Yield Strength, psi .....56,000 psi  
Elongation in 2" .....36%  
Impact Resistance .....RT ...92 ft•lbs  
(Charpy V Notch)  
DeLong Ferrite Number.....10

## Stainless Steel Solid Wires — Spooled/Coiled/Cut Lengths

### 316/316L

#### AWS ER316 & ER316L

A molybdenum bearing alloy for increased pitting corrosion resistance. The carbon is limited to the lower range for better intergranular corrosion resistance. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 19.00  
Ni – 12.50  
Mo – 2.50  
Mn – 1.70  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....86,000 psi  
Yield Strength, psi .....57,000 psi  
Elongation in 2" .....36%  
Impact Resistance .....RT ...82 ft•lbs (Charpy V Notch).....-320°F...34 ft•lbs  
DeLong Ferrite Number.....10

Cut lengths available

### 316L HiSiL

#### AWS ER316LSi

A 316L formulation with an increased silicon level for better wetting action when using the GMAW process. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 19.00  
Ni – 12.50  
Mo – 2.50  
Mn – 1.70  
Si – 0.85  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....87,000 psi  
Yield Strength, psi .....57,000 psi  
Elongation in 2" .....38%  
Impact Resistance .....RT ...95 ft•lbs (Charpy V Notch).....-320°F...36 ft•lbs  
DeLong Ferrite Number.....10

### 347

### AWS ER347

Stabilized with columbium to help prevent intergranular corrosion. Better corrosion resistance than Type 308. Used for Welding Types 347 and 321 steels. Good corrosion resistance in applications up to 1400°F. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.035  
Cr – 20.00  
Ni – 10.00  
Mo – 0.20  
Mn – 1.30  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....90,000 psi  
Yield Strength, psi .....59,000 psi  
Elongation in 2" .....42%  
Impact Resistance .....RT ..112 ft•lbs (Charpy V Notch).....-320°F...34 ft•lbs  
DeLong Ferrite Number.....9

Cut lengths available.

### 410

#### AWS ER410

Air-hardening stainless for welding 12Cr material. Heat treatable welding deposit. Pre- and post-weld heat treatments may be required. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-6)

#### Typical Deposit Analysis %

C – 0.08  
Cr – 13.00  
Mo – 0.10  
Mn – 0.50  
Si – 0.40  
Fe – Bal.

#### Typical Properties as Welded

Tensile Strength, psi .....79,000 psi  
Yield Strength, psi .....44,000 psi  
Elongation in 2" .....25%\*\*  
(Charpy V Notch).....-320°F...34 ft•lbs  
\*\*Heat Treated for 1 hr. @ 1375°F

### 312

#### AWS ER312

Welding Type 312 base metals. Excellent for dissimilar metal joining due to high ferrite potentials. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-6)

#### Typical Deposit Analysis %

C – 0.07  
Mn – 0.80  
Si – 0.40  
Cr – 28.50  
Ni – 9.10  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength .....115,000 psi  
Yield Strength .....95,000 psi  
Elongation in 2" .....25%  
DeLong Ferrite Number.....45

Cut lengths available

### 310

#### AWS ER310

For welding base metal of similar composition, when the stainless base metal is of unknown composition, and for dissimilar metal Used as a transition layer for high restrained joints of high carbon steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-6)

#### Typical Deposit Analysis %

C – 0.14  
Mn – 2.02  
Si – 0.46  
Cr – 26.12  
Ni – 21.00  
Fe – Bal.

#### Typical Properties and Ferrite Number of Weld Deposit as Welded

Tensile Strength .....86,000 psi  
Yield Strength .....63,000 psi  
Elongation in 2" .....40%  
DeLong Ferrite Number.....0



## Goldcor™ Stainless Steel Gas-Shielded Metal-Cored Wires

### Goldcor 308LSi

**AWS EC308LSi flat & horizontal**

An austenitic stainless steel wire used to join 301, 302, 304, 304L and 308 stainless steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.023  
Cr – 20.50  
Ni – 10.10  
Mo – 0.25  
Mn – 1.50  
Si – 0.85  
P – 0.02  
S – 0.01  
Cu – 0.2

#### Typical Weld Metal Properties\* (As Welded):

DeLong Ferrite .....10-18  
Schaeffler Number Range .....7-15  
WRC Number Range (1992) .....8-19  
98%Ar/2%O<sub>2</sub> or 95%Ar/5%CO<sub>2</sub>

#### Diameter

.045"  
1/16"

### Goldcor 309LSi

**AWS EC309LSi flat & horizontal**

An austenitic stainless steel wire used to join similar 309L alloys or join 300 series stainless steel to carbon or low alloys steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.025  
Cr – 23.90  
Ni – 13.10  
Mo – 0.25  
Mn – 1.50  
Si – 0.85  
P – 0.02  
S – 0.01  
Cu – 0.20

#### Typical Weld Metal Properties\* (As Welded):

DeLong Ferrite .....13-20  
Schaeffler Number Range .....11-17  
WRC Number Range (1992) .....11-19  
98%Ar/2%O<sub>2</sub> or 95%Ar/5%CO<sub>2</sub>

#### Diameter

.045"  
1/16"

### Goldcor 316LSi

**AWS EC316LSi flat & horizontal**

An austenitic stainless steel wire used to join 316 and 316L stainless steels. Approvals and conformance: AWS Spec A5.9, ASME SFA5.9 (F-6, A-8)

#### Typical Deposit Analysis %

C – 0.02  
Cr – 19.10  
Ni – 12.40  
Mo – 2.50  
Mn – 1.50  
Si – 0.85  
P – 0.02  
S – 0.01  
Cu – 0.20

#### Typical Weld Metal Properties\* (As Welded):

DeLong Ferrite .....4-10  
Schaeffler Number Range .....4-10  
WRC Number Range (1992) .....4-10  
98%Ar/2%O<sub>2</sub> or 95%Ar/5%CO<sub>2</sub>

#### Diameter

.045"  
1/16"

# Stainless Steel Wires

## Comparative Index of Stainless Steel Solid Wires

AWS Class	McKay	ESAB	Harris Welco	Lincoln	National Standard	Sandvik	Techalloy
ER308 & ER308L	<b>308/308L</b>	Arcaloy ER308L	ER308L	Blue Max S308/308L	308L		Techalloy 308L
ER308 & ER308H	<b>308/308H</b>	Arcaloy ER308H	ER308	—	308		Techalloy 308
ER308LSi	<b>308L HiSiL</b>	Arcaloy ER308LSi	ER308LSi	Blue Max MIG 308LSi	308L Hi SiL	19.9LSi	Techalloy 308L HS
ER309 & ER309L	<b>309/309L</b>	Arcaloy ER309L	ER309L	Blue Max S309/309L	309L	24.13.L	Techalloy 309L
ER309	<b>309 (H)</b>	—	ER309	—	309		Techalloy 309
ER309LSi	<b>309L HiSiL</b>	Arcaloy ER309LSi	ER309LSi	Blue Max MIG 309LSi	309L Hi SiL	24.13.LSi	Techalloy 309L HS
ER310		Arcaloy ER310					
ER316 & ER316L	<b>316/316L</b>	Arcaloy ER316L	ER316L	Blue Max S316/316L	316L		Techalloy 316L
ER316LSi	<b>316L HiSiL</b>	Arcaloy ER316LSi	ER316LSi	Blue Max MIG 316LSi	316L Hi SiL	19.12.3.NDSi	Techalloy 316L HS
ER347	<b>347</b>	Arcaloy ER347	ER347	—	347		Techalloy 347
ER410	<b>410</b>	Arcaloy ER410	ER410	—	410		Techalloy 410

## Typical Parameters for Short-Circuiting Welding With Bare Stainless Wires

Wire Diameter	Amperes DCEP	Voltage	Electrical Stick-out	90% He - 7-1/2% Ar - 2-1/2% CO <sub>2</sub> Flow Rate (CFH)
.030"	50-150	14-20	3/8"-1/2"	25
.035"	60-200	14-22	3/8"-1/2"	25
.045"	75-225	15-23	3/8"-1/2"	25
1/16"	100-250	16-23	3/8"-1/2"	25

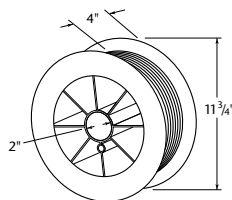
## Typical Parameters for Spray Transfer Welding With Bare Stainless Wires

Wire Diameter	Amperes DCEP	Voltage	Electrical Stick-out	Ar + 2% O <sub>2</sub> Flow Rate (CFH)
.030"	130-200	23-27	3/8"-1/2"	35
.035"	150-225	23-26	1/2"-3/4"	35
.045"	200-325	24-28	1/2"-3/4"	35
1/16"	300-350	24-27	1/2"-3/4"	35

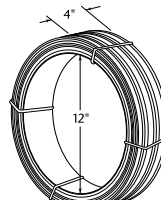
## Recommended Operating Parameters:

Diameter Electric Stickout Pos.	Arc Voltage (Volts)	Current DCEP (+) (Amps)	Approx. Wire Feed Speed (In/Min)	Deposition Rates (lbs/hr)
.045" (1.2 mm)	23	140	260	5.5
3/4" - 1" (19 mm)	26	190	390	9.0
Flat and Horizontal	33	300	490	11.6
1/16" (1.6 mm)	26	180	152	6.0
3/4" - 1" (19 - 25.4 mm)	29	250	250	11.0
Flat and Horizontal	32	390	442	18.0

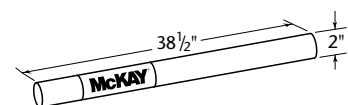
## Packaging Options



30 lb Plastic Spool



60 lb Coil



10 lb Tube (Cut Lengths)

## HARD SURFACING STICK ELECTRODE PRODUCT LINE OVERVIEW

McKay® has been a leading supplier of iron-based surfacing electrodes for over fifty years. The McKay full line of Hardalloy® electrodes and special alloy electrodes are formulated to cover a broad spectrum of wear-related applications.

Every McKay electrode product is formulated for maximum wear resistance and superior, consistent operation—then manufactured to exact standards. Every pound of product is backed by over fifty years of field hard surfacing experience.



### MAIN LINE PRODUCTS

- Hardalloy 118
- Chrome-Mang
- Hardalloy 32
- Hardalloy 58
- Hardalloy 140
- Hardalloy 155

Within the wide scope of McKay hard surfacing stick electrodes, six alloys have been specially designed to cover the majority of impact and abrasive wear applications. These six main line electrodes listed to the left are explained in great detail on pages 36 and 37.



### AWS SECTION

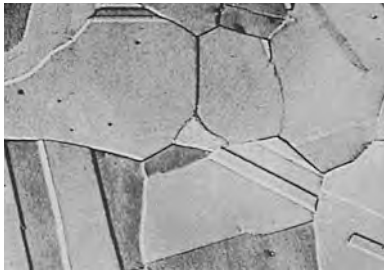
#### AWS (A5.15) Cast Iron Electrode Chemical Composition of Weld Metal Deposit, %

AWS Class	Carbon C	Manganese Mn	Silicon Si	Sulfur S	Iron Fe	Nickel <sup>a</sup> Ni	Copper <sup>b</sup> Cu	Aluminum Al
ENi-Ci	2.0 Max.	2.5 Max.	4.0 Max.	0.3 Max.	8.0 Max.	85 Min.	2.5 Max.	1.0 Max.
ENiFe-Ci	2.0 Max.	2.5 Max.	4.0 Max.	0.3 Max.	Balance	45-60	2.5 Max.	1.0 Max.
Note: 1.0 Max. of all other elements		<sup>a</sup> Nickel plus incidental cobalt			<sup>b</sup> Copper plus incidental silver			

#### AWS (A5.13) Hard Surfacing Electrode Chemical Composition of Weld Metal Deposit, %

AWS Class	Carbon C	Manganese Mn	Cobalt Co	Tungsten W	Nickel Ni	Chromium Cr	Molybdenum Mo	Iron Fe	Vanadium V	Silicon Si	Total Other Elements
EFe5-B	0.5-0.9	0.60 Max.	—	1.0-2.5	—	3.0-5.0	5.0-9.5	Balance	3.0-5.0	5.0-9.5	1.0 Max.

### Hard Surfacing Stick Electrode Alloy Classification



Photomicrograph of austenite.

#### Austenitic Alloys

Austenitic alloys are extremely tough, ductile and work-hardenable. They offer excellent impact resistance and fair abrasion resistance (which improves as it work-hardens). These alloys will normally work-harden to a surface hardness up to 50 HRC and still retain their good impact resistance.

#### McKay Austenitic Products

Hardalloy 118  
Hardalloy 119  
Chrome-Mang



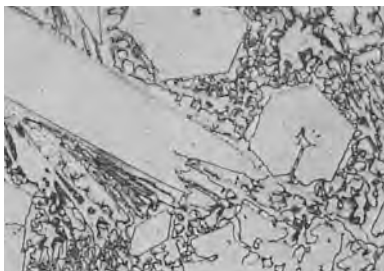
Photomicrograph of martensite.

#### Martensitic Alloys

Martensite is formed in steels by rapid cooling rates. Most of the hard surfacing alloys are air hardenable and heat treatable. They provide a good balance of impact and abrasion resistance. Martensitic alloys also have relatively high compression strength and excellent metal-to-metal wear resistance.

#### McKay Martensitic Products

Hardalloy 32  
Hardalloy M-932  
Hardalloy 58  
Hardalloy 61



Photomicrograph of large carbides in a carbide eutectic matrix.

#### Carbide Alloys

Carbide alloys are very much like asphalt. There are carbides (gravel) and matrix (tar). The carbides are what give the excellent abrasion resistance while the matrix (tar) holds the carbides in place and offers some impact resistance. Carbides are extremely hard and brittle. They cannot handle impact. The more carbides there are the higher the abrasion resistance but the lower the impact resistance.

#### McKay Carbide Products

Hardalloy 148  
Hardalloy 40 TiC  
Hardalloy 140  
Hardalloy 155

## Hard Surfacing Stick Electrode Product Line

### Build-Up Restoring worn parts to their original dimensions

McKay Product	Description	Characteristics	
		Manganese	Carbon
<b>Chrome-Mang</b>	Premium alloy for use on carbon and manganese steels.	●	●
<b>Hardalloy 118</b>	For build-up & joining of manganese steels only.	●	○
<b>Hardalloy 32</b>	Excellent build-up and overlay alloy for carbon steels.	○	●
Hardalloy 119	For build-up of manganese, carbon & low alloy steels.	●	●
Hardalloy M-932	Harder than Hardalloy 32 and still machinable.	○	●

### Overlay Providing additional resistance to wear

Application	McKay Product	Description	Characteristics
<b>Metal to Metal</b>	<b>Hardalloy 32</b>	Excellent build-up and overall alloy for carbon steels.	Hardness ██████████
	Hardalloy M-932	Harder than Hardalloy 32 and still machinable.	██████████
	<b>Hardalloy 58</b>	Very hard steel deposit for overlay only.	██████████
	Hardalloy 61	Similar to an M2 type tool steel in composition.	██████████
			0 20 40 60 (Rockwell)
<b>Impact</b>	<b>Chrome-Mang</b>	Premium alloy for use on carbon and manganese steels.	Manganese ● Carbon ●
	<b>Hardalloy 118</b>	For build-up & joining of manganese steels only.	● ○
	Hardalloy 119	For build-up of manganese, carbon & low alloy steels.	● ●
<b>Abrasion</b>	Hardalloy 148	For abrasion and impact resistance.	Abrasion Resistance ██████████
	<b>Hardalloy 140</b>	For heavy abrasion and moderate impact.	██████████
	Hardalloy 40TiC	Better abrasion than Hardalloy 140 with titanium carbides.	██████████
	<b>Hardalloy 155</b>	For extreme abrasion with minimal impact.	██████████
			0 2 4 6 (Carbon content %)

● Compatible ○ Incompatible Main line products indicated in yellow

### Special Alloys

McKay Product	Description
<b>Cast Iron</b>	Cast-Alloy Cast-Alloy 60 Nickel electrode for low stress applications and maximum machinability. Stronger and more ductile than Cast-Alloy with better hot cracking resistance.
<b>Heat &amp; Corrosion</b>	121 High carbon austenitic stainless steel alloy for high impact resistance & high temperature resistance.
<b>Maintenance</b>	GP Hardalloy 120 Recommended for joining dissimilar metals and hard-to-weld steels. Similar to GP although a more economical product with excellent operator appeal.

# Hard Surfacing Stick Electrodes

## Main Line Products for Build-up

### Hardalloy® 118

Hardalloy® 118 deposit is a work hardening austenitic manganese steel alloy. It is designed for the build-up and joining of austenitic manganese steels only. Provides a good wear resistance under heavy impact conditions. Weld deposits are extremely tough, and work hardens rapidly.

Diameter	Optimum Current Amps
1/8"	120
5/32"	180
3/16"	230
1/4"	280
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C - 0.80  
Mn - 16.50  
Si - 0.50  
Cr - 5.00  
Ni - 0.30  
Fe - Bal.

#### Typical Properties

Tensile Strength . . . . .127,000 psi  
Yield Strength . . . . .78,000 psi  
Elongation in 2" . . . . .50%  
Machinability . . . . .Difficult  
Hardness:  
As Deposited . . . . .18-22 Rc  
Work Hardened . . . . .50-55 Rc  
Flame cutting is difficult  
Nonmagnetic

#### Typical Applications

- Crusher Jaws & Cones
- Crusher Rolls
- Dredge Pump Casings, Impellers, & Side Plates
- Gyrotory Crusher Mantles & Cones
- Hammer Mill Hammers
- Impactor Crusher Bars
- Manganese Bucket Teeth
- Manganese Steel Railroad Crossovers & Frogs
- Sizing Screens

### Chrome-Mang™

Hardalloy® Chrome-Mang deposit is a premium work hardening chromium-manganese austenitic stainless steel alloy. It can be used for the build-up and joining of manganese, as well as carbon and low alloy steels. It has higher toughness than conventional manganese steel deposits. Crack resistance is excellent.

Diameter	Optimum Current Amps
1/8"	150
5/32"	200
3/16"	250
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C - 0.40  
Mn - 14.50  
Si - 0.60  
Cr - 14.00  
Ni - 1.00  
Mo - 1.50  
V - 0.50  
Fe - Bal.

#### Typical Properties

Tensile Strength . . . . .130,000 psi  
Yield Strength . . . . .94,000 psi  
Elongation in 2" . . . . .40%  
Machinability . . . . .Difficult  
Hardness:  
As Deposited . . . . .18-22 Rc  
Work Hardened . . . . .50-55 Rc  
Cannot be flame cut  
Nonmagnetic

#### Typical Applications

- Crusher Jaws & Cones
- Hammer Mill Hammers
- Hydroelectric Turbines
- Impactor Crusher Bars
- Similar to those for Hardalloy® 118, especially where the base metal is questionable or when contamination may be an issue
- Sizing Screens

### Hardalloy® 32

Hardalloy® 32 deposit is a heat treatable alloy steel suited for the build-up of carbon and low alloy steels only. The weld metal is sound, and the good compressive strength makes it an excellent base for hard surfacing. It has excellent resistance to cracking and checking in heavy thicknesses.

Diameter	Optimum Current Amps
1/8"	140
5/32"	180
3/16"	220
1/4"	300
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C - 0.18  
Mn - 0.90  
Si - 0.60  
Cr - 0.70  
Mo - 0.30  
Fe - Bal.

#### Typical Properties

Machinability . . . . .Excellent  
Typical Hardness, Rc  
No. of Layers . . . . .1020 Steel  
1-2 . . . . .17-20  
3-8 . . . . .25-30  
Can be flame cut  
Deposit is strongly magnetic  
Deposits is heat treatable and forgeable

#### Typical Applications

- Bucket Teeth & Lips
- Coupling Boxes
- Crane Wheels
- Dragline Buckets & Chain
- Dredge Ladder Rolls
- Gear Teeth
- Grizzly Bars & Fingers
- Kiln Trunnions
- Mine Car Wheels
- Steel Shafts
- Tractor Idlers & Rollers
- Wobbler Ends

## Main Line Products for Overlay

### Hardalloy® 58

Hardalloy® 58 deposit is a martensitic alloy for hard, tough overlays on carbon and low alloy steel parts only. The deposit is sound with a good combination of impact and abrasion resistance. Proper preheat is required for crack-free deposits.

Optimum Current	
Diameter	Amps
1/8"	110
5/32"	160
3/16"	210
1/4"	270
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C – 0.60  
Mn – 1.20  
Si – 0.70  
Cr – 5.50  
Mo – 0.50  
Fe – Bal.

#### Typical Properties

Machinability . . . . .Grinding Only  
Typical Hardness, Rc  
No. of Layers . . . . .1020 Steel  
1 . . . . .45-55  
2 . . . . .55-60  
Flame cutting is difficult  
Deposit is magnetic  
Deposit is heat treatable and forgeable

#### Typical Applications

- Coupling Boxes
- Dragline Chain
- Dredge Ladder Rolls
- Kiln Trunnions
- Mill Guides
- Sliding Metal Parts
- Wobbler Ends

### Hardalloy® 140

Hardalloy® 140 deposits a high chromium carbide alloy steel. It can be used to overlay surfaces subjected to high abrasion coupled with some impact. It maintains its wear resistance to a temperature of 1200°F and offers some corrosion resistance. Hardalloy 140 is designed for carbon, low alloy or austenitic manganese base metals or a weld metal base of Hardalloy 32, Hardalloy 118, or Chrome-Mang™.

Optimum Current	
Diameter	Amps
1/8"	120
5/32"	155
3/16"	190
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C – 3.00  
Mn – 0.40  
Si – 2.00  
Cr – 30.00  
Mo – 0.70  
Fe – Bal.

#### Typical Properties

Machinability . . . . .Grinding only		
Typical Hardness, Rc		
No. of Layers	1020 Steel	12-14% Mn Steel
1	53	50
2	57	55
3	54	56

Cannot be flame cut  
Deposit will relief-check crack  
Deposit maintains hot hardness to 1200°F

#### Typical Applications

- Ammonia Knives
- Augers
- Bucket Teeth & Lips
- Bulldozer Blades
- Cement Chutes
- Crusher Jaws & Cones
- Crusher Rolls
- Cultivator Chisels & Sweeps
- Dredge Cutter Heads & Teeth
- Dredge Pump Side Plates
- Grizzly Bars & Fingers
- Hammer Mill Hammers
- Impactor Crusher Bars
- Manganese Pump Sheels
- Mill Guides
- Muller Tires
- Pipeline Ball Joints
- Plow Shares
- Scraper Blades
- Screw Conveyers
- Sheepsfoot Tampers
- Sizing Screens

### Hardalloy® 155

Hardalloy® 155 deposits an extra high chromium carbide alloy steel intended for overlay on surfaces subjected to extremely severe abrasion. It maintains its hot hardness to 1250°F and has an excellent edge building capability. Hardalloy 155 is designed for overlay on carbon, low alloy, or manganese steel base metals or over a welded build-up base of Hardalloy 32, 118, or Chrome-Mang.

Optimum Current	
Diameter	Amps
1/8"	140
5/32"	150
3/16"	190
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C – 5.50  
Mn – 0.40  
Si – 1.00  
Cr – 32.00  
Mo – 4.50  
Fe – Bal.

#### Typical Properties

Machinability . . . . .Grinding Only  
Thickness . . . . .3 layers max  
Typical Hardness, 59-63 HRC  
Cannot be flame cut  
Deposit will relief-check crack readily  
Deposit maintains hot hardness to 1250°F

#### Typical Applications

- Ammonia Knives
- Augers
- Bucket Lips & Teeth
- Bulldozer Blades
- Cement Chutes
- Coal Feeder Screws
- Coke Chutes
- Coke Pusher Shoes
- Coal Pulverizer Hammers
- Conveyor Screws
- Crusher Jaws & Cones
- Crusher Rolls
- Cultivator Chisels & Sweeps
- Dredge Cutter Heads & Teeth
- Dredge Pump Inlet Nozzle & Side Plates
- Fan Blades
- Gizzly Bars & Fingers
- Manganese Pump Shells
- Muller Tires
- Ore/Coal Chutes
- Paving Agitator Screws
- Pipeline Ball Joints
- Pug Mill Paddles
- Ripper Shanks
- Road Rippers
- Sheepsfoot Tampers, similar to those for Hardalloy 140 where additional abrasion resistance is required
- Sizing Screens
- Subsoiler Teeth

# Hard Surfacing Stick Electrodes

## Hardalloy® 119

Hardalloy® 119 is a work hardening austenitic manganese steel. It is designed for the build-up or joining of austenitic manganese steels. Slightly harder than 118 in the "as deposited" condition and also work hardens quicker.

### Optimum Current

Diameter	Amps
1/8"	150
5/32"	200
3/16"	240
Polarity: DCEP Preferred or AC	

### Typical Deposit Analysis %

C - 01.00  
Mn - 19.50  
Si - 0.50  
Cr - 5.00  
Fe - Bal.

### Typical Properties

Tensile Strength . . . . .135,000 psi  
Yield Strength . . . . .97,000 psi  
Elongation in 2" . . . . .31%  
Machinability . . . . .Difficult/  
Grinding only  
Hardness:  
As Deposited . . . . .21 Rc  
Work Hardened . . . . .50-55 Rc  
Flame cutting is difficult

### Typical Applications

- Manganese Steel Railroad Crossovers & Frogs
- Similar to Hardalloy 118

## Hardalloy® M-932

Hardalloy® M-932 deposit is a martensitic alloy with good toughness and abrasion resistance designed for all weldable steels other than austenitic stainless or manganese steels. Deposits are just within the machinable range.

### Optimum Current

Diameter	Amps
5/32"	170
3/16"	220
1/4"	300
Polarity: DCEP Preferred or AC	

### Typical Deposit Analysis %

C - 0.13  
Mn - 0.80  
Si - 0.40  
Cr - 2.20  
Mo - 1.00  
Fe - Bal.

### Typical Properties

Tensile Strength . . . . .145,000 psi  
Hardness, as deposited, Rc  
No. of #132 Rail/ 1020  
Layers 1080 Steel\* Steel  
1 38 33  
2 39 36  
3 38 38

\*700°F preheat and interpass temperature  
Can be flame cut

### Typical Applications

- Crane Wheels
- Frogs & Switch Points
- Low Alloy Steel Railroad Crossovers
- Steel Shafts
- Tractor Undercarriage Idlers & Rollers

## Hardalloy® 600

Hardalloy® 600 is designed for overlay of mild and low alloy steels, providing moderate abrasion and impact and excellent metal-to-metal wear resistance. Hardalloy has a smooth, steady arc that allows smooth operation for increased productivity. It has good resistance to abrasion and impact which makes it versatile for overlaying different alloys.

### Optimum Current

Diameter	Amps
1/8"	110
5/32"	160
3/16"	210
Polarity: DCEP Preferred or AC	

### Typical Deposit Analysis %

C - 0.60  
Mn - 1.000  
Si - 0.40  
Cr - 4.00  
Fe - Bal.

### Typical Properties

Nonmachinable . . . . .Grinding only  
Typical Hardness, Rc  
No. of 1020  
Layers Steel  
1 45-55RC  
2 55-60RC  
3 55-60RC  
4 55-60RC

Flame cutting can be difficult  
Deposit is magnetic

### Typical Applications

- Coupling Boxes
- Dragline Chain
- Dredge Ladder Rolls
- Kiln Trunnions
- Mill Guides
- Sliding Metal Parts
- Wobbler Ends



## Hardalloy® 148

Hardalloy® 148 deposit is a high carbon-chromium austenitic plus carbide alloy steel suited to overlay surfaces subjected to light abrasion accompanied by impact. It has excellent metal-to-metal frictional wear resistance, and the deposit retains hardness at temperatures up to 1200°F

### Optimum Current

Diameter	Amps
1/8"	120
5/32"	160
3/16"	175

Polarity:  
DCEP Preferred or AC

### Typical Deposit Analysis %

C -	1.80
Mn -	0.60
Si -	1.80
Cr -	30.00
Ni -	3.00
Mo -	1.50
Fe -	Bal.

### Typical Properties

Low stress abrasion – excellent  
Machinability . . . . .Grinding only  
Typical Hardness, Rc

No. of Layers	1020 Steel	12-14% Mn Steel
1	36RC	35RC
2	39RC	38RC
3	43RC	40RC

Cannot be flame cut  
Little or no relief-check cracks  
Maintains hot hardness to 1200°F

### Typical Applications

- Gyratory Crusher Mantles & Cones
- Ingot Tongs
- Mill Guides
- Pulleys
- Slurry Mixer Paddles

## Hardalloy® 40 TIC

Hardalloy® 40 TIC deposit is a high alloy cast iron containing chromium and titanium as the important alloying ingredients added for increased wear life. It is suited for surfaces subjected to heavy abrasion and moderate impact. Hardalloy 40 TIC is an excellent overlay material on both carbon steels and austenitic manganese base metals.

### Optimum Current

Diameter	Amps
1/8"	120
5/32"	160
3/16"	200
1/4"	260

Polarity:  
DCEP Preferred or AC

### Typical Deposit Analysis %

C -	3.00
Mn -	1.10
Si -	0.80
Cr -	8.20
Ti -	1.50
Fe -	Bal.

### Typical Properties

Nonmachinaable nor fogeable  
Thickness . . . . .2 layers min./  
3 layers max.

Typical Hardness, Rc

No. of Layers	1020 Steel	12-14% Mn Steel
1	39	39
2	45	45
3	50	50

Cannot be flame cut  
deposit is nonmagnetic  
Some relief-check cracks  
Maintains hot hardness to 1200°F

### Typical Applications

- Ammonia Knives
- Augers
- Bucket Teeth & Lips
- Bulldozer End Bits & Blades
- Cement Chutes
- Coke Pusher Shoes
- Conveyor Screws
- Crusher Rolls
- Cultivator Chisels & Sweeps
- Dredge Pump Inlet Nozzle
- Hammer Mill Hammers
- Impactor Crusher Bars
- Mill Hammers
- Plow Shares
- Scraper Blades
- Sheepsfoot Tampers
- Subsoiler Teeth

## Hardalloy® 61

### AWS EFe5-B (AWS A5.13)

Hardalloy® 61 deposit is a martensitic surfacing alloy similar to a high speed tool steel deposit. It can be used for metal-to-metal wear and abrasive wear up to 1000°F.

### Optimum Current

Diameter	Amps
1/8"	140
5/32"	180

Polarity:  
DCEP Preferred or AC

### Typical Deposit Analysis %

C -	0.80
Mn -	0.50
Si -	0.70
Cr -	4.00
W -	1.10
Mo -	8.00
V -	1.10
Fe -	Bal.

### Typical Properties

Machinability . . . . .Grinding Only  
Typical Hardness, Rc

No. of Layers	1020 Steel
1	53-55
2	57-63

Cannot be flame cut  
Maintains hot hardness to 1000°F

### Typical Applications

- Shear Blades
- Sliding Metal Parts
- Trimming Dies & Punching Dies

# Hard Surfacing Stick Electrodes

## Special Alloy Electrodes — CAST IRON

### Cast-Alloy™

#### AWS ENi-CI

The "straight" nickel electrode excels in low stress welding applications on light and medium weight castings and where maximum machinability is desired. Approvals and conformance: AWS Spec A5.15, ASME SFA5.15

#### Optimum Current

Diameter	Amps
3/32"	70
1/8"	95
5/32"	130
3/16"	190

Polarity:  
DCEP Preferred or AC

#### Typical Deposit Analysis %

C -	1.10
Mn -	0.40
Si -	2.70
Cu -	1.40
Fe -	5.50
Ni -	89.00

#### Typical Properties as Welded

Tensile Strength, .....	40,000 psi
Yield Strength .....	38,000 psi
Elongation in 2" .....	4.5%

### Cast-Alloy™ 60

#### AWS ENiFe-CI

Because of its chemistry (approximately 50% iron and 50% nickel), the Cast-Alloy 60 can offer several advantages over conventional "straight" nickel electrodes. Among the benefits are stronger and more ductile deposits, better hot crack resistance, lower coefficient of thermal expansion, and lower cost. Approvals and conformance: AWS Spec A5.15, ASME SFA5.15

#### Optimum Current

Diameter	Amps
3/32"	70
1/8"	95
5/32"	130
3/16"	190

Polarity:  
DCEP Preferred or AC

#### Typical Deposit Analysis %

C -	1.30
Mn -	0.50
Si -	0.60
Fe -	48.00
Ni -	49.00

#### Typical Properties as Welded

Tensile Strength, .....	70,000 psi
Yield Strength .....	52,000 psi
Elongation in 2" .....	9.5%

## Special Alloy Electrodes — MAINTENANCE

### Hardalloy® 121

(Formerly known as Frogalloy®)

Hardalloy 121 deposit is a high carbon austenitic stainless steel alloy. It has high impact resistance and high temperature wear resistance.

#### Optimum Current

Diameter	Amps
1/8"	105
5/32"	140
3/16"	200
Polarity: DCEP	

#### Typical Deposit Analysis %

C	0.40
Mn	4.10
Si	0.40
Cr	19.20
Ni	9.20
Mo	1.40
Fe	Bal.

#### Typical Properties as Welded

Tensile Strength	116,000 psi
Yield Strength	89,000 psi
Elongation in 2"	16%
Hardness:	
As Deposited	21 Rc (220 BHN)
Work Hardened	50-55 Rc (460-550 BHN)

Cannot be flame cut

#### Typical Applications

- Furnace Skid Rails
- Ingot Tongs
- Manganese Steel Railroad Crossovers & Frogs
- Mill Guides
- Piercing Components
- Pulverizer Hammers

### GP

A special stainless alloy electrode balanced for maximum strength and crack resistance. McKay GP is recommended for joining dissimilar metals and hard-to-weld steels. Deposits have over 20% ferrite and crack resistance equal to the armor welding electrodes. McKay GP can be used for any high strength application, where wear, impact, heat and corrosion resistant properties are required. Excellent for highly alloyed steels and for repair of cracked dies. Excellent operation in all positions.

#### Optimum Current

Diameter	Amps
3/32"	70
1/8"	105
5/32"	140
3/16"	170
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C	0.06
Mn	1.00
Si	0.50
Cr	26.50
Ni	9.00
Fe	Bal.

#### Typical Properties as Welded

Tensile Strength	129,000 psi
Yield Strength	90,000 psi
Elongation in 2"	27%
Machinability	Good
Thickness	As required
Cannot be flame cut	
Nonmagnetic	

#### Typical Applications

- Welding Attachments to Manganese Castings
- Welding Grouser Bars to Grousers
- Welding T-1 Steel Lips to Manganese Buckets

### Hardalloy® 120

Hardalloy 120 deposit is a stainless steel alloy with a ferrite content of at least 20FN. It is designed to achieve good impact, abrasion resistance, high compressive strength, and superior joining properties in one product. It makes an excellent build-up material and is recommended for joining dissimilar metals. Due to a heavy coating, Hardalloy 120 electrodes compare with standard electrodes having 1/32" larger core wire.

#### Optimum Current

Diameter	Amps
1/8"	130
5/32"	175
3/16"	230
Polarity: DCEP Preferred or AC	

#### Typical Deposit Analysis %

C	0.07
Mn	1.30
Si	0.40
Cr	23.50
Ni	9.70
Fe	Bal.

#### Typical Properties as Welded

Abrasion Resistance	Fair	
Impact Resistance	Excellent	
Tensile Strength	97,000 psi	
Yield Strength	71,000 psi	
Elongation in 2"	37%	
Machinability	Very Good	
Hardness, as deposited, Rc		
No. of Layers	1020 Steel	12-14% Mn Steel
1	20	21
2	19	21
3-8	17	18
Work Hardened		40-45 Rc
Cannot be flame cut		
Good hot hardness to 1000°F		

#### Typical Applications

- Surfacing Valve Seats
- Welding Alloy Steel Tips to Manganese Buckets
- Welding Attachments to Manganese Castings

# Hard Surfacing Stick Electrodes

## Technical Section

### Comparative Index of Hard Surfacing Electrodes

McKay	Certanium	Lincoln	Stoody
Hardalloy 32	283 FC	BU	Build-Up LH
Hardalloy 40 TiC	222	ME, 44	21, 19, 35
Hardalloy 148	246	ABR	31, 33, 77
Hardalloy 58	281 FC, 246 FC	MM	Self-Hardening
Hardalloy 61	221	T&D	1102
Hardalloy 118	262 FC	Mangjet	Dynamang
Hardalloy 119	282	Frogmang	Trackwear
Hardalloy 140	247, 248 FC	ME	31, 19, 21
Hardalloy 155	246 FC, 247 FC, 284 FC	—	Superchrome, 2134
Hardalloy M-932	222, NC, N70	—	Rail End 932
Chrome-Mang	106 FC, 282 FC	15CrMn	2110
Hardalloy 600	222, NC, N70	Warshield ABR	77

### Comparative Index of Special Alloy Electrodes

McKay	Certanium	Eutectic	Stoody	UTP	Weld Mold
Cast-Alloy	—	244, 22*40, 3099, 409	99	8	700, 702, 706, 704
Cast-Alloy 60	887	22*33N, 3055, 4055	55	83 FN, 85 FN, 86 FN	750, 765
Hardalloy 121	233	6899 XHD	Thermalloy 400	—	762
GP	707 AC/DC	680	HD-20, Versalloy Plus, Versalloy GP	65, 653	881, 880, 8800
Hardalloy 120	706 AC/DC	680	HD-20, Versalloy Plus, Versalloy GP	65, 653	880-C

### Hard Surfacing Electrodes Per Pound

McKay Type	Diameter: Length:	1/8" (3.2 mm) 14"	5/32" (4.0 mm) 14"	3/16" (4.8 mm) 14"	7/32" (5.6 mm) 18"	1/4" (6.4 mm) 18"
Hardalloy 32		13	9	6	—	2
Hardalloy 40 TiC		14	9	6	—	2
Hardalloy 148		9	6	5	—	—
Hardalloy 58		14	9	6	—	2
Hardalloy 61		12	8	—	—	—
Hardalloy 118		12	8	5	—	2
Hardalloy 119		9	6	4	2	—
Hardalloy 140		9	6	4	2	—
Hardalloy 155		8	5	4	—	—
Chrome-Mang		8	5	4	—	—
Hardalloy M-932		—	9	6	—	2
Hardalloy 600		14	10	7	—	—

### Special Alloy Electrodes Per Pound

McKay Type	Diameter: Length:	3/32" (2.4 mm) 10"	1/8" (3.2 mm) 14"	5/32" (4.0 mm) 14"	3/16" (4.8 mm) 14"	7/32" (5.6 mm) 18"
Cast-Alloy		35	13	9	6	—
Cast-Alloy 60		37	14	9	6	—
GP		34	13	9	6	—
Hardalloy 121		—	13	8	6	—
Hardalloy 120		—	9	6	4	2

For other product comparisons please go to our Hard Surfacing Product Cross- Reference Guide at [www.hobartbrothers.com](http://www.hobartbrothers.com)

## TECHNICAL SECTION

### Suggested McKay Stick Electrode per Industry Application

#### Agriculture

Application Overlay	McKay Electrode
Ammonia Knives	140, 155, 40 TiC
Cultivator Chisels & Sweeps	140, 155, 40 TiC
Mill Hammers	40 TiC
Plow Shares	140, 40 TiC
Ripper Shanks	155
Steel Shafts	M-932
Subsoiler Teeth	155, 40 TiC

#### Dredging Industry

Application Build-Up	McKay Electrode Overlay
Dredge Bucket Lips	— 140, 155
Dredge Cutter Heads & Teeth	Chrome-Mang 140, 155
Dredge Pump Casings	118 —
Dredge Pump Inlet Nozzle	— 40 TiC, 155
Dredge Ladder Rolls	32 58
Dredge Pump Impellers	118 140
Dredge Pump Side Plates	118 140, 155
Pipeline Ball Joints	— 140, 155
Pump Shells (Manganese)	— 140, 155

#### Heavy Equipment/Mining Industries

Application Build-Up	McKay Electrode Overlay
Augers	— 140, 155, 40 TiC,
Bucket Teeth/Lips	32 140
Bulldozer Blades	— 140, 155, 40 TiC
Bulldozer End Bits	— 40 TiC
Crane Wheels	32 M-932
Dragline Buckets	32 —
Dragline Chain	32 58
Mine Car Wheels	32 —
Ore/Coal Chutes	— 155
Paving Agitator Screws	— 155
Power Shovel Bucket Teeth/Lips	32 140, 155
Road Rippers	— 155
Scraper Blades	— 140, 40 TiC
Sheepsfoot Tampers	— 140, 155, 40 TiC
Steel Shafts	32 M-932
Tractor Idlers/Rollers	32 M-932

#### Power Generation Industry

Application Overlay	McKay Electrode
Coal Feeder Screws	155
Coal Pulverizer Hammers	155
Fan Blades	155,
Hydroelectric Turbines	Chrome-Mang

#### Crushing/Quarry Industries

Application Build-Up	McKay Electrode Overlay
Bucket Lips	32 140, 155, 40 TiC
Bucket Teeth (Manganese Steel)	118, Chrome-Mang 140, 155, 40 TiC
Bulldozer End Bits	— 40 TiC
Cement Chutes	— 140, 155, 40 TiC
Conveyor Screws	— 155, 40 TiC
Crusher Jaws/Cones	118, Chrome-Mang 140, 155
Crusher Rolls	118, Chrome-Mang 140, 155, 40 TiC,
Gear Teeth	32 —
Gyratory Crusher Mantles/Cones	118, Chrome-Mang —
Hammer Mill Hammers	118, Chrome-Mang 140, 40 TiC,
Impactor Crusher Bars	118, Chrome-Mang 140, 40 TiC
Kiln Trunnions	32 58
Muller Tires	120 140, 155, 40 TiC
Pug Mill Paddles	— 155
Pulverizer Hammers	121 —
Sizing Screens	118, Chrome-Mang 140, 155
Steel Shafts	32 M-932

#### Iron & Steel Industry

Application Build-Up	McKay Electrode Overlay
Coke Chutes	— 155
Coke Pusher Shoes	— 155, 40 TiC
Coupling Boxes	32 58
Crane Wheels	— M-932
Furnace Skid Rails	— 121
Gear Teeth	32 —
Grizzly Bars & Fingers	Chrome-Mang 140, 155
Ingot Tongs	— 148, 121
Mill Guides	— 58, 140, 121
Piercing Components	— 121
Pulleys	— 148
Pug Mill Paddles	— 155
Screw Conveyors	— 140, 155
Shear Blades	— 61
Steel Shafts	32 M-932
Wobbler Ends	32 58

#### Railroad Industry

Application Overlay	McKay Electrode
Crossovers (Low Alloy Steel)	M-932, Chrome-Mang
Crossovers (Manganese Steel)	118, 119, 121, Chrome-Mang
Frogs (Carbon Steel)	M-932, Chrome-Mang
Frogs (Manganese Steel)	118, 119, Chrome-Mang
Rail Ends (Low Alloy Steel)	M-932, Chrome-Mang
Switch Points (Low Alloy Steel)	M-932, Chrome-Mang

# Hard Surfacing Stick Electrodes Technical Section

## Hard Surfacing Stick Electrode/Wire Equivalent

Stick Electrode	Open-Arc Wire	Gas-Shielded Wire	
		Flux-Cored	Metal-Cored
Hardalloy 118	Tube-Alloy 218-0	—	—
Chrome-Mang	Tube-Alloy AP-0	Vertiwear AP	—
Hardalloy 32	Tube-Alloy Build Up-0	—	Tube Alloy Build Up-G
—	ArmorWear™	—	—
Hardalloy 58	Tube-Alloy 258-0	Vertiwear 600	—
Hardalloy 140	Tube-Alloy 240-0	—	—
Hardalloy 155	Tube-Alloy 255-0	—	Tube-Alloy 255-G
Hardalloy 119	Tube-Alloy 219-0	—	—
Hardalloy M-932	Tube-Alloy 242-0	—	—
Hardalloy 148	—	—	—
Hardalloy 40TiC	—	—	—
Hardalloy 61	Tube-Alloy 258-0	—	Tube-Alloy 258-G
—	Tube-Alloy A43-0	—	—
—	Tube-Alloy A45-0	—	—
—	Tube-Alloy 218 TiC-0	—	—
—	Tube-Alloy 244 TiC-0	—	—

## Hard Surfacing Electrode Pallet Information

Length	McKay Type	Pallet Weight (lb)		Depth	Pallet Dimensions		Number of Units Per Pallet
		Net	Gross (est.)		Width	Height	
1/8"-14"	Hardalloy & Chrome-Mang Electrodes	1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
7/32"-18"		2205	2294	38"	40"	24"	49 (45 lb Cans)
1/4"-18"		2450	2539	38"	40"	24"	49 (50 lb Cans)
3/32"-12"	Cast-Alloy Electrodes	1320	1420	38"	45"	39"	132 (10 lb Cans)
1/8"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/32"-10"	GP & Hardalloy 121 Electrodes	660	760	38"	45"	39"	132 (5 lb Cans)
1/8"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
5/32"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)
3/16"-14"		1320	1420	38"	45"	39"	132 (10 lb Cans)

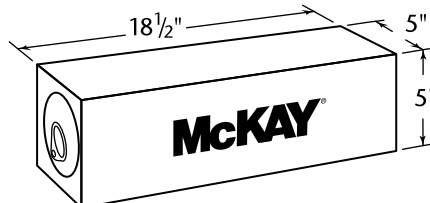
## Packaging Options

### 14-Inch Electrodes



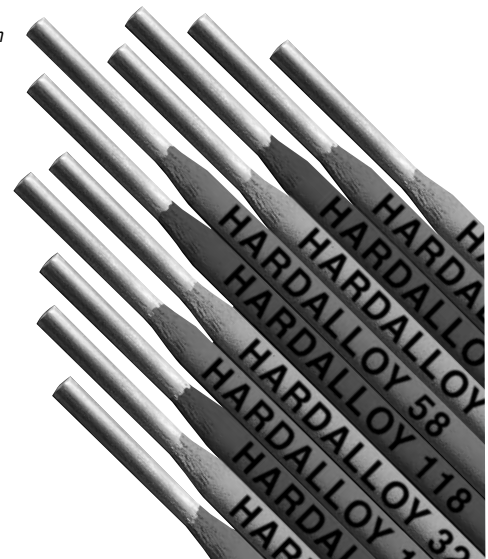
9 and 10 lb Hermetically Sealed Can

### 18-Inch Electrodes



45 and 50 lb Hermetically Sealed Can

All McKay hard surfacing electrodes are stamped with the product name.



## HARD SURFACING WIRE PRODUCT LINE OVERVIEW

McKay® has been a leading supplier of hard surfacing tubular wires for over fifty years. The McKay full line of Tube-Alloy® and VertiWear® wires are formulated to cover a broad spectrum of wear-related applications.

Every McKay tubular wire product is formulated for maximum wear resistance and superior, consistent operation—then manufactured to exacting standards. Every pound of product is backed by over fifty years of field hard surfacing experience.



25 lb Plastic Spool



60 lb Coil



100 lb Auto-Pak™



250 lb Auto-Pak™



500 lb Auto-Pak™

### MAIN LINE PRODUCTS

- Tube-Alloy 218-0
- Tube-Alloy AP-0
- VertiWear AP
- ArmorWear
- Tube-Alloy Build Up-0
- Tube-Alloy Build Up-G
- Tube-Alloy 258-0
- Tube-Alloy 258-G
- Tube-Alloy 240-0
- Tube-Alloy 255-0
- Tube-Alloy 255-G
- Tube-Alloy 260-G

Within the wide scope of McKay hard surfacing tubular wires, six open-arc wires and four gas-shielded wires have been specially designed to cover the majority of impact and abrasive wear applications. These twelve main line wires listed to the left are explained in great detail on the following pages.



## Hard Surfacing Wire Product Line

### Build-Up Restoring worn parts to their original dimensions

Open-Arc Tubular Wires	Gas-Shielded Tubular Wires
<b>Tube-Alloy Build Up-0*</b> <b>Tube-Alloy AP-0*</b> <b>Tube-Alloy 218-0*</b> Tube-Alloy 219-0 Tube-Alloy 242-0	<b>Tube-Alloy Build Up-G*</b> <b>VertiWear AP*</b>

### Overlay Providing additional resistance to wear

Application	Open-Arc Tubular Wires	Gas-Shielded Tubular Wires	Metal-Cored Submerged-Arc Tubular Wires
<b>Metal to Metal</b>	<b>Tube-Alloy Build Up-0*</b> <b>Tube-Alloy 258-0*</b> <b>ArmorWear*</b>  Tube-Alloy 242-0	<b>Tube-Alloy Build Up-G*</b> <b>Tube-Alloy 258-G*</b>  VertiWear 600  Tube-Alloy 260-G	Tube-Alloy BU-S Tube-Alloy 258-S Tube-Alloy 252-S Tube-Alloy 242-S Tube-Alloy 242-S Mod Tube-Alloy 8620-S Tube-Alloy 810-S Tube-Alloy 861-S Tube-Alloy 868-S Tube-Alloy 877-S Tube-Alloy 852-S Tube-Alloy 954-S Tube-Alloy 252-S Tube-Alloy A2JL-S Tube-Alloy 887-S Tube-Alloy A250-S Tube-Alloy A420M-S Tube-Alloy 865-S Mod

### Impact

<b>Tube-Alloy AP-0*</b> <b>Tube-Alloy 218-0*</b> Tube-Alloy 219-0	<b>VertiWear AP*</b>
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### Abrasion

<b>Tube-Alloy 255-0*</b> <b>Tube-Alloy 240-0*</b> Tube-Alloy 218TiC-0 Tube-Alloy 258TiC-0 Tube-Alloy 244-0 Tube-Alloy A43-0 Tube-Alloy A45-0	<b>Tube-Alloy 255-G*</b>
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### Special Alloys & Flux

Open-Arc Tubular Wires	Flux
GP-0	MK-N

\* Bold items are main line products



**Flux-Cored Open-Arc Hard Surfacing Wires — FOR BUILD-UP**

**Tube-Alloy® Build Up-0**

Tube-Alloy® Build Up-0 deposit is a low alloy steel. It is designed for build-up on mild and low alloy steels only. The weld metals have good compressive strength and impact resistance, making it an excellent base for more abrasion-resistant alloys. The deposit has excellent resistance to cracking, even in multiple layers, and is within the machinable range.

**Diameter and Polarity**

.045"  
1/16"  
7/64"  
DCEP

**Typical Deposit Analysis %**

C – 0.12  
Mn – 2.80  
Si – 0.80  
Cr – 1.20  
Fe – Bal.

**Typical Properties**

Abrasion Resistance .....Fair  
Impact Resistance.....Very Good  
Machinability .....Excellent  
Hardness, as deposited, Rc  

No. of	1020	4130
Layers	Steel	Steel
1	30	36
2	28	30
3	25	26

Can be flame cut  
Magnetic  
Heat Treatable

**Typical Applications**

- Bucket Teeth & Lips
- Crane Wheels
- Dragline Buckets
- Dragline Chain
- Dredge Ladder Rolls
- Gear Teeth
- Kiln Trunnion
- Mine Car Wheels
- Spindles
- Steel Shafts
- Wobbler Ends

**Tube-Alloy® 218-0**

Tube-Alloy® 218-0 is a work hardening austenitic manganese steel alloy. It can be used for build-up or overlay on austenitic manganese steel only. It can also be used for joining austenitic manganese steel to manganese steel. Deposits are extremely tough and work harden rapidly under high impact.

**Diameter and Polarity**

.045"  
1/16"  
7/64"  
DCEP

**Typical Deposit Analysis %**

C – 1.00  
Mn – 15.00  
Si – 0.40  
Cr – 3.10  
Ni – 0.40  
Fe – Bal.

**Typical Properties**

Abrasion Resistance .....Fair  
Impact Resistance .....Excellent  
Tensile Strength .....120,000 psi  
Yield Strength .....80,000 psi  
Elongation in 2" .....32%  
Machinability .....Difficult  
Hardness:  
As Deposited.....15-22 Rc  
Work Hardened .....50-55 Rc  
Flame Cutting .....Difficult  
Nonmagnetic

**Typical Applications**

- Bucket Teeth
- Crusher Jaws & Cones
- Dredge Pump Casings
- Gyratory Crusher Mantles & Cones
- Hammer Mill Hammers
- Impactor Crusher Bars
- Manganese Steel Railroad Crossovers & Frogs

**Tube-Alloy® AP-0**

Tube-Alloy® AP-0 deposit is a premium work hardening austenitic manganese steel alloy. It can be used for build-up or overlay on austenitic manganese steel, carbon steel and low alloy steel. It can also be used for joining austenitic manganese steel to manganese steel, carbon steel and low alloy steel. The weld metal has higher toughness than conventional manganese steel weld metal.

**Diameter and Polarity**

1/16"  
7/64"  
DCEP

**Typical Deposit Analysis %**

C – 0.42  
Mn – 16.50  
Si – 0.30  
Cr – 13.00  
Fe – Bal.

**Typical Properties**

Abrasion Resistance .....Fair  
Impact Resistance .....Excellent  
Tensile Strength .....124,000 psi  
Yield Strength .....83,000 psi  
Elongation in 2" .....40%  
Machinability .....Difficult  
Hardness:  
As Deposited.....18-24 Rc  
Work Hardened .....50-55 Rc  
Cannot be flame cut  
Nonmagnetic

**Typical Applications**

- Bucket Teeth & Lips
- Crusher Jaws & Cones
- Dragline Buckets
- Dredge Cutter Heads & Teeth
- Grizzly Bars & Fingers
- Gyratory Crusher Mantles & Cones
- Hammer Mill Hammers
- Hydroelectric Turbines
- Impactor Crusher Bars
- Muller Tires
- Pulverizer Hammers
- Similar to those for Tube-Alloy® 218-0, especially where the base metal verification is questionable or where contamination may be an issue
- Sizing Screens

# Main Line Products / Hard Surfacing Wires

## Flux-Cored Open-Arc Hard Surfacing Wires — OVERLAY

### Tube-Alloy® 258-0

Tube-Alloy® 258-0 deposit is a premium martensitic alloy steel of the hard, tough H-12 tool steel composition. It has excellent resistance to adhesive (metal-to-metal) wear. It is designed to surface mild and low alloy steel components subject to moderate abrasive wear and/or high temperature (up to 1000°F). Proper preheat is required for crack-free deposits.

#### Diameter and Polarity

.045"  
1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C – 0.45  
Mn – 1.40  
Si – 0.80  
Cr – 6.00  
Mo – 1.50  
W – 1.50  
Fe – Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Grind only  
Hardness, as deposited, Rc  
No. of 1020 4130  
Layers Steel\* Steel  
1 49 51  
2 53 54  
3 57 57

Flame cutting is difficult  
Magnetic  
Heat Treatable and Forgeable  
Maintains Hot Hardness to 1000°F

#### Typical Applications

- Coupling Boxes
- Dragline Chain
- Kiln Trunnions
- Mill Guides
- Spindles
- Wobbler Ends

### Tube-Alloy® 240-0

Tube-Alloy® 240-0 deposit is a chromium carbide surfacing alloy. It can be used on components subject to severe abrasive wear and heavy impact. The weld metal has higher toughness than conventional chromium carbide due to fewer stress relief-check cracks.

#### Diameter and Polarity

.045"  
1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C – 3.20  
Mn – 0.80  
Si – 1.90  
Cr – 15.50  
Fe – Bal.

#### Typical Properties

Abrasion Resistance.....Very Good  
Impact Resistance .....Fair  
Machinability .....Grinding only  
Thickness .....3-5 Layers Maximum  
Hardness, as deposited, Rc

No. of Layers	1020 Steel*	12-14% Manganese
1	40	35
2	48	42
3	52	50

Can be flame cut  
Deposit will relief-check crack

#### Typical Applications

- Ammonia Knives
- Augers
- Bucket Teeth & Lips
- Bulldozer End Bits & Blades
- Conveyor Screws
- Crusher Jaws & Cones
- Crusher Rolls
- Cultivator Chisels & Sweeps
- Dragline Buckets
- Dredge Pump Impellers & Side Plates
- Hammer Mill Hammers
- Impactor Crusher Bars
- Manganese Pump Shells
- Mill Guides
- Muller Tires
- Pipeline Ball Joints
- Pulverizer Hammers
- Scraper Blades
- Screw Conveyors
- Sheepsfoot Tampers
- Sizing Screens

### Tube-Alloy® 255-0

Tube-Alloy® 255-0 deposit is a premium high chromium carbide surfacing alloy. It can be used on components subject to extremely severe abrasive wear and moderate impact. It can also be used where high temperature (up to 1250°F) wear resistance is required. The weld metals will stress relief-check crack. Can be run as submerged arc by using MK-N neutral flux.

#### Diameter and Polarity

1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C – 4.50  
Mn – 0.90  
Si – 0.50  
Cr – 26.50  
Fe – Bal.

#### Typical Properties

Abrasion Resistance .....Excellent  
Impact Resistance .....Poor  
Machinability .....Grinding only  
Thickness .....3 Layers Maximum  
Hardness, as deposited, Rc

No. of Layers	1020 Steel*	12-14% Manganese
1	54	48
2	56	50
3	58	53

Cannot be flame cut  
Deposit will relief-check crack readily  
Maintains Hot Hardness to 1250°F

#### Typical Applications

- Ammonia Knives
- Augers
- Bucket Teeth & Lips
- Bulldozer Blades
- Bulldozer End Bits & Blades
- Cement Chutes
- Coal Feeder Screws
- Coal Pulverizer Hammers, Rolls & Table
- Coke Chutes
- Coke Pusher Shoes
- Conveyor Screws
- Dredge Pump Inlet Nozzle & Side Plates
- Fan Blades
- Grizzly Bars & Fingers
- Gyrotory Crusher Mantles & Cones
- Manganese Pump Shells
- Muller Tires
- Ore & Coal Chutes
- Pipeline Ball Joints
- Pug Mill Paddles
- Ripper Shanks
- Road Rippers
- Scraper Blades
- Screw Conveyors
- Sheepsfoot Tampers
- Similar to those for Tube-Alloy® 240-0 where additional abrasion resistance is required
- Sizing Screens
- Subsoiler Teeth

## Flux-Cored Open-Arc Hard Surfacing Wires — OVERLAY

### Tube-Alloy® 242-0

Tube-Alloy® 242-0 is a self-shielded, flux-cored wire that deposits a premium martensitic alloy steel. It has excellent resistance to adhesive (metal-to-metal) wear. The deposit has good resistance to abrasion and impact makes it a versatile overlay alloy. It is designed for use as an overlay on carbon and low alloy steels or as a base of Tube-Alloy Build Up-0. With proper preheating, crack-free deposits can be obtained. Tube-Alloy 242-0 should never be used for joining.

#### Diameter and Polarity

.045"  
1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C - 0.25  
Mn - 1.30  
Si - 0.70  
Cr - 4.00  
Mo - 0.50  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinable  
Hardness, as deposited, Rc  
No. of Layers                      1020 Steel  
1    36  
2    39  
3    42  
Can be flame cut  
Magnetic

#### Typical Applications

- Carbon Steel Rolls
- Crane Wheels
- Dragline Chain
- Frogs & Switch Points
- Idlers
- Low Alloy Steel Railroad Crossovers and Rail Ends
- Steel Shafts
- Tractor Rollers

### ArmorWear™

ArmorWear is a self-shielded, flux-cored wire that deposits a premium martensitic alloy steel of H-12 tool steel composition. It has excellent resistance to adhesive (metal-to-metal) wear. It also has good resistance to abrasion and impact, and maintains its hardness up to 1000°F. It is designed for use as an overlay on carbon and low alloy steels. Because of its high hardenability, proper preheat may be required for crack-free deposits, particularly on low alloy steels. ArmorWear is formulated to optimize performance with the small 110/220V type wire welding machines.

#### Diameter and Polarity

.035"  
.045"  
DCEN

#### Typical Deposit Analysis %

C - 0.40  
Mn - 1.00  
Si - 0.40  
Cr - 5.80  
Mo - 1.50  
W - 1.40  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Grind only  
Hardness, as deposited, Rc  
No. of                      1020  
Layers                      Steel\*  
1                                      47  
2                                      49  
3                                      53  
Flame cutting is difficult  
Magnetic  
Heat Treatable and Forgeable  
Maintains Hot Hardness to 1000°F

#### Typical Applications

- Bucket lips and teeth
- Cultivator chisels and sweeps
- Plow shares, scraper blades
- Shanks, knives, teeth
- Kiln trunnions
- Spindles
- Pump components

### Tube-Alloy® 219-0

Tube-Alloy® 219-0 is a work hardening austenitic manganese steel alloy. The high carbon and manganese content allows for a fully austenitic first layer on carbon steel. Deposits are extremely tough and work harden rapidly under high impact. It can be used for most railroad track maintenance applications.

#### Diameter and Polarity

1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C - 1.00  
Mn - 20.00  
Si - 0.60  
Cr - 4.50  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance .....Excellent  
Tensile Strength .....137,000 psi  
Yield Strength .....91,000 psi  
Elongation in 2" .....34%  
Machinability .....Difficult  
Hardness:  
As Deposited.....16-23 Rc  
Work Hardened .....50-55 Rc  
Flame cutting is difficult

#### Typical Applications

- Manganese Steel Railroad Crossovers & Frogs
- Similar to 218-0, except that it is slightly harder in the "as deposited" condition, and work hardens quicker

## Flux-Cored Open-Arc Hard Surfacing Wires — OVERLAY

### Tube-Alloy® 218 TiC-0

Tube-Alloy® 218 TiC-0 deposits a work hardenable austenitic manganese steel alloy containing titanium carbides. It offers the unique properties of high impact and high abrasion resistance. It can be used as a combination build-up and surfacing alloy.

#### Diameter and Polarity

7/64"  
DCEP

#### Typical Deposit Analysis %

C - 2.00  
Mn - 13.00  
Si - 0.60  
Cr - 3.20  
Ti - 3.50  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance.....Very Good  
Machinability .....Poor  
Hardness, as deposited, Rc  

No. of Layers	1020 Steel*	12-14% Mn Steel
1	25	30
2	29	30
3	31	30

Work hardens to 50-55 Rc  
Can be flame cut  
Nonmagnetic

#### Typical Applications

- Gyratory Crusher Mantles & Cones
- Hammer Mill Hammers
- Impactor Crusher Bars

### Tube-Alloy® 258TiC-0

Tube-Alloy® 218 TiC-0 deposit is a martensitic alloy steel containing a high volume fraction of titanium carbides. It is particularly good for resisting high stress abrasive wear. The alloy has good hot hardness. Deposits can be applied crack-free with proper procedures.

#### Diameter and Polarity

1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C - 2.10  
Mn - 1.30  
Si - 1.80  
Cr - 7.00  
Mo - 1.60  
Ti - 6.00  
Fe - Bal.

#### Typical Properties

Abrasion Resistance.....Excellent  
Impact Resistance .....Good  
Machinability .....Grinding only  
Hardness, as deposited, Rc  

No. of Layers	1020 Steel
1	60
2	55
3-8	48

Cannot be flame cut  
Magnetic  
Maintains hot hardness to 1000°F

#### Typical Applications

- Paving Agitator Screws

### Tube-Alloy® 244-0

Tube-Alloy® 244-0 deposit is a medium alloy carbide steel. It is designed primarily for the automatic rebuilding of dredge pump shells. Deposits do stress relief-check crack.

#### Diameter and Polarity

7/64"  
DCEP

#### Typical Deposit Analysis %

C - 2.50  
Mn - 1.60  
Si - 2.00  
Cr - 9.00  
Cu - 0.50  
Fe - Bal.

#### Typical Properties

Abrasion Resistance.....Very Good  
Impact Resistance .....Fair  
Machinability .....Very Difficult  
Thickness .....3-5 Layers Maximum  
Hardness, as deposited, Rc  

No. of Layers	1020 Steel	12-14% Mn Steel
1	34	24
2	37	33
3	40	38

Cannot be flame cut  
Slightly Magnetic  
Deposit will relief-check crack

#### Typical Applications

- Dredge Pump Impellers & Side Plates
- Pipeline Ball Joints
- Pump Shells

## Flux-Cored Open-Arc Hard Surfacing Wires — OVERLAY

### Tube-Alloy® A43-0

Tube-Alloy® A43-0 deposit is a premium high chromium-columbium carbide surfacing alloy. It can be used on components subject to extremely severe high and low stress abrasive wear and moderate impact. It can also be used where high temperature (up to 1250°F) wear resistance is required. The deposit will stress relief-check crack readily. Can be run as submerged arc by using MK-N neutral flux.

#### Diameter and Polarity

1/16"  
7/64"  
DCEP

#### Typical Deposit Analysis %

C – 5.50  
Mn – 0.20  
Si – 1.00  
Cr – 22.00  
Cb – 6.50  
Fe – Bal.

#### Typical Properties

Abrasion Resistance.....Excellent  
Impact Resistance.....Poor  
Machinability.....Grinding only  
Thickness.....3 Layers Maximum  
Hardness, as deposited, Rc

No. of Layers	1020 Steel	12-14% Mn Steel
1	58	48
2-3	62	56

Cannot be flame cut

#### Typical Applications

- Augers
- Bucket Lips & Teeth
- Coal Feeder Screws
- Coal Pulverizer Rolls & Table
- Coke Chutes
- Coke Pusher Shoes
- Conveyor Screws
- Dredge Cutter Heads & Teeth
- Dredge Pump Inlet Nozzle & Side Plates
- Fan Blades
- Grizzly Bars & Fingers
- Muller Tires
- Paving Agitator Screws
- Pipeline Ball Joints
- Pug Mill Paddles
- Scraper Blades
- Sheepsfoot Tampers
- Sizing Screws

### Tube-Alloy® A45-0

Tube-Alloy® A45-0 deposit is a combination of large chromium carbides and small fine columbium and alloy carbides in an austenitic eutectic carbide matrix. It is designed to resist severe high and low stress abrasion with minimal impact at elevated temperatures. The deposit will check crack readily. Can be run as submerged arc by using MK-N neutral flux.

#### Diameter and Polarity

7/64"  
DCEP

#### Typical Deposit Analysis %

C – 5.50  
Mn – 0.20  
Si – 1.00  
V – 1.00  
Cr – 21.00  
Mo – 6.50  
Cb – 6.50  
W – 1.50  
Fe – Bal.

#### Typical Properties

Abrasion Resistance.....Excellent  
Impact Resistance.....Poor  
Machinability.....Grinding only  
Thickness.....2-3 Layers Maximum  
Hardness, as deposited, Rc

No. of Layers	1020 Steel
1	60
2-3	64

Temp. Typical Hardness

up to 1000°F	60
at 1050°F	54
at 1100°F	50

Cannot be flame cut

#### Typical Applications

- Blast Furnace Bell's Burden Area
- Fan Blades
- Sheets in Blast Furnace Bell
- Sinter Breaker Bars
- Sinter Plant Parts

## Flux-Cored Gas-Shielded Hard Surfacing Wires

### VertiWear® 600

VertiWear® 600 deposits a multipurpose martensitic steel alloy. It can be used to surface mild and low alloy components subject to moderate abrasive wear and medium to high impact. Excellent operator appeal in all position.

#### Diameter and Polarity

.045"  
1/16"  
DCEP  
Gas-Shielded  
75/25 (Ar/CO<sub>2</sub>)  
or 100% CO<sub>2</sub>

#### Typical Deposit Analysis %

C - 0.40  
Mn - 0.75  
Si - 0.60  
Cr - 6.50  
Mo - 1.00  
V - 0.05  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance.....Very Good  
Machinability.....Good  
Hardness, as deposited, Rc  
No. of Layers                      1020 Steel  
1    52  
2    56  
3-8    57  
Flame cutting is difficult  
Magnetic

#### Typical Applications

- Coupling Boxes
- Dragline Chain
- Dredge Ladder Rolls
- Kiln Trunnions
- Mill Guides
- Sliding Metal Parts
- Wobbler Ends

### Tube-Alloy™ 255-G

Tube-Alloy® 255-G is a small-diameter, gas-shielded premium hard surfacing wire that deposits an extremely wear-resistant chromium-carbide overlay. It is designed for overlay on carbon, low alloy, cast iron, and austenitic manganese base metals. It outlasts competitive wires which deposit martensitic deposits 9 to 1.

#### Diameter and Polarity

.045"  
DCEP  
Gas-Shielded  
98/2 (Ar/O<sub>2</sub>)  
75/25 (Ar/CO<sub>2</sub>)

#### Typical Deposit Analysis %

C - 5.30  
Mn - 1.00  
Si - 0.40  
Cr - 18.00  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Excellent  
Impact Resistance .....Poor  
Machinability .....Grinding is Difficult  
Thickness .....3 Layers Maximum  
Hardness, as deposited, Rc  
No. of                      1020                      Manganese  
Layers                      Steel                      Steel  
1                                      58                                      47  
2                                      61                                      51  
3                                      65                                      54

Cannot be flame cut  
Deposit will relief-check crack readily  
Maintains hot hardness to 1250°F

#### Typical Applications

- Ammonia Knoves
- Augers
- Bucket Teeth & Lips
- Bulldozer End Bits and Blades
- Cement Chutes
- Coal Feeder Screws
- Coal Pulverizer Hammers, Rolls and Table
- Coke Chutes
- Coke Pusher Shoes
- Conveyer Screws
- Crusher Jaws and Cones
- Cultivator Chisels and Sweeps
- Dragline Buckets
- Dredge Cutter Heads and Teeth
- Dredge Pump Inlet Nozzle & Side Plates
- Fan Blades
- Grizzly Bars and Fingers
- Gyrotory Crusher Mantles and Cones
- Manganese Pump Shells
- Muller Tires
- Ore and Coal Chutes
- Pipeline Ball Joints
- Pug Mill Paddles
- Ripper Shanks
- Road Rippers
- Scraper Blades
- Screw Conveyors
- Sheepsfoot Tampers
- Sizing Screens
- Subsoiler Teeth

### VertiWear® AP

VertiWear® AP is a premium, work-hardening austenitic manganese steel alloy. This flux-cored, all-position wire can be used for build-up or overlay on austenitic manganese steel. It can also be used for joining austenitic manganese steel to manganese steel, carbon steel and low alloy steel. The deposit has an excellent impact resistance.

#### Diameter and Polarity

.045"  
DCEP  
Gas-Shielded  
75/25 (Ar/CO<sub>2</sub>)  
or 100% CO<sub>2</sub>

#### Typical Deposit Analysis %

C - 0.45  
Mn - 14.00  
Si - 0.50  
Cr - 13.50  
Ni - 0.50  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Excellent  
Machinability .....Fair  
Hardness:  
Work Hardened . . . . .50-55 Rc  
No. of Layers                      1020 Steel  
1    24 Rc  
2    20 Rc  
3-8    18 RC  
Cannot be flame cut

#### Typical Applications

- Bucket Teeth and Lips
- Crusher Jaws and Cones
- Dragline Buckets
- Dredge Cutter Heads and Teeth
- Grizzly Bars and Fingers
- Gyrotory Crusher Mantles and Cones
- Hammer Mill Hammers
- Hydroelectric Turbines
- Impactor Crusher Bars
- Muller Tires
- Pulverizer Hammers
- Sizing Screens

## Metal-Cored Gas-Shielded Hard Surfacing Wires

### Tube-Alloy® Build Up-G

Tube-Alloy® Build Up-G is a gas-shielded, metal-cored wire designed for build-up on carbon and low alloy steels. The weld metals have good compressive strength and impact resistance, making them excellent bases for more abrasion-resistant alloys.

#### Diameter and Polarity

.045"  
1/16"  
DCEP  
Gas-Shielded  
75/25 (Ar/CO<sub>2</sub>)  
or 100% CO<sub>2</sub>

#### Typical Deposit Analysis %

C - 0.26  
Mn - 1.73  
Si - 0.32  
Cr - 1.85  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance .....Very Good  
Machinability .....Good  
Hardness ..... .25 Rc  
Can be flame cut  
Magnetic

#### Typical Applications

- Bucket Teeth & Lips
- Crane Wheels
- Dragline Buckets
- Dragline Chain
- Dredge Ladder Rolls
- Gear Teeth
- Kiln Trunnions
- Mine Car Wheels
- Spindles
- Steel Shafts
- Wobbler Ends

### Tube-Alloy® 258-G

#### (Formerly known as HW-T)

Tube-Alloy® 258-G is a metal-cored, gas-shielded wire which deposits a sound hot work tool steel alloy of the AISI H-12 type. It is extremely resistant to thermal shock and erosion at working temperatures. The alloy has good dimensional stability and uniform heat-treatment response, making it ideally suited for fabrication, modification, and repair of dies and other tool steel parts.

#### Diameter and Polarity

.045"  
1/16"  
DCEP  
Gas-Shielded  
75/25 (Ar/CO<sub>2</sub>)  
or 100% CO<sub>2</sub>

#### Typical Deposit Analysis %

C - 0.40  
Mn - 1.00  
Si - 0.55  
Cr - 5.00  
Mo - 1.45  
W - 1.25  
V - 0.40  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance ..... Good  
Nonmachinable in As-Welded  
Condition .....Grinding only  
Hardness, as deposited, RC  
No. of Layers                      A36 Plate  
1    52  
2    53  
3    57  
Temp.                                      Typical Hardness  
950°F                                      54  
Flame Cutting                              Difficult  
Good Resistance to softening at elevated temperatures  
Heat treatable  
Good Dimensional Stability

#### Typical Applications

- Clean Out Rings
- Die Holders
- Dummy Blocks
- Extrusion Dies
- Forming Dies
- Forging Dies
- Gripper Dies
- Guide Rolls
- Header Dies
- Hot Forming Dies
- Mandrels
- Swaging Dies

### Tube-Alloy® 260-G

Tube-Alloy® 260-G is a gas-shielded, metal-cored wire that deposits a martensitic alloy steel. It is designed for use as an overlay on carbon and low alloy steels. It has very good resistance to adhesive (metal-to-metal) wear and good resistance to abrasion and impact.

#### Diameter and Polarity

.045"  
1/16"  
DCEP  
Gas-Shielded  
75/25 (Ar/CO<sub>2</sub>)  
or 100% CO<sub>2</sub>

#### Typical Deposit Analysis %

C - 0.70  
Mn - 2.00  
Si - 1.00  
Cr - 8.00  
Fe - Bal.

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance ..... Good  
Machinability .....Grinding only  
Hardness:  
As Deposited ..... .55-60 RC  
Cannot be flame cut  
Magnetic

#### Typical Applications

- Coupling Boxes
- Dragline Chain
- Kiln Trunnions
- Mill Guides
- Spindles
- Wobbler Ends

## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® BU-S

Tube-Alloy® BU-S deposit is a low alloy steel composition. It can be used for build-up on mild and low alloy steel components. The weld metal has good compressive strength, making it an excellent base for surfacing.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C – 0.12  
Mn – 1.80  
Si – 0.80  
Cr – 0.70  
Fe – Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance ..... Very Good  
Machinability .....Excellent  
Thickness.....As required

Hardness, as deposited, Rc		
No. of Layers	1020 Steel	1045 Steel
1	20	35
2	26	34
3	30	31

Can be flame cut  
Strongly Magnetic

#### Typical Applications

- Crane Wheels
- Dredge Ladder Rolls
- Mine Car Wheels
- Spindles
- Table Rolls
- Tractor Idlers & Rollers

### Tube-Alloy® 8620-S

Tube-Alloy® 8620-S deposit is a low alloy steel composition. Its sound, tough deposit makes it an excellent choice for steel mill roll build-up.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C – 0.17  
Mn – 0.80  
Si – 0.40  
Cr – 0.50  
Mo – 0.20  
Ni – 0.40  
Fe – Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance .....Very Good  
Machinability .....Excellent  
Thickness.....As required

Hardness, as deposited, Rc		
No. of Layers	1020 Steel	1045 Steel
1	12	21
2	19	21
3-8		21

Can be flame cut  
Strongly Magnetic

#### Typical Applications

- Continuous Caster Rolls
- Table Rolls

### Tube-Alloy® 861-S

Tube-Alloy® 861-S deposit is a premium chrome-molybdenum steel composition. It can be used as build-up or overlay for steel mill roll applications. It offers superior resistance to softening in service versus mild steel deposits.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C – 0.15  
Mn – 0.90  
Si – 0.50  
Cr – 1.70  
Mo – 0.60  
Fe – Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance .....Fair  
Machinability .....Very Good  
Thickness.....As required

Hardness, as deposited, Rc		
No. of Layers	1020 Steel	1045 Steel
1	21	21
2	28	28
3	30	30

Cannot be flame cut  
Magnetic

#### Typical Applications

- Continuous Caster Rolls
- Straightener Rolls
- Table Rolls



## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® 877-S

Tube-Alloy® 877-S deposit is a low alloy steel composition. It is a sound, tough, build-up alloy designed for use on steel mill con-cast rolls. Mechanical properties are outstanding.

#### Diameter and Polarity

1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C - 0.10  
Mn - 1.00  
Si - 0.60  
Cr - 1.00  
Mo - 0.40  
Ni - 1.30  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Fair  
Impact Resistance ..... Very Good  
Machinability .....Excellent  
Thickness.....As required  
Hardness, as deposited, Rc  
No. of Layers                      1020 Steel  
1    22  
2    23  
3-8    24  
Can be flame cut  
Strongly Magnetic

#### Typical Applications

- Continuous Caster Rolls

### Tube-Alloy® 242-S

Tube-Alloy® 242-S deposit is a low alloy medium hardness martensitic steel. It can be used as a hard surfacing overlay where good abrasion resistance and machinability are required.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.16  
Mn - 1.90  
Si - 0.80  
Cr - 1.60  
Mo - 0.60  
V - 0.20  
Fe - Bal.  
ESAB 50 Flux

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Good  
Hardness, as deposited, Rc  
No. of                      1020                      1045  
Layers                      Steel                      Steel  
1    29    44  
2    38    45  
3    39    40  
Can be flame cut  
Strongly Magnetic

#### Typical Applications

- Crane Wheels
- Tractor Idlers & Rollers

### Tube-Alloy® 242-S Mod

Tube-Alloy® 242-S Mod deposit is a low alloy medium hardness martensitic steel. It can be used as a hard surfacing overlay where good abrasion resistance and machinability are required.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.14  
Mn - 1.90  
Si - 0.80  
Cr - 3.00  
Mo - 0.80  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Good  
Hardness, as deposited, Rc  
No. of                      1020                      1045  
Layers                      Steel                      Steel  
1    29    44  
2    38    45  
3    39    40  
Can be flame cut  
Strongly magnetic

#### Typical Applications

- Crane Wheels
- Tractor Idlers & Rollers

## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® 252-S

Tube-Alloy® 252-S deposit is a low alloy medium hardness martensitic steel. It can be used as a hard surfacing overlay where maximum abrasion resistance and machinable deposits are required.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.18  
Mn - 2.10  
Si - 0.90  
Cr - 3.50  
Fe - Bal.  
ESAB 50 Flux

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance ..... Good  
Machinability .....Fair

Hardness, as deposited, Rc

No. of Layers	1020 Steel	1045 Steel
1	30	48
2	42	48
3	45	45

Can be flame cut  
Strongly Magnetic

#### Typical Applications

- Mine Car Wheels
- Tractor idlers & Rollers

### Tube-Alloy® 258-S

Tube-Alloy® 258-S deposit is a premium martensitic steel alloy. It is a hard, tough H-12 tool steel composition. It can be used as an overlay on steel mill rolls where high hardness and abrasion resistance are more important than fire cracking.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C - 0.34  
Mn - 1.50  
Si - 0.50  
Cr - 6.00  
Mo - 1.50  
W - 1.40  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability ....Difficult with carbide tools  
Thickness.....As required

Hardness, as deposited, Rc

No. of Layers	1020 Steel	1045 Steel
1	46	52
2	48	53
3	53	54

Flame cutting is difficult  
Magnetic

#### Typical Applications

- Spindles
- Table Rolls

### Tube-Alloy® 810-S

Tube-Alloy® 810-S is a premium martensitic alloy. It is a hard, tough, H-10 type tool steel composition. It should be used on high impact applications that still require high hardness and abrasion resistance. It is a high-deposition rate wire that produces sound, porosity-free, crack-free weld deposits.

#### Diameter and Polarity

3/32"  
1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.28  
Mn - 1.00  
Si - 0.70  
Cr - 5.50  
Mo - 3.50  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Good with carbide tools  
Hardness, as deposited, Rc

No. of Layers	1020 Steel	1045 Steel
1	45	51
2	48	52
3	52	53

Flame cutting is difficult  
Magnetic

#### Typical Applications

- Table Rolls
- Cold Mill Leveler Rolls
- Plate Leveler Rolls
- Work Rolls
- Back-up Rolls
- Straightener Rolls
- Down Coiler Pinch Rolls
- Aluminum Mill Edger Rolls
- Primary Roughing Mill Rolls

## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® A2JL-S

Tube-Alloy® A2JL-S deposit is a modified stainless steel composition. It offers good resistance to metal-to-metal wear corrosion and thermal fatigue fire cracking.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.04  
Mn - 0.80  
Si - 0.60  
Cr - 13.50  
Mo - 1.00  
Ni - 2.00  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
w/controlled ferrite  
Abrasion Resistance .....Good  
Impact Resistance ..... Good  
Machinability.....Good with carbide tools  
Thickness.....As required  
Hardness, as deposited, Rc  
No. of Layers                      1020 Steel  
1-3                                      40  
4-8                                      33  
Cannot be flame cut  
Slightly Magnetic

#### Typical Applications

- Continuous Caster Rolls

### Tube-Alloy® 868-S

Tube-Alloy® 868-S deposit is a modified stainless steel composition. It offers moderate resistance to wear, corrosion, and the ultimate resistance to thermal fatigue fire cracking. It is a high-deposition rate wire that produces sound, porosity-free, crack-free weld deposits.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C - 0.04  
Mn - 0.80  
Si - 0.60  
Cr - 13.50  
Mo - 1.00  
Ni - 4.50  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Abrasion Resistance .....Good  
Impact Resistance.....Very Good  
Machinability.....Good with carbide tools  
Thickness.....As required  
Cannot be flame cut  
Slightly magnetic  
Maintains hot hardness to 1400°F  
No. of Layers                      1020 Steel  
1-3                                      38 Rc  
4-8                                      34 Rc

#### Typical Applications

- Continuous Caster Rolls

### Tube-Alloy® 887-S

Tube-Alloy® 887-S is a premium martensitic stainless steel alloy. It is a hard, tough composition that offers good resistance to metal-to-metal wear, corrosion and thermal fatigue.

#### Diameter and Polarity

3/32"  
1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.14  
Mn - 0.88  
Si - 0.55  
Cr - 12.50  
V - 0.23  
Ni - 3.13  
Mo - 1.50  
Nb - 0.18  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability .....Fair  
Thickness.....As required  
Hardness, as deposited, Rc  
No. of Layers                      1020 Steel  
1    32  
2    38  
3    40  
Cannot be flame cut  
Magnetic

#### Typical Applications

- Continuous Caster Rolls

## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® A250-S

Tube-Alloy® A250-S deposit is a modified 420 stainless steel composition. It offers good resistance to fire cracking and corrosion frequently encountered by steel mill rolls.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C - 0.19  
Mn - 1.00  
Si - 0.50  
Cr - 12.30  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Good with carbide tools  
Thickness.....As required  
Hardness, as deposited, Rc  

No. of	1020	1045
Layers	Steel	Steel
1	44	46
2	46	50
3	48	50

Cannot be flame cut  
Slightly Magnetic

#### Typical Applications

- Continuous Caster Rolls
- Table Rolls

### Tube-Alloy® A420M-S

Tube-Alloy® A420M-S deposit is a modified high carbon 420 stainless steel composition. It offers higher hardness than standard 420 stainless steel deposits, resulting in longer roll life where thermal fatigue is not the prime consideration.

#### Diameter and Polarity

3/32"  
1/8"  
5/32"  
DCEP

#### Typical Deposit Analysis %

C - 0.24  
Mn - 1.60  
Si - 0.70  
Cr - 14.70  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance.....Very Good  
Impact Resistance ..... Fair  
Machinability .....Fair with carbide tools  
Thickness.....As required  
Hardness, as deposited, Rc  

No. of	1020	1045
Layers	Steel	Steel
1	46	48
2	49	52
3-8	53	56

Cannot be flame cut  
Slightly Magnetic

#### Typical Applications

- Back-Up Rolls
- Continuous Caster Rolls
- Plate Leveler Rolls
- Straightener Rolls

### Tube-Alloy® 865-S Mod

Tube-Alloy® 865-S Mod deposit is a modified stainless steel composition. It offers good resistance to metal-to-metal wear, corrosion and the ultimate resistance to thermal fatigue fire cracking frequently encountered by steel mill rolls.

#### Diameter and Polarity

3/32"  
1/8"  
DCEP

#### Typical Deposit Analysis %

C - 0.18  
Mn - 1.10  
Si - 0.40  
Cr - 13.50  
Mo - 1.00  
Ni - 2.70  
V - 0.20  
Cb - 0.20  
Fe - Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability .....Fair with carbide tools  
Thickness.....As required  
Hardness, as deposited, Rc  

No. of Layers	1020 Steel
1	45
2	46
3-8	48

Cannot be flame cut  
Magnetic

#### Typical Applications

- Continuous Caster Rolls

## Metal-Cored Submerged-Arc Hard Surfacing Wires

### Tube-Alloy® 952-S

Tube-Alloy® 952-S is a premium modified high carbon martensitic stainless steel that produces higher hardnesses than standard 420 types. It offers excellent toughness for higher impact applications along with good resistance to abrasive wear. This alloy can be used in higher temperature applications (up to 1050°F). It should not be used where thermal fatigue fire cracking is the prime consideration. It is a high-deposition rate wire that produces sound, porosity-free, crack-free weld deposits.

#### Diameter and Polarity

3/32"  
1/8"  
DCEP

#### Typical Deposit Analysis %

C – 0.27  
Mn – 1.20  
Si – 0.60  
Cr – 12.80  
W – 1.40  
Mo – 1.80  
Ni – 0.60  
V – 0.19  
Nb – 0.18  
Fe – Bal.  
MK-N Flux

#### Typical Properties

Microstructure .....Martensitic  
Abrasion Resistance .....Good  
Impact Resistance .....Good  
Machinability.....Good with carbide tools  
Thickness.....As required  
Hardness, as deposited, Rc

No. of Layers	1020 Steel	1045 Steel
1	40	44
2	45	49
3	49	49

Flame cutting is difficult  
Magnetic

#### Typical Applications

- Straightener Rolls
- Plate Leveler Rolls
- Edger Rolls
- Descale Rolls
- Back-up Rolls
- Aluminum Caster Rolls Cores

### Tube-Alloy® 954-S

Tube-Alloy® 954-S is a premium high carbon martensitic tool steel that contains primary and secondary niobium carbides. It is designed to surface low, medium and high carbon steel components subject to moderate impact, abrasive wear and high temperatures (up to 950°F). It is a high-deposition rate wire that produces sound, porosity-free, crack-free weld deposits.

#### Diameter and Polarity

1/8"  
DCEP

#### Typical Deposit Analysis %

C – 0.65  
Mn – 1.25  
Si – 1.10  
Cr – 5.50  
Mo – 1.00  
Nb – 3.45  
Fe – Bal.  
MK-N Flux

#### Typical Properties

Abrasion resistance . . . . .Very Good  
Impact resistance . . . . .Fair  
Machinability . . . . .Good with carbide tools  
Thickness . . . . .As required  
Corrosion Resistance . . . . .Good  
Cannot be flame cut  
Hardness, as deposited, Rc

No. of Layers	1020 Steel	1045 Steel
1	45 RC	48 RC
2	48 RC	48 RC
3	52 RC	52 RC

Magnetic

#### Typical Applications

- Pinch Rolls
- Scale Breaker Rolls
- Damning Rolls
- Wrapper Rolls
- Looper Rolls
- Cold Mill Pulling Rolls
- Leveler Rolls
- Straightener Rolls

# Hard Surfacing Wires and Flux

## Special Alloy Wires and Flux

### GP-0

McKay GP-0 is a multipurpose wire recommended for joining dissimilar metals and hard to weld steels. It can be used for any high-strength application where wear, impact, heat and corrosion resistant properties are required.

#### Diameter and Polarity

1/16"  
DCEP

#### Typical Deposit Analysis %

C - 0.06  
Mn - 1.00  
Si - 0.50  
Cr - 26.50  
Ni - 9.00  
Fe - Bal.

#### Typical Properties

Tensile Strength . . . . .120,000 psi  
Yield Strength . . . . .90,000 psi  
Elongation in 2" . . . . .27%  
Machinability . . . . .Good  
Thickness . . . . .As required  
Cannot be flame cut  
Nonmagnetic

#### Typical Applications

- Welding Attachments to Manganese Castings
- Welding Grouser Bars to Grousers
- Welding T-1 Steel Lips to Manganese Buckets

### HF-N

HF-N is a submerged arc flux designed for use with solid and tubular wires of the 400 series. It can also be used with low alloy wires. It has excellent recovery of alloying elements of the tubular wires, such as Cr, Ni, Mo, Nb, and V. HF-N has excellent hot slag removal and can be used when welding with twin-arc and oscillating technique. The weld beads are smooth and uniform and the weld metal has good wetting action.

## TECHNICAL SECTION

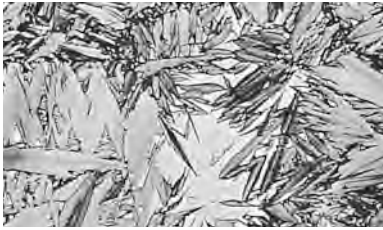
### Hard Surfacing Wire Alloy Classification



Photomicrograph of austenite.

#### Austenitic Alloys

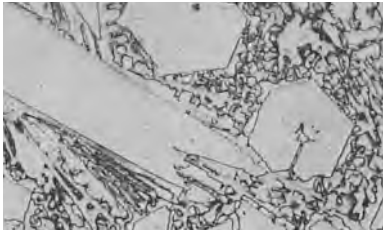
Austenitic alloys are extremely tough, ductile and work-hardenable. They offer excellent impact resistance and fair abrasion resistance (which improves as it work-hardens). These alloys will normally work-harden to a surface hardness up to 50 HRC and still retain their good impact resistance.



Photomicrograph of martensite.

#### Martensitic Alloys

Martensite is formed in steels by rapid cooling rates. Most of the hard surfacing alloys are air hardenable and heat treatable. They provide a good balance of impact and abrasion resistance. Martensitic alloys also have relatively high compression strength and excellent metal-to-metal wear resistance.



Photomicrograph of large carbides in a carbide eutectic matrix.

#### Carbide Alloys

Carbide alloys are very much like asphalt. There are carbides (gravel) and matrix (tar). The carbides are what give the excellent abrasion resistance while the matrix (tar) holds the carbides in place and offers some impact resistance. Carbides are extremely hard and brittle. They cannot handle impact. The more carbides there are the higher the abrasion resistance but the lower the impact resistance.

#### McKay Austenitic Products

Tube-Alloy 218-0  
Tube-Alloy 219-0  
Tube-Alloy AP-0  
VertiWear AP

#### McKay Martensitic Products

Tube-Alloy Build Up-0  
Tube-Alloy Build Up-G  
Tube-Alloy 242-0  
Tube-Alloy 258-0  
Tube-Alloy 258-G  
Tube-Alloy 260-G  
VertiWear 600  
ArmorWear

#### McKay Carbide Products

Tube-Alloy 218 TiC-0  
Tube-Alloy 244-0  
Tube-Alloy 258 TiC-0  
Tube-Alloy 240-0  
Tube-Alloy 255-0  
Tube-Alloy 255-G  
Tube-Alloy A43-0  
Tube-Alloy A45-0

### Hard Surfacing Wire/Stick Electrode Equivalent

Open-Arc Wire	Gas-Shielded Wire		Stick Electrode
	Flux-Cored	Metal-Cored	
Tube-Alloy 218-0	—	—	Hardalloy 118
Tube-Alloy AP-0	VertiWear AP	—	Chrome-Mang
Tube-Alloy Build Up-0	—	Tube-Alloy Build Up-G	Hardalloy 32
Tube-Alloy 258-0/ArmorWear	—	Tube-Alloy 258-G	Hardalloy 58
	VertiWear 600	—	—
	Tube-Alloy 260-G	—	—
Tube-Alloy 240-0	—	—	Hardalloy 140
Tube-Alloy 255-0	—	Tube-Alloy 255-G	Hardalloy 155
Tube-Alloy 219-0	—	—	Hardalloy 119
Tube-Alloy 242-0	—	—	Hardalloy M-932
—	—	—	Hardalloy 48
—	—	—	Hardalloy 40 TiC
			Hardalloy 61
Tube-Alloy 258 TiC-0	—	—	Hardalloy 65
Tube-Alloy A43-0	—	—	—
Tube-Alloy A45-0	—	—	—
Tube-Alloy 218 TiC-0	—	—	—
Tube-Alloy 244-0	—	—	—

# Hard Surfacing Wires

## Technical Section

### General Operating Parameters of Tube-Alloy G Flux-Cored Gas-Shielded Surfacing Wires

.045" Diameter			1/16" Diameter		
Use 1/2" to 1" wire stickout DC (electrode positive)			Use 1" to 1-1/2" wire stickout DC (electrode positive)		
Amps	Volts		Amps	Volts	
120-160	19-23		225-275	23-25	
160-190	24-25		275-350	24-27	
190-230	26-27		350-400	26-29	

### Typical Deposition Rates of Tube-Alloy G Flux-Cored Gas-Shielded Surfacing Wires

.045" Diameter		1/16" Diameter	
Amps	Lb/Hr	Amps	Lb/Hr
130	4	220	6
180	7	250	10
220	10	300	14

### General Operating Parameters of Tube-Alloy O Flux-Cored Open-Arc Surfacing Wires

.045" Diameter			1/16" Diameter		7/64" Diameter	
Use 1/2" to 1" wire stickout DC (electrode positive)			Use 1" to 1-1/2" wire stickout DC (electrode positive)		Use 1-1/2" to 2" wire stickout DC (electrode positive)	
Amps	Volts		Amps	Volts	Amps	Volts
120-160	19-23		225-275	23-25	350-400	24-27
160-190	24-25		275-350	24-27	400-450	26-29
190-230	26-27		350-400	26-29	450-500	28-32
With slight weave and 7 ipm travel speed average bead height will be 1/8" and width 3/8".						

### Typical Deposition Rates of Tube-Alloy O Flux-Cored Open-Arc Surfacing Wires

.045" Diameter		1/16" Diameter		7/64" Diameter	
Amps	Lb/Hr	Amps	Lb/Hr	Amps	Lb/Hr
130	4	220	6	300	11
180	7	250	10	350	14
220	10	300	14	400	18

### General Operating Parameters of Tube-Alloy S Metal-Cored Submerged-Arc Surfacing Wires

3/32" (2.4 mm)			1/8" (3.2 mm)			5/32" (4.0 mm)		
Use 1" to 1-1/4" (25-32 mm) wire stickout. Travel speed of 12" - 16" (305 - 406 mm) per minute.			Use 1-1/4" to 1-1/2" (32-38 mm) wire stickout. Travel speed of 14" - 18" (356-456 mm) per minute			Use 1-1/4" to 1-1/2" (32-38 mm) wire stickout. Travel speed of 16" - 20" (406 - 508 mm) per minute		
Amps	Volts	Lb/Hr	Amps	Volts	Lb/Hr	Amps	Volts	Lb/Hr
350-500	25-29	14-22	400-450	26-28	16	450-500	28-30	18
			450-500	27-30	20	500-600	29-32	23
			500-550	29-32	24			



### Comparative Index of Flux-Cored Open-Arc Hard Surfacing Wires

McKay	Certanium	Eutectic	Lincoln	Stoody	Welding Alloys
Tube-Alloy AP-0	282 FC	3005-A, 3302	15CrMn	110	19/9/6-0, AP-0
Tube-Alloy Build Up-0	283 FC	3110, 3010-A	BU, 33	Build-Up	T-0
Tube-Alloy 218-0	—	3220-A	M	Dynamang, Nicro-Mang, Foundry Co-Mang	NM-0
Tube-Alloy 218 TiC-0	285 FC	—	—	—	—
Tube-Alloy 219-0	282 FC	—	—	120, Trackwear, Nicro-Mang Plus	—
Tube-Alloy 240-0	284 FC	4025-A	50	12, SA/53, 131, 133, 134	MC-0, HC333-0/G
Tube-Alloy 242-0	—	—	40-0	Super Build-Up, Rail End 932	P-0, R-0
Tube-Alloy 244-0	—	—	—	117	—
Tube-Alloy 255-0	247 FC	4601-A	60-0	100HC, 101HC, 101HD, 100XHP	HC2-0, HC3-0, HC333-0/G
Tube-Alloy 258-0/ ArmorWear	281 FC	4415	55, T&D	102, 965-0	R-0, W-0, L-0
Tube-Alloy 258 TiC-0	246 FC	—	—	600	TiC-0
Tube-Alloy A43-0	—	—	—	SA/Super-20	CN-0, CN2-0
Tube-Alloy A45-0	—	—	—	145, 143	CNV-0, CNV2-0
GP-0	706 FC	690	—	Versalloy, GP-0	—

### Comparative Index of Flux-Cored Gas-Shielded Hard Surfacing Wires

McKay	Certanium	Lincoln	Hobart	Stoody
Tube-Alloy Build Up-G	283 FC	—	FabTuf 250	Build-Up AP-G
Tube-Alloy 255-G	—	—	—	—
Tube-Alloy 258-G	—	T&D	—	102
VertiWear 600	—	55	FabTuf 960	695AP-G
Tube-Alloy 260-G	—	55	FabTuf 960	695AP-G
VertiWear AP	—	15CrMn	—	110

For other product comparisons please go to our Hard Surfacing Product Cross-Reference Guide at [www.hobartbrothers.com](http://www.hobartbrothers.com)

## TECHNICAL SECTION

### Suggested McKay Tubular Wire Per Industry Application

#### Dredging Industry

Application	McKay Wire	
	Build-Up	Overlay
Dredge Bucket Lips	—	240-0, 255-0, 255-G
Dredge Cutter Heads & Teeth	AP-0, AP	255-0, 255-G, A43-0
Dredge Pump Casings	218-0	—
Dredge Pump Inlet Nozzle	—	255-0, 255-G, A43-0
Dredge Ladder Rolls	BU-0, BU-G, BU-S	—
Dredge Pump Impellers	—	244-0, 240-0
Dredge Pump Side Plates	—	244-0, 240-0, 255-0, 255-G, A43-0
Pipeline Ball Joints	—	244-0, 240-0, 255-0, 255-G, A43-0
Pump Shells (Carbon Steel)	—	244-0
Pump Shells (Manganese)	—	244-0, 240-0, 255-0, 255-G

#### Heavy Equipment/Mining Industries

Application	McKay Wire	
	Build-Up	Overlay
Augers	—	240-0, 255-0, 255-G, A43-0
Bucket Lips/Teeth	BU-0, BU-G	240-0, 255-0, 255-G, A43-0
Bulldozer Blades	—	240-0, 255-0, 255-G
Bulldozer End Bits	—	240-0, 255-0, 255-G
Crane Wheels	BU-0, BU-G, BU-S	242-0, 242-S
Dragline Buckets	BU-0, BU-G, AP-0, AP	240-0, 255-0, 255-G
Dragline Chain	BU-0, BU-G	242-0, 258-Q, 258-G, VertiWear 600
Mine Car Wheels	BU-0, BU-G, BU-S	242-S, 252-S
Ore/Coal Chutes	—	255-0, 255-G
Paving Agitator Screws	—	258 TiC-0, A43-0
Power Shovel Bucket Lips/Teeth	BU-0, BU-G, AP-0, AP	240-0, 255-0, 255-G
Pug Mill Paddles	—	255-0, 255-G
Road Rippers	—	255-0, 255-G, A43-0
Scraper Blades	—	240-0, 255-0, 255-G, A43-0
Sheepsfoot Tampers	—	240-0, 255-0, 255-G, A43-0
Steel Shafts	BU-0, BU-G	242-0
Tractor Idlers/Rollers	—	BU-S, 242-S, 252-S

#### Crushing/Quarry Industries

Application	McKay Wire	
	Build-Up	Overlay
Bucket Lips	—	240-0, 255-0, 255-G, A43-0
Bucket Teeth (Manganese Steel)	218-0, AP-0, AP	240-0, 255-0, 255-G, A43-0
Bulldozer End Bits	—	240-0, 255-0, 255-G
Cement Chutes	—	255-0, 255-G
Conveyor Screws	—	240-0, 255-0, 255-G, A43-0
Crusher Jaws/Cones	218-0, AP-0, AP	240-0, 255-0, 255-G
Crusher Rolls	—	240-0
Gear Teeth	BU-0, BU-G	—
Gyratory Crusher Mantles/Cones	218-0, AP-0, AP	218 TiC-0, 255-0, 255-G
Hammer Mill Hammers	218-0, AP-0, AP	218 TiC-0, 240-0
Impactor Crusher Bars	218-0, AP-0, AP	218 TiC-0, 240-0
Kiln Trunnions	BU-0, BU-G	258-0, 258-G, 258-S
Muller Tires	AP-0, AP	240-0, 255-0, 255-G, A43-0
Pug Mill Paddles	—	255-0, 255-G, A43-0
Pulverizer Hammers	AP-0, AP	240-0
Sizing Screens	AP-0, AP	240-0, 255-0, 255-G, A43-0
Steel Shafts	BU-0, BU-G	242-0

#### Iron & Steel Industry

Application	McKay Wire	
	Build-Up	Overlay
Blast Furnace Bell's Burden Area	—	A45-0
Coke Chutes	—	255-0, 255-G, A43-0
Coke Pusher Shoes	—	255-0, 255-G, A43-0
Con Caster Rolls	8620-S, 861-S	A250-S, 865-S Mod
Coupling Boxes	BU-0, BU-G	258-0, 258-G, VertiWear 600
Crane Wheels	BU-0, BU-G, BU-S	242-S
Gear Teeth	BU-0, BU-G	—
Grizzly Bars & Fingers	AP-0, AP	255-0, 255-G, A43-0
Mill Guides	—	258-0, 258-G, 240-0
Pug Mill Paddles	—	255-0, 255-G, A43-0
Screw Conveyors	—	240-0, 255-0, 255-G
Sheets in Blast Furnace Bell	—	A45-0
Sinter Breaker Bars	—	A45-0
Sinter Plant Parts	—	A45-0
Spindles	BU-0, BU-G, BU-S	258-0, 258-G, 258-S
Steel Shafts	BU-0, BU-G	242-0
Straightener Rolls	861-S	A420M-S
Table Rolls	BU-S, 8620-S, 861-S	A250-S, 258-S
Wobbler Ends	BU-0, BU-G	258-0, 258-G

#### Agriculture

Application	McKay Wire
Ammonia Knives	240-0, 255-0, 255-G
Cultivator Chisels & Sweeps	240-0, 255-0, 255-G
Mill Hammers	258 TiC-0
Ripper Shanks	255-0, 255-G
Steel Shafts	242-0
Subsoiler Teeth	255-0, 255-G

#### Railroad Industry

Application	McKay Wire
Crossovers (Low Alloy Steel)	242-0
Crossovers (Manganese Steel)	218-0, 219-0, AP-0, AP
Frogs (Carbon Steel)	242-0
Frogs (Manganese Steel)	218-0, 219-0, AP-0, AP
Rail Ends (Low Alloy Steel)	242-0
Switch Points (Low Alloy Steel)	242-0

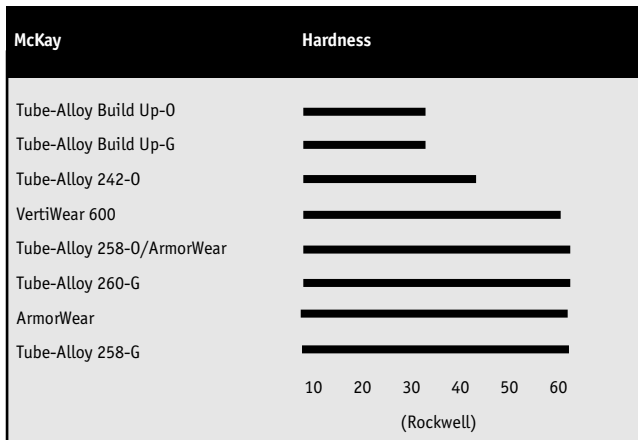
#### Power Generation Industry

Application	McKay Wire
Coal Feeder Screws	255-0, 255-G, A43-0
Coal Pulverizer Hammers	255-0, 255-G
Coal Pulverizer Rolls	255-0, 255-G, A43-0
Coal Pulverizer Table	255-0, 255-G, A43-0
Fan Blades	255-0, 255-G, A43-0, A45-0
Hydroelectric Turbines	AP-0, AP

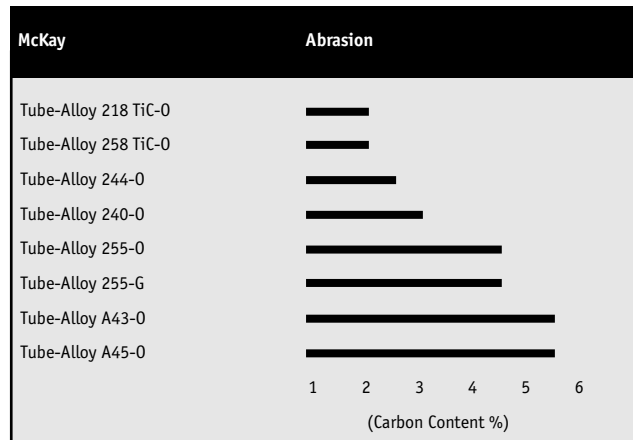
BU = Build-Up

## TECHNICAL SECTION

### Metal-to-Metal Wear Resistance



### Abrasion Resistance

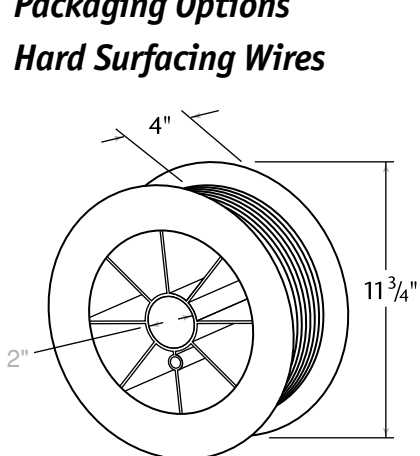


### Hard Surfacing Tubular Wire Pallet Information

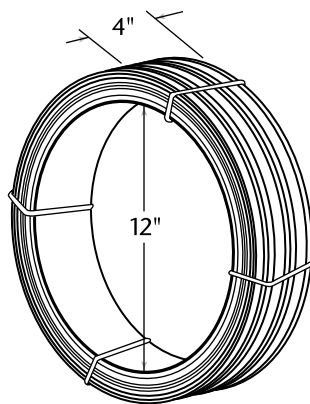
McKay Type	Pallet Weight (lb)		Pallet Dimensions			Number of Items Per Pallet
	Net	Gross (est.)	Depth	Width	Height	
25 lb Spool	500	605	24"	24"	27"	20 (25 lb Spools)
60 lb Coil	1680	1743	36"	36"	35"	28 (60 lb Coils)

Note: Please contact factory for Auto-Pak pallet requirements

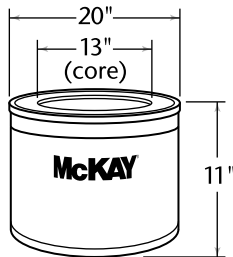
### Packaging Options Hard Surfacing Wires



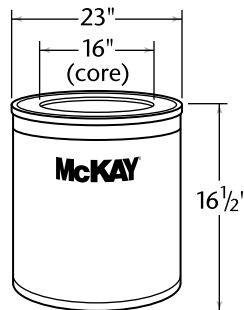
25 lb Plastic Spool



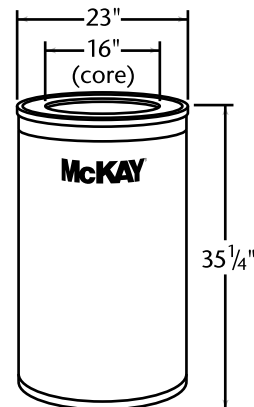
60 lb Coil



100 lb Auto-Pak



250 lb Auto-Pak



500 lb Auto-Pak

# Hard Surfacing Wires Technical Section

## Tensile Strength to Hardness Conversion Chart

Brinell Hardness No. (BHN)	Vickers Hardness No. (VHN)	Rockwell		Approximate Tensile Strength, 1000 psi
		C (HRC)	B (HRB)	
898	—	—	—	440
857	—	—	—	420
817	—	—	—	401
780	1150	70	—	384
745	1050	68	—	368
712	960	66	—	352
682	885	64	—	337
653	820	62	—	324
627	765	60	—	311
601	717	58	—	298
578	675	57	—	287
555	633	55	120	276
534	598	53	119	266
514	567	52	119	256
495	540	50	117	247
477	515	49	117	238
461	494	47	116	229
444	472	46	115	220
429	454	45	115	212
415	437	44	114	204
401	420	42	113	196
388	404	41	112	189
375	389	40	112	182
363	375	38	110	176
352	363	37	110	170
341	350	36	109	165
331	339	35	109	160
321	327	34	108	155
311	316	33	108	150
302	305	32	107	146
293	296	31	106	142
285	287	30	105	138
277	279	29	104	134
269	270	28	104	131
262	263	26	103	128
255	256	25	102	125
248	248	24	102	122
241	241	23	100	119
235	235	22	99	116
229	229	21	98	113
223	223	20	97	110
217	217	18	96	107
212	212	17	96	104
207	207	16	95	101
202	202	15	94	99
197	197	13	93	97
192	192	12	92	95
187	187	10	91	93
183	183	9	90	91
179	179	8	89	89
174	174	7	88	87
170	170	6	87	85
166	166	4	86	83
163	163	3	85	82
159	159	2	84	80
156	156	1	83	78
153	153	—	82	76
149	149	—	81	75
146	146	—	80	74
143	143	—	79	72
140	140	—	78	71
137	137	—	77	70
134	134	—	76	68
131	131	—	74	66
128	128	—	73	65
126	126	—	72	64
124	124	—	71	63
121	121	—	70	62
118	118	—	69	61
116	116	—	68	60
114	114	—	67	59
112	112	—	66	58
109	109	—	65	56
107	107	—	64	56
105	105	—	62	54
103	103	—	61	53
101	101	—	60	52
99	99	—	59	51
97	97	—	57	50
95	95	—	56	49

## Typical Composition and Suggested Preheat Temperatures for Several Steel Mill Roll Alloys.

Alloy	C	Mn	Si	Cr	Ni	Mo	V	W	Suggested Preheat (°F)*
AISI 1020	.20	.45	.25						300-500
AISI 1030	.30	.75	.25						400-550
AISI 1040	.40	.75	.25						450-600
AISI 8620	.20	.80	.28	.50	.55	.20			500-700
AISI 4130	.30	.50	.28	.90		.20			600-700
AISI 4140	.40	.55	.28	.90		.20			650-700
AISI 4320	.20	.55	.28	.50	1.80	.25			6000-700
AISI 4340	.40	.70	.28	.80	1.80	.25			650-700
H-12	.35	.30	1.00	5.00		1.50	.30	1.40	700-800
52100	1.00	.30	.28	1.40					700-800
CAST IRON†	3.25	.80	2.00						800-800
INTERNATIONAL	.40	.55	.30	1.10	1.40	.15			700-800
DIN 21 Cr.Mo.V.5-11	.20	.40	.45	1.35	.20	1.10	.30		700-800
DIN 1700G 13Cr.Mo 44	.15	.55	.25	.85		.45			600-800
EFC 21	.23	.40	.45	1.35		1.10	.30		700-800

† Gray or unalloyed ductile (nodular) iron.

\* Soak time varies with Roll Mass (usually 1/2 hour per inch of roll diameter once the surface has reached soak temperature).

## Oven Storage and Reconditioning of Filler Metals

Welding electrodes, wire, and flux may be damaged by atmospheric moisture. The following table recommends proper storage conditions, and time and temperature for reconditioning electrodes that have absorbed excess moisture.

**Notes for table:** Pallets and unopened cartons of electrodes and wire should be stored away from exposure to water in the form of rain, snow, spray, or humidity. Only hermetically sealed cans are safe against these conditions. Damaged cartons permit entry of damp air which may be picked up by the product and lower its quality. Humidity below 50% should be avoided for 6010, 6011, 6012 and 6013 electrodes. At no times should these classes of electrodes be stored in an oven above 175°F.

The instruction, "Dry at Room Temperature" in the table signifies that the humidity should be below 70% and the temperature should be within the limits 40°F and 120°F.

When reconditioning flux, it is important that the complete mass be brought up to the temperature desired. If the flux is held in large containers, this can take a very long time – perhaps over 24 hours. In thin layers, reduction in moisture can be accomplished in as little as one hour, for example, in layers one to two inches thick. Fossil fuel burners (natural gas, oil, etc.) are not recommended.

**CAUTION:** Welding characteristics of agglomerated flux may suffer if temperature exceeds 650°F.

Item Designation	Storage of Contents of Open Cartons*	Reconditioning*
Mild Steel – 6010, 6011	Dry at room temperature	Not recommended
Mild Steel – 6012, 6013, 7014, 7024	100F - 175F	250F - 300F
Mild Steel, Low Hydrogen, Low Alloy – 7016 and all XXX18	215F - 450F	700 F - 800F
Stainless Steel Stick Electrodes Sterling AP & AC/DC (AWS-16), DC Lime (AWS-15) Sterling (AWS-17)	215F - 260F 215F - 260F	400F - 600F 350F - 425F
Hardalloy® Surfacing	215F - 260F	450F - 600F
Special Maintenance - GP	215F - 260F	500F
Cast Iron Electrodes	215F - 230F	250F - 300F
Sub-Arc Fluxes	250F	600F
Mild Steel Solid Wire	Dry at room temperature	Not recommended
Tubular Wires – Speed-Alloy®, Tube-Alloy®, In-Flux® 0, ChromaWeld	Dry at room temperature	Not recommended
*Be sure that electrodes, wire, or fluxes are properly removed from packaging that may be damaged. For more detailed information, please refer to McKay publication ITR-53G		

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You can contact the McKay offices nearest you as listed below. You can also call 1-800-424-1543 (U.S.) to locate your nearest McKay distributor or visit our Web site - [www.hobartbrothers.com](http://www.hobartbrothers.com)

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### [www.MillerWelds.com](http://www.MillerWelds.com) 1-800-4-A-Miller (1-800-426-4553)

Founded in 1929, and a world leader in the manufacturing of arc welding and cutting equipment. Miller Electric manufactures welding power sources, wire feeders, welding guns and accessories, engine driven welding power sources/generators, automation welding controls, plasma arc cutting power sources, and resistance spot welding equipment.



### [www.smithequipment.com](http://www.smithequipment.com) 1-800-843-7912

Manufacturers since 1917 of premium, safety-engineered oxy-fuel cutting, welding and heating equipment, featuring the new Dual Guard Torch and Lifetime Warranty. Other products include specialty gas regulators, gas mixers and jeweler's torches. All USA-made.



### [www.bernardwelds.com](http://www.bernardwelds.com) 1-800-946-2281

Manufactures premium MIG (GMAW) welding guns, including both air-cooled and water-cooled semi-automatic, fully-automatic, and robotic products, as well as all accessory and replacement items. Also manufactures the complete line of OXO brand heavy-duty air-cooled MIG guns.



### [www.weldcraft.com](http://www.weldcraft.com) 1-800-752-7620

The world-leading manufacturer of TIG (GTAW) welding torches, consumables and accessories. A broad line of premium and value products includes the unique Crafter Series™, Legacy Series™, MicroTig™, Quick Connect System™, Supercool™, and Superflex™.



### [www.tempil.com](http://www.tempil.com) 1-800-757-8301

Manufactures precise temperature-indicating markers, inks, paints, labels, welding accessories, and sterilization indicators. For almost 60 years, welders, engineers and scientists have relied on premium Tempil products to indicate temperature from 100°F to 2500°F.



### [www.jetline.com](http://www.jetline.com) 1-949-951-1515

Designers and manufacturers of a full range of mechanized equipment and arc controls for welding, including Jetline and Cyclomatic. Jetline is your partner in welding automation — providing fixtures, arc controls, and system integration.



### [www.magnaflux.com](http://www.magnaflux.com) 1-847-657-5300

Offers a complete line of liquid penetrant and magnetic particle inspection equipment and accessories, as well as processing materials, all of which are designed specifically for the nondestructive testing (NDT) industry.



### [www.welding.org](http://www.welding.org) 1-800-332-9448 or 937-332-5000

Provides skill and technical training to career-oriented students and industry alike. Experienced welders, industry, and governmental agencies also rely on the Institute to provide technical, specialized, and certification training.



### [www.tregaskiss.com](http://www.tregaskiss.com) 1-877-737-3111 or 519-737-3000

Supplier of quality MIG welding torches and peripheral products. Brand names include TOUGH GUN®, TGX®, TOUGH GARD®, TOUGH LOCK®, and SURESTART.

**NOTES**

A series of 18 horizontal lines for writing notes, starting from a bracketed area on the left.