

# Hardfacing Stick Electrodes

## 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.

### Typical Applications

- crusher jaws & cones
- crusher rolls
- dredge pump casings, impellers, & side plates
- gyratory crusher mantles & cones
- hammer mill hammers
- impactor crusher bars
- manganese bucket teeth
- manganese steel railroad crossovers & frogs
- sizing screens

### Typical Deposit Analysis %

Carbon .....	0.80
Manganese .....	16.50
Silicon .....	0.50
Chromium .....	5.00
Nickel.....	0.30
Iron .....	Balance

### Typical Properties

Tensile Strength (psi)	127,000 (876 MPa)
Yield Strength (psi)	78,000 (538 MPa)
Elongation in 2"	50%
Machinability	Difficult
Hardness:	
As Deposited	18-22 Rc
Work Hardened	50-55 Rc
Flame cutting is difficult	
Nonmagnetic	

### Optimum Current

Diameter	Amps
1/8" .....	120
5/32" .....	180
3/16" .....	230
1/4" .....	280

Polarity: DCEP Preferred or AC

## 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.

### 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

### Typical Deposit Analysis %

Carbon .....	0.40
Manganese .....	14.50
Silicon .....	0.60
Chromium .....	14.00
Nickel.....	1.00
Molybdenum.....	1.50
Vanadium .....	0.50
Iron .....	Balance

### Typical Properties

Tensile Strength (psi)	130,000 (897 MPa)
Yield Strength (psi)	94,000 (648 MPa)
Elongation in 2"	40%
Machinability	Difficult
Hardness:	
As Deposited	18-22 Rc
Work Hardened	50-55 Rc
Cannot be flame cut	
Nonmagnetic	

### Optimum Current

Diameter	Amps
1/8" .....	150
5/32" .....	200
3/16" .....	250

Polarity: DCEP Preferred or AC

## 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 hardfacing. It has excellent resistance to cracking and checking in heavy thicknesses.

### 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
- wobblers ends

### Typical Deposit Analysis %

Carbon .....	0.18
Manganese .....	0.90
Silicon .....	0.60
Chromium .....	0.70
Molybdenum.....	0.30
Iron .....	Balance

### 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	

### Optimum Current

Diameter	Amps
1/8" .....	140
5/32" .....	180
3/16" .....	220
1/4" .....	300

Polarity: DCEP Preferred or AC

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## 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.

### Typical Applications

- coupling boxes
- dragline chain
- dredge ladder rolls
- kiln trunnions
- mill guides
- sliding metal parts
- wobbler ends

### Typical Deposit Analysis %

Carbon .....	0.60
Manganese .....	1.20
Silicon .....	0.70
Chromium .....	5.50
Molybdenum .....	0.50
Iron .....	Balance

### 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

### Optimum Current

Diameter	Amps
1/8" .....	110
5/32" .....	160
3/16" .....	210

Polarity: DCEP Preferred or AC

## 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™.

### 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 bBall joints
- plow shares
- scraper blades
- screw conveyers
- sheepsfoot tampers
- sizing screens

### Typical Deposit Analysis %

Carbon .....	3.00
Manganese .....	0.40
Silicon .....	2.00
Chromium .....	30.00
Molybdenum .....	0.70
Iron .....	Balance

### 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

### Optimum Current

Diameter	Amps
1/8" .....	120
5/32" .....	155
3/16" .....	190

Polarity: DCEP Preferred or AC

## 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.

### 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

### Typical Deposit Analysis %

Carbon .....	5.50
Manganese .....	0.40
Silicon .....	1.00
Chromium .....	32.00
Molybdenum .....	4.50
Iron .....	Balance

### 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

### Optimum Current

Diameter	Amps
1/8" .....	140
5/32" .....	150
3/16" .....	190

Polarity: DCEP Preferred or AC

# Hardfacing Stick Electrodes

## 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.

### Typical Applications

- crane wheels
- frogs & switch points
- low alloy steel railroad crossovers
- steel shafts
- tractor undercarriage idlers & rollers

### Typical Deposit Analysis %

Carbon .....	0.13
Manganese .....	0.80
Silicon .....	0.40
Chromium .....	2.20
Molybdenum.....	1.00
Iron .....	Balance

### Typical Properties

Tensile Strength (psi)	145,000 (1000 MPa)	
Hardness, as deposited, Rc		
No. of Layers	#132 Rail/1080 Steel*	1020 Steel
1	38	33
2	39	36
3	38	38

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

### Optimum Current

Diameter	Amps
5/32" .....	170
3/16" .....	220
1/4" .....	300

Polarity: DCEP Preferred or AC

## 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.

### Typical Applications

- coupling boxes
- dragline chain
- dredge ladder rolls
- kiln trunnions
- mill guides
- sliding metal parts
- wobbler ends

### Typical Deposit Analysis %

Carbon .....	0.60
Manganese .....	1.000
Silicon .....	0.40
Chromium .....	4.00
Iron .....	Balance

### Typical Properties

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

Flame cutting can be difficult  
Deposit is magnetic

### Optimum Current

Diameter	Amps
1/8" .....	110
5/32" .....	160
3/16" .....	210

Polarity: DCEP Preferred or AC

## Hardalloy® 148

Hardalloy® 148 deposit is a high carbonchromium 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.

### Typical Applications

- gyratory crusher mantles & cones
- ingot tongs
- mill guides
- pulleys
- slurry mixer paddles

### Typical Deposit Analysis %

Carbon .....	1.80
Manganese .....	0.60
Silicon .....	1.80
Chromium .....	30.00
Nickel.....	3.00
Molybdenum.....	1.50
Iron .....	Balance

### 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

### Optimum Current

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

Polarity: DCEP Preferred or AC

# Hardfacing Stick Electrodes

## Hardalloy® 40TiC

### (U.S. IPat. No. 4,584,459)

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.

### 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

### Typical Deposit Analysis %

Carbon	.....3.00
Manganese	.....1.10
Silicon	.....0.80
Chromium	.....8.20
Titanium	.....1.50
Iron	.....Balance

### Typical Properties

Nonmachinable nor forgeable  
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

### Optimum Current

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

Polarity: DCEP Preferred or AC

## 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.

### Typical Applications

- shear blades
- sliding metal parts
- trimming dies & punching dies

### Typical Deposit Analysis %

Carbon	.....0.80
Manganese	.....0.50
Silicon	.....0.70
Chromium	.....4.00
Tungsten	.....1.10
Molybdenum	.....8.00
Vanadium	.....1.10
Iron	.....Balance

### 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

### Optimum Current

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

Polarity: DCEP Preferred or AC

# Hardfacing 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.

#### Typical Deposit Analysis %

Carbon .....	1.10
Manganese .....	0.40
Silicon .....	2.70
Copper .....	1.40
Iron .....	5.50
Nickel.....	89.00

#### Typical Properties as Welded

Tensile Strength (psi)	40,000 (276 MPa)
Yield Strength (psi)	38,000 (262 MPa)
Elongation in 2"	4.5%

#### Optimum Current

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

Polarity: DCEP Preferred or AC

#### Approvals and conformances:

- AWS Spec A5.15, ASME SFA5.15

### 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.

#### Typical Deposit Analysis %

Carbon .....	1.30
Manganese .....	0.50
Silicon .....	0.60
Iron .....	48.00
Nickel.....	49.00

#### Typical Properties as Welded

Tensile Strength (psi)	70,000 (483 MPa)
Yield Strength (psi)	52,000 (359 MPa)
Elongation in 2"	9.5%

#### Optimum Current

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

Polarity: DCEP Preferred or AC

#### Approvals and conformances:

- AWS Spec A5.15, ASME SFA5.15

## — MAINTENANCE

### GP

A special stainless alloy electrode balanced for maximum strength and crack resistance. Hobart 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. Hobart 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.

#### Typical Applications

- welding attachments to manganese castings
- welding grouser bars to grousers
- welding T-1 steel lips to manganese buckets

#### Typical Deposit Analysis %

Carbon .....	0.06
Manganese .....	1.00
Silicon .....	0.50
Chromium .....	26.50
Nickel.....	9.00
Iron .....	Balance

#### Typical Properties as Welded

Tensile Strength (psi)	129,000 (889 MPa)
Yield Strength (psi)	90,000 (621 MPa)
Elongation in 2"	27%

Machinability: Good  
Thickness: As required  
Cannot be flame cut  
Nonmagnetic

#### Optimum Current

Diameter	Amps
3/32" .....	70
1/8" .....	105
5/32" .....	140

Polarity: DCEP Preferred or AC