



# **WASHINGTON ALLOY CO.**

**Quality Products and Services  
From the Quality Supplier**

## **CAST IRON WELDING ALLOYS**



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# CAST IRON ELECTRODES

UNS W82001

## WASHINGTON ALLOY NICKEL 99

AWS/SFA 5.15 ENI-CI, AC-DC

### DESCRIPTION

Washington Alloy Nickel 99 is recommended for all-position welding of thin cast iron sections where maximum machinability is required. Since the core wire is approximately 99% nickel, weld deposits are basically "soft" and can be shaped, milled, drilled, or tapped, while the color will match that of cast iron. Washington Alloy Nickel 99 is specifically suited for repairing cracked or porous castings and to weld cast iron to itself or dissimilar metals such as low alloy and carbon steels.

### APPLICATIONS

The weld deposits produced by Washington Alloy Nickel 99 have lower strength and ductility than those of 55% nickel cast iron electrodes. For this reason Washington Alloy Nickel 99 should only be used where maximum machinability of highly diluted weld metal is required or where weld stresses are not overly severe such as found in light and medium-sized castings. Common uses include thin plates, machinery parts, frames and housings.

### TYPICAL WELD METAL CHEMISTRY (%)

C .....	0.55	S .....	0.007
Si .....	0.46	Fe .....	0.850
Mn .....	0.33	Cu .....	0.160
P .....	0.017	Ni .....	Balance

### TYPICAL MECHANICAL PROPERTIES

#### OF WELD METAL (as welded)

Tensile strength (psi) .....	50,000
Yield strength (psi) .....	40,000
Elongation in 2" (%) .....	3-4
Brinell hardness .....	170

### SIZES AND RECOMMENDED CURRENT RANGES\* (AC/DC)

Sizes	Amperage
3/32 (2.4 mm) x 12" .....	30-70
1/8 (3.2 mm) x 14" .....	70-110
5/32 (4.0 mm) x 14" .....	90-130
3/16 (4.8 mm) x 14" .....	110-160

\*These settings are for flat or downhand positions. For overhead welding reduce 5-15 amps and for vertical welding reduce 10-20 amps.

Packaging: 10 lb. tubes / 60 lb. master carton

UNS W82002

## WASHINGTON ALLOY NICKEL 55

AWS/SFA 5.15 ENiFe-CI, AC-DC+

### DESCRIPTION

Washington Alloy Nickel 55 is designed for all-position joining and surfacing of cast iron, malleable iron and ductile iron to itself or dissimilar metals such as mild steel, stainless steel, wrought alloys or high nickel alloys. A core wire chemistry of approximately 55% nickel and 45% iron produces weld deposits with much lower weld shrinkage stress which in turn reduces the possibility of weld or heat-affected zone cracking. Washington Alloy Nickel 55 produces high strength, ductile weld deposits even when welding low grade cast iron containing excessive levels of phosphorus or other contaminants.

### APPLICATIONS

Washington Alloy Nickel 55 is especially suited for welding heavy sections such as motor blocks, housings, machine parts, frames, defective castings and building-up worn sections. Weld deposits are machinable and the deposit color will approximate that of cast iron.

### TYPICAL WELD METAL CHEMISTRY (%)

C .....	0.058	S .....	0.024
Si .....	0.66	Fe .....	Balance
Mn .....	1.27	Cu .....	2.45
P .....	0.024	Ni .....	55.03

### TYPICAL MECHANICAL PROPERTIES

#### OF WELD METAL (as welded)

Tensile strength (psi) .....	70,000
Yield strength (psi) .....	53,000
Elongation in 2" (%) .....	6-12
Brinell hardness .....	190

### SIZES AND RECOMMENDED CURRENT RANGES\* (AC/DC+)

Sizes	Amperage
3/32 (2.4 mm) x 12" .....	50-80
1/8 (3.2 mm) x 14" .....	80-120
5/32 (4.0 mm) x 14" .....	110-140
3/16 (4.8 mm) x 14" .....	130-170

\*These settings are for flat or downhand positions. For overhead welding reduce 5-15 amps and for vertical welding reduce 10-20 amps.

Packaging: 10 lb. tubes / 60 lb. master carton

UNS K01520

## WASHINGTON ALLOY EST

AWS/SFA 5.15 EST, AC-DC+

### DESCRIPTION

Washington Alloy EST is a non-nickel, non-machinable cast iron electrode. It is the most economical way to go for repairing various kinds of cast iron products — providing that machinability of the weld deposit is not required and where weld shrinkage stress is not a concern. Since the core wire is steel, the weld deposits will have a higher tensile strength (65,000 psi) than Nickel 99, however a color match of the base metal should not be expected. Washington Alloy EST melts at relatively low temperatures which permit the use of low welding currents. This electrode may be used in any position utilizing AC or DC (reverse polarity)

### APPLICATIONS

Commonly used on gears, motor housings, machine parts, farm equipment, large flanges or any other cast iron part where appearance of the weld deposit is not important.

### TYPICAL WELD METAL CHEMISTRY (%)

C .....	0.15	P .....	0.015
Si .....	0.55	S .....	0.003
Mn .....	0.37	Fe .....	Balance

### TYPICAL MECHANICAL PROPERTIES

#### OF WELD METAL (as welded)

Tensile strength (psi) .....	65,000
Yield strength (psi) .....	50,000
Elongation in 2" (%) .....	33
Brinell hardness .....	350

### SIZES AND RECOMMENDED CURRENT RANGES\* (AC/DC+)

Sizes	Amperage
3/32 (2.4 mm) x 12" .....	60-90
1/8 (3.2 mm) x 14" .....	90-130
5/32 (4.0 mm) x 14" .....	120-160
3/16 (4.8 mm) x 14" .....	150-200

\*These settings are for flat or downhand positions. For overhead welding reduce 5-15 amps and for vertical welding reduce 10-20 amps.

Packaging: 10 lb. tubes / 60 lb. master carton

## PROCEDURES FOR SMAW OF CAST IRON

Clean the work area. Preheating is not required, however it is useful in relieving stresses and to increase machinability of the weld deposit in parts greater than 1/2" thick. 200°F is an acceptable preheat temperature. Using AC or DC + (reverse polarity), hold the electrode 15° off vertical tilted toward the direction of travel. The arc length should be between 1/8" to 3/16". Use stringer beads or the weaving technique. Holding the arc over the molten deposited metal, follow the pool but do not allow the arc to lead or get ahead of the molten pool. If the part is less than 1/4" thick use a 1" bead, 1/4" to 1/2" use a 2" bead, over 1/2" use a 3" to 4" bead. Extinguish the electrode by whipping the arc back over the deposited metal. Peen the weld deposit with a blunt instrument to relieve stress and prevent the spread of cracks on the part. Re-strike the arc on the previously deposited weld metal. On thin or complex shaped parts use the skip weld technique. Always use an electrode diameter that is small enough to permit at least two passes. Note: If there is cracking of the part, make stopholes at both ends of the joint. Do not let the part become too hot during welding. Remove slag often. Gradual cooling of the weld metal is strongly recommended.



# CAST IRON WIRES

**UNS N02215**  
**CASCADE 17T & 17M**  
 AWS A5.15 Class ERNi-CI

**TIG/MIG**

## DESCRIPTION

High nickel alloy bare wire for TIG or MIG cast iron welding.

## APPLICATIONS

Cascade 17T and 17M are the TIG (17T) or MIG (17M) equivalents to Cascade 17A. Developed primarily for automatic and semi-automatic welding of ductile, malleable or gray cast iron to itself or to dissimilar metals such as low alloy and carbon steel, stainless steel, iron, copper, Monel®, etc. Cascade 17T and 17M are excellent for the buildup of worn parts, repairing machining errors or defective castings where maximum machinability of the deposit is required.

## FEATURES

Cascade 17T and 17M can be used in any position. Produces high quality welds with a minimal amount of effort. Weld deposits are strong, dense and fully machinable. Color will match that of cast iron.

## SPECIFICATIONS

Tensile strength (psi) ..... Up to 70,000  
 Yield strength (psi) ..... Up to 46,000  
 Brinell hardness ..... 170  
 Elongation (%) ..... Approximately 12  
 Reduction of area (%) ..... Approximately 20

## TYPICAL WIRE CHEMISTRY (%)

C .....	0.037	Ni .....	Balance
Si .....	0.440	Fe .....	0.01
Mn .....	0.240	Cu .....	0.02

## PROCEDURES

Clean the joint area. Bevel heavy sections. Preheating is not required, however it is useful in relieving stresses and to increase machinability of the weld deposit in parts greater than 1/2" thick. 600°F is an acceptable preheat temperature. Use DC- (straight polarity) in TIG applications, with the oscillating technique and DC+ (reverse polarity) in MIG applications, with the stringer bead technique. The oscillating technique will produce the lowest weld metal dilution. When using the stringer bead technique, be sure to strike the arc on the edge of previously deposited weld metal. This will reduce dilution. Be sure to use flux. Do not let the part become too hot during welding. Remove slag often. Gradual cooling of the weld metal is recommended.

**CASCADE 18T & 18M**  
 AWS A5.15 Class ENiFe-CI

**TIG/MIG**

## DESCRIPTION

A premium quality 55% Nickel - 45% Iron bare wire for TIG or MIG welding of cast iron components to themselves or to steel.

## APPLICATIONS

Cascade 18T and 18M are the TIG and MIG equivalents of Cascade 18A (coated electrodes). Developed for high deposition and greater welding efficiency using automatic or semi-automatic equipment. Cascade 18T/18M is excellent when doing large scale production welding of ductile (nodular) cast iron, malleable cast iron or gray cast iron to themselves or to carbon and low alloy steel. Preheating is generally not needed unless welding heavier and thicker castings. More common uses include the repair of thick and highly restrained weldments, worn or broken parts and for salvaging defective castings that require the higher tensile strength of steel, such as found in castings containing phosphorus levels greater than 0.20%.

## FEATURES

Cascade 18T and 18M contain sufficient levels of carbon which promote the formation of graphite in the weld deposit, thereby reducing shrinkage stresses and in turn, reducing the possibility of heat-affected zone cracking. Weld deposits are machinable using normal methods, but can be made easier by stress relieving the part at approximately 1100°F.

## SPECIFICATIONS

Tensile strength (psi) ..... Up to 78,000  
 Yield strength (psi) ..... Up to 59,000  
 Brinell hardness ..... 190  
 Elongation (%) ..... Approximately 10%

## TYPICAL WIRE CHEMISTRY (%)

C .....	0.005	Ni .....	54.85
Si .....	0.100	Fe .....	Balance
Mn .....	0.690	Cu .....	0.020
P .....	<0.002	Cr .....	0.030
S .....	<0.001	Ti .....	<0.10

## PROCEDURES

Clean the work area. Preheating is not required, although it may be useful in relieving stresses and to increase the machinability of weld deposits in castings 1/2" or thicker. 600°F is an acceptable preheat temperature when welding gray cast iron, but 1100 to 1200°F may be needed for very thick sections or high hardness cast irons. Use DC- (straight polarity) in TIG applications with the oscillating technique and DC+ (reverse polarity) in MIG applications with the stringer bead technique. The oscillating technique will produce the lowest weld metal dilution. When using the stringer bead technique, be sure to strike the arc on the edge of previously deposited weld metal. This will reduce dilution. Be sure to use flux. Do not let the part become too hot during welding. Remove slag often. Gradual cooling of the weld metal is recommended.

## AVAILABLE DIAMETERS

(in.)	.035	.045	1/16	3/32	1/8
(mm)	0.9	1.2	1.6	2.4	3.2

## PACKAGING

10 lb. and 30 lb. spools — 0.35, 0.45, 1/16.  
 36" straight lengths — .035, .045, 1/16, 3/32, 1/8.  
 (10 lb. tubes/50 lb. master carton)

GTAW Parameters: Use DC- (straight polarity) 100% Argon  
 GMAW Parameters: Use DC+ (reverse polarity) 100% Ar or 75Ar/25Co<sub>2</sub>  
 Gas Flow: 40-60 ft<sup>3</sup>/h. (1.1-1.7m<sup>3</sup>/h)

Wire Diameter		Shielding Gas	Voltage, V	Amperage A	Wire Feed		Travel Speed	
in	mm				in/min	mm/min	in/min	mm/min
0.062	1.6	100% Argon	26-31	240-350	150-225	3.8-5.7	10-25	250-640
		75% Ar/25% CO <sub>2</sub>	26-30	235-320	150-225	3.8-5.7	10-25	250-640
0.045	1.1	100%Argon	26-32	190-310	250-500	6.4-12.7	10-25	250-640
		75% Ar/25% CO <sub>2</sub>	26-32	180-280	250-500	6.4-12.7	10-25	250-640
0.035	0.9	100% Argon	24-28	150-250	300-575	7.6-14.6	10-25	250-640
		75% Ar/25% CO <sub>2</sub>	24-28	130-200	300-575	7.6-14.6	10-25	250-640



# CAST IRON ELECTRODES

# CAST IRON ROD

## CASCADE 17A

Arc AC/DC  
All Positions

### DESCRIPTION

Fully-machinable cast iron electrode for repair welding of thin sections.

### APPLICATIONS

Cascade 17A is a high nickel electrode used for cladding, buildup and joining all grades of cast iron to itself or dissimilar metals such as low alloy and carbon steels, stainless steels, iron, copper, Monel®, etc. Excellent for repairing and "cold welding" cracked or porous thin sections where maximum machinability of the weld deposit is required. Common uses include engine blocks, machinery parts, frames, gears and pulleys.

### FEATURES

Cascade 17A is an all-position electrode which produces porosity-free, non-cracking weld deposits that will match the color of cast iron. When properly used, the arc will penetrate through dirt and oil as well as over slag.

### SPECIFICATIONS

Tensile strength (psi) ..... Up to 65,000  
Yield strength (psi) ..... Up to 60,000  
Brinell hardness ..... Up to 218  
Elongation (%) ..... 3-6  
Color match ..... Excellent on cast iron

### AVAILABLE SIZES AND AMPERAGE (AC/DC)

(in.)	3/32	1/8	5/32	3/16
(mm)	2.4	3.2	4.0	4.8
Amps	50-70	70-100	100-130	130-160

## CASCADE 18A

Arc AC/DC+ (Reverse Polarity)  
All Positions

### DESCRIPTION

Premium cast iron electrode for heavy sections.

### APPLICATIONS

Cascade 18A is for general maintenance welding of cast iron, malleable iron and ductile (nodular) iron to themselves or dissimilar metals such as wrought alloys or high nickel alloys. Commonly used on motor blocks, gear housings, machine parts and frames. Excellent for filling holes and building up missing or worn heavy sections. Cascade 18A is recommended for "meehanite" and "Ni-Resist" alloys.

### FEATURES

Cascade 18A is an all-position electrode that produces machinable, high density and crack-resistant weld deposits. especially suited for welding dirty, oil-soaked castings of unknown composition.

### SPECIFICATIONS

Tensile strength (psi) ..... Up to 84,000  
Yield strength (psi) ..... Up to 63,000  
Brinell hardness ..... Up to 218  
Elongation (%) ..... 6-18  
Color match ..... Good

### AVAILABLE SIZES AND AMPERAGE (AC/DC+)

(in.)	3/32	1/8	5/32	3/16
(mm)	2.4	3.2	4.0	4.8
Amps	50-70	70-100	100-130	130-160

## RCI

AWS A5.15 RCI,  
UNS F10090, MIL-R-908A, Cl.2

### DESCRIPTION

RCI is a high-quality gray iron oxyacetylene welding rod, designed for gas welding of cast iron, general fabrication or building up new or worn surfaces on castings.

### APPLICATIONS

RCI is excellent for cast iron fabrication, repair of foundry defects, filling in or building up new or worn castings. RCI produces machinable weld deposits that have the same color, composition and granular structure as the base metal (gray iron). Properly made welds will be as strong as the original casting.

### FEATURES

RCI has properly balanced and controlled levels of high silicon, low manganese and increased amounts of phosphorus and sulfur. This composition insures greater fusion and tensile strength of the weld deposit. Machinable weld deposits and color match to gray cast iron.

### TYPICAL CHEMICAL ANALYSIS

C ..... 3.20-3.50	P ..... 0.50-0.75
Mn ..... 0.60-0.75	S ..... 0.10 Maximum
Si ..... 2.70-3.00	Fe ..... Balance

### TYPICAL MECHANICAL PROPERTIES OF THE WELD DEPOSIT

Tensile strength (psi) ..... 20,000 - 25,000 psi  
Brinell hardness ..... 150-210

### AVAILABLE SIZES

3/16" (4.8mm) x 24" (600mm) Square  
1/4" (6.4mm) x 24" (600mm) Square  
5/16" (7.9mm) x 24" (600mm) Square  
3/8" (9.5mm) x 24" (600mm) Square  
All 50 lb. bulk boxes

### PROCEDURES

Although not required, preheating at 800°F - 1050°F will equalize the expansion and contraction strain as well as promote easy machinability of the weld deposit. For welding, use a neutral flame. Flux is recommended to cleanse the joint area. Puddle the molten metal with the flame to eliminate porosity. Back-track with the torch to relieve any strain on the weld deposit. Allow the part to cool slowly.

## Copper-Base Welding Electrodes and Rods from AWS Specifications Suitable for Welding Cast Irons

Classification	Type	Specification	Characteristics and Uses
Cast Filler Metals (OFW)			
RBCuZn-A	Naval Bronze	A5.27	Naval Bronze - yellow; tin adds strength, corrosion resistance.
RBCuZn-B	Nickel Bronze	A5.27	Nickel Bronze - yellow; tin and manganese add strength, hardness and corrosion resistance
RBCuZn-C	Low Fuming Bronze	A5.27	Low-Fuming Bronze - yellow; silicon inhibits oxidation (fuming) of zinc.
Covered Electrodes (SMAW)			
ECuSn-A	Phosphor Bronze	A5.6	5 percent tin, hardens to 70-85 Brinell.
ECuSn-C	Copper-Tin	A5.6	8 percent tin, hardens to 85-100 Brinell.
ECuAl-A2	Copper-Aluminum	A5.6	Copper-aluminum electrodes deposit high strength, ductile weld metal; use for welding high-strength castings, surfacing

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