

# 2NI

Low Alloy Steel ■ AWS ER80S-Ni2

## KEY FEATURES

- Formulated to match the characteristics of weathering steel
- Developed for superior fracture toughness in as-welded joints in temperatures in the  $-60^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$ ) region

## WELDING POSITIONS

All

## SHIELDING GAS

100% Argon

## CONFORMANCES

AWS 5.28

ER80S-Ni2

## TYPICAL APPLICATIONS

- Storage Tanks
- Process Plants
- Pipework

## DIAMETERS / PACKAGING

Diameter mm (in)	5 kg (11 lb) Tube
2.4 (3/32)	T2NI-24

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.28

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf)		Hardness HV
				@-60°C (-76°F)	@-101°C (-150°F)	
<b>Requirements</b> AWS ER80S-Ni2	470 min	550 min	24 min	27 min	-	-
<b>Typical Results<sup>(3)</sup></b> As-Welded <sup>(4)</sup>	452	556	35	200	34	185

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.28

	%C	%Mn	%Si	%S
<b>Requirements</b> AWS ER80S-Ni2	0.06-0.12	0.8-1.25	0.40-0.80	0.025 max
<b>Typical Results<sup>(3)</sup></b>	0.08	1	0.5	0.010
	%P	%Cu	%Ni	
<b>Requirements</b> AWS ER80S-Ni2	0.025 max	0.35 max	2.0-2.75	
<b>Typical Results<sup>(3)</sup></b>	0.010	0.10	2.5	

## TYPICAL OPERATING PROCEDURES

Diameter mm (in)	Polarity	Amperage	Voltage
2.4 (3/32)	DC-	120A	14V

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer <sup>(4)</sup> Post Weld Heat Treated (PWHT) per AWS Specification

# 5CRMO

Low Alloy Steel ■ AWS ER80S-B6

## KEY FEATURES

- Developed for 5%Cr-0.50%Mo creep resisting steels
- Designed for high strength and improved corrosion resistance with hot hydrogen gas, super-heated steam, and Sulphur crude oil

## WELDING POSITIONS

All

## SHIELDING GAS

100% Argon

## CONFORMANCES

**AWS 5.28** ER80S-B6  
**BS EN ISO 21952-A** CrMo5Si

## TYPICAL APPLICATIONS

- Pressure Vessels
- Piping
- Heat Exchangers

## DIAMETERS / PACKAGING

Diameter mm (in)	5 kg (11 lb) Tube
2.4 (3/32)	T5CRMO-24
3.2 (1/8)	T5CRMO-32

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.28

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @20°C (68°F)	Hardness HV
<b>Requirements</b> AWS ER80S-B6	470 (68) min	590 (86) min	17 min	-	-
<b>Typical Results<sup>(3)</sup></b> As-Welded	530 (77)	640 (93)	28	240	195

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.28

	%C	%Mn	%Si	%S	%P
<b>Requirements</b> AWS ER80S-B6	0.03-0.10	0.40-0.70	0.30-0.50	0.02 max	0.02 max
<b>Typical Results<sup>(3)</sup></b>	0.07	0.5	0.4	0.01	0.01
	%Cr	%Ni	%Mo	%Cu	%V
<b>Requirements</b> AWS ER80S-B6	5.5-6.0	0.3 max	0.50-0.65	0.3 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	5.7	0.1	0.55	0.2	0.02

## TYPICAL OPERATING PROCEDURES

Diameter mm (in)	Polarity	Amperage	Voltage
2.4 (3/32)	DC-	140A	14V

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer

# 9CRMV-N

Low Alloy Steel ■ AWS ER90S-B9

## KEY FEATURES

- Improved long term creep properties
- Can weld equivalent (P91) 9CrMo steels

## WELDING POSITIONS

All

## CONFORMANCES

**AWS A5.28** ER90S-B9  
**BS EN ISO 21952-A** W CrMo91

## TYPICAL APPLICATIONS

- Power Plants
- Elevated Temperature Piping
- Turbine Castings
- Oil Refineries
- Coal Liquefaction Plants
- Gasification Plants

## DIAMETERS / PACKAGING

Diameter mm (in)	5 kg (11 lb) Tube
2.4 (3/32)	ED033377, T9CRMV-N-24*
3.2 (1/8)	ED033378, T9CRMV-N-32*

\*The Metrode part number will be replacing the current EDO numbers after the inventory has been depleted.

## MECHANICAL PROPERTIES<sup>(1)</sup> - As Required per AWS A5.28

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %		Charpy V-Notch J (ft·lbf) @ 20°C (68°F)	Hardness HV <sub>10</sub> <sup>(4)</sup>
			4.0 dia.	5.0 dia.		
<b>Requirements</b> AWS ER90S-B9	415 (60) min	620 (90) min	16 min	17 min	–	–
<b>Typical Results<sup>(3)</sup></b> Stress-Relieved @ 760°C (1400°F) for 2 hrs	675 (98)	780 (113)	22	19	220 (162)	265

## WIRE COMPOSITION<sup>(1)</sup> - As Required per AWS A5.28

	%C	%Mn	%Si	%S	%P	%Cr	%Ni
<b>Requirements</b> AWS ER90S-B9	0.08 - 0.13	0.40 - 0.80	0.15 - 0.50	0.010 max	0.010 max	8.5 - 9.5	0.40 - 0.80
<b>Typical Results<sup>(3)</sup></b>	0.10	0.50	0.25	0.006	0.008	8.7	0.60
	%Mo	%Nb	%V	%N	%Cu	%Al	
<b>Requirements</b> AWS ER90S-B9	0.85 - 1.10	0.03 - 0.08	0.15 - 0.25	0.03 - 0.07	0.10 max	0.40 max	
<b>Typical Results<sup>(3)</sup></b>	1.00	0.05	0.20	0.05	0.03	<0.01	

## TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in)	
	2.5 (3/32)	3.2 (1/8)
DC-	70 - 110	80 - 140

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry specific data, not required by AWS.  
 NOTE: Additional test data available upon request.

# LINCOLN® AK-10®

Low Alloy Steel ■ AWS ER100S-G

## KEY FEATURES

- Capable of producing welds with 690 MPa (100 ksi) tensile strength
- Suitable for use where consumables with less than 1% Ni are required
- Batch Managed Inventory
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

**AWS A5.28/A5.28M:** ER100S-G  
**ASME SFA-5.28:** ER100S-G

## TYPICAL APPLICATIONS

- NACE applications
- Oil tools
- Riser systems
- High-strength pipe

## TYPICAL BASE METALS

HY-80 or HY-100 per MIL-S-16216, A514 Grade B or P, AISI 4130 or 8620, API X-70 or X-80

## DIAMETERS / PACKAGING

Diameters in (mm)	10 lb. (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	ED034898
3/32 (2.4)	ED034899
1/8 (3.2)	ED034900

## WIRE COMPOSITION - As Required per AWS A5.28/A5.28M

	%C	%Mn	%Si	%Ni	%Mo	%Cr
<b>Requirements</b> - AWS ER100S-G	—	—	—	(A)	(A)	(A)
<b>Typical Results</b> <sup>(3)</sup>	0.10	1.55	0.57	0.88	0.48	0.27
	%S	%P	%V	%Al	%Cu	
<b>Requirements</b> - AWS ER100S-G	—	—	—	—	—	
<b>Typical Results</b> <sup>(3)</sup>	< 0.005	0.01	< 0.003	0.004	0.09	

(A) Must have the minimum of one or more of the following: 0.50% Ni, 0.30% Cr, or 0.20% Mo. <sup>(3)</sup>See test results disclaimer

# LINCOLN® ER80S-B2

Low Alloy Steel ■ AWS ER80S-B2

## KEY FEATURES

- Designed for welding 1.25% chromium, 0.5% molybdenum steels in high temperatures service applications such as pressure vessels or piping
- Designed for high temperature power generation applications
- Q2 Lot® - Certificates showing actual wire chemistry available online

## CONFORMANCES

**AWS A5.28/A5.28M:** ER80S-B2

**ASME SFA-5.28:** ER80S-B2

## TYPICAL APPLICATIONS

- Steam piping
- Turbine castings

## WELDING POSITIONS

All

## DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	ED034343
3/32 (2.4)	ED034344
1/8 (3.2)	ED034345

## WIRE COMPOSITION – As Required per AWS A5.28/A5.28M

	%C	%Mn	%Si	%Cr
<b>Requirements - AWS ER80S-B2</b>	0.07-0.12	0.45-1.00	0.05-0.30	1.00-1.75
	%Mo	%S	%P	%Cu
<b>Requirements - AWS ER80S-B2</b>	0.45-0.65	0.025	0.025	0.35

# LINCOLN® ER80S-D2

Low Alloy Steel ■ AWS ER70S-D2

## KEY FEATURES

- Capable of producing weld deposits with 550 MPA (80 KSI) tensile strength
- Contains 0.50% molybdenum for strength after stress valves
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

**AWS A5.28/A5.28M:** ER80S-D2  
**ASME SFA-5.28:** ER80S-D2

## TYPICAL APPLICATIONS

- Requirements for strengths after stress relieving
- ASTM A182, A217, A234 and A335 - High temperature service pipe, fittings, flanges and valves
- ASTM A336 pressure vessel forgings

## DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	ED034219
3/32 (2.4)	ED034220
1/8 (3.2)	ED034221

## WIRE COMPOSITION – As Required per AWS A5.28/A5.28M

	%C	%Mn	%Si	%S
<b>Requirements</b> - AWS ER80S-D2	0.07-0.12	1.60-2.10	0.50-0.80	0.025 max
	%P	%Cu <sup>(4)</sup>	%Ni	%Mo
<b>Requirements</b> - AWS ER80S-D2	0.025 max	0.50 max	0.15 max	0.40 max

<sup>(4)</sup>Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max.

# LINCOLN® ER80S-Ni1

Low Alloy Steel ■ AWS ER80S-Ni1

## KEY FEATURES

- Capable of producing weld deposits with 550 MPA (80 KSI) tensile strength
- High toughness at low temperatures with a nominal 1% Ni or less
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

**AWS A5.28/A5.28M:** ER80S-Ni1  
**ASME SFA-5.28:** ER80S-Ni1

## TYPICAL APPLICATIONS

- ASTM A588 weathering steel requiring good atmospheric corrosion resistance
- NACE applications

## DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	ED034346
3/32 (2.4)	ED034347
1/8 (3.2)	ED034348

## WIRE COMPOSITION – As Required per AWS A5.28/A5.28M

	%C	%Mn	%Si	%Ni	%Cr
<b>Requirements</b> - AWS ER80S-Ni1	0.12 max	1.25 max	0.40-0.80	0.80-1.10	0.15 max
<b>Typical Results</b> <sup>(3)</sup>	0.07-0.08	0.94-1.04	0.54-0.58	0.88-0.98	≤ 0.04
	%Mo	%S	%P	%V	%Cu (Total) <sup>(4)</sup>
<b>Requirements</b> - AWS ER80S-Ni1	0.035 max	0.025 max	0.025 max	0.05 max	0.35 max
<b>Typical Results</b> <sup>(3)</sup>	≤ 0.02	0.007-0.10	0.005-0.010	< 0.01	0.16-0.21

<sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max.

# LINCOLN® ER90S-B3

Low Alloy Steel ■ AWS ER90S-B3

## KEY FEATURES

- High strength filler metal used for precision welding of 2.25% Cr – 1% Mo high pressure piping, pressure vessels, and dissimilar combinations of Cr-Mo and carbon steels
- Designed to sustain elevated temperatures within demanding work environments
- Produced to the most stringent quality standards including AWS A.5.28 and ASME SFA-5.28
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.28/A5.28M:</b>	ER90S-B3
<b>ASME SFA-5.28</b>	ER90S-B3

## TYPICAL APPLICATIONS

- Power Generation, Nuclear Industries

## DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	ED034357
3/32 (2.4)	ED034358
1/8 (3.2)	ED034359

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.28/A5.28M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile MPa (ksi)	Elongation on 4d (%)	Charpy V-Notch @-28°C (-20°F) J (ft-lbf)	Hardness (Rockwell B)
<b>Requirements - AWS A5.28</b>	540 (78) min	620 (90) min	17 min	-	-
TIG (100% Argon)	575-620 (83-90)	690-725 (100-105)	22-24	250-264 (185-195)	95-97

## WIRE COMPOSITION<sup>(1)</sup> – As Required per AWS A5.28/A5.28M

	%C	%Mn	%Si	%S	%P	%Cr	%Ni	%Mo	%Cu
<b>Requirements AWS A5.28</b>	0.07-0.12	0.40-0.70	0.40-0.70	0.025 max	0.025 max	2.30-2.70	0.20 max	0.90-1.20	0.35 max
<b>Test Results<sup>(3)</sup></b>	0.10	0.56-0.58	0.53-0.54	0.003-0.004	0.005	2.4	0.03-0.04	1.02-1.04	0.06-0.08

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer



# TECHALLOY® 4130

Low Alloy Steel

## KEY FEATURES

- High strength, low alloy
- Preheat and inter-pass temperature of 400°F is required

## TYPICAL APPLICATIONS

- Joining steels of similar chemical composition
- Overlays where moderate hardness is required

## WELDING POSITIONS

All

## DIAMETERS / PACKAGING

Diameter in (mm)	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
1/16 (1.6)	TG4130062628
3/32 (2.4)	TG4130093628
1/8 (3.2)	TG4130125628

## WIRE COMPOSITION<sup>(1)</sup>

	%C	%Mn	%Si	%Fe	%Cr	%Mo	%Ni	%V
Typical Results <sup>(3)</sup>	0.31	0.52	0.28	Balance	0.93	0.20	-	-

## MECHANICAL PROPERTIES<sup>(1)</sup>

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %
Typical Results <sup>(3)</sup>	130,000 (900)	145,000 (1,000)	11

## TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
TIG	1/16 (1.6)	12-15	100-125	100% Ar
	3/32 (2.4)	15-20	125-175	
	1/8 (3.2)	15-20	175-250	

<sup>(1)</sup>Typical deposit composition. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer. Safety Data Sheets (SDS) are available on our website at [www.lincolnelectric.com](http://www.lincolnelectric.com)

# LINCOLN® ER70S-2

Mild Steel, Copper Coated ▪ AWS ER70S-2

## KEY FEATURES

- Contains zirconium, titanium, and aluminum in addition to silicon and manganese
- Produces x-ray quality welds over most surface conditions
- Recommended for TIG welding on all grades of steel
- Ink jet printing identification on entire length of electrode
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.18/A5.18M:</b>	ER70S-2
<b>ASME SFA-A5.18:</b>	ER70S-2
<b>CSA W48 CLASSIFICATION</b>	B-G 49A 3 CG2 (ER495-2)

## TYPICAL APPLICATIONS

- Repairs on a variety of mild and low alloy steel
- Small diameter pipe and tubing
- Sheet metal applications
- Root pass pipe welding

## DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Carton
1/16 (1.6)	ED033953*	ED034325	ED034328	ED034331
3/32 (2.4)	ED033953*	ED034326	ED034329	ED034332
1/8 (3.2)	ED033954*	ED034327	ED034330	ED034333
5/32 (4.0)			ED034810	

\*Tested Material

## WIRE COMPOSITION – As Required per AWS A5.18/A5.18M

	%C	%Mn	%S	%Si	%P	%Cu	%Cr
<b>Requirements - AWS ER70S-2</b>	0.07 max	0.90-1.40	0.035 max	0.40-0.70	0.0025 max	0.50 max	(1)
<b>Typical Results<sup>(2)</sup></b>	0.04	1.08	0.005	0.55	0.0003	0.20	0.08
	%Ni	%Mo	%V	%Al	%Ti	%Zr	
<b>Requirements - AWS ER70S-2</b>	(1)	(1)	(1)	0.05-0.15	0.05-0.15	0.02-0.12	
<b>Typical Results<sup>(2)</sup></b>	0.08	0.08	< 0.002	0.08	0.10	0.07	

<sup>(1)</sup>Total 0.50% maximum, combined. <sup>(2)</sup>See test results disclaimer

# LINCOLN® ER70S-6

Mild Steel, Copper Coated ▪ AWS ER70S-6

## KEY FEATURES

- High levels of manganese and silicon deoxidizers tolerate medium to heavy mill scale surfaces
- More puddle fluidity
- Excellent wetting action
- Ink jet printing identification on entire length of electrode
- Q2 Lot® - Certificates showing actual wire chemistry available online

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.18/A5.18M:</b>	ER70S-6
<b>ASME SFA-A5.18:</b>	ER70S-6
<b>CSA W48 CLASSIFICATION</b>	B-G 49A 3 CG6 (ER495-6)

## TYPICAL APPLICATIONS

- Repairs on a variety of mild and low alloy steel
- Small diameter pipe and tubing
- Sheet metal applications
- Root pass pipe welding

## DIAMETERS / PACKAGING

Diameter in (mm)	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Carton
1/16 (1.6)	ED034334	ED034337	ED034340
3/32 (2.4)	ED034335	ED034338	ED034341
1/8 (3.2)	ED034336	ED034339	ED034342
5/32 (4.0)		ED034781	

## WIRE COMPOSITION – As Required per AWS A5.18/A5.18M

	%C	%Mn	%S	%Si	%P
<b>Requirements</b> - AWS ER70S-6	0.06-0.15	1.40-1.85	0.035 max	0.80-1.15	0.025 max
<b>Typical Results</b> <sup>(2)</sup>	0.09	<1.60	0.007	0.90	0.007
	%Cu	%Cr	%Ni	%Mo	%V
<b>Requirements</b> - AWS ER70S-6	0.50 max	(1)	(1)	(1)	(1)
<b>Typical Results</b> <sup>(2)</sup>	0.20	0.05	0.05	0.05	0.05

<sup>(1)</sup>Total 0.50% maximum, combined. <sup>(2)</sup>See test results disclaimer

