

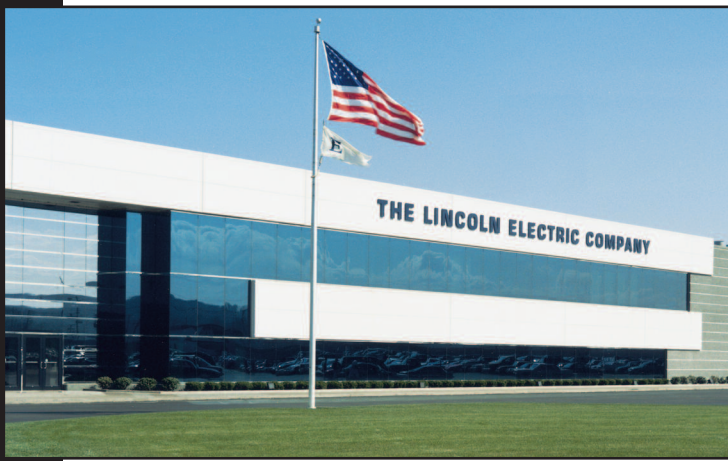


Stick Electrode Product Catalog

For Mild and Low Alloy Steels

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LINCOLN[®]
ELECTRIC
THE WELDING EXPERTS[®]



About The Lincoln Electric Company

Lincoln Electric is the world's leading manufacturer of welding equipment and consumables. Our focus is on helping companies make their welding operations more effective, more efficient, more profitable. We are dedicated to two equally important goals: exceptional quality and exceptional service. Our field support team — with hundreds of field sales engineers and thousands of knowledgeable and responsive Lincoln distributors in countries all over the world — is the largest in the industry. Innovative thinking. A quality, service-first attitude. Fresh approaches to design, manufacturing, and packaging. Worldwide strength. Choose Lincoln.

Lincoln's Stick Electrode

When great welders want great stick electrodes, they reach for Lincoln!

We know you're counting on your electrode. That's why we're so focused on making the welding industry's best-performing, most value-packed line of stick electrode products. Before Lincoln Electric's name goes onto it, Lincoln Electric's unparalleled welding expertise goes into it.

Better Performance

Great puddle control and puddle clarity. Excellent wash-in characteristics. Low spatter. Good restrikeability. Those are the qualities you want in your electrode. And when you choose Lincoln Electric stick products, those are the qualities you get.

Better Chemistry

At Lincoln, every bundle of incoming raw steel to be used in our electrode products is meticulously checked for nineteen different elements before it enters our manufacturing systems. Then, we verify the chemistry of our electrode at more than a dozen separate points during the manufacturing process.

Better Manufacturing Systems

Lincoln Electric's consumables are manufactured to standards for environmental and quality management systems. The result is consistently superior quality - time after time.



Better Product Breadth

With some forty distinct products to choose from, there's a great Lincoln Electric stick electrode for whatever your job demands. This catalog will help you choose the right electrode for your project. Your local Lincoln Distributor can also be an excellent resource for you as you match job characteristics with electrode qualities.

It All Adds Up To Better Value

Industry-leading engineering and performance with less waste equals improved productivity and higher product quality.

Built and Backed by the Best Welding Company on Earth

Lincoln Electric stick electrodes are engineered, manufactured and backed by the most respected welding company on the planet. When quality, consistency and value matter, the world's most demanding welding professionals demand products by Lincoln Electric.

Visit Our Website

Consumable AWS Certificates:
<http://www.lincolnelectric.com/products/certificates/>

Material Safety Data Sheets (MSDS):
<http://www.lincolnelectric.com/product/msds/>

ANSI Z49.1, E205 Safety Booklet, and other Arc Welding Safety Materials:
<http://www.lincolnelectric.com/community/safety/>

Safe Practices Article:
<http://www.lincolnelectric.com/knowledge/articles/content/lenstaybl.asp>

Contents **Page**

Introduction	2-3
Electrode Selection Guide	4-7
Stick Electrodes	
Fast Freeze, Out-of-Position	8-13
Fast Fill, High Deposition	14-15
Fill Freeze, High Speed	16-17
Low Hydrogen, Mild Steel	18-23
Low Hydrogen, Low Alloy Steel	24-33
Pipe Welding Electrodes	
Cellulosic	34-40
Basic, Low Hydrogen, Vertical Up	41-45
Basic, Low Hydrogen, Vertical Down	46-48
Appendix	
Packaging	49
Approvals	50
AWS Classifications	51
Electrode Selection Based on Joint Requirements	52
Storing and Re-drying Stick Electrodes	53-54
Lincoln Electric Sales Offices	55

STICK ELECTRODE SELECTION GUIDE

Electrode Name	AWS Classifications	Recommended Polarity	General Description	Page No.
Fast Freeze, Out-of-Position, Mild Steel Stick Electrodes				
Fleetweld® 5P	E6010	DC+	Fleetweld® 5P is a great choice for welding on dirty, rusty, greasy or painted steel – especially in vertical or overhead applications.	8
Fleetweld® 5P+	E6010	DC+	Lincoln's Fleetweld® 5P+ is ideal for steel that's less than clean. It's first choice for pipe welding, and vertical-up and overhead plate welding. This electrode is a long-time favorite among operators who handle cross-country and in-plant pipe welding.	9
Fleetweld® 180	E6011	AC DC±	Got a small AC welder? Here's your electrode! Fleetweld® 180 offers excellent arc stability for excellent performance with power sources as low as 50V open-circuit voltage (OCV). A great stick electrode with the ability to start easily on low open circuit voltage welders.	10
Fleetweld® 35	E6011	AC DC±	Operators consistently give this electrode high marks. This quality product is a proven performer for sheet metal welding applications and AC pipe welding. Fleetweld® 35 is a great electrode to use on jobs where the steel isn't clean.	11
Fleetweld® 35LS	E6011	AC DC±	Great for making tack welds under Innershield® deposits. Use Fleetweld® 35LS with confidence on plated, dirty, painted or greasy steel. It's an outstanding stick choice for AC pipe welding, for applications that require deep penetration, and in jobs where x-ray quality welds are required.	12
Fleetweld® 22	E6022	DC- AC	Developed specifically for floor decking and other applications where burnthrough spot welding on sheet metal is required. Fleetweld® 22 is great for galvanized or plated sheet steel, as well as on steel that is painted or dirty.	13
Fast-Fill, High Deposition, Mild Steel Stick Electrodes				
Jetweld® 1	E7024-1	AC DC±	When the project involves large welds, you can't pick a more user-friendly electrode! Operators appreciate Jetweld® 1's smooth bead and high deposition rates. A great general purpose electrode for single or multi-pass applications.	14
Jetweld® 2	E6027	AC DC±	When the job demands x-ray quality welds, high deposition rates, and excellent wash-in, reach for Jetweld® 2. We've designed Jetweld® 2 for peak performance on multiple pass welds, and fast-fill single pass welds.	15
Fill Freeze, High Speed, Mild Steel Stick Electrodes				
Fleetweld® 37	E6013	AC DC±	Here's a terrific all-position electrode for low amperage welding on sheet metal – especially in applications where appearance is important. We've designed Fleetweld® 37 for excellent performance with smaller AC welders with low open-circuit voltages. It's an excellent choice for jobs involving irregular or short welds that require a change in position.	16
Fleetweld® 47	E7014	AC DC±	Fleetweld® 47 features high deposition rates for fast performance. Operators love this easy-to-use, all-position electrode! Choose Fleetweld® 47 for sheet metal lap joints and fillet welds, general purpose plate welding and maintenance jobs.	17

STICK ELECTRODE SELECTION GUIDE

Electrode Name	AWS Classifications	Recommended Polarity	General Description	Page No.
Low Hydrogen, Mild Steel Stick Electrodes				
Excalibur® 7018 MR	E7018 H4R	DC+ AC	There's a long list of reasons why operators are so loyal to Excalibur® 7018 MR. They tell us they love the clean puddle, the square coating burnoff, the easy all-position handling and the excellent wash-in characteristics. It's a terrific choice for jobs that involve steels with poor weldability.	18
Excalibur® 7018-1 MR	E7018-1 H4R	DC+ AC	When the job involves critical, out-of-position welding, reach for Lincoln Electric's Excalibur® 7018-1 MR. It offers a beautifully clean weld puddle, uniform slag follow, and superior wash-in with no undercutting. Also great for welding on steels with marginal weldability.	19
Lincoln® 7018AC	E7018 H8	AC DC±	AC? DC? This electrode performs beautifully either way! Lincoln® 7018AC is a great choice for low open circuit voltage AC power sources. Cold restrikes are no problem with this versatile, all-position electrode.	20
Jetweld® LH®-70	E7018 H4R	DC+ AC	A top choice for welding on thick sections and restrained joints when cracking is an issue. It's also a good call when the project involves hard-to-weld steels. Jetweld® LH®-70 also offers high deposition rates.	21
Jet-LH® 78 MR	E7018 H4R	DC+ AC	Great for jobs on mild steel and some high-strength low-alloy steels. It also tolerates high sulfur and high silicon steels. Jet-LH® 78 MR features higher tensile strength for stress-relieved properties.	22
Excalibur® 7028	E7028 H8	DC+ AC	Excalibur® 7028 is a low hydrogen electrode designed for high deposition welding applications in the flat and horizontal positions. Excalibur® is Lincoln Electric's premium line of low hydrogen electrodes featuring excellent slag release, arc stability, resistance to starting porosity, and puddle control.	23
Low Hydrogen, Low Alloy Steel Stick Electrodes				
Excalibur® 7018-A1 MR	E7018-A1 H4R	DC+ AC	Excalibur® 7018-A1 MR is a low hydrogen stick electrode designed for all-position welding on 0.5% Molybdenum low alloy steels. Smooth arc, excellent strikeability, self-peeling slag and extremely low spatter levels of make Excalibur® electrodes the industry premium. For a low alloy, low hydrogen electrode with superior arc performance and operability - choose Excalibur® 7018-A1 MR.	24
Excalibur® 8018-B2 MR	E8018-B2 H4R	DC+ AC	Excalibur® 8018-B2 MR is a low hydrogen electrode designed for all-position welding on 1.25% Chrome, 0.5% Molybdenum low alloy steels. Smooth arc, excellent strikeability, self-peeling slag and extremely low spatter levels of make Excalibur® electrodes the industry premium. For a low alloy, low hydrogen electrode with superior arc performance and operability—choose Excalibur® 8018-B2 MR.	25
Excalibur® 8018-B2 XF MR	E8018-B2 H4R	DC+ AC	Excalibur® 8018-B2 XF MR is a low hydrogen stick electrode capable of producing low X-factor deposits (X<15) for welding of 1.25% chromium, 0.5% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode designed to resist temper embrittlement in high temperature service - choose Excalibur® 8018-B2 XF MR.	26
Excalibur® 8018-C1 MR	E8018-C1 H4R	DC+ AC	Excalibur® 8018-C1 MR is the ideal moisture resistant electrode for welding on equipment and pipe that transport liquid ammonia, propane and other gases. An excellent all position electrode for applications requiring a nominal 2-1/4% nickel deposit.	27

STICK ELECTRODE SELECTION GUIDE

Electrode Name	AWS Classifications	Recommended Polarity	General Description	Page No.
Low Hydrogen, Low Alloy Steel Stick Electrodes (cont.)				
Excalibur® 8018-C3 MR	E8018-C3 H4R	DC+ AC	Excalibur® 8018-C3 MR is a 1% nickel all position electrode for fabrication or repair of 1% nickel steels, as well as a wide variety of other low alloy and carbon steels.	28
Excalibur® 9018M MR	E9018-M H4R	DC+	Excalibur® 9018M MR is intended for welding high strength steels of 690 MPa (100 ksi) tensile strength and higher.	29
Excalibur® 9018-B3 MR	E9018-B3 H4R	DC+ AC	Excalibur® 9018-B3 MR is a low hydrogen electrode designed for all-position welding on 2.25% Chrome, 1% Molybdenum low alloy steels. Smooth arc, excellent strikeability, self-peeling slag and extremely low spatter levels of make Excalibur® electrodes the industry premium. For a low alloy, low hydrogen electrode with superior arc performance and operability – choose Excalibur® 9018-B3 MR.	30
Excalibur® 9018-B3 XF MR	E9018-B3 H4R	DC+ AC	Excalibur® 9018-B3 XF MR is a low hydrogen stick electrode capable of producing low X-factor deposits (X<15) for welding of 2.25% chromium, 1% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode designed to resist temper embrittlement in high temperature service – choose Excalibur® 9018-B3 XF MR.	31
Excalibur® 10018-D2 MR	E10018-D2 H4R	DC+ AC	Excalibur® 10018-D2 MR is a low hydrogen stick electrode designed for all-position welding of a variety of carbon-manganese, chromium-molybdenum and low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low hydrogen electrode capable of exceeding 690 MPa (100 ksi) tensile strength - choose Excalibur® 10018-D2 MR.	32
Excalibur® 11018M MR™	E11018M H4R	DC+ AC	Excalibur® 11018M MR™ is designed primarily for joining strength steel types in the as-welded or stress relieved conditions with excellent low temperature impact properties and robust welding procedures. All-position welding, except vertical down.	33
Pipe Welding Stick Electrodes - Cellulosic				
Shield-Arc® HYP+	E7010-P1	DC+	Tendency for “fingernailing” and electrode sticking have been virtually eliminated! Designed for all passes of API 5LX-52 through X-65 high strength pipe. Provides the welder with a clean, visible weld puddle and superior puddle control. A true E7010-P1 electrode.	34
Shield-Arc® 85	E7010-A1	DC+	Need a reliable, all-position stick electrode? Here's your electrode! Shield-Arc® 85 produces a 70,000 ksi, 1/2% molybdenum weld deposit for use on 1/2% molybdenum pipe steels and API 5LX-42 through X-56 line pipe.	35
Shield-Arc® 70+	E8010-G	DC+	Here's an electrode that makes short work of even the most challenging high silicon pipe applications! Shield-Arc® 70+ is an outstanding choice for API 5LX-56 through X-70 pipe, as well as for a wide range of sheet metal welding assignments.	36
Shield-Arc® 90	E9010-G	DC+	An all-position pipe electrode that's a great choice when the task is vertical down welding on API 5LX-70 through X-80 pipe. Shield-Arc® 90 also performs well in situations where low hydrogen processes are not practical, and when welding on dirty steels.	37
Pipelinor® 6P+	E6010	DC+	Pipelinor® 6P+ sets the standard for root pass welding in the pipeline industry. It is recommended for root pass welding in either vertical up or vertical down welding positions of up to X80 grade pipe as well as hot, fill and cap pass welding of up to X60 grade pipe. For all position pipe welding – choose Pipelinor® 6P+.	38

ELECTRODE SELECTION GUIDE

Electrode Name	AWS Classifications	Recommended Polarity	General Description	Page No.
<i>Pipe Welding Stick Electrodes - Cellulosic (cont.)</i>				
Pipeliner® 7P+	E7010-P1	DC+	Pipeliner® 7P+ allows for increased fill capabilities resulting in fewer fill passes. It is capable of meeting stringent pipeline welding requirements when tested for low temperature impact toughness. It is recommended for root pass welding of up to X80 grade pipe, and hot, fill and cap pass welding of up to X65 grade pipe. For vertical down pipe welding – choose Pipeliner® 7P+.	39
Pipeliner® 8P+	E8010-P1	DC+	Pipeliner® 8P+ is the highest strength cellulosic electrode in the Lincoln Pipeliner® family and allows for increased fill capabilities resulting in fewer fill passes. It is recommended for root pass welding of up to X80 grade pipe, and hot, fill and cap pass welding of up to X70 grade pipe. For vertical down pipe welding – choose Pipeliner® 8P+.	40
<i>Pipe Welding Stick Electrodes - Basic, Low Hydrogen, Vertical Up</i>				
Pipeliner® 16P	E7016 H4	DC± AC	Pipeliner® 16P has unique properties that enable low hydrogen SMAW root passes meeting strict pipe welding requirements. It is recommended for root pass welding of up to X100 grade pipe. For vertical up pipe welding – choose Pipeliner® 16P.	41
Pipeliner® 17P	E7018-1 H4R	DC+ AC	Pipeliner® 17P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X65 grade pipe. For vertical up pipe welding – choose Pipeliner® 17P.	42
Pipeliner® 18P	E8018-G H4R	DC+ AC	Pipeliner® 18P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X70 grade pipe. For vertical up pipe welding – choose Pipeliner® 18P.	43
Pipeliner® 19P	E10018-G H4R	DC+ AC	Pipeliner® 19P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X80 grade pipe. For vertical up pipe welding – choose Pipeliner® 19P.	44
Pipeliner® 20P	E12018-G H4R	DC+ AC	Pipeliner® 20P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass vertical up welding of up to X100 grade pipe. For vertical up pipe welding – choose Pipeliner® 20P.	45
<i>Pipe Welding Stick Electrodes - Basic, Low Hydrogen, Vertical Down</i>				
Pipeliner® LH-D80	E8045-P2 H4R	DC+	Pipeliner® LH-D80 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X70 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D80.	46
Pipeliner® LH-D90	E9045-P2 H4R	DC+	Pipeliner® LH-D90 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X80 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D90.	47
Pipeliner® LH-D100	E10045-P2 H4R	DC+	Pipeliner® LH-D100 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X90 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D100.	48

Fleetweld® 5P

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode (AWS E6010)

Fleetweld® 5P is a great choice for welding on dirty, rusty, greasy or painted steel – especially in vertical or overhead applications.

Key Features

- All-position, particularly good for vertical and overhead.
- Light slag with little slag interference for easy arc control.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, out-of-position.
- Manufactured under a quality system certified to ISO 9001 requirements.

Typical Applications

- Tolerates galvanized, plated, dirty, painted or greasy steel which cannot be completely cleaned.
- Pipe welding – cross country and in-plant.
- Joints requiring deep penetration such as square edge butt welds.
- Repair welding.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-5.1	E6010
ABS	E6011
Lloyd's	Grade 3M
CSA W48	E4310

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	40 - 70	75 - 130	90 - 175	140 - 225	200 - 275	220 - 325

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Carton	10 lb (4.5 kg) Easy Open Cans 30 lb (13.6 kg) Carton	50 lb (22.7 kg) Carton
3/32 (2.4)	12 (300)	ED032402	ED032561	ED010211
1/8 (3.2)	14 (350)	ED032403	ED032562	ED010203
5/32 (4.0)	14 (350)		ED032563	ED010216
3/16 (4.8)	14 (350)			ED010207
7/32 (5.6)	14 (350)			ED010219
1/4 (6.4)	14 (350)			ED010200

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6010	48,000 (331) min.	60,000 (414) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	48,000 - 67,000 (331 - 460)	60,000 - 76,000 (414 - 524)	22 - 33	20 - 71 (27 - 96)
Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	48,000 - 61,000 (331 - 420)	62,000 - 69,000 (427 - 475)	28 - 36	50 - 55 (68 - 75)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P
Requirements AWS E6010	Not Specified				
Typical Performance⁽²⁾	0.08 - 0.15	0.35 - 0.55	0.15 - 0.25	0.010 - 0.020	0.005 - 0.010

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Fleetweld® 5P+

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode (AWS E6010)

Lincoln's Fleetweld® 5P+ is ideal for steel that's less than clean. It's a first choice for pipe welding, and vertical-up and overhead plate welding. This electrode is a long-time favorite among operators who handle cross-country and in-plant welding.

Key Features

- Truly all-position, particularly good for vertical and overhead.
- Light slag with little slag interference for easy arc control. Easy slag removal, smooth bead.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, out-of-position.
- Better bead appearance and slag removal compared to Fleetweld® 5P.
- Manufactured under a quality system certified to ISO 9001 requirements.

Typical Applications

- Tolerates galvanized, plated, dirty, painted or greasy steel which cannot be completely cleaned.
- Pipe welding – cross country and in-plant.
- Repair welding.
- Joints requiring deep penetration such as square edge butt welds.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-5.1	E6010
ABS	E6010
CSA W48	E4310

TYPICAL OPERATING PROCEDURES

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

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Cans	50 lb (22.7 kg) Easy Open Cans
		30 lb (13.6 kg) Carton	
3/32 (2.4)	12 (300)	ED032564	ED010283
1/8 (3.2)	14 (350)	ED032565	ED010278
5/32 (4.0)	14 (350)	ED032566	ED010285
3/16 (4.8)	14 (350)		ED010281

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6010	48,000 (331) min.	60,000 (414) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	48,000 - 76,000 (331 - 524)	60,000 - 86,200 (414 - 594)	22 - 33	20 - 63 (27 - 85)
Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	51,000 - 64,000 (352 - 441)	67,000 - 78,000 (462 - 538)	30 - 34	45 - 53 (61 - 72)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P
Requirements AWS E6010	Not Specified			—	—
Typical Performance⁽²⁾	0.10 - 0.20	0.40 - 0.65	0.11 - 0.30	0.009 - 0.020	0.005 - 0.025

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Fleetweld® 180

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode (AWS E6011)

Got a small AC welder? Here's your electrode! Fleetweld® 180 offers excellent arc stability for excellent performance with power sources as low as 50V open-circuit voltage (OCV). A great stick electrode with the ability to start easily on low open circuit voltage welders.

Key Features

- An all-position electrode particularly good for vertical and overhead welding.
- Light slag with little slag interference for easy arc control.
- Deep penetration with high admixture.
- Manufactured under a quality system certified to ISO 9001 requirements.

Typical Applications

- Great for use with small AC welders.
- Excellent for sheet metal welding on edge, corner and butt joints.
- Plated, dirty, painted or greasy steel which cannot be completely cleaned.
- All-position welding.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-5.1	E6011
CSA W48	E4311

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
AC	40 - 90	60 - 120	115 - 150
DC+	40 - 80	55 - 110	105 - 135
DC-	40 - 80	55 - 110	105 - 135

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	1 lb (0.5 kg) Tube	5 lb (2.3 kg) Plastic Tube	50 lb (22.7 kg) Easy Open Cans
		6 lb (2.7 kg) Carton	20 lb (9.1 kg) Carton	
3/32 (2.4)	12 (300)	ED031152	ED032448	ED010110
1/8 (3.2)	14 (350)	ED031722	ED032449	ED010105
5/32 (4.0)	14 (350)			ED010114

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6011	48 (331) min.	60 (414) min.	22 min	20 (27) min.
Typical Performance⁽²⁾ As-welded	48 - 70 (331 - 480)	60 - 84 (414 - 579)	22 - 35	20 - 53 (27 - 72)

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P
Requirements AWS E6011	Not Specified				
Typical Performance⁽²⁾	0.10 - 0.18	0.40 - 0.70	0.25 - 0.50	0.005 - 0.020	0.005 - 0.015

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Fleetweld® 35

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode (AWS E6011)

Operators consistently give this electrode high marks. This quality Lincoln product is a proven performer for sheet metal welding applications and AC pipe welding. Fleetweld® 35 is a great electrode to use on jobs where the steel isn't clean.

Key Features

- A general purpose electrode particularly good for vertical and overhead welding.
- Light slag with little slag interference for easy arc control.
- Deep penetration with high admixture.
- Capable of x-ray quality welds, even out-of-position.

Typical Applications

- Excellent for sheet metal welding on edge, corner and butt joints.
- Plated, dirty, painted or greasy steel which cannot be completely cleaned.
- Pipe welding – in-plant, and non-critical small pipe.
- All-position welding.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-5.1	E6011
ABS	E6011
Lloyd's	Grade 3M

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
AC	50 - 85	75 - 120	90 - 160	120 - 200	150 - 260	190 - 300
DC+	40 - 75	70 - 110	80 - 145	110 - 180	135 - 235	170 - 270
DC-	40 - 75	70 - 110	80 - 145	110 - 180	135 - 235	170 - 270

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Carton
3/32 (2.4)	14 (350)	ED028152
1/8 (3.2)	14 (350)	ED028153
5/32 (4.0)	14 (350)	ED028154
3/16 (4.8)	14 (350)	ED028155
7/32 (5.6)	18 (450)	ED032301
1/4 (6.4)	18 (450)	ED028157

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6011	48 (331) min.	60 (414) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	48 - 63 (331 - 441)	60 - 78 (414 - 538)	22 - 34	20 - 76 (27 - 103)
Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	46 - 56 (317 - 386)	60 - 66 (414 - 455)	28 - 36	—

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P
Requirements AWS E6011	Not Specified				
Typical Performance⁽²⁾	0.12 - 0.18	0.45 - 0.60	0.14 - 0.20	0.003 - 0.015	0.005 - 0.015

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Fleetweld® 35

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode (AWS E6011)

Great for making tack welds under Innershield® deposits. Use Fleetweld® 35LS with confidence on plated, dirty, painted or greasy steel. It's an outstanding stick choice for AC pipe welding, for applications that require deep penetration, and in jobs where x-ray quality welds are required.

Key Features

- A general purpose electrode particularly good for vertical and overhead welding.
- Light slag with little slag interference for easy arc control.
- Deep penetration with high admixture.
- Capable of x-ray quality welds, even out-of-position.

Typical Applications

- Galvanized, plated, dirty, painted or greasy steel which cannot be completely cleaned.
- Pipe welding – in-plant, and non-critical small pipe.
- Vertical up and overhead welding.
- Joints requiring deep penetration such as square edge groove welds.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-5.1	E6011
CSA W48	E4311

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)	
	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
AC	80 - 130	120 - 160
DC+	70 - 120	110 - 150
DC-	70 - 120	110 - 150

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Carton
1/8 (3.2)	14 (350)	ED028158
5/32 (4.0)	14 (350)	ED028159

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6011	48 (331) min.	60 (414) min.	22 min	20 (27) min.
Typical Performance⁽²⁾ As-welded	48 - 54 (331 - 379)	60 - 67 (414 - 465)	22 - 34	20 - 50 (27 - 68)
Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	46 - 51 (317 - 352)	60 - 65 (414 - 448)	28 - 33	—

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P
Requirements AWS E6011	Not Specified				
Typical Performance⁽²⁾	0.07 - 0.11	0.55 - 0.65	0.06 - 0.09	0.15 max.	0.15 max.

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Fleetweld® 22

Fast Freeze, Out-of-Position, Mild Steel Stick Electrode. (AWS E6022)

Developed specifically for floor decking and other applications where burnthrough spot welding on sheet metal is required. Fleetweld® 22 is great for galvanized or plated sheet steel, as well as on steel that is painted or dirty.

Key Features

- Light slag with little slag interference for easy arc control.
- Deep penetration with high admixture.

Typical Applications

- Designed specifically for floor decking to beams with burnthrough spot welds and similar applications.
- Galvanized, plated, dirty, painted or greasy sheet steel which cannot be completely cleaned.
- Joints requiring deep penetration such as square edge butt welds.

Welding Positions

Flat and Horizontal

Conformance

AWS A5.1/A5.1M: 2004	E6022
ASME SFA-5.1	E6022

TYPICAL OPERATING PROCEDURES		
Polarity	Current (Amps)	
	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC-	110 - 150	150 - 180
AC	110 - 150	150 - 180

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING		
Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Carton
1/8 (3.2)	14 (350)	ED021896
5/32 (4.0)	14 (350)	ED021895

MECHANICAL PROPERTIES ⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004			
	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Longitudinal Bend Test
Requirements AWS E6022	Not Specified	60 (414) min.	Required
Typical Performance⁽²⁾ As-welded	—	60 - 82 (414 - 565)	Pass

DEPOSIT COMPOSITION ⁽¹⁾					
	%C	%Mn	%Si	%S	%P
Requirements AWS E6022	Not Specified				
Test Results⁽²⁾	0.17	0.93	0.02	0.009	0.03

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Jetweld® 1

Fast Fill, High Deposition, Mild Steel Stick Electrode (AWS E7024-1)

When the project involves large welds, you can't pick a more user-friendly electrode! Operators appreciate Jetweld® 1's smooth bead and high deposition rates. A great general purpose electrode for single or multi-pass applications.

Key Features

- Excellent deposition rates.
- Smooth beads with minimal spatter.
- Easy slag removal.
- Shallow penetration for minimum dilution.

Typical Applications

- Best choice when large welds are required.
- Flat and slightly downhill (15° max.) positions.
- For multiple pass welds including fillets and deep groove joints.
- Impacts @ 0°F (-18°C).

Welding Positions

Flat and Horizontal

Conformance

AWS A5.1/A5.1M: 2004	E7024-1
ASME SFA-5.1	E7024-1
ABS	E7024-1
Lloyd's	Grade 1M
DNV	Grade 1
GL	Grade 1
BV	Grade 1
CSA W48	E4924-1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)				
	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
AC	115 - 175	180 - 240	240 - 300	300 - 380	340 - 440
DC+	100 - 160	160 - 215	220 - 280	270 - 340	320 - 400
DC-	100 - 160	160 - 215	220 - 280	270 - 340	320 - 400

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Carton
1/8 (3.2)	14 (350)	ED010362
5/32 (4.0)	14 (350)	ED010372
3/16 (4.8)	18 (450)	ED010366
7/32 (5.6)	18 (450)	ED010375
1/4 (6.4)	18 (450)	ED010360

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7024-1 (As-welded)	58 (399) min.	70 (482) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	58 - 79 (399 - 545)	70 - 86 (482 - 593)	22 - 31	20 - 44 (27 - 60)
Stress-Relieved⁽³⁾ 1 hr @ 1150°F (620°C)	63 - 66 (434 - 455)	74 - 79 (510 - 545)	23 - 27	25 - 35 (34 - 47)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V
Requirements AWS E7024-1	Not Specified	1.25 max.	0.90 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.
Typical Performance⁽²⁾	0.05 - 0.10	0.70 - 1.00	0.30 - 0.90	0.005 - 0.020	0.010 - 0.020	0.01 - 0.06	<0.01	0.05 - 0.17	0.01 - 0.03

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Jetweld® 2

Fast Fill, High Deposition, Mild Steel Stick Electrode (AWS E6027)

When the job demands x-ray quality welds, high deposition rates, and excellent wash-in, reach for Jetweld® 2. We've designed Jetweld® 2 for peak performance on multiple pass welds, and fast-fill single pass welds.

Key Features

- Excellent deposition rates.
- Smooth beads with minimal spatter.
- Easy slag removal.
- Shallow penetration for minimum dilution.

Typical Applications

- Made especially for welding mild steels.
- Flat and horizontal positions.
- For multiple pass welds including fillets and deep groove welds.
- "Fast-Fill" single pass welds such as production fillets.

Welding Positions

Flat and Horizontal

Conformance

AWS A5.1/A5.1M: 2004	E6027
ASME SFA-5.1	E6027
ABS	E6027
Lloyd's	Grade 3M
DNV	Grade 3
GL	Grade 3
BV	Grade 3
CWB	E4327

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	1/4 in. (6.4 mm)
AC	190 - 240	250 - 300	350 - 450
DC+	175 - 215	230 - 270	315 - 405
DC-	175 - 215	230 - 270	315 - 405

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Carton
5/32 (4.0)	14 (350)	ED010502
3/16 (4.8)	18 (450)	ED010501
1/4 (6.4)	18 (450)	ED010500

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E6027 (As-welded)	48 (331) min.	60 (414) min.	22 min	20 (27) min.
Typical Performance⁽²⁾ As-welded	48 - 60 (331 - 414)	60 - 72 (414 - 496)	22 - 35	20 - 54 (27 - 73)
Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	50 - 59 (344 - 407)	62 - 70 (427 - 480)	25 - 32	—

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P
Requirements AWS E6027	Not Specified				
Typical Performance	0.05 - 0.10	0.65 - 0.95	0.15 - 0.30	0.010 - 0.025	0.015 - 0.025

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Fleetweld® 37

Fill Freeze, High Speed Mild Steel Stick Electrode (AWS E6013)

Here's a terrific all-position electrode for low amperage welding on sheet metal – especially in applications where appearance is important. We've designed Fleetweld® 37 for excellent performance with smaller AC welders with low open-circuit voltages. It's an excellent choice for jobs involving irregular or short welds that require a change in position.

Key Features

- An all-position electrode for the welding of mild steel.
- Excellent choice for sheet metal lap and fillet welds.
- Superior slag control which makes it a great choice for vertical down.

Typical Applications

- Sheet metal lap and fillet welds.
- Irregular or short welds that change direction or position, and downhill fillets and laps.
- General purpose plate welding and maintenance.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6013
ASME SFA-5.1	E6013
ABS	E6013
Lloyd's	Grade 3M
DNV	Grade 1
GL	Grade 1
BV	Grade 1
CSA W48	E4313

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	1/16 in. (1.6 mm)	5/64 in. (2.0 mm)	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
AC	20 - 45	50 - 80	75 - 105	110 - 150	160 - 200	205 - 260
DC+	20 - 45	45 - 75	70 - 95	100 - 135	145 - 180	190 - 235
DC-	20 - 45	45 - 75	70 - 95	100 - 135	145 - 180	190 - 235

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	1 lb (.05 kg) Tube	5 lb (2.3 kg) Plastic Tube	10 lb (4.5 kg) Easy Open Can	50 lb (22.7 kg) Carton
		6 lb (2.7 kg) Carton	20 lb (9.1 kg) Carton	30 lb (13.6 kg) Carton	
5/64 (2.0)	12 (300)				ED010170
3/32 (2.4)	12 (300)	ED031726	ED032450	ED032573	ED010161
1/8 (3.2)	14 (350)	ED031727	ED032451	ED032574	ED010153
5/32 (4.0)	14 (350)				ED010165
3/16 (4.8)	14 (350)				ED010156

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)
Requirements AWS E6013 As-welded	48 (331) min.	60 (414) min.	17 min.
Typical Performance⁽²⁾ As-welded	48 - 70 (331 - 482)	60 - 78 (414 - 538)	25 - 32

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P
Requirements AWS E6013	Not Specified				
Typical Performance⁽²⁾	0.05 - 0.10	0.35 - 0.50	0.15 - 0.25	0.005 - 0.020	0.005 - 0.020

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Fleetweld® 47

Fill Freeze, High Speed Mild Steel Stick Electrode (AWS E7014)

Fleetweld® 47 features high deposition rates for fast performance. Operators love this easy-to-use, all-position electrode! Choose Fleetweld® 47 for sheet metal lap joints and fillet welds, general purpose plate welding and maintenance jobs.

Key Features

- An all-position electrode for the welding of mild steel.
- Easy to use with excellent operator appeal.
- Excellent choice for sheet metal lap joints and fillet welds, especially diameters up to 3/16" (4.8 mm).

Typical Applications

- Sheet metal lap and fillet welds.
- Generally used for thicker steel than E6012 and E6013 electrodes.
- General purpose and maintenance welding.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E7014
ASME SFA-5.1	E7014
ABS	E7014
Lloyd's	Grade 1M
DNV	Grade 1
GL	Grade 1
BV	Grade 1
CSA W48	E4914

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
AC	80 - 100	110 - 160	150 - 225	200 - 280
DC+	75 - 95	100 - 145	135 - 200	185 - 235
DC-	75 - 95	100 - 145	135 - 200	185 - 235

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	1 lb (.05 kg) Tube 6 lb (2.7) Carton	5 lb (2.3 kg) Plastic Tubes 20 lb (9.1 kg) Carton	50 lb (22.7 kg) Carton
3/32 (2.4)	14 (350)	ED031713	ED032452	ED010189
1/8 (3.2)	14 (350)	ED031153	ED032453	ED010183
5/32 (4.0)	14 (350)			ED010193
3/16 (4.8)	14 (350)			ED010186

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A1.5/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)
Requirements AWS E7014 (As-welded)	58 (399) min.	70 (482) min.	17 min.
Typical Performance⁽²⁾ As-welded	58 - 74 (399 - 510)	70 - 83 (482 - 572)	17 - 29
Stress-Relieved⁽³⁾ 1 hr @ 1150°F (620°C)	55 - 70 (379 - 482)	67 - 77 (461 - 530)	24 - 30

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V
Requirements AWS E7014	Not Specified	1.25 max.	0.90 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.
Typical Performance⁽²⁾	0.06 - 0.11	0.25 - 0.55	0.40 - 0.65	0.01 - 0.02	0.005 - 0.010	0.02 - 0.06	0.005 - 0.02	0.02 - 0.10	0.01 - 0.02

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 7018 MR

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018 H4R)

There's a long list of reasons why operators are so loyal to Excalibur® 7018 MR. They tell us they love the clean puddle, the square coating burnoff, the easy all-position handling and the excellent wash-in characteristics. It's a terrific choice for jobs that involve steels with poor weldability.

Key Features

- Designed for welding mild steel, low alloy steels and steels of poor weldability.
- Capable of x-ray quality welds.
- Ability to tie-in to side walls without undercutting, especially for critical out-of-position applications.
- Clean weld puddle and uniform slag follow, make it easy for the welder to "see" and carry the puddle.

Typical Applications

- Structural steel and bridges.
- All-position welding of mild steels, some high strength, low alloy steels.
- Tolerates steels with poor weldability, such as high sulfur and high silicon steels.
- Welding of piping, fittings, and tie-ins in the petrochemical and power generation industries.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018, E7018 H4R
ASME SFA-5.1	E7018, E7018 H4R
ABS	E7018M, 3, 3YH5
Lloyd's	3M, 3YMH5
DNV	3YH5
GL	3YH5
BV	3YHHH
CSA W48	E4918

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300	250 - 330	300 - 400
AC	80 - 120	100 - 160	140 - 210	200 - 300	270 - 370	325 - 420

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	1 lb (.05 kg) Tube	10 lb (4.5 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
		6 lb (2.7 kg) Carton	30 lb (13.6 kg) Carton	
3/32 (2.4)	14 (350)	ED032086	ED032588	ED028280
1/8 (3.2)	14 (350)	ED031468	ED032589	ED028281
5/32 (4.0)	14 (350)	ED032087	ED032590	ED028282
3/16 (4.8)	14 (350)			ED028283
7/32 (5.6)	18 (450)			ED028917
1/4 (6.4)	18 (450)			ED028918

MECHANICAL PROPERTIES - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7018 H4R	58 (399) min.	70 (482) min.	22 min	20 (27) min.
Typical Performance⁽¹⁾ As-welded	58 - 74 (399 - 510)	70 - 87 (482 - 600)	22 - 35	20 - 220 (27 - 298)
Stress-Relieved⁽²⁾ 1 hr @ 1150°F (620°C)	56 - 64 (386 - 441)	72 - 74 (496 - 510)	32 - 38	204 - 263 (276 - 356)

DEPOSIT COMPOSITION - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V	Diffusible Hydrogen mL/100g weld deposit
Requirements AWS E7018 H4R	Not Specified	1.60 max.	0.75 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.	4 max.
Typical Performance⁽¹⁾	0.04 - 0.08	1.15 - 1.50	0.30 - 0.65	0.005 - 0.015	0.010 - 0.020	0.01 - 0.05	0.01 - 0.05	0.01 - 0.05	0.001 - 0.010	2 - 3

⁽¹⁾ See test results disclaimer on page 54. ⁽²⁾ Data provided for information only – not part of AWS classification.

Excalibur® 7018-1 MR

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018-1 H4R)

When the job involves critical, out-of-position welding, reach for Lincoln Electric's Excalibur® 7018-1 MR. It offers a beautifully clean weld puddle, uniform slag follow, and superior wash-in with no undercutting. Also great for welding on steels with marginal weldability.

Key Features

- Designed for welding mild steel, low alloy steels and steels of poor weldability.
- Capable of x-ray quality welds.
- Ability to tie-in to side walls without undercutting, especially for critical out-of-position applications.
- Clean weld puddle and uniform slag follow, make it easy for the welder to "see" and carry the puddle.

Typical Applications

- Structural steel and bridges.
- All-position welding of mild steels, some high strength, low alloy steels and applications requiring -50°F (-45°C) toughness properties.
- Tolerates steels with poor weldability, such as high sulfur and high silicon steels.
- Welding of piping, fittings, and tie-ins in the petrochemical and power generation industries.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018-1, E7018-1 H4R
ASME SFA-5.1	E7018-1, E7018-1 H4R
ABS	E7018M, 3, 3YH5
Lloyd's	3M, 3YMH5
DNV	3YH5
GL	3YH5
BV	3YHHH
CSA W48	E4918

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300	250 - 330	300 - 400
AC	80 - 120	100 - 160	140 - 210	200 - 300	270 - 370	325 - 420

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Cans	50 lb (22.7 kg) Easy Open Can
		30 lb (13.6 kg) Carton	
3/32 (2.4)	14 (350)	ED032591	ED028700
1/8 (3.2)	14 (350)	ED032592	ED028702
5/32 (4.0)	14 (350)		ED028704
3/16 (4.8)	14 (350)		ED028706
7/32 (5.6)	18 (450)		ED028919
1/4 (6.4)	18 (450)		ED028920

MECHANICAL PROPERTIES - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -50°F (-46°C)
Requirements AWS E7018-1 H4R	58 (399) min.	70 (482) min.	22 min.	20 (27) min.
Typical Performance⁽¹⁾ As-welded	58 - 79 (399 - 545)	70 - 91 (482 - 627)	22 - 35	20 - 130 (27 - 176)
Stress-Relieved⁽²⁾ 1 hr @ 1150°F (620°C)	56 - 72 (386 - 496)	73 - 86 (503 - 593)	29 - 36	125 - 263 (169 - 356)

DEPOSIT COMPOSITION - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V	Diffusible Hydrogen mL/100g weld deposit
Requirements AWS E7018-1 H4R	Not Specified	1.60 max.	0.75 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.	4 max.
Typical Performance⁽¹⁾	0.04 - 0.08	0.80 - 1.50	0.20 - 0.65	0.005 - 0.015	0.010 - 0.020	0.01 - 0.05	0.08 - 0.25	0.01 - 0.05	0.001 - 0.010	2 - 3

⁽¹⁾ See test results disclaimer on page 54. ⁽²⁾ Data provided for information only – not part of AWS classification.

Lincoln® 7018AC

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018 H8)

AC? DC? This electrode performs beautifully either way! Lincoln® 7018AC is a great choice for low open circuit voltage AC power sources. Cold restrikes are no problem with this versatile, all-position electrode.

Key Features

- Designed for welding, mild steel and many low alloy steels.
- All-position welding with good deposit rates.
- Flat or slightly convex beads have distinct ripples with little spatter.
- Good low current and low open circuit voltage operation.

Typical Applications

- Excellent for tack and skip welds because of easy restriking.
- General purpose low hydrogen electrode for AC application.
- Single-pass fillet welds on mild steel plate.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018
ASME SFA-5.1	E7018
CSA W48	E4918

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
AC	75 - 120	105 - 150	130 - 200
DC+	70 - 115	100 - 140	120 - 185

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	1 lb (0.5 kg) Tube	5 lb (2.3 kg) Plastic Tubes	50 lb (22.7 kg) Easy Open Can
		60 lb (2.7 kg) Carton	20 lb (9.1 kg) Carton	
3/32 (2.4)	14 (350)	ED031714	ED032454	ED031732
1/8 (3.2)	14 (350)	ED031715	ED032455	ED031734
5/32 (4.0)	14 (350)			ED031738

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7018 H8	58 (399) min.	70 (482) min.	22 min	20 (27) min.
Typical Performance⁽²⁾ As-welded	58 - 86 (399 - 593)	70 - 87 (482 - 600)	22 - 32	20 - 56 (27 - 76)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E7018 H8	Not Specified	1.60 max.	0.75 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.	8 max.
Typical Performance⁽²⁾	0.04 - 0.06	1.10 - 1.50	0.20 - 0.50	0.005 - 0.015	0.010 - 0.020	0.02 - 0.05	0.01 - 0.03	0.01 - 0.05	0.01 - 0.03	2 - 4

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Jetweld® LH-70

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018 H4R)

A top-choice electrode for welding on thick sections and restrained joints when cracking is an issue. It's also a good call when the project involves hard-to-weld steels. Jetweld® LH-70 also offers high deposition rates.

Key Features

- Designed for welding, mild steel and high strength low alloy steels. Also, tolerates high sulfur and high silicon steels, which have poor weldability.
- Capable of x-ray quality welds and excellent notch toughness.
- Low hydrogen may reduce the need for preheat or postheat.
- Shipped in hermetically sealed containers, which can be stored indefinitely in normal conditions, without danger of moisture pickup.

Typical Applications

- Structural steel and bridges.
- Thick sections and restrained joints when shrinkage tends to cause weld cracking.
- Cold rolled steel.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-5.1	E7018 H4R
ABS	E7018
Lloyd's	3M, 3YMH5
DNV	3Y40H5
GL	3YH5
BV	3YHHH
Military	MIL-E-22200/1; MIL-7018
CSA W48	E4918-1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	70 - 100	90 - 150	120 - 190	170 - 280		
AC	80 - 120	110 - 170	135 - 225	200 - 300		
AC DC+					260 - 380 210 - 330	325 - 440 290 - 430

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED010568
1/8 (3.2)	14 (350)	ED010561
5/32 (4.0)	14 (350)	ED010575
3/16 (4.8)	14 (350)	ED010564
7/32 (5.6)	18 (450)	ED010577
1/4 (6.4)	18 (450)	ED010558

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7018 H4R	58 (399) min.	70 (482) min.	22 min.	20 (27) min.
Typical Performance⁽¹⁾ As-welded	58 - 77 (399 - 530)	70 - 87 (482 - 600)	22 - 34	20 - 158 (27 - 214)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E7018 H4R	Not Specified	1.60 max.	0.75 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.	4 max.
Typical Performance⁽¹⁾	0.035 - 0.081	0.89 - 1.20	0.35 - 0.66	0.023 - 0.029	0.008 - 0.013	0.02 - 0.06	0.01 - 0.03	0.03 - 0.11	0.005 - 0.04	1 - 2

⁽¹⁾ See test results disclaimer on page 54.

Jet-LH[®] 78 MR

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018 H4R)

Great for jobs on mild steel and some high-strength low-alloy steels. It also tolerates high sulfur and high silicon steels. Jet-LH[®] 78 MR features higher tensile strength for stress-relieved properties.

Key Features

- Designed for welding, mild steel and high strength low alloy steels. Also, tolerates high sulfur and high silicon steels, which have poor weldability.
- Capable of x-ray quality welds.
- Low hydrogen may reduce the need for preheat or postheat.
- Shipped in hermetically sealed containers, which can be stored indefinitely in normal conditions, without danger of moisture pickup.

Typical Applications

- Structural steel and bridges.
- Cold rolled steel.
- Hard-to-weld steels.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-5.1	E7018 H4R
ABS	E7018
Lloyd's	3M, 3YMH5
DNV	3Y40H5
GL	3YH5
BV	3YHHH
CSA W48	E4918-1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	85 - 110	110 - 160	130 - 200	180 - 270	250 - 330	300 - 400
AC	—	120 - 170	140 - 230	210 - 290	270 - 370	325 - 420

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	5 lb (2.3 kg) Plastic Tubes	10 lb (4.5 kg) Easy Open Cans	50 lb (22.7 kg) Carton
		20 lb (9.1 kg) Carton	30 lb (13.6 kg) Carton	
3/32 (2.4)	12 (300)	ED032434	ED032585	ED015161
1/8 (3.2)	14 (350)	ED032435	ED032586	ED015198
5/32 (4.0)	14 (350)		ED032584	ED015141
3/16 (4.8)	14 (350)			ED015186
7/32 (5.6)	18 (450)			ED015258
1/4 (6.4)	18 (450)			ED015383

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7018 H4R	58 (399) min.	70 (482) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	58 - 80 (399 - 552)	70 - 90 (482 - 620)	22 - 34	20 - 150 (27 - 203)
Stress-Relieved ⁽³⁾ 10 hrs @ 1150°F (620°C)	56 - 73 (386 - 503)	71 - 85 (489 - 586)	27 - 33	50 - 112 (68 - 152)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Cr	%Mo	%Ni	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E7018 H4R	Not Specified	1.60 max.	0.75 max.	Not Specified	Not Specified	0.20 max.	0.30 max.	0.30 max.	0.08 max.	4 max.
Typical Performance⁽²⁾	0.04 - 0.08	0.90 - 1.30	0.35 - 0.65	0.010 - 0.020	0.006 - 0.015	0.02 - 0.06	0.01 - 0.02	0.03 - 0.07	0.01 - 0.03	1 - 3

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 7028

Low Hydrogen, Mild Steel Stick Electrode (AWS E7028 H8)

Excalibur® 7028 is a low hydrogen electrode designed for high deposition welding applications in the flat and horizontal positions. Excalibur® is Lincoln Electric's premium line of low hydrogen electrodes featuring excellent slag release, arc stability, resistance to starting porosity, and puddle control.

Key Features

- Low Hydrogen, high speed, high deposition electrode meets AWS H8 diffusible hydrogen limit.
- Smooth, consistent operation over a wide amperage range.
- Excellent slag release.
- Typical Charpy V-Notch toughness results exceeding 60 ft•lbf (84 J) @ -40°F (-40°C). Exceeds AWS minimum requirement of 20 ft•lbf (27 J) @ 0°F (-18°C).

Typical Applications

- Structural
- Heavy Fabrication
- Ship Building
- Storage Tanks
- Bridge Fabrication

Welding Positions

Flat and Horizontal

Conformance

AWS A5.1/A5.1M: 2004	E7028 H8
ASME SFA-5.1	E7028 H8
ABS	E7028, 3Y
Lloyd's	3YH10
DNV	IIIV
CSA W48	E4928

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)
AC	130 - 180	190 - 250	250 - 310
DC+	125 - 175	185 - 245	220 - 280

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Easy Open Can
5/32 (4.0)	14 (350)	ED032636
3/16 (4.8)	18 (450)	ED032790
7/32 (5.6)	18 (450)	ED032638

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7028 H8	58 (400) min.	70 (490) min.	22 min.	20 (27) Minimum at 0°F (-18°C) or lower
Typical Performance⁽²⁾ As-welded	66 - 69 (450 - 470)	79 - 82 (540 - 560)	27 - 34	62 - 142 (84 - 193) Tested at -40°F (-40°C)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/5.1M: 2004

	%C	%Mn	%Si	%S	%P	%Mo	%Ni	%Cr	%V	%Mn+Ni +Cr+Mo+V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E7028 H8	0.15 max.	1.60 max.	0.90 max.	0.035 max.	0.035 max.	0.30 max.	0.30 max.	0.20 max.	0.08 max.	1.75 max.	8 max.
Typical Performance⁽²⁾	0.03 - 0.06	1.17 - 1.51	0.44 - 0.71	0.004 - 0.008	0.007 - 0.014	0.01 - 0.03	0.02 - 0.04	0.02 - 0.05	0.01 max.	1.25 - 1.62	4 - 5

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Excalibur® 7018-A1 MR

Low Hydrogen, Mild Steel Stick Electrode (AWS E7018-A1 H4R)

Excalibur® 7018-A1 MR is a low hydrogen stick electrode designed for all-position welding of 0.5% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode with industry-leading arc performance and operability – choose Excalibur® 7018-A1 MR.

Key Features

- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Easy Strike and Re-Strike – Minimize starting porosity and grinding time while maximizing productivity.
- Effortless Slag Removal – Fast clean-up for higher productivity and quality.
- Stress-Relieved Mechanical Performance – Capable of exceeding AWS minimum requirement of 70 ksi (490 MPa) tensile strength after 8 hours at 1150°F (620°C).

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E7018-A1 H4R
ASME SFA-5.5	E7018-A1 H4R
CSA W48	E4918-A1

Typical Applications

- 0.5% Molybdenum Steels
- Pressure Vessels
- Power Generation
- Process Piping
- Petrochemical

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	8 lb (4.5 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can	24 lb (10.9 kg) Carton	30 lb (13.6 kg) Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
		3/32 (2.4)	1/8 (3.2)	5/32 (4.0)	12 (300)	14 (350)	14 (350)
		ED032893	ED032873	ED032875	ED032876	ED032877	

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7018-A1 H4R	57 (395) min.	70 (485) min.	22 min.	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hr @ 1150°F (620°C)	68 - 72 (470 - 500)	82 - 85 (565 - 585)	25 - 32	46 - 96 (60 - 130)
Stress-Relieved 8 hrs @ 1150°F (620°C) ⁽³⁾	65 - 70 (450 - 485)	79 - 83 (545 - 570)	27 - 32	38 - 79 (50 - 107)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo	Diffusible Hydrogen mL/100g weld deposit
Requirements AWS E7018-A1 H4R	0.12 max.	0.90 max.	0.80 max.	0.03 max.	0.03 max.	0.40 - 0.65	4 max.
Typical Performance⁽²⁾	0.04 - 0.06	0.55 - 0.80	0.35 - 0.55	≤0.01	≤0.01	0.45 - 0.65	2 - 4

⁽¹⁾ Typical all weld metal, DC+. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 8018-B2 MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E8018-B2 H4R)

Excalibur® 8018-B2 MR is a low hydrogen stick electrode designed for all-position welding of 1.25% chromium, 0.5% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode with industry-leading arc performance and operability – choose Excalibur® 8018-B2 MR.

Key Features

- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Easy Strike and Re-Strike – Minimize starting porosity and grinding time while maximizing productivity.
- Effortless Slag Removal – Fast clean-up for higher productivity and quality.
- Stress-Relieved Mechanical Performance – Capable of exceeding AWS minimum requirement of 80 ksi (550 MPa) tensile strength after 8 hours at 1275°F (690°C).

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E8018-B2 H4R
ASME SFA-5.5	E8018-B2 H4R
CSA W48	E5518-B2

Typical Applications

- 1.25% Chromium, 0.5% Molybdenum Steels
- Petrochemical
- Power Generation
- Pressure Vessels
- Process Piping

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
		24 lb (10.9 kg) Carton	30 lb (13.6 kg) Carton		
3/32 (2.4)	12 (300)	ED032878		ED032881	
1/8 (3.2)	14 (350)		ED032879		ED032882
5/32 (4.0)	14 (350)				ED032883

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E8018-B2 H4R	67 (460) min.	80 (550) min.	19 min.	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hr @ 1275°F (690°C)	78 - 85 (540 - 585)	93 - 99 (640 - 685)	24 - 26	52 - 94 (71 - 127)
Stress-Relieved ⁽³⁾ 8 hrs @ 1275°F (690°C)	72 - 78 (495 - 540)	88 - 93 (605 - 640)	25 - 28	47 - 83 (64 - 127)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E8018-B2 H4R	0.05 - 0.12	0.90 max.	0.80 max.	0.03 max.	0.03 max.	1.00 - 1.50	0.40 - 0.65	4 max.
Typical Performance⁽²⁾	0.08 - 0.11	0.65 - 0.80	0.35 - 0.55	≤0.02	≤0.01	1.05 - 1.30	0.40 - 0.60	2 - 4

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 8018-B2 XF MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E8018-B2 H4R)

Excalibur® 8018-B2 XF MR is a low hydrogen stick electrode capable of producing low X-factor deposits (X<15) for welding of 1.25% chromium, 0.5% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode designed to resist temper embrittlement in high temperature service – choose Excalibur® 8018-B2 XF MR.

Key Features

- Low X-factor (X<15) – Trace elements controlled to produce temper-embrittlement resistant weld deposits with X-factor (Bruscati factor) less than 15.
- Stress-Relieved Mechanical Performance – Capable of exceeding AWS minimum requirement of 550 MPa (80 ksi) tensile strength after 12 hours at 690°C (1275°F).
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule K. Actual certificates of test available at www.lincolnelectric.com.
- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Easy Strike, Re-Strike, and Slag Removal – Minimize starting porosity and grinding time while maximizing productivity.

Typical Applications

- 1.25% Chromium,
0.5% Molybdenum Steels
- High Temperature
- Step-cooling
- Petrochemical
- Pressure Vessels

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E8018-B2 H4R
ASME SFA-5.5	E8018-B2 H4R
CSA W48	E5518-B2

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
		24 lb (10.9 kg) Master	30 lb (13.6 kg) Master
3/32 (2.4)	12 (300)	ED033165	ED033166 ED033167
1/8 (3.2)	14 (350)		
5/32 (4.0)	14 (350)		

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)	Hardness ⁽⁴⁾ HV ₁₀
Requirements AWS E8018-B2 H4R	460 (67)	550 (80)	19	Not Specified	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hour @ 690°C (1275°F)	550 - 580 (80 - 84)	650 - 680 (95 - 99)	22 - 26	91 - 131 (67 - 97)	199 - 219
Stress-Relieved 8 hours @ 690°C (1275°F) ⁽³⁾	495 - 520 (72 - 76)	600 - 630 (87 - 92)	25 - 27	107 - 127 (79 - 94)	193 - 195

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Cr	%Mo	%Sb	%Sn	%As	Diffusible Hydrogen (mL/100g weld deposit)	X-Factor ^(4,5)
Requirements AWS E8018-B2 H4R	0.05 - 0.12	0.90 max.	0.80 max.	0.03 max.	0.03 max.	1.00 - 1.50	0.40 - 0.65	Not Specified	Not Specified	Not Specified	4.0 max.	≤15
Typical Performance⁽²⁾	0.08 - 0.11	0.60 - 0.86	0.35 - 0.71	0.0075 - 0.0104	≤0.01	1.25 - 1.42	0.49 - 0.57	0.0005 - 0.0008	0.0005 - 0.0036	0.0029 - 0.0040	2 - 4	9 - 12

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Industry specific data, not required by AWS. ⁽⁴⁾ X = (10 P + 5 Sb + 4 Sn + As) / 100 (elements in ppm). NOTE: Additional test data available upon request.

Excalibur® 8018-C1 MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E8018-C1 H4R)

Excalibur® 8018-C1 MR is the ideal moisture resistant electrode for welding on equipment and pipe that transport liquid ammonia, propane and other gases. An excellent all-position electrode for applications requiring a nominal 2-1/4% nickel deposit.

Key Features

- All-position, moisture resistant, low hydrogen, low alloy electrode.
- Clean puddle and uniform slag follow make it easy to “carry” the puddle.
- Exceptional Excalibur® operating characteristics with smooth even burnoff, make Excalibur® 8018-C1 MR the ideal choice for critical out-of-position applications.
- High operator appeal with superior tie-in at weld bead edges.
- Resistant to fingernailing in critical out-of-position joints, and a flexible coating means less breakage. CTOD Tested.

Typical Applications

- Primarily designed for low temperature applications where weld metal toughness is required.
- Refrigerated ammonia tanks, liquified gas storage, piping and transportation.
- Weathering steels and applications requiring weld metal stress-relieved properties.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.6
ABS
CSA W48

E8018-C1 H4R
E8018-C1 H4R
E8018-C1 H4R
E5518-C1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300	250 - 330	300 - 400
AC	80 - 120	100 - 160	140 - 210	200 - 300	270 - 370	325 - 430

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6kg) Carton	50 lb (22.7 kg) Easy Open Cans
3/32 (2.4)	14 (350)	ED032597 ED032598	ED030876
1/8 (3.2)	14 (350)		ED030877
5/32 (4.0)	14 (350)		ED030878
3/16 (4.8)	14 (350)		ED030879
7/32 (5.6)	18 (450)		ED030881
1/4 (6.4)	18 (450)		ED030880

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -75°F (-59°C)
Requirements AWS E8018-C1 H4R Stress-Relieved 1 hr @ 1125°F (610°C)	67 (460) min.	80 (550) min.	19 min.	20 (27) min.
Typical Performance⁽²⁾ Stress-Relieved 1 hr @ 1125°F (610°C)	67 - 78 (460 - 538)	80 - 93 (550 - 641)	19 - 32	20 - 110 (27 - 150)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E8018-C1 H4R	0.12 max.	1.25 max.	0.80 max.	0.03 max.	0.03 max.	2.00 - 2.75	4 max.
Typical Performance⁽²⁾	0.04 - 0.07	0.90 - 1.20	0.20 - 0.50	0.005 - 0.015	0.010 - 0.020	2.10 - 2.60	1 - 3

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Excalibur® 8018-C3 MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E8018-C3 H4R)

Excalibur® 8018-C3 MR is 1% nickel all-position electrode for fabrication or repair of 1% nickel steels, as well as a wide variety of other low alloy and carbon steels.

Key Features

- All position, moisture resistant, low hydrogen, low alloy electrode.
- Clean puddle and uniform slag follow make it easy to “carry” the puddle
- Exceptional Excalibur® operating characteristics, with smooth even burnoff, make Excalibur® 8018-C3 MR the ideal choice for critical out-of-position applications.
- High operator appeal with superior tie-in at weld bead edges.
- Resistant to fingernailing in critical out-of-position joints, and a flexible coating means less breakage. CTOD Tested.

Typical Applications

- Applications requiring weld metal toughness and a minimum of 80 ksi (552 MPa) tensile strength in the as-welded condition.
- Shipbuilding.
- Piping and storage tanks.
- Weathering steels.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E8018-C3 H4R
ASME SFA-5.5	E8018-C3 H4R
ABS	E8018-C3 H4R
CSA W48	E5518-C3

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)					
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)	7/32 in. (5.6 mm)	1/4 in. (6.4 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300	250 - 330	300 - 400
AC	80 - 120	100 - 160	140 - 210	200 - 300	270 - 370	325 - 425

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Cans	50 lb (22.7 kg) Easy Open Cans
		30 lb (13.6 kg) Carton	
3/32 (2.4)	14 (350)	ED032599	ED030892
1/8 (3.2)	14 (350)	ED032600	ED030893
5/32 (4.0)	14 (350)		ED030894
3/16 (4.8)	14 (350)		ED030895
7/32 (5.6)	18 (450)		ED030897
1/4 (6.4)	18 (450)		ED030896

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -40°F (-40°C)
Requirements AWS E8018-C3 H4R	68 - 80 (470 - 550)	80 (550) min.	24 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	68 - 80 (470 - 550)	80 - 93 (550 - 641)	24 - 32	20 - 110 (27 - 150)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo	%Ni	%Cr	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E8018-C3 H4R	0.12 max.	0.40 - 1.25	0.80 max.	0.03 max.	0.03 max.	0.35 max.	0.80 - 1.10	0.15 max.	4 max.
Typical Performance⁽²⁾	0.04 - 0.07	0.90 - 1.15	0.25 - 0.60	0.005 - 0.015	0.010 - 0.020	0.10 - 0.25	0.85 - 1.05	0.04 max.	2 - 3

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

Excalibur® 9018M MR

Low Hydrogen, Low Alloy Steel Stick Electrode (AWS E9018M H4R)

Excalibur® 9018M MR is intended for welding high strength steels of 90 ksi (620 MPa) tensile strength and higher.

Key Features

- All-position, moisture resistant, low hydrogen, low alloy electrode.
- Clean puddle and uniform slag follow make it easy to “carry” the puddle.
- Exceptional Excalibur® operating characteristics, with smooth even burnoff, make Excalibur® 9018M MR the ideal choice for critical out-of-position applications.
- CTOD Tested.
- High operator appeal with superior tie-in at weld bead edges.
- Resistant to fingernailing in critical out-of-position joints.
- Flexible coating means less breakage.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E9018M H4R
ASME SFA-5.5	E9018M H4R
ABS	E9018M H4R
CSA W48	E6218-M

Typical Applications

- High strength steel of 90 ksi (620 MPa) tensile strength and higher, such as HY-80, HY-90, T-1.

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032602	ED030868
1/8 (3.2)	14 (350)	ED032603	ED030869
5/32 (4.0)	14 (350)		ED030870
3/16 (4.8)	14 (350)		ED030871

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -60°F (-51°C)
Requirements AWS E9018M H4R	78 - 90 (540 - 620)	90 (620) min.	24 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	78 - 90 (540 - 620)	90 - 102 (620 - 703)	24 - 37	20 - 90 (27 - 122)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo	%Ni	%Cr	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E9018M H4R	0.10 max.	0.60 - 1.25	.80 max.	0.03 max.	0.03 max.	0.35 max.	1.40 - 1.80	0.15 max.	4 max.
Typical Performance⁽²⁾	0.04 - 0.07	0.90 - 1.10	0.30 - 0.50	0.005 - 0.015	0.010 - 0.020	0.25 - 0.35	1.50 - 1.80	0.05 - 0.12	1 - 3

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 9018-B3 MR

Low Hydrogen, Low Alloy Steel Stick Electrode (AWS E9018-B3 H4R)

Excalibur® 9018-B3 MR is a low hydrogen stick electrode designed for all-position welding of 2.25% chromium, 1% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode with industry-leading arc performance and operability – choose Excalibur® 9018-B3 MR.

Key Features

- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Easy Strike and Re-Strike – Minimize starting porosity and grinding time while maximizing productivity.
- Effortless Slag Removal – Fast clean-up for higher productivity and quality.
- Stress-Relieved Mechanical Performance – Capable of exceeding AWS minimum requirement of 90 ksi (620 MPa) tensile strength after 8 hours at 1275°F (690°C).

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E9018-B3 H4R
ASME SFA-5.5	E9018-B3 H4R
CSA W48	E6218-B3

Typical Applications

- 2.25% Chromium, 1% Molybdenum Steels
- Power Generation
- Petrochemical
- Pressure Vessels
- Process Piping

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	8 lb (4.5 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can	24 lb (10.9 kg) Carton	30 lb (13.6 kg) Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Carton
		3/32 (2.4)	12 (300)	ED032884	ED032885	ED032887	ED032888 ED032889
1/8 (3.2)	14 (350)						
5/32 (4.0)	14 (350)						

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -40°F (-40°C)
Requirements AWS E9018-B3 H4R	77 (530) min.	90 (620) min.	17 min.	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hr @ 1275°F (690°C)	86 - 88 (595 - 605)	102 - 104 (705 - 715)	20 - 23	42 - 53 (57 - 72)
Stress-Relieved ⁽³⁾ 8 hrs @ 1275°F (690°C)	77 - 84 (530 - 580)	94 - 99 (650 - 685)	20 - 24	32 - 79 (43 - 107)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E9018-B3 H4R	0.05 - 0.12	0.90 max.	0.80 max.	0.03 max.	0.03 max.	2.00 - 2.50	0.90 - 1.20	4 max.
Test Results⁽²⁾	0.07 - 0.08	0.65 - 0.79	0.39 - 0.49	0.01	0.01	2.21 - 2.46	1.03 - 1.13	2 - 4

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

Excalibur® 9018-B3 XF MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E9018-B3 H4R)

Excalibur® 9018-B3 XF MR is a low hydrogen stick electrode capable of producing low X-factor deposits ($X < 15$) for welding of 2.25% chromium, 1% molybdenum low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low alloy, low hydrogen electrode designed to resist temper embrittlement in high temperature service - choose Excalibur® 9018-B3 XF MR.

Key Features

- Low X-factor ($X < 15$) – Trace elements controlled to produce temper-embrittlement resistant weld deposits with X-factor (Bruscati factor) less than 15.
- Stress-Relieved Mechanical Performance – Capable of exceeding AWS minimum requirement of 620 MPa (90 ksi) tensile strength after 12 hours at 690°C (1275°F).
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule K. Actual certificates of test available at www.lincolnelectric.com.
- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Easy Strike, Re-Strike, and Slag Removal – Minimize starting porosity and grinding time while maximizing productivity.

Typical Applications

- 2.25% Chromium, 1% Molybdenum Steels
- High Temperature
- Step-cooling
- Petrochemical
- Pressure Vessels

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E9018-B3 H4R
ASME SFA-5.5	E9018-B3 H4R
CSA W48	E6218-B3

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master
		ED033168	ED033169 ED033170
3/32 (2.4)	12 (300)		
1/8 (3.2)	14 (350)		
5/32 (4.0)	14 (350)		

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)	Hardness ⁽⁴⁾ HV ₁₀
Requirements AWS E9018-B3 H4R	530 (77)	620 (90)	17	Not Specified	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hour @ 690°C (1275°F) Stress-Relieved 8 hours @ 690°C (1275°F) ⁽³⁾	620 - 700 (90 - 101) 565 - 575 (82 - 84)	745 - 775 (108 - 113) 670 - 695 (98 - 101)	19 - 25 20 - 21	56 - 74 (42 - 55) 56 - 80 (42 - 59)	225 - 233 206 - 215

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Cr	%Mo	%Sb	%Sn	%As	Diffusible Hydrogen (mL/100g weld deposit)	X-Factor ^(4,5)
Requirements AWS E9018-B3 H4R	0.05 - 0.12	0.90 max.	0.80 max.	0.03 max.	0.03 max.	2.00 - 2.50	0.90 - 1.20	Not Specified	Not Specified	Not Specified	4.0 max.	≤15
Typical Performance⁽²⁾	0.10 - 0.12	0.57 - 0.84	0.43 - 0.62	0.0070 - 0.0114	≤0.01	2.14 - 2.29	1.06 - 1.12	0.0004 - 0.0007	0.0008 - 0.0029	0.0027 - 0.0039	1 - 2	8 - 13

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Industry specific data, not required by AWS. ⁽⁴⁾ $X = (10P + 5Sb + 4Sn + As) / 100$ (elements in ppm). NOTE: Additional test data available upon request.

Excalibur® 10018-D2 MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E10018-D2 H4R)

Excalibur® 10018-D2 MR is a low hydrogen stick electrode designed for all-position welding of a variety of carbon-manganese, chromium-molybdenum and low alloy steels. A smooth arc, excellent strike and re-strike capabilities, self-peeling slag and extremely low spatter levels make Excalibur® the industry's premium brand of low hydrogen electrodes. For a low hydrogen electrode capable of exceeding 690 MPa (100 ksi) tensile strength - choose Excalibur® 10018-D2 MR.

Key Features

- Stress-Relieved Mechanical Performance – Capable of exceeding 550 MPa (80 ksi) yield strength after 12 hours at 635°C (1175°F) on 4130 AISI steel.
- Enhanced Arc Performance – Smooth arc and square coating burn-off for improved puddle control and visibility.
- Effortless Slag Removal – Fast clean-up for higher productivity and quality.
- Easy Strike and Re-Strike – Minimize starting porosity and grinding time while maximizing productivity.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule K. Actual certificates of test available at www.lincolnelectric.com.

Typical Applications

- Chromium-Molybdenum and other Low Alloy Steels, including AISI 4130, 4140, 8630 and ASTM A182 and A336 Grades F22.
- Carbon-Manganese and Other Low Alloy Steels
- Offshore and Subsea Components
- Process Piping
- Meets NACE MR0175/ISO15156-2

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E10018-D2 H4R
ASME SFA-5.5	E10018-D2 H4R
CSA W48	E6918-D2

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)
DC+	60 - 110	85 - 160	110 - 210
AC	65 - 120	90 - 170	115 - 220

NOTE: Preferred polarity is listed first.

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	25 lb (11.3 kg) Easy Open Can	50 lb (23 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033162	ED033163 ED033164
1/8 (3.2)	14 (350)		
5/32 (4.0)	14 (350)		

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength (0.2% Offset) MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -50°C (-60°F)	Hardness ⁽⁴⁾ HV ₁₀
Requirements AWS E10018-D2 H4R	600 (87)	690 (100)	16	27 (20) min.	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hour @ 620°C (1150°F)	650 - 715 (94 - 104)	725 - 780 (105 - 113)	22 - 25	56 - 69 (41 - 51)	219 - 242
WELDED ON AISI 4130 STEEL					
Typical Performance⁽²⁾ Stress-Relieved 12 hour @ 635°C (1175°F) ⁽⁴⁾	560 - 580 (81 - 84)	650 - 675 (94 - 98)	24 - 25	47 - 68 (35 - 50)	210 - 214

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E10018-D2 H4R	0.15 max.	1.65 - 2.00	0.80 max.	0.03 max.	0.03 max.	0.90 max.	0.25 - 0.45	4.0 max.
Typical Performance⁽²⁾	0.08 - 0.12	1.69 - 1.91	0.35 - 0.49	0.01 - 0.02	≤0.01	0.68 - 0.77	0.34 - 0.39	2 - 3

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Industry specific data, not required by AWS. ⁽⁴⁾ X = (10 P + 5 Sb + 4 Sn + As) / 100 (elements in ppm). NOTE: Additional test data available upon request.

Excalibur® 11018M MR

Low Hydrogen, Low Alloy Stick Electrode (AWS E11018M H4R)

Excalibur® 11018M MR is designed primarily for joining strength steel types in the as-welded or stress relieved conditions with excellent low temperature impact properties and robust welding procedures. All position welding, except vertical down.

Key Features

- Integrated Silicate Technology™, increased moisture resistance and decreased coating fragility.
- Easy Strike and Re-Strike – Minimize starting porosity and grinding time while maximizing productivity.
- Square burn-off, focused arc for hard to access welds.
- X-ray quality, demanding applications.
- Hermetically sealed packaging - easy open cans, delivers quality product, performance, reliability, and consistent results.

Typical Applications

- Certain Weldable Quenched & Tempered Steels, such as -T1, A514, A517 and A709.
- General Fabrication Requiring E11018-G or E11018M Electrode Classification.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.1
CSA W48

E11018M H4R / E7618M H4R
E11018M H4R
E7618-M-H4

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
DC+	70 - 110	90 - 160	130 - 210	180 - 300

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	10 lb (4.5 kg) Easy Open Cans	50 lb (22.7 kg) Easy Open Cans
		30 lb (13.6 kg) Carton	
3/32 (2.4)	14 (350)		ED031975
1/8 (3.2)	14 (350)	ED032607	ED031976
5/32 (4.0)	14 (350)	ED032608	ED031977
3/16 (4.8)	14 (350)		ED031978

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -60°F (-50°C)
Requirements AWS E11018M H4R	98 - 110 (680 - 760)	110 (760) min.	20 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded	100 - 110 (690 - 758)	111 - 117 (765 - 807)	20 - 25	40 - 65 (54 - 88)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo	%Ni	%Cr	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E11018M H4R	0.10 max.	1.30 - 1.80	0.60 max.	0.030 max.	0.030 max.	0.25 - 0.50	1.25 - 2.50	0.40 max.	0.05 max.	4 max.
Typical Performance⁽²⁾	0.04 - 0.05	1.55 - 1.80	0.40 - 0.55	0.005 - 0.020	0.010 - 0.030	0.35 - 0.50	1.90 - 2.50	0.02 - 0.15	0.005 - 0.015	1 - 4

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

SHIELD-ARC® HYP+

Fast Freeze, Out-of-Position Pipe Welding Low Alloy Steel Stick Electrode (AWS E7010-P1)

Tendency for “fingernailing” and electrode sticking have been virtually eliminated! Designed for all passes of API 5LX-52 through X65 high strength pipe. Provides the welder with a clean, visible weld puddle and superior puddle control.

Key Features

- All-position, pipe welding low alloy steel stick electrode.
- Light slag with little slag interference for easy arc control.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, out-of-position.

Typical Applications

- API 5LX-52 through X65 grade pipe.
- Pipe welding – cross country and in-plant.
- Vertical down and overhead plate welding.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006	E7010-G; E7010-P1
ASME SFA-5.5	E7010-G; E7010-P1
ABS	E7010-P1
CSA W48	E4910-P1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
DC+	75 - 130	90 - 185	140 - 225

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Easy Open Cans
1/8 (3.2)	14 (350)	ED029511
5/32 (4.0)	14 (350)	ED029513
3/16 (4.8)	14 (350)	ED029509

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7010-P1 As-welded	60 (414) min.	70 (480) min.	22 min.	20 (27) min.
Typical Performance⁽²⁾ As-welded Stress-Relieved 1 hr @ 1150°F (620°C) ⁽³⁾	60 - 71 (414 - 489) 59 - 66 (407 - 455)	70 - 86 (480 - 593) 75 - 82 (517 - 566)	22 - 30 28 - 31	20 - 41 (27 - 56) 35 - 45 (48 - 62)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo	%Cr	%Ni	%V
Requirements AWS E7010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.	0.50 max.	0.30 max.	1.00 max.	0.10 max.
Typical Performance⁽²⁾	0.13 - 0.17	0.49 - 0.63	0.08 - 0.18	0.008 - 0.011	0.009 - 0.014	0.27 - 0.31	0.02	0.01 - 0.02	<0.01

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification.

SHIELD-ARC® 85

Fast Freeze, Out-of-Position Pipe Welding Low Alloy Steel Stick Electrode (AWS E7010-A1)

Need a reliable, all-position stick electrode? Here's your electrode! Shield-Arc® 85 produces a 70 ksi, 0.50% molybdenum weld deposit for use on 0.50% molybdenum pipe steels and API 5LX-42 through X56 line pipe.

Key Features

- All position pipe welding low alloy steel stick electrode.
- Light slag with little slag interference for easy arc control.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, out-of-position.

Typical Applications

- API 5LX-42 through X56 grade pipe, and 0.50% moly steels.
- Pipe welding – in-plant, and non-critical small pipe.
- Vertical and overhead plate welding.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006	E7010-A1
ASME SFA-5.5	E7010-A1
ABS	E7010-A1
Military	MIL-E-22200/7
	MIL-7101-A1
CSA W48	E4910-A1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in. (2.4 mm)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
DC+	50 - 90	75 - 130	90 - 175	140 - 225

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED012893
1/8 (3.2)	14 (350)	ED012885
5/32 (4.0)	14 (350)	ED012896
3/16 (4.8)	14 (350)	ED012889

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J) @ -20°F (-29°C)
Requirements AWS E7010-A1 Stress-Relieved ⁽³⁾ 1 hr @ 1150°F (620°C)	57 (390) min.	70 (482) min.	22 min.	Not Specified
Typical Performance⁽²⁾ Stress-Relieved 1 hr @ 1150°F (620°C)	64 - 74 (441 - 510)	78 - 84 (538 - 579)	25 - 30	26 - 32 (35 - 43)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Mo
Requirements AWS E7010-A1	0.12 max.	0.60 max.	0.40 max.	0.03 max.	0.03 max.	0.40 - 0.65
Typical Performance⁽²⁾	0.08 - 0.12	0.30 - 0.55	0.10 - 0.30	0.005 - 0.020	0.005 - 0.020	0.40 - 0.55

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54.

SHIELD-ARC® 70+

Fast Freeze, Out-of-Position Pipe Welding Low Alloy Steel Stick Electrode (AWS E8010-G)

Here's an electrode that makes short work of even the most challenging high silicon pipe applications! Shield-Arc® 70+ is an outstanding choice for API 5LX-56 through X70 grade pipe, as well as for a wide range of sheet metal welding assignments.

Key Features

- All-position pipe welding low alloy steel stick electrode.
- Light slag with little slag interference for easy arc control.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, even out-of-position.

Typical Applications

- API 5LX-56 through X70 grade pipe, and relatively high silicon pipe.
- Pipe welding – cross country and in-plant.
- Vertical down and overhead plate welding.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006	E8010-G
ASME SFA-5.1	E8010-G
ABS	E8010-G
CSA W48	E5510-G

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)	3/16 in. (4.8 mm)
DC+	75 - 130	90 - 185	140 - 225

DIAMETERS/PACKAGING

Diameters in. (mm)	Length in. (mm)	50 lb (22.7 kg) Easy Open Can
1/8 (3.2)	14 (350)	ED012841
5/32 (4.0)	14 (350)	ED012849
3/16 (4.8)	14 (350)	ED012845

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J)	
				@ -20°F (-29°C)	@ -50°F (-46°C)
Requirements AWS E8010-G As-welded	67 (460) min.	80 (550) min.	19 min.	Not Specified	Not Specified
Typical Performance⁽²⁾ As-welded	67 - 76 (460 - 524)	80 - 94 (550 - 648)	19 - 28	38 - 57 (51 - 77)	27 - 47 (37 - 64)
Stress-Relieved⁽³⁾ 1 hr @ 1150°F (620°C)	67 - 72 (460 - 496)	76 - 80 (524 - 550)	23 - 24	44 - 64 (60 - 87)	34 - 53 (46 - 72)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Ni	%Cr	%Mo	%V
Requirements AWS E8010-G ⁽⁴⁾	Not Specified	1.00 min.	0.80 min.	Not Specified	Not Specified	0.50 min.	0.30 min.	0.20 min.	0.10 min.
Typical Performance⁽²⁾	0.13 - 0.17	0.60 - 1.20	0.05 - 0.30	0.007 - 0.010	0.008 - 0.012	0.75 - 0.97	0.01 - 0.20	0.05 - 0.15	0.025 - 0.040

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Data provided for information only – not part of AWS classification. ⁽⁴⁾ Weld deposit must meet the minimum requirement of at least one of the elements listed.

SHIELD-ARC® 90

Fast Freeze, Out-of-Position Pipe Welding Low Alloy Steel Stick Electrode (AWS E9010-G)

An all-position pipe electrode that's a great choice when the task is vertical down welding on API 5LX-70 through X80 pipe. Shield-Arc® 90 also performs well in situations where low hydrogen processes are not practical, and when welding on dirty steels.

Key Features

- All-position pipe welding low alloy steel stick electrode.
- Light slag with little slag interference for easy arc control.
- Deep penetration with maximum admixture.
- Capable of x-ray quality welds, even out-of-position.

Typical Applications

- API 5LX-56 through X70 grade pipe, and relatively high silicon pipe.
- Pipe welding – cross country and in-plant.
- Vertical down and overhead plate welding.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006 E9010-G
ASME SFA-5.1 E9010-G

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	4.8 mm (3/16 in.)
DC+	75 - 130	80 - 185	140 - 225

NOTE: Manufactured in metric diameters, U.S. Customary sizes are approximate.

DIAMETERS/PACKAGING

Diameters mm (in.)	Length in. (mm)	50 lb (22.7 kg) Easy Open Can
3.2 (1/8)	14 (350)	EDS01693
4.0 (5/32)	14 (350)	EDS01694
4.8 (3/16)	14 (350)	EDS01695

NOTE: These products are made to order.

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	Yield Strength ksi (MPa)	Tensile Strength ksi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (J)	
				@ -20°F (-29°C)	@ -50°F (-46°C)
Requirements AWS E9010-G As-welded	77 (530) min.	90 (620) min.	17 min.	Not Specified	Not Specified
Typical Performance⁽²⁾ As-welded	77 - 88 (530 - 607)	90 - 100 (620 - 690)	17 - 26	50 - 72 (68 - 98)	41 - 46 (56 - 62)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/5.5M: 2006

	%C	%Mn	%Si	%S	%P	%Ni	%Cr	%Mo	%V
Requirements AWS E9010-G ⁽³⁾	Not Specified	1.00 min.	0.80 min.	Not Specified	Not Specified	0.50 min.	0.30 min.	0.20 min.	0.10 min.
Typical Performance⁽²⁾	0.14 - 0.17	0.61 - 0.85	0.11 - 0.20	0.007 - 0.008	0.008 - 0.012	0.65 - 0.80	0.02 - 0.04	0.45 - 0.65	<0.01

⁽¹⁾ Typical All Weld Metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Weld deposit must meet the minimum requirement of at least one of the elements listed.

Pipeliner® 6P+

Stick (SMAW) Electrodes - Cellulosic (AWS E6010)

Pipeliner® 6P+ sets the standard for root pass welding in the pipeline industry. It is recommended for root pass welding in either vertical up or vertical down welding positions of up to X80 grade pipe as well as hot, fill and cap pass welding of up to X60 grade pipe. For all position pipe welding – choose Pipeliner® 6P+.

Key Features

- High Operator Appeal and Control – Forceful cellulosic arc for high operator appeal and control when root pass welding.
- True Cellulosic Electrode – Stiff, driving, penetrating arc for optimal hot pass penetration.
- Low Temperature Impact Toughness – Every lot tested to -29°C (-20°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance, reliability, and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.1, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position

Conformance

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-5.1	E6010
CSA W48	E4310

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	2.5 mm (3/32 in.)	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC+	50 - 70	75 - 125	100 - 165
DC-	50 - 70	75 - 125	100 - 165

DIAMETERS/PACKAGING

4.5 kg (10 lb) Easy Open Hermetic Can			
Diameters mm (in.)	Length in. (mm)	13.6 kg (30 lb) Cardboard Carton Master	22.7 kg (50 lb) Easy Open Hermetic Can
2.5 (3/32)	12 (300)	ED032609	
3.2 (1/8)	14 (350)	ED032610	ED030848
4.0 (5/32)	14 (350)	ED032611	ED030849

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements AWS E6010	330 (48) min.	415 (60) min.	22 min.	27 (20) min.
Typical Performance⁽²⁾ As-Welded	405 - 515 (59 - 75)	495 - 620 (72 - 90)	22 - 36	27 - 85 (20 - 63)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V
Requirements AWS E6010	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Performance⁽²⁾	0.11 - 0.23	0.51 - 0.77	0.15 - 0.32	0.006 - 0.16	0.005 - 0.011	0.01 - 0.04	0.01 - 0.04	0.01 - 0.02	≤0.01

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset.

NOTE: This AWS electrode classification is not required to deposit weld metal that is low in hydrogen. Therefore, these electrodes should not be used in applications where the hydrogen content of the weld metal is required to be controlled.

Pipeliner® 7P+

Stick (SMAW) Electrodes - Cellulosic (AWS E7010-P1)

Pipeliner® 7P+ allows for increased fill capabilities resulting in fewer fill passes. It is capable of meeting stringent pipeline welding requirements when tested for low temperature impact toughness. It is recommended for root pass welding of up to X80 grade pipe, and hot, fill and cap pass welding of up to X65 grade pipe. For vertical down pipe welding – choose Pipeliner® 7P+.

Key Features

- High Operator Appeal and Control – Less spatter and clear puddle while fill, hot or cap pass welding.
- High Productivity – True 5.0mm metric diameter yields 15-20% productivity gain over Shield-Arc® 70+. High productivity in vertical down and out-of-position pipe welding.
- Low Temperature Impact Toughness – Every lot tested to -29°C (-20°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance, reliability, and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.5
CSA W48

E7010-P1 (Also meets E7010-G)
E7010-P1 (Also meets E7010-G)
E4910-P1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	5.0 mm (13/64 in.)
DC+	65 - 130	100 - 165	130 - 210

Although not specified in AWS classification, Pipeliner® 7P+ can be run on DC-.

DIAMETERS/PACKAGING

Diameters mm (in.)	Length in. (mm)	22.7 kg (50 lb) Easy Open Hermetic Can
3.2 (1/8)	14 (350)	ED031611
4.0 (5/32)	14 (350)	ED031612
5.0 (13/64)	14 (350)	ED031613

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements AWS E7010-P1	415 (60) min.	485 (70) min.	22 min	27 (20) min.	Not Specified
Typical Performance ⁽²⁾ As-Welded	455 - 515 (66 - 75)	525 - 635 (76 - 92)	23 - 29	49 - 92 (36 - 68)	31 - 85 (23 - 63)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V
Requirements AWS E7010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.	1.00 max.	0.30 max.	0.50 max.	0.10 max.
Typical Performance ⁽²⁾	0.09 - 0.20	0.44 - 0.83	0.06 - 0.31	0.01 - 0.02	0.01 - 0.02	0.58 - 0.90	0.02 - 0.05	0.04 - 0.21	≤ 0.01

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. NOTE 1: This product contains micro-alloying elements. Additional information available on request.

NOTE 2: This AWS electrode classification is not required to deposit weld metal that is low in hydrogen. Therefore, these electrodes should not be used in applications where the hydrogen content of the weld metal is required to be controlled.

Pipelin[®]er 8P+

Stick (SMAW) Electrodes - Cellulosic (AWS E8010-P1)

Pipelin[®]er 8P+ is the highest strength cellulosic electrode in the Lincoln Pipelin[®]er family and allows for increased fill capabilities resulting in fewer fill passes. It is recommended for root pass welding of up to X80 grade pipe, and hot, fill and cap pass welding of up to X70 grade pipe. For vertical down pipe welding – choose Pipelin[®]er 8P+.

Key Features

- High Operator Appeal and Control – Less spatter and clear puddle while fill, hot or cap pass welding.
- High Productivity – True 5.0mm metric diameter yields 15-20% productivity gain over Shield-Arc[®] 70+. High productivity in vertical down and out-of-position pipe welding.
- Low Temperature Impact Toughness – Every lot tested to -29°C (-20°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance reliability and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.1, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.5
CSA W48

E8010-P1 (Also meets E8010-G)
E8010-P1 (Also meets E8010-G)
E5510-P1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	5.0 mm (13/64 in.)
DC+	65 - 120	100 - 165	130 - 210

DIAMETERS/PACKAGING

Diameters mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master	22.7 kg (50 lb) Easy Open Hermetic Can
3.2 (1/8)	ED032615	ED030826
4.0 (5/32)	ED032616	ED030827
5.0 (13/64)	ED032617	ED030828

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements AWS E8010-P1	460 (67) min.	550 (80) min.	19 min.	27 (20) min.	Not Specified
Typical Performance ⁽²⁾ As-Welded	475 - 545 (69 - 79)	560 - 670 (81 - 97)	19 - 32	49 - 149 (36 - 110)	41 - 119 (30 - 88)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V
Requirements AWS E8010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.	1.00 max.	0.30 max.	0.50 max.	0.10 max.
Typical Performance ⁽²⁾	0.09 - 0.20	0.55 - 0.98	0.07 - 0.27	0.01 - 0.02	0.01 - 0.02	0.73 - 1.00	0.02 - 0.05	0.13 - 0.22	0.01 max.

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. NOTE 1: This product contains micro-alloying elements. Additional information available on request.

NOTE 2: This AWS electrode classification is not required to deposit weld metal that is low in hydrogen. Therefore, these electrodes should not be used in applications where the hydrogen content of the weld metal is required to be controlled.

Pipeliner® 16P

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up (AWS E7016 H4)

Pipeliner® 16P has unique properties that enable low hydrogen SMAW root passes meeting strict pipe welding requirements. It is recommended for root pass welding of up to X100 grade pipe. For vertical up pipe welding – choose Pipeliner® 16P.

Key Features

- Low Hydrogen Vertical Up Capability – Excellent for repair welds or welds with increased sensitivity to cracking.
- Low Temperature Impact Toughness – Every lot tested to -29°C (-20°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance reliability and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.1, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7016 H4
ASME SFA-5.1	E7016 H4

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	2.5 mm (3/32 in.)	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC±	55 - 80	75 - 120	120 - 160
AC	60 - 80	80 - 120	120 - 160

DIAMETERS/PACKAGING

Diameters mm (in.)	Length in. (mm)	22.7 kg (50 lb) Easy Open Hermetic Can
2.5 (3/32)	14 (350)	ED030916
3.2 (1/8)	14 (350)	ED030917
4.0 (5/32)	18 (450)	ED030918

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements AWS E7016 H4	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Performance ⁽²⁾ As-Welded	435 - 545 (63 - 79)	550 - 640 (80 - 93)	23 - 34	84 - 161 (62 - 119)	65 - 129 (48 - 95)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V	Mn+Ni+Cr +Mo+V	Diffusible Hydrogen, mL/100g
Requirements AWS E7016 H4	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4 max.
Typical Performance ⁽²⁾	0.04 - 0.08	1.10 - 1.60	0.39 - 0.67	0.005 - 0.020	0.004 - 0.012	<0.07	0.01 - 0.07	0.01 - 0.03	0.01 - 0.02	1.14 - 1.71	1 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset.

Pipeliner® 17P

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up (AWS E7018-1 H4R)

Pipeliner® 17P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X65 grade pipe. For vertical up pipe welding – choose Pipeliner® 17P.

Key Features

- Low Hydrogen Vertical Up Capability – Excellent for repair welds or welds with increased sensitivity to cracking.
- Easy to Strike Tip – Improved arc starting and reduction of arc starting porosity.
- Low Temperature Impact Toughness – Every lot tested to -46°C (-50°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance, reliability, and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.1, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.1/A5.1M: 2004	E7018-1 H4R
ASME SFA-5.1	E7018-1 H4R
CSA W48	E4918-1

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)	
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC+	90 - 160	130 - 210
AC	100 - 160	140 - 160

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032618
4.0 (5/32)	350 (14)	ED032619

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lb)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E7018-1 H4R	400 (58) min.	485 (70) min.	22 min.	Not Specified	27 (20) min.
Typical Performance ⁽²⁾ As-Welded	400 - 470 (58 - 68)	515 - 550 (75 - 80)	28 - 33	163 - 355 (120 - 262)	115 - 285 (85 - 210)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.1/A5.1M: 2004

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V	Mn+Ni+Cr+ Mo+V	Diffusible Hydrogen, mL/100g
Requirements AWS E7018-1 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4 max.
Typical Performance ⁽²⁾	0.04 - 0.05	1.16 - 1.25	0.28 - 0.33	0.011 - 0.014	0.008 - 0.010	0.02 - 0.03	0.04 - 0.05	0.12 - 0.22	<0.01	1.39 - 1.47	1 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset.

Pipeliner® 18P

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up (AWS E8018-G H4R)

Pipeliner® 18P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X70 grade pipe. For vertical up pipe welding – choose Pipeliner® 18P.

Key Features

- Low Hydrogen Vertical Up Capability – Excellent for repair welds or welds with increased sensitivity to cracking.
- Easy to Strike Tip – Improved arc starting and reduction of arc starting porosity.
- Low Temperature Impact Toughness – Every lot tested to -46°C (-50°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance, reliability, and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C1 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E8018-G
ASME SFA-5.5	E8018-G H4R
CSA W48	E5518-G

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)	
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC+	80 - 145	120 - 185
AC	90 - 155	130 - 195

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032620
4.0 (5/32)	350 (14)	ED032621

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbft)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E8018-G H4R	460 (67) min.	550 (80) min.	19 min.	Not Specified	Not Specified
Typical Performance ⁽²⁾ As-Welded	515 - 655 (75 - 95)	620 - 710 (90 - 103)	24 - 32	96 - 167 (71 - 123)	50 - 121 (37 - 89)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn ⁽⁴⁾	%Si ⁽⁴⁾	%P	%S	%Ni ⁽⁴⁾	%Cr ⁽⁴⁾	%Mo ⁽⁴⁾	%V ⁽⁴⁾	%Cu ⁽⁴⁾	Diffusible Hydrogen, mL/100g
Requirements AWS E8018-G H4R	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 min.	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4 max.
Typical Performance ⁽²⁾	0.04 - 0.06	1.28 - 1.42	0.44 - 0.58	0.01 - 0.02	≤0.01	0.76 - 0.85	0.04 - 0.06	0.17 - 0.39	<0.01	0.04 - 0.13	1 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. ⁽⁴⁾ In order to meet the alloy requirements of the "G" group, the undiluted weld metal shall have the minimum of at least one of the elements listed.

Pipeliner® 19P

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up (AWS E10018-G H4R)

Pipeliner® 19P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass welding of up to X80 grade pipe. For vertical up pipe welding – choose Pipeliner® 19P.

Key Features

- Low Hydrogen Vertical Up Capability – Excellent for repair welds or welds with increased sensitivity to cracking.
- Easy to Strike Tip – Improved arc starting and reduction of arc starting porosity.
- Low Temperature Impact Toughness – Every lot tested to -46°C (-50°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance reliability and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006	E10018-G H4R
ASME SFA-5.5	E10018-G H4R
CSA W48	E6918-G

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)	
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC+	80 - 155	130 - 210
AC	80 - 160	140 - 215

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Cans 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032622
4.0 (5/32)	350 (14)	ED032623

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E10018-G H4R	600 (87) min.	690 (100) min.	15 min.	Not Specified	Not Specified
Typical Performance ⁽²⁾ As-Welded	660 - 740 (96 - 107)	740 - 825 (107 - 120)	20 - 26	91 - 129 (69 - 95)	81 - 111 (60 - 82)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn ⁽⁴⁾	%Si ⁽⁴⁾	%P	%S	%Ni ⁽⁴⁾	%Cr ⁽⁴⁾	%Mo ⁽⁴⁾	%V ⁽⁴⁾	%Cu ⁽⁴⁾	Diffusible Hydrogen, mL/100g
Requirements AWS E10018-G H4R	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 max.	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4 max.
Typical Performance ⁽²⁾	0.03 - 0.05	1.44 - 1.78	0.34 - 0.57	0.01 - 0.02	≤0.01	1.92 - 2.36	0.02 - 0.07	0.37 - 0.47	0.01 - 0.02	0.01 - 0.07	2 - 3

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. ⁽⁴⁾ In order to meet the alloy requirements of the "G" group, the undiluted weld metal shall have the minimum of at least one of the elements listed.

Pipeliner® 20P

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up (AWS E12018-G H4R)

Pipeliner® 20P has high operator appeal with a smooth arc, square burn-off and excellent puddle control. It is recommended for fill and cap pass vertical up welding of up to X100 grade pipe. For vertical up pipe welding – choose Pipeliner® 20P.

Key Features

- Low Hydrogen Vertical Up Capability – Excellent for repair welds or welds with increased sensitivity to cracking.
- Easy to Strike Tip – Improved arc starting and reduction of arc starting porosity.
- Low Temperature Impact Toughness – Every lot tested to -60°C (-76°F).
- Hermetically Sealed Packaging – Easy Open Cans – Delivers quality product, performance, reliability and consistent results.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C1 Schedule I. Actual certificates of test available at www.lincolnelectric.com.

Welding Positions

All Position, except vertical down

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.5
CSA W48

E12018-G H4R / E8318-G
E12018-G H4R
E8318-G

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)	
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)
DC+	80 - 130	120 - 180
AC	90 - 140	130 - 190

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032624
4.0 (5/32)	350 (14)	ED032625

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -60°C (-76°F)
Requirements AWS E12018-G H4R	740 (107) min.	825 (120) min.	14 min.	Not Specified	Not Specified
Typical Performance ⁽²⁾ As-Welded	795 - 840 (115 - 122)	820 - 850 (119 - 123)	17 - 21	80 (59)	60 (44)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn ⁽⁴⁾	%Si ⁽⁴⁾	%P	%S	%Ni ⁽⁴⁾	%Cr ⁽⁴⁾	%Mo ⁽⁴⁾	%V ⁽⁴⁾	%Cu ⁽⁴⁾	Diffusible Hydrogen, mL/100g
Requirements AWS E12018-G H4R	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 min.	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4 max.
Typical Performance ⁽²⁾	0.05 - 0.08	1.25 - 1.60	0.30 - 0.60	0.01 - 0.02	≤0.02	1.60 - 2.05	0.35 - 0.60	0.35 - 0.60	0.01 - 0.02	0.01 - 0.08	1 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. ⁽⁴⁾ In order to meet the alloy requirements of the "G" group, the undiluted weld metal shall have the minimum of at least one of the elements listed.

Pipeliner® LH-D80

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Down (AWS E8045-P2 H4R)

Pipeliner® LH-D80 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X70 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D80.

Key Features

- High Productivity – Carry and deposit more weld metal in vertical down pipe welding allowing for faster travel speeds and high deposition rates.
- Low Hydrogen - AWS H4R – Integrated Silicate Technology™ improves resistance to moisture pickup allowing this AWS H4R electrode to reduce chances for hydrogen-induced cracking.
- Easy Strike Tapered Tip – Innovative tip design enables easy touch start arc initiation for minimal starting porosity.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule I. Charpy V-notch testing at -40°C (-40°F). Actual certificates of test available at www.lincolnelectric.com.
- Best-in-Class Arc Performance – Smooth arc, excellent puddle control and low spatter for ease of use, operator appeal and higher productivity.

Welding Positions

All Position, except vertical up

Conformance

AWS A5.5/A5.5M: 2006	E8045-P2 H4R
ASME SFA-5.5	E8045-P2 H4R

TYPICAL OPERATING PROCEDURES

Polarity	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	4.5 mm (11/64 in.)
	Current (Amps)	Current (Amps)	Current (Amps)
DC+	120 - 170	170 - 250	200 - 300

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032626
4.0 (5/32)	350 (14)	ED032627
4.5 (11/64)	350 (14)	ED032628

MECHANICAL PROPERTIES⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E8045-P2 H4R	460 (67) min.	550 (80) min.	19 min.	27 (20) min.	Not Specified
Typical Performance⁽²⁾ As-Welded	485 - 515 (70 - 75)	570 - 600 (83 - 87)	26 - 31	75 - 125 (55 - 92)	50 - 95 (37 - 70)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen, mL/100g
Requirements AWS E8045-P2 H4R	0.12 max.	0.90 - 1.70	0.80 max.	0.03 max.	0.03 max.	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4 max.
Typical Performance⁽²⁾	0.04 - 0.06	1.10 - 1.25	0.35 - 0.50	≤0.01	≤0.01	≤0.04	≤0.05	≤0.02	≤0.01	2 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeliner® LH-D90

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Down (AWS E9045-P2 H4R)

Pipeliner® LH-D90 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X80 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D90.

Key Features

- High Productivity – Carry and deposit more weld metal in vertical down pipe welding allowing for faster travel speeds and high deposition rates.
- Low Hydrogen - AWS H4R – Integrated Silicate Technology™ improves resistance to moisture pickup allowing this AWS H4R electrode to reduce chances for hydrogen-induced cracking.
- Easy Strike Tapered Tip – Innovative tip design enables easy touch start arc initiation for minimal starting porosity.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule I. Charpy V-notch testing at -40°C (-40°F). Actual certificates of test available at www.lincolnelectric.com.
- Best-in-Class Arc Performance – Smooth arc, excellent puddle control and low spatter for ease of use, operator appeal and higher productivity.

Welding Positions

All Position, except vertical up

Conformance

AWS A5.5/A5.5M: 2006	E9045-P2 H4R
ASME SFA-5.5	E9045-P2 H4R

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	4.5 mm (11/64 in.)
DC+	120 - 170	170 - 250	200 - 300

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032629
4.0 (5/32)	350 (14)	ED032630
4.5 (11/64)	350 (14)	ED032631

MECHANICAL PROPERTIES⁽¹⁾ - As required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbft)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E9045-P2 H4R	530 (77) min.	620 (90) min.	17 min.	27 (20) min.	Not Specified
Typical Performance ⁽²⁾ As-Welded	550 - 600 (80 - 87)	625 - 670 (91 - 97)	24 - 28	89 - 119 (66 - 88)	65 - 95 (48 - 70)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen, mL/100g
Requirements AWS E9045-P2 H4R	0.12 max.	0.90 - 1.70	0.80 max.	0.03 max.	0.03 max.	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4 max.
Typical Performance ⁽²⁾	0.04 - 0.06	1.15 - 1.35	0.35 - 0.55	≤0.01	≤0.01	0.25 - 0.30 ⁽⁴⁾ 0.80 - 1.00 ⁽⁵⁾	≤0.05	0.15 - 0.25	≤0.01	2 - 4

⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. ⁽⁴⁾ Range for 3.2 (1/8 in.) mm size only. ⁽⁵⁾ Range for 4.0 mm (5/32 in.) and 4.5 mm (11/64 in.) sizes.
NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeliner® LH-D100

Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Down (AWS E10045-P2 H4R)

Pipeliner® LH-D100 is a low hydrogen high deposition electrode specially designed for the vertical down welding of pipe. It is recommended for fill and cap pass welding of up to X90 pipe as well as pipe repair and hot tapping applications. For an electrode capable of the lowest diffusible hydrogen levels of any vertical down stick electrode in the industry, high productivity and operator appeal – choose Pipeliner® LH-D100.

Key Features

- High Productivity – Carry and deposit more weld metal in vertical down pipe welding allowing for faster travel speeds and high deposition rates.
- Low Hydrogen - AWS H4R – Integrated Silicate Technology™ improves resistance to moisture pickup allowing this AWS H4R electrode to reduce chances for hydrogen-induced cracking.
- Easy Strike Tapered Tip – Innovative tip design enables easy touch start arc initiation for minimal starting porosity.
- Lot Control and Q2 Testing – Manufactured to lot control standards and tested per AWS A5.5, Class C3 Schedule I. Charpy V-notch testing at -40°C (-40°F). Actual certificates of test available at www.lincolnelectric.com.
- Best-in-Class Arc Performance – Smooth arc, excellent puddle control and low spatter for ease of use, operator appeal and higher productivity.

Welding Positions

All Position, except vertical up

Conformance

AWS A5.5/A5.5M: 2006
ASME SFA-5.5

E10045-P2 H4R
E10045-P2 H4R

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in.)	4.0 mm (5/32 in.)	4.5 mm (11/64 in.)
DC+	120 - 170	170 - 250	200 - 300

DIAMETERS/PACKAGING

Diameters mm (in.)	Length mm (in.)	4.5 kg (10 lb) Easy Open Hermetic Can 13.6 kg (30 lb) Cardboard Carton Master
3.2 (1/8)	350 (14)	ED032632
4.0 (5/32)	350 (14)	ED032633
4.5 (11/64)	350 (14)	ED032634

MECHANICAL PROPERTIES⁽¹⁾ - As required per AWS A5.5/A5.5M: 2006

	Yield Strength ⁽³⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbft)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
Requirements AWS E10045-P2 H4R	600 (87) min.	690 (100) min.	16 min.	27 (20) min.	Not Specified
Typical Performance ⁽²⁾ As-Welded	620 - 690 (90 - 100)	705 - 750 (102 - 109)	21 - 28	75 - 110 (55 - 81)	56 - 85 (41 - 63)

DEPOSIT COMPOSITION⁽¹⁾ - As Required per AWS A5.5/A5.5M: 2006

	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen, mL/100g
Requirements AWS E10045-P2 H4R	0.12 max.	0.90 - 1.70	0.80 max.	0.03 max.	0.03 max.	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4 max.
Typical Performance ⁽²⁾	0.04 - 0.06	1.25 - 1.65	0.35 - 0.55	≤0.01	≤0.01	0.70 - 1.00	≤0.08	0.40 - 0.50	≤0.01	2 - 4

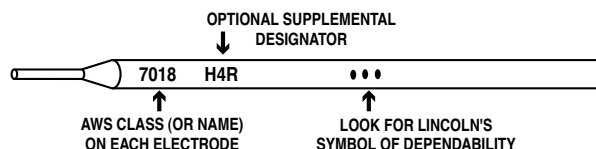
⁽¹⁾ Typical all weld metal. ⁽²⁾ See test results disclaimer on page 54. ⁽³⁾ Measured with 0.2% offset. NOTE: This product contains micro-alloying elements. Additional information available on request.

PACKAGING TYPES



Lincoln Electric's stick electrodes are packaged in either cartons or hermetically sealed easy-open cans. Unopened, Lincoln cans or cartons of electrode will retain their proper moisture content indefinitely when stored in good condition.

Electrodes come in 12, 14 and 18 inch (255 mm, 305 mm, 355 mm, and 460 mm) lengths, depending on electrode and packaging ranges from 5 to 50 lb (2.3 to 22.7 kg) cartons and 10 to 50 lb (4.5 to 22.7 kg) easy open cans.



ASME BOILER & PRESSURE VESSEL CODE Section IX F and A No.'s for Stick Electrode

F Number (per ASME Section IX and AWS D1.1)	AWS Classifications	Product	Weld Metal Analysis Classification (per ASME Section IX)
F-1	EXX20, EXX24, EXX27, EXX28, EXX20-X, EXX27-X	Fleetweld® 22 Jetweld® 2 Jetweld® 1 Excalibur® 7028	— A1 A1 A1
F-2	EXX12, EXX13, EXX14, EXX13-X	Fleetweld® 37 Fleetweld® 47	A1 A1
F-3	EXX10, EXX11, EXX10-X, EXX11-X	Fleetweld® 5P Fleetweld® 5P+ Fleetweld® 35 Fleetweld® 35LS Fleetweld® 180 Shield-Arc® 85 Shield-Arc® 70+ Shield-Arc® 90 Shield-Arc® HYP+ Pipelinor® 7P+ Pipelinor® 8P+	A1 A1 A1 A1 A1 A2 — A11 — — —
F-4	EXX15, EXX16, EXX18, EXX48, EXX15-X, EXX16-X, EXX18-X	Jetweld® LH-70 Jet-LH® 78 Lincoln® 7028 Excalibur® 7018 MR Excalibur® 7018-1 Excalibur® 7018-A1 MR Excalibur® 8018-B2 MR Excalibur® 8018-B2 XF MR Excalibur® 8018-C1 Excalibur® 8018-C3 Excalibur® 9018-B3 MR Excalibur® 9018-B3 XF MR Excalibur® 9018M MR Excalibur® 10018-D2 Excalibur® 11018M MR Pipelinor® 16P Pipelinor® 17P Pipelinor® 18P Pipelinor® 19P Pipelinor® 20P	A1 A1 A1 A1 — A2 A3 A3 A10 A10 A4 A4 A10 A11 — A1 — A10 A10 A12

AGENCY APPROVALS

Stick Electrode	AWS Class	ABS Grade	Lloyd's Register	DNV Grade	GL Grade	BV Grade	CWB/CSA Grade
Fleetweld® 5P	E6010	E6010	3M				E4310
Fleetweld® 5P+	E6010	E6010					E4310
Fleetweld® 180	E6011						E4311
Fleetweld® 35	E6011	E6011	3M				
Fleetweld® 35LS	E6011						E4311
Fleetweld® 22	E6022						
Jetweld® 1	E7024-1	E7024-1	1M	1	1	1	E4924-1
Jetweld® 2	E6027	E6027	3M	3	3	3	E4327
Fleetweld® 37	E6013	E6013	3M	1	1	1	E4313
Fleetweld® 47	E7014	E7014	1M	1	1	1	E4914
Excalibur® 7018 MR	E7018M E7018 H4R	E7018M, 3, 3YH5	3M 3YMH5	3YH5	3YH5	3YHHH	E4918
Excalibur® 7018-1 MR	E7018-1 E7018-1 H4R	E7018M, 3, 3YH5	3M 3YMH5	3YH5	3YH5	3YHHH	E4918
Lincoln® 7018AC	E7018						E4918
Jetweld® LH-70	E7018 H4R	E7018	3M, 3YMH5	3Y40H5	3YH5	3YHHH	E4918-1
Jet-LH® 78 MR	E7018 H4R	E7018	3M, 3YMH5	3Y40H5	3YH5	3YHHH	E4918-1
Excalibur® 7028	E7028 H8	E7028, 3Y	3YH10	IIIY			E4928
Excalibur® 7018-A1 MR	E7018-A1 H4R						E4918-A1
Excalibur® 8018-B2 MR	E8018-B2 H4R						E5518-B2
Excalibur® 8018-C1 MR	E8018-C1 H4R	E8018-C1 H4R					E5518-C1
Excalibur® 8018-C3 MR	E8018-C3 H4R	E8018-C3 H4R					E5518-C3
Excalibur® 9018M MR	E9018-M H4R	E9018M H4R					E6218-M
Excalibur® 9018-B3 MR	E9018-B3 H4R						E6218-B3
Excalibur® 11018M MR	E11018M H4R						E7618-M-H4
Shield-Arc® HYP+	E7010-P1 E7010-G	E7010-P1					E4910-P1
Shield-Arc® 85	E7010-A1	E7010-A1					E4910-A1
Shield-Arc® 70+	E8010-G	E8010-G					E5510-G
Shield-Arc® 90	E9010-G						
Pipelinor® 6P+	E6010						E4310
Pipelinor® 7P+	E7010-P1 E7010-G						E4910-1
Pipelinor® 16P	E7016 H4						
Pipelinor® 17P	E7018-1 H4R						E4918-1
Pipelinor® 18P	E8018-G H4R						E5518-G
Pipelinor® 19P	E10018-G H4R						E6918-G
Pipelinor® 20P	E12018-G H4R						E8318-G
Pipelinor® LH-D80	E8045-P2 H4R						
Pipelinor® LH-D90	E9045-P2 H4R						
Pipelinor® LH-D100	E10045-P2 H4R						

NOTE: Approvals are updated periodically. Consult your Lincoln Electric representative for the latest Approval/Grade revisions.

MILITARY APPROVALS

Stick Electrode	AWS/ASME	Military
Jetweld® LH-70	E7018 H4R	MIL-E-22200/1 MIL-7018
Shield-Arc® 85	E7010-A1	MIL-7101-A1

AWS A5.1 CARBON STEEL ELECTRODE

E6010

Electrode _____
Tensile in ksi _____
Position _____
Type of coating and current _____

Position

- 1 — Flat, Horizontal, Vertical, Overhead
- 2 — Flat and Horizontal only
- 4 — Flat, Horizontal, Vertical Down, Overhead

Types of Coating and Current

Digit	Type of Coating	Current
0	Cellulose sodium	DC+
1	Cellulose potassium	AC, DC±
2	Titania sodium	AC, DC-
3	Titania potassium	AC, DC+
4	Iron powder titania	AC, DC±
5	Low hydrogen sodium	DC+
6	Low hydrogen potassium	AC, DC+
7	Iron powder iron oxide	AC, DC±
8	Iron powder low hydrogen	AC, DC±

NOTE 1: Joining Electrodes, Non-Charpy V-Notch Rated

These electrodes (see below) and others of the same AWS classification, are not required to deposit weld metal capable of delivering any minimum specified Charpy V-Notch (CVN) properties. It should not be used in applications where minimum specified CVN properties are required. Typical applications where minimum specified CVN properties are required include, but are not restricted to, bridges, pressure vessels, and buildings in seismic zones. The user of this product is responsible for determining whether minimum CVN properties are required for the specific application.

Fleetweld® 22
Fleetweld® 37
Fleetweld® 47

AWS A5.5 LOW ALLOY STEEL ELECTRODE

E8018-B1 H4R

Electrode _____
Tensile in ksi _____
Position _____
For AC or DC+ _____
Chemical composition _____
Maximum diffusible hydrogen level obtained on the AWS A4.3 test. (Example: H4 = max 4.0 ml/100 g)

Moisture resistant. Meets specific low moisture pickup limits under controlled humidification tests.

Chemical Composition of Weld Deposit

Suffix	%Mn	%Ni	%Cr	%Mo	%V
A1				.50	
B1			.50	.50	
B2			1.25	.50	
B3			2.25	1.00	
C1		2.50			
C2		3.25			
C3		1.00	.15	.35	
D1/D2	1.25-.200			.25-.45	
G ⁽¹⁾		.50 min.	.30 min.	.20 min.	.10 min.

⁽¹⁾ Only one of the listed elements is required.

NOTE 2: Joining Electrodes, Non-Low Hydrogen

These electrodes (see below) and others of the same AWS classification, are not required to deposit weld metal that is low in diffusible hydrogen. Therefore, these electrodes should not be used in applications where the hydrogen content of the weld metal is required to be controlled, such as applications that involve steels with higher carbon and alloy content, and higher strength.

Fleetweld® 5P	Shield-Arc® 90
Fleetweld® 5P+	Shield-Arc® HYP+
Fleetweld® 35	Fleetweld® 47
Fleetweld® 35LS	Jetweld® 1
Fleetweld® 180	Jetweld® 2
Fleetweld® 37	Shield-Arc® 70+
Fleetweld® 22	
Shield-Arc® 85	

Welds on high strength and low alloy steel can often only be made with one or two specific electrodes. See pages 46 through 48 for selection information.

Full strength welds on mild steel can usually be made with a variety of different stick electrodes. Selection of the best stick electrode for maximum welding efficiency should be based on joint requirements.

Here is a three-step method for considering joint requirements:

1. Classify the joint as “Fast Freeze”, “Fast Fill”, Fill Freeze, or a combination of these.
2. Choose the electrode group “Fast Freeze”, “Fast Fill”, “Fill Freeze”, or Low Hydrogen from the following information.
3. Review the stick electrodes in the appropriate group to select the best stick electrode for the specific applications.

“Fast Freeze” Welding

The weld deposit rapidly solidifies for all-position welding. “Fast Freeze” stick electrodes have a high cellulose coating which produces a deep penetration, forceful spray-type arc with light slag coverage.

- Use on plate 3/16 - 5/8 in. (4.8 - 16 mm).
- For 5/8 in. (16 mm) and thicker plate, the “Fill Freeze”, low hydrogen electrodes are more economical because deposit rates are higher and they make welds with fewer large beads for reduced cleaning time.

“Fast Fill” Welding

The coating of “Fast Fill” stick electrodes is 50% iron powder and, therefore, produces a larger amount of weld deposition per electrode. “Fast Fill” stick electrodes are limited to level or slightly downhill (15° max) welding positions.

- Groove, flat and horizontal fillets, and lap welds in plate over 3/16 in. (4.8 mm) .
- For the required tight fitup, plates are butted tight, a back-up strip is used, or a stringer bead is made with “Fill Freeze” stick electrodes.

“Fill Freeze” Welding (Sheet Metal)

These stick electrodes have an increase of weld deposition compared to “Fast Freeze”, but can still be used for all-position welding. They have a titania rutile or lime based coating with the addition of iron powder in some cases.

- For sheet metal under 3/16 in. (4.8 mm) for electrodes that weld at high travel speeds with minimum skips, misses, slag entrapment and undercut.
- Fillet and lap welds in all-positions are best welded with EXX12 or EXX13 “Fill Freeze” electrode because of the excellent fast travel ability.
- Other types of joint are best welded with “Fast Freeze” stick electrodes because they have good puddle freezing ability.

Storing Low Hydrogen Electrodes

Low hydrogen electrodes must be dry to perform properly. Unopened Lincoln hermetically sealed containers provide excellent protection in good storage conditions. Opened cans should be stored in a cabinet at 250° - 300°F (120° - 150°C).

1. Low hydrogen electrode coatings that have picked up moisture may result in hydrogen induced cracking, particularly in steels with 80 ksi (550 MPa) and higher yield strength.

Moisture resistant electrodes with an “R” suffix have a high resistance to coating moisture pickup and, if properly stored, will be less susceptible to this problem, regardless of the yield strength of the steel being welded. Specific code requirements may indicate exposure limits different from these guidelines.

All low hydrogen electrodes should be stored properly, even those with an “R” suffix. Standard EXX18 electrodes should be supplied to welders twice per shift. Moisture resistant types may be exposed for up to 9 hours.

When containers are punctured or opened, low hydrogen electrodes may pick up moisture. Depending upon the amount of moisture, it will damage weld quality in the following ways:

2. A greater amount of moisture in low hydrogen electrodes may cause porosity. Detection of this condition requires x-ray inspection or destructive testing. If the base metal or weld metal exceeds 80,000 ksi (550 MPa) yield strength, this moisture may contribute to underbead or weld cracking.

3. A relatively high amount of moisture in low hydrogen electrode causes visible external porosity in addition to internal porosity. It also may cause excessive slag fluidity, a rough weld surface, difficult slag removal, and cracking.

3. Severe moisture pickup can cause weld cracks in addition to underbead cracking, severe porosity, poor appearance and slag problems.

Re-drying Low Hydrogen Electrodes

Re-drying, when done correctly, restores the electrodes' ability to deposit quality welds. Proper re-drying temperature depends upon the electrode type and its condition.

One hour at the listed final temperature is satisfactory. DO NOT dry electrodes at higher temperatures. Several hours at lower temperatures is not equivalent to using the specified requirements.

Electrodes of the E8018 and higher strength classifications should be given no more than three 1-hour re-dries in the 700° - 800°F (370° - 430°C) range. This minimizes the possibility of oxidation of alloys in the coating resulting in lower than normal tensile or impact properties.

Any low hydrogen electrode should be discarded if excessive re-drying causes the coating to become fragile and flake or break off while welding, or if there is a noticeable difference in handling or arc characteristics, such as insufficient arc force.

Electrodes to be re-dried should be removed from the can and spread out in the oven because each electrode must reach the drying temperature.

RE-DRYING CONDITIONS – LOW HYDROGEN

Condition	Pre-drying Temperature ⁽¹⁾	Final Re-drying Temperature	
		E7018, E7028	E8018, E9018, E10018, E11018
Electrodes exposed to air for less than one week; no direct contact with water.	—	650° - 750°F (340° - 400°C)	700° - 800°F (370° - 430°C)
Electrodes which have come in direct contact with water or which have been exposed to high humidity.	180° - 220°F (80° - 105°C)	650° - 750°F (340° - 400°C)	700° - 800°F (370° - 430°C)

⁽¹⁾ Pre-dry for 1-2 hours. This will minimize the tendency for coating cracks or oxidation of the alloys in the coating.

STORING AND RE-DRYING STICK ELECTRODES

Storing and Re-drying Non-Low Hydrogen Electrodes

Electrodes in unopened Lincoln cans or cartons retain the proper moisture content indefinitely when stored in good condition.

If exposed to humid air for long periods of time, electrodes from opened containers may pick up enough moisture to affect operating characteristics or weld quality. If moisture appears to be a problem, store electrodes from the opened containers in heated cabinets at 100° to 120°F (40° to 50°C). **DO NOT** use higher temperatures, particularly for electrodes from the “Fast Freeze” group.

Some electrodes from wet containers or long exposure to high humidity can be re-dried. Follow the procedures below for each type.

Using longer drying times or higher temperatures can easily damage the electrodes.

For drying, remove the electrodes from the container and spread them out in the furnace because each electrode must reach the drying temperature.

RE-DRYING CONDITIONS – NON-LOW HYDROGEN

Electrode	Electrode Group	Final Re-drying Temperature	Time
E6010: Fleetweld® 5P, 5P+ E6011: Fleetweld® 35, 35LS, 180 E7010-A1: Shield-Arc 85 ⁽¹⁾ E7010-G: Shield-Arc HYP+ ⁽¹⁾ E8010-G: Shield-Arc 70+ ⁽¹⁾ , E9010-G: Shield-Arc 90 ⁽¹⁾	Fast Freeze – Excessive moisture is indicated by a noisy arc and high spatter, rusty core wire at the hold end or objectionable coating blisters while welding. Rebaking of this group of electrodes is not recommended.	Not Recommended	—
E7024: Jetweld® 1 E6027: Jetweld® 2	Fast Fill – Excessive moisture is indicated by a noisy or “digging” arc, high spatter, tight slag, or undercut. Pre-dry unusually damp electrodes for 30 - 45 minutes at 200°F to 230°F (90° - 110°C) before final drying to minimize cracking of the coating.	400° - 500°F (200° - 260°C)	30 - 45 minutes
E6013: Fleetweld® 37 E7014: Fleetweld® 47 E6022: Fleetweld® 22	Fill Freeze – Excessive moisture is indicated by a noisy or “digging” arc, high spatter, tight slag, or undercut. Pre-dry unusually damp electrodes for 30 - 45 minutes at 200°F to 230°F (90° - 110°C) before final drying to minimize cracking of the coating.	300° - 350°F (150° - 180°C)	20 - 30 minutes

⁽¹⁾ Pre-dry for 1-2 hours. This will minimize the tendency for coating cracks or oxidation of the alloys in the coating.

**For best welding results with Lincoln Electric equipment,
always use Lincoln Electric consumables. Visit www.lincolnelectric.com for more details.**

Material Safety Data Sheets (MSDS) and Certificates of Conformance are available on our website at www.lincolnelectric.com

TEST RESULTS

Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

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