Premium Alloy Welding Solutions

Lincoln Electric is your single source for alloy welding consumables. Our newly expanded alloy portfolio covers the full spectrum of welding processes. Now featuring stainless steel, nickel, cobalt, low alloys, and hardfacing products for any application from power generation, chemical and petrochemical, offshore, LNG, and nuclear. We make it easy to access our special alloy products to meet your needs.

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Catalog User Guide

STICK (SMAW) ELECTRODE

Lincoln® 7018 AC

AWS E7018 H8 • Mild Steel, Low Hydrogen

Conformances

AWS A5.1/A5.1M: 2004	E7018 H8
ASME SFA-A5.1:	E7018 H8
CWB/CSA W48-06:	E4918-H8

Welding Positions

All, except vertical down

Shielding Gas

Key Features

- AC polarity welding
- Low open circuit voltage operation
- Minimal spatter
- Capable of cold re-strikes

Typical Applications

- General fabrication
- Thin sections
- Tack and skip welds

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED033512	ED033514	ED031732
1/8 (3.2)	14 (350)	ED033513	ED033515	ED031734
5/32 (4.0)	14 (350)		ED033516	ED031738

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H8	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	435-625 (63-80)	515-685 (75-90)	23-29	27-76 (20-56)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H8	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.04-0.07	1.00-1.60	0.32-0.63	0.01-0.02	≤ 0.01	0.01-0.03

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018 H8	0.20 max.	0.30 max.	0.08 max.	1.75 max.	8.0 max.
Typical Results[3]	0.03-0.08	≤ 0.01	0.02-0.05	1.00-1.40	2-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 16. [4]Preferred polarity is listed first.

1. **Catalog Section –** Refer to the top of each page for a reference to the consumable category.
2. **Brand Name –** The name of each product appears in the top left or right corner of each page.
3. **Product Category within Section –** Each consumable section of the catalog has subcategories to further define each product.
4. **Classification –** AWS or EN classification.
5. **Key Features –** Top features of each product.
6. **Typical Applications –** List of where customers typically use product.
7. **Conformances –** Every specification and conformance to which the product is tested.
8. **Welding Positions –** Flat and Horizontal or All Position capability.
9. **Shielding Gas –** Recommended shielding gas in order of performance and (where applicable).
10. **Diameters & Packaging Chart –** Diameters and packaging available for each product (manufactured to the unit of measurement listed first).
11. **Mechanical Properties –** Details the AWS mechanical property requirements and typical test results for each product's weld deposit.
12. **Chemical Composition –** Details the AWS chemical composition content requirements and typical wire composition or deposit composition results.
13. **Typical Operating Procedures –** Recommended operating ranges and resulting melt-off and/or deposition rates for each product diameter.

Lincoln Electric is focused on helping companies make their welding operations more effective, more efficient and 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 Electric distributors in countries all over the world — is the largest in the industry. Lincoln Electric's innovative thinking, fresh approach to design and a quality-first attitude presents our customers with worldwide strength and support.

Industry-Leading Consistency

Consistency is critical to the strength and appearance of every weld. Lincoln Electric quality starts with superior materials – incoming raw steel slated for use in consumables is analyzed for chemical composition, checking more than 20 different elements before being cleared for production. The result is a line of weld consumables that are reliably uniform in diameter and chemical composition. In fact, Lincoln Electric standards are considerably more restrictive than AWS requirements.

MANUFACTURED AT AN ISO 9001:2000 14001:2004 CERTIFIED FACILITY

Better Manufacturing Systems

Lincoln Electric employs the most technically advanced and carefully monitored manufacturing and quality control systems in the welding industry. The result is a line of weld consumables that are reliably uniform.

Industry Solutions

Lincoln Electric is committed to developing welding solutions that meet the unique needs of our customers, worldwide. Becoming Lincoln Electric's global partner provides your company with specialized, industry-tested equipment and consumables created to meet industry specific welding requirements. Whether your company manufactures pipelines, wind towers or offshore oil rigs, choosing Lincoln Electric ensures maximum productivity, quality and profitability for our customers.

The Symbol of Dependability

Our stick electrodes have been the number one choice of fabricators for over a century. They are easily identified by three dots, which are a symbol of quality, consistency, and unparalleled welding expertise. When only the best will do, there is no substitute for a Lincoln Electric stick electrode.

Q Lot Certifications

Certification to Meet Your Needs

Lincoln Electric offers three levels of Q Lot Certification. While each is indicative of a unique set of tests, traceabilities and records, all Q Lot Certs share a common heritage grounded in chemical composition control and Lincoln Electric's Six Sigma driven production system. No matter which Q Lot Cert you require – from our standard Q1 Lot® Cert to our comprehensive and exacting Q3 Lot® Cert, you get the peace-of-mind that comes from knowing that you can count on the performance of your welding consumables.

	Q1	Q2	Q3
Lincoln Electric standard ISO manufacturing system	■	■	■
Certificates of conformance	■	■	■
Lincoln Electric Q Lot number on product meets AWS A5.01 lot definition requirements	■	■	■
Link Q Lot number to certificate of conformance	■	■	■
Traceable to Lincoln manufacturing date, shift and operator	■	■	■
Recorded flux/mix chemistry	■	■	■
Items below represent additional agency requirements for testing and traceability			
Independent verification of records		■	■
Recorded steel chemistry		■	■
Lot control number per a specification (ASME code, for instance)		■	■
Testing per specification (when required)		■	■
Independent verification of all tests		■	■
Test results traceable to Lincoln archived records		■	■
Certification with test results issued to customer			■
Certification with test results traceable from Lincoln Electric to customer			■
Lincoln Electric keeps records on file			■
Certification issued to customer			■

Lincoln Electric's Quality System is derived from controlled chemical composition of steel. Our Q Lot System is comprised of 3 comprehensive levels:

Q1 Lot® – Lincoln Electric's standard manufacturing and Quality Assurance System. We start by evaluating the raw materials, analyzing the nose and tail end of each green rod coil for chemical composition ensuring it meets Lincoln's stringent requirements. Our tight tolerances go beyond AWS requirements to ensure consistency in product chemistry, mechanical properties and operation. Providing traceability to the date of manufacture, operator, line and shift. *Examples: Standard commercial products. Products have and AWS certificate of conformance.*

Q2 Lot® – Comprised of Q1 Lot®, plus archived lot controlled records of in-process testing and manufacturing, as well as actual and deposit composition test results of the finished product. Providing traceability to the date of manufacture, operator, line and shift. *Examples: Stainless, Nickel, Pipeliner® and all Batch Managed Inventory. Products have Certified Material Test Reports (CMTR's, 3.1)*

Q3 Lot® – Comprised of Q2 Lot®, plus special testing requirements and archived records for a specific shipment or customer. Products can be made to order per customer's purchase order.
Examples: Military and Nuclear certification. Products have Certified Material Test Reports (CMTR's, 3.1)

EN Certifications

EN 10204 Inspection Documents	Testing Levels per AWS A5.01 Filler Metal Procurement Guidelines	Examples of Lincoln Electric Options
Type 2.1 States "Products are in compliance with requirements of the order (WITHOUT any test results).	**Schedule F** The level of testing shall be the manufacturer's standard. A statement, "the product supplied will meet the requirements of the applicable AWS standard, when tested in accordance with that standard" and a summary of the typical properties of the material, when tested in that manner, shall be supplied upon written request.	Lincoln Electric "3 year" Certificate of Conformance applicable to a Q1 Lot®.
Type 2.2 States "Products are in compliance with requirements of the order (includes non-specific test results – NOT ACTUALS from the lot in question).	**Schedule G** Test results shall be supplied from any production run of the product made within the twelve months preceding the date of the purchase order. This shall include the results of all tests prescribed for that classification in the AWS standard.	Lincoln Electric "1 year" Certificate of Conformance applicable to a Q1 Lot®.
Type 3.1 States "Products are in compliance with requirements of the order and includes ACTUAL test results for some requirements, but not all.	**Schedule H** Chemical analysis of each lot shipped shall be supplied by the manufacturer. The analysis shall include those elements prescribed for that classification in the AWS standard."	Lincoln Electric "Q1 with Schedule H" Certificate of Actual Results on each S4 lot of SAW wire. Lincoln Electric "Q2" Certified Material Test Reports for stainless products.
	Schedule I Actual results of the tests called for in Table 2 of AWS A5.01 shall be supplied by the manufacturer for each lot shipped. These tests represent a consensus of those frequently requested for consumables certification; however, they do not necessarily include all tests required for Schedule J. The tests shall be performed as prescribed for that classification in the AWS standard.	Lincoln Electric "Q2" Certified Material Test Reports for products such as Pipeliner® brand.
	Schedule J Actual results of all of the tests prescribed for that classification in the AWS standard shall be supplied by the manufacturer for each lot shipped."	Lincoln Electric "Q2" Certified Material Test Reports for stainless solid wires such as BlueMax® MIG, Lincolnweld® stainless subarc wires, and Lincoln® stainless cut length products.
	Schedule K In addition to, or in place of, any of the tests called for in the AWS standard, the purchaser may require other tests (such as testing after a specified heat treatment). In all such cases, the purchaser shall identify on the purchase order the specific tests that are to be conducted, the procedures to be followed, the requirements that shall be met and the results to be reported by the manufacturer.	Lincoln Electric "Q3" Certified Material Test Reports to specific customer requirements. Lincoln Electric "Q1 with Schedule K" Certificate of Actual Results for composition on each lot of SAW flux.

Disclaimers

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 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.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

Important Information On Our Website

Consumable AWS Certificates:
http://www.lincolnelectric.com/LEExtranet/MyLincolnCerts/site/default.aspx

D1.8 Certificate Center:
http://www.lincolnelectric.com/LEExtranet/MyLincolnCerts/site/awsd.aspx

Material Safety Data Sheets (MSDS):
http://www.lincolnelectric.com/en-us/support/msds/Pages/msds.aspx

ANSI Z49.1, E205 Safety Booklet:
http://www.lincolnelectric.com/en-us/education-center/welding-safety/documents/e205.pdf

More Welding Safety Materials can be found at:
http://www.lincolnelectric.com/en-us/education-center/welding-safety/Pages/welding-safety.aspx

SMAW CONSUMABLES

STICK

Mild Steel, Cellulosic
Fleetweld® 5P 20
Fleetweld® 5P+ 21
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Mild Steel, Rutile
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Mild Steel, High Deposition
Jetweld® 2 28
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Mild Steel, Low Hydrogen
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Low Alloy, Low Hydrogen
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Excalibur® 11018M MR® 47
Chromet® 1X 48
Chromet® 2X 49
Chromet® 9-B9 50

Fleetweld® 5P

Mild Steel, Cellulosic • AWS E6010

Key Features

- Deep arc penetration
- Light slag with minimal arc interference
- Excellent vertical and overhead capability

Typical Applications

- Steel with moderate surface contaminants
- Cross country and in-plant pipe welding
- Square edge butt welds
- Welding on galvanized and specially coated steels

Conformances

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-A5.1:	E6010
ABS:	E6010
Lloyd's Register:	3M
CWB/CSA W48-06:	E4310
TUV:	EN ISO 2560-A: E 42 3 C25

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton*	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033509	ED032561	ED010211
1/8 (3.2)	14 (350)	ED033510	ED032562	ED010203
5/32 (4.0)	14 (350)	ED033511	ED032563	ED010216
3/16 (4.8)	14 (350)			ED010207
7/32 (5.6)	14 (350)			ED010219
1/4 (6.4)	14 (350)			ED010200

NOTE: Retail Small Packaging (RSP). All RSP products carry AWS compliance. Unlike the standard products, RSP products have no other agencies approvals.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6010	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	420-475 (61-69)	515-570 (75-83)	25-31	41-68 (30-50)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6010	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.09-0.17	0.40-0.63	0.09-0.43	0.005-0.017	0.005-0.014
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E6010	0.30 max.	0.20 max.	0.30 max.	0.08 max.	
Typical Results[3] - As-Welded	0.01-0.05	0.01-0.05	≤ 0.03	≤ 0.01	

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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+	40-80	70-130	90-165	140-225	200-275	220-325
DC-	50-85	75-135	100-175	–	–	–

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 5P+

AWS E6010 • Mild Steel, Cellulosic

Conformances

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-A5.1:	E6010
ABS:	E6010
CWB/CSA W48-06:	E4310
TUV:	EN ISO 2560-A: E 42 3 C25

Welding Positions

All

Key Features

- High operator appeal and control
- Easy slag removal
- Standard in the pipe welding industry

Typical Applications

- Cross country and in-plant pipe welding
- Steel with moderate surface contaminants
- Repair welding

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
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/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6010	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	415-500 (60-73)	500-610 (73-88)	22-29	51-93 (38-69)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6010	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.09-0.20	0.46-0.79	0.10-0.32	0.005-0.017	0.004-0.014
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E6010	0.30 max.	0.20 max.	0.30 max.	0.08 max.	
Typical Results[3] - As-Welded	≤ 0.04	≤ 0.04	≤ 0.02	≤ 0.01	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[4]	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+	50-85	75-135	100-175	140-225
DC-	50-85	75-135	100-175	–

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 180

Mild Steel, Cellulosic • AWS E6011

Key Features

- AC polarity welding
- Performs on low amperages and OCV
- Easy to strike arc

Typical Applications

- Small AC welders
- Sheet metal
- Edge, corner and butt joints
- Welding on galvanized and specially coated steels

Welding Positions

All

Conformances

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-A5.1:	E6011
CWB/CSA W48-06:	E4311

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton*	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033494	ED033496	ED010110
1/8 (3.2)	14 (350)	ED033495	ED033497	ED010105
5/32 (4.0)	14 (350)		ED033498	ED010114

NOTE: Retail Small Packaging (RSP). All RSP products carry AWS compliance. Unlike the standard products, RSP products have no other agencies approvals.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6011	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	460-490 (67-71)	570-590 (83-86)	22-32	35-72 (26-53)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6011	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.13-0.20	0.44-0.71	0.23-0.45	0.009-0.014	0.005-0.008

	%Ni	%Cr	%Mo	%V
Requirements - AWS E6011	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Results[3] - As-Welded	≤ 0.03	≤ 0.03	≤ 0.01	≤ 0.01

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[4]	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
AC	40-90	65-120	115-150
DC±	40-80	60-110	105-135

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 35

AWS E6011 • Mild Steel, Cellulosic

Conformances

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-A5.1:	E6011
ABS:	E6011
Lloyd's Register:	3M
EN ISO 2560-B:	E4311 A

Welding Positions

All

Key Features

- Stable arc performance
- High operator appeal
- AC and DC welding

Typical Applications

- Sheet metal
- In-plant pipe welding
- Steel with moderate surface contaminants
- Welding on galvanized and specially coated steels

DIAMETERS / PACKAGING

Diameter 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/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6011	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	385-415 (56-60)	470-510 (68-74)	26-33	56-101 (42-75)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6011	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.11-0.16	0.32-0.60	0.09-0.28	0.006-0.011	0.004-0.013

	%Ni	%Cr	%Mo	%V
Requirements - AWS E6011	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Results[3] - As-Welded	≤ 0.06	0.01-0.04	≤ 0.02	≤ 0.01

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 35LS

Mild Steel, Cellulosic • AWS E6011

Key Features

- Use for tack welds under Innershield® deposits
- Light, easy to remove slag
- AC and DC welding

Typical Applications

- Tack welding
- Steel with moderate surface contaminants

Conformances

AWS A5.1/A5.1M: 2004	E6011
ASME SFA-A5.1:	E6011
CWB/CSA W48-06:	E4311

Welding Positions

All

DIAMETERS / PACKAGING

Diameter 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/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6011	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	400-435 (58-63)	495-560 (72-81)	22-31	29-64 (22-47)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6011	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.09-0.19	0.75 - 1.10	0.03-0.13	0.007-0.017	0.005-0.011
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E6011	0.30 max.	0.20 max.	0.30 max.	0.08 max.	
Typical Results[3] - As-Welded	≤ 0.06	0.01-0.04	≤ 0.02	0.01 max.	

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[4]	1/8 in (3.2 mm)	5/32 in (4.0 mm)
AC	80-130	120-160
DC±	70-120	110-150

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 37

AWS E6013 • Mild Steel, Rutile

Conformances

AWS A5.1/A5.1M: 2004	E6013
ASME SFA-A5.1:	E6013
ABS:	E6013
Lloyd's Register:	3M
DNV Grade:	1
GL:	1
BV Grade:	1
CWB/CSA W48-06:	E4313
EN ISO 2560-B:	E4313 A

Welding Positions

All

Key Features

- Operable with low amperages on sheet metal
- Excellent bead appearance
- Slag control accommodates vertical down welding

Typical Applications

- Sheet metal
- Irregular short welds that change positions
- Maintenance or repair welding
- For use with small AC welders with low OCV

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton*	50 lb (22.7 kg) Carton
5/64 (2.0)	12 (300)			ED010170
3/32 (2.4)	12 (300)	ED033499	ED033501	ED010161
1/8 (3.2)	14 (350)	ED033500	ED033502	ED010153
5/32 (4.0)	14 (350)		ED033503	ED010165
3/16 (4.8)	14 (350)			ED010156

NOTE: Retail Small Packaging (RSP). All RSP products carry AWS compliance. Unlike the standard products, RSP products have no other agencies approvals.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6013	330 (48) min.	430 (60) min.	17 min.	Not Specified
Typical Results[3] - As-Welded	400-440 (58-64)	460-515 (67-75)	23	37-76 (27-56)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6013	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.04-0.07	0.32-0.45	0.16-0.24	0.01-0.02	0.01-0.02

	%Ni	%Cr	%Mo	%V
Requirements - AWS E6013	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Results[3] - As-Welded	≤ 0.07	0.02 - 0.04	≤ 0.02	0.01-0.02

TYPICAL OPERATING PROCEDURES

	Current (Amps)				
Polarity[4]	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	50-80	75-115	110-140	160-200	205-260
DC±	45-75	70-105	100-135	145-180	185-235

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 22

Mild Steel, Rutile • AWS E6022

Key Features

- Deep penetration
- Optimized for burn-through spot welding
- Little slag interference in arc

Typical Applications

- Spot welding floor decking to beams
- Steel with moderate surface contaminants

Conformances

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

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter 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/A5.1M: 2004*

	Tensile Strength MPa (ksi)	Longitudinal Bend Test
Requirements - AWS E6022	430 (60) min.	Required
Typical Results[3] - As-Welded	415-565 (60-82)	Pass

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[4]	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC-	110-150	150-180
AC	110-150	150-180

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Fleetweld® 47

AWS E7014 • Mild Steel, Rutile

Conformances

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

Welding Positions

All

Key Features

- High deposition rates
- Excellent operator appeal
- Easy to use
- Operates on low amperages

Typical Applications

- Maintenance and repair welding
- Sheet metal and fillet welds
- Heavy sections

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton*	50 lb (22.7kg) Carton
3/32 (2.4)	14 (350)	ED033504	ED033506	ED010189
1/8 (3.2)	14 (350)	ED033505	ED033507	ED010183
5/32 (4.0)	14 (350)		ED033508	ED010193
3/16 (4.8)	14 (350)			ED010186

NOTE: Retail Small Packaging (RSP). All RSP products carry AWS compliance. Unlike the standard products, RSP products have no other agencies approvals.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7014	400 (58) min.	490 (70) min.	17 min.	Not Specified
Typical Results[3] - As-Welded	400-510 (58-74)	490-585 (70-85)	23-29	45-103 (33-76)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E7014	0.15 max.	1.25 max.	0.90 max.	0.035 max.	0.035 max.
Typical Results[3] - As-Welded	0.06-0.10	0.25-0.67	0.04-0.69	0.01-0.02	≤ 0.02

	%Ni	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V
Requirements - AWS E7014	0.30 max.	0.20 max.	0.30 max.	0.08 max.	1.50 max.
Typical Results[3] - As-Welded	0.02-0.09	0.01-0.05	≤ 0.02	≤ 0.02	0.37

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[4]	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	110-155	150-225	200-285
DC±	75-95	100-145	135-200	185-235

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Jetweld® 2

Mild Steel, High Deposition • AWS E6027

Key Features

- High deposition rates
- Smooth bead appearance
- Shallow penetration for minimal dilution

Typical Applications

- Multiple pass welding
- Fast-fill single pass welds
- Fillet and lap welds

Conformances

AWS A5.1/A5.1M: 2004	E6027
ASME SFA-A5.1:	E6027
ABS:	E6027
Lloyd's Register:	3M
DNV Grade:	3
GL:	3
BV Grade:	3
CWB/CSA W48-06:	E4327
EN ISO 2560-B:	E4327 A

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Carton
3/16 (4.8)	18 (450)	ED010501
1/4 (6.4)	18 (450)	ED010500

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E6027	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	365-395 (53-57)	435-470 (63-68)	26-34	53-80 (39-60)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6027	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.02-0.07	0.70-1.10	0.12-0.41	0.016-0.024	0.005-0.013

	%Ni	%Cr	%Mo	%V
Requirements - AWS E6027	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Results[3] - As-Welded	0.03-0.07	0.02-0.05	0.01-0.04	≤ 0.01

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[4]	3/16 in (4.8 mm)	1/4 in (6.4 mm)
AC	250-300	350-450
DC±	230-270	315-405

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Jetweld® 1

AWS E7024-1 • Mild Steel, High Deposition

Conformances

AWS A5.1/A5.1M: 2004	E7024-1
ASME SFA-A5.1:	E7024-1
ABS:	E7024-1
Lloyd's Register:	1M
DNV Grade:	1
GL:	1
BV Grade:	1
CWB/CSA W48-06:	E4924-1
EN ISO 2560-B:	E4924-1 A

Welding Positions

Flat & Horizontal

Key Features

- High deposition rates
- Smooth bead appearance
- Minimal spatter
- Shallow penetration

Typical Applications

- Large welds
- Slightly downhill (15° max) positions
- Multiple pass welding

DIAMETERS / PACKAGING

Diameter 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]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)
Requirements - AWS E7024-1	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	455-490 (66-71)	530-565 (77-86)	22-31	27-60 (20-44)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E7024-1	0.15 max.	1.25 max.	0.90 max.	0.035 max.	0.035 max.
Typical Results[3] - As-Welded	0.03-0.06	0.63-1.02	0.13-0.68	0.010-0.022	0.005-0.011

	%Ni	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V
Requirements - AWS E7024-1	0.30 max.	0.20 max.	0.30 max.	0.08 max.	1.50 max.
Typical Results[3] - As-Welded	≤ 0.06	0.01-0.05	≤ 0.02	0.03 max.	0.75

TYPICAL OPERATING PROCEDURES

	Current (Amps)				
Polarity[4]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Excalibur® 7018 MR®

Mild Steel, Low Hydrogen • AWS E7018 H4R

Key Features

- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal
- Minimal spatter for enhanced operability and clean weld surface

Typical Applications

- Mild steel
- Power generation
- Petrochemical
- Pressure vessels
- Pressure piping

Conformances

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-A5.1:	E7018 H4R
ABS:	3Y H5
Lloyd's Register:	3YM H5
DNV Grade:	3 YH5
GL:	3YH5
BV Grade:	3YHHH
CWB/CSA W48-06:	E4918
EN ISO 2560-B:	E4918 A H5

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032086	ED032588	ED028280
1/8 (3.2)	14 (350)	ED031468	ED032589	ED028281
5/32 (4.0)	14 (350)		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[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	430-510 (62-74)	510-605 (74-88)	25-37	121-332 (89-246)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.03-0.08	1.01-1.55	0.34-0.68	0.01-0.02	≤ 0.01	0.01-0.06

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018 H4R	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.
Typical Results[3]	0.02-0.07	≤ 0.05	≤ 0.02	1.04-1.75	2-3

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Jetweld® LH-70

AWS E7018 H4R • Mild Steel, Low Hydrogen

Conformances

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-A5.1:	E7018 H4R
ABS:	E7018, 3Y
Lloyd's Register:	3YM H5
DNV Grade:	3 Y40H5
GL:	3YH5
BV Grade:	3YHHH
CWB/CSA W48-06:	E4918-1
MIL-E-22200/1:	MIL-7018

Key Features

- Low hydrogen
- Smooth arc performance

Typical Applications

- General fabrication
- Military low hydrogen applications

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter 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/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	400-485 (58-70)	490-570 (71-83)	23-36	156-334 (115-246)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.04-0.08	0.95-1.17	0.30-0.53	0.01-0.02	≤ 0.02	0.01-0.05

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018 H4R	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.
Typical Results[3]	0.03-0.06	≤ 0.02	≤ 0.02	1.05-1.50	1-2

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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	90-150	120-190	170-280	210-330	290-430
AC	80-120	110-170	135-225	200-300	260-380	325-440

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Jet-LH® 78 MR®

Mild Steel, Low Hydrogen • AWS E7018 H4R

Key Features

- Low hydrogen
- Smooth arc performance

Typical Applications

- General fabrication

Welding Positions

All, except vertical down

Conformances

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-A5.1:	E7018 H4R
ABS:	E7018
Lloyd's Register:	3YM H5
DNV Grade:	3 YH5
GL:	3YH5
BV Grade:	3YHHH
CWB/CSA W48-06	E4918-1

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton*	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033517	ED015161
1/8 (3.2)	14 (350)	ED033518	ED015198
5/32 (4.0)	14 (350)	ED033519	ED015141
3/16 (4.8)	14 (350)		ED015186
1/4 (6.4)	18 (450)		ED015383

NOTE: Retail Small Packaging (RSP). All RSP products carry AWS compliance. Unlike the standard products, RSP products have no other agencies approvals.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	415-570 (60-83)	495-640 (72-93)	22-34	156-353 (115-260)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.04-0.07	0.75-1.35	0.13-0.69	≤ 0.01	≤ 0.01	0.02-0.04

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018 H4R	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.
Typical Results[3]	0.02-0.06	≤ 0.03	≤ 0.03	1.00-1.40	1-3

TYPICAL OPERATING PROCEDURES

	Current (Amps)				
Polarity[4]	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)	1/4 in (6.4 mm)
DC+	65-100	110-160	130-200	180-270	300-400
AC	70-105	120-170	140-230	210-290	325-420

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Lincoln® 7018 AC

AWS E7018 H8 • Mild Steel, Low Hydrogen

Conformances

AWS A5.1/A5.1M: 2004	E7018 H8
ASME SFA-A5.1:	E7018 H8
CWB/CSA W48-06:	E4918-H8

Welding Positions

All, except vertical down

Key Features

- AC polarity welding
- Low open circuit voltage operation
- Minimal spatter
- Capable of cold re-strikes

Typical Applications

- General fabrication
- Thin sections
- Tack and skip welds

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED033512	ED033514	ED031732
1/8 (3.2)	14 (350)	ED033513	ED033515	ED031734
5/32 (4.0)	14 (350)		ED033516	ED031738

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H8	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	435-625 (63-80)	515-685 (75-90)	23-29	27-76 (20-56)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H8	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.04-0.07	1.00-1.60	0.32-0.63	0.01-0.02	≤ 0.01	0.01-0.03

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018 H8	0.20 max.	0.30 max.	0.08 max.	1.75 max.	8.0 max.
Typical Results[3]	0.03-0.08	≤ 0.01	0.02-0.05	1.00-1.40	2-4

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Excalibur® 7018-1 MR®

Mild Steel, Low Hydrogen • AWS E7018-1 H4R

Key Features

- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike and effortless slag removal
- Impact toughness tested to -46°C (-50°F)
- Q2 Lot® - Certificate showing actual deposit chemistry available online

Typical Applications

- Power generation
- Petrochemical
- Pressure vessels
- Pressure piping
- Fill and cap pass welding of up to X65 grade pipe

Conformances

AWS A5.1/A5.1M: 2004	E7018-1 H4R
ASME SFA-A5.1:	E7018-1 H4R
ABS:	3Y H5
Lloyd's Register:	3YM H5
DNV Grade:	3 YH5
GL:	3YH5
BV Grade:	3YHHH
CWB/CSA W48-06:	E4918-1
TUV:	DIN EN ISO 2560-A:E
EN ISO 2560-B:	E4918-1 A U H5

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033179		
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[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E7018-1 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	405-515 (59-75)	530-605 (77-88)	24-36	56-178 (42-131)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018-1 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.04-0.07	0.80-1.44	0.28-0.51	0.006-0.019	0.003-0.013	0.01-0.07

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018-1 H4R	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.
Typical Results[3]	0.01-0.07	0.11-0.28	≤ 0.01	0.93-1.65	2-3

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Excalibur® 7028

AWS E7028 H8 • Mild Steel, Low Hydrogen

Typical Applications

- Structural
- Heavy fabrication
- Shipbuilding
- Storage tanks
- Bridge fabrication

Conformances

AWS A5.1/A5.1M: 2004	E7028 H8
ASME SFA-A5.1:	E7028 H8
ABS:	E7028, 3Y H10 (Fillet Only)
Lloyd's Register:	3YM H10
DNV Grade:	3 YH10
CWB/CSA W48-06:	E4928 H8

Key Features

- High deposition rates
- Premium arc performance
- High travel speed
- H8 diffusible hydrogen levels
- Capable of producing weld deposits with impact toughness exceeding 84 J (60 ft•lbf) at -40°C (-40°F)

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter 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]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)
Requirements - AWS E7028 H8	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	450-470 (66-69)	540-560 (77-85)	27-34	84-193 (62-142)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7028 H8	0.15 max.	1.60 max.	0.90 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3]	0.03-0.06	1.17-1.51	0.44-0.77	0.007-0.014	0.004-0.008	0.02-0.04

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7028 H8	0.20 max.	0.30 max.	0.08 max.	1.75 max.	8.0 max.
Typical Results[3]	0.02-0.05	0.01-0.03	0.02 max.	1.25-1.62	4-5

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[4]	5/32 in (4.0 mm)	3/16 in (4.8 mm)	7/32 in (5.6 mm)
AC	190-210	235-255	250-270
DC+	160-180	215-235	260-280

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Shield-Arc® HYP+

Low Alloy, Cellulosic, Pipe • AWS E7010-P1

Key Features

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

Typical Applications

- Root pass welding of up to X80 grade pipe
- Hot, fill and cap pass of up to X65 grade pipe
- Vertical down welding

Conformances

AWS A5.5/A5.5M: 2006	E7010-P1, E7010-G
ASME SFA-A5.5:	E7010-P1, E7010-G
ABS:	E7010-P1
CWB/CSA W48-06:	E4910-P1
TUV:	DIN EN ISO 2560-A:E

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7010-P1	415 (60) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded	435-525 (63-76)	525-635 (76-92)	22-28	27-56 (20-41)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E7010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.
Typical Results[3]	0.13-0.17	0.43-0.63	0.08-0.18	≤ 0.01	≤ 0.01
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E7010-P1	1.00 max.	0.30 max.	0.50 max.	0.10 max.	
Typical Results[3]	0.01-0.02	0.02	0.27-0.31	< 0.01	

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Shield-Arc® 85

AWS E7010-A1 • Low Alloy, Cellulosic, Pipe

Conformances

AWS A5.5/A5.5M: 2006	E7010-A1
ASME SFA-A5.5:	E7010-A1
ABS:	E7010-A1
CWB/CSA W48-06:	E4910-A1
TUV:	DIN EN ISO 2560-A:E
MIL-E-22200/7:	MIL-7010-A1

Welding Positions

All

Key Features

- For welding 0.50% molybdenum steel
- Light slag for minimal arc interference
- Deep penetration and superior puddle control
- Clean, visible weld puddle
- Capable of 480 MPa (70 ksi) tensile strength weld deposits

Typical Applications

- API 5L X42 through X56 grade pipe
- Cross country and in-plant pipe

DIAMETERS / PACKAGING

Diameter 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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7010-A1	390 (57) min.	490 (70) min.	22 min.	Not Specified
Typical Results[3] - As-Welded	440-510 (64-74)	540-580 (78-84)	25-30	35-43 (26-32)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S	%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 Results[3]	0.07-0.12	0.29-0.59	0.08-0.26	0.01-0.02	≤ 0.01	0.40-0.62

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Shield-Arc® 70+

AWS E8010-G • Low Alloy, Cellulosic, Pipe

Key Features

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

Typical Applications

- Relatively high silicon pipe
- API 5L X56 through X70 grade pipe
- Cross country and in-plant pipe

Conformances

AWS A5.5/A5.5M: 2006	E8010-G, E8010-P1*
ASME SFA-A5.5:	E8010-G, E8010-P1*
ABS:	E8010-G
CWB/CSA W48-06:	E5510-G
TUV:	DIN EN ISO 2560-A:E

* This product is classified as an E8010-G; however, it also meets the requirements of an E8010-P1.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter 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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E8010-G	460 (67) min.	550 (80) min.	19 min.	Not Specified	Not Specified
Typical Results[3] - As-Welded	460-620 (67-90)	585-690 (85-100)	19-31	37-81 (27-60)	26-64 (19-47)

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%P	%S
Requirements[4] - AWS E8010-G	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.
Typical Results[3]	0.13-0.17	0.60-1.20	0.05-0.30	≤ 0.01	≤ 0.01
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements[4] - AWS E8010-G	0.50 min.	0.30 min.	0.20 min.	0.10 min.	
Typical Results[3]	0.75-0.97	0.01-0.20	0.35-0.45	0.02-0.04	

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy requirements of the "G" designation, the undiluted weld metal shall have the minimum of at least one of the elements listed.

Shield-Arc® 90

AWS E9010-G • Low Alloy, Cellulosic, Pipe

Conformances

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

Welding Positions

All

Key Features

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

Typical Applications

- Hot pass welding of up to X80 grade pipe, when followed by low hydrogen fill and cap
- API 5L X70 through X80 grade pipe
- Cross country pipe

DIAMETERS / PACKAGING

Diameter 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
5.0 (3/16)	14 (350)	EDS01695

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E9010-G	530 (77) min.	620 (90) min.	17 min.	Not Specified	Not Specified
Typical Results[3] - As-Welded	530-605 (77-88)	620-690 (90-100)	17-29	45-94 (33-69)	28-62 (21-46)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S
Requirements[4] - AWS E9010-G	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.
Typical Results[3]	0.13-0.18	0.55-0.79	0.08-0.22	0.01-0.02	≤ 0.01
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E9010-G	0.50 min.	0.30 min.	0.20 min.	0.10 min.	
Typical Results[3]	0.66-0.77	0.01-0.06	0.43-0.70	≤ 0.01	

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy requirements of the "G" designation, the undiluted weld metal shall have the minimum of at least one of the elements listed.

Excalibur® 7018-A1 MR®

Low Alloy, Low Hydrogen • AWS E7018-A1 H4R

Key Features

- Designed for welding 0.50% molybdenum steel
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal
- Capable of exceeding AWS minimum requirement of 490 MPa (70 ksi) tensile strength after 8 hours of stress-relieving at 620°C (1150°F)

Typical Applications

- Fabrication and maintenance welding
- Pressure vessels and pressure piping

Conformances

AWS A5.5/A5.5M: 2006	E7018-A1 H4R
ASME SFA-A5.5:	E7018-A1 H4R
ABS:	E7018-A1 H4R
CWB/CSA W48-06:	E4918-A1

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032893		ED032875	
1/8 (3.2)	14 (350)		ED032873		ED032876
5/32 (4.0)	14 (350)				ED032877

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018-A1 H4R	390 (57) min.	490 (70) min.	22 min.	Not Specified
Typical Results[3] - As-Welded				
Stress-Relieved 1 hr @ 620°C (1150°F)	470-500 (68-72)	565-585 (82-85)	25-32	60-130 (46-96)
Stress-Relieved 8 hrs @ 620°C (1150°F)[4]	450-485 (65-70)	545-570 (79-83)	27-32	50-107 (38-79)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P
Requirements - AWS E7018-A1 H4R	0.12 max.	0.90 max.	0.80 max.	0.03 max.
Typical Results[3]	0.04-0.06	0.55-0.80	0.35-0.55	≤ 0.01

	%S	%Mo	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7018-A1 H4R	0.03 max.	0.40-0.65	4.0 max.
Typical Results[3]	≤ 0.01	0.45-0.65	2-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[5]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry Specific Data (Not AWS Requirement). [5]Preferred polarity is listed first.

Excalibur® 8018-B2 MR®

AWS E8018-B2 H4R • Low Alloy, Low Hydrogen

Typical Applications

- Power generation
- Petrochemical
- Pressure vessels
- Process piping

Conformances

AWS A5.5/A5.5M: 2006	E8018-B2 H4R
ASME SFA-A5.5:	E8018-B2 H4R
CWB/CSA W48-06:	E5518-B2

Welding Positions

All, except vertical down

Key Features

- Designed for welding 1.25% chromium, 0.50% molybdenum steel
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal
- Capable of exceeding AWS minimum requirement of 550 MPa (80 ksi) tensile strength after 8 hours of stress-relieving at 690°C (1275°F)

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E8018-B2 H4R	460 (67) min.	550 (80) min.	19 min.	Not Specified
Typical Results[3]				
Stress-Relieved 1 hr @ 690°C (1275°F)	540-585 (78-85)	640-685 (93-99)	24-26	71-127 (52-94)
Stress-Relieved 8 hrs @ 690°C (1275°F)[4]	495-540 (72-78)	605-640 (88-93)	25-28	64-127 (47-83)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P
Requirements - AWS E8018-B2 H4R	0.05-0.12	0.90 max.	0.80 max.	0.03 max.
Typical Results[3]	0.08-0.11	0.65-0.80	0.35-0.55	≤ 0.02
	%S	**%Cr**	**%Mo**	**Diffusible Hydrogen (mL/100g weld metal)**
Requirements - AWS E8018-B2 H4R	0.03 max.	1.00-1.50	0.40-0.65	4.0 max.
Typical Results[3]	≤ 0.01	1.05-1.30	0.40-0.60	2-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[5]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry Specific Data (Not AWS Requirement). [5]Preferred polarity is listed first.

Excalibur® 8018-C1 MR®

Low Alloy, Low Hydrogen • AWS E8018-C1 H4R

Key Features

- Designed to produce a nominal 2.25% nickel deposit
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal
- Capable of exceeding AWS minimum requirement of 550 MPa (80 ksi) tensile strength after 1 hour of stress-relieving at 610°C (1125°F)

Typical Applications

- Low temperature applications
- Refrigerated ammonia tanks
- Liquefied gas storage, piping and transportation
- Weathering steels

Conformances

AWS A5.5/A5.5M: 2006	E8018-C1 H4R
ASME SFA-A5.5:	E8018-C1 H4R
CWB/CSA W48-06:	E5518-C1

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED030876
1/8 (3.2)	14 (350)	ED030877
5/32 (4.0)	14 (350)	ED030878
3/16 (4.8)	14 (350)	ED030879
1/4 (6.4)	18 (450)	ED030880

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -59°C (-75°F)
Requirements - AWS E8018-C1 H4R	460 (67) min.	550 (80) min.	19 min.	20 (27) min.
Typical Results[3] Stress-Relieved 1 hr @ 610°C (1125°F)[4]	460-525 (67-76)	565-615 (82-89)	24-32	79-129 (58-95)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P
Requirements - AWS E8018-C1 H4R	0.12 max.	1.25 max.	0.80 max.	0.03 max.
Typical Results[3] - As-Welded	0.05-0.09	0.89-1.25	0.17-0.53	≤ 0.02

	%S	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E8018-C1 H4R	0.03 max.	2.00-2.75	4.0 max.
Typical Results[3] - As-Welded	≤ 0.01	2.00-2.58	1-3

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[5]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry Specific Data (Not AWS Requirement). [5]Preferred polarity is listed first.

Excalibur® 8018-C3 MR®

AWS E8018-C3 H4R • Low Alloy, Low Hydrogen

Typical Applications

- Shipbuilding
- Piping and gas storage tanks
- Weathering steels
- Cross country pipe repair

Conformances

AWS A5.5/A5.5M: 2006	E8018-C3 H4R
ASME SFA-A5.5:	E8018-C3 H4R
ABS:	E8018-C3 H4R
CWB/CSA W48-06:	E5518-C3
EN ISO 2560-B:	E5518-N2 A U H5

Key Features

- Designed to produce a 1% nickel deposit
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E8018-C3 H4R	470-550 (68-80)	550 (80) min.	24 min.	27 (20) min.
Typical Results[3] - As-Welded	505-590 (73-86)	550-675 (80-98)	24-32	81-163 (60-120)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E8018-C3 H4R	0.12 max.	0.40-1.25	0.80 max.	0.03 max.	0.03 max.
Typical Results[3]	0.04-0.07	0.40-1.25	0.23-0.46	≤ 0.01	≤ 0.009

	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E8018-C3 H4R	0.80-1.10	0.15 max.	0.35 max.	0.05 max.	4.0 max.
Typical Results[3]	0.81-1.09	0.04-0.06	0.07-0.27	≤ 0.01	1-2

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity[4]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Excalibur® 9018-B3 MR®

Low Alloy, Low Hydrogen • AWS E9018-B3 H4R

Key Features

- Designed for all-position welding of 2.25% chromium, 1% molybdenum low alloy steels
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal
- Capable of exceeding AWS minimum requirements of 620 MPa (90 ksi) tensile strength after 8 hours of stress-relieving at 690°C (1275°F)

Typical Applications

- 2.25% chromium, 1% molybdenum steels
- Power generation
- Petrochemical
- Pressure vessels
- Process piping

Conformances

AWS A5.5/A5.5M: 2006	E9018-B3 H4R
ASME SFA-A5.5:	E9018-B3 H4R
CWB/CSA W48-06:	E6218-B3

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032884		ED032887	
1/8 (3.2)	14 (350)		ED032885		ED032888
5/32 (4.0)	14 (350)				ED032889

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E9018-B3 H4R	530 (77) min.	620 (90) min.	17 min.	Not Specified
Typical Results[3]				
Stress-Relieved 1 hr @ 690°C (1275°F)	595-605 (86-88)	705-715 (102-104)	20-23	57-72 (42-53)
Stress-Relieved 8 hrs @ 690°C (1275°F)[4]	530-580 (77-84)	650-685 (94-99)	20-24	43-107 (32-79)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P
Requirements - AWS E9018-B3 H4R	0.05-0.12	0.90 max.	0.80 max.	0.03 max.
Typical Results[3]	0.07-0.1	0.65-0.79	0.39-0.49	≤0.01
	%S	**%Cr**	**%Mo**	**Diffusible Hydrogen (mL/100g weld metal)**
Requirements - AWS E9018-B3 H4R	0.03 max.	2.00-2.50	0.90-1.20	4.0 max.
Typical Results[3]	≤0.01	2.21-2.46	1.03-1.13	2-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[5]	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry Specific Data (Not AWS Requirement). [5]Preferred polarity is listed first.

Excalibur® 9018M MR®

AWS E9018M H4R • Low Alloy, Low Hydrogen

Typical Applications

- High strength steel, such as HY-80, HY-90 and ASTM A514
- Cross country pipe repair
- DC welding

Conformances

AWS A5.5/A5.5M: 2006	E9018M H4R
ASME SFA-A5.5:	E9018M H4R
ABS:	E9018M H4R
CWB/CSA W48-06:	E6218-M H4R (9018M H4R)

Key Features

- Designed to produce weld deposits with 620 MPa (90 ksi) tensile strength
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master 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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -50°C (-60°F)
Requirements - AWS E9018M H4R	540-620 (78-90) min.	620 (90) min.	24 min.	27 (20) min.
Typical Results[3] - As-Welded	540-620 (78-90)	620-705 (90-102)	24-37	27-122 (20-90)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E9018M H4R	0.10 max.	0.60-1.25	0.80 max.	0.03 max.	0.03 max.
Typical Results[3]	0.04-0.07	0.90-1.10	0.30-0.50	0.01-0.02	≤ 0.01

	%Ni	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E9018M H4R	1.40-1.80	0.15 max.	0.35 max.	4.0 max.
Typical Results[3]	1.50-1.80	0.05-0.12	0.25-0.35	1-3

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Excalibur® 10018-D2 MR®

Low Alloy, Low Hydrogen • AWS E10018-D2 H4R

Key Features

- Capable of exceeding 550 MPa (80 ksi) yield strength after 12 hours at 635°C (1175°F) on 4130 AISI steel
- Premium arc performance
- Q2 Lot® - Certificate showing actual deposit chemistry available online
- Easy strike and re-strike
- Effortless slag removal

Welding Positions

All, except vertical down

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

Conformances

AWS A5.5/A5.5M: 2006	E10018-D2 H4R
ASME SFA-A5.5:	E10018-D2 H4R
ABS:	3YQ620 H5
Lloyd's Register:	3Y62 H5
DNV Grade:	3Y62 H5
CWB/CSA W48-06:	E6918-D2

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033162	
1/8 (3.2)	14 (350)		ED033163
5/32 (4.0)	14 (350)		ED033164

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)	Hardness[4] HV_{10}
Requirements - AWS E10018-D2 H4R	600 (87) min.	690 (100) min.	16 min.	27 (20) min.	Not Specified
Typical Results[3] - Stress-Relieved 1 hr @ 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 Results[3] - Stress-Relieved 12 hrs @ 620°C (1150°F)[4]	560-580 (81-84)	650-675 (94-98)	24-25	47-68 (35-50)	210-214

DEPOSIT COMPOSITION[1]

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

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry specific data, not required by AWS. [5]Preferred polarity is listed first.
NOTE: Additional test data available upon request.

Excalibur® 11018M MR®

AWS E11018M H4R • Low Alloy, Low Hydrogen

Typical Applications

- Quenched and tempered steels, such as A514, A517 and A709
- General fabrication of high strength steels
- Crane booms
- Trailer frames

Conformances

AWS A5.5/A5.5M: 2006	E11018M H4R
ASME SFA-A5.5:	E11018M H4R
ABS:	4YQ690 H5
DNV Grade:	4 YM69 H5
CWB/CSA W48-06:	E7618-M H4R

Key Features

- Capable of producing weld deposits with 760 MPa (110 ksi) tensile strength
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
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/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -50°C (-60°F)
Requirements - AWS E11018M H4R	680-760 (98-110)	760 (110) min.	20 min.	27 (20) min.
Typical Results[3] - As-Welded	690-758 (100-110)	765-807 (111-117)	20-26	76-103 (56-76)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E11018M H4R	0.10 max.	1.30-1.80	0.60 max.	0.03 max.	0.03 max.
Typical Results[3]	0.04-0.05	1.55-1.80	0.40-0.55	≤ 0.02	0.01-0.03

	%Ni	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E11018M H4R	1.25-2.50	0.40 max.	0.25-0.50	4.0 max.
Typical Results[3]	2.0-2.5	0.02-0.20	0.40-0.50	1-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity	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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Chromet® 1X

Low Alloy, Low Hydrogen • AWS E8018-B2

Key Features

- X-Factor < 15 ppm
- J-Factor < 180 ppm

Conformances

AWS A5.5	E8018-B2 H4
BS EN ISO 3580-A	E CrMo1 B
BS EN ISO 3580-B	E 5516-1CM
BS 2493	1CrMo B H
DIN 8575	ECrMo 1 B 2 6

Welding Positions

All

Typical Applications

- Designed for prolonged elevated temperatures up to 550°C (1022°F).
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F).
- Petro-Chemical
- Power Plants
- Piping
- Turbine Casting
- Steam Chests
- Valve Bodies
- Boiler Superheaters

DIAMETERS / PACKAGING

Diameter mm (in)	4.2 kg (9.3 lb) Easy Open Can	5.0 kg (11 lb) Easy Open Can	5.6 kg (12.3 lb) Easy Open Can
2.5 (3/32)	ED033570		
3.2 (1/8)		ED033563	
4.0 (5/32)			ED033564
5.0 (3/16)			ED033571

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Charpy V-Notch J (ft•lbf) @ -30°C (-22°F)	Hardness HV_{10}[4] @ PWHT
Requirements AWS E8018-B2	460	550 (80) min.	19	20	47	–	–
Typical Performance							
As-Welded 1 hr @ 690°C (1274°F)	525	610	25	21	160	100	300
Stress-Relieved 5 hr @ 690°C (1274°F)	515	610	29	25	200	160	220
5 hr @ 690°C (1274°F) + SC[7]	490	595	29	25	200	140	190

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn[5]	%Si[5]	%S	%P	%Cr
Requirements AWS E8018-B2	0.05 - 0.1	0.5 - 0.9	0.15 - 0.3	0.015 max.	0.012 max.	1.00 - 1.40
Typical Results	0.06	0.70	0.25	0.012	0.009	1.25
	%Mo	**%Cu**	**%Sn**	**%As**	**%Sb**	**X-Factor[6]**
Requirements AWS E8018-B2	0.45 - 0.65	0.15 max.	0.005 max.	0.01 max.	0.005 max.	15 max.
Typical Results	0.55	<0.05	0.002	0.003	<0.002	–

TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in) 2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (3/16)
DC+ or AC	70 - 110	80 - 140	100 - 180	140 - 240

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]Industry specific data, not required by AWS. [5]Mn+Si < 1.10%. [6]X = (10P + 5Sb +4 Sn + As) / 100 (elements in ppm).
[7]SC = Step Cooling **NOTE:** Additional test data available upon request.

Chromet® 2X

AWS E9018-B3 • Low Alloy, Low Hydrogen

Typical Applications

- Designed for prolonged elevated temperatures up to 600°C (1112°F).
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F) .
- Petro-Chemical
- Power Plants
- Piping
- Turbine Casting
- Steam Chests
- Valve Bodies
- Boiler Superheaters

Key Features

- X-Factor < 15 ppm
- J-Factor < 180 ppm

Conformances

AWS A5.5	E9018-B3
BS EN ISO 3580-A	E CrMo1 B 3 2
BS EN ISO 3580-B	E 6216-2C1M
BS 2493	2CrMo B H
DIN 8575	ECrMo 2 B 2 6

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	4.1 kg (9 lb) Easy Open Can	4.6 kg (10 lb) Easy Open Can	5.7 kg (13 lb) Easy Open Can
2.5 (3/32) 3.2 (1/8) 4.0 (5/32) 5.0 (3/16)	ED033572	ED033573	ED033574 ED033575

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Charpy V-Notch J (ft•lbf) @ -30°C (-22°F)	Hardness HV10[4] AW PWHT
Requirements AWS E9018-B3	540 min.	630 min.	17 min.	18 min.	47[2] min.	–	–
Typical Performance							
As-Welded							
1 hr @ 690°C (1274°F)	570	670	22	19	140	80	220 - 250
Stress-Relieved							
5 hr @ 690°C (1274°F)	560	660	27	24	170	140	195
5 hr @ 690°C (1274°F) + SC[7]	550	650	25	20	170	110	205

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn[5]	%Si[5]	%S	%P	%Cr
Requirements AWS E9018-B3	0.05 - 0.10	0.50 - 0.90	0.15 - 0.3	0.015 max.	0.012 max.	2.00 - 2.50
Typical Results	0.06	0.70	0.25	0.012	0.01	2.25
	%Mo	**%Cu**	**%Sn**	**%As**	**%Sb**	**X-Factor[6]**
Requirements AWS E9018-B3	0.90 - 1.20	0.15 max.	0.005 max.	0.010 max.	0.005 max.	15 max.
Typical Results	1.05	<0.05	0.002	0.003	<0.002	–

TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in) 2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (3/16)
DC+ or AC	70 - 110	80 - 140	100 - 180	140 - 240

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]Industry specific data, not required by AWS. [5]Mn+Si < 1.10%. [6]X = (10P + 5Sb +4 Sn + As) / 100 (elements in ppm).
[7]SC = Step Cooling
NOTE: Additional test data available upon request.

Chromet® 9-B9

Low Alloy, Low Hydrogen • AWS E9015-B9

Key Features

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

Conformances

AWS A5.5	E9015-B9
BS EN ISO 3580-B	E 6216-9C1MV

Welding Positions

All

Applications

- Intended for high integrity structural service at elevated temperature
- Main Steam Piping
- Power Plants
- Oil Refineries
- Coal Liquefaction Plants
- Gasification Plants

DIAMETERS / PACKAGING

Diameter mm (in)	4.5 kg (10 lb) Easy Open Can	5 kg (11 lb) Easy Open Can	5.5 kg (12 lb) Easy Open Can
2.5 (3/32)	ED033379		
3.2 (1/8)		ED033380	
4.0 (5/32)		ED033381	
5.0 (3/16)			ED033382

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Hardness HV10[4] @ PWHT
Requirements AWS E9015-B9	530 (77) min.	620 (90) min.	17 min.	15 min.	–	–
Typical Results[3]						
As-Welded 2 hr @ 760°C (1400°F)	590 (86)	710 (103)	22.5	19	75 (55)	450
Stress-Relieved						
550°C (1022°F)	>360 (52)	>450 (65)	–	>15	–	–
600°C (1112°F)	>255 (37)	>375 (54)	–	>17	–	–
650°C (1202°F)	>175 (25)	>285 (41)	–	>21	–	–

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn[5]	%Si[5]	%S	%P	%Cr
Requirements AWS E9015-B9	0.08 - 0.12	0.40 - 0.75	0.30 max.	0.01 max.	0.01 max.	8.0 - 10.0
Typical Results[3]	0.10	0.55	0.25	0.008	0.008	9.0
	%Ni[5]	**%Mo**	**%Nb**	**%V**	**%Cu**	**%Ai**
Requirements AWS E9015-B9	0.2 - 0.4	0.85 - 1.2	0.03 - 0.07	0.15 - 0.25	0.25 max.	0.04 max.
Typical Results[3]	0.3	1.0	0.04	0.20	0.05	<0.01

TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in) 2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (0.19)
DC+ or AC	70 - 110	80 - 140	100 - 180	140 - 240

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]Industry specific data, not required by AWS.
[5]Ni + Mn < 1.0%. Nickel is below 0.4% (as parent metal) although AWS allows up to 1.0%Ni. See Chromet 9MV-N or Chromet 9MVN+ for variant with 0.4 - 1.0%Ni conforming to BS EN ISO specification.
NOTE: Additional test data available upon request.

MIG & TIG

MIG Wire

Mild Steel, Bare

SuperGlide® S3 52
SuperGlide® S6 54

Mild Steel, Copper Coated

SuperArc® L-50® 56
SuperArc® L-56® 58
SuperArc® L-59® 60

Low Alloy, Copper Coated

SuperArc® LA-75 62
SuperArc® LA-90 64
SuperArc® LA-100 66

TIG Cut Length

Mild Steel, Copper Coated

Lincoln® ER70S-2 68
Lincoln® ER70S-6 69
9CrMoV-N 70

SuperGlide® S3

Mild Steel, Bare Wire • AWS ER70S-3

Key Features

- Moderate levels of manganese and silicon for deoxidization of clean to light mill scale surfaces
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

- Clean to light mill scale base material
- Sheet metal to 380-485 MPa (55-70 ksi) yield strength material
- Pipeline
- Pressure vessels
- Structural steel

Conformances

AWS A5.18/A5.18M: 2005	ER70S-3
ASME SFA-A5.18:	ER70S-3
CWB/CSA W48-06:	ER49S-3
EN ISO 14341-B:	G 49A 2 C S3

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30-50 CFH

SuperGlide® S3

(AWS ER70S-3)

DIAMETERS / PACKAGING

Diameter in (mm)	44 lb (20 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.035 (0.9)	ED028621	ED030772
0.045 (1.1)	ED028622	ED030773

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS ER70S-3 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3] - As-Welded with 100% CO_2	405 (59)	510 (74)	26	100 (74)	87 (64)

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-3	0.006-0.15	0.90-1.40	0.45-0.75	0.035 max.	0.025 max.
Typical Results[3]	0.07-0.10	1.15-1.27	0.52-0.59	0.002-0.008	0.005-0.013
	%Cr	**%Mo**	**%Ni**	**%V**	**%Cu**
Requirements - AWS ER70S-3	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results[3]	≤ 0.03	≤ 0.01	≤ 0.04	< 0.01	0.02-0.04

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 100% CO_2[5]	9-12 (3/8-1/2)	2.5 (100)	18	80	0.7 (1.6)
		3.8 (150)	19	120	1.1 (2.4)
		6.4 (250)	22	175	1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375)	23	195	2.7 (6.0)
		12.7 (500)	29	230	3.6 (8.0)
		15.2 (600)	30	275	4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 100% CO_2[5]	12-19 (1/2-3/4)	3.2 (125)	19	145	1.5 (3.4)
		3.8 (150)	20	165	1.8 (4.0)
		5.1 (200)	21	200	2.4 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350)	27	285	4.2 (9.2)
		12.1 (475)	30	335	5.7 (12.5)
		12.7 (500)	30	340	6.0 (13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout.
[5]Procedures in these areas are procedures for short circuiting mode using 100% CO_2. When using 75% Argon, 25% CO_2 for short circuit transfer, reduce voltage by 1 to 2 volts.

SuperGlide® S6

Mild Steel, Bare Wire • AWS ER70S-6

Key Features

- High levels of manganese and silicon deoxidizers tolerate medium to heavy mill scale surfaces
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

- Medium to heavy mill scale base material
- Sheet metal to 380 - 485 MPa (55 - 70 ksi) yield strength material
- Automotive repair

Conformances

AWS A5.18/A5.18M: 2005	ER70S-6
ASME SFA-A5.18:	ER70S-6
CWB/CSA W48-06:	ER49S-6
EN ISO 14341-B:	G 49A 3 C S6
MIL-E-23765/1:	MIL-70S-6

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30 - 50 CFH

SuperGlide® S6

(AWS ER70S-6)

DIAMETERS / PACKAGING

Diameter in (mm)	44 lb (20 kg) Fiber Spool	900 lb (408 kg) Accu-Trak® Drum
0.035 (0.9)	ED028635	ED034560
0.045 (1.1)	ED028636	ED034561

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4] - AWS ER70S-6 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.
Typical Results[3] - As-Welded with 100% CO_2	430 (62)	540 (78)	28	71 (52)

WIRE COMPOSITION

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.035 max.	0.025 max.
Typical Results[3]	0.08-0.09	1.42-1.65	0.81-0.87	0.006-0.010	0.004-0.010
	%Cr	**%Ni**	**%Mo**	**%V**	**%Cu (Total)**
Requirements - AWS ER70S-6	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results[3]	0.01-0.05	≤ 0.04	≤ 0.01	< 0.01	0.01-0.04

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 100% CO_2 [5]	9-12 (3/8-1/2)	2.5 (100)	18	80	0.7 (1.6)
		3.8 (150)	19	120	1.1 (2.4)
		6.4 (250)	22	175	1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375)	23	195	2.7 (6.0)
		12.7 (500)	29	230	3.6 (8.0)
		15.2 (600)	30	275	4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 100% CO_2 [5]	12-19 (1/2-3/4)	3.2 (125)	19	145	1.5 (3.4)
		3.8 (150)	20	165	1.8 (4.0)
		5.1 (200)	21	200	2.4 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350)	27	285	4.2 (9.2)
		12.1 (475)	30	335	5.7 (12.5)
		12.7 (500)	30	340	6.0 (13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout.
[5]Procedures in these areas are procedures for short circuiting mode using 100% CO_2. When using 75% Argon, 25% CO_2 for short circuit transfer, reduce voltage by 1 to 2 volts.

SuperArc® L-50®

Mild Steel, Copper Coated • AWS ER70S-3 & EM13K

Key Features

- Moderate levels of manganese and silicon for deoxidization of clean to light mill scale surfaces
- Superior feeding and arc stability
- Copper coated for long contact tip life
- Supports short-circuiting, globular, axial spray and pulsed spray transfer
- MicroGuard® Ultra provides superior feeding and arc stability

Typical Applications

- Clean to light mill scale base material
- Sheet metal to 380 - 485 MPa (55 - 70 ksi) yield strength material
- Pipeline
- Pressure vessels
- Structural steel

Conformances

AWS A5.18/A5.18M: 2005	ER70S-3
ASME SFA-A5.18:	ER70S-3
AWS A5.17/A5.17M: 1997	EM13K
ABS:	3YSA
Lloyd's Register:	3YS H15
DNV Grade:	III YMS
CWB/CSA W48-06:	ER49S-3
EN ISO 14341-B:	G 49A 2 C S3
MIL-E-23765/1:	MIL-70S-3

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Plastic Spool	33 lb (15 kg) Steel Spool	44 lb (20 kg) Steel Spool	44 lb (20 kg) Fiber Spool	60 lb (27.2 kg) Coil
0.030 (0.8)	ED032923	ED031407			
0.035 (0.9)	ED032924	ED031408	ED031914	ED021268	
0.045 (1.1)	ED032925	ED031409	ED031915	ED021270	
0.052 (1.3)			ED031916		
1/16 (1.6)					ED011317

Diameter in (mm)	60 lb (27.2 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum	500 lb (227 kg) Accu-Pak® Box	500 lb (227 kg) Infinity-Pak®	600 lb (272 kg) Speed-Feed® Drum
0.030 (0.8)		ED029223			
0.035 (0.9)	ED021269	ED021052	ED032899		
0.040 (1.0)					
0.045 (1.1)	ED021271	ED020526	ED032901	ED034535	
0.052 (1.3)	ED021273	ED020527	ED032902		
1/16 (1.6)	ED027274		ED032903		ED011316

Diameter in (mm)	900 lb (408 kg) Accu-Pak® Box	1000 lb (454 kg) Accu-Trak® Drum	1000 lb (454 kg) Accu-Pak® Box	1000 lb (454 kg) Precise-Trak® Reel	1000 lb (454 kg) Infinity-Pak®
0.030 (0.8)					
0.035 (0.9)	ED032842	ED028825		ED032379	
0.040 (1.0)				ED032380	
0.045 (1.1)		ED028826	ED032844	ED031614	
0.052 (1.3)		ED029082	ED032845	ED031615	
1/16 (1.6)		ED029083	ED032846	ED033270	

SuperArc® L-50®

(AWS ER70S-3)

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-3	0.006-0.15	0.90-1.40	0.45-0.75	0.035 max.	0.025 max.
Typical Results[3]	0.08-0.11	1.14-1.23	0.53-0.59	0.003-0.009	0.003-0.013
	%Cr	**%Mo**	**%Ni**	**%V**	**%Cu (Total)**[4]
Requirements - AWS ER70S-3	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results[3]	≤ 0.04	≤ 0.02	≤ 0.03	< 0.01	0.15-0.25

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch - J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)
Requirements - AWS ER70S-3 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
MIL-70S-3 per MIL-E-23765/1 As-Welded with CO_2 and 98% Ar/2% O_2	380-485 (55-70)	485 (70) min.	22 min.	Not Specified	Not Specified
Typical Results[3] As-Welded with 100% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	415 (60) 365 (53)	515 (75) 475 (69)	26 34	95 (70) 118 (87)	88 (65) 100 (74)
As-Welded with 75% Ar/25% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	420 (61) 365 (53)	525 (76) 490 (71)	28 33	106 (78) 165 (122)	102 (75) 163 (120)
As-Welded with 90% Ar/10% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	450 (65) 365 (53)	545 (79) 485 (70)	30 35	142 (105) – –	122 (90) 214 (158)
As-Welded with 98% Ar/2% O_2 Stress Relieved 1 hr. @ 621°C (1150°F)	425 (62) 350 (51)	540 (78) 475 (69)	27 33	108 (80) – –	95 (70) 339 (250)

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.030 in (0.8 mm), DC+					
Short Circuit Transfer 100% CO_2	9-12 (3/8-1/2)	1.9 (75) 3.8 (150) 7.6 (300)	17 18 22	35 70 130	0.4 (0.9) 0.8 (1.8) 1.6 (3.6)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	9-12 (3/8-1/2)	2.5 (100) 3.8 (150) 6.4 (250)	18 19 22	80 120 175	0.7 (1.6) 1.1 (2.4) 1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375) 12.7 (500) 15.2 (600)	23 29 30	195 230 275	2.7 (6.0) 3.6 (8.0) 4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	12-19 (1/2-3/4)	3.2 (125) 3.8 (150) 5.1 (200)	19 20 21	145 165 200	1.5 (3.4) 1.8 (4.0) 2.5 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350) 12.1 (475) 12.7 (500)	27 30 30	285 335 340	4.2 (9.2) 5.7 (12.5) 6.0 (13.2)
0.052 in (1.3 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	7.6 (300) 8.1 (320) 12.3 (485)	30 30 32	300 320 430	4.8 (10.6) 5.2 (11.5) 7.8 (17.1)
1/16 in (1.6 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-25 (1/2-1)	5.3 (210) 6.0 (235) 7.4 (290)	25 27 28	325 350 430	4.8 (10.7) 5.4 (12.0) 6.7 (14.8)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in these areas are procedures for short circuiting mode using 100% CO_2. When using 75% Argon, 25% CO_2 for short circuit transfer, reduce voltage by 1 to 2 volts.

SuperArc® L-56®

Mild Steel, Copper Coated • AWS ER70S-6 & EH11K

Key Features

- High levels of manganese and silicon deoxidizers tolerate medium to heavy mill scale surfaces
- Excellent toe-wetting provides optimal bead appearance
- Copper coated for long contact tip life
- Supports short-circuiting, globular, axial spray and pulsed spray transfer
- MicroGuard® Ultra provides superior feeding and arc stability

Typical Applications

- Medium to heavy mill scale base material
- Sheet metal to 380-485 MPa (55-70 ksi) yield strength material
- Automotive repair
- Robotic or hard automation
- Structural steel

Conformances

AWS A5.18/A5.18M: 2005	ER70S-6
ASME SFA-A5.18:	ER70S-6
AWS A5.17/A5.17M: 1997	EH11K
ABS:	3YSA
Lloyd's Register:	3YS H5
DNV Grade:	III YMS
CWB/CSA W48-06:	ER49S-6
DB:	EN 440 G3Si1
TUV:	EN 440 G3Si1
EN ISO 14341-B:	G 49A 3 C S6
MIL-E-23765/1:	MIL-70S-6

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	2 lb (1 kg) Plastic Spool 10 lb (4.5 kg) Master Carton	12.5 lb (5.7 kg) Plastic Spool	33 lb (15 kg) Plastic Spool	33 lb (15 kg) Steel Spool	44 lb (20 kg) Steel Spool
0.025 (0.6)	ED030583	ED015790			
0.030 (0.8)	ED030631	ED023334	ED032926		
0.035 (0.9)	ED030632	ED028676	ED032927	ED031411	ED025945
0.045 (1.1)		ED029042	ED032928	ED031412	ED025946

Diameter in (mm)	44 lb (20 kg) Fiber Spool	60 lb (27.2 kg) Coil	60 lb (27.2 kg) Fiber Spool	250 lb (113.4 kg) Accu-Trak® Drum	500 lb (227 kg) Accu-Trak® Drum
0.030 (0.8)					ED030771
0.035 (0.9)	ED021274		ED021275	ED029914	ED021056
0.040 (1.0)	ED027384				ED031937
0.045 (1.1)	ED021276		ED021277	ED029915	ED020532
0.052 (1.3)	ED021278		ED021279	ED029916	ED020533
1/16 (1.6)		ED011666			ED029225

Diameter in (mm)	500 lb (227 kg) Accu-Pak® Box	900 lb (408 kg) Accu-Pak® Box	1000 lb (454 kg) Accu-Trak® Drum	1000 lb (454 kg) Accu-Pak® Box	1000 lb (454 kg) Precise-Trak® Reel
0.035 (0.9)	ED032904	ED032847	ED028827		ED033271
0.040 (1.0)			ED031032		
0.045 (1.1)	ED032906		ED028828	ED032849	ED031616
0.052 (1.3)	ED032907		ED029084	ED032850	ED031617
1/16 (1.6)			ED029085	ED032851	

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.035 max.	0.025 max.
Typical Results(3)	0.08-0.09	1.42-1.60	0.81-0.87	0.006-0.010	0.004-0.010
	%Cr	**%Ni**	**%Mo**	**%V**	**%Cu (Total)**(4)
Requirements - AWS ER70S-6	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results(3)	0.01-0.05	≤ 0.04	≤ 0.01	< 0.01	0.17-0.22

SuperArc® L-56®

(AWS ER70S-6)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS ER70S-6 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
MIL-70S-6 per MIL-E-23765/1 As-Welded with CO_2 and 98% Ar/2% O_2	380-550 (55-80)	485 (70) min.	22 min.	Not Specified	Not Specified
MIL-70S-6 per MIL-E-23765/1 Stress Relieved 1 hr. @ 621°C (1150° F) with CO_2 and 98% Ar/2% O_2	360 (52) min.	485 (70) min.	26 min.	27 (20) min.	Not Specified
Typical Results[3]					
As-Welded with 100% CO_2	440 (64)	560 (81)	29	71 (52)	61 (45)
Stress Relieved 1 hr. @ 621°C (1150°F)	395 (57)	510 (74)	29	95 (70)	68 (50)
As-Welded with 75% Ar/25% CO_2	460 (67)	565 (82)	27	82 (60)	72 (53)
Stress Relieved 1 hr. @ 621°C (1150°F)	415 (60)	540 (78)	31	140 (103)	122 (90)
As-Welded with 90% Ar/10% CO_2	470 (68)	580 (84)	28	119 (88)	78 (57)
Stress Relieved 1 hr. @ 621°C (1150°F)	440 (64)	550 (80)	32	183 (135)	156 (115)
As-Welded with 98% Ar/2% O_2	455 (66)	565 (82)	27	122 (90)	108 (80)
Stress Relieved 1 hr. @ 621°C (1150°F)	415 (60)	545 (79)	34	190 (140)	176 (130)

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.025 in (0.6 mm), DC+					
Short Circuit Transfer 100% CO_2	9-12 (3/8-1/2)	2.5 (100)	17	35	0.4 (0.9)
		6.4 (250)	19	80	0.9 (2.0)
0.030 in (0.8 mm), DC+					
Short Circuit Transfer 100% CO_2	9-12 (3/8-1/2)	1.9 (75)	17	35	0.4 (0.9)
		3.8 (150)	18	70	0.8 (1.8)
		7.6 (300)	22	130	1.6 (3.6)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	9-12 (3/8-1/2)	2.5 (100)	18	80	0.7 (1.6)
		3.8 (150)	19	120	1.1 (2.4)
		6.4 (250)	22	175	1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375)	23	195	2.7 (6.0)
		12.7 (500)	29	230	3.6 (8.0)
		15.2 (600)	30	275	4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	12-19 (1/2-3/4)	3.2 (125)	19	145	1.5 (3.4)
		3.8 (150)	20	165	1.8 (4.0)
		5.1 (200)	21	200	2.5 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350)	27	285	4.2 (9.2)
		12.1 (475)	30	335	5.7 (12.5)
		12.7 (500)	30	340	6.0 (13.2)
0.052 in (1.3 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	7.6 (300)	30	300	4.8 (10.7)
		8.1 (320)	30	320	5.2 (11.5)
		12.3 (485)	32	430	7.8 (17.1)
1/16 in (1.6 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-25 (1/2-1)	5.3 (210)	27	325	4.8 (10.7)
		6.0 (235)	28	350	5.4 (12.0)
		7.4 (290)	29	430	6.7 (14.8)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in these areas are procedures for short circuiting mode using 100% CO_2. When using 75% Argon, 25% CO_2 for short circuit transfer, reduce voltage by 1 to 2 volts.

SuperArc® L-59®

Mild Steel, Copper Coated • AWS ER70S-6

Key Features

- High deposition rates similar to metal-cored wire
- Minimal spatter
- Engineered alloy system enhances silicon island management
- Copper coated for long contact tip life
- Fast travel speeds
- MicroGuard® Ultra provides superior feeding and arc stability

Typical Applications

- Robotic or hard automation
- Automotive
- Pipeline & Offshore
- Pressure vessels
- Heavy fabrication
- Alternative to metal-cored wire

Conformances

AWS A5.18/A5.18M: 2005	ER70S-6
ASME SFA-A5.18:	ER70S-6
ABS:	3YSA (100 CO_2 & Mixed)
DNV Grade:	III YMS H5 (Mixed)
BV Grade:	SA3YHHH (Mixed)
CWB/CSA W48-06:	ER49S-6
EN ISO 14341-B:	G 49A 3 C S6

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (14.9 kg) Plastic Spool	44 lb (20 kg) Fiber Spool	44 lb (20 kg) Steel Spool	60 lb (27.2 kg) Fiber Spool	500 lb (227 kg) Accu-Pak® Box
0.035 (0.9)	ED034270	ED033033	ED032366		ED032894
0.040 (1.0)					ED032895
0.045 (1.1)	ED034271		ED032367		ED032896
0.052 (1.3)	ED034272		ED032368	ED032814	ED032897
1/16 (1.6)	ED034356		ED032968		

Diameter in (mm)	900 lb (408 kg) Accu-Pak® Box	1000 lb (454 kg) Infinity-Pak®	1000 lb (454 kg) Accu-Pak® Box	1000 lb (454 kg) Precise-Trak® Reel
0.035 (0.9)	ED032861			
0.040 (1.0)				
0.045 (1.1)			ED032863	ED032808
0.052 (1.3)			ED032864	ED032809
1/16 (1.6)			ED032865	

SuperArc® L-59®

(AWS ER70S-6)

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS ER70S-6 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3]					
As-Welded with 100% CO_2	455 (66)	565 (82)	28	71 (52)	53 (39)
As-Welded with 75% Ar/25% CO_2	485 (70)	595 (86)	25	56 (41)	53 (39)
As-Welded with 90% Ar/10% CO_2	460 (67)	570 (83)	25	75 (55)	65 (48)

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.035 max.	0.025 max.
	%Cu[4]	**%Ni**	**%Cr**	**%Mo**	**%V**
Requirements - AWS ER70S-6	0.50 max.	0.15 max.	0.15 max.	0.15 max.	0.03 max.

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2[6]	12 (1/2)	2.5 (100) 3.8 (150) 6.4 (250)	17 18 20	80 120 175	0.7 (1.6) 1.1 (2.4) 1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	19 (3/4)	9.5 (375) 12.7 (500) 15.2 (600)	23 29 30	195 230 275	2.7 (6.0) 3.6 (8.0) 4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2[6]	12 (1/2)	3.2 (125) 3.8 (150) 5.1 (200)	18 19 20	145 165 200	1.5 (3.4) 1.8 (4.0) 2.4 (5.4)
Spray Transfer 90% Ar/10% CO_2	19 (3/4)	8.9 (350) 12.1 (475) 12.7 (500)	27 30 30	285 335 340	4.2 (9.2) 5.7 (12.5) 6.0 (13.2)
0.052 in (1.3 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	19 (3/4)	7.6 (300) 8.1 (320) 12.3 (485)	30 30 32	300 320 430	4.8 (10.6) 5.2 (11.5) 7.8 (17.1)
1/16 in (1.6 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	19 (3/4)	5.3 (210) 6.0 (235) 7.4 (290)	25 27 28	325 350 430	4.8 (10.7) 5.4 (12.0) 6.7 (14.8)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in these areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

SuperArc® LA-75

Low Alloy, Copper Coated • AWS ER80S-Ni1 & ENi1K

Key Features

- Capable of producing weld deposits with 550 MPa (80 ksi) tensile strength
- High toughness at low temperatures with a nominal 1% Ni or less
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

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

Conformances

AWS A5.28/A5.28M: 2005	ER80S-Ni1
ASME SFA-A5.28:	ER80S-Ni1
AWS A5.17/A5.17M: 1997	ENi1K
ABS:	ER80S-Ni1
CWB/CSA W48-06:	ER55S-Ni1 (ER80S-Ni1)
EN ISO 14341-B:	G 55A 4 A SN2

Welding Positions

All

Shielding Gas

75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30 - 50 CFH

SuperArc® LA-75

(AWS ER80S-Ni1 & ENi1K)

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool
0.035 (0.9)	ED031415
0.045 (1.1)	ED031416

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	@ -45°C (-50°F)	@ -62°C (-80°F)
Requirements - AWS ER80S-Ni1 As-Welded with 98% Ar/2% O_2	470 (68) min.	550 (80) min.	24 min.	Not Specified	27 (20) min.	Not Specified
Typical Results[3]						
As-Welded with 90% Ar/10% CO_2	475 (69)	580 (84)	28	119 (88)	82 (60)	35 (26)
Stress Relieved 1 hr. @ 621°C (1150° F)	450 (65)	565 (82)	32	- -	127 (93)	112 (82)
As-Welded with 75% Ar/25% CO_2	495 (72)	595 (86)	27	49 (36)	54 (40)	- -
Stress Relieved 1 hr. @ 621°C (1150° F)	440 (64)	560 (81)	31	127 (94)	114 (84)	54 (40)
As-Welded with 98% Ar/2% O_2	490 (71)	580 (84)	30	- -	172 (127)	- -
Stress Relieved 1 hr. @ 621°C (1150° F)	420 (61)	540 (78)	31	- -	230 (170)	165 (122)

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

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

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2 [6]	9-12 (3/8-1/2)	2.5 (100)	17	80	0.7 (1.6)
		3.8 (150)	18	120	1.1 (2.4)
		6.4 (250)	22	175	1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375)	23	195	2.7 (6.0)
		12.7 (500)	29	230	3.6 (8.0)
		15.2 (600)	30	275	4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2 [6]	12-19 (1/2-3/4)	3.2 (125)	19	145	1.5 (3.4)
		3.8 (150)	20	165	1.8 (4.0)
		5.1 (200)	21	200	2.4 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350)	27	285	4.2 (9.2)
		12.1 (475)	30	335	5.7 (12.5)
		12.7 (500)	30	340	6.0 (13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

SuperArc® LA-90

Low Alloy, Copper Coated • AWS ER80S-D2, ER90S-D2 & EA3K

Key Features

- Capable of producing weld deposits with 550 - 620 MPa (80 - 90 ksi) tensile strength
- Contains 0.50% molybdenum for strength after stress-relief
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

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

Conformances

AWS A5.28/A5.28M: 2005	ER80S-D2 (100% CO_2), ER90S-D2 (Mixed)
ASME SFA-A5.28:	ER80S-D2 (100% CO_2), ER90S-D2 (Mixed)
AWS A5.23/A5.23M: 2007	EA3K
CWB/CSA W48-06:	ER55S-D2 (ER80S-D2), ER62S-D2 (ER90S-D2)
EN ISO 16484-B:	G 59A 3 C 4M31
EN ISO 16834-B:	G 62A 3 A 4M31
MIL-E-23765/2:	MIL-80S-3

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30 - 50 CFH

DIAMETERS / PACKAGING

Diameter in	(mm)	33 lb (15 kg) Steel Spool	44 lb (20 kg) Steel Spool	44 lb (20 kg) Fiber Spool
0.035	(0.9)	ED031413	EDS30775	ED029546
0.045	(1.1)	ED031414	EDS30776	
0.052	(1.3)		EDS30777	
1/16	(1.6)			

Diameter in	(mm)	60 lb (27.2 kg) Coil	60 lb (27.2 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.035	(0.9)			EDS01372
0.045	(1.1)		EDS01380	ED001378
0.052	(1.3)			ED026627
1/16	(1.6)	ED013999		

Diameter in	(mm)	500 lb (227 kg) Accu-Pak® Box	1000 lb (454 kg) Accu-Trak® Drum	1000 lb (454 kg) Infinity-Pak®
0.035	(0.9)		EDS29590	
0.045	(1.1)	ED032919	ED029591	
0.052	(1.3)	ED032920	EDS29592	
1/16	(1.6)			

SuperArc® LA-90

(AWS ER80S-D2, ER90S-D2 & EA3K)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS ER80S-D2 As-Welded with 100% CO_2	470 (68) min.	550 (80) min.	17 min.	27 (20) min.	Not Specified
AWS ER90S-D2 As-Welded with 95-99% Ar/Balance O_2	540 (78) min.	620 (90) min.	17 min.	27 (20) min.	Not Specified
Typical Results[3]					
As-Welded with 100% CO_2	560 (81)	655 (95)	23	36 (26)	- -
As-Welded with 95% Ar/5% O_2	650 (94)	730 (106)	25	125 (92)	- -
As-Welded with 75% Ar/25% CO_2	620 (90)	705 (102)	26	124 (91)	122 (90)

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Mn	%Si	%Ni
Requirements - AWS ER80S-D2, ER90S-D2	0.07-0.12	1.60-2.10	0.50-0.80	0.15 max.
Typical Results[3]	0.09-0.11	1.63-1.74	0.56-0.64	≤ 0.04
	%Mo	**%S**	**%P**	**%Cu (Total)**[4]
Requirements - AWS ER80S-D2, ER90S-D2	0.40-0.60	0.025 max.	0.025 max.	0.50 max.
Typical Results[3]	0.43-0.46	≤ 0.010	0.007-0.016	0.16-0.22

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2[6]	9-12 (3/8-1/2)	2.5 (100) 3.8 (150) 6.4 (250)	18 19 22	80 120 175	0.7 (1.6) 1.1 (2.4) 1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375) 12.7 (500) 15.2 (600)	23 29 30	195 230 275	2.7 (6.0) 3.6 (8.0) 4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2[6]	12-19 (1/2-3/4)	3.2 (125) 3.8 (150) 5.1 (200)	19 20 21	145 165 200	1.5 (3.4) 1.8 (4.0) 2.5 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350) 12.1 (475) 12.7 (500)	27 30 30	285 335 340	4.2 (9.2) 5.7 (12.5) 6.0 (13.2)
0.052 in (1.3 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	7.6 (300) 8.1 (320) 12.3 (485)	30 30 32	300 320 430	4.8 (10.6) 5.2 (11.5) 7.8 (17.1)
1/16 in (1.6 mm), DC+					
Spray Transfer 90% Ar/10% CO_2	12-25 (1/2-1)	5.3 (210) 6.0 (235) 7.4 (290)	25 27 28	325 350 430	4.8 (10.7) 5.4 (12.0) 6.7 (14.8)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in these areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

SuperArc® LA-100

Low Alloy, Copper Coated • AWS ER100S-G, ER110S-G & EM2

Key Features

- Capable of producing welds with 690 MPa (100 ksi) tensile strength
- Excellent for welding quenched and tempered steels and HY-80 base materials
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

- HY-80 base material
- ASTM A514, A543, A724 and A782 quenched and tempered plate
- Various heat input conditions
- Military low alloy applications

Conformances

AWS A5.28/A5.28M: 2005	ER100S-G, ER110S-G
ASME SFA-A5.28:	ER100S-G, ER110S-G
AWS A5.23/A5.23M: 2007	EM2
ABS:	4YQ550SA
CWB/CSA W48-06:	ER69S-G (ER100S-G)
DB:	EN 12534 T 69 5 Mn3Ni1, 5 Mo
TUV:	EN 12534 T 69 5 Mn3Ni1, 5 Mo
EN ISO 16834-B:	G 69A 5 A N3M2
MIL-E-23765/2:	MIL-100S-1

Welding Positions

All

Shielding Gas

90-95% Argon / Balance CO_2
95-98% Argon / Balance O_2
Flow Rate: 30 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool	44 lb (20 kg) Steel Spool	60 lb (27.2 kg) Coil	500 lb (227 kg) Accu-Trak® Drum
0.035 (0.9)		EDS30778		ED031445
0.045 (1.1)	ED031417	EDS30779		EDS01162
1/16 (1.6)			ED010996	

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Mn	%Si	%Ni	%Mo
Requirements - AWS ER100S-G, ER110S-G	-	-	-	(A)	(A)
Typical Results(3)	0.05-0.06	1.63-1.69	0.46-0.50	1.88-1.96	0.43-0.45
	%Cr	**%S**	**%P**	**%V**	**%Al**
Requirements - AWS ER100S-G, ER110S-G	(A)	-	-	-	-
Typical Results(3)	0.04-0.06	0.002-0.005	0.005-0.009	≤ 0.01	≤ 0.01
	%Ti	**%Zr**	**%Cu**		
Requirements - AWS ER100S-G, ER110S-G	-	-	-		
Typical Results(3)	0.03-0.04	≤ 0.01	0.11-0.14		

(A) Must have the minimum of one or more of the following: 0.50% Ni, 0.30% Cr, or 0.20% Mo.

SuperArc® LA-100

(AWS ER100S-G, ER110S-G & EM2)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)
Requirements - AWS ER100S-G As-Welded - Gas Not Specified	Not Specified	690 (100) min.	Not Specified	Not Specified	Not Specified
AWS ER110S-G As-Welded - Gas Not Specified	Not Specified	760 (110) min.	Not Specified	Not Specified	Not Specified
MIL-100S-1 per MIL-E-23765/2C, 2D, 2E & T9074-BC-G1B-010/0200 As-Welded with 98% Ar /2% O_2	565-825 (82-120)	Not Specified	16 min.	81 (60) min.	47 (35) min.
Typical Results[3] As-Welded at 30 kJ/in with 95% Ar/5% CO_2 As-Welded at 45 kJ/in with 98% Ar/2% O_2	750 (109) 730 (106)	790 (115) 780 (114)	22 20	164 (121) - -	138 (102) 118 (87)
Pulse As-Welded at 110 kJ/in with 95% Ar/5% CO_2	580 (84)	745 (108)	25	138 (102)	70 (52)
CV As-Welded at 110 kJ/in with 95% Ar/5% CO_2	620 (90)	740 (107)	25	170 (125)	106 (78)
As-Welded at 45 kJ/in with 95% Ar/5% CO_2	682 (99)	765 (111)	20	- -	117 (86)

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 90% Ar/25% CO_2	9-12 (3/8-1/2)	2.5 (100) 3.8 (150) 6.4 (250)	18 19 22	80 120 175	0.7 (1.6) 1.1 (2.4) 1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	9-12 (3/8-1/2)	9.5 (375) 12.7 (500) 15.2 (600)	23 29 30	195 230 275	2.7 (6.0) 3.6 (8.0) 4.4 (9.6)
0.045 in (1.1 mm), DC+					
Pulsed Spray Transfer[5]	12-19 (1/2-3/4)	5.1 (200) 6.4 (250)	19-21 20-23	130 140	2.4 (5.4) 3.0 (6.7)
Spray Transfer 98% Ar/2% O_2 95% Ar/5% CO_2	12-19 (1/2-3/4)	8.9 (350) 12.1 (475) 12.7 (500)	27 30 30	285 335 340	4.2 (9.2) 5.7 (12.5) 6.0 (13.2)
0.052 in (1.3 mm), DC+					
Spray Transfer 98% Ar/2% O_2 95% Ar/5% CO_2	12-25 (1/2-1) 12-25 (1/2-1)	5.3 (210) 6.0 (235) 7.4 (290)	25 27 28	325 350 430	4.8 (10.7) 5.4 (12.0) 6.7 (14.8)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout.
[5]Procedures in this area are for pulse MIG mode for welding in the vertical up and overhead welding positions. Actual results are dependent on joint, material thickness, as well as wave shape and pulse frequency.

Lincoln® ER70S-2

Mild Steel Cut Length • AWS ER70S-2

Key Features

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

Typical Applications

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

Conformances

AWS A5.18/A5.18M: 2005	ER70S-2
ASME SFA-A5.18:	ER70S-2

Welding Positions

All

DIAMETERS / PACKAGING

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

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

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

(1)Total 0.50% maximum, combined. (2)See test results disclaimer on pg. 18.

Lincoln® ER70S-6

AWS ER70S-6 • Mild Steel Cut Length

Key Features

- High levels of silicon and manganese for use on slightly contaminated base materials
- More puddle fluidity
- Excellent wetting action
- Ink jet printing identification on entire length of electrode
- Q2 Lot® - Certificates showing actual wire chemistry available online

Conformances

AWS A5.18/A5.18M: 2005	ER70S-6
ASME SFA-A5.18:	ER70S-6

Welding Positions

All

Typical Applications

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

DIAMETERS / PACKAGING

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

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

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

[1]Total 0.50% maximum, combined. [2]See test results disclaimer on pg. 18.

9CrMoV-N

Low Alloy Cut Length • AWS ER90S-B9

Key Features

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

Conformances

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

Typical Applications

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

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	5 kg (11 lb) Tube
2.5 (3/32)	ED033377
3.2 (1/8)	ED033378

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.28*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Hardness HV_{10}[4]
Requirements AWS ER90S-B9	415 (60) min.	620 (90) min.	16 min.	17 min.	–	–
Typical Performance Stress-Relived @ 760°C (1400°F) for 2 hrs	675 (98)	780 (113)	22	19	220 (162)	265

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.28*

	%C	%Mn	%Si	%S	%P	%Cr	%Ni
Requirements AWS ER90S-B9	0.08 - 0.13	0.40 - 0.80	0.15 - 0.50	0.010 max.	0.010 max.	8.5 - 9.5	0.40 - 0.80
Typical Results[3]	0.10	0.50	0.25	0.006	0.008	8.7	0.60

	%Mo	%Nb	%V	%N	%Cu	%Al
Requirements AWS ER90S-B9	0.85 - 1.10	0.03 - 0.08	0.15 - 0.25	0.03 - 0.07	0.10 max.	0.40 max.
Typical Results[3]	1.00	0.05	0.20	0.05	0.03	<0.01

TYPICAL OPERATING PROCEDURES

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]Industry specific data, not required by AWS.
NOTE: Additional test data available upon request.

METAL-CORED

Mild Steel
Metalshield® MC-6®.....72
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Metalshield® MC-6®

Mild Steel • AWS E70C-6M H4

Key Features

- Excellent performance in fast follow, high travel speed applications
- Optimal wetting action, even at low voltages
- H4 diffusible hydrogen level
- Use with Rapid-Arc® Waveform Control Technology®
- Deoxidizing arc action minimizes pre-weld work

Typical Applications

- Robotics/Hard automation
- Automotive
- Structural fabrication
- Process piping and pressure vessels
- General fabrication

Conformances

AWS A5.18/A5.18M: 2005	E70C-6M H4
ASME SFA-A5.18:	E70C-6M H4
CWB/CSA W48-06:	E491C-6MJ-H4

Welding Positions

All

Shielding Gas

75-95% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool	50 lb (22.7 kg) Fiber Spool	60 lb (27.2 kg) Coil	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED030392	ED030554	ED030549	ED031011
0.052 (1.3)	ED030393	ED030556	ED030550	ED030946
1/16 (1.6)	ED030394	ED030555	ED030577	ED030947

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E70C-6M H4	400 (58) min.	480 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Performance[3]					
As-Welded with 75% Argon / 25% CO_2[4]	450-510 (65-75)	510-590 (75-85)	24-28	81-122 (60-90)	47-75 (35-55)
As-Welded with 90% Argon / 10% CO_2	480-550 (70-80)	550-620 (80-90)	24-28	75-102 (55-75)	61-81 (45-60)

Metalshield® MC-6®

(AWS E70C-6M H4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P	%Cu
Requirements - AWS E70C-6M H4	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.
Typical Performance[3]						
As-Welded with 75% Argon / 25% CO_2[4]	0.03-0.05	1.25-1.60	0.40-0.60	0.01-0.02	0.01-0.02	0.01-0.05
As-Welded with 90% Argon / 10% CO_2	0.03-0.05	1.25-1.70	0.40-0.70	0.01-0.02	0.01-0.02	0.01-0.05

	%Ni	%Cr	%Mo	%V	%Ni + %Cr + %Mo + %V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E70C-6M H4	0.50 max.	0.20 max.	0.30 max.	0.08 max.	0.50 max.	≤ 4
Typical Performance[3]						
As-Welded with 75% Argon / 25% CO_2[4]	0.02-0.05	0.01-0.04	0.01-0.02	0.01-0.02	0.05-0.10	2-4
As-Welded with 90% Argon / 10% CO_2	0.02-0.05	0.01-0.04	0.01-0.02	0.01-0.02	0.05-0.10	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage[6] (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1 (200)	21-23	170	2.5 (5.6)	2.3 (5.2)	92
		6.4 (250)	22-25	190	2.9 (6.4)	2.7 (6.1)	95
		7.6 (300)	22-26	210	3.5 (7.8)	3.2 (7.1)	92
		8.9 (350)	22-27	245	4.1 (9.1)	3.9 (8.7)	95
		10.2 (400)	23-27	265	4.6 (10.2)	4.5 (9.9)	97
		12.7 (500)	23-28	300	5.7 (12.6)	5.6 (12.4)	98
		15.2 (600)	25-29	335	7.0 (15.4)	6.9 (15.3)	99
		17.8 (700)	26-30	370	8.1 (17.8)	7.9 (17.5)	98
0.052 in (1.3 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1 (200)	22-24	220	3.2 (7.0)	2.9 (6.4)	92
		6.4 (250)	22-26	260	4.0 (8.7)	3.8 (8.3)	95
		7.6 (300)	22-27	300	4.9 (10.7)	4.7 (10.3)	96
		8.9 (350)	23-27	335	5.6 (12.3)	5.5 (12.0)	98
		10.2 (400)	24-28	360	6.3 (13.9)	6.3 (13.8)	99
		12.7 (500)	27-30	410	7.9 (17.4)	7.8 (17.3)	99
		15.2 (600)	27-31	455	9.5 (21.1)	9.4 (20.8)	99
1/16 in (1.6 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	2.5 (100)	21-24	175	2.1 (4.7)	2.0 (4.4)	93
		3.8 (150)	22-25	235	3.2 (7.1)	2.9 (6.4)	90
		5.1 (200)	22-26	290	4.3 (9.5)	4.0 (8.9)	94
		6.4 (250)	22-28	345	5.4 (11.9)	5.2 (11.4)	96
		7.6 (300)	23-29	360	6.4 (14.2)	6.3 (13.9)	98
		10.2 (400)	26-31	425	8.5 (18.7)	8.4 (18.5)	99
		12.7 (500)	27-32	485	10.8 (23.8)	10.7 (23.5)	99

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Required gas mixture 75-80% Argon/Balance CO_2 for AWS testing.
[5]To estimate ESO, subtract 3/16 in (4.8 mm) from CTWD. [6]For greater percentage of CO_2 shielding gas, increase voltage by 1-2 volts.

Metalshield® MC®-706

Mild Steel • AWS E70C-6M H4

Key Features

- High deposition rates and travel speed
- Enhanced silicon island management
- H4 diffusible hydrogen level
- Tolerates high amounts of surface contaminants
- Superior arc wetting and bead appearance

Conformances

AWS A5.18/A5.18M: 2005	E70C-6M H4
ASME SFA-A5.18:	E70C-6M H4
ABS:	E70C-6M H4
CWB/CSA W48-06:	E492C-6MJ-H4
AWS D1.8	
FEMA 353	

Typical Applications

- Robotics/hard automation
- Structural fabrication
- Process piping and pressure vessels
- Shipbuilding
- Heavy fabrication

Welding Positions

Flat & Horizontal

Shielding Gas

75-95% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool	50 lb (22.7 kg) Fiber Spool	50 lb (22.7 kg) Coil	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED031583	ED031586	ED031589	ED031592
0.052 (1.3)	ED031584	ED031587	ED031590	ED031593
1/16 (1.6)	ED031585	ED031588	ED031591	ED031594

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E70C-6M H4	400 (58) min.	480 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3]					
As-Welded with 75% Argon / 25% CO_2[4]	450-510 (65-75)	510-590 (75-85)	24-28	96-137 (71-101)	81-111 (60-82)
As-Welded with 90% Argon / 10% CO_2	480-550 (70-80)	550-620 (80-90)	24-28	57-108 (42-80)	41-94 (30-69)

Metalshield® MC®-706

(AWS E70C-6M H4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P	%Cu
Requirements - AWS E70C-6M H4	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.
Typical Results[3]						
As-Welded with 75% Argon / 25% CO_2[4]	0.03-0.05	1.25-1.60	0.50-0.80	0.02-0.03	0.01-0.02	0.01-0.05
As-Welded with 90% Argon / 10% CO_2	0.03-0.05	1.25-1.70	0.60-0.85	0.02-0.03	0.01-0.02	0.01-0.05

	%Ni	%Cr	%Mo	%V	%Ni + %Cr + %Mo + %V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E70C-6M H4	0.50 max.	0.20 max.	0.30 max.	0.08 max.	0.50 max.	≤ 4
Typical Results[3]						
As-Welded with 75% Argon / 25% CO_2[3]	0.01-0.03	0.01-0.04	0.01-0.02	0.01-0.02	0.05-0.10	2-4
As-Welded with 90% Argon / 10% CO_2	0.01-0.03	0.01-0.05	0.01-0.02	0.01-0.02	0.05-0.10	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	(in/min)	Voltage[6] (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	(lb/hr)	Deposition Rate kg/hr	(lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1	(200)	21-23	155	2.3	(5.0)	2.1	((4.6)	92
		6.4	(250)	22-24	185	2.8	(6.2)	2.6	(5.8)	94
		7.6	(300)	22-26	220	3.5	(7.7)	3.2	(7.0)	91
		8.9	(350)	22-27	245	4.0	(8.9)	3.7	(8.2)	93
		10.2	(400)	23-27	260	4.6	(10.1)	4.3	(9.4)	93
		11.4	(450)	23-28	280	5.2	(11.4)	4.9	(10.7)	94
		12.7	(500)	23-29	305	5.7	(12.6)	5.5	(12.2)	97
		14.0	(550)	24-29	315	6.3	(13.9)	6.2	(13.6)	98
		15.2	(600)	25-30	325	6.8	(15.1)	6.7	(14.8)	98
		16.5	(650)	26-30	355	7.5	(16.5)	7.4	(16.3)	98
		17.8	(700)	26-30	360	8.0	(17.7)	7.9	(17.5)	99
0.052 in (1.3 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1	(200)	22-24	210	3.0	(6.7)	2.9	(6.3)	94
		6.4	(250)	22-26	260	3.9	(8.5)	3.5	(7.8)	92
		7.6	(300)	22-27	290	4.6	(10.2)	4.3	(9.5)	94
		8.9	(350)	23-27	315	5.4	(11.8)	5.2	(11.4)	97
		10.2	(400)	24-28	350	6.3	(13.8)	6.1	(13.4)	97
		11.4	(450)	25-28	370	6.9	(15.2)	6.8	(15.1)	99
		12.7	(500)	27-29	390	7.7	(16.9)	7.6	(16.8)	99
		14.0	(550)	27-30	420	8.4	(18.5)	8.3	(18.3)	99
1/16 in (1.6 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	3.8	(150)	22-24	230	3.2	(7.0)	2.8	(6.2)	89
		5.1	(200)	22-25	280	4.3	(9.4)	3.9	(8.7)	93
		6.4	(250)	23-28	310	5.3	(11.6)	5.0	(11.0)	94
		7.6	(300)	24-29	370	6.3	(13.9)	6.3	(13.8)	99
		8.9	(350)	26-30	400	7.4	(16.3)	7.2	(15.9)	98
		10.2	(400)	26-31	450	8.3	(18.4)	8.3	(18.4)	99
		11.4	(450)	27-31	480	9.5	(21.0)	9.3	(20.6)	98

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Required gas mixture 75-80% Argon/Balance CO_2 for AWS testing. [5]To estimate ESO, subtract 3/16 in (4.8 mm) from CTWD. [6]For greater percentage of CO_2 shielding gas, increase voltage by 1-2 volts. NOTE: This product contains micro-alloying elements. Additional information available upon request.

Metalshield® MC-710XL®

Mild Steel • AWS E70C-6M H8

Key Features

- High column strength for excellent feedability
- Tolerates moderate amounts of surface contaminants

Conformances

AWS A5.18/A5.18M: 2005	E70C-6M H8, E70C-G H8
ASME SFA-A5.18:	E70C-6M H8, E70C-G H8
CWB/CSA W48-06:	E491C-6M-H8

Typical Applications

- Automotive
- Structural fabrication
- General fabrication

Welding Positions

All

Shielding Gas

75-95% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool	60 lb (27.2 kg) Coil	600 lb (272 kg) Accu-Trak® Drum
0.045 (1.1)	ED030592	ED028526	
0.052 (1.3)		ED028527	
1/16 (1.6)		ED028528	ED028450

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E70C-6M H8	400 (58) min.	480 (70) min.	22 min.	27 (20) min.
Typical Results[3]				
As-Welded with 75% Argon / 25% CO_2[4]	450-510 (65-75)	510-590 (75-85)	24-28	54-149 (40-110)
As-Welded with with 90% Argon / 10% CO_2	480-550 (70-80)	550-620 (80-90)	24-28	54-149 (40-110)

Metalshield® MC-710XL®

(AWS E70C-6M H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S
Requirements - AWS E70C-6M H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.
Typical Results[3]				
As-Welded with 75% Argon / 25% CO_2[4]	0.02-0.05	1.20-1.65	0.50-0.75	0.01-0.02
As-Welded with 90% Argon / 10% CO_2	0.02-0.05	1.40-1.85	0.50-0.90	0.01-0.02
	%P	**%Cu**	**%Ni**	**%Cr**
Requirements - AWS E70C-6M H8	0.03 max.	0.50 max.	0.50 max.	0.20 max.
Typical Results[3]				
As-Welded with 75% Argon / 25% CO_2[4]	0.01-0.02	0.01-0.05	0.02-0.04	0.01-0.04
As-Welded with 90% Argon / 10% CO_2	0.01-0.02	0.01-0.05	0.02-0.05	0.01-0.04
	%Mo	**%V**	**%Ni + %C + %Mo + %V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements - AWS E70C-6M H8	0.30 max.	0.08 max.	0.50 max.	≤ 8
Typical Results[3]				
As-Welded with 75% Argon / 25% CO_2[4]	0.01-0.02	0.01-0.02	0.05-0.10	6-8
As-Welded with 90% Argon / 10% CO_2	0.01-0.02	0.01-0.02	0.05-0.10	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage[6] (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1 (200)	24-25	165	2.3 (5.1)	2.2 (4.8)	94
		6.4 (250)	25-26	200	2.9 (6.4)	2.8 (6.1)	95
		8.9 (350)	28-29	230	4.1 (9.0)	3.9 (8.6)	95
		11.4 (450)	30-31	310	5.2 (11.5)	5.0 (11.1)	96
		14.0 (550)	32-33	355	6.4 (14.1)	6.2 (13.7)	97
		16.5 (650)	35-36	385	7.6 (16.7)	7.4 (16.2)	97
0.052 in (1.3 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	4.4 (175)	23-25	195	2.7 (6.0)	2.5 (5.5)	92
		6.4 (250)	25-27	260	3.9 (8.6)	3.6 (8.0)	93
		8.9 (350)	28-30	330	5.4 (11.9)	5.1 (11.2)	94
		11.4 (450)	31-33	390	7.0 (15.4)	6.6 (14.5)	94
		14.0 (550)	34-36	430	8.5 (18.8)	8.1 (17.8)	95
1/16 in (1.6 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	3.8 (150)	24-26	235	3.1 (6.9)	2.9 (6.5)	94
		6.4 (250)	28-30	330	5.2 (11.4)	4.9 (10.8)	95
		8.9 (350)	33-35	410	7.4 (16.3)	7.0 (15.5)	95
		11.4 (450)	35-37	460	9.4 (20.7)	9.0 (19.8)	96

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Required gas mixture 75-80% Argon/Balance CO_2 for AWS testing.
[5]To estimate ESO, subtract 3/16 in (4.8 mm) from CTWD. [6]For greater percentage of CO_2 shielding gas, increase voltage by 1-2 volts.

Metalshield® MC®-80Ni1

Low Alloy • AWS E80C-Ni1

Key Features

- H4 diffusible hydrogen levels
- Low spatter and excellent arc stability
- Deoxidizing agents minimize pre- and post-weld clean up
- Enhanced silicon island management
- Low temperature impact properties – Capable of exceeding 40 J (29 ft•lbf) @ -45°C (-50°F)
- Excellent bead shape and profile
- Meets the AWS E80C-Ni1 H4 requirement for tensile and yield strength in both the as-welded condition and after 2 hrs of post-weld heat treating (PWHT)

Typical Applications

- Robotics/hard automation
- Weathering grades of the appropriate strength ASTM A588 & A709 steels
- Structural fabrication
- Heavy fabrication

Conformances

AWS A5.28/A5.28M: 2005	E80C-Ni1 H4
ASME SFA-5.28	E80C-Ni1 H4
CWB / CSA W48-06	E55C-Ni1 H4 (E80C-Ni1 H4)

Welding Positions

All

Shielding Gas

75-95% Argon / Balance CO_2
95-99% Argon / Balance O_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in. (mm)	33 lb. (15 kg) Plastic Spool (Vacuum Sealed Foil Bag)	500 lb. (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED034213	ED034216
0.052 (1.3)	ED034214	ED034217
1/16 (1.6)	ED034215	ED034218

Metalshield® MC®-80Ni1

(AWS E80C-Ni1)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -45°C (-50°F)
Requirements - AWS E80C-Ni1 H4 As-Welded with Argon / 1-5% O_2	470 (68) min.	550 (80)	24 min.	27 (20) min.
Test Results[3] As-Welded with 98% Argon / 2% O_2	530-620 (77-90)	605-660 (88-96)	24-28	60-100 (43-76)
As-Welded with 92% Argon / 8% CO_2 Stress Relieved 2 hrs. @ 621°C (1150°F)	510 - 570 (74 - 83) 540 (78)	585 - 635 (85 - 92) 620 (90)	27 - 29 29	85 - 120 (61 - 89) 85 (61)
As-Welded with 75% Argon / 25% CO_2 Stress Relieved 2 hrs. @ 621°C (1150°F)	480 - 540 (70 - 78) 470 (68)	565 - 615 (82 - 89) 565 (82)	28 - 31 29	40 - 95 (29 - 70) 80 (58)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS E80C-Ni1 H4 As-Welded with Argon / 1-5% O_2	0.12 max.	1.50 max.	0.90 max.	0.030 max.	0.025 max.
Test Results[3] As-Welded with 98% Argon / 2% O_2 As-Welded with 92% Argon / 8% CO_2 As-Welded with 75% Argon / 25% CO_2	0.07 - 0.08 0.05 - 0.07 0.05 - 0.06	1.31 - 1.35 1.22 - 1.30 1.14 - 1.19	0.48 - 0.50 0.43 - 0.47 0.38 - 0.42	0.024 max. 0.024 max. 0.024 max.	0.012 0.012 0.012

	%Cu	%Ni	%Mo	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E80C-Ni1 H4 As-Welded with Argon / 1-5% O_2	0.35 max.	0.80 - 1.10	0.30 max.	0.03 max.	≤ 4
Test Results[3] As-Welded with 98% Argon / 2% O_2 As-Welded with 92% Argon / 8% CO_2 As-Welded with 75% Argon / 25% CO_2	0.03 - 0.05 0.03 - 0.05 0.04 - 0.06	0.84 - 0.86 0.83 - 0.86 0.80 - 0.85	0.10 max. 0.10 max. 0.10 max.	0.01 max. 0.01 max. 0.01 max.	3 - 4 3 - 4 3 - 4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage[5] (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ 92% Argon / 8% CO_2	19-25 (3/4-1)	5.1 (200) 6.4 (250) 7.6 (300) 8.9 (350) 10.2 (400) 12.7 (500) 15.2 (600)	21-23 22-25 22-26 22-27 23-27 23-28 25-29	180 220 250 280 310 350 380	2.5 (5.5) 3.1 (6.8) 3.7 (8.2) 4.4 (9.6) 4.9 (10.9) 6.2 (13.6) 7.4 (16.3)	2.2 (4.9) 2.9 (6.3) 3.4 (7.4) 3.9 (8.9) 4.5 (10.3) 5.6 (13.0) 6.9 (15.6)	89 93 90 92 94 96 96
0.052 in. (1.3 mm), DC+ 92% Argon / 8% CO_2	25-32 (1-1 1/4)	3.8 (150) 5.1 (200) 6.4 (250) 7.6 (300) 10.2 (400)	22-25 23-26 24-28 26-29 27-30	200 250 290 320 360	2.4 (5.3) 3.2 (7.0) 4.0 (8.8) 4.8 (10.5) 6.4 (14.0)	2.2 (4.8) 3.0 (6.6) 3.8 (8.4) 4.7 (10.4) 6.4 (14.0)	91 94 95 99 99
1/16 in. (1.6 mm), DC+ 92% Argon / 8% CO_2	25-32 (1-1 1/4)	3.8 (150) 5.1 (200) 6.4 (250) 7.6 (300) 10.2 (400)	22-25 23-26 24-28 26-29 27-30	235 295 350 395 465	3.4 (7.5) 4.4 (9.7) 5.8 (12.7) 6.9 (15.2) 9.2 (20.2)	3.0 (6.7) 4.2 (9.2) 5.4 (11.8) 6.5 (14.3) 8.8 (19.3)	89 95 93 94 96

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] To estimate ESO, subtract 1/4 in. (6.0 mm) from CTWD. [5] For shielding gas blends of 95-99% Argon / Balance O(2), decrease voltage by 1-2 volts.

Metalshield® MC®-90

Low Alloy • AWS E90C-K3 H4

Key Features

- H4 diffusible hydrogen levels
- Low spatter and excellent arc stability
- Deoxidizing agents minimize pre- and post-weld clean up
- Enhanced silicon island management
- Low temperature impact properties – Charpy V-Notch test results capable of exceeding 40 J (30 ft•lbf) @ -51°C (-60°F)
- Excellent bead shape and profile

Conformances

AWS A5.28/A5.28M: 2005:	E90C-K3 H4
ASME SFA-A5.28:	E90C-K3 H4
CWB / CSA W48-06:	E62C-K3 H4 (E90C-K3 H4)

Welding Positions

All

Typical Applications

- Robotics/hard automation
- HSLA steels (i.e. ASTM A678 & A710)
- Crane fabrication
- Structural fabrication
- Heavy fabrication
- Power generation

Shielding Gas

75-90% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb. (15 kg) Plastic Spool	500 lb. (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED033904	ED033907
0.052 (1.3)	ED033905	ED033908
1/16 (1.6)	ED033906	ED033909

Metalshield® MC®-90

(AWS E90C-K3 H4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)
Requirements					
AWS E90C-K3 H4	540 (78) min.	620 (90) min.	18 min.	Not Specified	27 (20) min.
Typical Performance[3]					
As-Welded with 75% Argon / 25% CO_2	585-685 (85-100)	655-755 (95-105)	19-27	60-93 (44-68)	36-87 (27-64)
As-Welded with 90% Argon / 10% CO_2	585-725 (85-105)	655-825 (95-120)	18-25	41-100 (30-74)	27-91 (20-67)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements						
AWS E90C-K3 H4	0.15 max.	0.15 max.	0.50-2.50	0.25-0.65	0.75-2.25	0.80 max.
Typical Performance[3]						
As-Welded with 75% Argon / 25% CO_2	0.04-0.08	0.01-0.10	1.50-1.90	0.30-0.45	1.00-1.51	0.20-0.35
As-Welded with 90% Argon / 10% CO_2	0.04-0.08	0.01-0.10	1.60-1.90	0.30-0.45	1.10-1.65	0.20-0.35

	%P	%S	%Cu	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements					
AWS E90C-K3 H4	0.025 max.	0.025 max.	0.35 max.	0.03 max.	≤4
Typical Performance[3]					
As-Welded with 75% Argon / 25% CO_2	0.01-0.02	0.01-0.02	0.02-0.06	0.01-0.02	2.5-4
As-Welded with 90% Argon / 10% CO_2	0.01-0.02	0.01-0.02	0.03-0.07	0.01-0.02	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas[4]	CTWD[5] mm (in)	Wire Feed Speed m/min	Wire Feed Speed (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	Melt-Off Rate (lb/hr)	Deposition Rate kg/hr	Deposition Rate (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1	(200)	21-23	170	2.4	(5.3)	2.2	(4.7)	89
		6.4	(250)	23-25	195	3.0	(6.7)	2.7	(6.0)	90
		8.9	(350)	25-27	250	4.3	(9.4)	3.8	(8.4)	89
		11.4	(450)	27-29	285	5.4	(11.9)	5.2	(11.4)	96
		14.0	(550)	29-31	330	6.6	(14.5)	6.4	(14.1)	97
		16.6	(650)	31-33	360	7.8	(17.3)	7.7	(16.9)	98
0.052 in (1.3 mm), DC+ 90% Argon / 10% CO_2	19 - 25 (3/4-1)	5.1	(200)	22-24	225	3.2	(7.1)	2.9	(6.5)	91
		6.4	(250)	24-26	260	4.0	(8.8)	3.6	(7.9)	90
		8.9	(350)	26-28	295	5.6	(12.4)	5.3	(11.8)	95
		11.4	(450)	28-30	345	7.2	(15.9)	7.1	(15.6)	98
		14.0	(550)	30-32	400	8.7	(19.2)	8.6	(18.9)	98
1/16 in (1.6 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	5.1	(200)	23-25	260	4.4	(9.7)	4.0	(8.9)	91
		6.4	(250)	26-28	300	5.5	(12.1)	5.2	(11.4)	94
		8.9	(350)	28-30	360	7.7	(16.9)	7.5	(16.5)	98
		11.4	(450)	30-32	420	9.9	(21.8)	9.7	(21.3)	98

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] For greater percentage of CO_2 shielding gas, increase voltage by 1-2 volts. [5] To estimate ESO, subtract 3/16 in. (4.8 mm) from CTWD.
NOTE: Consult steel manufacturer's recommendations regarding minimum and maximum pre-heat temperature, interpass temperature, and heat input.

Metalshield® MC®-110

Low Alloy • AWS E110C-K4 H4

Key Features

- H4 diffusible hydrogen levels
- Low spatter and excellent arc stability
- Deoxidizing agents minimize pre- and post-weld clean up
- Enhanced silicon island management
- Low temperature impact properties – Charpy V-Notch test results capable of exceeding 40 J (30 ft•lbf) @ -51°C (-60°F)
- Excellent bead shape and profile

Conformances

AWS A5.28/A5.28M: 2005:	E110C-K4 H4
ASME SFA-5.28: CWB/CSA	E110C-K4 H4
W48-06:	E76C-K4 H4 (E110C-K4 H4)

Welding Positions

All

Typical Applications

- Robotics/hard automation
- HSLA and quenched and tempered steels (i.e. HY-100 and ASTM 514)
- Crane fabrication
- Heavy Equipment
- Pressure vessels

Shielding Gas

75-90% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb. (15 kg) Plastic Spool	500 lb. (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED033910	ED033913
0.052 (1.3)	ED033911	ED033914
1/16 (1.6)	ED033912	ED033915

Metalshield® MC®-110

(AWS E110C-K4 H4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)
Requirements					
AWS E110C-K4 H4	680 (98) min.	760 (110) min.	15 min.	Not Specified	27 (20) min.
Typical Performance[3]					
As-Welded with 75% Argon / 25% CO_2	690-795 (100-115)	760-825 (110-120)	20-24	60-88 (44-65)	45-80 (34-59)
As-Welded with 90% Argon / 10% CO_2	725-825 (105-120)	790-895 (115-130)	18-23	66-95 (48-70)	59-82 (44-61)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements						
AWS E110C-K4 H4	0.15 max.	0.15-0.65	0.50-2.50	0.25-0.65	0.75-2.25	0.80 max.
Typical Performance[3]						
As-Welded with 75% Argon / 25% CO_2	0.05-0.08	0.20-0.35	2.00-2.20	0.45-0.55	1.45-1.75	0.45-0.65
As-Welded with 90% Argon / 10% CO_2	0.05-0.08	0.20-0.35	2.00-2.20	0.45-0.55	1.45-1.75	0.45-0.65

	%P	%S	%Cu	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements					
AWS E110C-K4 H4	0.025 max.	0.025 max.	0.35 max.	0.03 max.	≤4
Typical Performance[3]					
As-Welded with 75% Argon / 25% CO_2	0.01-0.02	0.01-0.02	0.02-0.06	0.01-0.02	2.5-4
As-Welded with 90% Argon / 10% CO_2	0.01-0.02	0.01-0.02	0.02-0.06	0.01-0.02	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas[4]	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1 (200)	22-24	170	2.4 (5.3)	2.1 (4.7)	88
		6.4 (250)	24-26	190	3.0 (6.7)	2.8 (6.1)	91
		8.9 (350)	26-28	240	4.2 (9.2)	3.8 (8.4)	91
		11.4 (450)	28-30	290	5.4 (11.8)	5.1 (11.3)	95
		14.0 (550)	30-32	330	6.5 (14.4)	6.3 (13.9)	97
		16.6 (650)	31-33	370	7.8 (17.1)	7.6 (16.7)	97
0.052 in (1.3 mm), DC+ 90% Argon / 10% CO_2	19-25 (3/4-1)	5.1 (200)	23-25	225	3.2 (7.0)	2.8 (6.2)	89
		6.4 (250)	25-27	255	4.0 (8.8)	3.7 (8.1)	92
		8.9 (350)	27-29	295	5.5 (12.2)	5.3 (11.6)	95
		11.4 (450)	29-31	350	7.2 (15.8)	7.0 (15.4)	98
		14.0 (550)	31-33	400	8.7 (19.1)	8.5 (18.8)	98
1/16 in (1.6 mm), DC+ 90% Argon / 10% CO_2	25-32 (1-1 1/4)	5.1 (200)	24-26	270	4.4 (9.6)	3.9 (8.6)	89
		6.4 (250)	26-28	320	5.4 (12.1)	5.1 (11.3)	94
		8.9 (350)	28-30	385	7.7 (16.9)	7.4 (16.4)	97
		11.4 (450)	30-32	465	9.8 (21.6)	9.6 (21.2)	98

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] For greater percentage of CO_2 shielding gas, increase voltage by 1-2 volts. [5] To estimate ESO, subtract 3/16 in. (4.8 mm) from CTWD.
NOTE: Consult steel manufacturer's recommendations regarding minimum and maximum pre-heat temperature, interpass temperature, and heat input.

Notes

FLUX-CORED

Self-Shielded (FCAW-S) Wire

Mild Steel, Flat and Horizontal

Innershield® NR®-5 86
Innershield® NS-3M 87
Innershield® NR®-305 88
Innershield® NR®-311 89
Innershield® NR®-131 90

Mild Steel, All Position

Innershield® NR®-152 91
Innershield® NR®-211-MP.....92
Innershield® NR®-203MP 94
Innershield® NR®-232 96
Innershield® NR®-233 98

Low Alloy, Flat and Horizontal

Innershield® NR®-311 Ni 100
Innershield® NR®-FAB-70.....102

Low Alloy, All Position

Innershield® NR®-203 Nickel (1%).....103
Innershield® NR®-212 104
Innershield® NR®-203 Ni C Plus-H.....106
Innershield® NR®-440Ni2 107
Innershield® NR®-207 108
Innershield® NR®-208-H.....109

Gas-Shielded (FCAW-G) Wire

Mild Steel, All Position

UltraCore® 71A85.....110
UltraCore® HD-M.....112
UltraCore® 71C.....114
UltraCore® HD-C.....116
UltraCore® 71A75 Dual.....118
UltraCore® 712C.....120
UltraCore® HD-12C.....122
UltraCore® 712A80.....124
UltraCore® HD-12M.....126
UltraCore® 712A80-H.....128
UltraCore® SR-12.....130
UltraCore® SR-12C.....132
UltraCore® SR-12M 134
Outershield® 71 Elite 136
Outershield® 71 Supreme.....138
Outershield® 71M.....140

Mild Steel, Flat and Horizontal

UltraCore® 70C.....142
UltraCore® 75C.....144
Outershield® 70.....146
Outershield® XLH-70 148

Low Alloy, All Position

UltraCore® 81Ni1A75-H.....150
UltraCore® 81Ni1C-H.....152
UltraCore® 81Ni2A75-H.....154
UltraCore® 81Ni2C-H.....156
UltraCore® 81K2A75-H.....158
UltraCore® 81K2C-H.....160
Outershield® 91K2-H.....162
Pipeliner® G90M.....164
Cormet® 1 165
Cormet® 2 166
Supercore® F91.....167

Innershield® NR®-5

Mild Steel, Flat & Horizontal • AWS E70T-3

Key Features

- Fast travel speeds
- Increased resistance to porosity
- Consistent bead appearance

Typical Applications

- Single pass welding on up to 48 mm (3/16 in) thicknesses
- 3 o'clock welding positions
- Welds with copper back-up
- Propane cylinders
- Robotics/hard automation

Conformances

AWS A5.20/A5.20M: E70T-3
ASME SFA-A5.20: E70T-3

Welding Positions

Flat & Horizontal

Warning

- NR-5 is NOT recommended for welding multiple passes.

Maximum Plate Thickness

Diameter - in (mm)	Maximum Plate Thickness - in (mm)
3/32 (2.4)	3/16 (4.8)
0.120 (3.0)	3/16 (4.8)

DIAMETERS / PACKAGING

Diameter in (mm)	600 lb (272 kg) Speed-Feed® Reel	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4) 0.120 (3.0)	ED012698	ED012699

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Transverse Tensile Strength MPa (ksi)	Longitudinal Bend Test	Hardness Rockwell B
Requirements - AWS E70T-3	480 (70) min.	180° over 3/4 in Radius No openings exceeding 1/8 in	–
Typical Results[2]	505-560 (75-80)	Passed	99

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al	%Ti
Requirements - AWS E70T-3	Not Specified						
Typical Results[2]	0.17-0.22	0.95-1.11	0.34-0.40	0.008-0.02	0.01-0.02	0.07-0.12	0.40-0.49

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
3/32 in (2.4 mm), DC+	32 (1-1/4)	2.5 (100)	22-23	340	4.5 (9.9)	3.5 (7.8)	77
		3.8 (150)	23-24	435	6.7 (14.8)	5.6 (12.3)	83
		5.1 (200)	24-25	510	9.0 (19.8)	7.7 (16.9)	85
		6.4 (250)	25-26	575	11.2 (24.7)	9.7 (21.4)	87
0.120 in (3.0 mm), DC+	32 (1-1/4)	3.3 (130)	22-23	500	8.2 (18.0)	7.6 (16.7)	93
		4.2 (165)	23-24	600	10.4 (23.0)	9.5 (20.9)	91
		6.5 (205)	24-25	700	12.9 (28.5)	11.6 (25.6)	90
		6.5 (255)	25-26	800	16.1 (35.5)	14.3 (31.5)	90

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Innershield® NS-3M

AWS E70T-4 • Mild Steel, Flat & Horizontal

Welding Positions

Flat & Horizontal

Conformances

AWS A5.20/A5.20M:	E70T-4
ASME SFA-A5.20:	E70T-4
CWB/CSA W48-06:	E492T-4 H16
DB:	EN 758 T38 Z W N 3
EN ISO 17632-A:	T38 Z V N 3

Key Features

- Very high deposition rates
- Increased resistance to hydrogen cracking and porosity
- Soft, low penetrating arc for minimal base material admixture

Typical Applications

- Open groove welds
- Machinery bases and heavy equipment repair
- Installing wear plates
- 6.4 - 12.7 mm (1/4 - 1/2 in) single pass fillet and lap welds

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
5/64 (2.0)	ED012739	ED012740	
3/32 (2.4)		ED012736	ED012735
0.120 (3.0)		ED012732	ED012731

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B
Requirements - AWS E70T-4	400 (58) min.	480-655 (70-95)	22 min.	–
Typical Results[3] - As-Welded	415-450 (60-65)	580-620 (84-90)	25-28	87-91

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E70T-4	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.21-0.25	0.37-0.53	0.25-0.29	≤0.01	≤0.01	1.3-1.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC+	54 (2 1/4)	5.1 (200)	29-31	280	5.5 (12.2)	4.6 (10.1)	83
		6.1 (240)	30-32	315	6.7 (14.8)	5.5 (12.1)	82
		6.6 (260)	30-32	330	7.3 (16.0)	6.0 (13.2)	83
		7.6 (300)	31-33	350	8.4 (18.6)	6.9 (15.2)	82
3/32 in (2.4 mm), DC+	76 (3)	2.8 (110)	28-30	250	4.6 (10.1)	3.7 (8.2)	81
		3.8 (150)	29-31	300	6.4 (14.0)	5.3 (11.7)	84
		4.7 (185)	30-32	350	7.9 (17.4)	6.6 (14.6)	84
		5.8 (230)	31-33	400	9.8 (21.6)	8.3 (18.3)	85
		7.0 (275)	32-34	450	11.8 (26.0)	10.0 (22.0)	85
0.120 in (3.0 mm), DC+ Electrical Stickout: 2 - 3/4 in (70 mm)	76 (3)	3.5 (140)	28-30	380	9.0 (19.8)	7.0 (15.5)	78
		4.4 (175)	29-31	450	11.2 (24.6)	9.1 (20.0)	81
		5.1 (200)	30-32	500	12.7 (28.0)	10.5 (23.2)	83
		7.6 (225)	31-33	550	14.2 (31.4)	11.9 (26.2)	83
0.120 in (3.0 mm), DC+ Electrical Stickout: 3 - 3/4 in (95 mm)	102 (4)	5.3 (210)	35-37	450	13.2 (29.0)	11.3 (25.0)	86
		6.4 (250)	36-38	500	15.6 (34.5)	13.2 (29.0)	84
		7.6 (300)	37-39	550	18.8 (41.5)	15.4 (34.0)	82
		9.0 (355)	38-40	600	22.2 (49.0)	18.0 (39.5)	81

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-305

Mild Steel, Flat & Horizontal • AWS E70T-6

Key Features

- High deposition rates in the flat and horizontal positions
- Smooth arc and low spatter levels
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -29°C (-20°F)
- Welds on lightly rusted or primed plate
- Meets FEMA 353 and AWS D1.8 seismic lot waiver requirements

Welding Positions

Flat & Horizontal

Typical Applications

- General plate fabrication
- Structural fabrication, including those subject to seismic requirements
- Bridges and offshore rigs
- Shipyards, stiffener welding on barges
- Welding over tack welds made with stick electrode

Conformances

AWS A5.20/A5.20M:	E70T-6 H16
ASME SFA-A5.20:	E70T-6 H16
FEMA 353:	
AWS D1.8:	

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)	50 lb (22.7 kg) Coil	50 lb (22.7 kg) Plastic Spool (Vacuum Sealed Foil Bag)
5/64 (2.0)	ED034185			
3/32 (2.4)		ED030971	ED012593	ED030005

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E70T-6	400 (58) min.	480-655 (70-95)	22 min.	–	27 (20) min.
Typical Results[3] - As-Welded	465-535 (68-77)	565-620 (82-90)	24-28	88-93	27-41 (20-30)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E70T-6	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.06-0.09	1.08-1.57	0.20-0.27	≤0.01	≤0.01	0.9-1.1

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC+	35-51 (1 3/8-2)	4.4 (175)	20-22	300	8.5 (10.5)	4.0 (8.8)	84
		5.6 (220)	21-23	330	6.0 (13.3)	5.0 (11.1)	83
		6.6 (260)	22-24	360	7.1 (15.7)	5.9 (13.1)	83
		7.6 (300)	24-26	375	8.2 (18.1)	6.9 (15.2)	84
		8.3 (325)	25-27	400	8.9 (19.7)	7.4 (16.4)	83
3/32 in (2.4 mm), DC+	41-54 (1 5/8-2 1/4)[4]	4.1 (160)	21-23	330	6.0 (13.3)	5.0 (11.0)	82
		6.1 (240)	24-26	425	9.1 (20.0)	7.6 (16.7)	83
		7.6 (300)	27-29	475	11.3 (25.0)	9.5 (21.0)	84
		10.2 (400)	33-35	525	15.2 (33.4)	12.7 (28.0)	83

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Use CTWD of 2 1/4 in (54 mm) for wire feed speeds greater than 300 ipm.
NOTE: FEMA 353 and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com.

Innershield® NR®-311

AWS E70T-7 • Mild Steel, Flat & Horizontal

Typical Applications

- Recommended for fillet, lap and butt welds on 3.2 mm (1/8 in) and thicker steel, including some low alloy steels
- General fabrication
- Assembly welding

Conformances

AWS A5.20/A5.20M:	E70T-7
ASME SFA-A5.20:	E70T-7
ABS:	E70T-7
CWB/CSA W48-06:	E492T-7

Key Features

- High deposition rates and fast travel speeds
- Easy slag removal
- Optimal toe wash-in
- Deep penetration
- High resistance to cracking
- Welds on lightly rusted or primed plate

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Reel	600 lb (272 kg) Speed-Feed® Drum
5/64 (2.0)	ED014464	ED030649	ED014459		
3/32 (2.4)			ED012629		ED012628
7/64 (2.8)			ED012632	ED012633	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B
Requirements - AWS E70T-7	400 (58) min.	480-655 (70-95)	22 min.	–
Typical Results[3] - As-Welded	420-475 (61-69)	600-645 (87-93)	23-26	88-92

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E70T-7	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.25-0.29	0.44-0.51	0.09-0.12	≤0.01	≤0.01	1.4-1.7

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC-	38 (1 1/2)	2.5 (100)	20-23	190	2.9 (6.4)	2.3 (5.0)	78
		4.1 (160)	24-28	275	4.7 (10.3)	3.6 (8.0)	78
		6.1 (240)	25-29	355	7.0 (15.4)	5.6 (12.4)	80
		7.6 (300)	27-31	410	8.8 (19.3)	7.2 (15.8)	82
3/32 in (2.4 mm), DC-	45 (1 3/4)	1.9 (75)	20-23	200	3.2 (7.0)	2.5 (5.4)	77
		3.4 (135)	23-26	300	5.9 (13.1)	4.6 (10.2)	78
		3.8 (150)	24-27	325	6.6 (14.6)	5.2 (11.4)	78
		5.3 (210)	26-28	400	9.3 (20.4)	7.5 (16.5)	81
		6.9 (270)	28-30	450	11.9 (26.2)	10.0 (22.0)	84
7/64 in (2.8 mm), DC-	45 (1 3/4)	2.5 (100)	23-26	325	5.4 (12.0)	4.5 (10.0)	83
		3.7 (145)	25-27	400	8.1 (17.8)	6.6 (14.5)	82
		4.4 (175)	26-28	450	9.8 (21.5)	8.2 (18.0)	83
		6.1 (240)	30-32	550	13.4 (29.5)	11.6 (25.5)	86
		7.6 (300)	32-34	625	16.7 (36.9)	15.0 (33.0)	89

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-131

Mild Steel, Flat & Horizontal • AWS E70T-10

Key Features

- Fast travel speeds and high deposition rates
- Maximum penetration
- Flat bead profile on butt welds
- Join dissimilar plate thicknesses with even heat distribution

Typical Applications

- Single pass welding on up to 2.8 mm (0.110 in) thicknesses
- Sheet metal
- Automotive

Conformances

AWS A5.20/A5.20M: E70T-10
ASME SFA-A5.20: E70T-10

Welding Positions

Flat & Horizontal

Warning

- NR-131 is NOT recommended for welding multiple passes.

DIAMETERS / PACKAGING

Diameter in (mm)	600 lb (272 kg) Speed-Feed® Reel
3/32 (2.4)	ED012163

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Transverse Tensile Strength MPa (ksi)	Longitudinal Bend Test	Hardness Rockwell B
Requirements - AWS E70T-10	480 (70) min.	180° over 3/4 in Radius No openings exceeding 1/8 in	–
Typical Results[3]	505-560 (75-80)	Passed	99

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E70T-10	Not Specified					
Typical Results[3]	0.22-0.26	0.42-0.65	0.20-0.27	0.005-0.007	0.007-0.02	1.18-1.49

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
3/32 in (2.4 mm), Single Arc, DC-	38 (1-1/2)	3.8 (150)	25-26	390	6.5 (14.3)	5.3 (11.6)	81
		5.1 (200)	25-27	490	8.6 (19.0)	7.1 (15.6)	82
		6.4 (250)	26-27	570	10.8 (23.7)	8.9 (19.6)	82
		8.9 (350)	26-28	720	15.0 (33.1)	33.6 (27.6)	83
		10.8 (425)	27-28	810	18.2 (40.1)	15.2 (33.6)	83
3/32 in (2.4 mm), Twinarc, DC-	44 (1-3/4)	3.3 (130)	25-26	550	11.1 (24.5)	8.1 (17.9)	72
		4.4 (175)	26-27	740	15.0 (33.0)	12.0 (26.4)	79
		5.7 (225)	26-28	910	19.3 (42.5)	15.8 (34.8)	81
		7.0 (275)	27-29	1030	23.5 (51.9)	19.1 (42.0)	80
		8.3 (325)	28-30	1090	27.9 (61.4)	21.9 (48.2)	78

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Innershield® NR®-152

AWS E71T-14 • Mild Steel, All Position

Conformances

AWS A5.20/A5.20M:	E71T-14
ASME SFA-A5.20:	E71T-14

Welding Positions

All

Maximum Plate Thickness

Diameter - in (mm)	Maximum Plate Thickness - in (mm)
1/16 (1.6)	3/16 (4.8)
0.068 (1.7)	3/16 (4.8)

Warning

- NR-152 is NOT recommended for welding multiple passes.

Key Features

- Designed for high speed welding of specially coated steels
- Soft, consistent arc
- Porosity resistant
- Excellent overlapping capabilities
- Ideal for robotic applications

Typical Applications

- Single pass welding on thicknesses from 0.8 mm - 4.8 mm (0.030 in - 3/16 in)
- Spot or short intermittent welds
- Continuous welding on galvanized or zinc coated carbon steel
- Automotive
- Transportation

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool	50 lb (22.7 kg) Coil	500 lb (227 kg) Speed-Feed® Drum
0.045 (1.1) 0.062 (1.6) 0.068 (1.7)	EDS01702	ED012185 ED012186	ED024301

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Transverse Tensile Strength MPa (ksi)	Longitudinal Bend Test	Hardness Rockwell B
Requirements - AWS E71T-14	480 (70) min.	180° over 3/4 in Radius / No openings exceeding 1/8 in	–
Typical Results[2]	480-550 (70-80)	Passed	93

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E71T-14	Not Specified					
Typical Results[2]	0.25-0.30	0.83-1.04	0.20-0.23	0.006-0.01	0.005-0.02	1.08-1.38

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1/16 in (1.6 mm), DC-	16 (5/8)	0.8 (30) 1.0 (40) 1.3 (50) 1.8 (70) 2.8 (110)	13-14 14-15 15-16 16-17 19-20	90 115 140 185 265	0.5 (1.3) 0.8 (1.8) 0.9 (2.2) 1.4 (3.1) 2.1 (4.8)	0.5 (1.2) 0.7 (1.6) 0.9 (2.0) 1.3 (2.8) 2.0 (4.4)	92 88 90 90 91
0.068 in (1.7 mm), Twinarc, DC-	19 (3/4)	0.8 (30) 1.0 (40) 1.3 (50) 1.5 (60) 2.0 (80) 2.8 (110)	13-14 13-14 14-15 15-16 16-17 20-21	68 95 120 145 190 240	0.7 (1.6) 0.9 (2.2) 1.2 (2.7) 1.4 (3.3) 1.9 (4.4) 2.7 (6.0)	0.6 (1.4) 0.9 (1.9) 1.1 (2.4) 1.3 (2.9) 1.8 (3.9) 2.4 (5.4)	87 86 88 87 88 90

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

NOTE: The preferred drag angle is 15°, however, NR-152 is capable of welding at zero drag angle, facilitating easy fixturing in automatic applications.

Innershield® NR®-211-MP

Mild Steel, All Position • AWS E71T-11

Key Features

- Versatile welding capability on a variety of base materials
- High operator appeal and good bead appearance
- Easy slag removal
- Fast freezing characteristics accommodate poor fit-up

Conformances

AWS A5.20/A5.20M:	E71T-11
ASME SFA-A5.20:	E71T-11
ABS:	E71T-11*
CWB/CSA W48-06:	E491T-11-H16
DB:	EN 758 T42 Z S N 1
TUV:	EN 758 T42 Z S N 1

*Except 0.030 in (0.8 mm) and 0.035 in (0.9 mm) diameters

Typical Applications

- Sheet or thin gauge metal
- Galvanized sheet metal
- Robotic / hard automation
- General fabrication
- 5/16 in. maximum plate thickness for 0.045 in. and smaller diameters
- 1/2 in. maximum plate thickness for 0.068 - 3/32 in. diameters

Welding Positions

All, except 3/32 in (2.4 mm) diameter

Maximum Plate Thickness

Diameter - in (mm)	Maximum Plate Thickness - in (mm)
0.030 (0.8)	5/16 (7.9)
0.035 (0.9)	5/16 (7.9)
0.045 (1.1)	5/16 (7.9)
0.068 (1.7)	1/2 (12.7)
5/64 (2.0)	1/2 (12.7)
3/32 (2.4)	1/2 (12.7)

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Spool 5 lb (2.3 kg) Master Carton	1 lb (0.5 kg) Plastic Spool 10 lb (4.5 kg) Master Carton	10 lb (4.5 kg) Plastic Spool
0.030 (0.8)	ED031448		ED033130
0.035 (0.9)		ED027641	ED016354
0.045 (1.1)			ED016363
0.068 (1.7)			
5/64 (2.0)			
3/32 (2.4)			

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
0.030 (0.8)			
0.035 (0.9)		ED030637	
0.045 (1.1)		ED030638	
0.068 (1.7)	ED012506	ED030641	ED012507
5/64 (2.0)	ED012508	ED030645	ED012509
3/32 (2.4)			ED013869

Innershield® NR®-211-MP

(AWS E71T-11)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B
Requirements - AWS E71T-11	400 (58) min.	480-655 (70-95)	20 min.	–
Typical Results[3]	435-475 (63-69)	605-645 (88-94)	22-25	89-92

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E71T-11	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.23-0.26	0.57-0.66	0.17-0.26	≤0.01	≤0.01	1.3-1.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.030 in (0.8 mm), DC-	13 (1/2)	1.3 (50)	13-14	30	0.2 (0.5)	0.2 (0.4)	81
		2.5 (100)	13-14	60	0.5 (1.1)	0.4 (0.8)	75
		3.8 (150)	14-15	80	0.7 (1.6)	0.6 (1.2)	78
		5.1 (200)	14-15	100	1.0 (2.1)	0.8 (1.7)	81
		6.4 (250)	15-16	130	1.2 (2.6)	1.0 (2.1)	80
		7.6 (300)	18-19	140	1.4 (3.2)	1.2 (2.6)	81
0.035 in (0.9 mm), DC-	13-16 (1/2-5/8)	1.3 (50)	14-15	30	0.4 (0.8)	0.3 (0.7)	81
		1.8 (70)	15-16	60	0.5 (1.2)	0.5 (1.0)	83
		2.8 (110)	16-17	115	0.7 (1.6)	0.6 (1.3)	78
		3.8 (150)	17-18	130	1.0 (2.2)	0.8 (1.7)	78
		5.1 (200)	18-19	155	1.4 (3.0)	1.1 (2.5)	84
		7.0 (275)	20-21	155	2.0 (4.4)	1.5 (3.4)	78
0.045 in (1.1 mm), DC-	16 (5/8)	1.8 (70)	15-16	120	0.7 (1.6)	0.5 (1.1)	69
		2.3 (90)	16-17	140	1.0 (2.2)	0.8 (1.7)	77
		2.8 (110)	17-18	160	1.2 (2.7)	1.0 (2.3)	85
		3.3 (130)	18-19	170	1.5 (3.2)	1.2 (2.7)	84
0.068 in (1.7 mm), DC-	19-32 (3/4-1 1/4)	1.0 (40)	15-16	125	1.0 (2.1)	0.8 (1.7)	81
		1.9 (75)	18-19	190	1.8 (4.0)	1.5 (3.4)	85
		3.3 (130)	20-21	270	3.2 (7.0)	2.8 (6.1)	88
		4.4 (175)	23-24	300	4.3 (9.4)	3.8 (8.4)	89
5/64 in (2.0 mm), DC-	19-32 (3/4-1 1/4)	1.3 (50)	16-17	180	1.6 (3.5)	1.3 (2.9)	83
		1.9 (75)	18-19	235	2.4 (5.3)	2.0 (4.5)	85
		3.0 (120)	20-21	290	3.8 (8.4)	3.4 (7.4)	88
		4.1 (160)	22-23	325	5.1 (11.2)	4.5 (10.0)	89
3/32 in (2.4 mm), DC-	19-32 (3/4-1 1/4)	1.3 (50)	16-17	245	2.3 (5.0)	1.9 (4.2)	84
		1.9 (75)	19-20	305	3.4 (7.5)	2.9 (6.4)	85
		2.5 (100)	20-21	365	4.5 (10.0)	3.9 (8.7)	87
		3.3 (130)	22-23	400	5.9 (12.9)	5.1 (11.3)	88

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-203MP

Mild Steel, All Position • AWS E71T-8-J

Key Features

- Designed to handle poor fit-up on heavy wall tubes and gaps up to 9.5 mm (3/8 in) with 6.4 mm (1/4 in) offset
- Fast freezing slag with excellent wash-in
- Root bead capability without back-up bars

Typical Applications

- General plate fabrication, including bridge fabrication, hull plate and stiffener welding on ships and barges
- Storage tanks
- Structural welding
- Offshore welding in TKY joints

Conformances

AWS A5.20/A5.20M:	E71T-8-JH16
ASME SFA-A5.20:	E71T-8-JH16
ABS:	3YSA
Lloyd's Register:	3YS H15
DNV Grade:	III YMS H10
GL:	3YH15S
BV Grade:	SA3YMH
CWB/CSA W48-06:	E491T-8 H16

Welding Positions

All

Innershield® NR®-203MP

(AWS E71T-8-J)

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool
0.068 (1.7)		ED030640
5/64 (2.0)	ED021604	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @-40°C (-40°F)
Requirements - AWS E71T-8-J	400 (58) min.	480-655 (70-95)	22 min.	–	Not Specified	27 (20) min.
Typical Results[3]	415-440 (60-64)	510-545 (74-79)	29-33	82-87	75-203 (55-150)	68-224 (50-165)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E71T-8-J	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.04-0.07	1.35-1.47	0.22-0.32	≤0.01	≤0.01	0.8-1.0

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.068 in (1.7 mm), DC-	25 (1)	1.8 (70)	16-17	145	1.5 (3.3)	1.0 (2.3)	69
		2.3 (90)	18-19	180	1.9 (4.2)	1.5 (3.2)	76
		3.0 (120)	20-21	225	2.5 (5.6)	2.0 (4.3)	76
		3.5 (140)	21-22	255	2.9 (6.4)	2.2 (4.8)	75
		3.8 (150)	23-24	265	3.1 (6.8)	2.3 (5.1)	75
5/64 in (2.0 mm), DC-	25 (1)	1.3 (50)	16-17	130	1.4 (3.1)	0.9 (1.9)	61
		1.8 (70)	18-19	180	2.0 (4.3)	1.3 (2.9)	67
		2.3 (90)	19-20	220	2.5 (5.6)	1.9 (4.2)	75
		2.8 (110)	20-21	260	3.1 (6.8)	2.4 (5.3)	77
		3.0 (120)	21-22	280	3.4 (7.4)	2.7 (5.9)	79
		3.5 (140)	22-23	310	3.9 (8.7)	3.1 (6.8)	79

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-232

Mild Steel, All Position • AWS E71T-8

Key Features

- High deposition rates for out-of-position welding
- Penetrating arc
- Fast freezing, easy to remove slag system
- Meets AWS D1.8 seismic lot waiver requirements

Typical Applications

- Structural fabrication, including those subject to seismic requirements
- General plate fabrication
- Hull plate and stiffener welding on ships and barges
- Machinery parts, tanks, hoppers, racks and scaffolding

Conformances

AWS A5.20/A5.20M:	E71T-8-H16
ASME SFA-A5.20:	E71T-8-H16
ABS:	3YSA
Lloyd's Register:	3YS H15
DNV Grade:	III YMS H15
GL:	3YH10S
BV Grade:	SA3YMH
CWB/CSA W48-06:	E491T-8 H16
DB:	EN 758 T42 3 Y N 2
TUV:	EN 758 T42 3 Y N 2
MIL-E-24403/1:*	MIL-71T-8AS
FEMA 353	
AWS D1.8	

*Military Grade Classification of MIL-71T-8AS for 0.068 in (1.7 mm) and 0.072 in (1.8 mm) diameters only.

Welding Positions

All

Innershield® NR®-232

(AWS E71T-8)

DIAMETERS / PACKAGING

Diameter in (mm)	13.5 lb (6.1 kg) Coil 54 lb (24.5 kg) Master Carton	13.5 lb (6.1 kg) Coil 54 lb (24.5 kg) Hermetically Sealed Pail	25 lb (11.3 kg) Steel Spool
0.068 (1.7)	ED012518	ED030232	ED030643
0.072 (1.8)	ED012522		ED030644
5/64 (2.0)	ED012525		ED030647

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)	50 lb (22.7 kg) Coil
0.068 (1.7)	ED030949	ED012519
0.072 (1.8)		ED012523
5/64 (2.0)		ED012526

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch / J ft•lbf) @ -29°C (-20°F)
Requirements - AWS E71T-8	400 (58) min.	480-655 (70-95)	22 min.	–	27 (20) min.
Typical Results[3] - As-Welded	460-520 (66-75)	575-615 (83-89)	25-31	87-90	47-75 (35-55)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E71T-8	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.16-0.18	0.61-0.72	0.26-0.33	≤0.01	≤0.01	0.5-0.8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[6] mm (in)	Wire Feed Speed m/min (in/min)	Voltage[7] (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.068 in (1.7 mm), DC-	19-32 (3/4-1 1/4)	2.8 (110)	18-19	195	2.3 (5.0)	1.8 (3.9)	78
		3.3 (130)	19-21	225	2.8 (6.2)	2.0 (4.6)	74
		3.8 (150)	19-21	250	3.2 (7.1)	2.4 (5.3)	75
		4.3 (170)	20-22	270	3.5 (7.8)	2.8 (6.1)	78
		5.0 (195)	23-24	300	4.3 (9.4)	3.2 (7.0)	74
		6.4 (250)	23-24	350	5.4 (11.8)	4.0 (9.0)	76
		7.4 (320)	25-27	400	6.9 (15.2)	5.2 (11.4)	75
0.072 in (1.8 mm), DC-	19-32 (3/4-1 1/4)	2.0 (80)	16-18	130	1.8 (4.0)	1.5 (3.3)	83
		3.5 (140)	18-21	225	3.1 (6.8)	2.5 (5.5)	81
		3.9 (155)	19-22	240	3.3 (7.2)	2.7 (6.0)	83
		4.3 (170)	20-23	255	3.6 (8.0)	2.9 (6.5)	81
		6.4 (250)	22-24	315	5.3 (11.7)	4.3 (9.6)	82
		7.4 (290)	23-25	350	6.2 (13.6)	5.0 (11.0)	81
5/64 in (2.0 mm), DC-	19-32 (3/4-1 1/4)	1.5 (60)	16-17	145	1.7 (3.7)	1.2 (2.7)	73
		2.9 (115)	19-20	260	3.2 (7.0)	2.5 (5.5)	78
		3.0 (120)	19-20	270	3.3 (7.3)	2.6 (5.7)	78
		3.3 (130)	20-21	285	3.5 (7.8)	2.8 (6.2)	79
		4.6 (180)	22-23	365	5.0 (10.9)	3.9 (8.7)	80

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: FEMA 353 and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com.

Innershield® NR®-233

Mild Steel, All Position • AWS E71T-8

Key Features

- High deposition rates for out-of-position welding
- Welder-friendly, easy to use and great bead appearance
- Minimal gas marking
- Meets AWS D1.8 seismic lot waiver requirements

Typical Applications

- Structural fabrication, including those subject to seismic requirements
- General plate fabrication
- Ship and barge fabrication
- Vertical up and overhead fillets and groove welds

Conformances

AWS A5.20/A5.20M:	E71T-8-H16
ASME SFA-A5.20:	E71T-8-H16
ABS:	E71T-8-H16
EN ISO 17632-B:	T493T8-1NA-H15
FEMA 353	
AWS D1.8	

Welding Positions

All

Notes

- Innershield® K126 Gun Assembly requires one of the following gun tube assemblies for better wire feeding - KP2454-1 (62°, 7.5 in), KP2455-1 (45°, 6 in), KP2456-1 (30°, 12 in)

Innershield® NR®-233

(AWS E71T-8)

DIAMETERS / PACKAGING

Diameter in (mm)	12.5 lb (5.7 kg) Plastic Spool 50 lb (22.7 kg) Master Carton	25 lb (11.3 kg) Plastic Spool	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1/16 (1.6)	ED030933	ED030934	ED031576
0.072 (1.8)		ED031030	
5/64 (2.0)		ED033039	ED033024

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E71T-8	400 (58) min.	480-655 (70-95)	22 min.	–	27 (20) min.
Typical Results[3] - As-Welded	435-455 (63-66)	575-595 (83-86)	26-29	87-89	34-54 (25-40)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E71T-8	0.30 max.	1.75 max.	0.60 max.	0.03 max.	0.03 max.	1.8 max.
Typical Results[3]	0.15-0.20	0.61-0.65	0.17-0.21	≤0.03	≤0.01	0.5-0.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1/16 in (1.6 mm), DC-	25 (1)	3.8 (150)	17-19	220	2.4 (5.3)	1.9 (4.2)	80
		5.1 (200)	19-21	245	3.2 (7.1)	2.5 (5.4)	76
		6.4 (250)	21-23	270	4.0 (8.9)	3.0 (6.6)	74
		7.6 (300)	23-25	295	4.7 (10.4)	3.5 (7.7)	75
		8.9 (350)	25-27	315	5.6 (12.3)	4.3 (9.4)	77
0.072 in (1.8 mm), DC-	19-25 (3/4-1)[4]	2.5 (100)	17-18	184	2.0 (4.5)	1.6 (3.6)	80
		3.8 (150)	18-19	250	3.1 (6.7)	2.5 (5.4)	80
		5.1 (200)	20-21	295	4.0 (8.9)	3.2 (7.1)	81
		6.4 (250)	22-23	330	5.1 (11.2)	4.0 (8.9)	79
		7.6 (300)	23-24	355	6.1 (13.4)	4.8 (10.6)	79
5/64 in (2.0 mm), DC-	19-25 (3/4-1)[4]	2.3 (90)	18-19	210	2.2 (4.9)	1.8 (4.1)	82
		3.2 (125)	19-20	260	3.2 (7.0)	2.6 (5.6)	81
		3.8 (150)	20-21	300	3.8 (8.4)	3.0 (6.7)	80
		5.1 (200)	21-22	340	5.1 (11.2)	4.1 (9.0)	81
		6.1 (240)	22-23	380	6.1 (13.3)	4.9 (10.8)	81

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD for 0.072 in. (1.8 mm) and 5/64 in. (2.0 mm) for 200 ipm or greater is 1 in (25 mm).
NOTE: For horizontal welding, subtract 1 volt. NOTE: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com/d1.8.

Innershield® NR®-311 Ni

Low Alloy, Flat & Horizontal • AWS E70T7-K2, E80TG-K2

Key Features

- Designed to provide a nominal 1.5% nickel weld deposit
- High deposition rates and fast travel speeds
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -29°C (-20°F)
- Color match on weathering steel applications
- 3/32 in (2.4 mm) diameter meets FEMA 353 and AWS D1.8 seismic lot waiver requirements

Conformances

AWS A5.29/A5.29M:	E70T7-K2-H16, E80TG-K2
ASME SFA-A5.29:	E70T7-K2-H16, E80TG-K2
ABS:	2YSA
Lloyd's Register:	2YS
DNV Grade:	II YMS
GL:	2YS
BV Grade:	SA2YM
DB:	EN 758 T42 2 1, 5Ni W N 5
FEMA 353:	3/32 in (2.4 mm) only
AWS D1.8:	3/32 in (2.4 mm) only

Typical Applications

- Fillet and lap welds
- Horizontal and square edge butt welds, such as column-to-column structural connections
- Deep groove welds
- Structural fabrication
- Weathering steels

Welding Positions

Flat & Horizontal

Innershield® NR®-311 Ni

(AWS E70T7-K2, E80TG-K2)

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil	50 lb (22.7 kg) Coil (Vacuum Sealed Foil Bag)
5/64 (2.0)	ED030650		
3/32 (2.4)		ED017822	ED032530
7/64 (2.8)		ED017824	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements					
AWS E70T7-K2	400 (58) min.	480-620 (70-90)	20 min.	–	27 (20) min.
AWS E80TG-K2	470 (68) min.	550-690 (80-100)	19 min.		Not Specified
Typical Results[3]					
As-Welded	470-515 (68-75)	575-615 (83-89)	27-30	88-93	41-87 (30-65)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements - AWS E70T7-K2 / E80TG-K2	0.15 max.	0.50-1.75	0.80 max.	0.030 max.	0.030 max.
Typical Results[3]	0.06-0.08	1.25-1.40	0.18-0.22	≤0.003	0.005-0.008
	%Ni	**%Cr**	**%Mo**	**%V**	**%Al**
Requirements - AWS E70T7-K2 / E80TG-K2	1.00-2.00	0.15 max.	0.35 max.	0.05 max.	1.8 max.
Typical Results[3]	1.29-1.56	0.03-0.04	≤0.03	–	1.0-1.3

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC-	32 (1 1/4)	2.5 (100)	21-23	170	2.5 (5.5)	1.8 (3.9)	70
		3.3 (130)	24-26	205	3.3 (7.2)	2.4 (5.2)	72
		4.1 (160)	25-27	235	4.0 (8.8)	2.9 (6.5)	73
		5.1 (200)	26-28	270	5.0 (11.0)	3.8 (8.3)	75
		6.1 (240)	27-29	295	6.1 (13.3)	4.5 (10.0)	75
3/32 in (2.4 mm), DC-	38 (1 1/2)	1.9 (75)	20-22	200	2.8 (6.2)	1.9 (4.2)	67
		2.5 (100)	21-23	245	3.8 (8.3)	2.7 (5.9)	71
		3.1 (125)	23-25	285	4.7 (10.4)	3.4 (7.5)	72
		3.8 (150)	25-27	330	5.7 (12.5)	4.1 (9.1)	72
		4.4 (175)	26-28	365	6.6 (14.5)	4.9 (10.8)	74
		5.1 (200)	27-29	390	7.6 (16.6)	5.6 (12.3)	74
7/64 in (2.8 mm), DC-	44.5 (1 3/4)	2.5 (100)	22-24	310	5.2 (11.4)	3.8 (8.4)	73
		3.5 (140)	24-26	370	7.2 (15.8)	5.4 (11.8)	74
		4.3 (170)	26-28	430	8.9 (19.5)	6.6 (14.5)	74
		5.1 (200)	28-30	470	10.4 (22.8)	7.7 (17.0)	74
		6.1 (240)	29-31	520	12.4 (27.2)	9.2 (20.4)	75

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com.

Innershield® NR®-FAB-70

Low Alloy, Flat & Horizontal • AWS E70T7-G

Key Features

- Proprietary design increases wire stiffness to aid feedability and promotes a smooth arc transfer.
- Capable of producing weld deposits with impact properties exceeding an average of 54 J (40 ft•lbf) at -29°C (-20°F).
- Meets FEMA 353 and AWS D1.8 seismic lot waiver requirements

Typical Applications

- Structural fabrication

Conformances

AWS A5.29/A5.29M:	E70T7-G
ASME SFA-5.29	E70T7-G
FEMA 353	
AWS D1.8	

Welding Positions

Flat & Horizontal

Notes

- Welding at high heat input procedures and slow travel speeds will significantly reduce the risk of slag entrapment.

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
3/32 (2.4)	ED033628	ED033631

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E70T7-G	400 (58) min.	485-620 (70-90)	20	Not Specified	Not Specified
Typical Results[3] - As Welded	405-480 (59-70)	510-570 (74-83)	23-28	88	96-162 (71-120)

CHEMICAL COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P	%Al
Requirements - AWS E70T7-G	Not Specified	0.50 min	1.00 max	0.030 max	0.030 max	1.8 max
Typical Results[3]	0.01-0.05	2.20-2.60	0.10-0.15	0.010 max	0.010 max	0.9-1.1

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
3/32 in. (2.4 mm), DC-	38 (1.5)	2.5 (100)	22-24	265	4.0 (8.7)	2.8 (6.1)	70
		3.2 (125)	23-25	320	4.9 (10.7)	3.6 (7.9)	74
		3.8 (150)	25-27	355	5.9 (13.1)	4.6 (10.1)	77
		4.6 (180)	25-27	380	7.1 (15.7)	5.5 (12.2)	77
		5.1 (200)	27-29	410	7.9 (17.5)	6.1 (13.4)	77
		5.3 (210)	27-29	425	8.2 (18.1)	6.5 (14.3)	79

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com.

Innershield® NR®-203 Nickel (1%)

Low Alloy, All Position • AWS E71T8-Ni1

Key Features

- Designed to produce a nickel bearing weld deposit
- Capable of producing weld deposits with impact toughness capable of exceeding 27 J (20 ft•lbf) at -29°C (-20°F)
- Color match on weathering steels
- Handles poor fit-up
- Root bead capability

Typical Applications

- Roundabout groove welds on heavy wall tubular construction
- Offshore
- Structural fabrication
- Bridges and other structural components made from weathering steels
- NACE applications

Conformances

AWS A5.29/A5.29M:	E71T8-Ni1-H16
ASME SFA-5.29:	E71T8-Ni1-H16
ABS:	3YSA
Lloyd's Register:	3YS H15
DNV Grade:	III YMS H10
CWB/CSA W48-06:	E491T8-Ni1 H16 (E71TG-G-H16)
DB:	EN 758 T42 3 1Ni Y N
TUV:	EN 758 T42 3 1Ni Y N

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	50 lb (22.7 kg) Coil
5/64 (2.0)	ED012385	ED012386

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E71T8-Ni1	400 (58) min.	480-620 (70-90)	20 min.	–	27 (20) min.
Typical Results[3] - As-Welded	450-480 (65-70)	545-575 (79-83)	27-32	86-90	81-156 (60-115)

CHEMICAL COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements - AWS E71T8-Ni1	0.12 max.	1.50 max.	0.80 max.	0.030 max.	0.030 max.
Typical Results[3]	0.05-0.07	1.10-1.22	0.30-0.33	≤0.010	0.005-0.008
	%Ni	**%Cr**	**%Mo**	**%V**	**%Al**
Requirements - AWS E71T8-Ni1	0.80-1.10	0.15 max.	0.35 max.	0.05 max.	1.8 min.
Typical Results[3]	0.89-1.05	0.02-0.03	0.01-0.02	≤0.01	0.8-1.0

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC-	25 (1)	1.3 (50)	16-17	145	1.4 (3.0)	1.0 (2.3)	76
		1.8 (70)	18-19	195	2.0 (4.3)	1.5 (3.3)	76
		2.3 (90)	19-20	240	2.5 (5.5)	2.0 (4.3)	78
		2.8 (110)	20-21	275	3.0 (6.7)	2.4 (5.3)	79
		3.0 (120)	21-22	290	3.3 (7.3)	2.6 (5.8)	79
		3.5 (140)	22-23	310	3.9 (8.5)	3.0 (6.9)	81

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-212

Low Alloy, All Position • AWS E71TG-G

Key Features

- Accommodates a wide range of mild steels
- Fast freeze characteristics accommodate poor fit-up
- Smooth arc performance and ease of use

Conformances

AWS A5.29/A5.29M:	E71TG-G
ASME SFA-A5.29:	E71TG-G
CWB/CSA W48-06:	E491TG-G-H16 (E71TG-G H16)

Welding Positions

All

Typical Applications

- Single or multiple pass welding on up to 19 mm (3/4 in) thicknesses
- General fabrication
- Robotics
- Truck bodies, tanks, hoppers, racks and scaffolding
- Welding on galvanized steel or zinc coated carbon steel

Maximum Plate Thickness - in (mm)

Diameter - in (mm)	Maximum Plate Thickness - in (mm)
0.045 (1.1)	3/4 (19.1)
0.068 (1.7)	3/4 (19.1)
5/64 (2.0)	3/4 (19.1)

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Spool	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
0.045 (1.1)	ED026090		ED030639	
0.068 (1.7)		ED027803	ED030642	
5/64 (2.0)		ED027794	ED030646	ED026858

Innershield® NR®-212

(AWS E71TG-G)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B
Requirements - AWS E71TG-G	400 (58) min.	480-655 (70-95)	20 min.	–
Typical Results[3]	440-505 (64-74)	575-605 (84-88)	24-28	89-92

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn[4]	%Si	%S	%P
Requirements - AWS E71TG-G	Not Specified	0.50 min.	1.00 max.	0.030 max.	0.030 max.
Typical Results[3]	0.06-0.11	0.84-1.55	0.20-0.33	≤0.003	0.006-0.009
	%Ni[4]	**%Cr[4]**	**%Mo[4]**	**%V[4]**	**%Al**
Requirements - AWS E71TG-G	0.50 min.	0.30 min.	0.20 min.	0.10 min.	1.8 max.
Typical Results[3]	1.02-1.15	0.02-0.04	≤0.02	–	1.3-1.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC-	16 (5/8)	1.4 (55)	14-15	75	0.5 (1.3)	0.5 (1.1)	84
		1.8 (70)	15-16	90	0.7 (1.6)	0.6 (1.4)	87
		2.3 (90)	16-17	115	1.0 (2.1)	0.8 (1.8)	85
		2.8 (110)	17-18	135	1.2 (2.6)	1.0 (2.2)	84
		3.3 (130)	18-19	155	1.4 (3.1)	1.2 (2.6)	83
		4.1 (160)	19-20	170	1.6 (3.5)	1.4 (3.0)	85
0.068 in (1.7 mm), DC-	25 (1)	1.5 (60)	16-17	145	1.4 (3.1)	1.1 (2.4)	77
		1.9 (75)	17-18	180	1.7 (3.8)	1.4 (3.2)	84
		2.3 (90)	18-19	200	2.0 (4.5)	1.7 (3.8)	84
		3.0 (120)	19-20	230	2.7 (6.0)	2.3 (5.2)	86
		3.8 (150)	20-21	255	3.3 (7.4)	2.9 (6.4)	86
		4.4 (175)	22-23	275	3.9 (8.7)	3.4 (7.5)	86
5/64 in (2.0 mm), DC-	25 (1)	1.5 (60)	16-17	200	1.7 (3.8)	1.5 (3.3)	86
		1.9 (75)	18-19	225	2.1 (4.7)	1.8 (4.1)	87
		2.3 (90)	19-20	245	2.6 (5.7)	2.3 (5.0)	87
		2.8 (110)	20-21	275	3.2 (7.1)	2.8 (6.2)	87
		3.3 (130)	21-23	300	3.7 (8.3)	3.3 (7.3)	87
		3.8 (150)	22-23	325	4.3 (9.6)	3.8 (8.4)	87

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy AWS requirements of the G group, the weld deposit needs to have the minimum, as specified in the table, of only one of these elements.

Innershield® NR®-203 Ni C Plus-H

Low Alloy, All Position • AWS E71T8-K2

Key Features

- A good choice for weathering steels
- Handles poor fit-up in the vertical up position
- Produces a nickel alloyed weld deposit (1.0-2.0%)
- Capable of meeting H8 diffusible hydrogen requirements

Typical Applications

- Offshore welding applications
- Roundabout groove welds on heavy wall tubular construction
- Structural fabrication
- General plate fabrication including bridges
- Hull plate and stiffener welding on ships and barges

Welding Positions

All

Conformances

AWS A5.29/A5.29M:	E71T8-K2
ASME SFA-5.29:	E71T8-K2

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
5/64 (2.0)	ED033040

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4] - AWS E71T8-K2	400 (58) min.	480-620 (70-90)	20 min.	27 (20) min.
Typical Results[3]	435-520 (63-76)	530-600 (77-87)	25-30	98-161

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P	%Ni
Requirements - AWS E71T8-K2	0.15 max.	0.50-1.75	0.80 max.	0.03 max.	0.03 max.	1.00-2.00
Typical Results[3, 4]	0.04-0.07	0.74-0.85	0.06-0.09	≤0.01	≤0.01	1.00-1.21

	%Cr	%Mo	%V	%Al	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E71T8-K2	0.15 max	0.35 max	0.05 max	1.8 max.	Not Specified
Typical Results[3, 4]	0.09-0.13	0.01-0.05	<0.01	0.65-1.12	5-8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC-	19 - 25 (3/4 - 1)	1.3 (50)	16-17	115	3.2 (1.5)	2.3 (1.0)	72
		1.8 (70)	17-18	170	4.5 (2.0)	3.3 (1.5)	73
		2.3 (90)	19-20	210	5.8 (2.6)	4.4 (2.0)	76
		2.8 (110)	20-21	245	7.0 (3.2)	5.5 (2.5)	79

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]The strength and elongation properties reported were obtained from a 0.505 in (2.8 mm) tensile specimen artificially aged at 104°C (220°F) for 48 hours, as permitted by AWS A5.29-98. A naturally aged tensile specimen may take months to achieve the specified properties. The time required for the natural aging of weld deposits is dependent upon ambient conditions, weldment geometry, the metallurgical structure of the weld deposit and other factors.

Innershield® NR®-440Ni2

AWS E71T8-Ni2-JH8 • Low Alloy, All Position

Typical Applications

- Offshore

Welding Positions

All

Conformances

AWS 5.29/A5.29M:	E71T8-Ni2-JH8
ASME SFA-5.29	E71T8-Ni2-JH8
ABS	4YSAH10
DNV	IV YMS H10
LR	4YS H10

Key Features

- Designed to provide optimal weldability in narrow TKY joints and poor fit up conditions
- Expect fast travel speeds and a flat bead face when using vertical-up or vertical-down welding techniques
- Low temperature impact toughness, meets ABS 4YSA and AWS J classification
- Meets H8 diffusible hydrogen requirements over a range of humidity levels
- ProTech® hermetically sealed packaging
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties per lot available online.

DIAMETERS / PACKAGING

Diameter mm (in)	8 lb (3.6 kg) Spool 48 lb (21.8 kg) Hermetically Sealed Pail	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
1.6 (1/16)	ED034365	ED034200
2.0 (5/64)	ED034195	ED033827

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-40°C (-40°F)
Requirements[4] - AWS E71T8-Ni2-JH8	400 (58) min.	480-655 (70-90)	22 min.	27 (20) min.
Typical Results[3]	400-485 (58-70)	490-570 (71-83)	22-36	215-460 (160-340)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Ni	%Si	%S	%P	%Al
Requirements AWS E71T8-Ni2-JH8	0.30 max.	1.75 max.	1.75-2.75	0.60 max.	0.030 max.	0.030 max.	1.8 max.
Typical Results[3,4]	0.01-0.03	0.74-1.12	1.77-2.10	0.13-0.17	0.002-0.004	0.007-0.012	0.84-1.07

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1.6 mm (1/16 in), DC-	22 (7/8)	2.3 (90)	17-18	160	1.6 (3.6)	1.1 (2.5)	69
		2.5 (100)	18-19	170	1.6 (3.6)	1.2 (2.8)	72
		2.8 (110)	18-19	180	2.0 (4.4)	1.4 (3.1)	73
		3.0 (120)	19-20	195	2.2 (4.8)	1.6 (3.5)	73
		3.3 (130)	19-20	210	2.3 (5.1)	1.7 (3.7)	73
2.0 mm (5/64 in), DC-	25 (1)	1.8 (70)	16-17	205	1.9 (4.2)	1.5 (3.2)	76
		2.0 (80)	17-18	225	2.2 (4.7)	1.6 (3.6)	77
		2.3 (90)	18-19	240	2.4 (5.3)	1.9 (4.2)	78
		2.5 (100)	19-20	260	2.7 (5.9)	2.1 (4.7)	79
		2.8 (110)	20-21	260	3.0 (6.5)	2.4 (5.2)	80
		3.0 (120)	20-21	295	3.2 (7.1)	2.5 (5.6)	79

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]The strength and elongation properties reported were obtained from a 2.8 mm (0.505 in) tensile specimen artificially aged at 104°C (220°F) for 48 hours, as permitted by AWS A5.20-05. A naturally aged tensile specimen may take months to achieve the specified properties. See AWS A5.20-05, paragraph A8.3. The time required for the natural aging of weld deposits is dependent upon ambient conditions, weldment geometry, the metallurgical structure of the weld deposit and other factors.

Innershield® NR®-207

Low Alloy, All Position • AWS E71T8-K6

Key Features

- Vertical down hot, fill and cap passes on standard cross-country pipelines and arctic grade pipe
- Recommended for API grades X42 up to undermatching X70
- High deposition rates

Welding Positions

All

Typical Applications

- Standard cross-country pipelines
- Arctic grade pipe up to undermatched X70

Conformances

AWS A5.29/A5.29M:	E71T8-K6-H16
ASME SFA-A5.29:	E71T8-K6-H16
ABS:	E71T-8-K6
DNV Grade:	III YMS H15
GL:	3YH15S
BV Grade:	SA3YMH

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
0.068 (1.7)	ED016312
5/64 (2.0)	ED012438

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4] - AWS E71T8-K6	400 (58) min.	480-620 (70-90)	20 min.	–	27 (20) min.
Typical Results[3]	415-445 (60-64)	520-545 (75-79)	29-33	84-87	81-237 (60-175)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements - AWS E71T8-K6	0.15 max.	0.50-1.50	0.80 max.	0.030 max.	0.030 max.
Typical Results[3]	0.05-0.07	0.87-0.96	0.23-0.27	≤0.003	0.004-0.008
	%Ni	**%Cr**	**%Mo**	**%V**	**%Al**
Requirements - AWS E71T8-K6	0.40-1.00	0.20 max.	0.15 max.	0.05 max.	1.8 max.
Typical Results[3]	0.73-0.83	0.02-0.03	0.02-0.03	≤0.01	0.9-1.1

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.068 in (1.7 mm), DC-	25 (1)	2.0 (80)	17-18	190	1.7 (3.8)	1.3 (3.0)	79
		2.6 (105)	18-19	230	2.2 (5.3)	1.8 (4.0)	80
		3.0 (120)	19-20	245	2.5 (5.7)	2.0 (4.5)	79
		3.5 (140)	21-22	275	3.0 (6.8)	2.4 (5.5)	81
		4.4 (175)	21-22	295	3.6 (8.0)	2.9 (6.4)	80
5/64 in (2.0 mm), DC-	25 (1)	1.7 (70)	17-18	205	2.0 (4.5)	1.5 (3.4)	76
		2.0 (80)	18-19	225	2.3 (5.1)	1.7 (3.9)	76
		2.2 (90)	18-19	240	2.6 (5.8)	2.0 (4.5)	78
		2.7 (110)	20-21	275	3.1 (7.0)	2.4 (5.5)	79
		3.3 (130)	20-21	300	3.7 (8.3)	2.9 (6.5)	78

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Innershield® NR®-208-H

AWS E91T8-G-H8 • Low Alloy, All Position

Conformances

AWS A5.29/A5.29M: E91T8-G-H8
ASME SFA-A5.29: E91T8-G-H8

Welding Positions

All, except vertical up

Key Features

- Designed to create high strength weld deposits
- Recommended for API grade X80
- High deposition rates

Typical Applications

- Standard cross-country pipelines
- Undermatched X80 grade pipe

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
5/64 (2.0)	ED023366

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Hardness Rockwell B	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E91T8-G-H8	540 (78) min.	620-760 (90-110)	17 min.	–	Not Specified
Typical Results[3] - As-Welded	555-600 (81-87)	630-670 (91-97)	24-27	91-95	54-129 (40-95)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P	%Ni[4]
Requirements - AWS E91T8-G-H8	Not Specified	0.50 min.	1.00 max.	0.030 max.	0.030 max.	0.50 min.
Typical Results[3]	0.04-0.07	1.48-2.02	0.11-0.31	≤0.003	0.004-0.010	0.71-0.98
	%Cr[4]	**%Mo[4]**	**%V[4]**	**%Al[4]**	**Diffusible Hydrogen (mL/100g weld metal)**	
Requirements - AWS E91T8-G-H8	0.30 min.	0.20 max.	0.10 min.	1.8 min.	8.0 max.	
Typical Results[3]	0.02-0.03	≤0.04	≤0.01	0.9-1.2	≤8	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
5/64 in (2.0 mm), DC-	25 (1)	1.7 (70)	16-17	195	1.8 (4.0)	1.4 (3.2)	81
		2.0 (80)	17-18	220	2.1 (4.6)	1.7 (3.9)	84
		2.2 (90)	18-19	235	2.5 (5.4)	2.0 (4.5)	84
		2.7 (110)	19-20	270	2.9 (6.5)	2.4 (5.5)	85
		3.3 (130)	19-20	295	3.5 (7.6)	2.9 (6.5)	85

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy requirements of the G group, the weld deposit needs to have the minimum, as specified in the table, of only one of the elements marked.

UltraCore® 71A85

Mild Steel, All Position • AWS E71T-1M, E71T-9M

Key Features

- Designed for welding with 75 - 85% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance
- Meets AWS D1.8 seismic lot waiver requirements

Conformances

AWS A5.20/A5.20M:	E71T-1M, E71T-9M
ASME SFA-A5.20:	E71T-1M, E71T-9M
ABS:	3YSA H10
Lloyd's Register:	3YS H10
DNV Grade:	III YMS H10
CWB/CSA W48-06:	E491T-9M H8
EN ISO 17632-B:	T493T1-1MA-H10
FEMA 353	
AWS D1.8	

Typical Applications

- Shipbuilding
- Seismic structural fabrication
- General fabrication

Welding Positions

All

Shielding Gas

75% - 85% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED031885	ED031663	ED031847	ED032047
0.052 (1.3)	ED031886	ED031664	ED031848	ED032048
1/16 (1.6)	ED031887	ED031665	ED031849	ED032049

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4]					
AWS E71T-1M	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified
AWS E71T-9M				Not Specified	27 (20) min.
Typical Results[3]					
As-Welded with 75%-85% Ar/balance CO_2	550-600 (80-88)	600-650 (87-94)	24 - 26	64-115 (47-85)	43-95 (32-70)

UltraCore® 71A85

(AWS E71T-1M, E71T-9M)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E71T-1M, E71T-9M	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8.0 max.
Typical Results[3] As-Welded with 75%-85% Ar/balance CO_2	0.03-0.04	1.43-1.56	0.52-0.59	<0.01	0.01	6-8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	4.4 (175)	21-26	125	1.8 (4.0)	1.6 (3.5)	86-88
		6.4 (250)	22-27	150	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	23-28	165	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	23-29	190	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	25-30	205	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	26-31	225	4.7 (10.3)	4.1 (9.0)	
		12.7 (500)	27-32	245	5.2 (11.4)	4.5 (10.0)	
		14.0 (550)	28-33	265	5.7 (12.5)	5.0 (10.9)	
		15.2 (600)	28-34	280	6.2 (13.7)	5.4 (11.9)	
0.052 in (1.3 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8 (150)	21-26	150	2.0 (4.5)	1.8 (3.9)	86-88
		5.1 (200)	21-27	165	2.7 (6.0)	2.4 (5.2)	
		6.4 (250)	22-27	190	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	23-28	215	4.1 (9.0)	3.5 (7.8)	
		8.9 (350)	24-29	235	4.7 (10.5)	4.1 (9.1)	
		9.5 (375)	25-30	255	5.1 (11.2)	4.4 (9.8)	
		10.8 (425)	26-31	275	5.8 (12.7)	5.0 (11.1)	
		12.1 (475)	27-32	295	6.4 (14.2)	5.6 (12.4)	
		12.7 (500)	27-33	315	6.8 (15.0)	5.9 (13.0)	
1/16 in (1.6 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.2 (125)	20-25	185	2.4 (5.3)	2.1 (4.6)	86-88
		4.4 (175)	21-26	215	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	22-27	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	23-28	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	24-29	285	4.8 (10.5)	4.2 (9.2)	
		7.6 (300)	25-30	315	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	26-31	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	27-32	365	6.7 (14.7)	5.8 (12.8)	
		10.2 (400)	28-33	385	7.6 (16.8)	6.6 (14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 75%-85% Argon/Balance CO_2 [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE 1: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com. NOTE 2: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® HD-M

Mild Steel, All Position • AWS E71T-1M-H8, E71T-9M-H8

Key Features

- Increase weld deposition to more than 10 lbs./hr. out-of-position
- Fast freezing slag for a flat bead shape and increased productivity in all positions, including vertical up
- Operators can set the machine on a single setting and weld in all positions

Conformances

AWS A5.20/A5.20M:	E71T-1M-H8, E71T-9M-H8
ASME SFA-5.20:	E71T-1M-H8, E71T-9M-H8
CWB / CSA W48-06:	E491T-1M-H8, E491T-9M-H8
ABS:	3YSA H10
Lloyd's Register	3YS H10
DNV:	III YMS (H10)

Typical Applications

- Shipbuilding
- General fabrication

Welding Positions

All

Shielding Gas

75% Argon / Balance CO_2

DIAMETERS / PACKAGING

Diameter in. (mm)	15 lb (7 kg) Plastic Spool 60 lb (28 kg) Carton	33 lb (15 kg) Fiber Spool (Plastic Bag)	50 lb (23 kg) Fiber Spool (Plastic Bag)
0.045 (1.1)	ED033986	ED033989	ED033992
0.052 (1.3)	ED033987	ED033990	ED033993
1/16 (1.6)	ED033988	ED033991	ED033994

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements					
AWS E71T-1M-H8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified
AWS E71T-9M-H8				Not Specified	27 (20) min.
Test Results[3]					
As-Welded with 75% Argon / 25% CO_2	570-588 (83-85)	615-633 (89-92)	26-28	54-74 (40-54)	31-43 (23-32)

UltraCore® HD-M

(AWS E71T-1M-H8, E71T-9M-H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E71T-1M-H8, E71T-9M-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8 max.
Test Results[3] As-Welded with 75% Argon / 25% CO_2	0.04-0.05	1.44-1.50	0.49-0.53	<0.01	0.01	3-7

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ 75% Argon / 25% CO_2	25 (1)	4.4 (175)	21-26	130	1.8 (4.0)	1.6 (3.5)	87 - 88
		6.4 (250)	22-27	155	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	23-28	170	3.1 (6.9)	2.7 (6.0)	
		8.9 (350)	23-29	190	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	25-30	205	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	26-31	225	4.7 (10.3)	4.1 (9.0)	
		12.7 (500)	27-33	230	5.2 (11.4)	4.5 (9.9)	
		14.0 (550)	28-33	245	5.7 (12.6)	4.9 (10.9)	
		15.2 (600)	28-34	265	6.2 (13.7)	5.4 (11.9)	
0.052 in. (1.3 mm), DC+ 75% Argon / 25% CO_2	25 (1)	3.8 (150)	22-26	145	2.0 (4.5)	1.8 (3.9)	87 - 88
		5.1 (200)	23-27	170	2.7 (6.0)	2.4 (5.2)	
		6.4 (250)	23-28	190	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	24-29	215	4.1 (9.0)	3.5 (7.8)	
		8.9 (350)	24-30	235	4.8 (10.5)	4.1 (9.1)	
		9.5 (375)	25-30	250	5.1 (11.2)	4.4 (9.8)	
		10.8 (425)	26-31	270	5.8 (12.7)	5.0 (11.1)	
		12.1 (475)	26-32	295	6.4 (14.2)	5.6 (12.4)	
		12.7 (500)	27-33	305	6.8 (15.0)	5.9 (13.0)	
1/16 in. (1.6 mm), DC+ 75% Argon / 25% CO_2	25 (1)	3.8 (150)	22 - 26	195	2.9 (6.3)	2.5 (5.5)	86 -87
		4.4 (175)	23 - 26	215	3.4 (7.4)	2.9 (6.4)	
		5.1 (200)	23 - 27	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	24 - 28	255	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	25 - 29	270	4.8 (10.5)	4.1 (9.1)	
		7.6 (300)	25 - 30	310	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	26 - 31	330	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	28 - 32	350	6.7 (14.7)	5.8 (12.8)	
		10.2 (400)	28 - 33	390	7.6 (16.8)	6.6 (14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]To estimate ESO, subtract 1/4 in. (6.0 mm) from CTWD.

UltraCore® 71C

Mild Steel, All Position • AWS E71T-1C-H8, E71T-9C-H8

Key Features

- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance
- Meets AWS D1.8 seismic lot waiver requirements

Conformances

AWS A5.20/A5.20M:	E71T-1C-H8, E71T-9C-H8
ASME SFA-A5.20:	E71T-1C-H8, E71T-9C-H8
ABS:	E71T-1C-H8, E71T-9C-H8
Lloyd's Register:	3YS H10
DNV Grade:	III YMS H10
CWB/CSA W48-06:	E491T-9 H8
EN ISO 17632-B:	T493T1-1CA- H10
FEMA 353	
AWS D1.8	

Typical Applications

- Shipbuilding
- Seismic structural fabrication
- General fabrication
- Barge and railcar fabrication

Welding Positions

All

Shielding Gas

100% CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED031818	ED031666	ED031822	ED031876
0.052 (1.3)	ED031819	ED031667	ED031823	ED031877
1/16 (1.6)	ED031820	ED031668	ED031824	ED031878

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4]					
AWS E71T-1C-H8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified
AWS E71T-9C-H8				Not Specified	27 (20) min.
Typical Results[3]					
As-Welded with 100% CO_2	515-560 (74-81)	570-605 (82-87)	25-27	56-115 (41-85)	34-72 (25-53)

UltraCore® 71C

(AWS E71T-1C-H8, E71T-9C-H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E71T-1C-H8 AWS E71T-9C-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8.0 max.
Typical Results[3] As-Welded with 100% CO_2	0.03-0.04	1.31-1.41	0.43-0.49	0.01	0.01	4-7

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 100% CO_2	25 (1)	4.4 (175)	21-26	125	1.8 (4.0)	1.6 (3.5)	86-88
		6.4 (250)	22-27	155	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	23-28	165	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	24-29	190	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	25-30	205	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	26-31	230	4.7 (10.3)	4.1 (9.0)	
		12.7 (500)	27-32	245	5.2 (11.4)	4.5 (10.0)	
		14.0 (550)	28-33	265	5.7 (12.5)	5.0 (10.9)	
		15.2 (600)	29-34	275	6.2 (13.7)	5.4 (11.9)	
0.052 in (1.3 mm), DC+ 100% CO_2	25 (1)	3.8 (150)	21-26	150	2.0 (4.5)	1.8 (3.9)	86-88
		5.1 (200)	22-27	165	2.7 (6.0)	2.4 (5.2)	
		6.4 (250)	23-28	190	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	24-29	215	4.1 (9.0)	3.5 (7.8)	
		8.9 (350)	25-30	235	4.7 (10.5)	4.1 (9.1)	
		9.5 (375)	26-31	255	5.1 (11.2)	4.4 (9.8)	
		10.8 (425)	28-33	275	5.8 (12.7)	5.0 (11.1)	
		12.1 (475)	29-34	295	6.4 (14.2)	5.6 (12.4)	
		12.7 (500)	30-36	315	6.8 (15.0)	5.9 (13.0)	
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.2 (125)	21-26	185	2.4 (5.3)	2.1 (4.6)	86-88
		4.4 (175)	22-27	215	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	23-28	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	24-29	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	25-30	285	4.8 (10.5)	4.2 (9.2)	
		7.6 (300)	27-31	315	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	26-33	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	29-34	365	6.7 (14.7)	5.8 (12.8)	
		10.2 (400)	30-36	395	7.6 (16.8)	6.6 (14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com.

UltraCore® HD-C

Mild Steel, All Position • AWS E71T-1C-H8, E71T-9C-H8

Key Features

- High deposition rates, increase weld deposition up to 10 lbs/hr out-of-position
- Fast freezing slag for a flat bead shape and increased productivity in all positions, including vertical up
- Operators can set the machine on a single setting and weld in all positions
- Little or no pre-weld clean up required, weld over light rust, mill scale, and primer

Conformances

AWS 5.20/A5.20M:	E71T-1C-H8, E71T-9C-H8
ABS:	3YSA H10
Lloyd's Register:	3YS H10
DNV:	III YMS H10
CWB/CSA W48-06:	E491T-9-H8

Welding Positions

All

Typical Applications

- Shipbuilding
- General fabrication

Shielding Gas

100% CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in. (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED033756	ED033755	ED033757	
0.052 (1.3)	ED033759	ED033758	ED033760	
1/16 (1.6)	ED033762	ED033761	ED033763	ED033785

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements					
AWS E71T-1C-H8	400 (58)	480-660	22	27 (20) min.	Not Specified
AWS E71T-9C-H8	min.	(70-95)	min.	Not Specified	27 (20) min.
Test Results[3] - As-Welded with 100% CO_2	540-560 (78-81)	590-610 (86-89)	27	37-111 (27-82)	31-85 (23-63)

UltraCore® HD-C

(AWS E71T-1C-H8, E71T-9C-H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si
Requirements - AWS E71T-1C-H8, E71T-9C-H8	0.12 max.	1.75 max.	0.90 max.
Test Results[3] - As-Welded with 100% CO_2	0.04-0.05	1.36-1.46	0.38-0.42
	%S	**%P**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements - AWS E71T-1C-H8, E71T-9C-H8	0.03 max.	0.03 max.	8 max.
Test Results[3] - As-Welded with 100% CO_2	0.01	0.01	4-6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ 100% CO_2	19 - 25 (3/4 - 1)	4.4 (175)	22-25	145	1.8 (3.9)	1.5 (3.4)	85 - 87
		6.4 (250)	23-28	185	2.5 (5.6)	2.2 (4.8)	
		7.6 (300)	24-30	215	3.1 (6.8)	2.6 (5.8)	
		8.9 (350)	25-31	235	3.6 (7.9)	3.1 (6.8)	
		10.2 (400)	27-32	255	4.1 (9.0)	3.5 (7.8)	
		11.4 (450)	28-33	280	4.6 (10.1)	4.0 (8.8)	
		12.7 (500)	27-33	300	5.1 (11.3)	4.4 (9.8)	
		14.0 (550)	28-33	315	5.6 (12.4)	4.9 (10.8)	
		15.2 (600)	30-35	335	6.1 (13.5)	5.3 (11.7)	
0.052 in. (1.3 mm), DC+ 100% CO_2	19 - 25 (3/4 - 1)	3.8 (150)	22-25	155	2.1 (4.7)	1.7 (3.8)	81 - 85
		5.1 (200)	23-26	190	2.9 (6.3)	2.4 (5.2)	
		6.4 (250)	23-27	225	3.5 (7.8)	2.9 (6.5)	
		7.6 (300)	24-29	265	4.3 (9.4)	3.6 (7.9)	
		8.9 (350)	26-30	285	5.0 (11.0)	4.2 (9.2)	
		9.5 (375)	27-30	310	5.3 (11.7)	4.5 (9.9)	
		10.8 (425)	28-32	325	6.0 (13.3)	5.1 (11.2)	
		12.1 (475)	29-33	345	6.8 (14.9)	5.7 (12.6)	
		12.7 (500)	30-34	360	7.1 (15.6)	6.0 (13.3)	
1/16 in. (1.6 mm), DC+ 100% CO_2	19 - 25 (3/4 - 1)	3.8 (150)	21-26	195	2.9 (6.4)	2.4 (5.3)	84 - 87
		4.4 (175)	22-27	245	3.4 (7.5)	2.9 (6.3)	
		5.1 (200)	22-27	260	3.9 (8.5)	3.3 (7.2)	
		5.7 (225)	23-28	290	4.4 (9.6)	3.7 (8.1)	
		6.4 (250)	24-29	310	4.8 (10.6)	4.1 (9.1)	
		7.6 (300)	25-30	330	5.8 (12.7)	4.9 (10.9)	
		8.3 (325)	25-30	365	6.3 (13.8)	5.4 (11.9)	
		8.9 (350)	26-30	390	6.7 (14.8)	5.8 (12.8)	
		10.2 (400)	27-31	405	7.7 (16.9)	6.7 (14.7)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2 [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 71A75 Dual

Mild Steel, All Position • AWS E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8

Key Features

- Designed for welding with either 100% CO_2 or 75% Argon/25% CO_2 shielding gases
- Premium arc performance and bead appearance

Typical Applications

- General fabrication

Conformances

AWS A5.20/A5.20M: E71T-9C-H8, E71T-9M-H8
E71T-1C-H8, E71T-1M-H8,
ASME SFA-A5.20: E71T-9C-H8, E71T-9M-H8
E491T-9 H8, E491T-9M H8
CWB/CSA W48-06: T493T1-1MA-H10,
EN ISO 17632-B: T493T1-1CA-H10
E71T-1C-H8, E71T-1M-H8,

Welding Positions

All

Shielding Gas

100% CO_2
75% Argon / 25% CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED031882	ED031669	ED031844	ED032044
0.052 (1.3)		ED031670	ED031845	
1/16 (1.6)		ED031671	ED031846	ED032046

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4]					
AWS E71T-1C-H8, E71T-1M-H8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified
AWS E71T-9C-H8, E71T-9M-H8				Not Specified	27 (20) min.
Typical Results[3]					
As-Welded with 100% CO_2	510-550 (73-79)	570-600 (82-87)	26-28	38-95 (28-70)	27-65 (20-48)
As-Welded with 75% Ar/25% CO_2	570-610 (82-88)	620-660 (89-95)	24-26	62-111 (46-82)	39-85 (29-63)

UltraCore® 71A75 Dual

(AWS E71T-1C-H8, E71T-1M-H8, E71T-9C-H8, E71T-9M-H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4]						
AWS E71T-1C-H8, E71T-1M-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8.0 max.
AWS E71T-9C-H8, E71T-9M-H8						
Typical Results[3]						
As-Welded with 100% CO_2	0.03-0.04	1.28-1.41	0.42-0.49	0.01	0.01-0.02	3-8
As-Welded with 75% Ar/25% CO_2	0.03-0.04	1.45-1.60	0.54-0.62	0.01	0.01-0.02	4-8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas[5]	CTWD[6] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	25 (1)	4.4 (175)	20-25	135	1.8 (4.0)	1.6 (3.5)	86-88
		6.4 (250)	21-26	150	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	22-27	165	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	23-28	190	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	24-29	205	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	25-30	225	4.7 (10.3)	4.1 (9.0)	
		12.7 (500)	26-31	245	5.2 (11.4)	4.5 (10.0)	
		14.0 (550)	27-32	265	5.7 (12.5)	5.0 (10.9)	
		15.2 (600)	27-33	285	6.2 (13.7)	5.4 (11.9)	
0.052 in (1.3 mm), DC+ 75% Ar/25% CO_2	25 (1)	3.8 (150)	20-25	155	2.0 (4.5)	1.8 (3.9)	86-88
		5.1 (200)	21-26	165	2.7 (6.0)	2.4 (5.2)	
		6.4 (250)	22-27	190	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	23-28	215	4.1 (9.0)	3.5 (7.8)	
		8.9 (350)	24-29	235	4.7 (10.5)	4.1 (9.1)	
		9.5 (375)	25-30	255	5.1 (11.2)	4.4 (9.8)	
		10.8 (425)	27-31	275	5.8 (12.7)	5.0 (11.1)	
		12.1 (475)	28-33	295	6.4 (14.2)	5.6 (12.4)	
		12.7 (500)	29-35	325	6.8 (15.0)	5.9 (13.0)	
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	25 (1)	3.2 (125)	20-25	195	2.4 (5.3)	2.1 (4.6)	86-88
		4.4 (175)	21-26	215	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	22-27	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	23-28	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	24-29	285	4.8 (10.5)	4.2 (9.2)	
		7.6 (300)	25-31	315	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	25-32	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	26-33	365	6.7 (14.7)	5.8 (12.8)	
		10.2 (400)	28-35	405	7.6 (16.8)	6.6 (14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2 & As-Welded 75% Argon / 25% CO_2. [5] When welding under CO_2, increase voltage by 1 Volt. [6]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® 712C

Mild Steel, All Position • AWS E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8

Key Features

- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F)
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance

Conformances

AWS A5.20/A5.20M:	E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8
ASME SFA-A5.20:	E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8
ABS:	3YSA H10
Lloyd's Register:	3YS H10
DNV Grade:	III YMS H10
CWB/CSA W48-06:	E491T-12J H8, E491T-9J H8
EN ISO 17632-B:	T494T12-1CA-K-H10

Typical Applications

- Bridge fabrication
- Pressure vessels
- Shipbuilding
- Offshore
- ASME related applications

Welding Positions

All

Shielding Gas

100% CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)		ED031672		ED031681
0.052 (1.3)		ED031673	ED031839	
1/16 (1.6)	ED031896	ED031674	ED031840	ED031799

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements[4]						
AWS E71T-1C-JH8	400 (58) min.		22 min.	27 (20) min.	Not Specified	27 (20) min.
AWS E71T-9C-JH8		480-655 (70-95)		Not Specified	27 (20) min.	
AWS E71T-12C-JH8		480-620 (70-90)		Not Specified	27 (20) min.	
Typical Results[3]						
As-Welded with 100% CO_2	485-535 (70-77)	540-585 (78-84)	25-28	135-193 (100-143)	91-164 (67-121)	57-133 (42-98)

UltraCore® 712C

(AWS E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4]							
AWS E71T-1C-JH8, E71T-9C-JH8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.	8.0 max.
AWS E71T-12C-JH8		1.60 max.					
Typical Results[3]							
As-Welded with 100% CO_2	0.03	1.34-1.49	0.26-0.32	0.01	0.01-0.02	0.33-0.41	3-8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 100% CO_2	25 (1)	4.4 (175)	20-25	135	1.8 (4.0)	1.6 (3.5)	86-88
		5.7 (225)	21-26	150	2.3 (5.1)	2.0 (4.5)	
		7.0 (275)	22-27	165	2.8 (6.3)	2.5 (5.5)	
		8.3 (325)	23-28	190	3.4 (7.4)	2.9 (6.5)	
		8.9 (350)	24-29	205	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	25-30	230	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	26-31	245	4.7 (10.3)	4.1 (9.1)	
		12.1 (475)	27-32	265	4.9 (10.8)	4.3 (9.5)	
		13.3 (525)	28-33	285	5.4 (12.0)	4.7 (10.4)	
0.052 in (1.3 mm), DC+ 100% CO_2	25 (1)	3.8 (150)	22-27	160	2.0 (4.5)	1.8 (3.9)	86-88
		5.1 (200)	23-28	165	2.7 (6.0)	2.4 (5.2)	
		6.4 (250)	24-29	190	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	26-31	215	4.1 (9.1)	3.5 (7.8)	
		8.9 (350)	27-32	235	4.7 (10.5)	4.1 (9.1)	
		9.5 (375)	28-33	255	5.1 (11.2)	4.4 (9.8)	
		10.8 (425)	30-35	275	5.8 (12.7)	5.0 (11.1)	
		12.1 (475)	31-36	295	6.4 (14.2)	5.6 (12.4)	
		12.7 (500)	32-37	340	6.8 (15.0)	5.9 (13.0)	
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.8 (150)	21-27	215	2.9 (6.3)	2.5 (5.5)	86-88
		4.4 (175)	23-28	250	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	24-29	290	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	25-31	315	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	27-34	330	4.8 (10.5)	4.2 (9.2)	
		7.6 (300)	29-36	365	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	31-38	390	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	32-39	420	6.7 (14.7)	5.8 (12.8)	
		11.4 (450)	34-39	445	8.6 (18.9)	7.5 (16.5)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® HD-12C

Mild Steel, All Position • AWS E71T-1CJ, E71T-9CJ, E71T-12CJ H8

Key Features

- Increase weld deposition to more than 14 lbs/hr. out-of-position
- Fast freezing slag for a flat bead shape and increased productivity in all positions
- Operators can set the machine on a single setting and weld in all positions
- Weld over light rust, mill scale, and primer
- Capable of exceeding 27 J (20 ft•lbf) at -40°C (-40°F)

Typical Applications

- Heavy Fabrication
- Mining
- General Fabrication
- Structural
- Applications requiring PWHT of mild steels

Conformances

AWS A5.20/5.20M:	E71T-1CJ, E71T-9CJ, E71T-12CJ H8
ASME SFA-5.20:	E71T-1CJ, E71T-9CJ, E71T-12CJ H8

Welding Positions

All

Shielding Gas

100% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Fiber Spool
0.045 (1.1)	ED034274
0.052 (1.3)	ED034275
1/16 (1.6)	ED034276

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements[4]						
AWS E71T-1CJ, E71T-9CJ, E71T-12CJ H8	400 (58) min.	480-620 (70-90)	22 min.	27 (20) min.	Not Specified	Not Specified
As-Welded with 100% CO_2				Not Specified	27 (20) min.	27 (20) min.
Typical Results[3]						
As-Welded with 100% CO_2	538 (78)	593 (86)	28	–	93 (68)	51 (38)
Stress-Relieved for 1 hr @ 620°C (1150°F)	496 (72)	579 (84)	28	–	58 (43)	–

UltraCore® HD-12C

(AWS E71T-1CJ, E71T-9CJ, E71T-12CJ H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/5.20M*

	%C	%Mn	%Si	%Ni
Requirements[4] AWS E71T-1CJ, E71T-9CJ, E71T-12CJ H8 As-Welded with 100% CO_2	0.12 max.	1.75 max.	0.90 max.	0.50 max.
Typical Results[3] As-Welded with 100% CO_2	0.04	1.35	0.33	0.40

	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E71T-1CJ, E71T-9CJ, E71T-12CJ H8 As-Welded with 100% CO_2	0.03 max.	0.03 max.	8 max.
Typical Results[3] As-Welded with 100% CO_2	0.01	0.01	4-7

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ As-Welded with 100% CO_2	25 (1)	4.4 (175)	24-29	115	1.8 (3.9)	1.5 (3.4)	85-88
		6.4 (250)	25-30	140	2.5 (5.6)	2.2 (4.8)	
		7.6 (300)	26-31	155	3.1 (6.8)	2.6 (5.8)	
		8.9 (350)	26-31	170	3.6 (7.9)	3.1 (6.8)	
		10.2 (400)	26-31	185	4.1 (9.0)	3.5 (7.8)	
		11.4 (450)	27-32	200	4.6 (10.1)	4.0 (8.8)	
		12.7 (500)	27-32	215	5.1 (11.3)	4.4 (9.8)	
		14.0 (550)	28-33	230	5.6 (12.4)	4.9 (10.8)	
		15.2 (600)	28-33	245	6.1 (13.5)	5.3 (11.7)	
0.052 in (1.3 mm), DC+ As-Welded with 100% CO_2	25 (1)	3.8 (150)	24-29	140	2.1 (4.7)	1.7 (3.8)	85-88
		5.1 (200)	25-30	160	2.9 (6.3)	2.4 (5.2)	
		6.4 (250)	26-31	180	3.5 (7.8)	3.0 (6.5)	
		7.6 (300)	26-31	205	4.3 (9.4)	3.6 (7.9)	
		8.9 (350)	27-32	225	5.0 (11.0)	4.2 (9.2)	
		9.5 (375)	27-32	235	5.3 (11.7)	4.5 (9.9)	
		10.8 (425)	27-32	255	6.0 (13.3)	5.1 (11.2)	
		12.1 (475)	28-33	275	6.8 (14.9)	5.7 (12.6)	
		12.7 (500)	28-33	290	7.1 (15.6)	6.0 (13.3)	
1/16 in (1.6 mm), DC+ As-Welded with 100% CO_2	25 (1)	3.8 (150)	23-28	200	2.9 (6.4)	2.4 (5.3)	85-88
		4.4 (175)	24-29	215	3.4 (7.5)	2.9 (6.3)	
		5.1 (200)	24-29	230	3.9 (8.5)	3.3 (7.2)	
		5.7 (225)	24-29	245	4.4 (9.6)	3.7 (8.1)	
		6.4 (250)	25-30	255	4.8 (10.6)	4.1 (9.1)	
		7.6 (300)	25-30	285	5.8 (12.7)	4.9 (10.9)	
		8.3 (325)	26-31	300	6.3 (13.8)	5.4 (11.9)	
		8.9 (350)	26-31	310	6.7 (14.8)	5.8 (12.8)	
		10.2 (400)	27-32	340	7.7 (16.9)	6.7 (14.7)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 712A80

Mild Steel, All Position • AWS E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8

Key Features

- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F)
- Designed for welding with 75-80% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance

Typical Applications

- Offshore
- Pressure vessels
- Shipbuilding
- Heavy equipment
- ASME related applications

Conformances

AWS A5.20/A5.20M:	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8
ASME SFA-A5.20:	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8
ABS:	4YSA H10
Lloyd's Register:	4YS H10
DNV Grade:	IV YMS H10
CWB/CSA W48-06:	E491T-12MJ-H8, E491T-9MJ-H8
EN ISO 17632-B:	T494T12-1MA-K-H10

Welding Positions

All

Shielding Gas

75% - 80% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*	50 lb (22.7 kg) Fiber Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)		ED031675	ED031850	ED032050
0.052 (1.3)		ED031676	ED031851	ED032051
1/16 (1.6)	ED031890	ED031677	ED031852	ED032052

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements[4]						
AWS E71T-1M-JH8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified	27 (20) min.
AWS E71T-9M-JH8				Not Specified	27 (20) min.	
AWS E71T-12M-JH8		480-620 (70-90)		Not Specified	27 (20) min.	
Typical Results[3] As-Welded with 75%-80% Ar/balance CO_2	505-555 (73-80)	565-610 (82-88)	25-27	166-186 (123-137)	100-160 (74-118)	72-142 (53-105)

UltraCore® 712A80

(AWS E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4]							
AWS E71T-1M-JH8, E71T-9M-JH8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.	8.0 max.
AWS E71T-12M-JH8		1.60 max.					
Typical Results[3]							
As-Welded with 75%-80% Ar/balance CO_2	0.03-0.04	1.40-1.53	0.31-0.36	0.01	0.01	0.32-0.38	4 - 8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	4.4 (175)	20-25	140	1.8 (4.0)	1.6 (3.5)	86-88
		5.7 (225)	21-26	150	2.3 (5.1)	2.0 (4.5)	
		7.0 (275)	22-27	165	2.8 (6.3)	2.5 (5.5)	
		8.3 (325)	22-27	190	3.4 (7.4)	2.9 (6.5)	
		8.9 (350)	23-28	205	3.6 (8.0)	3.2 (7.0)	
		10.2 (400)	24-29	230	4.1 (9.1)	3.6 (8.0)	
		11.4 (450)	25-31	245	4.7 (10.3)	4.1 (9.0)	
		12.1 (475)	26-32	265	4.9 (10.8)	4.3 (9.5)	
		13.3 (525)	27-33	280	5.4 (12.0)	4.7 (10.4)	
0.052 in (1.3 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	3.8 (150)	20-25	150	2.0 (4.5)	1.8 (3.9)	86-88
		4.4 (175)	21-26	165	2.4 (5.2)	2.1 (4.6)	
		5.1 (200)	22-27	190	2.7 (6.0)	2.4 (5.2)	
		5.7 (225)	23-28	215	3.1 (6.7)	2.7 (5.9)	
		6.4 (250)	24-29	235	3.4 (7.5)	2.9 (6.5)	
		7.6 (300)	25-30	255	4.1 (9.0)	3.5 (7.8)	
		8.3 (325)	27-31	275	4.4 (9.7)	3.8 (8.5)	
		8.9 (350)	28-32	295	4.7 (10.5)	4.1 (9.1)	
		11.4 (450)	29-34	330	6.1 (13.5)	5.3 (11.7)	
1/16 in (1.6 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	3.8 (150)	21-26	200	2.9 (6.3)	2.5 (5.5)	86-88
		4.4 (175)	22-27	215	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	22-28	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	24-29	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	25-30	285	4.8 (10.5)	4.2 (9.2)	
		7.6 (300)	26-31	315	5.7 (12.6)	5.0 (11.0)	
		8.3 (325)	27-32	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	28-33	365	6.7 (14.7)	5.8 (12.8)	
		10.2 (400)	29-34	415	7.6 (16.8)	6.6 (14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded 75%-80% Argon/Balance CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® HD-12M

Mild Steel, All Position • AWS E71T-1MJ, E71T-9MJ, E71T-12MJ H8

Key Features

- Increase weld deposition up to 14 lbs/hr. out-of-position
- Results in a flat bead shape and enhanced productivity in all positions
- Operators can set the machine on a single setting and weld in all positions
- Capable of exceeding 27 J (20 ft•lbf) at -40°C (-40°F)

Conformances

AWS A5.20/5.20M: E71T-1MJ, E71T-9MJ, E71T-12MJ H8

ASME SFA-5.20: E71T-1MJ, E71T-9MJ, E71T-12MJ H8

Welding Positions

All

Typical Applications

- Heavy Fabrication
- Mining
- General Fabrication

Shielding Gas

75-80% Argon / Balance CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Fiber Spool
0.045 (1.1)	ED034277
0.052 (1.3)	ED034278
1/16 (1.6)	ED034279

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements						
AWS E71T-1MJ, E71T-9MJ, E71T-12MJ H8				27 (20) min.	Not Specified	Not Specified
As-Welded with 75-80% Ar / Balance CO_2	400 (58) min.	480-655 (70-95)	22 min.	Not Specified	27 (20) min.	27 (20) min.
Typical Results[3]						
As-Welded with 75% Argon / 25% CO_2	538 (78)	600 (87)	26	–	102 (75)	65 (48)
Stress Relieved for 1 hr @ 620°C (1150°F)	503 (73)	593 (86)	29	–	68 (50)	–

UltraCore® HD-12M

(AWS E71T-1MJ, E71T-9MJ, E71T-12MJ H8)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/5.20M*

	%C	%Mn	%Si	%Ni
Requirements[4] AWS E71T-1MJ, E71T-9MJ, E71T-12MJ H8 As-Welded with 75-80% Ar / Balance CO_2	0.12 max.	1.75 max.	0.90 max.	0.50 max.
Typical Results[3] As-Welded with 75% Argon / 25% CO_2	0.05	1.40	0.39	0.40

	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E71T-1MJ, E71T-9MJ, E71T-12MJ H8 As-Welded with 75-80% Ar / Balance CO_2	0.03 max.	0.03 max.	8 max.
Typical Results[3] As-Welded with 75% Argon / 25% CO_2	0.01	0.01	4-7

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ As-Welded with 75% Ar/25% CO_2	25 (1)	4.4 (175) 6.4 (250) 7.6 (300) 8.9 (350) 10.2 (400) 11.4 (450) 12.7 (500) 14.0 (550) 15.2 (600)	23-28 24-29 25-30 25-30 25-30 26-31 26-31 27-32 27-32	115 140 155 170 185 200 215 230 245	1.8 (3.9) 2.5 (5.6) 3.1 (6.8) 3.6 (7.9) 4.1 (9.0) 4.6 (10.1) 5.1 (11.3) 5.6 (12.4) 6.1 (13.5)	1.5 (3.4) 2.2 (4.8) 2.6 (5.8) 3.1 (6.8) 3.5 (7.8) 4.0 (8.8) 4.4 (9.8) 4.9 (10.8) 5.3 (11.7)	85-88
0.052 in (1.3 mm), DC+ As-Welded with 75% Ar/25% CO_2	25 (1)	3.8 (150) 5.1 (200) 6.4 (250) 7.6 (300) 8.9 (350) 9.5 (375) 10.8 (425) 12.1 (475) 12.7 (500)	23-28 24-29 25-30 25-30 26-31 26-31 26-31 27-32 27-32	140 160 180 205 225 235 255 275 290	2.1 (4.7) 2.9 (6.3) 3.5 (7.8) 4.3 (9.4) 5.0 (11.0) 5.3 (11.7) 6.0 (13.3) 6.8 (14.9) 7.1 (15.6)	1.7 (3.8) 2.4 (5.2) 3.0 (6.5) 3.6 (7.9) 4.2 (9.2) 4.5 (9.9) 5.1 (11.) 5.7 (12.6) 6.0 (13.3)	85-88
1/16 in (1.6 mm), DC+ As-Welded with 75% Ar/25% CO_2	25 (1)	3.8 (150) 4.4 (175) 5.1 (200) 5.7 (225) 6.4 (250) 7.6 (300) 8.3 (325) 8.9 (350) 10.2 (400)	22-27 23-28 23-28 23-28 24-29 24-29 25-30 25-30 26-31	200 215 230 245 255 285 300 310 340	2.9 (6.4) 3.4 (7.5) 3.9 (8.5) 4.4 (9.6) 4.8 (10.6) 5.8 (12.7) 6.3 (13.8) 6.7 (14.8) 7.7 (16.9)	2.4 (5.3) 2.9 (6.3) 3.3 (7.2) 3.7 (8.1) 4.1 (9.1) 4.9 (10.9) 5.4 (11.9) 5.8 (12.8) 6.7 (14.7)	85-88

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 712A80-H

Mild Steel, All Position • AWS E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4

Key Features

- Capable of producing low hydrogen weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F)
- Designed for welding with 75-80% Argon/ balance CO_2 gas
- Premium arc performance and bead appearance
- ProTech® foil bag packaging
- Meets H4 diffusible hydrogen levels

Typical Applications

- Offshore
- Heavy equipment
- Shipbuilding
- Pressure vessels

Conformances

AWS A5.20/A5.20M:	E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4
ASME SFA-A5.20:	E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4
ABS:	4YSA H5
Lloyd's Register:	4YS H5
DNV Grade:	IV YMS H5
CWB/CSA W48-06:	E491T-12MJ H4, E491T-9MJ H4
EN ISO 17632-B:	T494T12-1MA-K-H5

Welding Positions

All

Shielding Gas

75% - 80% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Spool*
0.045 (1.1)	ED031891	ED031678
0.052 (1.3)		ED031679
1/16 (1.6)	ED031893	ED031680

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements[4]						
AWS E71T-1M-JH4	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified	27 (20) min.
AWS E71T-9M-JH4				Not Specified	27 (20) min.	
AWS E71T-12M-JH4		480-620 (70-90)		Not Specified	27 (20) min.	
Typical Results[3] As-Welded with 75%-80% Ar/balance CO_2	490-570 (71-83)	550-615 (80-89)	27-28	149-180 (111-133)	56-164 (41-121)	27-98 (20-72)

UltraCore® 712A80-H

(AWS E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4]							
AWS E71T-1M-JH4, E71T-9M-JH4	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.	4.0 max.
AWS E71T-12M-JH4		1.60 max.					
Typical Results[3]							
As-Welded with 75%-80% Ar/balance CO_2	0.03-0.04	1.25-1.37	0.28-0.33	0.01	0.01	0.35-0.41	2-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	4.4 (175)	21-25	140	1.8 (4.0)	1.6 (3.5)	86-88
		5.1 (200)	22-26	150	2.1 (4.6)	1.8 (4.0)	
		6.4 (250)	23-27	165	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	23-28	190	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	24-29	205	3.6 (8.0)	3.2 (7.0)	
		9.5 (375)	25-30	230	3.9 (8.6)	3.4 (7.5)	
		10.8 (425)	26-31	245	4.4 (9.7)	3.8 (8.5)	
		12.1 (475)	27-32	265	4.9 (10.8)	4.3 (9.5)	
		12.7 (500)	28-33	275	5.2 (11.4)	4.5 (10.0)	
0.052 in (1.3 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	3.8 (150)	21-25	150	2.0 (4.5)	1.8 (3.9)	86-88
		4.7 (185)	22-26	165	2.5 (5.5)	2.2 (4.8)	
		5.7 (225)	23-27	190	3.1 (6.7)	2.7 (5.9)	
		6.4 (250)	24-28	215	3.4 (7.5)	2.9 (6.5)	
		6.9 (275)	24-29	235	3.7 (8.2)	3.2 (7.2)	
		7.6 (300)	24-30	255	4.1 (9.0)	3.5 (7.8)	
		8.5 (335)	25-31	275	4.5 (10.0)	4.0 (8.7)	
		9.5 (375)	26-32	295	5.1 (11.2)	4.4 (9.8)	
		10.2 (400)	26-33	310	5.4 (12.0)	4.7 (10.4)	
1/16 in (1.6 mm), DC+ 75%-80% Ar/ balance CO_2	25 (1)	3.8 (150)	22-26	200	2.9 (6.3)	2.5 (5.5)	86-88
		4.4 (175)	23-27	210	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	24-29	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	24-29	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	24-30	285	4.8 (10.5)	4.2 (9.2)	
		6.9 (275)	26-31	315	5.3 (11.6)	4.6 (10.1)	
		8.3 (325)	27-32	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	28-33	365	6.7 (14.7)	5.8 (12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded 75%-80% Argon/Balance CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® SR-12

Mild Steel, All Position • AWS E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8

Key Features

- Meets AWS strength and low temperature impact toughness requirements in the as-welded and stress relieved conditions
- Premium arc performance and bead shape makes SR-12 easy to use for welders of all skill levels

Conformances

AWS A5.20/5.20M:	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8
ASME SFA-5.20:	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8

Typical Applications

- Pressure vessel fabrication
- Applications requiring PWHT of mild steel

Welding Positions

All

Shielding Gas

75-80 % Argon / Balance CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Fiber Spool
0.045 (1.1)	ED034109	ED034111

UltraCore® SR-12

(AWS E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements[4] AWS E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8 As-Welded with 75% Ar / 25% CO_2	400 (58) min.	480-620 (70-90)	22 min.	27 (20) min.
Typical Results[3] As-Welded with 75% Ar / 25% CO2 Stress-Relieved for 8 hrs. @ 620°C (1150°F)	503-530 (73-77) 450 (65)	565-586 (82-85) 540 (78)	28-29 30	108-162 (80-120) 100-150 (70-110)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/5.20M*

	%C	%Mn	%Si
Requirements[4] - AWS E71T-12M-JH4 As-Welded with 75% Ar / 25% CO_2	0.12 max.	1.60 max.	0.90 max.
Typical Results[3] As-Welded with 75% Ar / 25% CO_2	0.03-0.06	1.27-1.60	0.27-0.45

	%Ni	%S	%P
Requirements[4] - AWS E71T-12M-JH4 As-Welded with 75% Ar / 25% CO_2	0.50 max.	0.03 max.	0.03 max.
Typical Results[3] As-Welded with 75% Ar / 25% CO_2	0.34-0.41	<0.01	<0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar / 25% CO_2	22 (7/8)	4.4 (175)	22-24	125	1.8 (4.0)	1.5 (3.4)	88
		5.7 (225)	22-24	145	2.3 (5.1)	2.0 (4.4)	
		7.0 (275)	23-25	165	2.9 (6.3)	2.5 (5.5)	
		8.3 (325)	23-25	185	3.4 (7.4)	2.9 (6.4)	
		9.5 (375)	24-26	205	3.9 (8.6)	3.4 (7.5)	
		10.8 (425)	25-27	225	4.4 (9.7)	3.8 (8.4)	
		12.1 (475)	26-28	245	4.9 (10.9)	4.3 (9.5)	
		13.3 (525)	29-31	315	5.5 (12.0)	4.8 (10.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded 75%-80% Argon/Balance CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® SR-12C

Mild Steel, All Position • AWS E71T-12C-JH8

Key Features

- Capable of meeting 20 ft•lbf @ -50°F in both the as-welded and stress relieved conditions
- A premium arc performance and fast freezing slag make UltraCore® SR-12C easy to use for welders of all skill levels

Applications

- General Fabrication
- Offshore Industry
- Petrochemical

Welding Positions

All

Conformances

AWS A5.20/5.20M:	E71T-12C-JH8
AWS A5.36:	E71T12-C1A5-CS2-H8, E71T12-C1P5-CS2-H8
ASME SFA-5.20:	E71T-12C-JH8

Shielding Gas

100% CO_2

DIAMETERS / PACKAGING

Diameter in. (mm)	33 lb (15 kg) Fiber Spool
0.045 (1.1)	ED034532
0.052 (1.3)	ED034533
1/16 (1.6)	ED034534

UltraCore® SR-12C

(AWS E71T-12C-JH8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.36/5.36M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements AWS A5.20 - E71T-12C-JH8 As-Welded with 100% CO_2	400 (58) min.	480-620 (70-90)	22 min.	27 (20) min.	–
AWS A5.36 - E71T1-C1A5-CS2-H8 As-Welded with 100% CO_2		480-655 (70-95)		–	27 (20) min.
AWS A5.36 - E71T1-C1P5-CS2-H8 Stress Relieved 1hr. @ 620°C (1150°F) with 100% CO_2		480-655 (70-95)		–	27 (20) min.
Test Results[3] As-Welded with 100% CO_2	490 (71)	550 (80)	22	47 (34)	61 (45)
Stress-Relieved 1 hr. @ 620°C (1150°F) with 100% CO_2	435 (63)	545 (79)	32	-	92 (68)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.36/5.36M*

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS A5.20 - E71T-12C-JH8 As-Welded with 100% CO_2	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.	3.0 max.
AWS A5.36 - E71T1-C1A5-CS2-H8 As-Welded with 100% CO_2		1.60 max.		0.030 max.	0.030 max.		
Test Results[3] As-Welded with 100% CO_2	0.05	1.42	0.52	0.007	0.016	0.02	5.9

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ As-Welded with 100% CO_2	25 (1)	4.4 (175)	23-28	115	1.8 (3.9)	1.5 (3.4)	85-88
		6.4 (250)	24-29	140	2.5 (5.6)	2.1 (4.6)	
		7.6 (300)	25-30	155	3.1 (6.8)	2.6 (5.8)	
		10.2 (400)	25-30	185	4.1 (9.0)	3.4 (7.5)	
		12.7 (500)	26-31	215	5.1 (11.3)	4.4 (9.8)	
		5.2 (600)	27-32	245	6.1 (13.5)	5.1 (11.3)	
0.052 in. (1.3 mm), DC+ As-Welded with 100% CO_2	25 (1)	3.8 (150)	23-28	140	2.1 (4.7)	1.7 (3.8)	85-88
		6.4 (250)	25-30	180	3.5 (7.8)	3.0 (6.5)	
		8.9 (350)	26-31	225	5.0 (11.0)	4.2 (9.2)	
		10.8 (425)	26-31	255	6.0 (13.3)	5.1 (11.2)	
		12.7 (500)	27-32	290	7.1 (15.6)	6.0 (13.3)	
1/16 in. (1.6 mm), DC+ As-Welded with 100% CO_2	25 (1)	3.8 (150)	22-27	200	2.9 (6.4)	2.4 (5.3)	85-88
		5.1 (200)	23-28	230	3.7 (8.1)	3.0 (6.7)	
		6.4 (250)	24-29	255	4.8 (10.6)	4.1 (9.1)	
		7.6 (300)	25-30	300	5.5 (12.1)	4.6 (10.2)	
		10.2 (400)	26-31	360	6.7 (14.8)	5.8 (12.8)	

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] To estimate ESO, subtract 1/4 in. (6.0 mm) from CTWD.

UltraCore® SR-12M

Mild Steel, All Position • AWS E71T-12MJ

Key Features

- Capable of meeting 20 ft•lbf @ -50°F in both the as-welded and stress relieved conditions
- A premium arc performance make UltraCore® SR-12M easy to use for welders of all skill levels

Typical Applications

- General Fabrication
- Offshore Industry
- Petrochemical

Welding Positions

All

Conformances

AWS A5.36/5.36M:	E71T-12M J
AWS A5.36/5.36M:	E71T12-M21A5-CS2-H8, E71T12-M21P5-CS2-H8
ASME SFA-5.36:	E71T-12M J

Shielding Gas

75 - 80% Argon / balance CO_2

DIAMETERS / PACKAGING

Diameter in. (mm)	33 lb (15 kg) Fiber Spool
0.045 (1.1)	ED034529
0.052 (1.3)	ED034530
1/16 (1.6)	ED034531

UltraCore® SR-12M

(AWS E71T-12MJ)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.36/5.36M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements AWS A5.36 - E71T-12M-JH8 As-welded with 75-80% Ar / Balance CO_2	400 (58) min.	480-620 (70-90	22 min.	27 (20) min.	–
AWS A5.36 - E71T1-M21A5-CS2-H8 As-Welded with 75%-80% Ar/ Balance CO_2		480-655 (70-95)		–	27 (20) min.
AWS A5.36 - E71T1-M21P5-CS2-H8 Stress Relieved 1hr. @ 620°C (1150°F) with 75%-80% Ar/ Balance CO_2		480-655 (70-95)		–	27 (20) min.
Test Results[3] As-Welded with 75%-80% Ar/ Balance CO_2	500 (73)	590 (86)	25	134 (99)	125 (92)
Stress-Relieved 1 hr. @ 620°C (1150°F) with 75%-80% Ar/ Balance CO_2	440 (64)	545 (79)	33	–	117 (86)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.36/5.36M*

	%C	%Mn	%Si	%S	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS A5.36 - E71T-12M-JH8 As-Welded with 75-80% Ar / Balance CO_2 AWS A5.36 - E71T1-M21A5-CS2-H8 E71T1-M21P5-CS2-H8	0.12 max.	1.60 max.	0.90 max.	0.03 max. 0.030 max.	0.03 max. 0.030 max.	0.50 max.	8 max.
Test Results[3] As-Welded with 75% Ar / 25% CO_2	0.06	1.45	0.44	0.008	0.014	0.01	5.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ As-Welded with 75% Ar / 25% CO_2	25 (1)	3.8 (175)	20-25	140	1.8 (4.0)	1.6 (3.5)	85-88
		5.7 (225)	21-26	150	2.3 (5.1)	2.0 (4.5)	
		6.4 (250)	22-27	170	2.6 (5.7)	2.2 (4.8)	
		7.6 (300)	23-28	200	3.5 (7.7)	3.1 (6.8)	
		10.2 (400)	24-29	220	4.2 (9.2)	3.5 (7.8)	
		12.7 (500)	26-32	260	5.1 (11.2)	4.5 (9.9)	
		15.2 (600)	27-33	270	6.2 (13.7)	5.3 (11.7)	
0.052 in. (1.3 mm), DC+ As-Welded with 75% Ar / 25% CO_2	25 (1)	3.8 (150)	20-25	150	2.0 (4.5)	1.8 (3.9)	85-88
		6.4 (250)	24-29	235	3.4 (7.5)	2.9 (6.5)	
		8.9 (350)	28-32	295	4.7 (10.5)	4.1 (9.1)	
		11.4 (450)	29-34	330	6.1 (13.5)	5.3 (11.7)	
1/16 in. (1.6 mm), DC+ As-Welded with 75% Ar / 25% CO_2	25 (1)	3.8 (150)	21-26	200	2.9 (6.3)	2.5 (5.5)	85-88
		5.1 (200)	22-27	245	3.8 (8.4)	2.9 (6.4)	
		6.4 (250)	24-29	285	4.8 (10.6)	4.1 (9.1)	
		7.6 (300)	26-31	325	5.8 (12.7)	4.9 (10.9)	
		8.9 (350)	28-33	340	6.7 (14.7)	5.8 (12.8)	

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] To estimate ESO, subtract 1/4 in. (6.0 mm) from CTWD.

Outershield® 71 Elite

Mild Steel, All Position • AWS E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8

Key Features

- Smooth arc transfer and low spatter
- Designed for welding with either 100% CO_2 or 75-82% Argon/balance CO_2 shielding gases
- Good bead appearance
- Fast freezing slag for out-of-position welding
- Meets AWS D1.8 seismic lot waiver requirements

Conformances

AWS A5.20/A5.20M:	E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8
ASME SFA-A5.20:	E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8
ABS:	3SA, 3YSA H10
DNV Grade:	III YMS H10
GL:	3YH10S
LR:	3YS H10
CWB/CSA W48-06:	E491T-9-H8, E491T-9M-H8

Typical Applications

- Shipbuilding, barges and offshore platforms
- Heavy equipment
- Structural fabrication
- General fabrication

Welding Positions

All

Shielding Gas

100% CO_2
75 - 82% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (6.8 kg) Plastic Spool 60 lb (27.2 kg) Master Carton	33 lb (15 kg) Steel Spool	60 lb (27.2 kg) Coil	600 lb (272 kg) Accu-Trak® Drum
0.045 (1.1)	ED029418	ED029201	ED029202	
0.052 (1.3)	ED029419	ED029204	ED029205	
1/16 (1.6)		ED029206	ED029207	ED029387

Outershield® 71 Elite

(AWS E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements					
AWS E71T-1C-H8, E71T-9C-H8	400 (58) min.	485-655 (70-95)	22 min.	27 (20) min.	–
AWS E71T-1M-H8, E71T-9M-H8				–	27 (20) min.
Typical Results[3]					
As-Welded with 100% CO_2	545-565 (79-82)	585-615 (85-90)	28	74-83 (55-61)	58-64 (43-47)
As-Welded with 75% Ar/25% CO_2	585-595 (85-87)	625-630 (91-92)	25-28	92-99 (68-73)	70-83 (52-61)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P
Requirements					
AWS E71T-1C-H8, E71T-9C-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.
AWS E71T-1M-H8, E71T-9M-H8					
Typical Results[3]					
As-Welded with 100% CO_2	0.01-0.04	1.41-1.50	0.44-0.60	≤0.01	≤0.01
As-Welded with 75% Ar/25% CO_2	0.02-0.04	1.55-1.65	0.56-0.75	≤0.01	≤0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas[4]	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar / 25% CO_2	19 (3/4)	4.5 (175)	21-24	130	1.7 (3.8)	1.5 (3.3)	87
		6.4 (250)	23-26	155	2.4 (5.4)	2.1 (4.7)	87
		7.6 (300)	24-27	180	2.9 (6.4)	2.5 (5.6)	87
		8.9 (350)	25-28	205	3.4 (7.6)	3.0 (6.6)	87
		10.2 (400)	26-29	230	4.0 (8.7)	3.5 (7.6)	87
		12.8 (500)	27-30	260	5.0 (10.9)	4.3 (9.5)	87
		15.3 (600)	28-31	290	6.0 (13.1)	5.2 (11.4)	87
0.052 in (1.3 mm), DC+ 75% Ar / 25% CO_2	19 (3/4)	3.8 (150)	21-24	150	2.1 (4.6)	1.8 (3.9)	86
		5.1 (200)	22-25	180	2.8 (6.1)	2.4 (5.2)	86
		6.4 (250)	23-26	210	3.4 (7.6)	3.0 (6.5)	86
		7.6 (300)	24-27	240	4.8 (10.6)	4.1 (9.1)	86
		10.2 (400)	26-28	315	6.2 (13.7)	5.4 (11.8)	86
		12.8 (500)	28-31	335	6.9 (15.2)	6.0 (13.1)	86
1/16 (1.6 mm), DC+ 75% Ar / 25% CO_2	19 (3/4)	3.2 (125)	21-24	190	2.4 (5.2)	2.0 (4.4)	85
		3.8 (150)	22-25	205	2.8 (6.2)	2.4 (5.3)	85
		5.1 (200)	22-26	240	3.8 (8.3)	3.2 (7.0)	85
		6.4 (250)	23-27	290	4.7 (10.3)	4.0 (8.8)	85
		7.6 (300)	24-28	325	5.6 (12.4)	4.8 (10.5)	85
		10.2 (400)	27-31	400	7.5 (16.5)	6.4 (14.0)	85

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]When welding under CO_2, increase voltage by 1 Volt. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

Outershield® 71 Supreme

Mild Steel, All Position • AWS E71T-1C-H4, E71T-9C-H4, E71T-1M-H4, E71T-9M-H4

Key Features

- Designed to be used with either 100% CO_2 or 75% Argon/25% CO_2 gas
- Smooth, consistent arc performance
- The finished weld exhibits an extremely smooth bead appearance, even on out-of-position welds
- Meets H4 diffusible hydrogen levels

Typical Applications

- Mining
- Offshore
- Bridge fabrication
- High strength fabrication
- Structural steel

Welding Positions

All

Conformances

AWS A5.20/A5.20M:	E71T-1C-H4, E71T-9C-H4 E71T-1M-H4, E71T-9M-H4
ASME SFA-A5.20:	E71T-1C-H4, E71T-9C-H4 E71T-1M-H4, E71T-9M-H4
CWB/CSA W48-06:	E491T-9-H4, E491T-9M-H4

Shielding Gas

75% Argon / 25% CO_2
100% CO_2
Flow Rate: 40 - 50 CFH

Note

- This product is only sold in Canada.
- This product contains micro-alloying elements. Additional information available upon request.

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool	500 lb (227 kg) Accu-Trak® Drum	600 lb (272 kg) Accu-Trak® Drum
0.045 (1.1)	ED503040	ED503046*	
0.052 (1.3)	ED503041	ED503047*	
1/16 (1.6)	ED503042		ED503048*

*Made to Order (MTO)

Outershield® 71 Supreme

(AWS E491T-9C-H4, E491T-9M-H4)

MECHANICAL PROPERTIES[1] – *As Required per CSA W48.06*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements				
CWB E491T-9-H4, E491T-9M-H4	400 (58) min.	490 (71) min.	22 min.	27 (20) min.
Test Results[3]				
100% CO_2	520-593 (75-86)	580-640 (84-93)	26-28	49-98 (36-72)
75%Ar/25% CO_2	560-646 (81-94)	510-699 (88-101)	25-28	102-126 (75-93)

DEPOSIT COMPOSITION[1] – *As Required per CSA W48.06*

	%C	%Mn	%Si	%S	%P	%Ni
Requirements						
CWB E491T-9-H4, E491T-9M-H4	0.18 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	0.50 max.
Test Results[3]						
100% CO_2	0.04-0.05	1.29-1.43	0.43-0.49	0.01	0.01	0.02-0.03
75%Ar/25% CO_2	0.03-0.05	1.45-1.64	0.54-0.68	0.01	0.01	0.02-0.03

	%Cr	%Mo	%V	%Cu	Diffusible Hydrogen (mL/100g weld deposit)
Requirements					
CWB E491T-9-H4, E491T-9M-H4	0.20 max.	0.30 max.	0.08 max.	0.35 max.	4.0 max.
Test Results[3]					
100% CO_2	0.04-0.05	0.02-0.03	0.03	0.04-0.10	3-4
75%Ar/25% CO_2	0.04-0.05	0.02	0.03-0.04	0.04-0.08	3-4

TYPICAL OPERATING PROCEDURES – *All Position*

Diameter Polarity Shielding Gas[4]	Wire Weight g/m (lbs/1000 in)	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%Ar/25% CO_2	6.4 (0.361)	25 (1)	4.4-12.7 (175-500)	22-28	125-260	2.0-5.2 (4.5-11.3)	1.8-4.6 (4.0-10.05)	86-88
0.052 in (1.3 mm), DC+ 75%Ar/25% CO_2	8.6 (0.482)	25 (1)	3.8-10.2 (150-400)	22-31	135-295	2.1-5.4 (4.6-12.0)	1.8-4.9 (4.0-10.07)	86-88
1/16 in (1.6 mm), DC+ 75%Ar/25% CO_2	12.1 (0.683)	25 (1)	3.8-8.9 (150-350)	23-31	135-365	2.9-6.7 (6.4-14.7)	2.5-5.9 (5.6-13.1)	86-88

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]When welding under CO_2, increase voltage by 1 Volt. [5]To estimate ESO, subtract 6.0 mm (1/4 in.) from CTWD.

Outershield® 71M

Mild Steel, All Position • AWS E71T-1C-J, E71T-9C-J, E71T-1M-J, E71T-9M-J

Key Features

- Dual classified for both 100% CO_2 and 75% Argon / 25% CO_2 mixed gas
- Charpy V-Notch impact toughness tested to -40°C (-40°F)
- High travel speeds
- Spray like transfer with minimal spatter
- Rod based manufacturing for industry leading wire stiffness and feedability
- Increased rigidity allows for easy manual break-off

Typical Applications

- Bridge, ship, & barge
- General fabrication
- Machinery fabrication
- Structural fabrication
- Offshore applications

Welding Positions

All, except vertical down

Conformances

AWS A5.20/A5.20M:	E71T-1C-J, E71T-9C-J E71T-1M-J, E71T-9M-J
ASME SFA-A5.20:	E71T-1C-J, E71T-9C-J E71T-1M-J, E71T-9M-J
ABS*:	3YSA H15
Lloyd's Register:	3YS H15
DNV Grade:	III YMS H10
BV Grade:	SA3YH (CO_2 only)
CWB/CSA W48-06:	E491T-9 , E491T-9M
EN ISO 17632-B:	T494T1-1MA-H15 T494T1-1CA-H15
MIL-E-24403/1:	MIL-71T-1C, MIL-71T-1M

*Only for 0.045, 0.052 and 1/16 in. diameters

Shielding Gas

100% CO_2
75% Argon / 25% CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Spool	25 lb (11.3 kg) Plastic Spool	33 lb (15 kg) Steel Spool	50 lb (22.7 kg) Coil
0.035 (0.9)	ED026804	ED026805		
0.045 (1.1)	ED020836	ED022659	ED030007	ED020844
0.052 (1.3)		ED022660	ED030008	ED020845
1/16 (1.6)		ED022661	ED030009	ED020846

Diameter in (mm)	300 lb (136 kg) Speed-Feed® Reel	500 lb (227 kg) Accu-Trak® Drum	600 lb (272 kg) Speed-Feed® Reel
0.035 (0.9)			
0.045 (1.1)		ED027364	
0.052 (1.3)		ED029778	
1/16 (1.6)	ED020848	ED029779	ED020851

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	@ -29°C (-20°F)	@ -40°C (-40°F)
Requirements						
AWS E71T-1C-J / E71T-1M-J	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	–	27 (20) min.[a]
AWS E71T-9C-J / E71T-9M-J				–	27 (20) min.	27 (20) min.[a]
Test Results[3]						
As-Welded with 100% CO_2 and 75% Argon/25% CO_2	500-570 (72-83)	560-630 (81-91)	27-29	176-190 (130-140)	176-190 (130-140)	130-163 (96-120)

[a]Electrodes with the optional supplemental designator "J" shall meet the minimum Charpy V-Notch impact energy requirement for its classification at a test temperature of 10°C lower than the test temperature for its classification.

Outershield® 71M

(AWS E71T-1C-J, E71T-9C-J, E71T-1M-J, E71T-9M-J)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P
Requirements AWS E71T-1C-J / E71T-1M-J AWSE71T-9C-J / E71T-9M-J	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.
Test Results[3] As-Welded with 100% CO_2 and 75% Argon/25% CO_2	0.05-0.07	1.04-1.60	0.25-0.50	≤ 0.01	< 0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas[4]	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.035 in (0.9 mm), DC+ 100% CO_2	19-25 (3/4-1)	5.1 (200)	20-23	95	1.3 (2.8)	1.1 (2.8)	85
		6.4 (250)	21-24	115	1.6 (3.5)	1.4 (3.5)	85
		7.6 (300)	22-25	130	1.9 (4.2)	1.6 (4.2)	86
		8.9 (350)	23-26	150	2.2 (4.9)	1.9 (4.9)	86
		10.2 (400)	24-27	160	2.6 (5.6)	2.2 (5.6)	86
		12.7 (500)	26-29	185	3.2 (7.0)	2.7 (7.0)	86
		15.2 (600)	28-31	200	3.8 (8.4)	3.3 (8.4)	86
		17.8 (700)	30-33	215	4.4 (9.8)	3.8 (9.8)	86
0.045 in (1.1 mm), DC+ 100% CO_2	19-25 (3/4-1)	5.1 (200)	23-26	165	2.1 (4.6)	1.8 (3.9)	83
		6.4 (250)	24-27	190	2.6 (5.8)	2.2 (4.8)	84
		7.6 (300)	25-28	220	3.1 (6.9)	2.6 (5.8)	84
		8.9 (350)	26-29	245	3.7 (8.1)	3.1 (6.8)	84
		10.2 (400)	26-29	265	4.2 (9.2)	3.5 (7.8)	84
		12.7 (500)	28-31	295	5.2 (11.5)	4.4 (9.7)	84
		15.2 (600)	30-33	315	6.3 (13.8)	5.3 (11.7)	85
		17.8 (700)	32-35	325	7.3 (16.1)	6.2 (13.7)	85
0.052 in (1.3 mm), DC+ 100% CO_2	19-25 (3/4-1)	3.8 (150)	22-25	150	2.1 (4.7)	1.7 (3.8)	81
		5.1 (200)	23-26	180	2.8 (6.2)	2.3 (5.1)	83
		6.4 (250)	24-27	210	3.5 (7.7)	2.9 (6.5)	83
		7.6 (300)	25-28	235	4.2 (9.3)	3.5 (7.8)	84
		8.9 (350)	27-30	265	4.9 (10.8)	4.2 (9.1)	84
		11.4 (450)	29-32	305	6.3 (13.9)	5.4 (11.8)	85
		12.7 (500)	30-33	325	7.0 (15.5)	6.0 (13.2)	85
		15.2 (600)	33-36	360	8.4 (18.6)	7.2 (15.8)	85
1/16 in (1.6 mm), DC+ 100% CO_2	19-25 (3/4-1)	3.2 (125)	23-26	205	2.5 (5.4)	2.0 (4.5)	82
		3.8 (150)	24-27	225	3.0 (6.5)	2.4 (5.4)	82
		5.1 (200)	25-28	260	4.0 (8.7)	3.3 (7.2)	83
		6.4 (250)	26-29	295	4.9 (10.9)	4.1 (9.1)	83
		7.6 (300)	28-31	330	5.9 (13.0)	5.0 (10.9)	84
		10.2 (400)	30-33	395	7.9 (17.4)	6.6 (14.6)	84
		12.7 (500)	33-36	445	9.9 (21.7)	8.3 (18.3)	84

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]When welding under mixed gas, decrease voltage. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements.

UltraCore® 70C

Mild Steel, Flat & Horizontal • AWS E70T-1C-H8, E70T-9C-H8

Key Features

- High deposition in the flat and horizontal positions
- Low fume generation rates
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance

Typical Applications

- Structural fabrication
- Heavy equipment
- Shipbuilding

Conformances

AWS A5.20/A5.20M:	E70T-1C-H8, E70T-9C, E70T-9C-H8
ASME SFA-A5.20:	E70T-1C-H8, E70T-9C, E70T-9C-H8
ABS:	2YSA H10
CWB/CSA W48-06:	E492T-9 H8
EN ISO 17632-B:	T493T1-0CA-H10
FEMA 353	
AWS D1.8	

Welding Positions

Flat & Horizontal

Shielding Gas

100% CO_2
Flow Rate: 40-55 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	500 lb (227 kg) Accu-Trak® Drum	500 lb (227 kg) Speed-Feed® Drum
1/16 (1.6)	ED032978	ED033064	
5/64 (2.0)	ED032977		ED033065
3/32 (2.4)	ED032941		ED033066

UltraCore® 70C

(AWS E70T-1C-H8, E70T-9C-H8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4] AWS E70T-1C-H8 & E70T-9C-H8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	485-520 (70-75)	555-590 (81-86)	28-30	47-72 (35-53)	28-47 (21-35)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E70T-1C-H8 & E70T-9C-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8.0 max.
Typical Results[3] As-Welded with 100% CO_2	0.04-0.05	1.46-1.59	0.54-0.59	≤ 0.01	≤ 0.01	5-8

TYPICAL OPERATING PROCEDURES – *Flat & Horizontal*

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.2 (125) 5.1 (200) 6.4 (250) 7.6 (300) 9.5 (375)	23-27 24-28 25-30 27-31 28-32	170 225 260 280 320	2.4 (5.3) 3.8 (8.4) 4.8 (10.5) 5.7 (12.6) 7.1 (15.7)	2.1 (4.7) 3.2 (7.1) 4.1 (9.0) 4.9 (10.8) 6.1 (13.5)	84 - 89
5/64 in (2.0 mm), DC+ 100% CO_2	25 (1)	3.2 (125) 4.4 (175) 5.7 (225) 6.4 (250) 7.6 (300) 8.3 (325)	23-27 24-29 25-30 26-32 27-33 29-34	230 305 365 385 420 450	3.8 (8.4) 5.4 (11.8) 6.8 (15.0) 7.7 (16.9) 9.0 (19.8) 9.9 (21.7)	3.2 (7.1) 4.6 (10.1) 5.9 (13.0) 6.5 (14.3) 7.8 (17.2) 8.7 (19.0)	84 - 88
3/32 in (2.4 mm), DC+ 100% CO_2	25 (1)	3.2 (125) 5.1 (200)	26-33 27-34	350 500	5.4 (11.9) 8.6 (19.0)	4.7 (10.3) 7.6 (16.7)	87 - 89
	31 (1 1/4)	6.4 (250) 7.6 (300) 8.3 (325)	29-35 31-37 32-38	570 630 720	10.6 (23.3) 13.1 (28.8) 14.3 (31.5)	9.4 (20.8) 11.4 (25.1) 12.4 (27.2)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 75C

Mild Steel, Flat & Horizontal • AWS E70T-5C-JH4

Key Features

- High deposition in the flat and horizontal positions
- H4 diffusible hydrogen levels
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance

Typical Applications

- Highly restrained joints
- Heaving equipment
- Mining
- Hard to weld base metals
- Thick steel sections in structural fabrication

Welding Positions

Flat & Horizontal

Conformances

AWS A5.20/A5.20M:	E70T-5C-JH4
ASME SFA-A5.20:	E70T-5C-JH4
CWB/CSA W48-06:	E492T-5J H4
EN ISO 17632-B:	T494T5-0CA-H5

Shielding Gas

100% CO_2
Flow Rate: 40-55 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil
1/16 (1.6)	ED032974
5/64 (2.0)	ED032975
3/32 (2.4)	ED032940

UltraCore® 75C

(AWS E70T-5C-JH4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements[4] - AWS E70T-5C-JH4	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	465-510 (68-74)	545-580 (79-84)	29-32	91-142 (67-105)	53-113 (39-83)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] - AWS E70T-5C-JH4	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	4.0 max.
Typical Results[3] - As-Welded with 100% CO_2	0.06-0.08	1.51-1.66	0.44-0.53	0.01	0.01	2-4

TYPICAL OPERATING PROCEDURES – Flat & Horizontal

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1/16 in (1.6 mm), DC+ 100% CO_2	19-25 (3/4-1)	5.1 (200)	29-34	230	4.0 (8.7)	3.1 (6.9)	76-86
		6.4 (250)	31-36	270	5.0 (11.0)	3.8 (8.5)	
		7.6 (300)	32-37	295	5.9 (13.1)	4.5 (10.0)	
		8.9 (350)	33-38	335	6.9 (15.2)	5.5 (12.1)	
		10.2 (400)	33-38	360	7.9 (17.4)	6.3 (13.9)	
		12.7 (500)	35-40	415	9.9 (21.8)	7.9 (17.5)	
5/64 in (2.0 mm), DC+ 100% CO_2	25-32 (1-1 1/4)	5.1 (200)	29-34	295	5.7 (12.7)	4.8 (10.5)	82-86
		6.4 (250)	30-35	345	7.2 (15.9)	6.0 (13.2)	
		7.6 (300)	32-37	390	8.6 (19.0)	7.1 (15.6)	
		8.9 (350)	33-38	425	10.1 (22.3)	8.5 (18.7)	
		10.2 (400)	34-39	465	11.5 (25.3)	9.9 (21.8)	
3/32 in (2.4 mm), DC+ 100% CO_2	32 (1-3/8)	3.2 (125)	23-28	335	5.5 (12.2)	4.8 (10.7)	87-90
		5.1 (200)	27-32	445	8.8 (19.3)	7.6 (16.7)	
		6.4 (250)	29-34	500	10.9 (24.1)	9.6 (21.3)	
		7.6 (300)	31-36	590	13.2 (29.2)	11.8 (26.0)	
		8.3 (325)	32-37	605	14.2 (31.4)	12.8 (28.3)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

Outershield® 70

Mild Steel, Flat & Horizontal • AWS E70T-1C-H16, E70T-9C-H16

Key Features

- High deposition in the flat and horizontal positions
- Designed for welding with 100% CO_2 shielding gas
- Excellent bead wetting and low spatter
- Tolerates mild levels of surface contaminants
- Stiff wire for easy breaking

Conformances

AWS A5.20/A5.20M:	E70T-1C-H16, E70T-9C-H16
ASME SFA-A5.20:	E70T-1C-H16, E70T-9C-H16
ABS:	2YSA
DNV Grade:	II YMS H15
CWB/CSA W48-06:	E492T-9 H16
TUV:	EN 758 T 46 0 R C3 / M3 H10
MIL-E-24403/1:	MIL-70T-1C

Typical Applications

- Structural fabrication
- Barge fabrication
- Heavy fabrication
- Construction equipment

Welding Positions

Flat & Horizontal

Shielding Gas

100% CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Reel	600 lb (272 kg) Speed-Feed® Drum
1/16 (1.6)	ED012782	ED014588	
5/64 (2.0)	ED012785		
3/32 (2.4)	ED012784	ED014120	ED030262

Outershield® 70

(AWS E70T-1C-H16, E70T-9C-H16)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements AWS E70T-1C-H16	400 (58) min.	485-655 (70-95)	22 min.	27 (20) min.	–
AWS E70T-9C-H16				–	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	525-575 (76-83)	620-635 (90-92)	27-28	39-42 (29-31)	31-34 (21-25)
Stress Relieved with 100% CO_2 for 1 hr @ 621°C (1150°F)	525 (76)	555 (80)	27-28	27 (20)	24 (18)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P
Requirements - AWS E70T-1C, E70T-9C	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.
Typical Results[3] As-Welded with 100% CO_2	0.08	1.41-1.43	0.64-0.73	0.01	0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.2 (125)	23-25	170	2.4 (5.3)	2.1 (4.6)	87
		5.1 (200)	25-27	235	3.8 (8.5)	3.4 (7.6)	87
		6.4 (250)	25-28	275	4.8 (10.6)	4.2 (9.2)	87
		7.6 (300)	27-29	310	5.8 (2.7)	5.0 (11.1)	87
		9.5 (375)	29-31	365	7.2 (15.9)	6.4 (14.0)	88
5/64 in (2.0 mm), DC+ 100% CO_2	28 (1-1/8)	3.2 (125)	23-26	250	3.8 (8.4)	3.2 (7.0)	83
		4.4 (175)	26-28	350	5.4 (11.8)	4.5 (10.0)	85
		5.7 (225)	27-29	375	6.9 (15.2)	5.9 (13.0)	86
		6.4 (250)	29-31	400	7.7 (16.9)	6.5 (14.4)	86
		7.6 (300)	30-32	450	9.2 (20.2)	7.9 (17.4)	86
		8.3 (325)	31-33	470	9.9 (21.9)	8.5 (18.8)	86
3/32 in (2.4 mm), DC+ 100% CO_2	32 (1-1/4)	3.2 (125)	24-27	335	5.3 (11.7)	4.4 (9.8)	84
		5.1 (200)	28-31	455	8.5 (18.6)	7.3 (16.0)	86
		6.4 (250)	30-32	530	10.6 (23.3)	9.2 (20.2)	87
		7.6 (300)	31-34	590	12.7 (28.0)	11.0 (24.3)	87
		8.3 (325)	33-35	615	13.7 (30.3)	12.0 (26.4)	87

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

Outershield® XLH-70

Mild Steel, Flat & Horizontal • AWS E70T-1C-H8, E70T-9C-H8

Key Features

- Meets AWS D1.8 seismic lot waiver requirements for demand critical welds.
- H8 diffusible hydrogen levels - controlled for high resistance to hydrogen induced cracking.
- High deposition rates and excellent fast follow characteristics.
- Stiff wire enables feeding over long distances.
- Tolerates mild levels of surface contaminants.
- Designed for welding with CO_2 shielding gas.

Conformances

AWS A5.20/A5.20M:	E70T-1C-H8, E70T-9C-H8
ASME SFA-5.20:	E70T-1C-H8, E70T-9C-H8
ABS:	3YSA-H5
FEMA 353	
AWS D1.8	

Welding Positions

Flat & Horizontal

Typical Applications

- Structural fabrication
- General fabrication
- Machinery fabrication
- Heavy equipment
- Seismic applications

Shielding Gas

100% CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	500 lb (227 kg) Speed-Feed® Drum
3/32 (2.4)	ED030236	ED030360

NOTE: Speed-Feed® drums require rotation for proper payoff.

Outershield® XLH-70

(AWS E70T-1C, E70T-9C)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements AWS E70T-1C-H8	400 (58) min.	480-660 (70-95)	22 min.	27 (20) min.	–
AWS E70T-9C-H8				–	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	480-530 (70-77)	570-620 (82-89)	27-30	61-134 (45-99)	42-107 (31-79)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si
Requirements - AWS E70T-1C-H8, E70T-9C-H8	0.12 max.	1.75 max.	0.90 max.
Test Results[3] As-Welded with 100% CO_2	0.06-0.07	1.40-1.60	0.48-0.58

	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E70T-1C-H8, E70T-9C-H8	0.03 max.	0.03 max.	8.0 max.
Test Results[3] As-Welded with 100% CO_2	≤0.01	≤0.01	3-6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	Wire Feed Speed (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	Melt-Off Rate (lb/hr)	Deposition Rate kg/hr	Deposition Rate (lb/hr)	Efficiency (%)
3/32 in. (2.4 mm), DC+ 100% CO_2	32 (1-1/4)	3.8	(150)	23-26	345	6.5	(14.4)	5.6	(12.4)	86
		5.1	(200)	27-30	445	8.7	(19.2)	7.6	(16.8)	87
		6.4	(250)	28-31	510	10.9	(24.0)	9.5	(21.0)	87
		7.6	(300)	30-32	570	13.1	(28.8)	11.4	(25.2)	87
		8.3	(325)	31-33	600	14.2	(31.2)	12.4	(27.3)	87

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 81Ni1A75-H

Low Alloy, All Position • AWS E81T1-Ni1M-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 88 - 123 J (65 - 91 ft•lbf) at -40°C (-40°F)
- Designed for welding with 75-85% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance
- Meets AWS D1.8 seismic lot waiver requirements
- ProTech® foil bag packaging
- Color match on weathering steel

Typical Applications

- Bridge fabrication
- Weathering steels
- Offshore
- Structural fabrication
- NACE applications

Conformances

AWS A5.29/A5.29M:	E81T1-Ni1M-JH4
ASME SFA-A5.29:	E81T1-Ni1M-JH4
ABS:	4YQ460SA H5
Lloyd's Register:	4Y46S H5
DNV Grade:	IV 46MS H5
CWB/CSA W48-06:	E551T1-Ni1M-JH4 (E81T1-Ni1M-JH4)
EN ISO 17632-B:	T554T1-1MA-N2-H5
FEMA 353	
AWS D1.8	

Welding Positions

All

Shielding Gas

75% - 85% Argon / Balance CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032206
0.052 (1.3)	ED032279
1/16 (1.6)	ED032207

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements[4] - AWS E81T1-Ni1M-JH4	470 (68) min.	550-690 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	545-595 (79-86)	595-640 (86-93)	24-28	107-142 (79-105)	88-123 (65-91)

UltraCore® 81Ni1A75-H

(AWS E81T1-Ni1M-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements[4] - AWS E81T1-Ni1M-JH4	0.12 max.	1.50 max.	0.80 max.	0.030 max.	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.04-0.05	1.26-1.36	0.25-0.29	0.006-0.009	0.005-0.008
	%Ni	**%Mo**	**%Cr**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements[4] - AWS E81T1-Ni1M-JH4	0.80-1.10	0.35 max.	0.15 max.	0.05 max.	4.0 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.86-0.96	0.01	0.04-0.05	0.02-0.03	2-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	(in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	(lb/hr)	Deposition Rate kg/hr	(lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	4.4	(175)	22-27	140	1.8	(4.0)	1.6	(3.5)	86-88
		5.1	(200)	23-28	150	2.1	(4.6)	1.8	(4.0)	
		6.4	(250)	24-29	165	2.6	(5.7)	2.3	(5.0)	
		7.6	(300)	24-29	190	3.1	(6.8)	2.7	(6.0)	
		8.9	(350)	25-30	205	3.6	(8.0)	3.2	(7.0)	
		9.5	(375)	25-30	225	3.9	(8.6)	3.4	(7.5)	
		10.8	(425)	26-31	245	4.4	(9.7)	3.8	(8.5)	
		12.1	(475)	27-32	265	4.9	(10.8)	4.3	(9.5)	
		12.7	(500)	28-33	275	5.2	(11.4)	4.5	(10.0)	
0.052 in (1.3 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8	(150)	22-27	150	2.0	(4.5)	1.8	(3.9)	86-88
		4.7	(185)	23-28	165	2.5	(5.5)	2.2	(4.8)	
		5.7	(225)	23-28	190	3.1	(6.7)	2.7	(5.9)	
		6.4	(250)	24-29	215	3.4	(7.5)	2.9	(6.5)	
		7.0	(275)	24-29	235	3.7	(8.2)	3.2	(7.2)	
		7.6	(300)	25-30	265	4.1	(9.0)	3.5	(7.8)	
		8.5	(335)	25-31	275	4.5	(10.0)	4.0	(8.7)	
		9.5	(375)	26-32	295	5.1	(11.2)	4.4	(9.8)	
		10.2	(400)	26-33	310	5.4	(12.0)	4.7	(10.4)	
1/16 in (1.6 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8	(150)	22-27	200	2.9	(6.3)	2.5	(5.5)	86-88
		4.4	(175)	23-28	210	3.3	(7.4)	2.9	(6.4)	
		5.1	(200)	24-29	235	3.8	(8.4)	3.3	(7.3)	
		5.7	(225)	24-29	265	4.3	(9.5)	3.7	(8.2)	
		6.5	(250)	25-30	285	4.8	(10.5)	4.2	(9.2)	
		7.0	(275)	25-31	315	5.3	(11.6)	4.6	(10.1)	
		8.3	(325)	26-32	335	6.2	(13.7)	5.4	(11.9)	
		8.9	(350)	27-33	365	6.7	(14.7)	5.8	(12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 75% Argon / 25% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE 1 : FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com. NOTE 2: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® 81Ni1C-H

Low Alloy, All Position • AWS E81T1-Ni1C-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 84 - 130 J (62 - 96 ft•lbf) at -40°C (-40°F)
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance
- Meets AWS D1.8 seismic lot waiver requirements
- ProTech® foil bag packaging
- Color match on weathering steels

Typical Applications

- Bridge fabrication
- Weathering steels
- Offshore
- Structural fabrication
- NACE applications

Conformances

AWS A5.29/A5.29M:	E81T1-Ni1C-JH4
ASME SFA-A5.29:	E81T1-Ni1C-JH4
ABS:	4YQ460SA H5
Lloyd's Register:	4Y46S H5
DNV Grade:	IV Y46MS H5
CWB/CSA W48-06:	E551T1-Ni1C-JH4 (E81T1-Ni1C-JH4)
EN ISO 17632-B:	T554T1-1CA-N2-H5
FEMA 353	
AWS D1.8	

Welding Positions

All

Shielding Gas

100% CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032204
0.052 (1.3)	ED032280
1/16 (1.6)	ED032205

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements[4] - AWS E81T1-Ni1C-JH4	470 (68) min.	550-690 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	540-585 (78-84)	595-635 (86-91)	25-28	111-152 (82-112)	84-130 (62-96)

UltraCore® 81Ni1C-H

(AWS E81T1-Ni1C-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements[4] - AWS E81T1-Ni1C-JH4	0.12 max.	1.50 max.	0.80 max.	0.030 max.	0.030 max.
Typical Results[3] As-Welded with 100% CO_2	0.04-0.05	1.24-1.34	0.27-0.31	0.006-0.007	0.007-0.009
	%Ni	**%Mo**	**%Cr**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements[4] - AWS E81T1-Ni1C-JH4	0.80-1.10	0.35 max.	0.15 max.	0.05 max.	4.0max.
Typical Results[3] As-Welded with 100% CO_2	0.88-0.99	0.01	0.04-0.05	0.02-0.03	3-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	(in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	(lb/hr)	Deposition Rate kg/hr	(lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 100% CO_2	25 (1)	4.4	(175)	23-28	140	1.8	(4.0)	1.6	(3.5)	86-88
		5.1	(200)	24-29	150	2.1	(4.6)	1.8	(4.0)	
		6.4	(250)	25-30	165	2.6	(5.7)	2.3	(5.0)	
		7.6	(300)	25-30	190	3.1	(6.8)	2.7	(6.0)	
		8.9	(350)	26-31	205	3.6	(8.0)	3.2	(7.0)	
		9.5	(375)	26-31	225	3.9	(8.6)	3.4	(7.5)	
		10.8	(425)	27-32	245	4.4	(9.7)	3.8	(8.5)	
		12.1	(475)	28-33	265	4.9	(10.8)	4.3	(9.5)	
		12.7	(500)	29-34	275	5.2	(11.4)	4.5	(10.0)	
0.052 in (1.3 mm), DC+ 100% CO_2	25 (1)	3.8	(150)	23-28	150	2.0	(4.5)	1.8	(3.9)	86-88
		4.7	(185)	24-29	165	2.5	(5.5)	2.2	(4.8)	
		5.7	(225)	24-29	190	3.1	(6.7)	2.7	(5.9)	
		6.4	(250)	25-30	215	3.4	(7.5)	2.9	(6.5)	
		7.0	(275)	25-30	235	3.7	(8.2)	3.2	(7.2)	
		7.6	(300)	26-31	255	4.1	(9.0)	3.5	(7.8)	
		8.5	(335)	26-31	275	4.5	(10.0)	4.0	(8.7)	
		9.5	(375)	27-32	295	5.1	(11.2)	4.4	(9.8)	
		10.2	(400)	27-34	310	5.4	(12.0)	4.7	(10.4)	
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.8	(150)	24-29	200	2.9	(6.3)	2.5	(5.5)	86-88
		4.4	(175)	24-30	210	3.3	(7.4)	2.9	(6.4)	
		5.1	(200)	25-30	235	3.8	(8.4)	3.3	(7.3)	
		5.7	(225)	25-31	265	4.3	(9.5)	3.7	(8.2)	
		6.4	(250)	26-31	285	4.8	(10.5)	4.2	(9.2)	
		7.0	(275)	26-32	305	5.3	(11.6)	4.6	(10.1)	
		8.3	(325)	27-32	335	6.2	(13.7)	5.4	(11.9)	
		8.9	(350)	28-34	365	6.7	(14.7)	5.8	(12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE 1: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com. NOTE 2: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® 81Ni2A75-H

Low Alloy, All Position • AWS E81T1-Ni2M-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 41 - 89 J (30 - 66 ft•lbf) at -51°C (-60°F)
- Designed for welding with 75-85% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance
- H4 diffusible hydrogen levels
- ProTech® foil bag packaging

Typical Applications

- Mining
- Offshore
- Bridge fabrication
- High strength fabrication

Conformances

AWS A5.29/A5.29M:	E81T1-Ni2M-JH4
ASME SFA-A5.29:	E81T1-Ni2M-JH4
ABS:	3YSA H5
Lloyd's Register:	3YS H5
DNV Grade:	III Y40MS H5
CWB/CSA W48-06:	E551T1-Ni2M-JH4 (E81T1-Ni2M-JH4)
EN ISO 17632-B:	T556T1-1MA-N5-H5

Welding Positions

All

Shielding Gas

75% - 85% Argon / Balance CO_2
Flow Rate: 40-55 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032217
0.052 (1.3)	ED032277
1/16 (1.6)	ED032216

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)
Requirements[4] - AWS E81T-1Ni2M-JH4	470 (68) min.	550-670 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	555-580 (80-84)	615-635 (89-92)	25-28	69-115 (51-85)	41-89 (30-66)

UltraCore® 81Ni2A75-H

(AWS E81T1-Ni2M-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S
Requirements[4] - AWS E81T1-Ni2M-JH4	0.12 max.	1.50 max.	0.80 max.	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.04-0.05	0.93-1.05	0.25-0.28	0.005-0.006

	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] - AWS E81T1-Ni2M-JH4	0.030 max.	1.75-2.75	4.0 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.006-0.008	2.01-2.13	3-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	(in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	(lb/hr)	Deposition Rate kg/hr	(lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	4.4	(175)	21-26	140	1.8	(4.0)	1.6	(3.5)	86-88
		5.1	(200)	22-27	150	2.1	(4.6)	1.8	(4.0)	
		6.4	(250)	22-27	165	2.6	(5.7)	2.3	(5.0)	
		7.6	(300)	23-28	190	3.1	(6.8)	2.7	(6.0)	
		8.9	(350)	24-29	205	3.6	(8.0)	3.2	(7.0)	
		9.5	(375)	24-29	225	3.9	(8.6)	3.4	(7.5)	
		10.8	(425)	25-30	245	4.4	(9.7)	3.8	(8.5)	
		12.1	(475)	26-31	265	4.9	(10.8)	4.3	(9.5)	
		12.7	(500)	27-32	275	5.2	(11.4)	4.5	(10.0)	
0.052 in (1.3 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8	(150)	21-26	150	2.0	(4.5)	1.8	(3.9)	86-88
		4.7	(185)	22-27	165	2.5	(5.5)	2.2	(4.8)	
		5.7	(225)	22-27	190	3.1	(6.7)	2.7	(5.9)	
		6.4	(250)	23-28	215	3.4	(7.5)	2.9	(6.5)	
		7.0	(275)	23-28	235	3.7	(8.2)	3.2	(7.2)	
		7.6	(300)	24-29	255	4.1	(9.0)	3.5	(7.8)	
		8.5	(335)	24-30	275	4.5	(10.0)	4.0	(8.7)	
		9.5	(375)	25-31	295	5.1	(11.2)	4.4	(9.8)	
		10.2	(400)	25-32	310	5.4	(12.0)	4.7	(10.4)	
1/16 in (1.6 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8	(150)	21-27	200	2.9	(6.3)	2.5	(5.5)	86-88
		4.4	(175)	21-28	210	3.3	(7.4)	2.9	(6.4)	
		5.1	(200)	22-29	235	3.8	(8.4)	3.3	(7.3)	
		5.7	(225)	23-30	265	4.3	(9.5)	3.7	(8.2)	
		6.4	(250)	24-31	285	4.8	(10.5)	4.2	(9.2)	
		7.0	(275)	24-32	315	5.3	(11.6)	4.6	(10.1)	
		8.3	(325)	24-32	335	6.2	(13.7)	5.4	(11.9)	
		8.9	(350)	25-33	365	6.7	(14.7)	5.8	(12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 75% Argon / 25% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 81Ni2C-H

Low Alloy, All Position • AWS E81T1-Ni2C-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 54 - 84 J (40 - 62 ft•lbf) at -51°C (-60°F)
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance
- H4 diffusible hydrogen levels
- ProTech® foil bag packaging

Typical Applications

- Mining
- Offshore
- Bridge fabrication
- High strength fabrication

Conformances

AWS A5.29/A5.29M:	E81T1-Ni2C-JH4
ASME SFA-A5.29:	E81T1-Ni2C-JH4
ABS:	3YSA H5
Lloyd's Register:	3YS H5
DNV Grade:	III Y40MS H5
CWB/CSA W48-06:	E551T1-Ni2C-JH4 (E81T1-Ni2C-JH4)
EN ISO 17632-B:	T556T1-1CA-N5-H5

Welding Positions

All, except vertical down

Shielding Gas

100% CO_2
Flow Rate: 40-50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032215
0.052 (1.3)	ED032278
1/16 (1.6)	ED032214

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)
Requirements[4] - AWS E81T1-Ni2C-JH4	470 (68) min.	550-670 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	555-600 (80-86)	615-650 (89-94)	26-28	76-111 (56-82)	54-84 (40-62)

UltraCore® 81Ni2C-H

(AWS E81T1-Ni2C-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S
Requirements[4] - AWS E81T1-Ni2C-JH4	0.12 max.	1.50 max.	0.80 max.	0.030 max.
Typical Results[3] As-Welded with 100% CO_2	0.04-0.05	1.14-1.24	0.27-0.32	0.006-0.007

	%P	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] - AWS E81T1-Ni2C-JH4	0.030 max.	1.75-2.75	4.0 max.
Typical Results[3] As-Welded with 100% CO_2	0.006-0.007	1.86-2.19	2-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	(in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	(lb/hr)	Deposition Rate kg/hr	(lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 100% CO_2	25 (1)	4.4	(175)	23-28	140	1.8	(4.0)	1.6	(3.5)	86-88
		5.1	(200)	24-29	150	2.1	(4.6)	1.8	(4.0)	
		6.4	(250)	25-30	165	2.6	(5.7)	2.3	(5.0)	
		7.6	(300)	25-30	190	3.1	(6.8)	2.7	(6.0)	
		8.9	(350)	26-31	205	3.6	(8.0)	3.2	(7.0)	
		9.5	(375)	26-31	225	3.9	(8.6)	3.4	(7.5)	
		10.8	(425)	27-32	245	4.4	(9.7)	3.8	(8.5)	
		12.1	(475)	28-33	265	4.9	(10.8)	4.3	(9.5)	
		12.7	(500)	29-34	275	5.2	(11.4)	4.5	(10.0)	
0.052 in (1.3 mm), DC+ 100% CO_2	25 (1)	3.8	(150)	23-28	150	2.0	(4.5)	1.8	(3.9)	86-88
		4.7	(185)	24-29	165	2.5	(5.5)	2.2	(4.8)	
		5.7	(225)	24-29	190	3.1	(6.7)	2.7	(5.9)	
		6.4	(250)	25-30	215	3.4	(7.5)	2.9	(6.5)	
		7.0	(275)	25-30	235	3.7	(8.2)	3.2	(7.2)	
		7.6	(300)	26-31	255	4.1	(9.0)	3.5	(7.8)	
		8.5	(335)	26-31	275	4.5	(10.0)	4.0	(8.7)	
		9.5	(375)	27-32	295	5.1	(11.2)	4.4	(9.8)	
		10.2	(400)	27-34	310	5.4	(12.0)	4.7	(10.4)	
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.8	(150)	24-29	200	2.9	(6.3)	2.5	(5.5)	86-88
		4.4	(175)	24-30	210	3.3	(7.4)	2.9	(6.4)	
		5.1	(200)	25-30	235	3.8	(8.4)	3.3	(7.3)	
		5.7	(225)	25-31	265	4.3	(9.5)	3.7	(8.2)	
		6.4	(250)	26-31	305	4.8	(10.5)	4.2	(9.2)	
		7.0	(275)	26-32	305	5.3	(11.6)	4.6	(10.1)	
		8.3	(325)	27-32	335	6.2	(13.7)	5.4	(11.9)	
		8.9	(350)	28-34	365	6.7	(14.7)	5.8	(12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 81K2A75-H

Low Alloy, All Position • AWS E81T1-K2M-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 89 - 127 J (66 - 94 ft•lbf) at -40°C (-40°F)
- Designed for welding with 75-85% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance
- H4 diffusible hydrogen levels
- ProTech® foil bag packaging

Conformances

AWS A5.29/A5.29M:	E81T1-K2M-JH4
ASME SFA-A5.29:	E81T1-K2M-JH4
ABS:	4YQ460SA H5
Lloyd's Register:	4Y46S H5
DNV Grade:	IV 46MS H5
EN ISO 17632-B:	T554T1-1MA-N3-H5

Welding Positions

All, except vertical down

Typical Applications

- High strength steels with 550 MPa (80 ksi) tensile strength
- Offshore
- Shipbuilding

Shielding Gas

75% - 85% Argon / Balance CO_2
Flow Rate: 35 - 45 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032385
0.052 (1.3)	ED032386
1/16 (1.6)	ED032387

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements[4] - AWS E81T1-K2M-JH4	470 (68) min.	550-690 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 75% Argon/25% CO_2	535-550 (78-80)	585-605 (85-88)	26-27	117-155 (86-114)	89-127 (66-94)

UltraCore® 81K2A75-H
(AWS E81T1-K2M-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements[4] - AWS E81T1-K2M-JH4	0.15 max.	0.50-1.75	0.80 max.	0.030 max.	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.04-0.05	0.98-1.09	0.25-0.28	0.006-0.009	0.005-0.008
	%Ni	**%Cr**	**%Mo**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements[4] - AWS E81T1-K2M-JH4	1.00-2.00	0.15 max.	0.35 max.	0.05 max.	4 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	1.40-1.63	0.03-0.04	0.01-0.02	0.02-0.03	2-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	4.4 (175)	22-27	140	1.8 (4.0)	1.6 (3.5)	86-88
		5.1 (200)	23-28	150	2.1 (4.6)	1.8 (4.0)	
		6.4 (250)	24-29	165	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	24-29	190	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	25-30	205	3.6 (8.0)	3.2 (7.0)	
		9.5 (375)	25-30	225	3.9 (8.6)	3.4 (7.5)	
		10.8 (425)	26-31	245	4.4 (9.7)	3.8 (8.5)	
		12.1 (475)	27-32	265	4.9 (10.8)	4.3 (9.5)	
		12.7 (500)	28-33	275	5.2 (11.4)	4.5 (10.0)	
0.052 in (1.3 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8 (150)	22-27	150	2.0 (4.5)	1.8 (3.9)	86-88
		4.7 (185)	23-28	165	2.5 (5.5)	2.2 (4.8)	
		5.7 (225)	23-28	190	3.1 (6.7)	2.7 (5.9)	
		6.4 (250)	24-29	215	3.4 (7.5)	2.9 (6.5)	
		6.9 (275)	24-29	235	3.7 (8.2)	3.2 (7.2)	
		7.6 (300)	25-30	255	4.1 (9.0)	3.5 (7.8)	
		8.5 (335)	25-31	275	4.5 (10.0)	4.0 (8.7)	
		9.5 (375)	26-32	295	5.1 (11.2)	4.4 (9.8)	
		10.2 (400)	26-33	310	5.4 (12.0)	4.7 (10.4)	
1/16 in (1.6 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.8 (150)	22-27	200	2.9 (6.3)	2.5 (5.5)	86-88
		4.4 (175)	23-28	210	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	24-29	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	24-29	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	25-30	285	4.8 (10.5)	4.2 (9.2)	
		6.9 (275)	25-31	315	5.3 (11.6)	4.6 (10.1)	
		8.3 (325)	26-32	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	27-33	365	6.7 (14.7)	5.8 (12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 75% Argon/25% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

UltraCore® 81K2C-H

Low Alloy, All Position • AWS E81T1-K2C-JH4

Key Features

- Capable of producing weld deposits with impact toughness exceeding 111 - 141 J (82 - 104 ft•lbf) at -40°C (-40°F)
- Designed for welding with 100% CO_2 shielding gas
- Premium arc performance and bead appearance
- H4 diffusible hydrogen levels
- ProTech® foil bag packaging

Typical Applications

- High strength steels with 550 MPa (80 ksi) tensile strength
- Offshore
- Shipbuilding

Conformances

AWS A5.29/A5.29M:	E81T1-K2C-JH4
ASME SFA-A5.29:	E81T1-K2C-JH4
ABS:	4YQ460SA H5
Lloyd's Register:	4Y46S H5
DNV Grade:	IV 46MS H5
EN ISO 17632-B:	T554T1-1CA-N3-H5

Welding Positions

All

Shielding Gas

100% CO_2
Flow Rate: 35 - 45 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool*
0.045 (1.1)	ED032388
0.052 (1.3)	ED032389
1/16 (1.6)	ED032390

*Spool may be plastic or fiber.

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40° C (-40° F)
Requirements - AWS E81T1-K2C-JH4 As-Welded with 100% CO_2	470 (68) min.	550-690 (80-100)	19 min.	27 (20) min.	27 (20) min.
Typical Results[3] As-Welded with 100% CO_2	530-555 (77-80)	580-610 (84-88)	27-29	127-157 (94-116)	111-141 (82-104)

UltraCore® 81K2C-H

(AWS E81T1-K2C-JH4)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%S	%P
Requirements[4] - AWS E81T1-K2C-JH4	0.15 max.	0.50-1.75	0.80 max.	0.030 max.	0.030 max.
Typical Results[3] As-Welded with 100% CO_2	0.04	1.08-1.15	0.23-0.31	0.005-0.009	0.005-0.009
	%Ni	**%Cr**	**%Mo**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements[4] - AWS E81T1-K2C-JH4	1.00-2.00	0.15 max.	0.35 max.	0.05 max.	4.0 max.
Typical Results[3] As-Welded with 100% CO_2	1.30-1.62	0.03-0.05	0.01-0.02	0.01-0.02	2-3

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 100% CO_2	25 (1)	4.4 (175)	23-28	140	1.8 (4.0)	1.6 (3.5)	86-88
		5.1 (200)	24-29	150	2.1 (4.6)	1.8 (4.0)	
		6.4 (250)	25-30	165	2.6 (5.7)	2.3 (5.0)	
		7.6 (300)	25-30	190	3.1 (6.8)	2.7 (6.0)	
		8.9 (350)	26-31	205	3.6 (8.0)	3.2 (7.0)	
		9.5 (375)	26-31	225	3.9 (8.6)	3.4 (7.5)	
		10.8 (425)	27-32	245	4.4 (9.7)	3.8 (8.5)	
		12.1 (475)	28-33	265	4.9 (10.8)	4.3 (9.5)	
		12.7 (500)	29-34	275	5.2 (11.4)	4.5 (10.0)	
0.052 in (1.3 mm), DC+ 100% CO_2	25 (1)	3.8 (150)	23-28	150	2.0 (4.5)	1.8 (3.9)	86-88
		4.7 (185)	24-29	165	2.5 (5.5)	2.2 (4.8)	
		5.7 (225)	24-29	190	3.1 (6.7)	2.7 (5.9)	
		6.4 (250)	25-30	215	3.4 (7.5)	2.9 (6.5)	
		6.9 (275)	25-30	235	3.7 (8.2)	3.2 (7.2)	
		7.6 (300)	26-31	255	4.1 (9.0)	3.5 (7.8)	
		8.5 (335)	26-31	275	4.5 (10.0)	4.0 (8.7)	
		9.5 (375)	27-32	295	5.1 (11.2)	4.4 (9.8)	
		10.2 (400)	27-34	310	5.4 (12.0)	4.7 (10.4)	
1/16 in (1.6 mm), DC+ 100% CO_2	25 (1)	3.8 (150)	24-29	200	2.9 (6.3)	2.5 (5.5)	86-88
		4.4 (175)	24-30	210	3.3 (7.4)	2.9 (6.4)	
		5.1 (200)	25-30	235	3.8 (8.4)	3.3 (7.3)	
		5.7 (225)	25-31	265	4.3 (9.5)	3.7 (8.2)	
		6.4 (250)	26-31	285	4.8 (10.5)	4.2 (9.2)	
		6.9 (275)	26-32	305	5.3 (11.6)	4.6 (10.1)	
		8.3 (325)	27-32	335	6.2 (13.7)	5.4 (11.9)	
		8.9 (350)	28-34	365	6.7 (14.7)	5.8 (12.8)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 100% CO_2. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

Outershield® 91K2-H

Low Alloy, All Position • AWS E91T1-K2M-H8

Key Features

- Designed for welding with 75-95% Argon/ balance CO_2 shielding gas
- Capable of producing weld deposits with tensile strength exceeding 620 MPa (90 ksi)
- Use on high strength, low alloy steel applications
- H8 diffusible hydrogen levels

Conformances

AWS A5.29/A5.29M:	E91T1-K2M-H8
ASME SFA-A5.29:	E91T1-K2M-H8
ABS:	E91T1-K2M-H8

Welding Positions

All, except vertical down

Typical Applications

- For applications requiring high strength weld metal, such as HY-80, HSLA 80 and ASTM A710 steels

Shielding Gas

75 - 95% Argon / Balance CO_2
Flow Rate: 35 - 45 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED030975
0.052 (1.3)	ED030976
1/16 (1.6)	ED030977

Outershield® 91K2-H

(AWS E91T1-K2M-H8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -51° C (-60° F)
Requirements - AWS E91T1-K2M-H8	540 (78) min.	620-760 (90-110)	17 min.	27 (20) min.	–
				–	27 (20) min.
Typical Results[3]					
As-Welded with 75% Ar/25% CO_2	565-605 (82-88)	620-690 (90-100)	22-28	81-149 (60-110)	47-95 (35-70)
As-Welded with 95% Ar/5% CO_2	650 (94)	660 (96)	27	108 (80)	79 (58)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Ni	%Si	%Mo
Requirements - AWS E91T1-K2M-H8	0.15 max.	0.50-1.75	1.00-2.00	0.80 max.	0.35 max.
Typical Results[3]					
As-Welded with 75% Ar/25% CO_2	0.06	1.35	1.80	0.30	0.02
As-Welded with 95% Ar/5% CO_2	0.06	1.45	1.80	0.32	0.02

	%P	%S	%Cr	%V
Requirements - AWS E91T1-K2M-H8	0.030 max.	0.030 max.	0.15 max.	0.05 max.
Typical Results[3]				
As-Welded with 75% Ar/25% CO_2	0.005	0.010	0.03	<0.01
As-Welded with 95% Ar/5% CO_2	0.005	0.010	0.03	<0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.2 mm), DC+ 75-95% Ar/ balance CO_2	25 (1)	4.4 (175)	20-22	130	2.0 (4.3)	1.5 (3.4)	79
		7.0 (275)	23-25	180	3.0 (6.7)	2.4 (5.4)	81
		9.5 (375)	25-27	220	4.1 (9.1)	3.4 (7.4)	81
		12.7 (500)	27-29	265	5.2 (12.2)	4.3 (10.0)	82
		15.9 (625)	30-32	305	6.9 (15.2)	5.8 (12.7)	84
1/16 in (1.6 mm), DC+ 75-95% Ar/ balance CO_2	25 (1)	3.2 (125)	21-23	170	2.4 (5.3)	2.0 (4.3)	81
		5.1 (200)	22-24	235	3.8 (8.4)	3.2 (7.0)	83
		6.4 (250)	24-25	275	4.8 (10.5)	4.0 (8.8)	84
		7.6 (300)	25-27	310	5.7 (12.5)	4.8 (10.6)	85
		8.9 (350)	27-29	350	6.6 (14.6)	5.6 (12.4)	85
		10.2 (400)	28-30	385	7.6 (16.7)	6.5 (14.2)	85
		10.8 (425)	30-31	400	8.1 (17.8)	6.9 (15.2)	85

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.

Pipeliner® G90M

Low Alloy, All Position • AWS E111T1-K3M-JH8

Key Features

- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -29°C (-20°F)
- Q2 Lot® - Certificate showing actual deposit chemistry available online
- High stacking efficiency
- ProTech® hermetically sealed packaging

Typical Applications

- For applications requiring high strength weld metal

Welding Positions

All, except vertical down

Conformances

AWS A5.29/A5.29M:	E111T1-K3M-JH8
ASME SFA-A5.29	E111T1-K3M-JH8
ABS:	E111T1-K3MJ-H8

Shielding Gas

75 - 80% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter mm (in)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	33 lb (15 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1.2 (0.047)		ED031931
1.3 (0.052)	ED032664	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E111T1-K3M-JH8	675 (98) min.	760-860 (110-130)	15 min.	27 (20) min.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	760-825 (110-120)	795-860 (115-125)	19-22	56-85 (41-63)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E111T1-K3M-JH8	0.15 max.	0.75-2.25	0.80 max.	0.030 max.	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.05-0.07	1.45-1.70	0.21-0.28	0.01-0.02	0.01-0.02
	%Ni	**%Cr**	**%Mo**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements - AWS E111T1-K3M-JH8	1.25-2.60	0.15 max.	0.25-0.65	0.05 max.	8.0 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	1.80-2.22	0.03-0.06	0.50-0.61	0.02	2-5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.2 mm (0.045 in), DC+, 75-80% Ar/ balance CO_2	25 (1)	4.4-10.2 (175-400)	23-30	130-275	1.8-4.1 (3.9-9.0)
1.3 mm (0.052), DC+, 75-80% Ar/ balance CO_2	25 (1)	4.4-9.5 (175-375)	23-30	130-275	2.5-5.0 (5.5-11.0)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]For electrical stickout (ESO) subtract 6.4 mm (1/4 in) from contact tip to work distance (CTWD).
NOTE: This product contains micro-alloying elements. Additional information available upon request.

Cormet® 1

AWS E81T1-B2C/M-H4

Typical Applications

- Designed for prolonged elevated temperature service up to 550°C (1022°F).
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F).
- Petro-Chemical
- Power Plants
- Piping
- Turbine Casting
- Steam Chests
- Valve Bodies
- Boiler Superheaters

Key Features

- High metal recovery
- Smooth arc performance in all positions

Conformances

AWS A5.29	E81T1-B2C/M-H4
BS EN ISO 17634-B	T55T1-1C/M-1CM
ASME IX	QW432 F-No 6, QW442 A-No 3

Welding Positions

All

Shielding Gas

80% Argon / 20% CO_2
100% CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33 lb) Spool
1.2 (0.045)	ED033354

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.29*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Hardness HV10[4] AW PWHT
Requirements AWS E81T1-B2C/M-H4	470 min.	550 min.	19 min.	17 min.	–	–
Typical Performance Stress-Relieved 1-2 hr @ 690°C (1274°F)	550	650	24	22	>40	220

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.29*

	%C	%Mn	%Si	%S
Requirements AWS E81T1-B2C/M-H4	0.05 - 0.12	1.25 max.	0.80 max.	0.030 max.
Typical Results[3]	0.06	1.0	0.30	0.01
	%P	**%Cr**	**%Mo**	**%Cu**
Requirements AWS E81T1-B2C/M-H4	0.030 max.	1.00 - 1.50	0.40 - 0.65	0.30 max.
Typical Results[3]	0.01	1.3	0.55	0.05

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout mm (in)
1.2 (0.045) DC+	160 - 260A 24 - 30V	190A 25V	15 - 25 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry specific data, not required by AWS.
NOTE: Additional test data available upon request.

Cormet® 2

AWS E91T1-B3C/M-H4

Key Features

- High metal recovery
- Smooth arc performance in all positions

Conformances

AWS A5.29	E91T1-B3C/M-H4
BS EN ISO 17634-B	T62T1-1C/M-2C1M
ASME IX	QW432 F-No 6, QW442 A-No 4

Welding Positions

All

Shielding gas

80% Argon / 20% CO_2
100% CO_2

Typical Applications

- Designed for prolonged elevated temperature service up to 600°C (1112°F).
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F).
- Petro-Chemical
- Power Plants
- Piping
- Turbine Casting
- Steam Chests
- Valve Bodies
- Boiler Superheaters

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33 lb) Spool
1.2 (0.045)	ED033365

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.29*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Hardness HV10[4] @ PWHT
Requirements AWS E91T1-B3C/M-H4	540 min.	620 min.	17 min.	15 min.	–	–
Typical Performance As-Welded Stress-Relieved	625	725	22	20	>70	235

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.29*

	%C	%Mn	%Si	%S
Requirements AWS E91T1-B3C/M-H4	0.05 - 0.12	1.25 max.	0.80 max.	0.030 max.
Typical Results[3]	0.06	1.0	0.30	0.01
	%P	**%Cr**	**%Mo**	**%Cu**
Requirements AWS E91T1-B3C/M-H4	0.030 max.	2.00 - 2.50	0.90 - 1.20	0.30 max.
Typical Results[3]	0.01	2.3	1.0	0.05

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout in (mm)
1.2 (0.045) DC+	160 - 260A 24 - 30V	190A 25V	15 - 25 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry specific data, not required by AWS.
NOTE: Additional test data available upon request.

Supercore® F91

AWS E91T1-B9C/M-H4

Typical Applications

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

Welding Positions

All

Key Features

- High deposition rates
- Fast freezing slag for out of position welding

Conformances

AWS A5.28	E91T1-B9C/M-H4
BS EN ISO 17634-B	T69T1-1C/M-9C1MV

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33 lb) Spool
1.2 (0.045)	ED033387

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.28*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Hardness HV10[4] AW PWHT
Requirements AWS E91T1-B9C/M-H4	565 (82) min.	690 (100) min.	16 min.	14 min.	–	–
Typical Results						
2 hr @760°C (1400°F)	660 (96)	790 (115)	20	18	25 (18)	260
6 hr @ 760°C (1400°F)	630 (91)	760 (110)	–	–	–	–
Stress-Relieved						
+566°C (1050°F)	360 (52)	450 (65)	21	20	–	–
+600°C (1112°F)	288 (42)	420 (61)	27	25	–	–
+650°C (1202°F)	245 (36)	396 (57)	29	26	–	–

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.28*

	%C	%Mn	%Si	%S	%P	%Cr	%Ni
Requirements AWS E91T1-B9C/M-H4	0.08 - 0.13	0.60 - 1.20	0.50 max.	0.015 max.	0.020 max.	8.0 - 10.0	0.80 max.
Typical Results[3]	0.10	0.80	0.30	0.01	0.016	9.0	0.50
	%Mo	**%Nb**	**%V**	**%N**	**%Cu**	**%Al**	**%Ni+Mn**
Requirements AWS E91T1-B9C/M-H4	0.85 - 1.2	0.02 - 0.07	0.15 - 0.25	0.02 - 0.07	0.15 max.	0.40 max.	1.5 max.
Typical Results[3]	1.0	0.04	0.20	0.05	0.05	0.01	1.30

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout in (mm)
1.2 (0.045) DC+	140 - 170A 24 - 26V	160A, 25V	15 - 25 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18 [4]Industry specific data, not required by AWS.
NOTE: Additional test data available upon request.

Notes

SUBMERGED ARC

Flux

700 Series Active Flux

Lincolnweld® 760® 170
Lincolnweld® 761® 171
Lincolnweld® 780® 172
Lincolnweld® 781™ 173

800 Series Neutral Flux

Lincolnweld® 842-H™ 174
Lincolnweld® 860® 175
Lincolnweld® 865™ 176
Lincolnweld® 880™ 177
Lincolnweld® 880M® 178
Lincolnweld® 882™ 179
Lincolnweld® 888™ 180
Lincolnweld® 8500™ 181
Lincolnweld® MIL800-H™ 182
Lincolnweld® 812-SRC™ 183

Special Neutral Flux

Lincolnweld® 960® 184
Lincolnweld® 980™ 185
Lincolnweld® WTX™ 186

Flux for Seam Welding of Pipe

Lincolnweld® 761-Pipe™ 187
Lincolnweld® P223™ 188
Lincolnweld® SPX80™ 189
Lincolnweld® 995N™ 190

High Performance/Alloy Flux

Lincolnweld® A-XXX 10™ 191
Lincolnweld® MIL800-HPNi™ 192

Solid Wire

Mild Steel

Lincolnweld® L-50® 193
Lincolnweld® L-56® 193
Lincolnweld® L-60 194
Lincolnweld® L-61® 195
Lincolnweld® L-S3 196
Lincolnweld® LA-71 196

Low Alloy

Lincolnweld® L-70 197
Lincolnweld® LA-75 197
Lincolnweld® LA-81 198
Lincolnweld® LA-82 198
Lincolnweld® LA-84 199
Lincolnweld® LA-85 199
Lincolnweld® LA-90 200
Lincolnweld® LA-92 200
Lincolnweld® LA-93 201
Lincolnweld® LA-100 201

Cored Wire

Mild Steel

Lincolnweld® LC-72 202

Low Alloy

Lincolnweld® LAC-B2 202
Lincolnweld® LAC-Ni2 203
Lincolnweld® LAC-690 204

Lincolnweld® 760®

700 Series Active Flux • EN 760 – S A MS 1; EN 760 – S A CS 1

Key Features

- Highly active flux for handling rust and mill scale
- Helps resist porosity caused by arc blow
- Slow freezing slag for good weld appearance
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single pass welding of mild steel
- Flat fillet welds with constant voltage power source

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-60, and L-61®

Product Information

Basicity Index: 0.8
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag ED032799

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	% Metal Alloys
Lincolnweld® 760®	47	33	17	5	2	2	1	6 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	440 (64)	550 (80)	30	53 (39)	-18 (0)	F7A0-EM13K
L-60	As-welded	390 (57)	490 (71)	30	98 (72)	-29 (-20)	F6A2-EL12
L-61®	As-welded	410 (59)	530 (77)	28	69 (51)	-29 (-20)	F7A2-EM12K

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 761®

EN 760 – S A MS 1; EN 760 – S A CS 1 • 700 Series Active Flux

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-60, and L-61®
Low Alloy Steel
Lincolnweld® L-70

Product Information

Basicity Index: 0.8
Density: 1.2 g/cm³

Packaging

50 lb (22.7 kg) Plastic Bag ED032765

Key Features

- Manganese alloying and carbon reducing flux designed to provide superior crack resistance
- Slow freezing slag for a wide, flat weld
- Excellent resistance to cracking in single pass applications
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single pass welding of mild steel
- Large fillets with constant current power sources

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%TiO_2	%FeO	% Metal Alloys
Lincolnweld® 761®	45	19	22	5	2	2	2	1	6 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	480 (69)	590 (85)	29	45 (33)	-29 (-20)	F7A2-EM13K-H8
L-60	As-welded	440 (64)	530 (75)	29	64 (47)	-29 (-20)	F7A2-EL12
L-61®	As-welded	480 (70)	590 (85)	28	54 (40)	-29 (-20)	F7A2-EM12K-H8
L-70	As-welded	550 (80)	640 (93)	24	58 (43)	-18 (0)	F9A0-EA1-G

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 780®

700 Series Active Flux • EN 760 – S A AB 1; EN 760 – S A AR 1

Key Features

- Industry standard for submerged arc welding applications
- Fast freezing slag for easy removal and minimized spilling on circumferential welds
- When paired with Lincolnweld® L-61® it is recommended for up to three pass welding applications
- Excellent bead shape and slag removal
- Good resistance to moisture contamination for reduced porosity
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single pass welding of mild steel
- Roundabouts with minimal spillage
- Horizontal position welding

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-60 and L-61®

Product Information

Basicity Index: 0.7
Density: 1.4 g/cm^3

Packaging

50 lb (22.7 kg) Bag	ED019586
550 lb (249.5 kg) Steel Drum	ED032007
3000 lb (1361 kg) Bulk Bag	ED033188

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%TiO_2	% Metal Alloys
Lincolnweld® 780®	9	16	2	11	2	45	1	9	6 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	520 (75)	600 (87)	27	65 (48)	-18 (0)	F7A0-EM13K
L-60	As-welded	440 (64)	520 (76)	30	88 (65)	-18 (0)	F7A0-EL12-H8
L-61®	As-welded	530 (77)	600 (87)	27	46 (34)	-29 (-20)	F7A2-EM12K-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 781™

EN 760 – S A ZS 1 • 700 Series Active Flux

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-60, and L-61®
Low Alloy Steel
Lincolnweld® L-70

Product Information

Basicity Index: 0.8
Density: 1.5 g/cm^3

Packaging

50 lb (22.7 kg) Bag ED019587

Key Features

- Features fast follow characteristics that allow for uniform welds at high speeds without undercut or voids
- Recommended for high speed, limited pass welding on clean plate and sheet steel
- Good wetting action
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single pass welding – on clean plate and sheet metal up to 48 mm (3/16 in) in thickness
- Hot water tanks, metal buildings and other applications requiring high speed welds

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%ZrO_2	%TiO_2	%CaO	% Metal Alloys
Lincolnweld® 781®	21	17	14	5	2	4	21	12	1	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	@ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	530 (77)	610 (89)	29	38 (28)	-18 (0)	F7A0-EM13K
L-60	As-welded	460 (67)	550 (80)	29	42 (31)	-18 (0)	F7A0-EL12
L-61®	As-welded	530 (77)	610 (89)	28	31 (23)	-18 (0)	F7A0-EM12K
L-70	As-welded	590 (85)	660 (96)	25	35 (26)	-18 (0)	F9A0-EA1-G

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 842-H™

800 Series Neutral Flux • EN ISO 14174 S A FB 1 55 AC H4

Key Features

- Less than 3 mL/100g of deposited weld metal in DC+ or AC polarity
- Excellent resistance to moisture pick-up.
- Consistent and low temperature impact and CTOD toughness
- Capable of welding on multiple arcs
- Excellent slag detachment and bead profiles
- Superior flux particle strength for use in central recovery system
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Semi-submersible production and exploration platforms
- Fixed, jacket and work platforms
- Compliant towers
- Topside structural applications
- SPAR, FPSO, and FSO applications
- Jack up rigs

Recommended Wires

Mild Steel Electrode
Lincolnweld® L-S3
Low Alloy Electrodes
Lincolnweld® LA-85, LA-84, LAC-690

Product Information

Basicity Index: 2.3
Density: 1.1 g/cm^3

Packaging

50 lb (22.7 kg) Hermetically Sealed Pail ED034371

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	% Metal Alloys
Lincolnweld® 842-H™	15	2	32	21	2	21	4	1 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa	(ksi)	Tensile Strength MPa	(ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	@ °C (°F)	AWS Classification (A5.17/A5.23)
L-61	As-Welded	440	(64)	520	(76)	33	318 (234)	-51 (-60)	F7A6-EM12K-H4
	Stress Relieved[3]	370	(53)	480	(70)	38	335 (247)	-62 (-80)	F6P8-EM12K-H4
L-S3	As-Welded	490	(72)	580	(84)	30	187 (138)	-62 (-80)	F7A8-EH12K-H4
	Stress Relieved[3]	420	(61)	550	(79)	32	161 (119)	-62 (-80)	F7P8-EH12K-H4
LA-85	As-Welded	540	(78)	610	(89)	28	171 (126)	-62 (-80)	F8A8-ENi5-Ni5-H4
	Stress Relieved[3]	510	(74)	600	(87)	30	149 (110)	-62 (-80)	F8P8-ENi5-Ni5-H4
LA-84	As-Welded	640	(93)	720	(104)	25	140 (103)	-62 (-80)	F9A8-EF3-F3-H4
	Stress Relieved[3]	610	(89)	700	(101)	28	83 (61)	-62 (-80)	F9P8-EF3-F3-H4
LAC-690	As-Welded	700	(102)	790	(115)	23	129 (95)	-73 (-100)	F11A10-ECF5-F5-H4

[1] See test results disclaimer on pg. 18. [2] Measured with 0.2% offset. [3] Stress-relieved for 1 hour at 621°C (1150°F)
NOTE: For the most up-to-date AWS certificates of conformance please visit www.lincolnelectric.com

Lincolnweld® 860®

800 Series Neutral Flux • EN 760 – S A AB 1

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-56®, L-60, L-61®, LA-71, L-S3

Low Alloy Steel
Lincolnweld® L-70, LA-75, LA-82, LA-85

Product Information

Basicity Index: 1.1
Density: 1.4 g/cm³

Packaging

50 lb (22.7 kg) Bag ED019589

Key Features

- Industry standard for submerged arc welding applications
- Excellent operating characteristics in a variety of general welding applications
- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F) with Lincolnweld® L-61®
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- AASHTO Fracture Critical applications with Lincolnweld® L-61® wire
- Pipe and other double ending applications
- General purpose structural and multiple pass welds
- Storage tanks using L-61® or LA-85

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%TiO_2	% Metal Alloys
Lincolnweld® 860®	19	11	17	12	2	32	2	2	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	@ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	430 (62)	520 (75)	30	84 (62)	-29 (-20)	F7A2-EM13K-H8
L-56®	As-welded	470 (68)	590 (86)	28	61 (45)	-29 (-20)	F7A2-EH11K
L-56®	Stress-relieved[3]	440 (64)	570 (82)	29	80 (59)	-29 (-20)	F7P2-EH11K
L-60	As-welded	370 (54)	450 (65)	34	138 (102)	-29 (-20)	F6A2-EL12-H8
L-61®	As-welded	410 (59)	500 (72)	31	58 (43)	-40 (-40)	F7A4-EM12K-H8
L-61®	Stress-relieved[3]	340 (49)	440 (64)	37	222 (164)	-46 (-50)	F6P5-EM12K-H8
L-S3	As-welded	500 (73)	590 (86)	28	52 (38)	-29 (-20)	F7A2-EH12K
LA-71	As-welded	450 (65)	540 (78)	30	110 (81)	-29 (-20)	F7A2-EM14K-H8
LA-71	Stress relieved[3]	400 (58)	520 (75)	32	119 (88)	-29 (-20)	F7P2-EM14K-H8
L-70	As-welded	450 (65)	550 (80)	28	54 (40)	-29 (-20)	F7A2-EA1-A2-H8
L-70	Stress-relieved[3]	430 (62)	520 (76)	31	47 (35)	-29 (-20)	F7P2-EA1-A2-H8
LA-75	As-welded	460 (66)	550 (80)	32	107 (79)	-29 (-20)	F7A2-ENi1K-Ni1-H8
LA-75	Stress-relieved[3]	410 (60)	540 (79)	30	99 (73)	-29 (-20)	F7P2-ENi1K-Ni1-H8
LA-82	As-welded	660 (96)	740 (107)	24	50 (37)	-40 (-40)	F9A4-EF2-F2-H8
LA-85	As-welded	520 (75)	600 (87)	26	38 (28)	-40 (-40)	E8A4-ENi5-Ni5-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 865™

EN 760 – S A AB 1; EN 760 – S A AR 1 • 800 Series Neutral Flux

Key Features

- General purpose flux designed to weld butt joints and flat and horizontal fillets
- When used with Lincolnweld® L-50® or L-61®, it is capable of producing 480 MPa (70 ksi) tensile strength after stress relief
- Small loss of strength when used in the stress-relieved condition
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Butt joints and flat and horizontal fillets
- Pair with Lincolnweld® L-61® on A516 steels

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-61®, LA-71

Low Alloy Steel
Lincolnweld® LA-75

Product Information

Basicity Index: 1.0
Density: 1.3 g/cm^3

Packaging

50 lb (22.7 kg) Bag EDS27857

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%TiO_2	% Metal Alloys
Lincolnweld® 865™	11	1	14	19	2	37	12	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile trength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	500 (72)	580 (84)	27	53 (39)	-29 (-20)	F7A2-EM13K-H8
L-50®	Stress-relieved[3]	440 (64)	550 (80)	30	28 (21)	-46 (-50)	F7P5-EM13K-H8
L-61®	As-welded	480 (70)	570 (83)	22	85 (63)	-29 (-20)	F7A2-EM12K-H8
L-61®	Stress-relieved[3]	450 (65)	550 (80)	30	117 (86)	-29 (-20)	F7P2-EM12K-H8
LA-71	As-welded	540 (78)	630 (91)	26	73 (54)	-29 (-20)	F7A2-EM14K-H8
LA-75	As-welded	520 (76)	600 (87)	23	77 (57)	-29 (-20)	F8A2-ENi1K-G-H8
LA-75	Stress-relieved[3]	500 (73)	610 (88)	27	79 (58)	-29 (-20)	F8P2-ENi1K-G-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 880™

800 Series Neutral Flux • EN 760 – S A AS 1; EN 760 – S A FB 1

Recommended Wires

Low Alloy Steel
Lincolnweld® LA-75, LA-90, LA-100, LAC-B2, LAC-M2, LAC-Ni2

Product Information

Basicity Index: 2.0
Density: 1.4 g/cm^3

Packaging

50 lb (22.7 kg) Bag	ED027866
550 lb (249.5 kg) Steel Drum	ED028322

Key Features

- Can be used for both joining and hardfacing welding
- Optimal bead appearance when used with solid low alloy steel electrodes with a minimum of 0.20% silicon
- Use with both solid and flux cored wires
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Applications requiring smooth bead appearance
- Hardfacing applications

FLUX COMPOSITION[1]

	%SiO_2	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%ZrO_2	% Metal Alloys
Lincolnweld® 880™	17	27	27	2	16	2	7	5 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	@ °C (°F)	AWS Classification (A5.17/A5.23)
LA-75	As-welded	430 (62)	530 (77)	30	98 (72)	-62 (-80)	F7A8-ENi1K-Ni1-H8
LA-90	As-welded	540 (79)	640 (93)	28	61 (45)	-40 (-40)	F8A4-EA2K-A4-H8
LA-100	As-welded	630 (92)	700 (101)	28	53 (39)	-40 (-40)	F9A4-EM2-M2-H8
LAC-B2	Stress relieved[4]	480 (70)	590 (85)	26	135 (100)	-29 (-20)	F8P2-ECB2-B2-H8
LAC-M2	As-welded	730 (106)	820 (119)	18	72 (53)	-51 (-60)	F11A6-ECM2-M2-H8
LAC-Ni2	As-welded	460 (66)	540 (79)	29	140 (103)	-51 (-60)	F7A6-ECNi2-Ni2-H8
LAC-Ni2	Stress relieved[3]	430 (63)	540 (78)	30	95 (70)	-73 (-100)	F7P10-ECNi2-Ni2-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 880M®

EN 760 – S A FB 1 • 800 Series Neutral Flux

Key Features

- A basic flux which features industry proven results in multiple pass applications
- Recommended for welding with solid mild steel and low alloy electrodes, as well as Lincoln's LAC series of low alloy flux-cored electrodes
- Good deep groove slag removal
- Excellent choice for single arc AC submerged arc welding
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Packaging

50 lb (22.7 kg) Plastic Bag ED031853

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-56®, LA-71, L-S3

Low Alloy Steel
Lincolnweld® LA-75, LA-85, LA-90, LA-92, LA-93, LA-100, LAC-B2, LAC-M2, LAC-Ni2

Product Information

Basicity Index: 3.3
Density: 1.2 g/cm^3

Typical Applications

- Tandem arc applications for offshore fabrication
- Jobs requiring 480 MPa (70 ksi) tensile strength after stress relief when used with L-56®, L-S3, or LA-71

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%K_2O	% Metal Alloys
Lincolnweld® 880M®	12	1	29	29	1	18	8	1	1 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	410 (59)	510 (74)	32	263 (194)	-62 (-80)	F7A8-EM13K-H8
L-56®	As-welded	480 (69)	580 (85)	31	121 (89)	-51 (-60)	F7A6-EH11K-H8
L-56®	Stress-relieved[3]	400 (58)	540 (78)	32	158 (116)	-51 (-60)	F7P6-EH11K-H8
L-S3	As-welded	400 (58)	510 (74)	32	264 (195)	-51 (-60)	F7A6-EH12K-H8
LA-71	As-welded	480 (70)	570 (82)	29	143 (105)	-62 (-80)	F7A8-EM14K-H8
LA-71	Stress-relieved[3]	430 (63)	550 (80)	31	164 (121)	-62 (-80)	F7P8-EM14K-H8
LA-75	As-welded	440 (64)	550 (80)	31	167 (123)	-62 (-80)	F7A8-ENi1K-Ni1-H8
LA-85	As-welded	520 (76)	610 (88)	24	57 (42)	-51 (-60)	F7A6-ENi5-Ni5-H8
LA-85	Stress-relieved[3]	490 (71)	590 (85)	27	145 (107)	-62 (-80)	F7P8-ENi5-Ni5-H8
LA-90	As-welded	580 (84)	680 (99)	26	68 (50)	-51 (-60)	F9A6-EA3K-A3-H8
LA-90	Stress-relieved[3]	520 (75)	630 (91)	28	145 (107)	-62 (-80)	F8P8-EA3K-A3-H8
LA-92	Stress-relieved[4]	460 (66)	570 (82)	28	178 (131)	-29 (-20)	F7P2-EB2R-B2-H8
LA-93	Stress-relieved[4]	510 (74)	610 (88)	26	214 (158)	-18 (0)	F7P0-EB3R-B3-H8
LA-100	As-welded	680 (98)	730 (106)	25	129 (95)	-51 (-60)	F9A6-EM2-M2-H8
LAC-B2	Stress-relieved[4]	500 (72)	600 (87)	25	144 (106)	-29 (-20)	F8P2-ECB2-B2-H8
LAC-M2	As-welded	760 (110)	820 (119)	23	83 (61)	-51 (-60)	F11A6-ECM2-M2-H8
LAC-Ni2	As-welded	510 (73)	600 (87)	22	77 (57)	-73 (-100)	F7A10-ECNi2-Ni2-H8
LAC-Ni2	Stress-relieved[3]	480 (69)	570 (83)	28	103 (76)	-73 (-100)	F7P10-ECNi2-Ni2-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 882™

800 Series Neutral Flux • EN 760 – S A AS 1; EN 760 – S A AS 2

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-56®, L-60, L-61®, LA-71, L-S3

Low Alloy Steel
Lincolnweld® L-70, LA-75, LA-82, LA-85, LA-92, LA-93, LAC-Ni2

Product Information

Basicity Index: 1.6
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Bag ED027859

Key Features

- Designed for a variety of welding applications and is known for providing consistent mechanical properties
- Recommended for stainless steel welding and can be paired with both mild and low alloy steel electrodes
- Smooth bead appearance
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single wire or tandem welding
- Used for welding of stainless, mild and low alloy steel
- Excellent for multiple pass fillet welds

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%ZrO_2	% Metal Alloys
Lincolnweld® 882™	16	1	22	24	2	24	1	7	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	420 (61)	520 (76)	29	130 (96)	-51 (-60)	F7A6-EM13K-H8
L-56®	As-welded	500 (73)	600 (87)	28	92 (68)	-40 (-40)	F7A4-EH11K-H8
L-56®	Stress-relieved[3]	420 (61)	560 (81)	30	47 (35)	-46 (-50)	F7P5-EH11K-H8
L-60	As-welded	370 (54)	460 (67)	32	207 (153)	-51 (-60)	F6A6-EL12-H8
L-61®	As-welded	400 (58)	500 (72)	31	190 (140)	-51 (-60)	F7A6-EM12K-H8
L-S3	As-welded	410 (60)	520 (76)	28	130 (96)	-51 (-60)	F7A6-EH12K-H8
LA-71	As-welded	480 (69)	570 (82)	31	61 (45)	-51 (-60)	F7A6-EM14K-H8
LA-71	Stress-relieved[3]	430 (62)	550 (80)	32	70 (52)	-51 (-60)	F7P6-EM14K-H8
L-70	Stress-relieved[3]	450 (65)	550 (80)	30	76 (56)	-40 (-40)	F7P4-EA1-A2-H8
LA-75	As-welded	430 (62)	540 (79)	32	133 (98)	-40 (-40)	F7A4-ENi1K-Ni1-H8
LA-82	As-welded	660 (95)	740 (108)	26	56 (41)	-51 (-60)	F10A6-EF2-F2-H8
LA-85	As-welded	510 (74)	610 (88)	25	88 (65)	-40 (-40)	F7A4-ENi5-Ni5-H8
LA-85	Stress-relieved[3]	500 (73)	590 (86)	26	102 (75)	-40 (-40)	F7P4-ENi5-Ni5-H8
LA-92	Stress-relieved[4]	520 (75)	610 (89)	27	83 (61)	-29 (-20)	F7P2-EB2R-B2-H8
LA-93	Stress-relieved[4]	610 (88)	700 (101)	23	214 (158)	-18 (0)	F9P0-EB3R-B3-H8
LAC-Ni2	As-welded	570 (83)	660 (95)	20	72 (53)	-40 (-40)	F8A4-ECNi2-Ni2-H8
LAC-Ni2	Stress-relieved[3]	500 (73)	600 (87)	25	100 (74)	-40 (-40)	F7P4-ECNi2-Ni2-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 888™

EN 760 – S A Z • 800 Series Neutral Flux

Key Features

- Designed for deep groove slag removal in critical applications
- Low H4 diffusible hydrogen levels
- Moisture resistant packaging
- Charpy V-Notch and CTOD test results available for most alloy systems
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Packaging

50 lb (22.7 kg) Plastic Bag	ED031596
2600 lb (1179 kg) Bulk Bag	ED033490

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-56®, L-S3, L-61®, LA-71

Low Alloy Steel
Lincolnweld® L-70, LA-75, LA-82, LA-84, LA-85, LA-90, LA-100, LAC-Ni2, LAC-M2, LAC-B2, LAC-690

Product Information

Basicity Index: 2.2
Density: 1.3 g/cm^3

Typical Applications

- Excellent operation with multiple arcs
- Offshore
- Structural fabrication
- Shipbuilding

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%FeO	%K_2O	% Metal Alloys
Lincolnweld® 888™	18	1	27	25	2	19	5	1	2	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	430 (62)	540 (78)	31	122 (90)	-62 (-80)	F7A8-EM13K-H4
L-50®	Stress-relieved[3]	370 (53)	510 (74)	32	187 (138)	-62 (-80)	F6P8-EM13K-H4
L-56®	As-welded	510 (74)	610 (88)	29	71 (52)	-51 (-60)	F8A6-EH11K-H4
L-56®	Stress-relieved[3]	410 (59)	540 (79)	32	118 (87)	-62 (-80)	F7P8-EH11K-H4
L-61®	As-welded	420 (61)	520 (75)	31	121 (89)	-51 (-60)	F7A6-EM12K-H4
L-S3	As-welded	480 (70)	570 (83)	33	70 (52)	-62 (-80)	F7A8-EH12K-H4
L-S3	Stress-relieved[3]	370 (54)	510 (74)	33	165 (122)	-62 (-80)	F6P8-EH12K-H4
LA-71	As-welded	520 (75)	610 (89)	28	68 (50)	-51 (-60)	F7A6-EM14K-H4
LA-71	Stress-relieved[3]	410 (60)	540 (78)	32	134 (99)	-62 (-80)	F7P8-EM14K-H4
L-70	As-welded	510 (74)	600 (87)	29	60 (45)	-40 (-40)	F7A4-EA1-A2-H4
L-70	Stress-relieved[3]	470 (69)	570 (83)	31	126 (93)	-40 (-40)	F7P4-EA1-A2-H4
LA-75	As-welded	470 (68)	580 (84)	31	122 (90)	-62 (-80)	F7A8-ENi1K-Ni1-H4
LA-82	As-welded	690 (99)	780 (113)	23	70 (52)	-62 (-80)	F10A8-EF2-F2-H4
LA-82	Stress-relieved[3]	600 (87)	700 (102)	25	79 (58)	-51 (-60)	F9P6-EF2-F2-H4
LA-84	As-welded	630 (92)	720 (105)	23	77 (57)	-62 (-80)	F9A8-EF3-F3-H4
LA-84	Stress-relieved[3]	580 (84)	670 (98)	26	34 (25)	-51 (-60)	F8P6-EF3-F3-H4
LA-85	As-welded	540 (78)	640 (92)	26	79 (58)	-51 (-60)	F8A6-ENi5-Ni5-H4
LA-85	Stress-relieved[3]	500 (72)	590 (86)	27	76 (56)	-51 (-60)	F7P6-ENi5-Ni5-H4
LA-90	As-welded	610 (89)	700 (102)	26	56 (41)	-51 (-60)	F9A6-EA3K-A3-H4
LA-100	As-welded	690 (100)	760 (111)	25	61 (45)	-40 (-40)	F10A4-EM2-M2-H4
LAC-M2	As-welded	860 (124)	930 (135)	15	63 (46)	-62 (-80)	F12A8-ECG-G-H8
LAC-Ni2	As-welded	540 (78)	630 (92)	20	56 (42)	-62 (-80)	F8A8-ECNi2-Ni2-H8
LAC-Ni2	Stress-relieved[3]	480 (70)	580 (84)	27	64 (47)	-73 (-100)	F7P10-ECNi2-Ni2-H8
LAC-690	As-welded	800 (116)	860 (124)	22	91 (67)	-73 (-100)	F11A10-ECG-G-H4
LAC-690	Stress-relieved[3]	707 (103)	776 (113)	21	51 (37)	-51 (-60)	F11P6-ECG-G-H4

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 8500™

800 Series Neutral Flux • EN 760 – S A FB 1

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-56®, L-61®, L-S3, LA-71

Low Alloy Steel
Lincolnweld® LA-82, LA-85, LA-90, LA-92

Product Information

Basicity Index: 2.9
Density: 1.3 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag ED031854

Key Features

- Capable of providing impact properties necessary for thick weld joints from root to cap pass
- Operates well on AC and multiple arcs with good resistance to nitrogen porosity
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -62°C (-80°F)
- CTOD data available for this flux with many alloy systems
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Fabrication of offshore drilling platforms
- Multiple pass welding
- Single and multiple arc welding

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%K_2O	%TiO_2	% Metal Alloys
Lincolnweld® 8500™	13	1	30	24	2	19	8	1	1	1 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	430 (63)	520 (76)	32	129 (95)	-62 (-80)	F7A8-EM13K-H8
L-56®	As-welded	470 (68)	570 (82)	31	132 (97)	-62 (-80)	F7A8-EH11K
L-56®	Stress-relieved[3]	430 (62)	540 (79)	33	151 (111)	-62 (-80)	F7P8-EH11K
L-61®	As-welded	400 (58)	480 (70)	31	168 (124)	-51 (-60)	F7A6-EM12K-H8
L-S3	As-welded	460 (67)	570 (82)	29	91 (67)	-62 (-80)	F7A8-EH12K-H8
LA-71	As-welded	450 (66)	550 (80)	30	155 (115)	-62 (-80)	F7A8-EM14K-H8
LA-71	Stress-relieved[3]	420 (61)	520 (75)	32	220 (162)	-62 (-80)	F7P8-EM14K-H8
LA-82	As-welded	660 (95)	740 (108)	22	87 (64)	-51 (-60)	F9A6-EF2-F2-H8
LA-82	Stress-relieved[3]	610 (89)	700 (102)	24	83 (61)	-51 (-60)	F9P6-EF2-F2-H8
LA-85	As-welded	510 (74)	590 (86)	29	155 (114)	-62 (-80)	F8A8-ENi5-Ni5-H8
LA-85	Stress-relieved[3]	500 (72)	590 (85)	28	134 (99)	-51 (-60)	F7P6-ENi5-Ni5-H8
LA-90	As-welded	670 (97)	590 (85)	24	84 (62)	-29 (-20)	F9A2-EA3K-A3-H8
LA-92	Stress-relieved[4]	550 (80)	640 (93)	26	209 (154)	-18 (0)	F8P0-EB2-B2-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE 1: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com NOTE 2: This product contains micro-alloying elements. Additional information available upon request.

Lincolnweld® MIL800-H™

EN 760 – S A CS 1; EN 760 – S A FB 1 • 800 Series Neutral Flux

Key Features

- Capable of providing industry leading H2 diffusible hydrogen levels
- Designed for low temperature applications
- Recommended for both single and multiple arc welding of both butt and fillet welds
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- HY-80 and HSLA-80 steels with Lincolnweld® LA-100 wire
- Horizontal and flat fillet welds
- Single and multiple arc welding
- High strength or highly restrained weldments where delayed cracking is a concern

Recommended Wires

Mild Steel
Lincolnweld® L-S3, LA-71

Low Alloy Steel
Lincolnweld® LA-75, LA-82, LA-85, LA-90, LA-93, LA-100

Product Information

Basicity Index: 3.2
Density: 1.3 g/cm^3

Packaging

50 lb (22.7 kg)
Hermetically Sealed Pail ED020925

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%K_2O	% Metal Alloys
Lincolnweld® MIL800-H™	13	1	34	23	1	16	8	1	1 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-S3	As-welded	500 (73)	610 (88)	27	76 (56)	-62 (-80)	F7A8-EH12K-H2
L-S3	Stress-relieved[3]	440 (64)	570 (82)	30	118 (87)	-62 (-80)	F7P8-EH12K-H2
LA-71	As-welded	470 (68)	570 (82)	30	163 (120)	-51 (-60)	F7A6-EM14K-H2
LA-71	Stress-relieved[3]	420 (61)	540 (79)	32	193 (140)	-51 (-60)	F7P6-EM14K-H2
LA-75	As-welded	460 (67)	560 (82)	30	156 (115)	-62 (-80)	F7A8-ENi1K-Ni1-H2
LA-82	As-welded	700 (102)	800 (116)	21	91 (67)	-51 (-60)	F10A6-EF2-F2-H2
LA-82	Stress-relieved[3]	660 (95)	740 (108)	25	76 (56)	-51 (-60)	F10P6-EF2-F2-H2
LA-85	As-welded	570 (82)	660 (95)	25	108 (80)	-62 (-80)	F8A8-ENi5-Ni5-H2
LA-85	Stress-relieved[3]	540 (78)	630 (92)	26	83 (61)	-62 (-80)	F8P8-ENi5-Ni5-H2
LA-90	As-welded	620 (90)	710 (103)	26	77 (57)	-51 (-60)	F9A6-EA3K-A3-H2
LA-90	Stress-relieved[3]	590 (86)	690 (100)	26	84 (62)	-51 (-60)	F9P6-EA3K-A3-H2
LA-93	Stress-relieved[4]	580 (84)	690 (99)	23	34 (25)	-29 (-20)	F9P2-EB3R-B3R-H2
LA-100	As-welded	670 (97)	780 (112)	25	107 (79)	-51 (-60)	F10A6-EM2-M2-H2

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 812-SRC™

800 Series Neutral Flux • EN 760 - S A FB 1

Recommended Wires

Low Alloy Electrodes
Lincolnweld® LA-84

Product Information

Basicity Index: 2.2
Density: 1.3 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag ED034171

Key Features

- Carbon-neutral flux designed to provide excellent mechanical properties after extended stress-relief
- Industry leading low H4 diffusible hydrogen levels
- Smooth bead appearance and excellent slag release
- Excellent resistance to moisture pick up.
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Offshore applications with extended post-weld heat treatment (PWHT)
- Quench and tempered steels such as AISI 4130, 8620, and similar chemistries

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2
Lincolnweld® 812-SRC™	16	3	30	19
	%Na_2O	%Al_2O_3	%CaO	% Metal Alloys
Lincolnweld® 812-SRC™	2	22	4	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
LA-84	As-welded	680 (98)	790 (114)	24	87 (64)	-51 (-60)	F10A6-EF3-F3-H4 F9P6-RF3-F3-H$

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE 1: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 960®

EN 760 – S A AB 1 • Special Neutral Flux

Key Features

- Low cost, general purpose flux designed to weld butt joints and both single and multiple pass fillets
- Recommended for automatic and semiautomatic submerged arc welding
- A versatile, cost-effective flux that can be used with many alloy systems
- Can be used on A588 weathering steels when combined with Lincolnweld® LA-75
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single and multiple pass welding
- Fillet and butt welds with unlimited plate thickness
- Can weld steel with heavy scale or rust when used with Lincolnweld® L-50® wire
- Weathering steels when used with Lincolnweld® LA-75 wire

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-61®, LA-71

Low Alloy Steel
Lincolnweld® LA-75, LA-85, LA-93, LA-100

Product Information

Basicity Index: 1.1
Density: 1.4 g/cm^3

AWS D1.8 and FEMA 353

Approved when paired with the following wires:
- 3/32 in (2.4 mm) Lincolnweld® L-56®
- 1/8 in (3.2 mm) Lincolnweld® L-61®
- 1/8 in (3.2 mm) Lincolnweld® LA-85

Packaging

50 lb (22.7 kg) Bag ED022412

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%TiO_2	% Metal Alloys
Lincolnweld® 960®	21	10	21	10	2	31	1	1	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	460 (66)	570 (83)	27	58 (43)	-29 (-20)	F7A2-EM13K-H8
L-61®	As-welded	420 (61)	520 (75)	32	125 (92)	-29 (-20)	F7A2-EM12K-H8
LA-71	As-welded	460 (66)	570 (82)	29	44 (32)	-29 (-20)	F7A2-EM14K-H8
LA-71	Stress-relieved[3]	420 (61)	540 (79)	31	89 (66)	-29 (-20)	F7P2-EM14K-H8
LA-75	As-welded	480 (69)	600 (87)	30	76 (56)	-29 (-20)	F8A2-ENi1K-Ni1-H8
LA-75	Stress-relieved[3]	420 (61)	550 (80)	29	53 (39)	-51 (-60)	F7P6-ENi1K-Ni1-H8
LA-85	As-welded	520 (76)	640 (93)	24	57 (42)	-29 (-20)	F8A2-ENi5-G-H8
LA-85	Stress-relieved[3]	500 (73)	610 (88)	25	39 (29)	-46 (-50)	F7P5-ENi5-G-H8
LA-93	Stress-relieved[4]	580 (84)	680 (98)	22	65 (48)	-18 (0)	F9P0-EB3R-G-H8
LA-100	As-welded	680 (99)	740 (108)	25	33 (24)	-40 (-40)	F10A4-EM2-G-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F). [4]Stress-relieved for 1 hour at 691°C (1275°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 980™

Special Neutral Flux • EN 760 – S A AB 1; EN 760 – S A AR 1

Recommended Wires

Mild Steel
Lincolnweld® L-50®, L-61®, LC-72

Low Alloy Steel
Lincolnweld® LA-75, LAC-Ni2

Product Information

Basicity Index: 0.6
Density: 1.4 g/cm^3

Packaging

50 lb (22.7 kg) Bag ED027861

Key Features

- Combines many of the features of the 700 and 800 series fluxes and is ideal for semiautomatic submerged arc welding
- Exceptional resistance to flash-through and porosity caused by arc blow in a variety of applications
- Especially high productivity when used with Lincolnweld® LC-72 wire
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Semiautomatic, single and multiple pass submerged arc welding
- General purpose fabrication
- Fillet welds

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%TiO_2	% Metal Alloys
Lincolnweld® 980™	11	14	2	12	2	47	7	4 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-50®	As-welded	430 (63)	540 (78)	31	43 (32)	-29 (-20)	F7A2-EM13K-H8
L-61®	As-welded	430 (63)	530 (77)	31	37 (27)	-29 (-20)	F7A2-EM12K-H8
LC-72	As-welded	450 (65)	540 (78)	28	43 (32)	-29 (-20)	F7A2-EC1-H8
LA-75	As-welded	510 (74)	600 (87)	28	61 (45)	-29 (-20)	F7A2-ENi1K-Ni1-H8
LAC-Ni2	As-welded	540 (79)	630 (91)	25	110 (81)	-29 (-20)	F8A2-ECNi2-Ni2-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® WTX™

EN 760 – S A AB 1 • Special Neutral Flux

Key Features

- Neutral submerged arc welding flux designed to meet the specific requirements of wind tower welding applications
- Recommended for use with Lincolnweld® L-61® electrode on both longitudinal and circumferential seam welds
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -62°C (-80°F)
- Smooth bead profile to achieve excellent toe angles, tie-in, and bead appearance on interior and exterior applications
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Wind tower base
- Wind tower door frame

Recommended Wires

Mild Steel
Lincolnweld® L-61®

Low Alloy Steel
Lincolnweld® L-70

Product Information

Basicity Index: 1.4
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag ED032990

FLUX COMPOSITION[1]

	%SiO_2	%Mn_xO_y	%MgO	%CaF_2	%NaO	%Al_2O_3	%CaO	%ZrO_2	%FeO	%K_2O	%TiO_2
Lincolnweld® WTX™	21	9	23	13	2	25	5	1	2	1	1

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	As-welded	430 (63)	540 (78)	31	84 (62)	-62 (-80)	F7A8-EM12K-H8
L-70	As-welded	500 (73)	610 (88)	25	46 (34)	-40 (-40)	F8A4-EA1-A3-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 761-Pipe™

Flux for Seam Welding of Pipe • EN 760 – S A MS 1; EN 760 – S A CS 1

Recommended Wires

Mild Steel
Lincolnweld® L-61®

Low Alloy Steel
Lincolnweld® L-70

Product Information

Basicity Index: 0.8
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag	ED032797
2600 lb (1179 kg) Bulk Bag	ED032768

Key Features

- Features the chemical composition of 761 with a particle size optimized for seam welding
- Low-melting slag system produces wide flat welds with superior resistance to cracks and pockmarking
- Can handle up to 5 arcs or 5,000 amps
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Single and multiple arc welding
- Longitudinal seam welding of API grade pipe
- Spiral seam welding of API grade or water pipe

FLUX COMPOSITION[1]

	%SiO_2	%Mn_xO_y	%MgO	%CaF_2	%NaO	%Al_2O_3	%TiO_2	%FeO	% Metal Alloys
Lincolnweld® 761-Pipe™	45	19	22	5	2	2	2	1	6 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	As-welded	490 (70)	580 (85)	28	54 (40)	-29 (-20)	F7A2-EM12K-H8
L-70	As-welded	550 (80)	640 (93)	24	58 (43)	-18 (0)	F9A0-EA1-G

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® P223™

EN 760 – S A AB 1 • Flux for Seam Welding of Pipe

Key Features

- Industry standard for pipe welding on up to X80 grade pipe
- Fast freezing and easily removable slag for excellent bead profile
- Can be used for welding with up to three arcs
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Pipe welding up to X80 grade pipe
- Two run welding applications for pipe fabrication
- Multiple pass welding for general construction

Recommended Wires

Mild Steel
Lincolnweld® L-56®, L-61®, LA-71, L-S3

Low Alloy Steel
Lincolnweld® L-70, LA-90

Product Information

Basicity Index: 1.5
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag	ED032764
2600 lb (1179 kg) Bulk Bag	ED032767

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%NaO	%Al_2O_3	%CaO	%TiO_2	%K_2O	%FeO	% Metal Alloys
Lincolnweld® P223™	23	4	21	21	2	20	4	2	1	1	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-56®	As-welded	500 (73)	620 (90)	30	68 (50)	-51 (-60)	F7A6-EH11K-H8
L-56®	Stress-relieved[3]	540 (65)	580 (84)	30	66 (49)	-51 (-60)	F7P6-EH11K-H8
L-61®	As-welded	430 (63)	530 (77)	31	126 (93)	-40 (-40)	F7A4-EM12K
LA-71	As-welded	480 (69)	570 (83)	29	94 (69)	-40 (-40)	F7A4-EM14K-H8
LA-71	Stress-relieved[3]	410 (60)	540 (78)	32	76 (56)	-51 (-60)	F7P6-EM14K-H8
L-S3	As-welded	460 (67)	570 (82)	30	88 (65)	-62 (-80)	F7A8-EH12K-H8
L-70	As-welded	550 (80)	650 (94)	25	53 (39)	-29 (-20)	F8A2-EA1-A2
LA-90	As-welded	630 (91)	720 (105)	25	60 (44)	-18 (0)	F9A0-EA3K-G

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset. [3]Stress-relieved for 1 hour at 621°C (1150°F).
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® SPX80™

Flux for Seam Welding of Pipe • EN 760 – S A AB 1

Typical Applications

- Spiral pipe mills
- Weld up to API X80 pipe
- Two run welding applications

Recommended Wires

Mild Steel
Lincolnweld® L-61®
Low Alloy Steel
Lincolnweld® L-70, LA-81, LA-90

Product Information

Basicity Index: 1.3
Density: 1.2 g/cm^3

Packaging

50 lb (22.7 kg) Plastic Bag	ED032960
2600 lb (1179 kg) Bulk Bag	ED033319

Key Features

- Designed to meet the specific requirements of spiral pipe seam welding of up to API X80 grade pipe
- High speed welding capability for increased productivity
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -51°C (-60°F) with Lincolnweld® LA-81
- Smooth bead profile achieves optimal appearance on both inner and outer diameter welds
- Self-peeling slag allows for clean and easy slag removal for reliable non-destructive testing results
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%NaO	%Al_2O_3	%CaO	%ZrO_2	%FeO	%TiO_2
Lincolnweld® SPX80™	23	9	21	14	2	25	2	2	1	1

AWS TEST RESULTS[1] - MULTI-PASS

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	As-Welded	430 (62)	543 (79)	31	94 (69)	-46 (-50)	F7A5-EM12K-H8
L-70	As-Welded	530 (77)	620 (89)	25	68 (50)	-40 (-40)	F8A4-EA1-A4-H8
LA-90	As-Welded	610 (89)	720 (105)	25	39 (29)	-40 (-40)	F8A4-EA1-A4-H8

AWS TEST RESULTS[1] - TWO RUN

Flux/Wire Combination	Steel Type	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	A131	As-welded	460 (67)	600 (87)	30	45 (33)	-18 (0)	F7TA0-EM12K
L-70	A131	As-welded	500 (72)	620 (89)	27	38 (28)	-40 (-40)	F7TA4-EA1
L-70	X65	As-welded	560 (82)	650 (94)	26	88 (65)	-40 (-40)	F8TA4G-EA1
LA-81	X65	As-welded	580 (84)	680 (98)	25	43 (32)	-40 (-40)	F9TA4G-EG
LA-81	X80	As-welded	630 (92)	690 (101)	26	114 (84)	-51 (-60)	F9TA6G-EG
LA-90	X65	As-welded	590 (86)	690 (101)	24	37 (27)	-51 (-60)	F9TA6G-EA3K
LA-90	X70	As-welded	580 (85)	700 (102)	27	113 (83)	-40 (-40)	F9TA4G-EA3K
LA-90	X80	As-welded	630 (93)	690 (100)	27	72 (53)	-40 (-40)	F9TA4G-EA3K

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® 995N™

EN 760 – S A AB 1 • Flux for Seam Welding of Pipe

Key Features

- A nitrogen limiting flux designed for seam welding of pipe
- Recommended for automatic single pass welding with up to five arcs
- Produces welds with minimal buildup and good penetration
- Capable of producing Charpy V-Notch test results required for arctic grade service
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Recommended Wires

Mild Steel
Lincolnweld® L-61®

Low Alloy Steel
Lincolnweld® L-70, LA-81, LA-90

Product Information

Basicity Index: 1.3
Density: 1.0 g/cm^3

Typical Applications

- Automatic, single pass welding
- Single or multiple arc welding
- High speed longitudinal seam welding on a range of pipe steels
- One side welding requiring impact properties

Packaging

50 lb (22.7 kg) Plastic Bag ED032831

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%ZrO_2	%FeO	%TiO_2	% Metal Alloys
Lincolnweld® 995N™	19	11	16	14	3	27	5	2	1	1	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	As-welded	430 (63)	540 (79)	29	83 (61)	-40 (-40)	F7A4-EM12K-H8
L-70	As-welded	510 (74)	610 (88)	24	73 (54)	-29 (-20)	F8A2-EA1-A4
LA-81	As-welded	590 (96)	660 (96)	26	58 (43)	-29 (-20)	F9A2-EG-G
LA-90	As-welded	600 (87)	700 (102)	25	54 (40)	-29 (-20)	F9A2-EA3K-G

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® A-XXX10™

High Performance / Alloy Flux • EN 760 – S A AS 1

Recommended Wires

For Low Alloy
Lincolnweld® L-61®

Product Information

Basicity Index: 1.0
Density: 1.4 g/cm^3

Packaging

50 lb (22.7 kg) Bag ED027862

Notes

- Since the alloy level in the weld deposit depends upon the arc voltage, and thus the arc length, always maintain a consistent arc voltage. If more flexibility in procedure is necessary, use 960 flux and LA-75 electrode.

Key Features

- An alloy flux designed to produce a 1% nickel-bearing weld deposit
- Recommended for use on ASTM A533 Class 1 and A588 weathering steels when combined with Lincolnweld® L-61®
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Welding of A588 weathering steels and ASTM A533-Class 1

FLUX COMPOSITION[1]

	%SiO_2	%MnO	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%ZrO_2	%TiO_2	% Metal Alloys
Lincolnweld® A-XXX10™	18	5	22	11	2	19	22	1	5 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
L-61®	As-welded	460 (67)	570 (83)	30	85 (63)	-40 (-40)	F7A4-EM12K-Ni1-H8

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® MIL800-HPNi™

EN 760 - S A FB 1 • High Performance / Alloy Flux

Key Features

- When used with Lincolnweld® LA-85 the nickel content will increase from a nominal 1% to a minimum 1%
- Use on high performance steel applications, including HPS70W or HPS100W
- Capable of producing ultra low H2 diffusible hydrogen levels on HPS steels
- Actual (Type 3.1) certificates for each lot of flux showing chemical composition, particle size and moisture level are available in the certificate center of lincolnelectric.com

Typical Applications

- Bridge fabrication with HPS70W steel, when used with LA-85 wire
- Single or multiple wire arc welding
- Butt and fillet welds on low alloy steels

Recommended Wires

Low Alloy Steel
Lincolnweld® LA-75, LA-85, LA-100

Product Information

Basicity Index: 3.1
Density: 1.3 g/cm^3

Packaging

50 lb (22.7 kg)
Hermetically Sealed Pail ED028657

FLUX COMPOSITION[1]

	%SiO_2	%MgO	%CaF_2	%Na_2O	%Al_2O_3	%CaO	%TiO_2	%K_2O	%FeO	% Metal Alloys
Lincolnweld® MIL800-HPNi™	13	34	22	1	16	8	2	1	1	3 max.

AWS TEST RESULTS[1]

Flux/Wire Combination	Weld Condition	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation (%)	Charpy V-Notch J (ft•lbf)	Charpy V-Notch @ °C (°F)	AWS Classification (A5.17/A5.23)
LA-75	As-welded	560 (81)	640 (93)	28	145 (107)	-51 (-60)	F8A6-ENi1K-G-H2
LA-85	As-welded	600 (88)	690 (100)	25	143 (105)	-40 (-40)	F9A4-ENi5-G-H2
LA-100	As-welded	800 (116)	850 (123)	23	91 (67)	-40 (-40)	F11A4-EM2-G-H2

[1]See test results disclaimer on pg. 18. [2]Measured with 0.2% offset.
NOTE: For the most up-to-date AWS certificates of conformances please visit www.lincolnelectric.com

Lincolnweld® L-50®

Mild Steel Solid Electrode • AWS EM13K

Conformances

AWS A5.17/A5.17M: 1997	EM13K
MIL-E-23765/1D &1E:	MIL-70S-3
EN 756:	SZ

Recommended Fluxes

Lincolnweld® 760®, 761®, 780®, 781®, 860®, 865™, 880M®, 882™, 888™, 8500™, 960®, 980™, P223™

Key Features

- A low carbon, medium manganese, medium silicon wire
- Pair it with Lincolnweld® 980™ flux for the best flux/wire combination when semiautomatic submerged arc welding
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in. (mm)	60 lb (27.2 kg) Coil	600 lb (272 kg) Speed Feed® Drum	1000 lb (453 kg) Speed Feed® Drum	1000 lb (453 kg) Accu-Trak® Drum	2200 lb (998 kg) Speed Feed® Stem
1/16 (1.6)	ED011317	ED011316		ED029083	
5/64 (2.0)	ED011335		ED011334		
3/32 (2.4)	ED011328		ED011327		
1/8 (3.2)	ED011323		ED011322		ED033481
5/32 (4.0)	ED011332		ED011331		ED032997

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® L-50®	0.06-0.16	0.90-1.40	0.35-0.75	0.030	0.030	0.35

Lincolnweld® L-56®

Mild Steel Solid Electrode • AWS EH11K

Conformances

AWS A5.17/A5.17M: 1997	EH11K
MIL-E-23765/1D & 1E:	MIL-70S-6
EN 756:	SZ

Recommended Fluxes

Lincolnweld® 860®, 880M®, 882™, 888™, 8500™, P223™

Key Features

- A low carbon, high manganese, very high silicon wire
- Can be used with Lincolnweld® 800 series fluxes for welds requiring 480 MPa (70 ksi) tensile strength in stress relieved conditions
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in. (mm)	60 lb (27.2 kg) Coil	Accu-Trak® Drum 500 lb (227 kg)	Accu-Trak® Drum 1000 lb (453 kg)	1000 lb (453 kg) Speed Feed® Reel	1000 lb (453 kg) Speed Feed® Drum	2200 lb (998 kg) Speed Feed® Stem
1/16 (1.6)	ED011666	ED029225	ED029085			
5/64 (2.0)	ED011678			EDS01631		
3/32 (2.4)	ED011674				ED030425	
1/8 (3.2)	ED011671				ED030426	ED032998
5/32 (4.0)	EDS11677				ED028264	ED032999

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® L-56®	0.06-0.15	1.40-1.85	0.80-1.15	0.030	0.030	0.35

[1]Single values are maximums.

Lincolnweld® L-60

AWS EL12 • Mild Steel Solid Electrode

Key Features

- A low carbon, low manganese, low silicon general purpose electrode
- Provides the lowest hardness and is best suited for use with the Lincolnweld® 700 series of active fluxes
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.17/A5.17M: 1997	EL12
MIL-E-23765/4:	MIL-EL12
EN 756:	S1

Recommended Fluxes

Lincolnweld® 760®, 761®, 780®, 781™, 860®, 882™

DIAMETERS / PACKAGING

Diameter in. (mm)	60 lb (27.2 kg) Coil	600 lb (272 kg) Speed Feed® Drum	1000 lb (453 kg) Speed Feed® Drum
5/64 (2.0)	ED011762	EDS11760	ED011761
3/32 (2.4)	ED011752		ED011751
1/8 (3.2)	ED011743	EDS11741	ED011742
5/32 (4.0)	ED011758		ED011757
3/16 (4.8)	ED011749		ED011748

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® L-60	0.04-0.14	0.25-0.60	0.10	0.030	0.030	0.35

Lincolnweld® L-61®

AWS EM12K • Mild Steel Solid Electrode

Conformances

AWS A5.17/A5.17M: 1997	EM12K
MIL-E-23765/4:	MIL-EM12K
EN 756:	S2Si

Recommended Fluxes

Lincolnweld® 760®, 761®, 780®, 781™, 860®, 865™, 882™, 888™, 761-Pipe™, P223™, 960®, 980™, WTX™, AXXX-10™, 995N™, SPX80™

Key Features

- Industry standard for submerged arc welding applications
- A low carbon, medium manganese, low silicon general purpose submerged arc electrode
- A good choice for a wide range of applications with single or multiple pass subarc welding
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in. (mm)	60 lb (27.2 kg) Coil	250 lb (113 kg) Speed Feed® SlimReel™	300 lb (136 kg) Speed Feed® Reel	300 lb (136 kg) Speed Feed® Drum
1/16 (1.6)	ED011803			
5/64 (2.0)	ED011825			
3/32 (2.4)	ED011815	ED033074		
1/8 (3.2)	ED011807	ED033075		
5/32 (4.0)	ED011821	ED033076	ED030412	ED030628
3/16 (4.8)	ED011812			

Diameter in. (mm)	600 lb (272 kg) Speed Feed® Drum	750 lb (340 kg) Speed Feed® Reel	1000 lb (453 kg) Speed Feed® Drum	2200 lb (998 kg) Speed Feed® Stem
1/16 (1.6)				
5/64 (2.0)	EDS11823	ED011826	ED011824	
3/32 (2.4)	EDS11813	EDS11817	ED011814	
1/8 (3.2)	EDS11805	EDS11809	ED011806	ED032973
5/32 (4.0)	EDS11819	ED030012	ED011820	ED032972
3/16 (4.8)			ED011811	ED032994

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® L-61®	0.05-0.15	0.80-1.25	0.10-0.35	0.030	0.030	0.35

[1]Single values are maximums.

Lincolnweld® L-S3

Mild Steel Solid Electrode • AWS EH12K

Key Features

- A low carbon, high manganese, medium silicon electrode designed for use with the Lincolnweld® 800 series of neutral fluxes
- Capable of producing weld deposits with impact properties exceeding 27 J (20 ft•lbf) at -62°C (-80°F) when used with Lincolnweld® 888™, 8500™, and MIL800-H™ neutral fluxes
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.17/A5.17M: 1997	EH12K
EN 756:	S3Si

Recommended Fluxes

Lincolnweld® 860®, 880M®, 882™, 888™, 8500™, MIL800-H™, P223™

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil
1/8 (3.2)	ED016767
5/32 (4.0)	ED016248

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® L-S3	0.06-0.15	1.50-2.0	0.25-0.65	0.025	0.025	0.35

Lincolnweld® LA-71

Mild Steel Solid Electrode • AWS EM14K

Key Features

- A low carbon, medium manganese, medium silicon electrode containing approximately 0.1% titanium
- Small addition of titanium allows deposits to be stress-relieved with little loss of strength, even with extended stress relief times
- Widely used with neutral basic fluxes in both as-welded and post-weld heat treated conditions

Conformances

AWS A5.17/A5.17M: 1997	EM14K
EN 756:	SZ

Recommended Fluxes

Lincolnweld® 860®, 865™, 880M®, 882™, 888™, 8500™, MIL800-H™, 960®, P223™

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum
3/32 (2.4)	ED011052	
1/8 (3.2)	ED011051	EDS30781
5/32 (4.0)	ED011053	EDS30782

WIRE COMPOSITION[1] - *As Required per AWS A5.17/A5.17M:1997*

	%C	%Mn	%Si	%Ti	%S	%P	%Cu
Lincolnweld® LA-71	0.06-0.19	0.90-1.40	0.35-0.75	0.03-0.17	0.025	0.025	0.35

[1]Single values are maximums.

Lincolnweld® L-70

Low Alloy Solid Electrode • AWS EA1

Conformances

AWS A5.23/A5.23M: 2007	EA1
MIL-E-23765/4:	MIL-EA1
EN 756:	S2Mo

Recommended Fluxes

Lincolnweld® 761®, 781™, 860®, 882™, 888™, 995N™, 761-Pipe™, P223™, SPX80™

Key Features

- A low carbon, medium manganese, low silicon, 1/2% molybdenum wire used for single or multiple pass welds
- A standard choice for pipe fabrication and other limited pass applications
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum	2200 lb (998 kg) Speed Feed® Stem
5/64 (2.0)	ED012054		
1/8 (3.2)	ED012051	ED021192	ED032971
5/32 (4.0)	ED012053	ED021193	ED032970
3/16 (4.8)	ED012052	EDS21194	ED032996

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Mo	%S	%P	%Cu
Lincolnweld® L-70	0.05-0.15	0.65-1.00	0.20	0.45-0.65	0.025	0.025	0.35

Lincolnweld® LA-75

Low Alloy Solid Electrode • AWS ENi1K

Conformances

AWS A5.23/A5.23M: 2007	ENi1K
EN 756:	SZ

Recommended Fluxes

Lincolnweld® 860®, 865™, 880™, 880M®, 882™, 888™, MIL800-H™, MIL800-HPNi™, 960®, 980™

Key Features

- A low carbon, medium manganese, high silicon, nickel-bearing electrode designed for use with Lincolnweld® neutral fluxes
- Suitable for use in applications requiring less than 1% Ni wire composition
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum
5/64 (2.0)	ED011066	
3/32 (2.4)	ED011064	ED027225
1/8 (3.2)	ED011062	
5/32 (4.0)	ED011065	ED027224

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Ni	%S	%P	%Cu
Lincolnweld® LA-75	0.12	0.80-1.40	0.40-0.80	0.75-1.25	0.020	0.020	0.35

[1]Single values are maximums.

Lincolnweld® LA-81

AWS EG • Low Alloy Solid Electrode

Key Features

- A low carbon, medium manganese, low silicon, 1/2% molybdenum wire containing small additions of titanium and boron for improved fracture toughness
- Generally used in two run applications for arctic grade line pipe
- It can be used to weld up to API X90 grade pipe
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007	EG
EN ISO 26304-A:	SZ

Recommended Fluxes

Lincolnweld® 995N™, SPX80™

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum	2200 lb (998 kg) Speed Feed® Stem
1/8 (3.2) 5/32 (4.0) 3/16 (4.8)	ED023163	EDS31060	ED032993 ED032992 ED032995

WIRE COMPOSITION - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Mo	%Ti	%B	%Cu
Lincolnweld® LA-81[1]	0.05	1.2	0.2	0.50	0.1	0.01	0.20

Lincolnweld® LA-82

AWS EF2 • Low Alloy Solid Electrode

Key Features

- Designed especially for high strength applications
- Recommended when over 620 MPa (90 ksi) tensile strength is required in the as-welded condition or when low temperature impact toughness is required in the stress-relieved condition
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007	EF2
EN ISO 26304-A:	SZ

Recommended Fluxes

Lincolnweld® 860®, 882™, 888™, 8500™, MIL800-H™

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil
3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	EDS30785 ED026958 ED026959

WIRE COMPOSITION[2] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Ni	%Mo	%S	%P	%Cu
Lincolnweld® LA-82	0.10-0.18	1.70-2.40	0.2	0.40-0.80	0.40-0.65	0.025	0.025	0.35

[1]No AWS limits. Values are typical. [2]Single values are maximums.

Lincolnweld® LA-84

Low Alloy Solid Electrode • AWS EF3

Conformances

AWS A5.23/A5.23M: 2007 EF3
EN ISO 26304-A: S3Ni1Mo

Recommended Fluxes

Lincolnweld® 860®, 880M®, 882™, 888™, P223™, MIL800-H™, MIL800-HPNi™

Key Features

- A nickel-bearing electrode with 1/2% molybdenum
- Can be used for higher strength weldments where impact properties exceeding 27 J (20 ft•lbf) at -62°C (-80°F) are required
- Suitable for use where consumables with less than 1% Ni are required
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum
5/64 (2.0)	ED034211	ED031872
3/32 (2.4)	ED031871	
1/8 (3.2)	ED033323	
5/32 (4.0)	ED034212	

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Ni	%Mo	%S	%P	%Cu
Lincolnweld® LA-84	0.10-0.18	1.75-2.20	0.2	0.80-1.0	0.45-0.60	0.010-0.020	0.010-0.020	0.05-0.15

Lincolnweld® LA-85

Low Alloy Solid Electrode • AWS ENi5

Conformances

AWS A5.23/A5.23M: 2007 ENi5
EN ISO 26304-A: SZ

Recommended Fluxes

Lincolnweld® 860®, 880M®, 882™, 888™, 8500™, MIL800-H™, MIL800-HPNi™, 960®

Key Features

- A nickel-bearing wire with 0.2% molybdenum designed for use on weathering steels
- Capable of producing weld deposits with 480-550 MPa (70-80 ksi) tensile strength in the as-welded and stress-relieved conditions
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum
3/32 (2.4)	ED023166	ED029965
1/8 (3.2)	ED023167	
5/32 (4.0)	ED023168	
3/16 (4.8)	ED023169	

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Ni	%Mo	%S	%P	%Cu
Lincolnweld® LA-85	0.12	1.20 - 1.60	0.05 - 0.30	0.75 - 1.25	0.10 - 0.30	0.025	0.020	0.35

[1]Single values are maximums.

Lincolnweld® LA-90

AWS EA3K • Low Alloy Solid Electrode

Key Features

- A low carbon, high manganese, high silicon, 1/2% molybdenum special purpose wire
- Recommended for seam welding of pipe and for the general welding of high strength plate
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007 EA3K
EN ISO 26304-A: SZ

Recommended Fluxes

Lincolnweld® 880™, 880M®, 888™, 8500™, MIL800-H™, 995N™, P223™, SPX80™

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	750 lb (340 kg) Speed Feed® Reel	1000 lb (453 kg) Speed Feed® Drum
1/16 (1.6)	ED013999		
5/64 (2.0)	ED011086		
3/32 (2.4)	ED011084		
1/8 (3.2)	EDS11083		
5/32 (4.0)	EDS11085	EDS01154	EDS01152

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Mo	%S	%P	%Cu
Lincolnweld® LA-90	0.05-0.15	1.60-2.10	0.50-0.80	0.40-0.60	0.025	0.025	0.35

Lincolnweld® LA-92

AWS EB2R • Low Alloy Solid Electrode

Key Features

- Designed for welding 1 1/4% chromium, 1/2% molybdenum steels in high temperature service applications such as pressure vessels or piping
- The AWS R designator denotes ultra low residuals which will result in a low Bruscato factor (X-factor)
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007 EB2R
EN ISO 24598-A: S CrMo1

Recommended Fluxes

Lincolnweld® 880M®, 882™, MIL800-H™, 960®

DIAMETERS / PACKAGING

Diameter in. (mm)	60 lb (27.2 kg) Coil
3/32 (2.4)	EDS30783
1/8 (3.2)	EDS26960
5/32 (4.0)	EDS26961

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Cr	%Mo	%S	%P	%Cu
Lincolnweld® LA-92	0.07-0.15	0.45-1.00	0.05-0.30	1.00-1.75	0.45-0.65	0.025	0.025	0.35

[1]Single values are maximums.

Lincolnweld® LA-93

Low Alloy Solid Electrode • AWS EB3R

Conformances

AWS A5.23/A5.23M: 2007 EB3R
EN ISO 24598-A: S CrMo2

Recommended Fluxes

Lincolnweld® 880M®, 882™, MIL800-H™, 960®

Key Features

- Designed for high temperature applications such as pressure vessels and piping for 2 1/4% chromium, 1% molybdenum steels
- The AWS R designator denotes ultra low residuals which will result in a low Bruscato factor (X-factor)
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil	1000 lb (453 kg) Speed Feed® Drum
3/32 (2.4)	EDS30784	ED032185
1/8 (3.2)	EDS26962	
5/32 (4.0)	EDS26963	

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Cr	%Mo	%S	%P	%Cu
Lincolnweld® LA-93	0.05 - 0.15	0.40 - 0.80	0.05 - 0.30	2.25 - 3.00	0.90 - 1.10	0.025	0.025	0.35

Lincolnweld® LA-100

Low Alloy Solid Electrode • AWS EM2 & ER100S-G & ER110S-G

Conformances

AWS A5.23/A5.23M: 2007 EM2
MIL-E-23765/2D & /2E:* MIL-100S-1 or MIL-100S-2 (with MIL800-H)
EN ISO 26304-A: SZ

*NAVSEA Technical Publication T9074-BC-GIB-010/0200

Recommended Fluxes

Lincolnweld® 880™, 880M®, 888™, MIL800-H™, MIL800-HPNi™, 960®

Key Features

- A low carbon, high manganese wire with nickel and molybdenum designed to weld high strength steels such as HY-80 and HSLA-80
- Delivers yield strength greater than 690 MPa (100 ksi)
- Low H2 hydrogen levels can be achieved when used with MIL800-H™ flux
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil
1/16 (1.6)	ED010996
5/64 (2.0)	ED011002
3/32 (2.4)	ED010999
1/8 (3.2)	ED010998
5/32 (4.0)	EDS11001

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Cr	%Ni	%Mo	%Ti	%Zr	%Al	%V	%S	%P	%Cu
Lincolnweld® LA-100	0.10	1.25-1.80	0.20-0.60	0.30	1.40-2.10	0.25-0.55	0.10	0.10	0.10	0.05	0.015	0.010	0.25

[1]Single values are maximums.

Lincolnweld® LC-72

AWS EC1 • Mild Steel Cored Electrode

Key Features

- A cored wire designed to increase deposition rates 10-30% when used with 980 flux
- Designed to provide optimal bead shape, penetration, and slag removal in semiautomatic submerged arc welding
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.17/A5.17M: 1997 EC1

Recommended Fluxes

Lincolnweld® 980™

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (23 kg) Coil	300 lb (136 kg) Speed Feed® Reel	600 lb (272 kg) Speed Feed® Reel	600 lb (272 kg) Speed Feed® Drum
5/64 (2.0)	ED011099		EDS27184	
3/32 (2.4)	ED011098	EDS01186		EDS01187

DEPOSIT COMPOSITION - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%S	%P	%Cu
Lincolnweld® LC-72[1]	0.15	1.8	0.9	0.035	0.035	0.35

Lincolnweld® LAC-B2

AWS ECB2 • Low Alloy Cored Electrode

Key Features

- Designed to weld with either single or tandem arcs using a neutral flux
- A cost-effective choice when welding 1 1/4% chromium, 1/2% molybdenum steels where a low Bruscato factor (X-factor) is not required
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007 ECB2

Recommended Fluxes

Lincolnweld® 880™, 880M®

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (23 kg) Coil	600 lb (272 kg) Speed Feed® Drum
3/32 (2.4)	ED010954	ED019581
5/32 (4.0)	ED010955	ED019582

[1]Limits are for weld metal deposited with a particular flux (Lincolnweld® 980™ flux).

Lincolnweld® LAC-Ni2

AWS ECNi2 • Low Alloy Cored Electrode

Conformances

AWS A5.23/A5.23M: 2007 ECNi2

Recommended Fluxes

Lincolnweld® 880™, 880M®, 882™, 888™, 980™

Key Features

- A 2% nickel electrode used primarily in weathering steel applications
- When used with 888 flux, it can produce impact properties exceeding 27 J (20 ft•lbf) at -73°C (-100°F)
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (23 kg) Coil
3/32 (2.4)	ED010986

Lincolnweld® LAC-690

Low Alloy Cored Electrode • AWS ECG

Key Features

- Combine with Lincolnweld® 888™ flux for H4 diffusible hydrogen weld deposits.
- Charpy V-notch test results capable of exceeding 27 J (20 ft•lbf) @ -73°C (-100°F) with Lincolnweld® 888™ flux.
- Excellent Tandem, AC and DC Operation
- Clean and easy slag removal minimizes risk of inclusions, even in narrow gap applications.
- Actual (Type 3.1) certificates for each lot of wire showing chemical composition are available in the certificate center of lincolnelectric.com

Conformances

AWS A5.23/A5.23M: 2007 F11A10-ECG-G-H4
F11P6-ECG-G-H4

Recommended Fluxes

Lincolnweld® 888™

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (23 kg) Coil
3/32 (2.4)	ED032958
1/8 (3.2)	ED032959
5/32 (4.0)	ED033302

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%S	%P
Lincolnweld® LAC-690[2]	0.08	1.51	0.36	0.007	0.011
	%Cr	**%Ni**	**%Mo**	**%Cu**	**Diffusible Hydrogen (mL/100g weld deposit)**
Lincolnweld® LAC-690[2]	0.36	2.59	0.44	0.04	3.6

[1]See test results disclaimer on pg. 18. [2]Limits are for weld metal deposited with a particular flux (Lincolnweld® 888™ flux).

STAINLESS

Stick Electrode
Excalibur® 308/308L-15 206
Excalibur® 308L-16 207
Excalibur® 308/308H-16 208
Excalibur® 308/308L-17 209
Excalibur® 309/309L-15 210
Excalibur® 309/309L-16 211
Excalibur® 309/309L-17 212
Excalibur® 316/316L-15 213
Excalibur® 316/316L-16 214
Excalibur® 316/316L-17 215
Tech-Rod® 308/308H 216
Tech-Rod® 308/308L 217
Tech-Rod® 309/309L 218
Tech-Rod® 310 219
Tech-Rod® 312 220
Tech-Rod® 316/316L 221
Tech-Rod® 317L 222
Tech-Rod® 320LR 223
Tech-Rod® 330 224
Tech-Rod® 347 225
Tech-Rod® 385 226
Tech-Rod® 410 227
Tech-Rod® 410NiMo 228
Tech-Rod® 630 229
Tech-Rod® 2209 230
Tech-Rod® 2594 231

MIG Wire
Blue Max® MIG 308LSi 232
Blue Max® MIG 309LSi 234
Blue Max® MIG 316LSi 236
Blue Max® LNM 307 238
Blue Max® LNM 347Si 239
Blue Max® LNM 4462 240
Techalloy® 307 241
Techalloy® 308/308H 242
Techalloy® 308/308L 243
Techalloy® 308LHS 244
Techalloy® 309/309L 245
Techalloy® 309LHS 246
Techalloy® 309LMo 247
Techalloy® 310 248
Techalloy® 312 249
Techalloy® 316/316L 250
Techalloy® 316LHS 251
Techalloy® 317L 252
Techalloy® 320LR 253
Techalloy® 330 254
Techalloy® 347 255
Techalloy® 385 256
Techalloy® 409Nb 257
Techalloy® 410 258
Techalloy® 410NiMo 259
Techalloy® 630 260
Techalloy® 2209 261
Techalloy® 2594 262

Flux-Cored (FCAW-G) Wire
UltraCore® FC 308L 263
UltraCore® FCP 308L 264
UltraCore® FC 309L 266
UltraCore® FCP 309L 268
UltraCore® FC 316L 270
UltraCore® FCP 316L 272
SuperCore® 347 274
SuperCore® 2205P 275

Submerged Arc Wire
Lincolnweld® 308/308L 276
Lincolnweld® 309/309L 277
Lincolnweld® 316/316L 278

Submerged Arc Flux
Lincolnweld® P2000™ 279
Lincolnweld® P2007™ 280
Lincolnweld® ST-100™ 281

TIG Cut Length
Lincoln® ER308/308L 282
Lincoln® ER309/309L 283
Lincoln® ER316/316L 284
Blue Max® LNT 4462 285

Metal-Cored Wire
PRIMALLOY™ T-409Ti 286
PRIMALLOY™ T-439Ti 287

Excalibur® 308/308L-15

Stainless • AWS E308-15, E308L-15

Key Features

- Flux coating is fast freezing for vertical down welding
- Versatile electrode designed to weld several types of austenitic steels
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

Typical Applications

- 304 and 304L stainless steels
- Common austenitic stainless steels referred to as "18-8" steels

Conformances

AWS A5.4/A5.4M: 2006	E308-15, E308L-15
ASME SFA-A5.4:	E308-15, E308L-15
ABS:	E308-15, E308L-15

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033087
1/8 (3.2)	12 (300)	ED033088

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E308-15	Not Specified	550 (80) min.	35 min.	Not Specified
AWS E308L-15	Not Specified	520 (75) min.	35 min.	Not Specified
Test Results[3] - As-Welded	455 (66)	625 (91)	44	8 -10

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E308L-15	0.04 max.	18.0-21.0	9.0-11.0	0.75 max.	0.5-2.5
Typical Performance[3]	≤0.03	≤19.9	9.9-10.2	0.05-0.09	0.7-0.8
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E308L-15	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.69-0.73	≤0.02	≤0.01	≤0.08	

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 3/32 in (2.4 mm)	1/8 in (3.2 mm)
DC+	60-70	90-100

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E308-15 is 0.08% max. carbon.

Excalibur® 308L-16

AWS E308L-16 • Stainless

Typical Applications

- Type 302, 304 and 308 stainless steels
- A743 and A744 Type CF-8 cast material

Conformances

AWS A5.4/A5.4M: 2006	E308L-16
ASME SFA-A5.4:	E308L-16
ABS:	E308L-16
CWB/CSA W48-06:	E308L-16
MIL-E-22200/2:	MIL-308L-16

Welding Positions

All, except vertical down

Key Features

- Flux coating provides smooth arc transfer in all welding positions, except vertical down
- Versatile electrode designed to weld several types of austenitic stainless steels
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033079	
1/8 (3.2)	14 (350)		ED033080
5/32 (4.0)	14 (350)		ED033081
3/16 (4.8)	14 (350)		ED033082

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS E308L-16	Not Specified	520 (75) min.	35 min.	Not Specified
Typical Performance[3] - As-Welded	370-420 (54-61)	540-595 (78-86)	50-55	8-9

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E308L-16	0.04-0.08[4]	18.0-21.0	9.0-11.0	0.75 max.	0.5-2.5
Typical Performance[3]	0.02-0.03	19.5-19.8	9.7-10.3	0.04-0.13	0.6-0.9

	%Si	%P	%S	%Cu
Requirements - AWS E308L-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.
Typical Performance[3]	0.29-0.36	≤0.03	≤0.02	≤0.10

TYPICAL OPERATING PROCEDURES

Polarity[5]	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	60-100	90-140	120-185
AC	40-70	60-100	90-140	120-185

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E308-16 is 0.08% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 308/308H-16

Stainless • AWS E308-16, E308H-16

Key Features

- Flux coating provides smooth transfer for all position except vertical down
- Versatile electrode designed to weld several types of austenitic steels
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online

Welding Positions

All, except vertical down

Typical Applications

- 304 and 304L stainless steels
- ASTM A743 or A744 Types CF-8 and CF-5
- Common austenitic stainless steels referred to as "18-8" steels

Conformances

AWS A5.4/A5.4M: 2006	E308-16, E308H-16
ASME SFA-A5.4:	E308-16, E308H-16
ABS:	E308-16, E308H-16
CWB/CSA W48-06:	E308-16, E308H-16
MIL-E-22200/2:	MIL-308-16

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033083	
1/8 (3.2)	14 (350)		ED033084
5/32 (4.0)	14 (350)		ED033085
3/16 (4.8)	14 (350)		ED033086

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E308-16	Not Specified	550 (80) min.	35 min.	Not Specified
AWS E308H-16	Not Specified	550 (80) min.	35 min.	Not Specified
Typical Performance[3] - As-Welded	435-545 (63-79)	595-640 (86-93)	41-48	2-4

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E308H-16	0.04 - 0.08[4]	18.0 - 21.0	9.0 - 11.0	0.75 max.	0.5 - 2.5
Typical Performance[3]	0.05 - 0.06	19.7 - 20.3	9.9 - 10.1	0.03 - 0.07	0.7 - 0.8
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E308H-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.30 - 0.40	≤0.03	≤0.02	≤0.17	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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	60 - 100	90 - 140	120 - 185
AC	40 - 70	60 - 100	90 - 140	120 - 185

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E308L-16 is 0.04% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 308/308L-17

Stainless • AWS E308-17, E308L-17

Typical Applications

- 304 and 304L stainless steels
- Common austenitic stainless steels referred to as "18-8" steels
- ASTM A743 or A744 Types CF-8 and CF-6

Conformances

AWS A5.4/A5.4M: 2006	E308-17, E308L-17
ASME SFA-A5.4:	E308-17, E308L-17
CWB/CSA W48-06:	E308-17, E308L-17

Welding Positions

Flat & Horizontal

Key Features

- Flux coating provides smooth arc transfer in the flat and horizontal positions
- Versatile electrode designed to weld several types of austenitic stainless steels
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)		ED033089	
1/8 (3.2)	14 (350)	ED033093		ED033090
5/32 (4.0)	14 (350)			ED033091
3/16 (4.8)	14 (350)			ED033092

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E308-17	Not Specified	550 (80) min.	35 min.	Not Specified
AWS E308L-17	Not Specified	520 (75) min.	35 min.	Not Specified
Typical Performance[3] - As-Welded	425 - 470 (62 - 68)	585 - 635 (85 - 92)	42 - 50	6 - 11

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E308L-17	0.04 max.	18.0 - 21.0	9.0 - 11.0	0.75 max.	0.5 - 2.5
Typical Performance[3]	≤0.03	20.0 - 20.5	9.7 - 9.9	≤0.20	0.6 - 0.7
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E308L-17	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.56 - 0.77	≤0.03	≤0.02	≤0.22	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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 - 80	75 - 110	95 - 150	130 - 200
AC	40 - 80	75 - 110	95 - 150	130 - 200

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E308-17 is 0.08% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 309/309L-15

AWS E309-15, E309L-15 • Stainless

Key Features

- Flux coating is fast freezing for vertical down welding
- Designed for joining stainless steel to mild or low alloy steel.
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

Typical Applications

- Joining stainless steel to mild or low alloy steel
- ASTM A240 Type 309S

Conformances

AWS A5.4/A5.4M: 2006:	E309-15, E309L-15
ASME SFA-A5.4:	E309-15, E309L-15
ABS:	E309-15, E309L-15

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033098
1/8 (3.2)	12 (300)	ED033099

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E309-15	Not Specified	550 (80) min.	30 min.	Not Specified
AWS E309L-15	Not Specified	520 (75) min.	30 min.	Not Specified
Test Results[3] - As-Welded	490 (71)	640 (93)	38	6-8

DEPOSIT COMPOSITION[1]

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E309L-15	0.04 max.	22.0-25.0	12.0-14.0	0.75 max.	0.5-2.5
Typical Performance[3]	≤0.03	23.6-23.9	13.6-13.8	0.03-0.05	0.7-1.0

	%Si	%P	%S	%Cu
Requirements - AWS E309L-15	1.00 max.	0.04 max.	0.03 max.	0.75 max.
Typical Performance[3]	0.74-0.82	≤0.02	≤0.01	≤0.06

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[5]	3/32 in (2.4 mm)	1/8 in (3.2 mm)
DC+	60-70	90-100

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E309-15 is 0.15% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 309/309L-16

Stainless • AWS E309-16, E309L-16

Typical Applications

- Joining stainless steel to mild or low alloy steel
- ASTM A240 Type 309S

Conformances

AWS A5.4/A5.4M: 2006:	E309-16, E309L-16
ASME SFA-A5.4:	E309-16, E309L-16
ABS:	E309-16, E309L-16
CWB/CSA W48-06:	E309-16, E309L-16
MIL-E-22200/2:	MIL-309-16, MIL-309L-16

Welding Positions

All, except vertical down

Key Features

- Flux coating provides smooth arc transfer in all welding positions, except vertical down
- Designed for joining stainless steel to mild or low alloy steel
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033097	
1/8 (3.2)	14 (350)		ED033094
5/32 (4.0)	14 (350)		ED033095
3/16 (4.8)	14 (350)		ED033096

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E309-16	Not Specified	550 (80) min.	30 min.	Not Specified
AWS E309L-16	Not Specified	520 (75) min.	30 min.	Not Specified
Typical Performance[3] - As-Welded	455-470 (66-68)	580-585 (84-85)	38-47	10-18

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E309L-16	0.04 max.	22.0-25.0	12.0-14.0	0.75 max.	0.5-2.5
Typical Performance[3]	0.02-0.04	23.9-24.5	12.6-13.2	0.05-0.09	1.0-1.5
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E309L-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.33-0.38	≤0.03	≤0.02	≤0.09	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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	60-100	90-140	120-185
AC	40-70	60-100	90-140	120-185

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E309-16 is 0.15% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 309/309L-17

AWS E309-17, E309L-17 • Stainless

Key Features

- Flux coating provides for smooth arc transfer in the flat and horizontal positions
- Designed for joining stainless steel to mild or low alloy steel
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

Typical Applications

- Joining stainless steel to mild or low alloy steel
- ASTM A240 Type 309S

Conformances

AWS A5.4/A5.4M: 2006:	E309-17, E309L-17
ASME SFA-A5.4:	E309-17, E309L-17
ABS:	E309-17, E309L-17
CWB/CSA W48-06:	E309-17, E309L-17

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033100	
1/8 (3.2)	14 (350)		ED033101
5/32 (4.0)	14 (350)		ED033102
3/16 (4.8)	14 (350)		ED033103

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E309-17	Not Specified	550 (80) min.	30 min.	Not Specified
AWS E309L-17	Not Specified	520 (75) min.	30 min.	Not Specified
Typical Performance[3] - As-Welded	455-490 (66-71)	585-620 (85-90)	37-45	7-11

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E309L-17	0.04 max.	22.0-25.0	12.0-14.0	0.75 max.	0.5-2.5
Typical Performance[3]	0.02-0.04	23.5-24.0	13.0-13.5	0.05-0.09	0.7-0.9

	%Si	%P	%S	%Cu
Requirements - AWS E309L-17	1.00 max.	0.04 max.	0.03 max.	0.75 max.
Typical Performance[3]	0.72-0.77	≤0.03	≤0.01	≤0.17

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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+	40-80	75-110	95-150	130-200
AC	40-80	75-110	95-150	130-200

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E309-17 is 0.15% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 316/316L-15

Stainless • AWS E316-15, E316L-15

Typical Applications

- Molybdenum bearing austenitic stainless steels
- Type 316 and 316L

Conformances

AWS A5.4/A5.4M: 2006:	E316-15, E316L-15
ASME SFA-A5.4:	E316-15, E316L-15
ABS:	E316-15, E316L-15
CWB/CSA W48-06:	E316-15, E316L-15

Welding Positions

All

Key Features

- Flux coating is fast freezing for vertical down welding
- Molybdenum grade for increased corrosion resistance
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033108
1/8 (3.2)	12 (300)	ED033109

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E316-15	Not Specified	520 (75) min.	30 min.	Not Specified
AWS E316L-15	Not Specified	490 (70) min.	30 min.	Not Specified
Test Results[3] - As-Welded	470 (68)	620 (90)	38	4 - 12

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E316L-15	0.04 max.	17.0-20.0	11.0-14.0	2.0-3.0	0.05-2.5
Typical Performance[3]	≤0.02	18.6-19.3	12.0-12.4	2.2-2.6	≤0.7
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E316L-15	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.72-0.74	≤0.02	≤0.01	≤0.24	

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 3/32 in (2.4 mm)	1/8 in (3.2 mm)
DC+	60-70	90-100

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E316-15 is 0.08% max. carbon.

Excalibur® 316/316L-16

AWS E316-16, E316L-16 • Stainless

Key Features

- Flux coating provides smooth arc transfer in all welding positions, except vertical down
- Molybdenum grade for increased corrosion resistance
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Designed with low carbon levels to help eliminate carbide precipitation in high temperature service

Typical Applications

- Molybdenum bearing austenitic stainless steels
- Type 316 and 316L

Conformances

AWS A5.4/A5.4M: 2006	E316-16, E316L-16
ASME SFA-A5.4:	E316-16, E316L-16
ABS:	E316-16, E316L-16
CWB/CSA W48-06:	E316L-16
MIL-E-22200/2:	MIL-316-16, MIL-316L-16

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033104	
1/8 (3.2)	14 (350)		ED033105
5/32 (4.0)	14 (350)		ED033106
3/16 (4.8)	14 (350)		ED033107

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E316-16	Not Specified	520 (75) min.	30 min.	Not Specified
AWS E316L-16	Not Specified	490 (70) min.	30 min.	Not Specified
Typical Performance[3] - As-Welded	425-450 (62-65)	560-585 (81-85)	40-54	8-13

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E316L-16	0.04 max.	17.0-20.0	11.0-14.0	2.0-3.0	0.05-2.5
Typical Performance[3]	0.03-0.04	18.7-19.2	11.4-12.1	2.2-2.4	0.7-0.9
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E316L-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.29-0.39	≤0.02	≤0.02	≤0.26	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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	60-100	90-140	120-185
AC	40-70	60-100	90-140	120-185

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E316-16 is 0.08% max. carbon. [5]Preferred polarity is listed first.

Excalibur® 316/316L-17

Stainless • AWS E316-17, E316L-17

Conformances

AWS A5.4/A5.4M: 2006:	E316-17, E316L-17
ASME: SFA-A5.4:	E316-17, E316L-17
CWB/CSA W48-06:	E316-17, E316L-17

Welding Positions

Flat & Horizontal

Key Features

- Substantial ferrite content for crack resistance
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online

Typical Applications

- 316 and 316L stainless steel
- ASTM A240 Type 316 and 316L
- ASTM A743 or A744 Types CF-8M and CF-3M
- For joining extra low carbon molybdenum bearing austenitic stainless steels

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can	10 lb (4.5 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033110	
1/8 (3.2)	14 (350)		ED033111
5/32 (4.0)	14 (350)		ED033112
3/16 (4.8)	14 (350)		ED033113

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.4/A5.4M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E316-17	Not Specified	520 (75) min.	30 min.	Not Specified
AWS E316L-17	Not Specified	490 (70) min.	30 min.	Not Specified
Test Results[3] - As-Welded	469 (68)	586 (85)	45	13

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS E316L-17	0.04 max.	17.0-20.0	11.0-14.0	2.0-3.0	0.5-2.5
Typical Performance[3]	≤0.03	19.1-19.7	11.6-12.7	2.1-2.4	0.8-1.0
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS E316L-17	1.00 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Performance[3]	0.61-0.72	≤0.02	≤0.01	≤0.26	

TYPICAL OPERATING PROCEDURES

	Current (Amps)			
Polarity[5]	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+	40-80	75-110	95-150	130-200
AC	40-80	75-110	95-150	130-200

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for E316-17 is 0.08% max. carbon. [5]Preferred polarity is listed first.

Tech-Rod® 308/308H

Stainless • AWS E308-16/308H-16

Key Features

- Used to weld unstabilized austenitic stainless steels such as 302, 304H and 305.
- Provide a high carbon deposit (minimum of 0.04% carbon) for high temperature applications.

Welding Positions

All, except vertical down

Conformances

AWS A5.4/A5.4M: 2010: E308-16/308H-16

ASME SFA-A5.4: E308-16/308H-16

Typical Applications

- Chemical Process & Petrochemical
- Catalytic Crackers
- Pulp and Paper

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Tube 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	EL308H16093632	
1/8 (3.2)	14 (355)		EL308H16125634
5/32 (4.0)	14 (355)		EL308H16156634
3/16 (4.8)	14 (355)		EL308H16187634

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS 308H-16	0.04-0.08	18.0 - 21.0	9.0 - 11.0	0.75 max.	0.5 - 2.5
Typical Results[2] Tech-Rod® 308/308H	0.05	19.7	9.9	0.16	1.5
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS 308H-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 308/308H	0.53	0.02	0.01	0.11	4 - 9

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 308/308L

AWS E308-16/308L-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010:	E308-16/308L-16
ASME SFA-A5.4:	E308-16/308L-16

Typical Applications

- 304 Steels

Key Features

- A weld deposit, with reduced carbon levels (0.04% max) that offers increased resistance to inter-granular corrosion.
- Type 308L is ideal for welding.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Tube 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	EL308L16093632	
1/8 (3.2)	14 (355)		EL308L16125634
5/32 (4.0)	14 (355)		EL308L16156634
3/16 (4.8)	14 (355)		EL308L16187634

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Mn	%P	%S	%Si
Requirements AWS E308-16/308L-16	0.04 max.	0.5 - 2.5	0.04 max.	0.03 max.	1.00 max.
Typical Results[2] Tech-Rod® 308/308L	0.03	1.6	0.03	0.01	0.52
	%Cr	**%Ni**	**%Mo**	**%Cu**	**FN**
Requirements AWS E308-16/308L-16	18.0 - 21.0	9.0 - 11.0	0.75 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 308/308L	19.7	9.9	0.16	0.14	6 - 11

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 309/309L

Stainless • AWS E309-16/309L-16

Key Features

- Ideal for joining stainless steels to themselves or to carbon or low alloy steels, and can be used at temperatures of up to 700°F (371°C).
- Reduced carbon levels help prevent intergranular corrosion.
- Reduced carbon levels (0.04% max) that offers increased resistance to inter-granular corrosion.

Conformances

AWS A5.4/A5.4M: 2010:	E309-16/309L-16
ASME SFA-A5.4:	E309-16/309L-16

Typical Applications

- Do not exceed service temperatures of 700°F (371°C).

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Tube 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	EL309L16093632	
1/8 (3.2)	14 (355)		EL309L16125634
5/32 (4.0)	14 (355)		EL309L16156634
3/16 (4.8)	14 (355)		EL309L16187634

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS 309L-16	0.04 max.	22.0 - 25.0	12.0 - 14.0	0.75 max.	0.5 - 2.5
Typical Results[2] Tech-Rod® 309/309L	0.03	23.8	12.9	0.06	1.6
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS 309L-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 309/309L	0.54	0.02	0.01	0.04	8 - 15

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 310-16

AWS E310-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010: E310-16

ASME SFA-A5.4: E310-16

Typical Applications

- Head Shields
- Furnace Parts
- Ducting

Key Features

- Used for welding stainless steels of similar composition in cast and wrought forms.
- The weld deposit is fully austenitic, and as such, calls for minimal heat input during welding.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED034993	
1/8 (3.2)	14 (355)		ED034994
5/32 (4.0)	14 (355)		ED034995

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E310-16	0.08 - 0.20	25.0 - 28.0	20.0 - 22.5	0.75 max.	1.0 - 2.5
Typical Results[2]	0.11	25.5	21.0	0.1	2.0
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E310-16	0.75 max.	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2]	0.58	0.02	0.01	0.02	–

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 312-16

Stainless • AWS E312-16

Key Features

- Used to weld cast and wrought alloys of similar compositions.
- Can be used for joining hard to weld materials and dissimilar metals.
- Applications should be limited to 800°F (420°C).
- The weld deposits exhibit high tensile strength and offer some resistance to abrasion.

Conformances

AWS A5.4/A5.4M: 2010:	E312-16
ASME SFA-A5.4:	E312-16

Typical Applications

- Tool Steels
- Hard to Weld Steels
- Cast and Wrought Alloys
- Dissimilar Metals

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
1/8 (3.2)	14 (355)	ED034996
5/32 (4.0)	14 (355)	ED034997
3/16 (4.8)	14 (355)	ED034998

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E312-16	0.15 max.	28.0 - 32.0	8.0 - 10.5	0.75 max.	0.5 - 2.5
Typical Results[2]	0.12	29.4	9.4	0.15	1.4
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E312-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2]	0.57	0.02	0.01	0.06	30 - 60

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 316/316L

AWS E316-16/E316L-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010: E316-16/E316L-16

ASME SFA-A5.4: E316-16/E316L-16

Typical Applications

- Power Generation
- Chemical and Petrochemical Processing

Key Features

- Used for welding 316L base metals.
- The 2-3% molybdenum in the electrode improves pitting corrosion resistance of the weld deposit.
- Low carbon content reduces the possibility of carbide precipitation and intergranular corrosion.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Tube 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	EL316L16093632	
1/8 (3.2)	14 (355)		EL316L16125634
5/32 (4.0)	14 (355)		EL316L16156634
3/16 (4.8)	14 (355)		EL316L16187634

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E316L-16	0.04 max.	17.0 - 20.0	11.0 - 14.0	2.0 - 3.0	0.5 - 2.5
Typical Results[2]	0.02	18.4	12.3	2.4	1.5
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E316L-16	1.00 max.	0.04 max	0.03 max.	0.75 max.	Not Required
Typical Results[2]	0.51	0.02	0.01	0.16	4 - 9

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 317L

Stainless • AWS E317L-16

Key Features

- A weld deposit similar to 316L with a higher molybdenum content.
- Electrodes are used for welding alloys with similar compositions used in highly corrosive environments.

Conformances

AWS A5.4/A5.4M: 2010:	E317L-16
ASME SFA-A5.4:	E317L-16

Typical Applications

- FGP
- Chemical Processing Plants
- Condensors
- Petrochemical

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Tube 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	EL317L16093632	
1/8 (3.2)	14 (355)		EL317L16125634
5/32 (4.0)	14 (355)		EL317L16156634

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E317L-16	0.04 max.	18.0 - 21.0	12.0 - 14.0	3.0 - 4.0	0.5 - 2.5
Typical Results[2] Tech-Rod® 317L	0.02	19.7	13.1	3.6	1.4
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E317L-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 317L	0.48	0.02	0.01	0.15	4 - 9

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 320LR-16

AWS E320LR-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010: E320LR-16

ASME SFA-A5.4: E320LR-16

Typical Applications

- Process Piping
- Heat Exchangers
- Chemical Processing Industry

Key Features

- Are typically used for welding base metals with similar compositions including alloy 20.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED034999	
1/8 (3.2)	14 (355)		ED035000
5/32 (4.0)	14 (355)		ED035001
3/16 (4.8)	14 (355)		ED035002

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Nb+Ta	%Mn
Requirements AWS E320LR-16	0.03 max.	19.0 - 21.0	32.0 - 36.0	2.0 - 3.0	0.4 max.	1.50 - 2.50
Typical Results[2] Tech-Rod® 320LR	0.02	19.9	33.8	2.3	0.1	1.70
	%Si	**%P**	**%S**	**%Cu**	**FN**	
Requirements AWS E320LR-16	0.30 max.	0.020 max.	0.015 max.	3.0 - 4.0	Not Required	
Typical Results[2] Tech-Rod® 320LR	0.16	0.016	0.006	3.2	–	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 330-16

Stainless • AWS E330-16

Key Features

- Used to weld wrought and cast forms of stainless steels of similar chemical compositions, which offer good heat and scale resistance to 1800°F (980°C).
- High sulfur environments adversely affect the high temperature performance.
- The heat input must be kept to a minimum during welding to avoid the possibility of micro-fissuring.

Conformances

AWS A5.4/A5.4M: 2010: E330-16

ASME SFA-A5.4: E330-16

Typical Applications

- Heat Treatment
- Furnace Environments

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED035003	
1/8 (3.2)	14 (355)		ED035004
5/32 (4.0)	14 (355)		ED035005

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E330-16	0.18 - 0.25	14.0 - 17.0	33.0 - 37.0	0.75 max.	1.0 - 2.5
Typical Results[2] Tech-Rod® 330	0.21	15.5	34.3	0.13	1.7
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E330-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 330	0.49	0.02	0.003	0.06	–

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 347-16

AWS E347-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010: E347-16

ASME SFA-A5.4: E347-16

Typical Applications

- Food Processing
- Pharmaceutical Equipment

Key Features

- Niobium stabilized stainless steel electrodes used for the welding of types 347 and 321 stainless and stainless clad steels.
- The addition of niobium reduces intergranular corrosion in severe operating conditions.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED035006	
1/8 (3.2)	14 (355)		ED035007
5/32 (4.0)	14 (355)		ED035008
3/16 (4.8)	14 (355)		ED035009

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Nb+Ta	%Mn
Requirements AWS E347-16	0.08 max.	18.0 - 21.0	9.0 - 11.0	0.75 max.	8 x C to 1.00 max.	0.5 - 2.5
Typical Results[2] Tech-Rod® 347	0.03	19.5	10.1	0.19	0.36	1.5
	%Si	**%P**	**%S**	**%Cu**	**FN**	
Requirements AWS E347-16	1.00 max.	0.04 max.	0.03 max.	0.75 max.	Not Required	
Typical Results[2] Tech-Rod® 347	0.54	0.02	0.01	0.16	5 - 10	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 385-16

Stainless • AWS E385-16

Key Features

- Used for welding materials of similar chemical composition (type 904L).
- Used in fabrication of equipment and vessels for handling and storage of sulfuric acid and phosphoric acid.
- The weld metal is fully austenitic, and must be done with low heat input, using a stringer bead technique.

Conformances

AWS A5.4/A5.4M: 2010:	E385-16
ASME SFA A5.4:	E385-16

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
1/8 (3.2)	14 (355)	ED035010
5/32 (4.0)	14 (355)	ED035011

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E385-16	0.03 max.	19.5 - 21.5	24.0 - 26.0	4.2 - 5.2	1.0 - 2.5
Typical Results[2]	0.02	20.4	24.9	4.8	1.4
	%Si	**%P**	**%S**	**%Cu**	
Requirements AWS E385-16	0.90 max.	0.03 max.	0.02 max.	1.2 - 2.0	
Typical Results[2]	0.34	0.01	0.01	1.6	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 410-16

AWS E410-16 • Stainless

Conformances

AWS A5.4/A5.4M: 2010: E410-16

ASME SFA-A5.4: E410-16

Typical Applications

- Surfacing Steel Mill Rolls
- Furnace and Burner Parts
- Turbine Parts

Welding Positions

All, except vertical down

Key Features

- Designed to weld stainless steels of similar chemical composition as well as to overlay carbon steels to impart corrosion, erosion and abrasion resistance.
- This material, being an air-hardening type, calls for a pre-heat and inter-pass temperature of not less than 400°F (200°C) during welding.

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
1/8 (3.2)	14 (355)	ED035012
5/32 (4.0)	14 (355)	ED035013
3/16 (4.8)	14 (355)	ED035014

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E410-16	0.12 max.	11.0 - 13.5	0.7 max.	0.75 max.	1.0 max.
Typical Results[2]	0.08	12.2	0.2	0.01	0.7
	%Si	**%P**	**%S**	**%Cu**	
Requirements AWS E410-16	0.90 max.	0.04 max.	0.03 max.	0.75 max.	
Typical Results[2]	0.40	0.02	0.01	0.06	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 410NiMo-16

Stainless • AWS E410NiMo-16

Key Features

- Designed to weld materials of similar chemical composition in cast and wrought forms.
- This electrode is also used to overlay mild and low alloy steels.
- Preheat and inter-pass temperatures of not less than 300°F (150°C) are recommended during welding.
- Post-weld heat treatment should not exceed 1150°F (620°C) as higher temperatures may result in hardening.

Conformances

AWS A5.4/A4.5M: 2010:	E410NiMo-16
ASME SFA-A5.4:	E410NiMo-16

Typical Applications

- Turbines
- Valve Bodies
- High Pressure Piping
- Offshore
- Power Generation

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
1/8 (3.2)	14 (355)	ED035015
5/32 (4.0)	14 (355)	ED035016
3/16 (4.8)	14 (355)	ED035018

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS E410NiMo-16	0.06 max.	11.0 - 12.5	4.0 - 5.0	0.40 - 0.70	1.0 max.
Typical Results[2] Tech-Rod® 410NiMo	0.02	11.7	4.6	0.58	0.5
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS E410NiMo-16	0.90 max.	0.04 max.	0.03 max.	0.75 max.	Not Required
Typical Results[2] Tech-Rod® 410NiMo	0.37	0.02	0.01	0.07	–

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage	
		Flat	Vertical & Overhead
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 630-16

AWS E630-16 • Stainless

Conformances

AWS A5.4/A4.5M: 2010: E630-16

ASME SFA-A5.4: E630-16

Typical Applications

- Hydraulic Equipment
- Impellers
- Pump Shafts

Key Features

- A precipitation hardening stainless steel covered electrode used for welding materials of similar chemical composition such as 17-4 and 17-7.
- Can be used in the as welded condition or may be heat treated to obtain higher strength.
- Mechanical properties of the alloy are greatly influenced by the heat treatment.

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED035019	
1/8 (3.2)	14 (355)		ED035020
5/32 (4.0)	14 (355)		ED035021
3/16 (4.8)	14 (355)		ED035022

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Nb+Ta
Requirements AWS E630-16	0.05 max.	16.00 - 16.75	4.5 - 5.0	0.75 max.	0.15 - 0.30
Typical Results[2] Tech-Rod® 630	0.03	16.30	4.8	0.11	0.16
	%Mn	**%Si**	**%P**	**%S**	**%Cu**
Requirements AWS E630-16	0.25 - 0.75	0.75 max.	0.04 max.	0.03 max.	3.25 - 4.00
Typical Results[2] Tech-Rod® 630	0.62	0.36	0.02	0.01	3.43

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 2209-16

Stainless • AWS E2209-16

Key Features

- Used to weld duplex stainless steels such as (Type 2205).
- The welds offer excellent resistance to stress corrosion, cracking and pitting.
- The microstructure of the weld metal consists of austenite and ferrite.
- The ferrite content of the weld metal will be lower than the ferrite content of type 2205 base metal.
- Welding of duplex stainless steels calls for controlled welding parameters to achieve specified mechanical and corrosion resistant properties.

Conformances

AWS A5.4/A4.5M: 2010:	E2209-16
ASME SFA-A5.4:	E2209-16

Typical Applications

- Offshore
- Oil and Gas
- Chemical
- Petrochemical

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED034985	
1/8 (3.2)	14 (355)		ED034986
5/32 (4.0)	14 (355)		ED034987
3/16 (4.8)	14 (355)		ED034988

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements AWS E2209-16	0.04 max.	21.5 - 23.5	8.5 - 10.5	2.5 - 3.5	0.5 - 2.0	1.0 max.
Typical Results[2] Tech-Rod® 2209	0.02	22.3	9.5	3.2	1.1	0.5
	%P	**%S**	**%N**	**%Cu**	**FN**	
Requirements AWS E2209-16	0.04 max.	0.03 max.	0.08 - 0.20	0.75 max.	Not Required	
Typical Results[2] Tech-Rod® 2209	0.02	0.01	0.16	0.06	30 - 60	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Excalibur® 2594-16

AWS E2594-16 • Stainless

Conformances

AWS A5.4/A4.5M: 2010: E2594-16

ASME SFA-A5.4: E2594-16

Typical Applications

- Process Pipework
- Pumps and Valves
- Pressure Vessels

Welding Positions

All, except vertical down

Key Features

- A super-duplex grade electrode that provides matching chemistry and mechanical property characteristics to wrought super-duplex alloys such as 2507 and Zeron 100, as well as to super-duplex casting alloys (ATSM A890).
- The electrode is over-alloyed 2-3% in nickel to provide the optimum ferrite/austenite ratio in the finished weld.
- This structure results in high tensile and yield strengths and superior resistance to stress corrosion cracking (SCC) and pitting corrosion.

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (305)	ED034989	
1/8 (3.2)	14 (355)		ED034990
5/32 (4.0)	14 (355)		ED034991
3/16 (4.8)	14 (355)		ED034992

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.4/A5.4M: 2010*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements AWS E2594-16	0.04 max.	24.0 - 27.0	8.0 - 10.5	3.5 - 4.5	0.5 - 2.0	1.00 max.
Typical Results[2] Tech-Rod® 2594	0.02	25.4	9.2	4.2	0.8	0.58
	%P	**%S**	**%N**	**%Cu**	**FN**	
Requirements AWS E2594-16	0.04 max.	0.03 max.	0.20 - 0.30	0.75 max.	Not Required	
Typical Results[2] Tech-Rod® 2594	0.01	0.01	0.22	0.07	30 - 60	

NOTE: Nitrogen in these weld deposits is usually between 0.04% and 0.08%

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Blue Max® MIG 308LSi

Stainless • AWS ER308Si, ER308LSi

Key Features

- High silicon level for increased puddle fluidity and toe wetting
- Proprietary surface lubricant for steady feeding and arc stability
- Versatile electrode designed to weld CrNi austenitic stainless steels
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Controlled ferrite content for maximum corrosion resistance

Typical Applications

- 304 and 304L stainless steels
- Common austenitic stainless steels referred to as "18-8" steels
- ASTM A743 or A744 Types CF-8 and CF-3

Conformances

AWS A5.9/A5.9M: 2006:	ER308Si, ER308LSi
ASME SFA-A5.9:	ER308Si, ER308LSi
ABS:	ER308Si, ER308LSi
CWB/CSA W48-06:	ER308LSi
EN ISO 14343-B:	SS308LSi

Welding Positions

All

Shielding Gas

Short Circuiting Transfer:
90% Helium / 7-1/2% Argon / 2-1/2% CO_2

Axial Spray Transfer:
98% Argon / Balance Oxygen

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool	500 lb (227 kg) Accu-Trak® Drum	1000 lb (454 kg) Precise-Trak™ Reel
0.030 (0.8)	ED023961	ED029768	ED032834
0.035 (0.9)	ED019292	ED029769	
0.045 (1.1)	ED019293		
1/16 (1.6)	ED019294		

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER308Si, ER308LSi	Not Specified			
Test Results[3] - As-Welded	455 (66)	635 (92)	46	13

Blue Max® MIG 308LSi

(AWS ER308Si, ER308LSi)

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[3]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER308LSi	0.03 max.	19.5-22.0	9.0-11.0	0.75 max.	1.0-2.5
Test Results[3]	0.01	19.9	10.0	0.16	2.1
	%Si	**%P**	**%S**	**%N[4]**	**%Cu**
Requirements - AWS ER308LSi	0.65-1.00	0.03 max.	0.03 max.	Not Specified	0.75 max.
Test Results[3]	0.88	0.02	0.01	0.05	0.17

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)
1/16 in (1.6 mm), DC+ 98% Ar/2% O_2	19 (3/4)	4.4 (175)	25	260	4.3 (9.2)
	19 (3/4)	5.1 (200)	26	310	4.9 (10.5)
	19 (3/4)	6.4 (250)	26	330	6.2 (13.1)
	19 (3/4)	7.0 (275)	27	360	6.8 (14.4)
	19 (3/4)	7.6 (300)	28	390	7.4 (15.8)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18. [3]AWS Requirement for ER308Si is 0.08% max. carbon. [4]Included in 0.50% max. for other elements not specified. [5]To estimate ESO, subtract 1/8 in (3 mm) from CTWD.

Blue Max® MIG 309LSi

Stainless • AWS ER309Si, ER309LSi

Key Features

- High silicon level for increased puddle fluidity and toe wetting
- Proprietary surface lubricant for steady feeding and arc stability
- Designed for joining stainless steel to mild or low alloy steel
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Controlled ferrite content for maximum corrosion resistance

Typical Applications

- Joining stainless steel to mild or low alloy steel
- ASTM A240 Type 309S

Conformances

AWS A5.9/A5.9M: 2006:	ER309Si, ER309LSi
ASME SFA-A5.9:	ER309Si, ER309LSi
ABS:	ER309Si, ER309LSi
CWB/CSA W48-06:	ER309LSi
EN ISO 14343-B:	SS309LSi

Welding Positions

All

Shielding Gas

Short Circuiting Transfer:
90% Helium / 7-1/2% Argon / 2-1/2% CO_2

Axial Spray Transfer:
98% Argon / Balance Oxygen

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool	500 lb (227 kg) Accu-Trak® Drum
0.030 (0.8)	ED023962	
0.035 (0.9)	ED019295	ED029770
0.045 (1.1)	ED019296	ED029771
1/16 (1.6)	ED019297	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER309Si, ER309LSi	Not Specified			
Test Results[3] - As-Welded	450 (65)	595 (86)	42	14

Blue Max® MIG 309LSi

(AWS ER309Si, ER309LSi)

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[3]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER309LSi	0.03 max.	23.0-25.0	12.0-14.0	0.75 max.	1.0-2.5
Test Results[3]	0.03	23.5	13.7	0.28	2.0
	%Si	**%P**	**%S**	**%N[4]**	**%Cu**
Requirements - AWS ER309LSi	0.65-1.00	0.03 max.	0.03 max.	Not Specified	0.75 max.
Test Results[3]	0.89	0.02	0.01	0.06	0.22

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)
1/16 in (1.6 mm), DC+ 98% Ar/2% O_2	19 (3/4)	4.4 (175)	25	260	4.3 (9.2)
	19 (3/4)	5.1 (200)	26	310	4.9 (10.5)
	19 (3/4)	6.4 (250)	26	330	6.2 (13.1)
	19 (3/4)	7.0 (275)	27	360	6.8 (14.4)
	19 (3/4)	7.6 (300)	28	390	7.4 (15.8)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18. [3]AWS Requirement for ER309Si is 0.12% max. carbon. [4]Included in 0.50% max. for other elements not specified. [5]To estimate ESO, subtract 1/8 in (3 mm) from CTWD.

Blue Max® MIG 316LSi

Stainless • AWS ER316Si, ER316LSi

Key Features

- High silicon level for increased puddle fluidity and toe wetting
- Proprietary surface lubricant for steady feeding and arc stability
- Molybdenum grade for increased corrosion resistance
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Controlled ferrite content for maximum corrosion resistance

Typical Applications

- Molybdenum bearing austenitic stainless steels
- Type 316 and 316L

Conformances

AWS A5.9/A5.9M: 2006:	ER316Si, ER316LSi
ASME SFA-A5.9:	ER316Si, ER316LSi
ABS:	ER316Si, ER316LSi
CWB/CSA W48-06:	ER316LSi
EN ISO 14343-B:	SS316LSi

Welding Positions

All

Shielding Gas

Short Circuiting Transfer:
90% Helium / 7-1/2% Argon / 2-1/2% CO_2

Axial Spray Transfer:
98% Argon / Balance Oxygen

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool	500 lb (227 kg) Accu-Trak® Drum
0.030 (0.8)	ED023963	
0.035 (0.9)	ED019298	ED029772
0.045 (1.1)	ED019299	ED029773
1/16 (1.6)	ED019300	

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER316Si, ER316LSi	Not Specified			
Test Results[3] - As-Welded	405 (59)	560 (81)	40	10

Blue Max® MIG 316LSi

(AWS ER316Si, ER316LSi)

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[3]	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER316LSi	0.03 max.	18.0-20.0	11.0-14.0	2.0-3.0	1.0-2.5
Test Results[3]	0.02	18.9	11.8	2.2	2.1
	%Si	**%P**	**%S**	**%N[4]**	**%Cu**
Requirements - AWS ER316LSi	0.65-1.00	0.03 max.	0.03 max.	Not Specified	0.75 max.
Test Results[3]	0.81	0.02	0.01	0.05	0.23

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)
1/16 in (1.6 mm), DC+ 98% Ar/2% O_2	19 (3/4)	4.4 (175)	25	260	4.3 (9.2)
	19 (3/4)	5.1 (200)	26	310	4.9 (10.5)
	19 (3/4)	6.4 (250)	26	330	6.2 (13.1)
	19 (3/4)	7.0 (275)	27	360	6.8 (14.4)
	19 (3/4)	7.6 (300)	28	390	7.4 (15.8)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18. [3]AWS Requirement for ER309Si is 0.12% max. carbon. [4]Included in 0.50% max. for other elements not specified. [5]To estimate ESO, subtract 1/8 in (3 mm) from CTWD.

Blue Max® LNM 307

Stainless • Similar to AWS ER307

Key Features

- Designed for joining dissimilar steels
- 7% Mn increases resistance to hot cracking
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online

Typical Applications

- Armor plate
- Non-magnetic austenitic steel
- Hardenable steel
- Work hardening manganese steel

Conformances

Similar to
AWS A5.9/A5.9M: 2006: ER307
EN ISO 14343-A: G 18 8 Mn

Welding Positions

All

Shielding Gas

95% Argon / Balance CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	33 lb (15 kg) Steel Spool
1.2 (0.045)	ED031326

MECHANICAL PROPERTIES[1] – *As Required per AWS Similar to AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)	Charpy V-Notch J (ft•lbf) @ -120°C (-184°F)
Requirements - AWS ER307[4]	Not Specified				
Test Results[3] - As-Welded	400 (58)	630 (91)	40	80 (59)	50 (37)

WIRE COMPOSITION[1] – *As Required per AWS Similar to AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER307[4]	0.04-0.14	19.5-22.0	8.0-10.7	0.5-1.5	3.3-4.75
Test Results[3]	0.08	19.2	9.0	0.3	7.1
	%Si	**%P**	**%S**	**%Cu**	
Requirements - AWS ER307[4]	0.30-0.65	0.03	0.03	0.75	
Test Results[3]	0.80	0.03	0.03	0.30	

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Nearest classification.

Blue Max® LNM 347Si

AWS ER347Si • Stainless

Typical Applications

- AISI 321, 321H, 347, 347H
- CR-8C
- UNS S32100, S32109, S34700, S34709, J92710

Conformances

AWS A5.9/A5.9M:2006: ER347Si
EN ISO 14343-A: G 19 9 NbSi

Shielding Gas

95% Argon / Balance CO_2
97% Argon / Balance O_2

Key Features

- Designed for joining Ti or Nb (Cb) stabilized CrNi steels
- Excellent resistance to intergranular corrosion and oxidizing environments
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	33 lb (15 kg) Steel Spool
1.2 (0.045)	ED031352

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)
Requirements - AWS ER347Si	Not Specified			
Test Results[3] - As-Welded	460 (68)	650 (94)	35	100 (74)

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER347Si	0.08 max.	19.0-21.5	9.0-11.0	0.75 max.	1.0-2.5
Test Results[3]	0.04	19.2	9.9	0.3	1.3
	%Si	**%P**	**%S**	**%Cu**	**Nb[4]**
Requirements - AWS ER347Si	0.65-1.00	0.03max.	0.03max.	0.75max.	10 X C min. / 1.0 max.
Test Results[3]	0.90	0.03	0.02	0.30	0.6

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Included in 0.50% max. for other elements not specified.

Blue Max® LNM 4462

Stainless • AWS ER2209

Key Features

- Premium performance and quality
- Designed for joining duplex stainless steels (2205)
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- Provides high resistance to general corrosion, pitting and stress corrosion
- Composition is controlled to produce consistent mechanical properties
- Designed for 50-50 microsfracture austenitic to ferrite

Typical Applications

- Alloy 2205: UNS S31803, UNS S31500
- Alloy 2304: UNS S32304, UNS S31200

Conformances

AWS A5.9-93:	ER2209
EN ISO 14343-A:	W 22 9 3 N L
TUV, BV, GL & Controlas	

Welding Positions

All

Shielding Gas

95% Argon / Balance CO_2
97% Argon / Balance O_2

DIAMETERS / PACKAGING

Diameter mm (in)	33 lb (15 kg) Steel Spool
0.9 (0.035)	ED033716
1.0 (0.040)	ED031302
1.2 (0.045)	ED031303

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9-93:*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS ER2209	Not Specified			
Test Results[3]	625 (91)	810 (118)	28	40 (30)

WIRE COMPOSITION[1] – *As Required per AWS Similar to AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER2209	0.030 max.	21.5-23.5	7.5-9.5	2.5-3.5	0.5-2.0
Test Results[3]	0.018	22.7	8.5	3.0	1.5
	%Si	**%P**	**%S**	**%Cu**	**%N**
Requirements - AWS ER2209	0.90 max.	0.03 max.	0.03 max.	0.75 max.	0.08-0.20
Test Results[3]	0.50	0.03	0.03	0.30	0.15

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Techalloy® 307

Stainless

Conformances

ISO 14343-A: 18 8 Mn

**Similar to ER307*

Welding Positions

All

Shielding Gas

Short Circuiting Transfer
90% Helium / 7.5% / 2.5 CO_2
Axial Spray Transfer
98% Argon / Balance O_2

Key Features

- Austenitic stainless steel solid wire used extensively in automotive exhaust system applications as wel as joining dissimilar stainless steels.

Typical Applications

- Automotive exhaust systems
- Joining dissimilar stainless steels

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket
0.045	(1.2)	MG307045667

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Mn	%Si	%Cr	%Ni
Requirements	0.04 - 0.14	3.30 - 4.75	0.30 - 0.65	19.5 - 22.0	8.0 - 10.7
Typical Performance Techalloy® 307	0.017	1.93	0.80	17.84	9.97
	%S	**%P**	**%Mo**	**%Cu**	**%FN**
Requirements	0.03 max.	0.03 max.	0.5 - 1.5	0.75 max.	NR
Typical Performance Techalloy® 307	0.009	0.023			

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.2) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 308/308H

Stainless • AWS ER308H

Key Features

- Used to weld unstabilized austenitic stainless steels such as 302, 304H and 305.
- Provide a high carbon deposit (minimum of .04% carbon) for high temperature applications.

Welding Positions

All

Conformances

AWS: A5.9/A5.9M: 2006: ER308H

UNS: S30880

Typical Applications

- Chemical
- Petrochemical industries
- Distillery
- Dairy
- Restaurant Equipment
- Catalytic Crackers
- Pulp and Paper

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.030	(0.8)	MG308H030667		
0.035	(0.9)	MG308H035667		
0.045	(1.1)	MG308H045667		
1/16	(1.6)	MG308H062667	TG308H062638	
3/32	(2.4)		TG308H093638	SA308H093726
1/8	(3.2)		TG308H125638	SA308H125726

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER308H	0.04 - 0.08	19.5 - 22.0	9.00 - 11.00	0.50 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 308/308H	0.06	19.9	9.7	0.07	1.8
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER308H	0.30 - 0.65	0.04 max.	0.03 max	0.75 max.	Not Required
Typical Performance[2] Techalloy® 308/308H	0.44	0.02	0.006	0.10	5 - 12

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90-130 120-175 150-220	20-40 CFH	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-30 29-32	275-350 350-450		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 308/308L

AWS ER308L • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER308L
UNS:	S30880/S30883
ISO 14343:2009:	(19 9 L)

Typical Applications

- 304 Steels

Key Features

- Give a weld deposit with reduced carbon levels (0.04% max) that offers increaded resistance to inter-granular corrosion.
- Type 308L is ideal for welding Type 304L stainless steels.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
*0.035	(0.9)	MG308L035667		
*0.045	(1.1)	MG308L045667		
1/16	(1.6)	MG308L062667	TG308L062638	SA308L062726
3/32	(2.4)		TG308L093638	SA308L093726
1/8	(3.2)		TG308L125638	SA308L125726
5/32	(4.0)		TG308L156638	SA308L156726

* Bulk packaging available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER308L	0.03 max	19.5 - 22.0	9.00 - 11.00	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 308/308L	0.01	19.7	9.7	0.17	1.7
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER308L	0.30 - 0.65	0.03 max	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 308/308L	0.37	0.02	0.01	0.18	8 - 14

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)		90-130 120-175 150-220 160-230	20-40 CFH	100% Argon
SAW	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	28-33 29-32 30-33	275-350 350-450 400-550	275-350 350-450 400-550	Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 308LHS

Stainless • AWS ER308LSi

Key Features

- Used to primarily weld equipment made with 304 type stainless steel.
- Higher silicon content improves wetting of the weld metal and potentially higher travel speeds compared to standard 308L products.

Conformances

AWS A5.9/A5.9M: 2006:	ER308LSi
UNS:	S30888
ISO 14343:2009:	(19 9 L Si)

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.030	(0.8)	MG308LHS030667	
0.035	(0.9)	MG308LHS035667	
0.045	(1.1)	MG308LHS045667	
1/16	(1.6)	MG308LHS062667	
1/8	(3.2)		TG308LHS125638

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER308LSi	0.03 max.	19.5- 22.0	9.0 - 11.0	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 308LHS	0.02	17.8	9.9	0.46	1.9
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER308LSi	0.65 - 1.00	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 308LHS	0.80	0.02	0.80	0.13	6 - 12

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	5/32 (2.4)		160-230	20 - 40 CFH	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 309/309L

AWS ER309L • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER309L
UNS:	30983
UNS:	30980
ISO 14343:2009:	(23 12 L)
CWB	

Typical Applications

- Do not exceed service temperatures of 700°F (371°C).

Key Features

- Reduced carbon levels (0.04% max) that offers increased resistance to inter-granular corrosion.
- Ideal for joining stainless steels to themselves or to carbon or low alloy steels, and can be used at temperatures of up to 700°F (371°C).
- Reduced carbon levels help prevent intergranular corrosion.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG309L035667		
0.045	(1.1)	MG309L045667		
1/16	(1.6)	MG309L062667	TG309L062638	
3/32	(2.4)		TG309L093638	SA309L093726
1/8	(3.2)		TG309L125638	SA309L125726
5/32	(4.0)		TG309L156638	SA309L156726

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER309L	0.03 max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 309/309L	0.01	23.4	13.6	0.06	1.6
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER309L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 309/309L	0.38	0.02	0.007	0.07	9 - 14

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)		90-130 120-175 150-220 160-230	20 - 40 CFH	100% Argon
SAW	3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	28-33 29-32 30-33	275-350 350-450 400-550		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 309LHS

Stainless • AWS ER309LSi

Key Features

- The same composition as Techalloy® 309L with higher silicon content to improve the bead appearance and increase welding ease.
- Used for mild steel to stainless joining applications.
- Excellent contour of the weld minimizes the need for grinding.

Conformances

AWS A5.9/A5.9M: 2006:	ER309LSi
UNS:	S30988
ISO 14343:2009:	(23 12 L Si)

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket
0.030	(0.8)	MG309LHS030667
*0.035	(0.9)	MG309LHS035667
*0.045	(1.1)	MG309LHS045667

* Bulk packaging available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER309LSi	0.03 max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 309LHS	0.01	23.2	13.8	0.04	1.8
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER309LSi	0.65 - 1.00	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 309LHS	0.80	0.02	0.007	0.10	10 - 24

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 309LMo

Similar to AWS ER309LMo • Stainless

Conformances

Similar to
AWS A5.9/A5.9M: 2006: ER309LMo
ISO 14343:2009: 23 12 2 L

Welding Positions

All

Key Features

- Similar to 309 with the exception for the addition of 2.0 - 3.0% molybdenum to increase its pitting corrosion resistance in halide-containing environments.
- Surfacing of base metals to improve their resistance to corrosion.
- Used to achieve a single-layer overlay with a chemical composition similar to that of a 316L stainless steel.
- Used for the first layer of multilayer overlays with filler metals such as 316L or 317L stainless steel.

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG309LMO035667		
0.045	(1.1)	MG309LMO045667		
1/16	(1.6)	MG309LMO062667		
3/32	(2.4)			SA309LMO093726
1/8	(3.2)			
5/32	(4.0)		TG309LMO156638*	

*Made to Order (MTO)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements[1] AWS ER309LMo	0.03 max.	23.0 - 25.0	12.0 - 14.0	2.0 - 3.0	1.0 - 2.5
Typical Performance[2] Techalloy® 309LMo	0.01	22.3	15.0	2.6	1.40
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements[1] AWS ER309LMo	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 309LMo	0.40	0.02	0.01	0.10	6 - 12

[1] Nearest classification

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	5/32 (4.0)		160-230	20-40 CFH	100% Argon
SAW	3/32 (2.4)	28-33	275-350		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 310

Stainless • AWS ER310

Key Features

- Used for welding stainless steels of similar composition in cast and wrought forms.
- The weld deposit is fully austenitic, and as such, calls for minimal heat input during welding.

Welding Positions

All

Conformances

AWS A5.9/A5.9M: 2006:	ER310
UNS:	S31080
ISO 14343: 2009:	(25 20)

Typical Applications

- Head shields
- Furnace parts
- Ducting

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG310035667		
0.045	(1.1)	MG310045667		
1/16	(1.6)	MG310062667	TG310062638	SA310062726
3/32	(2.4)		TG310093638	SA310093726
1/8	(3.2)		TG310125638	

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER310	0.08 - 0.15	25.0 - 28.0	20.0 - 22.5	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 310	0.11	27.1	21.0		1.90
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER310	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 310	0.40	0.01	0.003	0.04	

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90-130 120-175 150-220	20-40 CFH	100% Argon
SAW	1/16 (1.6) 3/32 (2.4)	28-33	275-350		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 312

AWS ER312 • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER312
UNS:	S31380
ISO 14343: 2009:	(29 9)

Typical Applications

- Tool steels
- Hard to weld steels
- Cast and wrought alloys
- Dissimilar metals

Key Features

- Used to weld cast and wrought alloys of similar compositions.
- Can be used for joining hard to weld materials and dissimilar metals.
- Applications should be limited to 800°F (420°C).
- The weld deposits exhibit high tensile strength and offer some resitance to abrasion.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.045	(1.1)	MG312045667	
1/16	(1.6)	MG312062667	TG312062638
3/32	(2.4)		TG312093638
1/8	(3.2)		TG312125638

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER312	0.15 max.	28.0 - 32.0	8.0 - 10.5	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 312	0.11	29.6	8.9		1.6
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER312	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 312	0.44	0.02	0.01	0.10	50 - 80

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.045 (1.1) 1/16 (1.6)	28-32 29-33	180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90-130 120-175 150-220	20-40 CFH	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 316/316L

Stainless • AWS ER316L

Key Features

- Used for welding 316L base metals
- The 2-3% molybdenum improves pitting corrosion resistance of the weld deposit.
- Low carbon content reduces the possibility of carbide precipitation and intergranular corrosion.

Welding Positions

All

Conformances

AWS A5.9/A5.9M: 2006:	ER316L
UNS:	S31683
UNS:	S31680
ISO 14343:2009:	(19 12 3 L)

Typical Applications

- Power Generation
- Chemical and Petrochemical Processing

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.030	(0.8)	MG316L030667		
0.035	(0.9)	MG316L035667		
*0.045	(1.1)	MG316L045667		
1/16	(1.6)	MG316L062667	TG316L062638	
3/32	(2.4)		TG316L093638	SA316L093726
1/8	(3.2)		TG316L125638	SA316L125726
5/32	(4.0)		TG316L156638	SA316L156726

*Bulk packages available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER316L	0.03 max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5
Typical Performance[2] Techalloy® 316/316L	0.01	18.5	12.1	2.4	1.6
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER316L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 316/316L	0.36	0.02	0.01	0.09	6 - 12

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)		90-130 120-175 150-220 160-230	20-40 CFH	100% Argon
SAW	3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	28-33 29-32 30-33	275-350 350-450 400-550		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 316LHS

AWS ER316LSi • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER316LSi
UNS:	S31688
ISO 14343:2009:	(19 12 3 L Si)

Welding Positions

All

Key Features

- Similar to 316L, with higher silicon content for optimum ease and speed in MIG welding and smooth bead appearance.
- This alloy is intended for joining 316 type stainless steels.

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (15 kg) Wire Basket
0.030	(0.8)	MG316LHS030667
0.035	(0.9)	MG316LHS035667
*0.045	(1.1)	MG316LHS045667
*0.062	(1.6)	MG316LHS062667

*Bulk packages available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER316LSi	0.03 max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5
Typical Performance[2] Techalloy® 316LHS	0.02	18.5	12.2	2.4	1.70
	%Si	**%P**	**%S**	**%Cu**	**FN**
Requirements AWS ER316LSi	0.65 - 1.0	0.03 max.	0.03 max.	0.75 max.	Not Required
Typical Performance[2] Techalloy® 316LHS	0.80	0.01	0.009	0.13	5 - 10

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 0.062 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 317L

Stainless • AWS ER317L

Key Features

- Weld deposit similar to 316L with a high molybdenum content.
- Used for welding alloys with similar composition in high corrosive environments.

Welding Positions

All

Conformances

AWS A5.9/A5.9M: 2006:	ER317L
UNS:	S31783
ISO 14343: 2009:	(18 15 3 L)

Typical Applications

- FGP
- Chemical Processing Plants
- Condensors
- Petrochemical

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG317L035667		
0.045	(1.1)	MG317L045667		
1/16	(1.6)	MG317L062667	TG317L062638	
3/32	(2.4)		TG317L093638	SA317L093726
1/8	(3.2)		TG317L125638	SA317L125726
5/32	(4.0)		TG317L156638	

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER317L	0.03 max.	18.5 - 20.5	13.0 - 15.0	3.0 - 4.0	1.0 - 2.5
Typical Performance[2] Techalloy® 317L	0.01	18.9	13.7	3.5	1.4

	%Si	%P	%S	%Cu
Requirements AWS ER317L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.
Typical Performance[2] Techalloy® 317L	0.45	0.01	0.008	0.08

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)		90-130 120-175 150-220 160-230	20-40 CFH	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-33 29-32	275-350 350-450		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 320LR

AWS ER320LR • Stainless

Conformances

AWS A5.9/A5.9M: 2006: ER320LR

UNS: N08022

Key Features

- Typically used for welding base metals with similar compositions including alloy 20.

Typical Applications

- Tanks
- Process Piping
- Heat Exchangers

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG320LR035667		
0.045	(1.1)	MG320LR045667		
1/16	(1.6)	MG320LR062667	TG320LR062638	
3/32	(2.4)		TG320LR093638	SA320LR093726
1/8	(3.2)		TG320LR125638	

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER320LR	0.025 max.	19.0 - 21.0	32.0 - 36.0	2.0 - 3.0	1.5 - 2.0
Typical Performance[2] Techalloy® 320LR	0.003	20.1	33.3	2.4	1.7
	%Si	**%P**	**%S**	**%Cu**	**%Nb**
Requirements AWS ER320LR	0.15 max.	0.015 max.	0.02 max.	3.0 - 4.0	Required 8 x C / 1.0 max.
Typical Performance[2] Techalloy® 320LR	0.01	0.010	0.001	3.3	0.22

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90-130 120-175 150-220	20-40 CFH	100% Argon
SAW	3/32 (2.4)	29-32	350-450		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 330

Stainless • AWS ER330

Key Features

- Used to weld wrought and cast forms of stainless steels of similar chemical compositions, which offer good heat and scale resistance to 1800°F (980°C).
- High sulfur environments adversely affect the high temperature performance.
- Heat input must be kept to a minimum during welding to avoid ethe possibility of micro-fissuring.

Conformances

AWS A5.9/A5.9M: 2006:	ER330
UNS:	N08331
ISO 14343: 2009:	(18 69 H)

Typical Applications

- Heat Treatment
- Furnace Environments

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG330035667	
0.045	(1.1)	MG330045667	
3/32	(2.4)		TG330093638
1/8	(3.2)		TG330125638

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER330	0.18 - 0.25	15.0 - 17.0	34.0 - 37.0	0.75 max.	1.0 - 2.5
Typical Performance[2] Techalloy® 330	0.23	15.9	35.2		1.9

	%Si	%P	%S	%Cu
Requirements AWS ER330	0.30 - 0.65	0.03	0.03	0.75 max.
Typical Performance[2] Techalloy® 330	0.42	0.01	0.005	0.10

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	3/32 (2.4) 1/8 (3.2)		120-175 150-220	20-40 CFH	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 347

AWS ER347 • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER347
UNS:	S34780
ISO 14343: 2009:	(19 9 Nb)

Typical Applications

- Food Processing
- Pharmaceutical Equipment

Key Features

- Niobium stabilized stainless steel electrodes used for the welding of types 347 and 321 stainless and stainless clad steels.
- The addition of niobium reduces intergranular corrosion in severe operating conditions.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG347035667		
0.045	(1.1)	MG347045667		
*1/16	(1.6)	MG347062667	TG347062638	
*3/32	(2.4)		TG347093638	SA347093726
1/8	(3.2)		TG347125638	SA347125726

*Bulk packages available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Nb + Ta
Requirements AWS ER347	0.08 max.	19.0 - 21.5	9.0 - 11.0	0.75 max.	10 x C - 1.0
Typical Performance[2] Techalloy® 347	0.03	19.5	9.3	0.25	0.60
	%Mn	**%Si**	**%P**	**%S**	**%Cu**
Requirements AWS ER347	1.0 - 2.5	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.
Typical Performance[2] Techalloy® 347	1.7	0.45	0.01	0.007	0.10

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90-130 120-175 150-220	20-40 CFH	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-33 29-32	275-350 350-450		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 385

Stainless • AWS ER385

Key Features

- Used for welding materials of similar chemical composition (Type 904L).
- Used in fabrication of equipment and vessels for handling and storage of sulfuric acid and phosphoric acid.
- Weld metal is fully austenitic and must be done with low heat input using a stringer bead technique.

Conformances

AWS A5.9/A5.9M: 2006:	ER385
UNS:	N08904
ISO 14343: 2009:	(20 25 5 Cu L)

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG385035667		
0.045	(1.1)	MG385045667		
1/16	(1.6)	MG385062667	TG385062638	
3/32	(2.4)		TG385093638	SA385093726

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER385	0.025 max.	19.5 - 21.5	24.0 - 26.0	4.2 - 5.2	1.0 - 2.5
Typical Performance[2] Techalloy® 385	0.010	19.9	25.0	4.2	1.8

	%Si	%P	%S	%Cu
Requirements AWS ER385	0.50 max.	0.02 max.	0.03 max.	1.2 - 2.0
Typical Performance[2] Techalloy® 385	0.3	0.01	0.001	1.4

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	160-210 180-250 200-280	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4)		90 - 130 120 - 175	20-40 CFH	100% Argon
SAW	3/32 (2.4)	28-33	275-350		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 409Nb

AWS ER409Nb • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER409Nb
UNS:	S40940

Welding Positions

All

Key Features

- A ferritic stainless steel welding wire used to weld Type 409 and 409Ti base materials.
- The addition of niobium improves corrosion resistance and promotes a ferritic micro-structure.
- For the best results, welding must be done in a low heat input procedure and is not recommended for multi-pass applications.

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG409NB035667	
0.045	(1.1)	MG409NB045667	
1/16	(1.6)		TG409NB062638
3/32	(2.4)		TG409NB093638

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Nb
Requirements AWS ER409Nb	0.08 max	10.5 - 13.5	0.6 max.	0.50 max.	0.075 max.
Typical Performance[2] Techalloy® 409Nb	0.04	11.5	0.4	0.03	0.50
	%Mn	**%Si**	**%P**	**%S**	**%Cu**
Requirements AWS ER409Nb	0.8 max.	1.0 max.	0.04 max.	0.03 max.	0.75 max.
Typical Performance[2] Techalloy® 409Nb	0.62	0.48	0.02	0.02	0.04

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4)		90-130 120-175	20-40 CFH	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 410

Stainless • AWS ER410

Key Features

- Designed to weld stainless steels of similar chemical composition as well as to overlay carbon steels to impart corrosion, erosion and abrasion resistance.
- This material, being an air-hardening type, calls for a pre-heat and inter-pass temperature of not less than 400°F (200° C) during welding.

Welding Positions

All

Conformances

AWS A5.9/A5.9M: 2006:	ER410
UNS:	S41080
ISO 14343: 2009:	13

Typical Applications

- Surfacing Steel Mill Rolls
- Furnace and Burner Parts
- Turbine Parts

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG410035667	
*0.045	(1.1)	MG410045667	
1/16	(1.6)		TG410062638
3/32	(2.4)		TG410093638
1/8	(3.2)		TG410125638

*Bulk packages available - Contact Lincoln Electric

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER410	0.12 max.	11.5 - 13.5	0.6 max.	0.75 max.	0.6 max.
Typical Performance[2] Techalloy® 410	0.11	12.5	0.1	0.03	0.45

	%Si	%P	%S	%Cu
Requirements AWS ER410	0.5 max.	0.03 max.	0.03 max.	0.75 max.
Typical Performance[2] Techalloy® 410	0.39	0.01	0.01	0.14

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)		90 - 130 120 - 175 150 - 220	20-40 CFH	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 410NiMo

AWS ER410 • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER410NiMo
UNS:	S41086
ISO 14343: 2009:	(13 4)

Typical Applications

- Turbines
- Valve Bodies
- High Pressure Piping
- Offshore
- Power Generation

Key Features

- Designed to weld materials of similar chemical composition in cast and wrought forms.
- Used to overlay mild and low alloy steels.
- Preheat and inter-pass temperatures of not less than 300°F (150cdC) are recommended during welding.
- Post-weld heat treatment should not exceed 1150°F (620° C) as higher temperatures may result in hardening.

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) 30 lb (13.6 kg) Master Carton	SAW 60 lb (27.2 kg) Coil
0.035	(0.9)	MG410NM035667		
0.045	(1.1)	MG410NM045667		
1/16	(1.6)		TG410NM062638	
3/32	(2.4)		TG410NM093638	
1/8	(3.2)			SA410NM125726

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS ER410NiMo	0.06 max.	11.0 - 12.5	4.0 - 5.0	0.4 - 0.7	0.6 max.
Typical Performance[2] Techalloy® 410NiMo	0.02	11.7	4.7	0.5	0.2

	%Si	%P	%S	%Cu
Requirements AWS ER410NiMo	0.5 max.	0.03 max.	0.03 max.	0.75 max.
Typical Performance[2] Techalloy® 410NiMo	0.2	0.01	0.002	0.06

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4)		60-85 120-175	20-40 CFH	100% Argon
SAW	1/8 (3.2)	29-32	350-450		Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 630

Stainless • AWS ER630

Key Features

- Precipitation hardening stainless steel covered electrode used for welding materials of similar chemical composition such as 17-4 and 17-7.
- Can be used in the as welded condition or may be heat treated to obtain higher strength.
- Mechanical properties of the alloy are greatly influenced by the heat treatment.

Welding Positions

All

Conformances

AWS A5.9/A5.9M: 2006:	ER630
UNS:	S17480

Typical Applications

- Hydraulic Equipment Components
- Impellers
- Pump Shafts

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) 30 lb (13.6 kg) Master Carton	SAW 60 lb (27.2 kg) Coil
0.035	(0.9)	MG630035667		
0.045	(1.1)	MG630045667		
1/16	(1.6)		TG630062638	
3/32	(2.4)		TG630093638	SA630093692

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Nb
Requirements AWS ER630	0.05 max.	16.00 - 16.75	4.5 - 5.0	0.75 max.	0.15 - 0.30
Typical Performance[2] Techalloy® 630	0.03	16.5	4.8	0.2	0.22
	%Mn	**%Si**	**%P**	**%S**	**%Cu**
Requirements AWS ER630	0.25 - 0.75	0.75 max.	0.03 max.	0.03 max.	3.25 - 4.0
Typical Performance[2] Techalloy® 630	0.54	0.43	0.02	0.02	3.6

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	98/99% Argon + 2/1% Oxygen 97% Argon + 3% CO_2
TIG	1/16 (1.6) 3/32 (2.4)		90-130 120-175	20-40 CFH	100% Argon
SAW	3/32 (2.4)				Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Blue Max® MIG 2209

AWS ER2209 • Stainless

Conformances

AWS A5.9/A5.9M: 2006:	ER2209
UNS:	S39209
ISO 14343:2009:	(22 9 3 N L)

Typical Applications

- Offshore
- Oil and Gas
- Chemical
- Petrochemical

Welding Positions

All

Key Features

- Used to weld duplex stainless steels such as (Type 2205).
- The welds offer excellent resistance to stress corrosion, cracking and pitting.
- The microstructure of the weld metal consists of austenite and ferrite.
- The ferrite content of the weld metal will be lower than the ferrite content of type 2205 base metal.
- Welding of duplex stainless steels calls for controlled welding parameters to achieve specified mechanical and corrosion resistant properties.

DIAMETERS / PACKAGING

Diameter in	(mm)	33 lb (15 kg) Plastic Spool	33 lb (15 kg) Steel Spool
0.030	(0.8)		ED035023
0.035	(0.9)	ED035024	ED035025
0.045	(1.1)	ED035026	ED035027
1/16	(1.6)	ED035028	

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements AWS ER2209	0.03 max.	21.5 - 23.5	7.5 - 9.5	2.5 - 3.5	0.5 - 2.0	0.90 max.
Typical Performance[2]	0.01	22.7	8.5	3.0	1.4	0.4

	%P	%S	%N	%Cu	FN
Requirements AWS ER2209	0.03 max.	0.03 max.	0.08 - 0.20	0.75 max.	Not Required
Typical Performance[2]	0.01	0.001	0.15	0.06	30 - 60

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
0.035 (0.9)	26-29	160-210	30-50 CFH	Argon + 2-5% CO_2
0.045 (1.1)	28-32	180-250		
1/16 (1.6)	29-33	200-280		

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Blue Max® MIG 2594

Stainless • AWS ER2594

Key Features

- A super-duplex grade electrode that provides matching chemistry and mechanical property characteristics to wrought super-duplex alloys such as 2507 and Zeron 100, as well as to super-duplex casting alloys (ATSM A890).
- The electrode is over-alloyed 2-3% in nickel to provide the optimum ferrite/austenite ratio in the finished weld resulting iin high tensile and yield strength and superior resistance to stress corrosion, cracking (SCC) and pitting corrosion.

Conformances

AWS A5.9/A5.9M: 2006:	ER2594
UNS:	S32750
ISO 14343:2009:	25 9 4 N L

Typical Applications

- Process Pipework
- Pumps and Valves
- Pressure Vessels

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in	(mm)	33 lb (15 kg) Plastic Spool	33 lb (15 kg) Steel Spool
0.035	(0.9)		ED035029
0.045	(1.1)		ED035030
*0.045	(1.2)		ED035031
1/16	(1.6)	ED035032	

*This diameter is manufactured to mm.

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn	%Si
Requirements AWS ER2594	0.03 max.	24.0 - 27.0	8.0 - 10.5	2.5 - 4.5	2.5 max.	1.0 max.
Typical Performance[2]	0.02	24.6	8.6	3.8	0.8	0.3
	%P	**%S**	**%N**	**%Cu**	**%W**	**FN**
Requirements AWS ER2594	0.03 max.	0.02 max.	0.20 - 0.30	1.5 max.	1.00 max.	Not Required
Typical Performance[2]	0.02	0.01	0.25	0.01	0.01	30 - 60

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas Flow	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	160-210 180-250	30-50 CFH	Argon + 2-5% CO_2

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

UltraCore® FC 308L

AWS E308T0-1, E308T0-4, E308LT0-1, E308LT0-4 • Stainless

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E308LT0-1, E308LT0-4, E308T0-1, E308T0-4
ABS:	E308LT0-1, E308LT0-4, E308T0-1, E308T0-4
CWB/CSA W48-06:	E308LT0-1, E308LT0-4

Welding Positions

Flat & Horizontal

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

Key Features

- Designed for flat and horizontal welding positions
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Typical Applications

- 304L and other common18/8 stainless steels
- Nitrogen bearing 304LN and titanium stabilized 321
- General fabrication including piping, tanks and pressure vessels

DIAMETERS / PACKAGING

Diameter - in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED033004
1/16 (1.6)	ED033005

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.22/A5.22M: 1995*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E308T0-1, E308T0-4	Not Specified	520 (75) min.	35 min.	Not Specified
AWS E308LT0-1, E308LT0-4	Not Specified	550 (80) min.		Not Specified
Test Results[3] - As-Welded				
with 100% CO_2	405 (59)	580 (84)	43	7-11
with 75% Ar/25% CO_2	440 (64)	605 (88)	37	8-11

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.22/A5.22M: 1995*

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E308LT0-1, E308LT0-4	0.04 max.	0.5-2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3] - As-Welded					
with 100% CO_2	≤0.03	1.2-1.3	0.60-0.70	≤0.02	≤0.02
with 75% Ar/25% CO_2	≤0.03	1.2-1.3	0.68-0.77	≤0.01	≤0.02

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E308LT0-1, E308LT0-4	9.0-11.0	18.0-21.0	0.5 max.	0.5 max.
Test Results[3] - As-Welded				
with 100% CO_2	9.3-9.7	18.2-18.5	≤0.27	≤0.31
with 75% Ar/25% CO_2	9.3-9.7	18.7-18.9	≤0.27	≤0.27

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	6.4 (250)	23-26	145	2.7 (5.9)	2.3 (5.2)	88
	3/4 (19)	8.9 (350)	24-27	170	3.7 (8.3)	3.3 (7.3)	88
	3/4 (19)	11.4 (450)	25-28	205	4.8 (10.6)	4.2 (9.3)	88
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	23-26	175	2.8 (6.3)	2.5 (5.4)	86
	1 (25)	6.4 (250)	24-27	260	5.1 (11.1)	4.4 (9.7)	87
	1 (25)	7.6 (300)	25-28	285	9.1 (20.0)	7.9 (17.4)	87

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal, DC+. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Requirement for E308T0-1 and E308T0-4 is 0.08% max. carbon. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2.

UltraCore® FCP 308L

Stainless • AWS E308LT1-1, E308LT1-4, E308T1-1, E308T1-4

Key Features

- Designed for all-position welding
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Typical Applications

- 304L and other common 18/8 stainless steels
- Nitrogen bearing 304LN and titanium stabilized 321
- General fabrication including piping, tanks, and pressure vessels

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E308LT1-1, E308LT1-4, E308T1-1, E308T1-4
ABS:	E308LT1-1, E308LT1-4, E308T1-1, E308T1-4
CWB/CSA W48-06:	E308LT1-1, E308LT1-4

Welding Positions

All

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED027949
1/16 (1.6)	ED027950

UltraCore® FCP 308L

(AWS E308LT1-1, E308LT1-4, E308T1-1, E308T1-4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.22/A5.22M: 1995*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E308LT1-1, E308LT1-4	Not Specified	520 (75) min.	35	Not Specified
AWS E308T1-1, E308T1-4	Not Specified	550 (80) min.	min.	Not Specified
Typical Performance[3]				
As-Welded with 100% CO_2	407 (59)	566 (82)	42	6
As-Welded with 75% Ar/25% CO_2	421 (61)	587 (85)	39	7

DEPOSIT COMPOSITION[1]

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E308LT1-1 & E308LT1-4	0.04 max.	0.5 - 2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3]					
As-Welded with 100% CO_2	0.03	1.4	0.6	0.02	0.03
As-Welded with 75% Ar/25% CO_2	0.03	1.5	0.7	0.02	0.03

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E308LT1-1 & E308LT1-4	9.0 - 11.0	18.0 - 21.0	0.5 max.	0.5 max.
Test Results[3]				
As-Welded with 100% CO_2	9.8	18.6	0.3	0.3
As-Welded with 75% Ar/25% CO_2	9.7	18.9	0.3	0.3

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	5.1 (200)	23-26	120	2.1 (4.7)	1.8 (4.0)	85
	3/4 (19)	7.6 (300)	25-28	155	3.2 (7.0)	2.7 (6.0)	86
	3/4 (19)	10.2 (400)	27-30	185	4.3 (9.4)	3.6 (7.9)	84
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	23-26	175	2.8 (6.2)	2.4 (5.3)	85
	1 (25)	5.1 (200)	24-27	210	4.0 (8.9)	3.4 (7.4)	83
	1 (25)	8.9 (350)	26-29	290	7.0 (15.5)	5.9 (13.0)	84

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Typical all weld metal, DC+. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] Requirement for E308T0-1 and E308T0-4 is 0.08% max. carbon. [5] To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2

UltraCore® FC 309L

Stainless • AWS E309T0-1, E309T0-4, E309LT0-1, E309LT0-4

Key Features

- Designed for flat and horizontal welding positions
- For welding dissimilar metals - stainless and mild or low alloy
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E309T0-1, E309T0-4, E309LT0-1, E309LT0-4
ABS:	E309T0-1, E309T0-4, E309LT0-1, E309LT0-4
CWB/CSA W48-06:	E309LT0-1, E309LT0-4

Welding Positions

Flat & Horizontal

Typical Applications

- Buffer layers and clad steels – overlays on CMn, mild steel or low alloy steels
- Dissimilar joints – stainless types 410, 304L, 321, and 316L to mild and low alloy steels

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED033006
1/16 (1.6)	ED033007

UltraCore® FC 309L

(AWS E309T0-1, E309T0-4, E309LT0-1, E309LT0-4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.22/A5.22M: 1995*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E309LT0-1, E309LT0-4	Not Specified	520 (75) min.	30	Not Specified
AWS E309T0-1, E309T0-4	Not Specified	550 (80) min.	min.	Not Specified
Test Results[3]				
As-Welded with 100% CO_2	440 (64)	570 (83)	36	15 - 21
As-Welded with 75% Ar/25% CO_2	435 (63)	580 (84)	37	15 - 21

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.22/A5.22M: 1995*

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E309LT0-1 & E309LT0-4	0.04 max.	0.5 - 2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3]					
As-Welded with 100% CO_2	≤0.03	1.3 - 1.5	0.65 - 0.75	≤0.01	≤0.02
As-Welded with 75% Ar/25% CO_2	≤0.03	1.2 - 1.5	0.72 - 0.78	≤0.01	≤0.02

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E309LT0-1 & E309LT0-4	12.0 - 14.0	22.0 - 25.0	0.5 max.	0.5 max.
Test Results[3]				
As-Welded with 100% CO_2	12.2 - 12.8	22.6 - 23.9	≤0.27	≤0.31
As-Welded with 75% Ar/25% CO_2	12.2 - 12.8	23.0 - 24.0	≤0.23	≤0.27

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	6.4 (250)	24-27	145	2.7 (5.9)	2.4 (5.2)	88
	3/4 (19)	8.9 (350)	25-28	180	3.8 (8.3)	3.3 (7.3)	88
	3/4 (19)	11.4 (450)	26-29	200	4.9 (10.7)	4.3 (9.4)	88
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	22-25	170	2.8 (6.3)	2.5 (5.5)	87
	1 (25)	6.4 (250)	24-27	245	5.1 (11.2)	4.4 (9.7)	87
	1 (25)	7.6 (300)	26-29	270	6.1 (13.4)	5.3 (11.6)	87

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal, DC+. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Requirement for E309T1-1 and E309T1-4 is 0.10% max. carbon. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2

UltraCore® FCP 309L

Stainless • AWS E309LT1-1, E309LT1-4, E309T1-1, E309T1-4

Key Features

- Designed for all-position welding
- For welding dissimilar metals - stainless and mild or low alloy
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Typical Applications

- Buffer layers and clad steels - overlays on CMn, mild steel or low alloy steels
- Dissimilar joints - stainless types 410, 304L, 321, and 316L to mild and low alloy steels

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E309LT1-1, E309LT1-4, E309T1-1, E309T1-4
ABS:	E309LT1-1, E309LT1-4, E309T1-1, E309T1-4
CWB/CSA W48-06:	E309LT1-1, E309LT1-4

Welding Positions

All

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED033010
1/16 (1.6)	ED033011

UltraCore® FCP 309L

(AWS E309LT1-1, E309LT1-4, E309T1-1, E309T1-4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.22/A5.22M: 1995*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E309LT1-1, E309LT1-4	Not Specified	520 (75) min.	30	Not Specified
AWS E309T1-1, E309T1-4	Not Specified	550 (80) min.	min.	Not Specified
Test Results[3]				
As-Welded with 100% CO_2	440 (64)	570 (83)	35	14 - 19
As-Welded with 75% Ar/25% CO_2	450 (65)	580 (84)	35	14 - 19

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.22/A5.22M: 1995*

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E309LT1-1 & E309LT1-4	0.04 max.	0.5 - 2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3]					
As-Welded with 100% CO_2	≤0.03	0.9 - 1.1	0.57 - 0.63	≤0.10	≤0.02
As-Welded with 75% Ar/25% CO_2	≤0.03	0.9 -1.1	0.64 - 0.73	≤0.02	≤0.03

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E309LT1-1 & E309LT1-4	12.0 - 14.0	22.0 - 25.0	0.5 max.	0.5 max.
Test Results[3]				
As-Welded with 100% CO_2	13.3 - 13.8	23.4 - 23.9	≤0.27	≤0.27
As-Welded with 75% Ar/25% CO_2	13.3 - 13.8	23.6 - 24.4	≤0.27	≤0.31

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	5.1 (200)	24-27	130	2.1 (4.6)	1.8 (3.9)	85
	3/4 (19)	7.6 (300)	25-28	155	3.2 (7.0)	2.6 (5.8)	83
	3/4 (19)	10.2 (400)	26-29	190	4.2 (9.3)	3.5 (7.8)	84
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	23-26	170	2.8 (6.1)	2.3 (5.0)	82
	1 (25)	5.1 (200)	25-28	210	3.9 (8.7)	3.2 (7.1)	82
	1 (25)	8.9 (350)	26-29	290	6.9 (15.1)	5.7 (12.5)	83

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal, DC+. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Requirement for E309T1-1 and E309T1-4 is 0.10% max. carbon. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2

UltraCore® FC 316L

Stainless • AWS E316T0-1, E316T0-4, E316LT0-1, E316LT0-4

Key Features

- Designed for flat and horizontal welding positions
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Typical Applications

- 1.5 – 3% Mo austenitic stainless steel
- Suitable for Ti or Nb stabilized and nitrogen-bearing versions of the above alloys
- Applications requiring good resistance to pitting and general corrosion

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E316LT0-1, E316LT0-4, E316T0-1, E316T0-4
ABS:	E316LT0-1, E316LT0-4, E316T0-1, E316T0-4
CWB/CSA W48-06:	E316LT0-1, E316LT0-4

Welding Positions

Flat & Horizontal

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED033008
1/16 (1.6)	ED033009

UltraCore® FC 316L

(AWS E316T0-1, E316T0-4, E316LT0-1, E316LT0-4)

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E316T0-1, E316T0-4	Not Specified	520 (75) min.	30	Not Specified
AWS E316LT0-1, E316LT0-4	Not Specified	550 (80) min.	min.	Not Specified
Test Results[3]				
As-Welded with 100% CO2	435 (63)	570 (83)	35	6 - 9
As-Welded with 75% Ar/25% CO_2	430 (62)	580 (84)	37	7 - 9

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.22/A5.22M: 1995*

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E316LT0-1 & E316LT0-4	0.04 max.	0.5 - 2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3]					
As-Welded with 100% CO_2	≤0.03	1.2 - 1.3	0.60 - 0.70	≤0.01	≤0.02
As-Welded with 75% Ar/25% CO_2	≤0.03	1.1 - 1.4	0.70 - 0.73	≤0.01	≤0.02

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E316LT0-1 & E316LT0-4	11.0 - 14.0	17.0 - 20.0	2.0 - 3.0	0.5 max.
Test Results[3]				
As-Welded with 100% CO_2	11.3 - 12.2	17.7 - 18.3	≤2.87	≤0.35
As-Welded with 75% Ar/25% CO_2	11.2 - 11.6	17.7 - 18.3	≤2.66	≤0.27

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	6.4 (250)	23-26	140	2.7 (5.9)	2.3 (5.1)	86
	3/4 (19)	8.9 (350)	24-27	170	3.8 (8.3)	3.2 (7.1)	86
	3/4 (19)	11.4 (450)	25-28	200	4.8 (10.7)	4.2 (9.3)	87
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	25-29	155	2.8 (6.2)	2.4 (5.3)	85
	1 (25)	6.4 (250)	27-31	250	5.0 (11.0)	4.2 (9.3)	85
	1 (25)	7.6 (300)	28-32	285	6.0 (13.2)	5.2 (11.4)	86

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal, DC+. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Requirement for E316T1-1 and E316T1-4 is 0.08% max. carbon. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2

UltraCore® FCP 316L

Stainless • AWS E316LT1-1, E316LT1-4, E316T1-1, E316T1-4

Key Features

- Designed for all-position welding
- Superior weld performance and enhanced operator appeal
- Q2 Lot® - Certificate showing actual deposit composition and ferrite number (FN) by ferrite scope available online
- ProTech® hermetically sealed packaging

Typical Applications

- 1.5 - 3% Mo austenitic stainless steel
- Suitable for Ti or Nb stabilized and nitrogen-bearing versions of the above alloys
- Applications requiring good resistance to pitting and general corrosion

Conformances

AWS A5.22/A5.22M: 1995 & ASME SFA-A5.22:	E316LT1-1, E316LT1-4, E316T1-1, E316T1-4
ABS:	E316LT1-1, E316LT1-4, E316T1-1, E316T1-4
CWB/CSA W48-06:	E316LT1-1, E316LT1-4

Welding Positions

All

Shielding Gas

100% CO_2
75% Argon / 25% CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED033012
1/16 (1.6)	ED033013

UltraCore® FCP 316L

(AWS E316LT1-1, E316LT1-4, E316T1-1, E316T1-4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.22/A5.22M: 1995*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements				
AWS E316LT1-1, E316LT1-4	Not Specified	520 (75) min.	30	Not Specified
AWS E316T1-1, E316T1-4	Not Specified	550 (80) min.	min.	Not Specified
Test Results[3]				
As-Welded with 100% CO_2	435 (63)	565 (82)	39	7 - 10
As-Welded with 75% Ar/25% CO_2	450 (65)	585 (85)	39	7 - 10

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.22/A5.22M: 1995*

	%C[4]	%Mn	%Si	%S	%P
Requirements - AWS E316LT1-1 & E316LT1-4	0.04 max.	0.5 - 2.5	1.0 max.	0.03 max.	0.04 max.
Test Results[3]					
As-Welded with 100% CO_2	≤0.03	1.0 - 1.1	0.57 - 0.63	≤0.02	≤0.02
As-Welded with 75% Ar/25% CO_2	≤0.03	1.0 - 1.2	0.67 - 0.73	≤0.15	≤0.23

	%Ni	%Cr	%Mo	%Cu
Requirements - AWS E316LT1-1 & E316LT1-4	11.0 - 14.0	17.0 - 20.0	2.0 - 3.0	0.5 max.
Test Results[3]				
As-Welded with 100% CO_2	12.3 - 12.8	18.4 - 18.8	≤2.73	≤0.31
As-Welded with 75% Ar/25% CO_2	12.3 - 12.8	18.9 - 19.4	≤2.81	≤0.31

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75% Ar/25% CO_2	3/4 (19)	5.1 (200)	22-25	130	2.1 (4.7)	1.8 (4.0)	85
	3/4 (19)	7.6 (300)	23-26	165	3.2 (7.1)	2.7 (5.9)	83
	3/4 (19)	10.2 (400)	24-27	190	4.3 (9.4)	3.6 (7.9)	84
1/16 in (1.6 mm), DC+ 75% Ar/25% CO_2	1 (25)	3.6 (140)	23-26	170	2.8 (6.2)	2.3 (5.1)	82
	1 (25)	5.1 (200)	24-27	205	4.0 (8.8)	3.3 (7.2)	82
	1 (25)	8.9 (350)	25-28	290	7.0 (15.3)	5.6 (12.4)	81

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal, DC+. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Requirement for E316T1-1 and E316T1-4 is 0.08% max. carbon. [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE: Increase Voltage by 2V when using 100% CO_2

SuperCore® 347

AWS E347T0-1/4

Key Features

- High deposition flat / horizontal wire
- Improved bead appearance

Conformances

AWS A5.28	E347T0-1/4
BS EN ISO 17633-A	T19 9 Nb R C/M 3
BS EN ISO 17633-B	TS347-FB0

Welding Positions

Flat and horizontal

Applications

- Food
- Brewery
- Pharmaceutical Equipment
- Architectural
- General Fabrication

Shielding Gas

75-80% Argon / Balance CO_2
100% CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33 lb) Spool
1.2 (0.045)	ED034129

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.28*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)
Requirements AWS E347T0-1/4	350 min.	550 min.	30 min.	25 min.	–
Typical Results As-Welded	435	600	47	42	90

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.28*

	%C	%Mn	%Si	%S	%P	%Cr
Requirements AWS E347T0-1/4	0.08 max.	0.5 - 2.0	1.0 max.	0.025 max.	0.030 max.	18.0 - 21.0
Typical Results[3]	0.03	1.20	0.40	0.01	0.02	19.0
	%Ni	**%Mo**	**%Nb**	**%Cu**	**FN**	
Requirements AWS E347T0-1/4	9.0 - 11.0	0.3 max.	8x - 1.0	0.3 max.	4 - 12	
Typical Results[3]	10.5	0.10	0.50	-0.90	8.0	

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout in (mm)
1.2 (0.045) DC+	120 - 280A 22 - 34V	180A, 29V	15 - 25 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below.
NOTE: Additional test data available upon request.

SuperCore® 2205P

AWS E2209T1-1/4

Key Features

- Smooth all position weldability
- Vacuum sealed pack
- Excellent slag removal

CONFORMANCES

AWS A5.22	E2209T1-1/4
BS EN ISO 17633-A	T 22 9 3 N L P M 2, TS2209-FB1

WELDING POSITIONS

All

APPLICATIONS

- Duplex Stainless Steel Pipe, Plate, Fittings and Forgings
- Offshore
- Chemical / Petrochemical
- Pipework Systems
- Flowlines
- Risers
- Manifolds

Shielding Gas

80% Argon / 20%CO_2
100% CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33.1 lb) Spool
1.2 (0.045)	ED033462

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.22*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ -20°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -50°C (-58°F)	Charpy V-Notch J (ft•lbf) @ -75°C (-103°F)	Hardness HV_{10}[4]
Requirements AWS E2209T1-1/4	480 min.	690 min.	20 min.	20 min.	–	–	–	–
Typical Results As-Welded	630	800	32	29	65	55	30	270

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.22*

	%C	%Mn	%Si	%S	%P	%Cr
Requirements AWS E2209T1-1/4	0.04 max.	0.5 - 2.0	1.00 max.	0.02 max.	0.030 max.	21.5 - 24.0
Typical Results[3]	0.03	1.20	0.70	<0.01	0.02	23.0

	%Ni	%Mo	%Cu	%N	PRE[5]
Requirements AWS E2209T1-1/4	8.5 - 10.0	2.8 - 4.0	0.3 max	0.08 - 0.20	34 - 38
Typical Results[3]	9.20	3.10	0.10	0.12	35.0

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout in (mm)
1.2 (0.045) DC+	130 - 250A 20 - 34V	140A, 23V	15 - 25 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]Industry specific data, not required by AWS. [5]PRE (pitting resistance equivalent) = Cr + 3.3Mo = 16N.
NOTE: Additional test data available upon request.

Lincolnweld® 308/308L

Stainless • AWS ER308, ER308L

Key Features

- Designed to be used primarily with basic fluxes
- Versatile electrode designed to weld several types of austenitic steels
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Balanced chromium and nickel levels provide enough ferrite in the weld metal for high resistance to hot cracking
- Low carbon content recommended where there is a risk of intergranular corrosion

Typical Applications

- ASTM A743, A744 Types CF-8 and CF-3
- ASTM A240 Types 302, 304, 304L
- For joining the more common austenitic stainless steel grades referred to as "18-8" steels

Conformances

AWS A5.9/A5.9M: 2006	ER308, ER308L
ASME SFA-A5.9:	ER308, ER308L
ABS:	ER308, ER308L
CWB/CSA W48-06:	ER308L
EN ISO 14343-B:	SS308L

Recommended Fluxes

Lincolnweld® 801, 802, 880, 880M, 882, P2007, ST-100

DIAMETERS / PACKAGING

Diameter in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033147
3/32 (2.4)	ED033148
1/8 (3.2)	ED033149
5/32 (4.0)	ED033150

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER308, ER308L	Not Specified			
Test Results[3, 5] - As-Welded	380 (55)	565 (82)	42	15

WIRE & DEPOSIT COMPOSITION[1]

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER308L	0.03 max.	19.5 - 22.0	9.0 - 11.0	0.75 max.	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
Wire Composition	0.02	20.1	9.8	0.10	1.8	0.50
All Weld Metal Composition[5]	0.02	19.0 - 19.5	9.8	0.10	1.5 - 1.9	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER308 is 0.08% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

Lincolnweld® 309/309L

AWS ER309, ER309L • Stainless

Typical Applications

- ASTM A743, A744 Types CF-8 and CF-3 and ASTM A240 Type 309S
- For joining carbon or mild alloy steel to austenitic stainless steels
- Can also be used on "18-8" steels, since it overmatches the corrosion resistance, if the weldment will not be exposed to temperatures of 538° C to 927° C (1000° F to 1700° F)

Conformances

AWS A5.9/A5.9M: 2006	ER309, ER309L
ASME SFA-A5.9:	ER309, ER309L
ABS:	ER309, ER309L
CWB/CSA W48-06:	ER309L
EN ISO 14343-B:	SS309L

Key Features

- Designed to be used primarily with basic fluxes that recover nearly all of the wire chromium in the deposit
- Designed for joining stainless steel to mild or low alloy steel
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Low carbon content recommended where there is a risk of intergranular corrosion

Recommended Fluxes

Lincolnweld® 801, 802, 880, 880M, 882, P2007, ST-100

DIAMETERS / PACKAGING

Diameter - in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033151
3/32 (2.4)	ED033152
1/8 (3.2)	ED033153
5/32 (4.0)	ED033154

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER309, ER309L	Not Specified			
Test Results[3, 5] - As-Welded	400 (58)	575 (83)	35	8

WIRE & DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER309L	0.03 max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
Wire Composition	0.02	23.9	13.0	0.15	1.8	0.50
All Weld Metal Composition[5]	0.03	23.1 - 23.6	13.0	0.15	1.5 - 2.0	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter - in (mm)	Wire Feed Speed - m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER309 is 0.12% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

Lincolnweld® 316/316L

Stainless • AWS ER316, ER316L

Key Features

- Designed to be used primarily with basic fluxes that recover nearly all of the wire chromium in the deposit
- Molybdenum grade for increased corrosion resistance
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Low carbon content recommended where there is a risk of intergranular corrosion

Recommended Fluxes

Lincolnweld® 801, 802, 880, 880M, 882, P2007, ST-100

Typical Applications

- ASTM A743, A744 Types CF-8 and CF-3
- Type 316 and 316L
- For joining the more common austenitic stainless steel grades referred to as "18-8" steels
- For very good corrosion resistance in acid environments

Conformances

AWS A5.9/A5.9M: 2006	ER316, ER316L
ASME SFA-A5.9:	ER316, ER316L
ABS:	ER316, ER316L
CWB/CSA W48-06:	ER316L
EN ISO 14343-B:	SS316L

DIAMETERS / PACKAGING

Diameter - in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033155
3/32 (2.4)	ED033156
1/8 (3.2)	ED033157
5/32 (4.0)	ED033158

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER316, ER316L	Not Specified			
Test Results[3, 5] - As-Welded	380 (55)	550 (80)	42	9

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER316L	0.03 max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
As-Welded	0.02	19.0	11.9	2.2	1.8	0.50
All Weld Metal Composition[5]	0.02	17.8 - 18.4	11.9	2.2	1.6 - 2.0	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter - in (mm)	Wire Feed Speed - m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER316 is 0.08% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

Lincolnweld® P2000™

EN 760 – S A AF 2 • Stainless & Nickel

Typical Applications

- For submerged arc welding of stainless steel
- and nickel alloys.

Conformances

AWS EN 760 - S A AF 2

Packaging

50 lb. (22.7 kg) Plastic Bag ED034290

Key Features

- Neutral basic flux designed for welding stainless steel and nickel alloys
- Produces sound welds with excellent slag removal and bead appearance
- Exhibits superior resistance to moisture pickup
- Nickel overlays applications
- Stainless overlay and joining applications

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Ni	%Mo	%P	%S
Lincolnweld® P2000™[2]								
With Lincolnweld® 308/308L	0.018	1.24	0.631	19.34	9.86	0.04	0.03	0.007
With Lincolnweld® 309/309L	0.014	1.23	0.569	23.18	13.27	0.11	0.02	0.007
With Lincolnweld® 316/316L	0.014	1.30	0.568	18.25	12.00	2.69	0.015	0.013

[1] Typical all weld metal. [2] See test results disclaimer below.
NOTE: There are not AWS requirements for submerged arc stainless steel deposits.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: There are no AWS requirements for submerged arc stainless steel deposits.

Lincolnweld® P2007™

Stainless & Nickel • EN 760 – S A AF 2

Key Features

- Neutral basic flux designed for welding stainless steel and nickel alloys
- Produces sound welds with excellent slag removal and bead appearance
- Exhibits superior resistance to moisture pickup
- Nickel overlays applications
- Stainless overlay and joining applications

Typical Applications

- For submerged arc welding of the 300 and 400 series stainless steels, nickel alloys and similar alloy filler metal

Packaging

50 lb (22.7 kg) Plastic Bag	ED033159

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Lincolnweld® P2007[3]				
With Lincolnweld® 308/308L	380 (55)	565 (82)	42	10
With Lincolnweld® 309/309L	400 (58)	570 (83)	35	8
With Lincolnweld® 316/316L	380 (55)	550 (80)	42	9

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Ni	%Mo	%P	%S
Lincolnweld® P2007[3]								
With Lincolnweld® 308/308L	0.02	1.52	0.63	18.83	9.67	0.13	0.02	0.01
With Lincolnweld® 309/309L	0.03	1.71	0.59	23.58	13.35	0.09	0.02	<0.01
With Lincolnweld® 316/316L	0.02	1.36	0.58	18.04	11.50	2.14	0.02	0.01

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: There are no AWS requirements for submerged arc stainless steel deposits.

Lincolnweld® ST-100™

EN 760 – S A AS 2 • Stainless

Typical Applications

- General submerged arc welding of common austenitic stainless steels such as 304, 304L, 316, 316L, 309 and 347

Packaging

60 lb (27.2 kg) Plastic Bag ED031856

Key Features

- An alloy flux designed for use with solid stainless steel electrodes to compensate for chromium in the wire that is not recovered in the weld deposit
- Slag removal characteristics are exceptionally good, even on niobium (columbium) bearing steels
- Good performance on seamer applications

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Lincolnweld® ST-100[3]				
With Lincolnweld® S308/308L	405 (59)	600 (87)	38	10
With Lincolnweld® S309/309L	415 (60)	585 (85)	37	14
With Lincolnweld® S316/316L	415 (60)	585 (85)	40	10

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Ni	%Mo
Lincolnweld® ST-100[3, 4]						
With Lincolnweld® S308/308L	0.01	1.9	0.50	19.6	9.8	0.10
Groove Weld	0.02	2.1	0.70	19.6	9.7	0.10
With Lincolnweld® S309/309L	0.02	2.1	0.40	23.8	13.7	0.10
Groove Weld	0.03	2.3	0.60	24.1	13.6	0.10
With Lincolnweld® S316/316L	0.02	1.7	0.45	19.0	11.9	2.20
Groove Weld	0.02	1.7	0.65	18.8	11.8	2.20

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Results shown are typical wire compositions for the Blue Max® subarc wires listed, and typical weld deposit composition for 1 in groove welds on matching plate.
NOTE: There are no AWS requirements for submerged arc stainless steel deposits.

Lincoln® ER308/308L

Stainless • AWS ER308, ER308L

Key Features

- Use on base metals of similar composition
- Dual classification ensures the maximum carbon content is 0.03%
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- 0.03% carbon content increases resistance to intergranular corrosion
- Ink jet printing identification on entire length of electrode

Typical Applications

- Sheet metal on the corresponding stainless steel base metals
- High pressure piping and tubing

Conformances

AWS A5.9/A5.9M: 2006	ER308, ER308L
ASME SFA-A5.9:	ER308, ER308L
EN ISO 14343-B:	SS308L

Welding Positions

All

Shielding Gas

100% Argon

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Tube 10 lb (4.5 kg) Master Carton	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton	10 lb (4.5 kg) Carton	50 lb (22.7 kg) Carton
1/16 (1.6)	ED025410	ED034439	ED025412	ED026655
3/32 (2.4)	ED025413	ED034440	ED025415	ED026656
1/8 (3.2)	ED025416	ED034441	ED025418	ED026657

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER308L	0.03[2] max.	19.5 - 22.0	9.0 -11.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	20.2	9.2	0.03	1.6
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER308L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.44	0.02	0.02	0.11	0.03

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1]See test results disclaimer on pg. 18. [2]Requirements for ER308 is 0.08% max. carbon.

Lincoln® ER309/309L

AWS ER309, ER309L • Stainless

Typical Applications

- Sheet metal on the corresponding stainless steel base metals
- High pressure piping and tubing

Conformances

AWS A5.9/A5.9M: 2006	ER309, ER309L
ASME SFA-A5.9:	ER309, ER309L
EN ISO 14343-B:	SS309L

Shielding Gas

100% Argon

Key Features

- Use for welding dissimilar alloys in wrought or cast form
- Occasionally used for welding “18-8” base metals when severe corrosion conditions exist or dissimilar metals
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- 0.03% carbon content increases resistance to intergranular corrosion
- Ink jet printing identification on entire length of electrode

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Tube 10 lb (4.5 kg) Master Carton	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton	10 lb (4.5 kg) Carton	50 lb (22.7 kg) Carton
1/16 (1.6)	ED025419	ED034442	ED025421	ED026658
3/32 (2.4)	ED025422	ED034443	ED025424	ED026659
1/8 (3.2)	ED025425	ED034444	ED025427	ED026660

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER309L	0.03[2] max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	23.7	13.9	0.04	1.8
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER309L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.51	0.02	0.01	0.05	0.06

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]See test results disclaimer on pg. 18. [2]Requirements for ER309 is 0.12% max. carbon.

Lincoln® ER316/316L

Stainless • AWS ER316, ER316L

Key Features

- Use for welding similar alloys containing approximately 2% molybdenum
- Use for high temperature service applications
- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- 0.03% carbon content increases resistance to intergranular corrosion
- Ink jet printing identification on entire length of electrode

Typical Applications

- Sheet metal on the corresponding stainless steel base metals
- High pressure piping and tubing

Conformances

AWS A5.9/A5.9M: 2006	ER316, ER316L
ASME SFA-A5.9:	ER316, ER316L
EN ISO 14343-B:	SS316L

Welding Positions

All

Shielding Gas

100% Argon

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Tube 10 lb (4.5 kg) Master Carton	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master Carton	10 lb (4.5 kg) Carton	50 lb (22.7 kg) Carton
1/16 (1.6)	ED025419	ED034445	ED025421	ED026658
3/32 (2.4)	ED025422	ED034446	ED025424	ED026659
1/8 (3.2)	ED025425	ED034447	ED025427	ED026660

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER316L	0.03[2] max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5
Test Results[1]	0.02	18.7	11.8	2.3	1.7
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER316L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.52	0.02	0.01	0.10	0.30

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] See test results disclaimer on pg. 18. [2] Requirements for ER316 is 0.08% max. carbon.

Blue Max® LNT 4462

AWS ER2209 • Stainless

Conformances

AWS A5.9-93:	ER2209
EN ISO 14343-A:	G 22 9 3 N L
TUV, Controlas	

Welding Positions

All

Shielding Gas

100% Argon

Key Features

- Premium performance and quality
- Designed for joining duplex stainless steels
- Provides high resistance to general corrosion, pitting and stress corrosion
- Composition is controlled to produce consistent mechanical properties

Typical Applications

- Alloy 2205: UNS S31803, UNS S31500
- Alloy 2304: UNS S32304, UNS S31200

DIAMETERS / PACKAGING

Diameter mm (in)	22 lb (10 kg) Carton
2.4 (3/32)	ED031311
3.2 (1/8)	ED031312

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9-93*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -20°C (-4°F)	Charpy V-Notch J (ft•lbf) @ -60°C (-75°F)
Requirements - AWS ER2209	Not Specified				
Test Results[2] - As-Welded	600 (87)	800 (116)	28	60 (44)	45 (33)

WIRE COMPOSITION[1] – *As Required per AWS A5.9-93*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER2209	0.030 max.	21.5-23.5	7.5-9.5	2.5-3.5	0.5-2.0
Test Results[3]	0.018	22.7	8.5	3.0	1.5
	%Si	**%P**	**%S**	**%Cu**	**%N**
Requirements - AWS ER2209	0.90 max.	0.03 max.	0.03 max.	0.75 max.	0.08-0.20
Test Results[3]	0.50	0.03	0.03	0.30	0.15

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

PRIMALLOY™ T-409Ti

Stainless • AWS EC409

Key Features

- Minimal spatter and slag
- Good deposition rate and corrosion resistance[1]
- High travel speed welding on thin material
- Q2 Lot® certificate showing actual deposit composition available online.

[1]See procedures for more information.

Typical Applications

- Designed for joining components of automotive exhaust systems, such as catalytic converters Single pass welding

Conformances

AWS A5.9/A5.9M EC409

Welding Positions

Flat & horizontal only

Packaging

- Precision layer wound plastic spools, vacuum-packed in foil-poly bags
- Available in 500 lb. bulk packaging

Shielding gas

98% Ar / 2% O2,
18L/min or 40-45 CFH

DIAMETERS / PACKAGING

	33 lb (15 kg) Plastic Spool	500 lb (227 kg) Bulk Drum
Diameter - in (mm) 0.045 (1.2)	ED034208	ED034209
Pallet Weight - lb (kg)	2381 (1080)	1000 (454)

WELD COMPOSITION[1] – *As Required per AWS A5.9/5.9M*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS EC409	0.08	10.5-13.5	0.60	0.50	0.80
Typical Results 98% Argon / 2% O_2	0.025	11.1	0.02	0.027	0.46

	%Si	%P	%S	%Ti
Requirements AWS EC409	0.80	0.03	0.03	10xC min. 1.5 max.
Typical Results 98% Argon / 2% O_2	0.60	0.007	0.008	1.02

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD in (mm)	Wire Feed Speed (in/mm)	Approx. Current (amps)	Volts (DCt)
0.045 (1.2), DC+ 98% Argon /2% CO_2	5/8 (15.8)	200 250 300 450	22 23 25 28	200 230 260 335

[1]See test results disclaimer on pg. 18.

PRIMALLOY™ T-439Ti

AWS EC409 • Stainless

Conformances

AWS A5.9/A5.9M EC439

Welding Positions

Flat & horizontal only

Packaging

- Precision layer wound plastic spools, vacuum-packed in foil-poly bags
- Available in 500 lb. bulk packaging

Shielding gas

98% Ar / 2% O2,
18L/min or 40-45 CFH

Key Features

- Minimal spatter and slag
- Good deposition rate and corrosion resistance[1]
- High travel speed welding on thin material
- Q2 Lot® certificate showing actual deposit composition available online

[1]See procedures for more information.

Typical Applications

- Designed for joining components of automotive exhaust systems, such as catalytic converters
- Single pass welding

DIAMETERS / PACKAGING

	33 lb (15 kg) Plastic Spool	500 lb (227 kg) Bulk Drum
Diameter - in (mm) 0.045 (1.2)	ED034293	ED034294
Pallet Weight - lb (kg)	2381 (1080)	1000 (454)

WELD COMPOSITION[1] – *As Required per AWS A5.9/5.9M*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements AWS EC439	0.04	17.0-19.0	0.60	0.50	0.80
Typical Results 98% Argon / 2% O_2	0.027	17.43	0.017	0.015	0.47
	%Si	**%P**	**%S**	**%Ti**	
Requirements AWS EC439	0.80	0.03	0.03	10xC min. 1.5 max.	
Typical Results 98% Argon / 2% O_2	0.38	0.007	0.011	0.284	

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD in (mm)	Wire Feed Speed (in/min)	Approx. Current (amps)	Volts (DCt)
0.045 (1.2), DC+ 98% Argon /2% CO_2	5/8 (15.8)	200 250 300 450	22 23 25 28	200 230 260 335

[1]See test results disclaimer on pg. 18.

Notes

NICKEL

Stick Electrode

Tech-Rod® 55 290
Tech-Rod® 99 291
Tech-Rod® 112 292
Tech-Rod® 112LFe 293
Tech-Rod® 117 294
Tech-Rod® 122 295
Tech-Rod® 141 296
Tech-Rod® 182 297
Tech-Rod® 187 298
Tech-Rod® 190 299
Tech-Rod® 276 300
Tech-Rod® Weld A 301

MIG Wire

Techalloy® 55 302
Techalloy® 99 303
Techalloy® 208 304
Techalloy® 276 305
Techalloy® 413 306
Techalloy® 418 307
Techalloy® 606 308
Techalloy® 617 309
Techalloy® 622 310
Techalloy® 625 311
Techalloy® 718 312
Techalloy® 825 313

Flux-Cored (FCAW-G) Wire

SuperCore® 625P 314

Tech-Rod® 55

Nickel • AWS ENiFe-CI

Key Features

- Used for welding of cast irons to other cast irons as well as for joining cast irons to mild steels
- Used for the repair of castings
- The welds are moderately hard and required carbide tipped tools for machining
- A preheat and inter-pass temperature of not less than 350°F is required during welding to prevent cracking

Conformances

AWS A5.15/A5.15M: 1990	ENiFe-CI
UNS	W82002
ASME	QSC-395

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL55093632	
1/8 (3.2)	14 (355)		EL55125634
5/32 (4.0)	14 (355)		EL55156634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.15/A5.15M: 1990*

	%C	%Mn	%Si	%S	%Fe
Requirements AWS ENiFe-CI	2.0 max.	2.5 max.	4.0 max.	0.03 max.	Remainder
Typical Performance[2] Tech-Rod® 55	0.7	0.7	0.1	0.003	–
	%Ni	**%Cu**	**%Al**	**%Other**	
Requirements AWS ENiFe-CI	45.0 - 60.0	2.5 max.	1.0 max.	1.0 max.	
Typical Performance[2] Tech-Rod® 55	54.4	0.3	0.01	–	

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	110-120

[1]Typical all weld metal. [2]See test results disclaimer on pg 16.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 99

AWS ENi-CI • Nickel

Conformances

AWS A5.15/A5.15M: 1990	ENi-CI
UNS	W82001
ASME	QSC-395

Key Features

- Used for welding of cast irons to other cast irons as well as for joining cast irons to mild steels and stainless steels
- Readily used for the repair of castings
- The welds produced are generally more machinable than a Tech-Rod® 55 deposit
- A preheat and inter-pass temperature of not less than 350°F is required during welding to prevent cracking

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL99093632	
1/8 (3.2)	14 (355)		EL99125634
5/32 (4.0)	14 (355)		EL99156634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.15/A5.15M: 1990*

	%C	%Mn	%Si	%S	%Fe
Requirements AWS ENi-CI	2.0 max.	2.5 max.	4.0 max.	0.03 max.	8.0 max.
Typcial Performance[2] Tech-Rod® 99	0.5	0.1	0.2	0.002	1.2
	%Ni	**%Cu**	**%Al**	**%Other**	
Requirements AWS ENi-CI	85.0 min	2.5 max.	1.0 max.	1.0 max.	
Typcial Performance[2] Tech-Rod® 99	97.5	0.2	0.06	1.0 max.	

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	110-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 112

Nickel • AWS ENiCrMo-3

Key Features

- A covered electrode which is used to weld nickel-chromium-molybdenum alloys.
- Used extensively in overlay cladding where a similar chemical composition is required on the clad side
- Dissimilar joints between nickel-chromium-molybdenum alloys to stainless steels, carbon or low alloy steels
- These electrodes are used in applications where the temperature ranges from cryogenic up to 1800°F (982°C)

Conformances

AWS A5.11/A5.11M: 2010	ENiCrMo-3
UNS	W86112
ASME	QSC-395

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL112093632	
1/8 (3.2)	14 (355)		EL112125634
5/32 (4.0)	14 (355)		EL112156634
3/16 (4.8)	14 (355)		EL112187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENiCrMo-3	0.10 max.	1.0 max.	7.0 max.	0.03 max.	0.02 max.	0.75 max.
Typcial Performance[2] Tech-Rod® 112	0.03	0.3	1.9	0.01	0.003	0.33

	%Ni	%Cr	%Nb+Ta	%Mo	%Other
Requirements AWS ENiCrMo-3	55.0 min.	20.0 - 23.0	3.15 - 4.15	8.0 - 10.0	0.50 max.
Typcial Performance[2] Tech-Rod® 112	62.1	22.4	3.63	8.7	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	110-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 112LFe

AWS ENiCrMo-3 • Nickel

Conformances

AWS A5.11/A5.11M: 2010	ENiCrMo-3
UNS	W86112
ASME	QSC-395

Key Features

- A low iron version of the standard Tech-Rod® 112 covered electrode which is used to weld nickel-chromium-molybdenum alloys
- The product is designed to have less than 1% Iron (Fe) for overlay applications to minimize dilution of parent metal iron in the deposit

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
1/8 (3.2)	14 (355)	EL112LFE125634
5/32 (4.0)	14 (355)	EL112LFE156634
3/16 (4.8)	14 (355)	EL112LFE187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENiCrMo-3	0.10 max.	1.0 max.	7.0 max.	0.03	0.02 max.	0.75 max.
Typcial Performance[2] Tech-Rod® 112LFe	0.02	0.2	0.8	0.01	0.003	0.27
	%Cu	**%Ni**	**%Cr**	**%Nb+Ta**	**%Mo**	**%Other**
Requirements AWS ENiCrMo-3	0.50 max.	55.00 min.	20.0 - 23.0	3.15 - 4.15	8.0 - 10.0	0.50 max.
Typcial Performance[2] Tech-Rod® 112LFe	0.02	63.8	22.5	3.6	8.7	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage	
		Flat	Vertical & Overhead
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	110-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 117

Nickel • AWS ENiCrCoMo-1

Key Features

- A covered electrode which is used for welding of nickel-chromium-cobalt-molybdenum alloys
- This electrode can also be used for overlay cladding where similar composition is required
- The deposited weld metal provides optimum strength and oxidation resistance between 1500°F to 2100°F, especially when welding on base metals of nickel-iron-chromium alloys

Conformances

AWS A5.11/A5.11M: 2010	ENiCrCoMo-1
ASME SFA-A5.4	ENiCrCoMo-1

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL117093632	
1/8 (3.2)	14 (355)		EL117125634
5/32 (4.0)	14 (355)		EL117156634
3/16 (4.8)	14 (355)		EL117187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11: 2010*

	%C	%Mn	%Fe	%P	%S
Requirements[2] AWS ENiCrCoMo-1	0.05 - 0.15	0.3 - 2.5	5.0 max.	0.03 max.	0.015 max.
Typical Performance Tech-Rod® 117	0.08	0.9	1.6	0.01	0.004
	%Si	**%Cu**	**%Ni**	**%Co**	**%Cr**
Requirements AWS ENiCrCoMo-1	0.75 max.	0.50 max.	Remainder	9.0 - 15.0	21.0 - 26.0
Typical Performance[2] Tech-Rod® 117	0.31	0.03	53.00	11.3	23.4
	%Nb+Ta	**%Mo**	**%W**	**%Other**	
Requirements AWS ENiCrCoMo-1	1.0 max.	8.0 - 10.0	Not Specified	0.50 max.	
Typical Performance[2] Tech-Rod® 117	0.4	8.4	0.03	–	

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 122

AWS ENiCrMo-10 • Nickel

Conformances

AWS A5.11/A5.11M: 2010	ENiCrMo-10
ASME SFA-A5.4	ENiCrMo-10

Key Features

- Used for welding of nickel-chromium-molybdenum alloys as well as for overlay cladding on carbon, low alloy or stainless steels
- Used for dissimilar joints between nickel-chromium-molybdenum alloys and stainless, carbon or low alloy steels
- Excellent corrosion resistance in oxidizing as well as reducing media in a wide variety of chemical process environments
- Offers an outstanding resistance to stress corrosion cracking, pitting and crevice corrosion
- Better corrosion resistance than 276 and 625

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Can	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL122093632	
1/8 (3.2)	14 (355)		EL122125634
5/32 (4.0)	14 (355)		EL122156634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11: 2010*

	%C	%Mn	%Fe	%P	%S
Requirements AWS ENiCrMo-10	0.02 max.	1.0 max.	2.0 - 6.0	0.03 max.	0.02 max.
Typical Performance[2] Tech-Rod® 122	0.01	0.4	4.3	0.01	0.003
	%Si	**%Cu**	**%Ni**	**%Co**	**%Cr**
Requirements AWS ENiCrMo-10	0.2 max.	0.50 max.	Remainder	2.5 max.	20.0 - 22.5
Typical Performance[2] Tech-Rod® 122	0.1	0.002	55.8	0.03	22.1
	%Nb+Ta	**%Mo**	**%V**	**%W**	**%Other**
Requirements AWS ENiCrMo-10	Not Specified	12.5 - 14.5	0.35 max.	2.5 - 3.5	0.50 max.
Typical Performance[2] Tech-Rod® 122	0.008	13.7	0.02	3.1	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 141

Nickel • AWS ENi-1

Key Features

- Welding of cast and wrought forms of pure nickel alloys
- Used for surfacing as well as dissimilar welding between nickel or mild steel and stainless steel

Conformances

AWS A5.11/A5.11M: 2010	ENi-1
ASME SFA-A5.4	ENi-1

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL141093632	
1/8 (3.2)	14 (355)		EL141125634
5/32 (4.0)	14 (355)		EL141156634
3/16 (4.8)	14 (355)		EL141187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11/A5.11M: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENi-1	0.10 max.	0.75 max.	0.75 max.	0.03 max.	0.02 max.	1.25 max.
Typical Performance[2] Tech-Rod® 141	0.02	0.43	0.52	0.01	0.01	0.93

	%Cu	%Ni	%Ti	%Al	%Other
Requirements AWS ENi-1	0.25 max.	92.0 min.	1.0 - 4.0	1.0 max.	0.50 max.
Typical Performance[2] Tech-Rod® 141	0.04	96.7	1.2	0.03	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 182

AWS ENiCrFe-3 • Nickel

Conformances

AWS A5.11/A5.11M: 2010	ENiCrFe-3
ASME SFA-A5.4	ENiCrFe-3

Key Features

- Used for welding of nickel-chromium-iron alloys to themselves and for dissimilar welding between nickel-chromium-iron alloys to mild steels or stainless steels
- High manganese of this weld deposit reduces the possibility of micro fissures but reduces creep strength which limits its usage up to 900°F (482°C)

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL182093632	
1/8 (3.2)	14 (355)		EL182125634
5/32 (4.0)	14 (355)		EL182156634
3/16 (4.8)	14 (355)		EL182187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENiCrFe-3	0.10 max.	5.0 - 9.5	10.0 max.	0.03 max.	0.015 max.	1.0 max.
Typical Performance[2] Tech-Rod® 182	0.05	5.6	8.4	0.01	0.004	0.3
	%Cu	**%Ni**	**%Ti**	**%Cr**	**%Nb+Ta**	**%Other**
Requirements AWS ENiCrFe-3	0.50 max.	59.0 min.	1.0 max.	13.0 - 17.0	1.0 - 2.5	0.50 max.
Typical Performance[2] Tech-Rod® 182	0.03	68.5	0.05	15.4	1.2	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 187

Nickel • AWS ECuNi

Key Features

- A copper-nickel electrode for shielded metal and welding of wrought of cast alloys of similar composition as well as 80/20 and 90/10 Cu/Ni alloys
- Used for the clad side of copper-nickel clad steels
- This filler metal is widely used in marine applications because of its good resistance to the corrosive effects of sea water

Conformances

AWS A5.6/A5.6M: 2008	ECuNi
ASME SFA-A5.4	ECuNi

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL187093632	
1/8 (3.2)	14 (355)		EL187125634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.6: 2008*

	%Mn	%Fe	%P	%Si	%Cu
Requirements AWS ECuNi	1.00 - 2.50	0.40 - 0.75	0.020 max.	0.50 max.	Remainder
Typical Performance[2] Tech-Rod® 187	1.19	0.50	0.005	0.01	67.0

	%Ni	%Ti	%Pb	%Other
Requirements AWS ECuNi	29.0 - 33.0	0.50 max.	0.02 max.	0.50 max.
Typical Performance[2] Tech-Rod® 187	31.0	0.24	0.003	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 190

AWS ENiCu-7 • Nickel

Conformances

AWS A5.11/A5.11M: 2010	ENiCu-7
ASME SFA-A5.4	ENiCu-7

Key Features

- Welding nickel-copper alloys to themselves and to steel
- Used for overlay welding as well as for welding of clad steels where nickel-copper surfacing is required
- Dissimilar applications include joining 200 series nickel alloys to copper-nickel alloys

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL190093632	
1/8 (3.2)	14 (355)		EL190125634
5/32 (4.0)	14 (355)		EL190156634
3/16 (4.8)	14 (355)		EL190187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11/A5.11M: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENiCu-7	0.15	4.0 max.	2.5 max.	0.02 max.	0.015 max.	1.5 max.
Typcial Performance[2] Tech-Rod® 190	0.03	3.1	0.9	0.01	0.004	0.61

	%Cu	%Ni	%Al	%Ti	%Other
Requirements AWS ENiCu-7	Remainder	62 - 69	0.75 max.	1.0 max.	1.0 max.
Typcial Performance[2] Tech-Rod® 190	27	65	0.05	0.21	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® 276

Nickel • AWS ENiCrMo-4

Key Features

- Used for welding materials of similar composition
- This low carbon, nickel-chromium-molybdenum filler metal can also be used for dissimilar welding between nickel base alloys and stainless steels, as well as for surfacing and cladding
- Due to high molybdenum content, this alloy offers excellent resistance to stress corrosion cracking and pitting and crevice corrosion

Conformances

AWS A5.11/A5.11M: 2010	ENiCrMo-4
ASME SFA-A5.4	ENiCrMo-4

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	EL276093632	
1/8 (3.2)	14 (355)		EL276125634
5/32 (4.0)	14 (355)		EL276156634
3/16 (4.8)	14 (355)		EL276187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11/A5.11M: 2010*

	%C	%Mn	%Fe	%P	%S	%Si	%Cu
Requirements AWS ENiCrMo-4	0.02 max.	1.0 max.	4.0 - 7.0	0.04 max.	0.03 max.	0.2 max.	0.50 max.
Typcial Performance[2] Tech-Rod® 276	0.01	0.7	6.0	0.01	0.003	0.1	0.04
	%Ni	**%Co**	**%Cr**	**%Mo**	**%V**	**%W**	**%Other**
Requirements AWS ENiCrMo-4	Remainder	2.5 max.	14.5 - 16.5	15.0 - 17.0	0.35 max.	3.0 - 4.5	0.50 max.
Typcial Performance[2] Tech-Rod® 276	57.3	0.02	15.8	15.7	0.03	3.9	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Tech-Rod® Weld A

AWS ENiCrFe-2 • Nickel

Conformances

AWS A5.11/A5.11M: 2010	ENiCrFe-2
UNS	W86133
ASME	QSC-395

Key Features

- Used for welding of nickel-chromium-iron alloys to themselves as well as for dissimilar welding between various nickel alloys to a steel or stainless steels
- Overlay cladding where a similar composition is needed
- Applications ranging from cryogenic temperature up to 1500°F

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Can 30 lb (13.6 kg) Master Can
3/32 (2.4)	12 (305)	ELWLDA093632	
1/8 (3.2)	14 (355)		ELWLDA125634
5/32 (4.0)	14 (355)		ELWLDA156634
3/16 (4.8)	14 (355)		ELWLDA187634

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.11/A5.11M: 2010*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ENiCrFe-2	0.10 max.	1.0 - 3.5	12.0 max.	0.03 max.	0.02 max.	0.75 max.
Typical Performance[2] Tech-Rod® Weld A	0.02	2.6	9.9	0.012	0.004	0.36
	%Cu	**%Ni**	**%Cr**	**%Nb+Ta**	**%Mo**	**%Other**
Requirements AWS ENiCrFe-2	0.50 max.	62.0 min.	13.0 - 17.0	0.5 -3.0	0.5 - 2.5	0.50 max.
Typical Performance[2] Tech-Rod® Weld A	0.05	65.4	15.9	2.1	0.96	–

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Length in (mm)	Amperage Flat	Amperage Vertical & Overhead
3/32 (2.4)	12 (305)	70-85	65-75
1/8 (3.2)	14 (355)	85-110	80-90
5/32 (4.0)	14 (355)	110-140	100-120
3/16 (4.8)	14 (355)	120-160	110-130

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 55

Nickel • AWS Similar to ENiFe-CI

Key Features

- Used for welding of cast irons to other cast irons as well as for joining cast irons to mild steels
- Readily used for the repair of castings
- The welds are moderately hard and require carbide tipped tools for machining
- A preheat and inter-pass temperature of not less than 350°F (175°C) is required during welding to prevent cracking

Conformances

Similar to AWS A5.15/A5.15M: 1990 ENiFe-CI

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG55035667	
0.045	(1.1)	MG55045667	
1/8	(3.2)		TG55125638

DEPOSIT COMPOSITION [1] - *As Required per AWS A5.15/A5.15M: 1990*

	%C	%Mn	%Si	%S	%Fe
Requirements AWS ENiFe-CI	2.0 max.	2.5 max.	4.0 max.	0.03 max.	Remainder
Typical Performance[2] Techalloy® 55	0.01	0.5	0.1	0.002	44.5

	%Ni	%Cu	%Al	%Other
Requirements AWS ENiFe-CI	45-60	2.5 max.	1.0 max.	1.0 max.
Typical Performance[2] Techalloy® 55	54	0.02	0.005	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1)	26-29 28-32	150-190 180-220	75% Argon / 25% Helium
TIG	1/8 (3.2)	–	150-220	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 99

AWS ERNi-CI • Nickel

Conformances

AWS A5.15/A5.15M: 1990	ERNi-CI
UNS	N02215
CWB	

Key Features

- Used for welding of cast irons to other cast irons as well as for joining cast irons to mild steels and stainless steels
- Readily used for the repair of castings
- Welds produced are generally more machinable than a Tech-Rod® 55 deposit
- A preheat and inter-pass temperature of not less than 350°F (175°C) is required during welding to prevent cracking

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG99035667	
0.045	(1.1)	MG99045667	
3/32	(2.4)		TG99093638

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.15/A5.15M: 1990*

	%C	%Mn	%Si	%S	%Fe
Requirements AWS ERNi-CI	2.0 max.	2.5 max.	4.0 max.	0.03 max.	8.0 max.
Typical Performance[2] Techalloy® 99	0.003	0.07	0.09	0.001	0.1

	%Ni	%Cu	%Al	%Other
Requirements AWS ERNi-CI	85 min.	2.5 max.	1.0 max.	1.0 max.
Typical Performance[2] Techalloy® 99	99	0.02	0.1	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1)	24-27 25-30	150-190 200-290	75% Argon / 25% Helium
TIG	3/32 (2.4)	–	120-175	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 208

Nickel • AWS ERNi-1

Key Features

- For TIG, MIG and SAW welding of nickel 200 or 201
- This filler metal is also employed for overlay on steel as well as repairing cast iron castings
- Used for dissimilar joints between nickel or nickel alloys to stainless or ferritic steels

Conformances

AWS A5.14 ERNi-1

UNS N02061

CWB

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG208035667	
0.045	(1.1)	MG208045667	
1/16	(1.6)	MG208062667	TG208062638
3/32	(2.4)		TG208093638
1/8	(3.2)		TG208125638

DEPOSIT COMPOSITION

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ERNi-1	0.15 max.	1.0 max.	1.0 max.	0.03 max.	0.015 max.	0.75 max.
Typical Performance[2] Techalloy® 208	0.005	0.4	0.04	0.004	0.002	0.44

	%Cu	%Ni	%Al	%Ti	%Other
Requirements AWS ERNi-1	0.25 max.	93.0 min	1.5 max.	2.0 - 3.5	0.50 max
Typical Performance[2] Techalloy® 208	0.02	96.0	0.1	2.8	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	24-29 26-30 29-33	180-200 250-270 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 276

AWS ERNiCrMo-4 • Nickel

Conformances

AWS A5.14	ERNiCrMo-4
UNS	N10276

Key Features

- Used for welding materials of similar composition
- Low carbon, nickel-chromium-molybdenum filler metal can also be used for dissimilar welding between nickel base alloys and stainless steels, as well as for surfacing and cladding
- Due to high molybdenum content, this alloy offers excellent resistance to stress corrosion cracking, pitting and crevice corrosion

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Basket
0.035	(0.9)	MG276035667		
0.045	(1.1)	MG276045667		
1/16	(1.6)	MG276062667	TG276062638	
3/32	(2.4)		TG276093638	SA276093726
1/8	(3.2)		TG276125638	SA276125726
5/32	(4.0)		TG276156638	

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si	%Cu
Requirements AWS ERNiCrMo-4	0.02 max.	1.0 max.	4.0 - 7.0	0.04 max.	0.03 max.	0.08 max.	0.50 max
Typcial Performance[2] Techalloy® 276	0.008	0.4	5.7	0.003	0.002	0.03	0.02
	%Ni	**%Co**	**%Cr**	**%Mo**	**%V**	**%W**	**%Other**
Requirements AWS ERNiCrMo-4	Remainder	2.5 max.	14.5 - 16.5	15.0 - 17.0	0.35 max.	3.0 - 4.5	0.50 max.
Typcial Performance[2] Techalloy® 276	58.0	0.07	16.0	15.5	0.04	3.8	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	150-190 180-220 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	13-16 14-18 15-20 15-20	80-110 90-130 120-175 150-220	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-30 29-32	275-350 350-450	Lincolnweld® P2000 or Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 413

Nickel • AWS ERCuNi

Key Features

- Used for TIG, MIG, SAW and oxy-fuel welding of 70/30, 80/20 and 90/10 copper-nickel alloys
- This filler metal can be used for MIG overlay on steel after a first layer with Nickel 208
- Dissimilar welding applications include joining copper-nickel alloys to Nickel 200 or nickel-copper alloys

Conformances

AWS A5.7	ERCuNi
UNS	C71581
CWB	

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG413035667	
0.045	(1.1)	MG413045667	
1/16	(1.6)	MG413062667	TG413062638
3/32	(2.4)		TG413093638
1/8	(3.2)		TG4131252638

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.7*

	%Cu	%Mn	%Fe	%Si	%Ni
Requirements AWS ERCuNi	Remainder	1.0 max.	0.40 - 0.75	0.25 max.	29 - 32
Typcial Performance[2] Techalloy® 413	67.5	0.8	0.59	0.07	30

	%P	%Pb	%Ti	%Other
Requirements AWS ERCuNi	0.02 max.	0.02 max.	0.20 - 0.50	0.50 max.
Typcial Performance[2] Techalloy® 413	0.006	0.003	0.27	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	25-29 25-28 29-33	150-190 180-240 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 418

AWS ERNiCu-7 • Nickel

Conformances

AWS A5.14	ERNiCu-7
UNS	N04060
CWB	

Typical Applications

- Marine

Key Features

- Used for TIG, MIG and SAW welding of copper alloys (ASTM B127, B163, B164 and B165 UNS Number N04400).
- This filler metal can be used for MIG overlay on steel after a first layer with nickel 208.
- Dissimilar welding applications include joining alloys to Nickel 200 and copper-nickel alloys.

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG418035667		
0.045	(1.1)	MG418045667		
1/16	(1.6)	MG418062667	TG418062638	
3/32	(2.4)		TG418093638	SA418093726
1/8	(3.2)		TG418125638	SA418125726

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ERNiCu-7	0.15 max.	4.0 max.	2.5 max.	0.02 max.	0.015 max.	1.25 max.
Typical Performance[2] Techalloy® 418	0.07	3.5	0.08	0.002	0.001	0.33

	%Cu	%Ni	%Al	%Ti	%Others
Requirements AWS ERNiCu-7	Remainder	62.0 - 69.0	1.25 max.	1.5 - 3.0	0.50 max.
Typical Performance[2] Techalloy® 418	27.5	65.9	0.07	2.3	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	25-28 26-30 29-33	160-200 190-230 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-30 29-32	275-350 350-450	Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 606

Nickel • AWS ERNiCr-3

Key Features

- Used for TIG, MIG and SAW welding of base materials such as ASTM B163, B166, B167 and B168 alloys which have UNS Number N06600
- Suitable for applications ranging from cryogenic to high temperatures making this alloy on of the most used in the nickel family
- This filler metal can also be used for dissimilar welding applications between various nickel alloys and stainless or carbon steels, as well as for overlay

Conformances

AWS A5.14	ERNiCr-3
UNS	N06082

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 60 lb (27.2 kg) Coil
0.035	(0.9)	MG606035667		
0.045	(1.1)	MG606045667		
1/16	(1.6)	MG606062667	TG606062638	
3/32	(2.4)		TG606093638	SA606093726
1/8	(3.2)		TG606125638	SA606125726

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si
Requirements AWS ERNiCr-3	0.10 max.	2.5 - 3.5	3.0 max.	0.03 max.	0.015	0.50 max.
Typical Performance[2] Techalloy® 606	0.04	3.1	0.9	0.003	0.002	0.03
	%Cu	**%Ni**	**%Ti**	**%Cr**	**%Nb + Ta**	**%Others**
Requirements AWS ERNiCr-3	0.50 max.	67.0 min	0.75 max.	18.0 - 22.0	2.0 - 3.0	0.50 max.
Typical Performance[2] Techalloy® 606	0.01	71.7	0.42	21.0	2.4	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	150-190 180-220 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-30 29-32	275-350 350-450	Suitable Flux may be used

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 617

AWS ERNiCrCoMo-1 • Nickel

Conformances

AWS A5.14	ERNiCrCoMo-1
UNS	N06617
CWB	

Key Features

- Used for TIG, MIG and SAW welding of nickel-chrome-cobalt-molybdenum alloys to themselves as well as dissimilar metals such as stainless, carbon or low alloy steels
- This filler wire can also be used for overlay welding where similar chemical composition is desired
- The weld metal provides optimum strength and oxidation resistance from 1500°F (815°C) up to 2100°F (1150°C)

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Coil
0.035	(0.9)	MG617035667		
0.045	(1.1)	MG617045667		
1/16	(1.6)	MG617062667	TG617062638	
3/32	(2.4)		TG617093638	
1/8	(3.2)		TG617125638	SA617125726
5/32	(4.0)		TG617156638	

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si	%Cu
Requirements AWS ERNiCrCoMo-1	0.05 - 0.15	1.0 max.	3.0 max.	0.03 max.	0.015 max.	1.0 max.	0.50 max.
Typical Performance[2] Techalloy® 617	0.07	0.2	0.3	0.004	0.002	0.2	0.09

	%Ni	%Co	%Al	%Ti	%Cr	%Mo	%Other
Requirements AWS ERNiCrCoMo-1	Remainder	10.0 - 15.0	0.8 - 1.5	0.60 max.	20.0 - 24.0	8.0 - 10.0	0.50 max.
Typical Performance[2] Techalloy® 617	53.7	12.0	1.0	0.35	22.8	8.7	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	150-190 180-220 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	– – – –	80-110 90-130 120-175 150-220	100% Argon
SAW	1/8 (3.2)	29-32	350-450	Suitable Flux may be used

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 622

Nickel • AWS ERNiCrMo-10

Key Features

- A nickel based alloy with chromium, molybdenum, and tungsten as the principal alloying elements
- Used to weld alloys of similar composition as well as dissimilar joints between nickel-chromium-molybdenum alloys and stainless, carbon or low alloy steels
- Used for cladding overlay as well as thermal spray applications
- Excellent corrosion resistance in oxidizing as well as reducing media in a wide variety of chemical process environments
- Outstanding resistance to stress corrosion cracking, pitting and crevice corrosion

Conformances

AWS A5.14	ERNiCrMo-10
UNS	N06022
CWB	

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 60 lb (27.2 kg) Coil
0.035	(0.9)	MG622035667		
0.045	(1.1)	MG622045667		
1/16	(1.6)	MG622062667	TG622062638	
3/32	(2.4)		TG622093638	SA622093726
1/8	(3.2)		TG622125638	

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si	%Cu
Requirements AWS ERNiCrMo-10	0.015 max.	0.50 max.	2.0 - 6.0	0.02 max.	0.010 max.	0.08 max.	0.50 max.
Typical Performance[2] Techalloy® 622	0.01	0.01	4.5	0.003	0.002	0.07	0.01
	%Ni	**%Co**	**%Cr**	**%Mo**	**%V**	**%W**	**%Other**
Requirements AWS ERNiCrMo-10	Remainder	2.50 max.	20.0 - 22.5	12.5 - 14.5	0.35 max.	2.5 - 3.5	0.50 max.
Typical Performance[2] Techalloy® 622	55.89	0.02	21.8	13.8	0.01	3.1	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	140-190 160-200 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon
SAW	3/32 (2.4)	28-30	275-350	Suitable Flux may be used

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.
Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 625

AWS ERNiCrMo-3 • Nickel

Conformances

AWS A5.14	ERNiCrMo-3
UNS	N06625

Key Features

- Used for TIG, MIG and SAW welding of nickel-chromium-molybdenum alloys
- The same chemical and mechanical properties (Weld Metal) but with slightly different wire characteristics suited to the hot wire TIG process
- This filler metal may be used for cladding and welding dissimilar base metals such as Ni-Cr-Mo alloys to stainless and carbon steels
- The Ni-Cr-Mo alloy system provides excellent resistance to oxidizing and reducing environments
- The high molybdenum content provides good stress, pitting and crevice corrosion resistance

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton	SAW 55 lb (25 kg) Basket
0.035	(0.9)	MG625035667		
0.045	(1.1)	MG625045667		
1/16	(1.6)	MG625062667	TG625062638	
3/32	(2.4)		TG625093638	SA625093726
1/8	(3.2)		TG625125638	SA625125726
5/32	(4.0)		TG625156638	

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S
Requirements AWS ERNiCrMo-3	0.10 max.	0.50 max.	5.0 max.	0.02 max.	0.015 max.
Typcial Performance[2] Techalloy® 625	0.02	0.20	0.28	0.005	0.002
	%Si	**%Cu**	**%Ni**	**%Al**	**%Ti**
Requirements AWS ERNiCrMo-3	0.50 max.	0.50 max.	58.0 min.	0.40 max.	0.40 max.
Typcial Performance[2] Techalloy® 625	0.06	0.01	63.9	0.11	0.21
	%Cr	**%Nb+Ta**	**%Mo**	**%Other**	
Requirements AWS ERNiCrMo-3	20.0 - 23.0	3.15 - 4.15	8.0 - 10.0	0.50 max.	
Typcial Performance[2] Techalloy® 625	22.7	3.66	8.5	–	

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	150-190 180-220 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	– – – –	80-110 90-130 120-175 150-220	100% Argon
SAW	3/32 (2.4) 1/8 (3.2)	28-30 29-32	275-350 350-450	Lincolnweld® P2000 and Lincolnweld® P2007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 718

Nickel • AWS ERNiFeCr-2

Key Features

- Used for TIG welding alloys 718, 706 and X-750
- Mainly used for welding high strength aircraft components and liquid rocket components involving cryogenic temperatures
- High heat input process such as MIG welding often result in micro fissuring
- This alloy can be age hardened to higher strengths

Conformances

AWS A5.14 ERNiFeCr-2

UNS N07718

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG718035667	
0.045	(1.1)	MG718045667	
1/16	(1.6)	MG718062667	
3/32	(2.4)		TG718093638
1/8	(3.2)		TG718125638

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S
Requirements AWS ERNiFeCr-2	0.08 max.	0.35 max.	Remainder	0.015 max.	0.015 max.
Typcial Performance[2] Techalloy® 718	0.05	0.03	20.2	0.005	0.001
	%Si	**%Cu**	**%Ni**	**%Al**	**%Ti**
Requirements AWS ERNiFeCr-2	0.35 max.	0.30 max.	50.0 - 55.0	0.20 - 0.80	0.65 - 1.15
Typcial Performance[2] Techalloy® 718	0.12	0.002	51.8	0.40	1.11
	%Cr	**%Nb + Ta**	**%Mo**	**%Other**	
Requirements AWS ERNiFeCr-2	17.0 - 21.0	4.75 - 5.50	2.80 - 3.30	0.50 max.	
Typcial Performance[2] Techalloy® 718	17.8	5.33	2.95	–	

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9)	26-29	150-190	75% Argon / 25% Helium
	0.045 (1.1)	28-32	180-220	
	1/16 (1.6)	29-33	200-250	
TIG	3/32 (2.4)	–	120-175	100% Argon
	1/8 (3.2)	–	150-220	

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

Techalloy® 825

AWS ERNiFeCr-1 • Nickel

Conformances

AWS A5.14 ERNiFeCr-1

UNS N08065

Key Features

- Used for TIG and MIG welding of nickel-chromium-molybdenum-copper alloys
- Can be used to overlay cladding where similar chemical composition is required

DIAMETERS / PACKAGING

Diameter in	(mm)	MIG 33 lb (14.9 kg) Wire Basket	TIG 10 lb (4.5 kg) Tube 30 lb (13.6 kg) Master Carton
0.035	(0.9)	MG825035667	
0.045	(1.1)	MG825045667	
1/16	(1.6)	MG825062667	TG825062638
3/32	(2.4)		TG825093638
1/8	(3.2)		TG825125638

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.14*

	%C	%Mn	%Fe	%P	%S	%Si	%Cu
Requirements AWS ERNiFeCr-1	0.05 max.	1.0 max.	22.0 min	0.03 max.	0.03 max.	0.50 max.	1.5 - 3.0
Typcial Performance[2] Techalloy® 825	0.007	0.5	28.8	0.01	0.002	0.19	2.1

	%Ni	%Al	%Ti	%Cr	%Mo	%Other
Requirements AWS ERNiFeCr-1	38.0 - 46.0	0.20 max.	0.6 - 1.2	19.5 - 23.5	2.5 - 3.5	0.50 max.
Typcial Performance[2] Techalloy® 825	41.8	0.13	0.8	22.1	3.0	–

TYPICAL OPERATING PROCEDURES

Process	Diameter in (mm)	Voltage (volts)	Amperage	Gas
MIG	0.035 (0.9) 0.045 (1.1) 1/16 (1.6)	26-29 28-32 29-33	150-190 180-220 200-250	75% Argon / 25% Helium
TIG	1/16 (1.6) 3/32 (2.4) 1/8 (3.2)	– – –	90-130 120-175 150-220	100% Argon

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Safety Data Sheets (SDS) are available on our website at www.techalloy.com

SuperCore® 625P

Nickel • AWS ENiCrMo3T1-4

Key Features

- Smooth all position weldability
- Vacuum sealed foil package
- Excellent slag removal

Conformances

AWS A5.34/A5.34M ENiCrMo3T1-4

Welding Positions

All

Applications

- Furnace Equipment
- Petrochemical
- 9% Ni for LNG storage tanks
- Dissimilar welds between Nickel alloys, stainless steels, and mild steel.

Shielding Gas

75-80% Argon / Balance CO_2
100% CO_2

DIAMETERS / PACKAGING

Diameter mm (in)	15 kg (33 lb) Spool
1.2 (0.045)	ED034130

MECHANICAL PROPERTIES[1] - *As Required per AWS A5.34*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation % 4.0 dia.	Elongation % 5.0 dia.	Charpy V-Notch J (ft•lbf) @ 20°C (68°F)
Requirements AWS ENiCrMo3T1-4	–	690 min.	25 min.	–	–
Typical Results As-Welded	500	770	46	42	95

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.34*

	%C	%Mn	%Si	%S	%P	%Cr
Requirements AWS ENiCrMo3T1-4	0.10 max.	0.50 max.	0.50 max.	0.015 max.	0.02 max.	20.0 - 23.0
Typical Results[3]	0.02	0.30	0.20	0.005	0.005	21.0
	%Ni	**%Mo**	**%Nb**	**%Cu**	**%Ti**	**%Fe**
Requirements AWS ENiCrMo3T1-4	58.0 min.	8.0 - 10.0	3.15 - 4.15	0.50 max.	0.40 max.	0.50 max.
Typical Results[3]	66.0	8.50	3.40	0.02	0.20	1.0

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Amp-Volt Range	Typical	Stickout in (mm)
1.2 (0.045) DC+	150 - 180A 25 - 28V	160A, 26V	15 - 20 (5/8 - 1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below.
NOTE: Additional test data available upon request.

HARDFACING

Stick Electrode

Build-Up
Wearshield® BU 316

Metal-to-Metal Wear
Wearshield® MI 317
Wearshield® Mangjet® 318

Severe Impact
Wearshield® 15CrMn 319
Wearshield® FROG MANG® 320

Abrasion Plus Impact
Wearshield® ABR 321
Wearshield® 44 322

Metal-to-Earth Wear
Wearshield® ME 323

Severe Abrasion
Wearshield® 60 324

Maintenance and Repair
Blue Max® 2100 325
Weartech™ WT-1 SMAW 326
Weartech™ WT-6 SMAW 327
Weartech™ WT-12 SMAW 328
Weartech™ WT-21 SMAW 329

TIG (GTAW) Cut Lengths
Weartech™ WT-1 TIG 330
Weartech™ WT-6 TIG 331
Weartech™ WT-12 TIG 332
Weartech™ WT-21 TIG 333

Metal-Cored Wire

Severe Abrasion
Lincore® 60-G 334
Weartech™ WT-1 MIG 335
Weartech™ WT-6 MIG 336
Weartech™ WT-12 MIG 337
Weartech™ WT21 MIG 338

Metal-Cored Submerged Arc Wire

Build-Up
Lincore® 30-S 339

Metal-to-Metal, Build Up
Lincore® 32-S 340
Lincore® 35-S 341

Metal-to-Metal
Lincore® 40-S 342
Lincore® 42-S 343

Roll Rebuilding, Build Up
Lincore® 20 344
Lincore® 8620 345
Lincore® 4130 346

Roll Rebuilding, Metal-to-Metal
Lincore® 410 347
Lincore® 410NiMo 348
Lincore® 423L 349
Lincore® 423Cr 350
Lincore® 420 351
Lincore® 96-S 352
Lincore® 102W 353
Lincore® 102HC 354

Flux-Cored (FCAW-G) Wire

Build-Up
Lincore® BU-G 355

Metal-to-Metal
Lincore® 55-G 356

Flux-Cored (FCAW-S) Wire

Build-Up
Lincore® BU 357
Lincore® 33 358

Metal-to-Metal
Lincore® 40-O 359
Lincore® 55 360
Lincore® T & D 361

Severe Impact
Lincore® M 362
Lincore® 15CrMn 363
Lincore® FROG MANG® 364

Flux-Cored (FCAW-S) Wire

Abrasion Plus Impact
Lincore® 50 365

Severe Abrasion
Lincore® 60-O 366
Lincore® 65-O 367

Submerged Arc Flux

Hardfacing
Lincolnweld® A-96-S 368
Lincolnweld® H-535™ 368
Lincolnweld® H-560™ 369

Neutral Flux
Lincolnweld® 801® 369
Lincolnweld® 802® 370
Lincolnweld® 803™ 370

Wearshield® BU

Build-Up

Key Features

- Build-up with moderate hardness to resist shock and metal-to-metal wear, as in rolling and sliding
- Can be used as underbase for other hardfacing deposits or as final overlay on parts to be machined or forged
- Unlimited layers with proper preheat, interpass temperatures and procedures
- Use on mild and low alloy steels

Typical Applications

For Build-Up
- Shovel and bucket lips
- Pump impellers and housings
- Pulverizer plows
- Mill hammers

For Hardfacing
- Trunnions, tractor rolls, cranes and gears

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master Carton
5/32 (4.0)	14 (350)	ED021991
3/16 (4.8)	14 (350)	ED021993

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)		
1 Layer	2 Layers	3 Layers
15-20	18-23	23-28

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%S	%P
2 or more layers	0.14	1.15	0.60	1.40	0.025	0.015

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[2]	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	145-210	180-280
AC	155-225	200-290

NOTE: Using a short arc with a slight weave motion, deposit beads about 1/2 in - 3/4 in (13-19 mm) wide with the 5/32 in and 3/16 in (4.0-4.8 mm) electrode diameters, and about 1 in (25 mm) wide with the 1/4 in (6.4 mm) diameter. However, on edges and corners, fast-moving stringer beads or very narrow weaved beads are usually preferred. The exact width and thickness of the bead will depend on the mass of the piece being welded.

Work-hardened base or weld metal should be removed before applying Wearshield® BU, since such areas are more prone to embrittlement and possible cracking. The part should be preheated to at least 21°C (70°F). Preheating above 40°C (100°F) is usually not required. Preheating depends largely on the base metal composition. On large, complex, or restrained parts, a preheat of 150°- 260°C (300°- 500°F) may be necessary.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® MI

Metal-to-Metal

Typical Applications

- Boom heels
- Conveyor screws
- Dipper lips
- Tractor grousers
- Ditcher teeth
- Lumber equipment
- Hammer mills

Welding Positions

All, except vertical down

Key Features

- Provides a martensitic deposit with considerable retained austenite
- General purpose electrode, a good compromise for metal-to-metal wear, moderate impact and mild abrasion
- Can be used on carbon and low alloy steel parts
- Deposits tend to cross check crack and are usually best limited to two layers

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master Carton
1/8 (3.2)	14 (350)	ED022003
5/32 (4.0)	14 (350)	ED022005
3/16 (4.8)	14 (350)	ED022007

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
1 Layer	2 or More Layers
50	54

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr	%Mo
2 or More Layers	0.9	0.4	0.4	9.5	0.6

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	70-120	110-150	150-200
AC	70-120	110-150	150-200

NOTE: In welding with Wearshield® MI, a short arc or a long arc may be used. The short arc will give greater build-up with each bead. The long arc is ideal for depositing thin layers, though alloy recovery may be reduced. In depositing Wearshield® MI, preheat and interpass temperatures of 200°C (400°F) minimum are helpful, as well as limiting deposit to two layers, to reduce cracking and avoid chipping and fragmentation. Weld deposit cannot be cut with oxy-fuel process. Plasma arc and air-carbon arc processes can cut or gouge the weld deposit successfully. Grinding is usually best if the deposit needs to be shaped.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® Mangjet®

Severe Impact

Key Features

- For building up austenitic manganese steel and cladding carbon steels
- Produces an austenitic manganese deposit that will work harden in service
- Unlimited layers with proper preheat, interpass temperatures and procedures

Typical Applications

- Dragline pins
- Dipper teeth
- Crusher screens and rolls
- Chain hooks
- Hammers
- Bucket teeth

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7kg) Carton
5/32 (4.0)	14 (350)	ED021976
3/16 (4.8)	14 (350)	ED021978
1/4 (6.4)	18 (450)	ED021979

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
As-Welded (2 Layers)	Work Hardened (2 Layers)
18	47

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Mo	%S
2 or More Layers	0.65	14.5	0.14	1.15	0.01

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	5/32 in (4.0 mm)	3/16 in (4.8 mm)	1/4 in (6.4 mm)
DC+	120-180	160-260	200-350
AC	125-210	175-275	225-375

NOTE: Work-hardened base metal or previously deposited weld metal should be ground off before applying a new deposit, since such areas are more prone to embrittlement and possible cracking. Areas that cannot be easily indented with a center punch should be removed.

When joining manganese steel, the joint should be prepared for 100% penetration. A cutting torch may be used to bevel the edges of the plate which can crack if care is not taken to prevent overheating the base metal.

Preheat is not necessary unless work is below room temperature, or if the part is unusually massive or complex in design. In such cases, heating the piece to about room temperature, or 38° - 66°C (100° - 150°F) at the most, should be sufficient.

As with all austenitic manganese welding products, interpass temperatures should be limited to 260ºC (500ºF) maximum. A stringer bead, or at most, a slight weave is recommended to limit heat build-up. Excessive heat build-up causes manganese carbide precipitation which damages the toughness of austenitic manganese.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® 15CrMn

Severe Impact

Typical Applications

- Crusher hammers
- Rebuilding and joining of austenitic
- Manganese plates and parts
- Earth moving equipment

Welding Positions

All, except vertical down

Key Features

- Provides a premium austenitic chromium manganese deposit
- Resists severe impact or gouging even in a single layer over carbon steel
- Used to join Hadfield manganese steel to itself or to carbon steel
- Excellent for build-up on carbon steel prior to chromium carbide hardfacing deposit with an electrode such as Wearshield® 60
- Unlimited layers

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master Carton
1/8 (3.2)	14 (350)	ED021980
5/32 (4.0)	14 (350)	ED021982
3/16 (4.8)	14 (350)	ED021984

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c) (Single or Multiple Layers)	
As-Welded	Work Hardened
18-24	40-50

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr
2 or More Layers	0.35	14.0	0.6	15.0

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	140-160	190-210	220-250
AC	140-160	190-210	220-250

NOTE: In welding with Wearshield® 15CrMn, a short arc is preferred. The electrode can easily be dragged without fear of snuffing out the arc. For situations involving severe impact and abrasion, a build-up of Wearshield® 15CrMn capped with a single layer of Wearshield® 60 or Lincore® 60-O can provide excellent service. In depositing Wearshield® 15CrMn on itself or on austenitic manganese steel, preheat is generally unnecessary unless the metal is below 16°C (60°F). However, highly hardenable carbon or low alloy steel base metals may require preheat in the 150°C - 204°C (300° - 400°F) range to avoid heat affected zone cracking.

Wearshield® 15CrMn deposits work harden rapidly, which makes them difficult to machine. Best results are obtained with carbide or ceramic tool bits. Avoid superficial cuts, and maintain a sharp cutting edge. Grinding can also be done successfully. Because of the high chromium content, Wearshield®15CrMn cannot be cut with oxy-fuel processes. Plasma arc and air carbon arc processes can cut or gouge the weld deposit successfully. Limit interpass temperature to 260°C (500°F) to avoid embrittlement.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® FROG MANG®

Severe Impact

Key Features

- Designed specifically for building up manganese frogs and manganese crossing diamonds in the railroad industry
- Provides a high strength, high alloy austenitic manganese deposit to handle the increased loading of railroad cars
- Unlimited layers with proper preheat, interpass temperatures and procedures
- Resistant to deformation and the resultant metal flow

Typical Applications

- Manganese crossing diamonds
- Manganese railroad frogs

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	12 lb (5.4 kg) Easy Open Can 36 lb (16.3 kg) Master Carton
5/32 (4.0)	14 (350)	ED033134	
3/16 (4.8)	14 (350)	ED033135	
1/4 (6.4)	18 (450)		ED033133

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
As-Welded	Work Hardened
20 - 30	40 - 50

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr
6 Layers	1.20	21.0	0.4	5.3

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	5/32 in (4.0 mm)	3/16 in (4.8 mm)	1/4 in (6.4 mm)
DC+	140 - 175	175 - 215	235 - 280
AC	150 - 180	185 - 215	235 - 280

NOTE: Weld Preparation Remove all damaged and foreign material by air-carbon arc gouging or grinding. Make sure all defective metal is removed. In the event hairline cracks remain at flangeway depth, use a 3.2 mm (1/8 in) E308 stainless electrode, such as Blue Max® or Red Baron® 308L AC-DC to tie up these cracks. This will avoid hot cracking during the build-up process. Apply only thin layers and do not build-up with E308 stainless. This is for emergency situations where no other alternative is available to repair flangeway cracks.

Use DC+ to avoid excessive spatter. When possible, weld at alternate locations (skip weld) to avoid overheating of metal in a localized area. Do not exceed interpass temperature of 260°C (500°F). Use a temperature marker 13 mm (1/2 in) from the welded area at frequent intervals to ensure that interpass temperature does not exceed 260°C (500°F).

Use a short arc and a stringer bead width of 10 to 13 mm (3/8 to 1/2 in).

Finish the casting by grinding to a safe contour. Leave enough weld metal during the welding process to allow a level and even contour after grinding. Make sure all areas are finished and the casting has no further visible defects. Check with straight edge so that the casting is free of low spots. As with all austenitic manganese welding products, interpass temperatures should be limited to 260°C (500°F) maximum. A stringer bead, or at most, a slight weave is recommended to limit heat build-up. Excessive heat build-up causes manganese carbide precipitation which damages the toughness of austenitic manganese.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® ABR

Abrasion & Impact

Typical Applications

- Crusher hammers
- Dozer blades
- Dipper teeth and lips
- Coal mining cutters
- Truck chain and gears

Welding Positions

All

Key Features

- Provides good resistance to abrasion, impact and some metal-to-metal wear
- Good hot forging properties
- Use on carbon, stainless and manganese steels
- Deposits limited to two layers
- Can be forged readily without affecting its mechanical properties

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Carton
1/8 (3.2)	14 (350)	ED021996
5/32 (4.0)	14 (350)	ED021998
3/16 (4.8)	14 (350)	ED022000

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_0)	
1 Layer	2 Layers
24-53	28-53

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr	%Mo
2 Layers	2.1	1.1	0.75	6.5	0.40

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	40-150	75-200	110-250
AC	50-165	80-220	120-275

NOTE: Wearshield® ABR can be forged readily without affecting its mechanical properties. As deposited, Wearshield® ABR weld metal is not machinable, although the deposit can be shaped by grinding.

To obtain a deposit that is machinable with carbide tools, heat to about 749ºC (1380ºF) and hold for one hour per inch of thickness.

Air cool to room temperature.

For maximum machinability, heat to 870° - 900°C (1600° - 1650°F) and hold for one hour per inch of thickness. Furnace cool to 650°C (1200°F) at a rate not exceeding 10°C (50°F) per hour, and air or furnace cool to room temperature. Variation in welding procedures will have little affect on abrasion resistance.

The abrasion resistance can be restored by heating to about 790°C (1450°F), quenching and tempering at 200°C (400°F).

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

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Wearshield® 44

Abrasion & Impact

Key Features

- Moderate hardness to resist abrasion with impact up to 600°C (1100°F)
- Higher alloy results in improved spalling resistance than Wearshield® ABR
- Can be used on carbon steels, low alloy steels, cast irons, austenitic manganese steels and austenitic stainless steels

Typical Applications

- Buckets
- Chain links
- Rolling mill guides
- Pulleys
- Ingot tongs

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master Carton
1/8 (3.2)	14 (350)	ED024940
5/32 (4.0)	14 (350)	ED024941

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)		
1 Layer	2 Layers	4 Layers
42	47	48

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr	%Mo
1 Layer	1.56	0.17	0.77	19.5	1.92
2 Layers	1.96	0.16	0.87	24.2	2.48
4 Layers	2.21	0.18	0.93	27.1	2.86

TYPICAL OPERATING PROCEDURES

	Current (Amps)	
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	120 - 160	150 - 220
AC	130 - 160	180 - 220

NOTE: Wearshield® 44 electrodes form a deep cup, which permits light dragging of the electrode during welding. The arc is steady with little spatter in the DC+ mode. During AC welding, the arc is also steady, but the usable current range is reduced, and the melt-off rates are reduced at any current. Since the amount of dilution does not affect the microstructure, the impact properties and abrasion resistance will be similar from the first layer to the last.

On cast irons, Wearshield® 44 deposits usually check crack. These check cracks should be closely spaced to prevent spalling. This is obtained by using stringer beads.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® ME

Metal-to-Earth

Typical Applications

- Muller tires
- Augers
- Bucket teeth
- Dozer blades

Welding Positions

Flat & Horizontal

Key Features

- High alloy produces chrome carbides and austenite
- Provides greater abrasion resistance than Wearshield® ABR or Wearshield® 44
- Low dilution weld metal provides eutectic mix of chromium carbides and austenite, with limited primary carbides.
- To be used on carbon and low alloy, austenitic manganese and austenitic stainless steels

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master Carton
1/8 (3.2)	14 (350)	ED023323
5/32 (4.0)	14 (350)	ED023324
3/16 (4.8)	14 (350)	ED023325

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)		
1 Layer	2 Layers	3 Layers
49	59	59

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr
1 Layer	2.5	0.17	0.8	27.0
2 Layers	3.0	0.17	1.0	30.5
3 Layers	3.3	0.16	1.1	32.6

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	125 - 175	175 - 250	220 - 330
AC	130 - 170	180 - 220	230 - 270

NOTE: Wearshield® ME is a heavily coated electrode which forms a deep cup that permits light dragging of the stick during welding. Deposits generally check crack except for single layers on thin base metal. Stringer beads produce a consistent crack spacing of about 13-25 mm (1/2-1 in).

Wide weaves may produce very widely spaced check cracks which can lead to deposit spalling in multiple layers. Weaving is not recommended. For maximum spalling resistance on carbon and low alloy steels, especially in multiple layers, apply a butter layer of Wearshield® 15CrMn, Lincore® 15CrMn or an austenitic stainless steel electrode such as Blue Max® 309/309L AC-DC, before applying Wearshield® ME.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Wearshield® 60

Severe Abrasion

Key Features

- Designed to resist severe abrasion
- It exhibits higher alloy and higher abrasion resistance than Wearshield® ABR, Wearshield® 44 or Wearshield® ME
- Can be used on carbon, low alloy, stainless, and manganese steels
- Deposits consist of primary carbides in a matrix of austenite-carbide eutectic
- Deposits should be limited to two layers

Typical Applications

- Conveyor screws
- Grader blades
- Crusher rolls, plates and jaws
- Sleeves
- Brick and coke machinery

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Carton 40 lb (18.1 kg) Master CartonCarton
1/8 (3.2)	14 (350)	ED022010
5/32 (4.0)	14 (350)	ED022011
3/16 (4.8)	14 (350)	ED022012

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
1 Layer	2 Layers
57 - 60	60 - 62

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr	%Mo	%V
2 Layers	5.0	0.80	1.0	23.0	2.3	0.6

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[2]	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	100 - 140	130 - 180	210 - 250
AC	110 - 150	140 - 200	230 - 270

NOTE: The deposit is not machinable or forgeable. Cooling rate does not significantly influence abrasion resistance. Deposit will usually cross check.

If more than two-layer build-up is required, use Wearshield® 15CrMn (preferred), Wearshield® BU or Wearshield® BU30 for the preliminary layer or layers under Wearshield® 60. On manganese steel, use Wearshield® Mangjet® or Wearshield® 15CrMn as build-up. Preheat is not generally necessary except to be sure that work is in room temperature range 25° - 45ºC (75° - 100ºF). However, preheat of 120° - 200ºC (250° - 400ºF) may be necessary to prevent heat affected zone cracking on high carbon steel or low alloy steel base metals. If more than two layers must be used, or if cross checks must be eliminated, preheat to 650ºC (1200ºF).

Prolonged or repeated heating of manganese steel base metal over 260ºC (500ºF) can cause embrittlement and spalling. Avoid base metal embrittlement by:

- Limiting the temperature 260ºC (500ºF) at distances of 13 mm (1/2 in) away from the weld.
- Minimizing the time at elevated temperatures.

The correct welding technique is a vertical electrode with a 3.2 - 4.8 mm (1/8 - 3/16 in) arc length. The large ball on the end of the electrode should never touch the puddle. This technique will give a smooth transfer, low spatter and smooth bead.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Blue Max® 2100

Maintenance & Repair

Typical Applications

- High carbon, low alloy, high strength, manganese steels
- Base for hardfacing or stainless steel cladding

Key Features

- High resistance to cracking
- High strength
- Designed for joining difficult to weld steel

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	10 lb (4.5 kg) Easy Open Can
2.5 (3/32)	14 (350)	ED032298
3.2 (1/8)	14 (350)	ED032299

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Test Results	670 (97)	805 (117)	22	> 50

TYPICAL OPERATING PROCEDURES

Polarity[2]	Current (Amps) 2.4 mm (3/32 in)	3.2 mm (1/8 in)
DC+	40 -80	75 - 110
AC	40 -80	75 - 110

[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material. [2]Preferred polarity is listed first.

Weartech™ WT-1 SMAW

Hardfacing • AWS A5.13 ECoCr-C

Applications

- Wear Pads
- Mixer Rotors
- Pump Sleeves

Welding positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034876
5/32 (4.0)	ED034877

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.13 ECoCr-C	1.7-3.0	2.0 max	2.0 max	25-33	3.0 max
Typical Results	2.1	0.6	0.6	28.1	2.4
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.13 ECoCr-C	5.0 max	1.0 max	11-14	Balance	Not Required
Typical Results	4.1	0.1	12.3	50	52

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	115-135	145-165

Weartech™ WT-6 SMAW

AWS A5.13 ECoCr-A • Hardfacing

Welding positions

All

Applications

- Shear Blades
- Fluid Flow Valves
- Extrusion Screws
- Roll Bushings
- High Temperature
- Valve Bearing Surface

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034878
5/32 (4.0)	ED034879
3/16 (4.8)	ED034880

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.13 ECoCr-A	0.7-1.4	2.0 max	2.0 max	25-32	3.0 max
Typical Results	1.2	0.9	1.1	27.3	2.5
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.13 ECoCr-A	5.0 max	1.0 max	3.0 -6.0	Balance	Not Required
Typical Results	3.3	0.1	4.60	58	41

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+	115-135	145-165	175-195

Weartech™ WT-12 SMAW

Hardfacing • AWS A5.13 ECoCr-B

Applications

- Chain Saw Bars
- Saw Teeth
- Extrusion Dies

Welding positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034881

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.13 ECoCr-B	1.0-1.7	2.0 max	2.0 max	25-32	3.0 max
Typical Results	1.5	0.9	1.1	28.7	2.6
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.13 ECoCr-B	5.0 max	1.0 max	7.0 -9.5	Balance	Not Required
Typical Results	3.1	0.1	8.5	53	46

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 1/8 in (3.2 mm)
DC+	115-135

Weartech™ WT-21 SMAW

AWS A5.13 ECoCr-E • Hardfacing

Welding positions

All

Applications

- Steam Valves
- Hot Shears
- Chemical and Petrochemical Valves
- Cavation Repair
- Forging Dies

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034882
5/32 (4.0)	ED034883
3/16 (4.8)	ED034884

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.13 ECoCr-E	0.15-0.40	1.5 max	2.0 max	24-29	2.0 -4.0
Typical Results	0.23	0.8	0.8	27.7	2.8
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.13 ECoCr-E	5.0 max	4.5-6.5	0.50 max	Balance	Not Required
Typical Results	2.4	5.5	0.05	59	28

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+	115-135	145-165	175-195

Weartech™ WT-1 TIG

Hardfacing • AWS A5.21 ERCoCr-C

Welding Positions

All

Welding Processes

- Gas Tungsten Arc Welding
- Oxyfuel Welding

Typical Applications

- Wear Pads
- Mixer Rotors
- Pump Sleeves

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034870

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCoCr-C	2.0-3.0	1.0 max	2.0 max	26-33	3.0 max
Typical Results	2.2	0.1	1.0	29.5	2.4
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCoCr-C	3.0 max	1.0 max	11-14	Balance	Not Required
Typical Results	2.5	0.1	12.4	50	52

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 1/8 in (3.2 mm)
DC-	115-135

Weartech™ WT-6 TIG

AWS A5.21 ERCoCr-A • Hardfacing

Typical Applications

- Shear Blades
- Fluid Flow Valves
- Extrusion Screws
- Roll Bushings
- High Temperature
- Valve Bearing Surface

Welding positions

All

Welding Processes

- Gas Tungsten Arc Welding
- Oxyfuel Welding

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034871
5/32 (4.0)	ED034872
3/16 (4.8)	ED034873

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCoCr-A	0.9-1.4	1.0 max	2.0 max	26-32	3.0 max
Typical Results	1.1	0.1	1.3	28.2	2.5
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCoCr-A	3.0 max	1.0 max	3.0 -6.0	Balance	Not Required
Typical Results	2.5	0.1	4.7	59	42

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-	115-135	145-165	175-195

Weartech™ WT-12 TIG

AWS A5.21 ERCoCr-B • Hardfacing

Welding Positions

All

Welding Processes

- Gas Tungsten Arc Welding
- Oxyfuel Welding

Applications

- Chain Saw Bars
- Saw Teeth
- Extrusion Dies

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034874

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCoCr-B	1.2-1.7	1.0 max	2.0 max	26-32	3.0 max
Typical Results	1.4	0.1	1.4	29.5	2.5
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCoCr-B	3.0 max	1.0 max	7.0 -9.5	Balance	Not Required
Typical Results	2.6	0.1	8.8	53	47

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 1/8 in (3.2 mm)
DC-	115-135

Weartech™ WT-21 TIG

Hardfacing • AWS A5.21 ERCoCr-E

Applications

- Steam Valves
- Hot Shears
- Chemical and Petrochemical Valves
- Cavation Repair
- Forging Dies

Welding positions

All

Welding Processes

- Gas Tungsten Arc Welding
- Oxyfuel Welding

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/8 (3.2)	ED034875

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCoCr-E	0.15-0.40	1.5 max	1.5 max	25-30	1.5 -4.0
Typical Results	0.22	0.9	0.9	27.5	2.9
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCoCr-E	3.0 max	4.5-7.0	0.50 max	Balance	Not Required
Typical Results	1.5	5.6	0.1	60	27

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 1/8 in (3.2 mm)
DC-	115-135

Lincore® 60-G

Abrasion

Key Features

- Deposits feature higher alloy levels than to resist both abrasion and moderate impact
- Can be used at temperatures up to 704°C (1300°F)
- To be used on carbon, low alloy, manganese and stainless steels and cast iron
- Deposit is limited to two layers

Typical Applications

- Augers
- Bucket lips and sides
- Loaders
- Brushing and grinding equipment
- Shaper sides and blades

Welding Positions

Flat & Horizontal

Shielding Gas

75-90% Argon / Balance CO_2
98% Argon / 2% O_2

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool
0.045 (1.1)	ED029936

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
1 Layer	2 Layer
58	60

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr
1 Layer	4.6	1.2	0.5	13.8
2 Layers	5.5	1.3	0.6	17.3

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, ESO - in (mm) Shielding Gas	Wire Feed Speed m/min (in/min)	Voltage (Volts)
0.045 in (1.1 mm), DC+, 3/4 (20) 75% Ar/25% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	23 - 24 25 - 26 27 - 28
0.045 in (1.1 mm), DC+, 3/4 (20) 90% Ar/10% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	22 - 23 24 - 25 26 - 27
0.045 in (1.1 mm), DC+, 3/4 (20) 98% Ar/2% O_2	5.1 (200) 7.6 (300) 10.2 (400)	22 - 23 24 - 25 26 - 27

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Weartech™ WT-1 MIG

AWS A5.21 ERCCoCr-C • Hardfacing

Welding positions

Flat

Shielding Gas

100% Argon

Applications

- Wear Pads
- Mixer Rotors
- Pump Sleeves

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool
0.045 (1.1)	ED034885

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCCoCr-C	2.0-3.0	2.0 max	2.0 max	25-33	3.0 max
Typical Results	2.5	0.8	0.3	28.9	0.2
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCCoCr-C	5.0 max	1.0 max	11-14	Balance	Not Required
Typical Results	3.7	0.1	11.3	50	49

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Approx. Current (amps)	Voltage (volts)	CTWD in (mm)
0.045 (1.1)	175 225 240 260	20 24 26 28	1 (25)

Weartech™ WT-6 MIG

Hardfacing • AWS A5.21 ERCCoCr-A

Applications

- Shear Blades
- Fluid Flow Valves
- Extrusion Screws
- Roll Bushings
- High Temperature
- Valve Bearing Surface

Welding positions

Flat

Shielding Gas

100% Argon

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool
0.045 (1.1)	ED034886
1/16 (1.6)	ED034887

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCCoCr-A	0.7-1.4	2.0 max	2.0 max	25-32	3.0 max
Typical Results	1.2	0.8	0.5	28.2	0.3
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCCoCr-A	5.0 max	1.0 max	3.0 -6.0	Balance	Not Required
Typical Results	3.9	0.1	4.1	58	40

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Approx. Current (amps)	Voltage (volts)	CTWD in (mm)
0.045 (1.1)	175 225 240 260	20 24 26 28	1 (25)
1/16 (1.6)	280 300	26 28	1 (25)

Weartech™ WT-12 MIG

AWS A5.21 ERCCoCr-B • Hardfacing

Welding positions

Flat

Shielding Gas

100% Argon

Applications

- Chain Saw Bars
- Saw Teeth
- Extrusion Dies

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool
0.045 (1.1)	ED034888
1/16 (1.6)	ED034889

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCCoCr-B	1.2-2.0	2.0 max	2.0 max	25-32	3.0 max
Typical Results	1.5	0.9	1.0	27.4	0.2

	%Fe	%Mo	%W	%Co	Hardness, Rc
Requirements AWS A5.21 ERCCoCr-B	5.0 max	1.0 max	7-10	Balance	Not Required
Typical Results	3.9	0.1	8.4	53	45

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Approx. Current (amps)	Voltage (volts)	CTWD in (mm)
0.045 (1.2)	175 225 240 260	20 24 26 28	1 (25)
1/16 (1.6)	280 300	26 28	1 (25)

Weartech™ WT-21 MIG

Hardfacing • AWS A5.21 ERCCoCr-E

Applications

- Steam Valves
- Hot Shears
- Chemical and Petrochemical Valves
- Cavation Repair
- Forging Dies

Welding positions

Flat

Shielding Gas

100% Argon

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Spool
0.045 (1.1)	ED034890
1/16 (1.6)	ED034891

DEPOSIT COMPOSITION

	%C	%Mn	%Si	%Cr	%Ni
Requirements AWS A5.21 ERCCoCr-E	0.15-0.40	2.0 max	1.5 max	25-30	1.5 -4.0
Typical Results	0.25	0.7	0.6	27.5	2.1
	%Fe	**%Mo**	**%W**	**%Co**	**Hardness, Rc**
Requirements AWS A5.21 ERCCoCr-E	5.0 max	4.5-7.0	0.50 max	Balance	Not Required
Typical Results	3.9	5.5	0.1	59	24

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Approx. Current (amps)	Voltage (volts)	CTWD in (mm)
0.045 (1.1)	175 225 240 260	20 24 26 28	1 (25)
1/16 (1.6)	280 300	26 28	1 (25)

Lincore® 30-S

Build-Up

Typical Applications

For Build-up
- Tractor rollers
- Trunnions
- Idlers
- Crane wheels

For Hardfacing
- Shafts
- Track rails
- Idlers

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802, 860

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

Key Features

- Intended for build-up before final overlay, and as a final surface for metal-to-metal wear with moderate impact
- For automatic and semiautomatic operation on mild and low alloy steels
- Good resistance to cross checking
- Unlimited deposit thickness with proper preheat and interpass temperatures and procedures

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED011200	ED011199
1/8 (3.2)	ED015889	ED015891

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
6 Layers - Under 801 or 802 Flux	6 Layers - Under 860 Flux
27	27

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Mo
6 Layers - Under 801 or 802	0.11	2.5	0.40	0.50
6 Layers - Under 860	0.11	2.7	0.60	0.50

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.5 (60)	26	220	2.7 (6.0)
	3.0 (120)	27	360	5.2 (11.5)
	4.6 (180)	28	500	7.7 (17.0)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.3 (50)	27	310	3.4 (7.5)
	2.0 (80)	28	450	6.4 (14.0)
	2.8 (110)	28	600	9.1 (20.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 32-S

Metal-to-Metal, Build-Up

Key Features

- Designed for build-up on 4140 drill stems in the deep hole drilling industry
- For automatic and semiautomatic operation on mild and low alloy steels
- Good resistance to cross checking
- Unlimited deposit thickness with proper preheat and interpass temperatures and procedures

Typical Applications

- Drill stems

Recommended Flux

Primary Flux[1]	Secondary Flux
802	803

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	300 lb (136 kg) Speed-Feed® Drum	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED025656	
1/8 (3.2)		ED025131

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)			
2 Layers		2 Layers on 4140 Steel	
Under 802 Flux	Under 803 Flux	Under 802 Flux	Under 803 Flux
28	24	33	32

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Mo	%Ni
2 Layers w/ 802	0.05	2.20	0.60	1.80	0.33	0.07
2 Layers w/ 803	0.04	2.50	0.33	1.80	0.35	0.08
On 4140 Steel						
2 Layers w/ 802	0.13	2.11	0.51	1.63	0.30	0.09
2 Layers w/ 803	0.11	2.31	0.24	1.57	0.29	0.10

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.9 (75)	25	350	3.4 (7.5)
	2.5 (100)	25	400	4.5 (10.0)
	3.3 (130)	25	460	5.9 (13.0)
	4.2 (165)	25	510	7.5 (16.5)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.3 (50)	28	370	3.9 (8.5)
	2.5 (100)	28	540	7.9 (17.5)
	3.2 (125)	28	630	9.6 (21.1)
	3.8 (150)	28	720	11.8 (26.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 35-S

Metal-to-Metal, Build-Up

Typical Applications

For Build-up
- Tractor rollers
- Idlers
- Trunnions
- Crane wheels
- Caster rolls

For Hardfacing
- Mine car wheels
- Track rails
- Shafts
- Bearing journals

Key Features

- Intended for rolling and sliding metal-to-metal wear with moderate impact and abrasion
- For automatic and semiautomatic operation on mild and low alloy steels
- Recommended as final overlay where medium hardness and good machinability are required
- Unlimited deposit thickness with proper preheat and interpass temperatures and procedures

Recommended Fluxes

Primary Flux	Secondary Flux[1]
801	802, 880

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED019880	
1/8 (3.2)	ED019881	ED019884
5/32 (4.0)		ED019885

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)
39

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Mo
With Recommended Neutral Flux	0.19	1.7	0.60	2.0	0.50

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.3 (50)	28	340	3.6 (8.0)
	2.5 (100)	28	500	7.5 (16.5)
	3.8 (150)	28	660	11.3 (25.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 40-S

Metal-to-Metal

Key Features

- Designed for rebuilding heavy equipment undercarriages
- Deposit is machinable and hot forgeable and resists rolling and sliding metal-to-metal wear
- Use on carbon and low alloy steels for good puddle control on roundabout welding
- Limited to 4 layers

Typical Applications

- Idlers
- Drive sprockets
- Mine car wheels

Recommended Fluxes

Primary Flux	Secondary Flux[1]
801	802, 880

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
1/8 (3.2)	ED015892	ED015909

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c) 3 or More Layers After 2 Hours Post Weld Heat Treat
39 - 42

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Mo
With Recommended Neutral Flux	0.12	2.75	3.30	0.50	0.85

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/8 in (3.2 mm), DC+ 1-1/4 (32)	1.7 (65) 2.3 (90) 3.0 (120)	27 28 29	330 425 525	4.4 (9.6) 5.9 (12.9) 7.8 (17.3)
1/8 in (3.2 mm), DC+ 2-1/2 (65)	2.0 (80) 2.8 (110) 3.7 (145)	29 30 31	345 425 500	5.2 (11.5) 7.3 (16.0) 9.4 (20.8)
1/8 in (3.2 mm), DC+ 3-1/2 (90)	2.5 (100) 3.3 (130) 4.6 (180)	31 32 33	375 435 520	6.5 (14.3) 8.6 (18.9) 11.9 (26.1)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 42-S

Metal-to-Metal

Typical Applications

- Tractor rollers
- Tractor idlers
- Track pads

Recommended Fluxes

Primary Flux	Secondary Flux
801	802, 880

[1] 802 and 880 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

Key Features

- Designed for rebuilding heavy equipment undercarriages
- The deposit exhibits enhanced crack resistance and toughness compared to Lincore® 40-S
- Intended to resist rolling and sliding metal-to-metal wear
- For automatic and semiautomatic operation

DIAMETERS / PACKAGING

Diameter in (mm)	300 lb (136 kg) Speed-Feed® Drum	600 lb (272 kg) Speed-Feed® Drum
1/8 (3.2)	ED029264	ED029161

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C) 1 Layer
40

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux	%C	%Mn	%Si	%Cr	%Mo
1/8 in Diameter (3/4 in ESO)					
1 Layer	0.14	2.13	0.34	1.45	0.43
2 Layers	0.12	2.70	0.39	2.22	0.66
4 Layers	0.11	3.33	0.44	2.95	0.84
6 Layers	0.10	3.51	0.46	3.20	0.80
1/8 in Diameter (1-5/8 in ESO)					
1 Layer	0.14	2.49	0.33	2.02	0.60
2 Layers	0.13	3.05	0.42	2.96	0.84
4 Layers	0.13	3.41	0.47	3.15	0.99
6 Layers	0.13	3.55	0.51	3.31	1.06

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/8 in (3.2 mm), DC+ 3/4 (20)	1.3 (50) 2.5 (100) 3.2 (125)	27 28 29	350 565 675	3.8 (8.4) 7.5 (16.5) 9.3 (20.5)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.3 (50) 2.5 (100) 3.2 (125)	27 28 29	325 510 605	3.8 (8.3) 7.5 (16.6) 9.4 (20.8)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 20

Roll Rebuilding - Build Up

Key Features

- Metal-cored wire with moderate hardness for build-up before stainless overlay
- Good crack resistance and high compressive strength

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802, 880

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	EDS18565	
1/8 (3.2)	EDS18566	ED018569
5/32 (4.0)		EDS18570

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)
23 - 28

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux					
%C	%Mn	%Si	%Cr	%Ni	%Mo
0.05	0.60	0.40	1.40	2.40	0.40

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 3/4 (20)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	270 400 500	3.0 (6.7) 5.6 (12.4) 8.2 (18.1)
1/8 in (3.2 mm), DC+ 3/4 (20)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	400 550 680	4.7 (10.4) 7.8 (17.3) 11.0 (24.2)
5/32 in (4.0 mm), DC+ 1-1/2 (38)	1.4 (55) 2.2 (85) 2.9 (115)	27 30 32	520 725 880	6.6 (14.6) 10.2 (22.5) 13.8 (30.4)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 8620

Roll Rebuilding - Build Up

Typical Applications

- Caster rolls

Key Features

- Metal-cored wire for build-up on worn rolls
- A little softer than Lincore® 20 for easier machining

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802, 880

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
1/8 (3.2)	ED020788	ED020791

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)
16 - 20

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux					
%C	%Mn	%Si	%Cr	%Ni	%Mo
0.09	0.80	0.30	0.45	0.55	0.15

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/8 in (3.2 mm), DC+ 3/4 (20)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	400 550 680	4.7 (10.4) 7.8 (17.3) 11.0 (24.2)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 4130

Roll Rebuilding - Build Up, Flame Hardenable

Key Features

- Metal-cored wire for general build-up
- Can be flame hardened to 38 Rockwell C (R_c)
- Used on mining components such as cable drums, sheaves, gears and shafts

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802, 880

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED015265	ED015532
1/8 (3.2)	ED015266	ED015405

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
17 - 21

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux				
%C	%Mn	%Si	%Cr	%Mo
0.12	1.10	0.30	0.80	0.20

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 3/4 (20)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	300 410 520	2.9 (6.5) 5.4 (12.0) 7.9 (17.5)
1/8 in (3.2 mm), DC+ 3/4 (20)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	350 465 590	3.9 (8.5) 7.2 (16.0) 10.6 (23.5)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 410

Roll Rebuilding - Metal-to-Metal

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

Key Features

- Metal-cored wire with a 410 martensitic stainless steel deposit
- Low carbon content and high corrosion resistance
- Soft and easily machined

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED018583	
5/32 (4.0)		ED018588

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)
27 - 32

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux			
%C	%Mn	%Si	%Cr
0.08	0.80	0.40	12.50

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 3/4 (20)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	250 375 450	2.9 (6.5) 5.4 (12.0) 7.9 (17.5)
5/32 in (4.0 mm), DC+ 1-1/2 (38)	1.4 (55) 2.2 (85) 2.9 (115)	27 30 32	475 650 800	5.9 (13.1) 9.2 (20.2) 12.4 (27.3)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 410NiMo

Roll Rebuilding - Metal-to-Metal

Key Features

- Metal-cored wire with low carbon deposit, which forms softer, tougher martensite than other roll alloys

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux	Secondary Flux[1]
801	802

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4) 1/8 (3.2) 5/32 (4.0)	ED018589 ED018590 EDS18591	ED018593

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
32 - 40

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux					
%C	%Mn	%Si	%Cr	%Ni	%Mo
0.05	0.80	0.50	13.00	2.00	1.00

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	250 325 425	2.6 (5.8) 4.9 (10.7) 7.1 (15.6)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 3.6 (140)	26 30	325 575	4.3 (9.4) 9.9 (21.8)
5/32 in (4.0 mm), DC+ 1-5/8 (40 mm)	1.4 (55) 2.2 (85) 2.9 (115)	27 30 32	440 575 700	5.8 (12.8) 9.0 (19.8) 12.2 (26.8)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 423L

Roll Rebuilding - Metal-to-Metal

Typical Applications

- Caster rolls

Key Features

- Metal-cored wire, provides a softer "as-welded" deposit than Lincore® 420
- More resistance to softening during tempering above 482°C (900°F)

Recommended Flux

Primary Flux[1]
802

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	600 lb (272 kg) Speed-Feed® Drum
1/8 (3.2)	ED018551

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
41-47

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux						
%C	%Mn	%Si	%Cr	%Ni	%Mo	%V
0.15	1.20	0.40	11.50	2.00	1.00	0.15

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	350 500 610	4.2 (9.3) 7.0 (15.5) 9.8 (21.7)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 423Cr

Roll Rebuilding - Metal-to-Metal

Key Features

- Metal-cored wire with a higher chrome deposit than Lincore® 423L for improved corrosion resistance

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux[1]

802

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	EDS18553	
1/8 (3.2)	EDS18554	ED018557

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
41-47

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux						
%C	%Mn	%Si	%Cr	%Ni	%Mo	%V
0.15	1.20	0.40	13.50	2.00	1.00	0.15

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	250 350 450	2.7 (6.0) 5.0 (11.0) 7.3 (16.0)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	375 540 640	4.5 (9.9) 7.5 (16.5) 10.5 (23.1)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 420

Roll Rebuilding - Metal-to-Metal

Typical Applications

- Caster rolls

Key Features

- Metal-cored wire that is most widely used for caster roll rebuilding

Recommended Flux

Primary Flux	Secondary Flux
801	802

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED015260	ED015261
1/8 (3.2)	ED015262	ED015268
5/32 (4.0)		ED015264

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)
46-50

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux			
%C	%Mn	%Si	%Cr
0.20	1.20	0.50	12.00

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	250 375 450	2.9 (6.5) 5.4 (12.0) 7.9 (17.5)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	350 500 625	4.3 (9.5) 7.2 (15.8) 10.0 (22.1)
5/32 in (4.0 mm), DC+ 1-5/8 (40)	1.4 (55) 2.2 (85) 2.9 (115)	27 30 32	475 650 800	5.9 (13.1) 9.2 (20.2) 12.4 (27.3)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 96-S

Roll Rebuilding - Metal-to-Metal

Key Features

- Metal-cored wire which produces a high carbon, 420 stainless steel deposit
- Use where a higher hardness is required
- Can be used on work rolls and backup rolls when water spray causes pitting on tool steel deposits

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux	Secondary Flux
801	802

DIAMETERS / PACKAGING

Diameter in (mm)	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED018574
1/8 (3.2)	ED018575
5/32 (4.0)	ED018576

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
48-54

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux				
%C	%Mn	%Si	%Cr	%Ni
0.23	1.20	0.40	13.00	0.20

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.7 (65) 2.5 (100) 4.4 (175)	24 28 31	250 525 450	2.6 (5.7) 7.1 (15.7) 7.0 (15.5)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	360 525 635	4.3 (9.4) 7.1 (15.7) 10.0 (22.0)
5/32 in (4.0 mm), DC+ 1-5/8 (40)	1.4 (55) 2.2 (85) 2.9 (115)	27 30 32	450 650 775	5.9 (12.9) 9.1 (20.0) 12.3 (27.1)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 102W

Roll Rebuilding - Metal-to-Metal

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux[1]	Secondary Flux
802	801

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

Key Features

- Metal-cored wire which produces a tool steel deposit that retains hardness at high working temperatures
- Used for guide rolls, and work rolls
- Can also be used as the seat on blast furnace bells and hoppers

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)	ED018578	ED018580
1/8 (3.2)		ED018581
5/32 (4.0)		ED018582

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
48-54

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux						
%C	%Mn	%Si	%Cr	%Mo	%V	%W
0.28	1.50	0.40	6.50	1.00	0.15	1.00

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-5/8 (40)	1.7 (65)	24	240	2.8 (6.2)
	3.0 (120)	28	400	5.2 (11.5)
	4.4 (175)	31	500	7.6 (16.8)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60)	26	390	4.4 (9.8)
	2.5 (100)	28	540	7.4 (16.4)
	3.6 (140)	30	680	10.4 (23.0)
5/32 in (4.0 mm), DC+ 1-5/8 (40)	1.4 (55)	27	500	6.4 (14.2)
	2.2 (85)	30	685	9.9 (21.9)
	2.9 (115)	32	850	13.4 (29.6)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 102HC

Roll Rebuilding - Metal-to-Metal

Key Features

- Metal-cored wire with a higher carbon content than Lincore® 102W
- Will give a higher hardness tool steel deposit
- Deposit is "hot" [above 204°C (400°F)] machinable, for easy sizing after welding

Typical Applications

- Caster rolls

Recommended Flux

Primary Flux[1]	Secondary Flux
802	801

[1] 802 and 860 standard flux are not sized for semiautomatic applications; however, they can be ordered in special sizing by contacting your Lincoln Electric representative.

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	600 lb (272 kg) Speed-Feed® Drum
3/32 (2.4)		ED026086
1/8 (3.2)	ED026085	ED026087

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
54 - 60

DEPOSIT COMPOSITION[1]

With Recommended Neutral Flux						
%C	%Mn	%Si	%Cr	%Mo	%V	%W
0.40	2.10	1.60	6.70	1.60	0.20	1.30

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
3/32 in (2.4 mm), DC+ 1-1/2 (38)	1.7 (65) 3.0 (120) 4.4 (175)	24 28 31	240 400 500	2.8 (6.2) 5.2 (11.5) 7.6 (16.8)
1/8 in (3.2 mm), DC+ 1-5/8 (40)	1.5 (60) 2.5 (100) 3.6 (140)	26 28 30	390 540 680	4.4 (9.8) 7.4 (16.4) 10.4 (23.0)

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® BU-G

Build-Up

Typical Applications

- Rolls
- Shafts
- Pump and shovel parts
- Pulverizer
- Plows

Shielding Gas

75-90% Argon / Balance CO_2
98% Argon / 2% O_2

Welding Positions

Flat & Horizontal

Key Features

- Delivers deposits with moderate hardness for build-up or as final overlay
- Provides some resistance to metal-to-metal wear and moderate impact
- Unlimited layers with proper preheat and interpass temperatures and procedures

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Plastic Spool
0.045 (1.1)	ED029079
1/16 (1.6)	ED029080

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_b)	
As-Welded	Work-Hardened
21 - 33	40 - 42

DEPOSIT COMPOSITION[1]

On Carbon Steel	%C	%Mn	%Si	%Cr	%Mo
4 Layers	0.08	1.60	0.50	0.90	0.30

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, ESO - in (mm) Shielding Gas	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1 mm), DC+, 5/8 (16) 75% Ar/25% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	29 30 32	175 240 300	1.7 (3.7) 2.8 (6.1) 3.9 (8.6)
0.045 in (1.1 mm), DC+ , 3/4 (20) 90% Ar/10% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	25 27 29	215 250 285	2.1 (4.7) 3.1 (6.9) 4.1 (9.1)
0.045 in (1.1 mm), DC+, 3/4 (20) 98% Ar/2% O_2	5.1 (200) 7.6 (300) 10.2 (400)	25 26 28	210 280 315	2.0 (4.5) 3.2 (7.1) 4.4 (9.7)
1/16 in (1.6 mm), DC+, 5/8 (16) 75% Ar/25% CO_2	3.8 (150) 6.4 (250) 8.9 (350)	27 29 31	280 370 460	2.6 (5.8) 4.7 (10.4) 6.8 (15.1)
1**/16 in (1.6 mm),** DC+, 3/4 (20) 90% Ar/10% CO_2	3.8 (150) 6.4 (250) 8.9 (350)	25 27 29	270 375 470	2.6 (5.7) 4.9 (10.8) 7.2 (15.9)
1/16 in (1.6 mm), DC+, 3/4 (20) 98% Ar/2% O_2	3.8 (150) 6.4 (250) 8.9 (350)	24 26 28	290 390 490	2.8 (6.1) 5.0 (11.1) 7.3 (16.1)

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[1]Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 55-G

Metal-to-Metal

Key Features

- Produces a deposit which resists metal-to-metal wear and mild abrasion
- The deposit results in an even harder material when used with the Bulk Tungsten Carbide process
- To be used on carbon steel and low alloy steel
- Unlimited layers with proper preheat and interpass temperatures and procedures

Typical Applications

- Crane wheels
- Blower blades
- Bucket lips
- Dredge parts
- Tillage tools

Welding Positions

All, except overhead

Shielding Gas

75-90% Argon / Balance CO_2
98% Argon / 2% O_2

DIAMETERS / PACKAGING

Diameter - in (mm)	25 lb (11.3 kg) Plastic Spool	500 lb (227 kg) Accu-Trak® Drum
0.045 (1.1)	ED028176	ED031475
1/16 (1.6)	ED028177	ED032661

MECHANICAL PROPERTIES[1]

	Rockwell Hardness (R_c)		
Shielding Gas	1 Layer	2 Layer	4 Layers
75%Ar/25%CO_2	50 - 51	53 - 54	54 - 55
98%Ar/2%O_2	54 - 55	55 - 56	56 - 57

DEPOSIT COMPOSITION[1]

On Carbon Steel (2 Layers)	%C	%Mn	%Si	%Cr	%Mo
0.045 in (1.1 mm) - Ar/CO_2	0.39	1.24	0.93	5.61	0.55
0.045 in (1.1 mm) - Ar/O_2	0.47	1.30	1.18	6.44	0.65
1/16 in (1.6 mm) - Ar/CO_2	0.41	1.24	0.95	5.69	0.57
1/16 in (1.6 mm) - Ar/O_2	0.45	1.25	1.10	5.81	0.58

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, ESO - in (mm) Shielding Gas	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1 mm), DC+, 5/8 (16) 75% Ar/25% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	27 29 31	165 225 290	2.0 (4.3) 3.0 (6.7) 4.2 (9.2)
0.045 in (1.1 mm), DC+, 3/4 (20) 90% Ar/10% CO_2	5.1 (200) 7.6 (300) 10.2 (400)	25 28 30	145 195 245	2.1 (4.7) 3.3 (7.2) 4.4 (9.7)
0.045 in (1.1 mm), DC+, 3/4 (20) 98% Ar/2% O_2	5.1 (200) 7.6 (300) 8.9 (350) 10.2 (400)	25 27 28 29	145 200 225 250	2.3 (5.1) 3.4 (7.5) 3.9 (8.7) 4.4 (9.8)
1/16 in (1.6 mm), DC+, 5/8 (16) 75% Ar/25% CO_2	3.8 (150) 6.4 (250) 8.9 (350)	28 30 32	260 340 420	2.6 (5.8) 4.7 (10.4) 6.8 (15.1)
1/16 in (1.6 mm), DC+, 3/4 (20) 90% Ar/10% CO_2	3.8 (150) 6.4 (250) 8.9 (350)	25 27 29	230 315 400	2.7 (6.0) 4.9 (10.7) 7.0 (15.4)
1/16 in (1.6 mm), DC+, 3/4 (20) 98% Ar/2% O_2	3.8 (150) 6.4 (250) 8.9 (350)	24 26 28	220 315 410	2.9 (6.4) 5.0 (11.0) 7.1 (15.7)

NOTE: Work area should be clean, with any previous hardfacing deposit removed, and cracks properly repaired. Cold parts should be warmed to at least 25ºC (75ºF). Higher preheat of 150° - 260ºC (300° - 500°F) on thick parts or heavy sections.

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Lincore® BU

Build-Up

Typical Applications

- Cable sheaves
- Crane wheels
- Drums and pulleys

Welding Positions

Flat & Horizontal

Key Features

- Provides a tough machinable deposit for build-up or final overlay
- Delivers non-severe metal-to-metal wear with outstanding crack resistance
- Ideal for rebuilding worn parts to near final dimensions before applying final hardfacing layers which are more wear resistant
- Can also be used as the final hardfacing layer for non-severe metal-to-metal wear applications
- Unlimited layers with proper preheat and interpass temperatures and procedures

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
5/64 (2.0)	ED031115	ED022064
7/64 (2.8)		ED022065

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_B)	
As-Welded	Work-Hardened
78 - 90	86 - 98

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al
6 Layers	0.24	0.50	0.25	1.50

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
5/64 in (2.0 mm), DC+ 2 (50)	5.1 (200)	29	280	4.6 (10.1)
	6.1 (240)	30	315	5.5 (12.1)
	6.6 (260)	30	330	6.1 (13.2)
	7.6 (300)	31	350	6.9 (15.2)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	3.4 (135)	26	360	5.7 (12.6)
	3.8 (150)	27	385	6.3 (13.9)
	4.4 (175)	28	420	7.3 (16.0)
	5.1 (200)	29	450	8.2 (18.1)
	5.9 (235)	30	470	9.6 (21.1)

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 33

Build-Up

Key Features

- Delivers tough machinable deposits for build-up or final overlay intended for metal-to-metal wear
- Use for build-up of steel mill parts such as rougher couplings
- Build-up deposit on carbon steel and low alloy steel base metals
- It is ideal for rebuilding worn parts to near final dimensions before applying final hardfacing layers which are more wear resistant
- Unlimited layers with proper preheat and interpass temperatures and procedures

Typical Applications

- Tractor rolls and idlers
- Shovel parts
- Mine car wheels
- Mill and crusher hammers
- Dredge pumps

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
0.045 (1.2) 1/16 (1.6) 5/64 (2.0) 7/64 (2.8)	ED011237	ED031116 ED031117 ED031118	ED011238 ED011240

MECHANICAL PROPERTIES[1]

No. of Layers	Rockwell Hardness (R_c) As-Welded	Work-Hardened	Flame-Hardened / Water Quenched
1	14-30	28-34	–
2	26-32	32-36	38-42
3	25-34	35-38	–

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr	%S	%P
3 Layers (0.045 in & 1/16 in)	0.11-0.18	1.8-2.1	0.50-0.75	1.6-1.9	1.2-1.4	0.002-0.005	0.004-0.012
3 Layers (5/64 in & 7/64 in)	0.13-0.15	2.1-2.3	0.45-0.60	1.45-1.70	1.1-1.4	0.002-0.005	0.004-0.008

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1 mm), DC+ 1-3/4 (45)	5.1 (200) 8.9 (350) 12.7 (500)	25 28 31	80 130 150	1.5 (3.3) 2.7 (6.0) 3.9 (8.7)
1/16 in (1.6 mm), DC+ 1-3/4 (45)	3.8 (150) 6.4 (250) 8.9 (350)	26 29 32	125 180 225	2.1 (4.6) 3.5 (7.8) 5.0 (11.1)
5/64 in (2.0 mm), DC+ 2 (50)	3.2 (125) 5.1 (200) 6.4 (250)	23 27 29	200 290 325	3.1 (6.9) 4.9 (10.8) 6.1 (21.1)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	3.4 (135) 4.4 (175) 6.0 (235)	26 28 30	360 420 470	5.7 (12.6) 7.3 (16.0) 9.6 (21.1)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 40-0

Metal-to-Metal

Typical Applications

- Tractor rolls
- Mine car wheels
- Guide rollers
- Bucket links and bases
- Actuating cams

Welding Positions

Flat & Horizontal

Key Features

- Higher hardness for metal-to-metal wear and mild abrasion
- Used on transfer rollers and guides, crane wheels and shafts
- Can be used on low carbon and low alloy steels
- Unlimited layers with proper preheat and interpass temperatures and procedures

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
5/64 (2.0)	ED031119	ED025907

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)		
1 Layer	2 Layers	3 Layers
36	41	38

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr	%Mo
1 Layer	0.18	1.25	0.53	1.34	2.51	0.32
2 Layers	0.20	1.46	0.67	1.72	3.25	0.42
3 Layers	0.21	1.55	0.76	1.97	3.52	0.46

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
5/64 in (2.0 mm), DC+ 1-3/4 (45)	3.2 (125) 5.1 (200) 6.4 (250)	24 27 30	218 282 327	3.2 (7.0) 5.0 (11.1) 6.3 (13.9)

NOTE: Area to be overlayed should be clean and free of rust, oil, etc. Any previous hardfacing deposit that has been embrittled by severe work hardening should be removed. Cracks and other irregularities should be properly repaired.

Cold parts should be warmed to at least 25ºC (75ºF). Higher preheat of 150 - 260ºC (300 - 500ºF) may be necessary on thick parts or heavy sections. Interpass temperature between 150ºC (300ºF) and 200ºC (400ºF) do not affect the hardness of Lincore® 40-0 significantly.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® 55

Metal-to-Metal

Key Features

- Delivers a deposit which resists metal-to-metal rolling or sliding wear as well as mild abrasion
- To be used on carbon steel, low alloy steel and manganese steel
- Unlimited layers with proper preheat and interpass temperatures and procedures

Typical Applications

- Crane wheels
- Blower blades
- Rail ends
- Skip guides
- Cams and transfer tables

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Master Carton	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
0.045 (1.2)		ED031120	
1/16 (1.6)		ED031121	
5/64 (2.0)	ED011277	ED031122	ED011278
7/64 (2.8)			ED011280

MECHANICAL PROPERTIES[1]

	Rockwell Hardness (R_C)			
No. of Layers	As-Welded	Work-Hardened	180°C (350°F) Interpass Temp	Flame-Hardened / Water Quenched
1	50 - 59	53 - 62	50 - 55	–
2	50 - 60	56 - 62	55 - 59	52 - 54

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr	%Mo	%S	%P
0.045 in & 1/16 in	0.45	1.3	0.53	1.4	5.3	0.80	0.004	0.010
5/64 in & 7/64 in	0.45	1.4	0.60	1.4	5.3	0.80	0.004	0.010

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1 mm), DC+ 1-3/4 (45)	5.1 (200)	25	85	1.6 (3.6)
	8.9 (350)	28	125	3.0 (6.6)
	12.7 (500)	31	165	4.3 (9.4)
1/16 in (1.6 mm), DC+ 1-3/4 (45)	3.8 (150)	26	125	2.2 (4.8)
	6.4 (250)	29	195	3.8 (8.4)
	8.9 (350)	32	245	5.5 (12.1)
5/64 in (2.0 mm), DC+ 1-3/4 (45)	3.2 (125)	24	190	3.2 (7.0)
	5.1 (200)	27	295	5.0 (11.0)
	6.4 (250)	30	330	6.2 (13.7)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	2.3 (90)	25	280	3.8 (8.4)
	3.2 (125)	27	350	5.2 (11.5)
	4.4 (175)	30	420	7.3 (16.0)

NOTE: Area to be overlayed should be clean and free of rust, oil, etc. Any previous hardfacing deposit that has been embrittled by severe work hardening should be removed. Cracks and other irregularities should be properly repaired.

Cold parts should be warmed to at least 25ºC (75ºF). Higher preheat of 150 - 260ºC (300 - 500ºF) may be necessary on thick parts or heavy sections. Interpass temperature between 150ºC (300ºF) and 200ºC (400ºF) do not affect the hardness of Lincore® 55 significantly.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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[1] Composition and properties depend upon dilution. Single layer deposit properties depend upon base metal and/or build-up material.

Lincore® T & D

Metal-to-Metal

Typical Applications

- Punch dies
- Shear blades

Welding Positions

Flat & Horizontal

Key Features

- Delivers a deposit similar to H12 tool steel
- For build-up of tool steel dies and edges, or applying wear resistance surface on carbon or low alloy steels
- To be used on carbon steel, low alloy steel or tool steel

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool
1/16 (1.6)	ED031134

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_C)	
As-Welded	Tempered at 540°C (1000°F)
48 - 55	55 - 65

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr	%Mo	%W
6 Layers Open Arc	0.65	1.5	0.8	1.8	7.0	1.4	1.6
6 Layers w/ 802 Flux	0.50	1.9	1.0	1.0	7.0	1.4	1.6

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/16 in (1.6 mm), DC+ 1-1/4 (32)	3.8 (150)	22	170	2.4 (5.4)
	5.1 (200)	23	210	3.6 (7.9)
	6.4 (250)	24	250	4.1 (8.9)
	7.6 (300)	25	270	4.9 (10.8)
	8.9 (350)	26	300	5.4 (12.0)

NOTE: Minimum preheat and interpass temperatures of 315°C (600°F) are essential for crack-free welding on mild steel or low alloy steel. For crack-free welding on tool steel parts, preheat of 538°C (1000°F) or higher may be necessary. After welding, very slow cooling to 121°C (250°F) is usually required. This can be followed by post-weld heat treating at 538° - 593°C (1000° - 1100°F) to develop maximum hardness.

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Lincore® M

Severe Impact

Key Features

- Deposit resists severe impact as well as moderate abrasion
- Produces an austenitic manganese deposit that work-hardens
- Recommended for build-up and repair of Hadfield-type austenitic manganese materials as well as carbon and low alloy steels
- Unlimited layers with proper preheat and interpass temperatures and procedures

Typical Applications

- Hammers
- Dredge parts
- Crushers
- Breaker bars
- Buckets

Welding Positions

Flat

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil	125 lb (56.7 kg) Speed-Feed® Drum	600 lb (272 kg) Speed-Feed® Drum
0.045 (1.1)	ED031128			
1/16 (1.6)	ED031129			
5/64 (2.0)	ED031130	ED011160		
7/64 (2.8)		ED011164	ED011163	ED011162

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
As-Welded	Tempered at 540°C (1000°F)
18 - 28	30 - 48

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr	%Ni
Open Arc	0.60	13.0	0.4	4.9	0.5
w/ 803 Flux	0.50	13.0	0.4	4.3	0.5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1 mm), DC+ 1 (25)	5.1 (200)	22	80	1.5 (3.3)
	8.9 (350)	24	145	2.7 (6.0)
	12.7 (500)	26	185	4.4 (9.6)
1/16 in (1.6 mm), DC+ 1-1/8 (30)	3.8 (150)	23	130	2.2 (4.9)
	6.4 (250)	25	200	3.9 (8.6)
	8.9 (350)	27	250	5.6 (12.4)
5/64 in (2.0 mm), DC+ 1-1/4 (32)	3.2 (125)	24	240	2.9 (6.4)
	4.4 (175)	27	300	4.2 (9.3)
	6.4 (250)	29	360	6.2 (13.6)
7/64 in (2.8 mm), DC+ 1-3/4 (45)	1.9 (75)	25	240	3.5 (7.8)
	3.2 (125)	27	360	6.2 (13.6)
	3.8 (150)	28	395	7.5 (16.6)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	1.9 (75)	25	240	3.6 (8.0)
	4.4 (175)	30	400	8.8 (19.5)
	5.7 (225)	32	455	11.6 (25.6)

NOTE: As with all austenitic manganese welding products, interpass temperatures should be limited to 260°C (500°F) maximum. A stringer bead, or at most, a slight weave is recommended to limit heat build-up. Excessive heat build-up causes manganese carbide precipitation which damages the toughness of austenitic manganese.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

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Lincore® 15CrMn

Severe Impact

Typical Applications

- Spreader cones
- Crusher hammers
- Austenitic manganese parts

Welding Positions

Flat & Horizontal

Key Features

- Provides an austenitic manganese deposit which exhibits very good crack resistance
- Work-hardens for overlay or joining austenitic manganese steel to itself or to carbon steel
- Can be used as a build-up layer before capping with abrasion resistant alloys
- Can be used in open arc mode for joining austenitic manganese steel to carbon steel, low alloy steel, austenitic manganese steel, or stainless steel
- Unlimited layers with proper preheat and interpass temperatures and procedures

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil	125 lb (56.7 kg) Speed-Feed® Drum
5/64 (2.0)	ED031126	ED022060	
7/64 (2.8)		ED022061	ED022068

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
As-Welded	Work-Hardened
18 - 22	40-50

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr
Six Layers Open Arc	0.4	15.0	0.25	16.0
Six Layers w/ 801 Flux	0.4	15.0	0.6	16.0

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
5/64 in (2.0 mm), DC+ 1-1/4 (32)	3.2 (125)	26	210	3.3 (7.3)
	5.1 (200)	29	280	5.3 (11.7)
	6.4 (250)	30	320	6.8 (15.1)
	8.9 (350)	32	380	9.7 (21.3)
7/64 in (2.8 mm), DC+ 1-3/4 (45)	1.9 (75)	26	250	2.5 (5.5)
	3.2 (125)	28	320	5.1 (11.3)
	3.8 (150)	29	350	6.6 (14.6)
	4.4 (175)	30	380	7.5 (16.4)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	3.8 (150)	30	320	6.7 (14.9)
	5.1 (200)	33	390	8.7 (19.2)
	5.7 (225)	34	410	9.8 (21.7)
	6.4 (250)	35	425	11.4 (25.1)

NOTE: As with all austenitic manganese welding products, interpass temperatures should be limited to 260°C (500°F) maximum. A stringer bead, or at most, a slight weave is recommended to limit heat build-up. Excessive heat build-up causes manganese carbide precipitation which damages the toughness of austenitic manganese.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

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Lincore® FROG MANG®

Severe Impact

Key Features

- Designed for repair of manganese frogs and manganese crossing diamonds in the railroad industry
- High alloy austenitic manganese deposit
- Unlimited layers with proper preheat and interpass temperatures and procedures

Typical Applications

- Manganese crossing diamonds
- Manganese railroad frogs

DIAMETERS / PACKAGING

Diameter in (mm)	9 lb (4 kg) Plastic Spool 36 lb (16.3 kg) Master Carton	25 lb (11.3 kg) Steel Spool
1/16 (1.6)		ED026106
5/64 (2.0)	ED034485	ED026105

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)	
As-Welded	Work-Hardened
20 - 30	40 - 50

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr
6 Layers	1.07	25.5	0.17	4.59

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
1/16 in (1.6 mm), DC+ 1 (25)	5.1 (200)	27	220	3.0 (6.7)
	6.4 (250)	29	250	4.0 (8.7)
	8.3 (325)	32	300	5.3 (11.6)
5/64 in (2.0 mm), DC+ 2 (50)	3.8 (150)	27	240	3.4 (7.4)
	5.1 (200)	29	290	4.9 (10.7)
	6.4 (250)	31	340	6.4 (14.0)

NOTE: Remove all damaged and foreign material by the air-carbon arc gouging process and grinding. Make sure all defective metal is removed. In the event hairline cracks remain at flangeway depth, use a 1/8 in diameter E308 stainless product, such as Blue Max® or Red Baron® 308L AC-DC to tie up these cracks and avoid hot cracking during the buildup process. Use only light amounts and do not build-up with E308 stainless. It is for use in emergency situations where no other alternative is available to repair flangeway cracks. As with all austenitic manganese welding products, interpass temperatures should be limited to 260°C (500°F) maximum. A stringer bead, or at most, a slight weave is recommended to limit heat build-up. Excessive heat build-up causes manganese carbide precipitation which damages the toughness of austenitic manganese.

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

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Lincore® 50

Abrasion & Impact

Typical Applications

- Crusher rolls
- Dredge cutter teeth
- Ore chute baffles
- Muller plows and tires
- Coal mining cutting teeth

Welding Positions

Flat & Horizontal

Key Features

- Delivers an abrasion resistant deposit, even under conditions of moderate impact
- Larger wire diameter sizes may be used for the submerged arc process
- Can be used on low carbon, medium carbon, low alloy, manganese and stainless steels
- Limited to 4 layers

DIAMETERS / PACKAGING

Diameter - in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil	125 lb (56.7 kg) Speed-Feed® Drum
0.045 (1.1)	ED031123		
1/16 (1.6)	ED031124	ED020829	
5/64 (2.0)	ED031125	ED017825	
7/64 (2.8)		ED011275	ED011274

MECHANICAL PROPERTIES[1]

	Rockwell Hardness (R_C)		
	1 Layer	2 Layers	3 Layers
On Mild Steel	34-37	44-48	48-52
On 0.50% Carbon Steel	41-43	47-50	50-53
On Austenitic Mn Steel	-	43-45	48-50
with 801 Flux	38-43	47-52	48-56

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr	%Mo
Open Arc						
0.045 in & 1/16 in	2.4	1.3	1.0	0.6	11.4	–
5/64 in & 7/64 in	2.0	0.9	1.0	0.6	9.2	0.5
Submerged Arc 5/64 in & 7/64 in						
w/ 801 Flux	2.5	1.1	1.3	0.4	10.1	0.5
w/ 803 Flux	2.5	1.8	1.2	0.2	11.1	0.5
w/ 860 Flux	2.5	2.0	1.7	0.2	11.0	0.5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1mm), DC+ 1 (25)	5.1 (200) 10.2 (400) 15.2 (600)	19-21 23-25 27-29	120 190 250	1.9 (4.2) 3.9 (8.5) 5.8 (12.8)
1/16 in (1.6 mm), DC+ 1 (25)	3.8 (150) 8.4 (350) 11.4 (450)	22-24 29-31 32-34	175 325 365	2.7 (5.9) 6.2 (13.6) 7.9 (17.5)
5/64 in (2.0 mm), DC+ 1-1/4 (32)	3.2 (125) 5.1 (200) 6.4 (250)	27 31 33	210 325 380	3.4 (7.4) 5.4 (11.9) 6.8 (14.9)
7/64 in (2.8 mm), DC+ 1-1/4 (32)	2.0 (80) 2.5 (100) 3.3 (130)	26 27 29	315 375 450	3.9 (8.6) 4.9 (10.7) 6.4 (14.0)
7/64 in (2.8 mm), DC+ 2-1/2 (64)	2.5 (100) 3.3 (130) 4.4 (175)	27 29 31	315 370 450	4.9 (10.7) 6.4 (14.0) 8.6 (19.0)
With Recommended Neutral Fluxes				
7/64 in (2.8 mm), DC+ 1-1/4 (32)	2.5 (100) 3.0 (120) 4.4 (175)	29 30 33	400 450 540	5.2 (11.4) 6.2 (13.7) 9.1 (20.0)

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Lincore® 60-0

Severe Abrasion

Key Features

- Deposits feature higher alloy levels than to resist both abrasion and moderate impact
- Can be used at temperatures up to 704°C (1300°F)
- To be used on carbon, low alloy, manganese, stainless steels and cast iron
- Deposit is limited to two layers

Typical Applications

- Bucket lips
- Crusher hammers
- Ore chutes
- Dozer blades
- Ripper teeth

Welding Positions

Flat & Horizontal

DIAMETERS / PACKAGING

Diameter in (mm)	25 lb (11.3 kg) Steel Spool	50 lb (22.7 kg) Coil
0.045 (1.1)	ED031131	
1/16 (1.6)	ED031132	
5/64 (2.0)	ED031133	ED019887
7/64 (2.8)		ED019888

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)
55-60

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Al	%Cr
2 Layers Open Arc	4.2	1.6	1.3	0.6	25.4
2 Layers w/ 803 Flux	4.8	4.1	1.2	0.2	25.8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
0.045 in (1.1mm), DC+ 1 (25)	5.1 (200)	21	125	1.9 (4.1)
	10.2 (400)	25	185	3.7 (8.2)
	12.7 (500)	27	210	4.7 (10.3)
1/16 in (1.6 mm), DC+ 7/8 (22)	5.1 (200)	28	240	3.4 (7.6)
	7.6 (300)	31	300	5.1 (11.2)
	11.4 (450)	33	350	7.5 (16.6)
5/64 in (2.0 mm), DC+ 1-1/4 (32)	3.2 (125)	26	250	3.4 (7.4)
	5.1 (200)	30	350	5.4 (12.0)
	6.4 (250)	32	400	6.9 (15.1)
7/64 in (2.8 mm), DC+ 1-1/8 (30)	1.9 (75)	27	250	3.4 (7.4)
	3.2 (125)	30	340	5.4 (11.9)
	4.4 (175)	32	420	7.5 (16.5)
With Recommended Neutral Fluxes				
7/64 in (2.8 mm), DC+ 1-1/8 (30)	2.5 (100)	30	295	4.4 (9.6)
	3.2 (125)	32	340	5.4 (11.9)
	4.4 (175)	34	420	7.5 (16.5)

NOTE: Deposit thickness limit is two layers unless high travel speed is used to obtain very closely spaced check cracks. Many layers can be used with high travel speed and small bead sizes to ensure close-spaced check cracks. Lincore® 60-0 deposit cross cracks (commonly called cross-checking) on cooling. This is desirable, since cross-cracking of the deposit relieves cooling stresses and prevents spalling.

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Lincore® 65-0

Severe Abrasion

Typical Applications

- Screw augers
- Ore chutes and wearplates
- Crusher rolls
- Ripper teeth

Welding Positions

Flat & Horizontal

Key Features

- Deposits include higher carbon and chrome levels than Lincore® 60-O
- Recommended for use on wear plate, coal pulverizer rolls, earth engaging tools, and on slurry pipe and elbows
- To be used on carbon, low alloy, manganese, stainless steels and cast iron
- Limited to four layers

DIAMETERS / PACKAGING

Diameter in (mm)	50 lb (22.7 kg) Coil	500 lb (227 kg) Speed-Feed® Drum
7/64 (2.8)	ED026077	ED026083

MECHANICAL PROPERTIES[1]

Rockwell Hardness (R_c)		
1 Layer	2 Layers	4 Layers
57	60	64

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%Cr
1 Layer	3.7	1.3	0.7	19.9
2 Layers	4.9	1.6	1.0	26.2
4 Layers	5.7	1.8	1.1	30.8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity ESO - in (mm)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
7/64 in (2.8 mm), DC+ 1-1/8 (30)	1.9 (75)	27	225	3.2 (7.0)
	2.5 (100)	28	280	4.4 (9.6)
	3.8 (150)	30	360	7.5 (16.6)
	5.1 (200)	31	420	8.9 (19.7)
	6.4 (250)	32	480	11.1 (24.4)
	7.6 (300)	33	500	13.5 (29.8)

4 layers of Lincore 65-O	
Condition	Rockwell Hardness C
As-Welded	63
Aged at 1200°F (650°C) for 2 hours	56
Aged at 1400°F (760°C) for 2 hours	54

NOTE: Postweld heat treatment up to 1400°F (760°C) will not affect abrasion resistance very significantly, but will affect hardness to some extent. Typical results are shown above:

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Lincolnweld® A-96-S

Alloy Flux

Key Features

- Modified Type 420 stainless deposit with a carbon content near the high side for as-welded hardness
- Designed to produce a weld deposit with 13% chromium, 0.23% carbon when proper procedures are followed

Typical Applications

- Use with Lincolnweld® L-60 mild steel wire for hardfacing

Packaging

60 lb (27.2 kg) Plastic Bag	ED031860

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

Lincolnweld® H-535™

Alloy Flux

Key Features

- Produces a deposit with good abrasion resistance, allows some machinability
- Low carbon martensitic deposit
- Hardness range is 24-45 Rockwell C (R_C), depending upon the actual welding procedure used

Typical Applications

- Use with Lincolnweld® L-60 mild steel wire for hardfacing

Packaging

50 lb (22.7 kg) Paper Bag	ED027865

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

Lincolnweld® H-560™

EN 760 – S A Z 3 • Alloy Flux

Typical Applications

- Use with Lincolnweld® L-60 mild steel wire for hardfacing

Packaging

100 lb (45.4 kg) Paper Bag	ED010345

Key Features

- High alloy flux depositing primary carbides in a martensitic matrix
- Excellent material for severe abrasion applications
- Resistance to abrasion is 50 to 60 times that of plain carbon steel

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

Lincolnweld® 801®

EN 760 – S A FB 1; EN 760 – S A FB 2 • Neutral Flux

Packaging

50 lb (22.7 kg) Paper Bag	ED019588
550 lb (249 kg) Drum	ED023403
3000 lb (1361 kg) Bulk Bag	EDS30786

Key Features

- Provides smooth beads and excellent slag removal
- Fast-freezing

Typical Applications

- Hardfacing
- Use with Lincore® 20, 30-S, 35-S, 40-S, 42-S, 4130, 8620, 410, 410NiMo, 420 and 96S

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

Lincolnweld® 802®

Neutral Flux • EN 760 – S A CS 1; EN 760 – S A CS 2

Key Features

- Excellent hot slag removal with wire containing niobium, vanadium or very high chrome levels

Typical Applications

- Hardfacing
- Use with Lincore® 102W, 423L, 423Cr and 102HC

Packaging

50 lb (22.7 kg) Paper Bag	ED032800
450 lb (204 kg) Drum	ED023365
2700 lb (1225 kg) Bulk Bag	EDS30787

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

Lincolnweld® 803™

Neutral Flux

Key Features

- Specially designed for high speed welding applications, such as the resurfacing of coal crusher rolls or blast furnace bells and hoppers

Typical Applications

- Hardfacing with Lincore® 60-S

Packaging

50 lb (22.7 kg) Plastic Bag	ED032796

NOTE: Deposit carbon, alloy content and hardness depend upon the ratio of flux melted to wire melted. High voltage promotes high carbon and alloy contents, while low voltage promotes lower carbon and alloy content.

ALUMINUM & CAST IRON

Aluminum
MIG Wire
SuperGlaze® 4043 372
SuperGlaze® 4047 373
SuperGlaze® 5183 374
SuperGlaze® 5356 375
SuperGlaze® 5356 TM™ 376
SuperGlaze® 5554 377
SuperGlaze® 5556 378

TIG Cut Length
SuperGlaze® 4043 379
SuperGlaze® 5356 380

Cast Iron
Stick Electrode
Ferroweld™ 381

SuperGlaze® 4043

Aluminum • AWS ER4043

Key Features

- Designed for welding heat-treatable base alloys and more specifically 6XXX series alloys
- Lower melting point and more fluidity than 5XXX series filler alloys
- Low sensitivity to weld cracking with 6XXX series base alloys
- Suitable for sustained elevated temperature service, i.e. above 65°C (150°F)

Typical Applications

- For welding 6XXX alloys, and most casting alloys
- Automotive components such as frame and drive shafts
- Bicycle frames

Conformances

AWS A5.10/A5.10M: 1999 ER4043
ASME SFA-A5.10: ER4043
CWB/CSA W48-06: ER4043

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Spool 20 lb (9.1 kg) Master Carton	16 lb (7.3 kg) Plastic Spool	20 lb (9.1 kg) Plastic Spool	275 lb (125 kg) Accu-Pak® Box	275 lb (125 kg) Gem-Pak™ Box
0.030 (0.8)	ED030307				
0.035 (0.9)	ED030308	ED028395		ED033117	ED034721
3/64 (1.2)	ED030310		ED029234	ED030982[a]	ED034548
1/16 (1.6)			ED030281	ED030983[b]	ED034549

[a]Wire payoff kit K2858-1 sold separately. [b]Wire payoff kit K2859-1 sold separately.

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER4043	Remainder	4.50-6.00	0.80 max.	0.30 max.	0.05 max.
Typical Performance[2]	Remainder	5.26	0.15	0.01	0.01
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER4043	0.05 max.	—	0.10 max.	0.20 max.	0.0008 max.
Typical Performance[2]	0.03	—	0.001	0.01	<0.0002

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 4047

AWS ER4047 • Aluminum

Conformances

AWS A5.10/A5.10M: 1999 ER4047
ASME SFA-A5.10 ER4047

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

Key Features

- Lower melting point and higher fluidity than 4043 wires
- Can be used as a substitute for 4043 wires to increase silicon in the weld metal, minimize hot cracking and produce higher fillet weld shear strength

Typical Applications

- Automotive components
- Heat exchangers
- Body panels

DIAMETERS / PACKAGING

Diameter in (mm)	16 lb (7.3 kg) Plastic Spool
3/64 (1.2)	EDS28417
1/16 (1.6)	EDS28418

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER4047	Remainder	11.00-13.00	0.80 max.	0.30 max.	0.15 max.
Typical Performance[2]	As Reported per AWS Requirements				
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER4047	0.10 max.	—	0.20 max.	—	0.0008 max.
Typical Performance[2]	As Reported per AWS Requirements				

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 5183

Aluminum • AWS ER5183

Key Features

- Designed to meet the tensile strength requirements of high magnesium alloys
- For 5083 and 5654 base materials

Typical Applications

- Marine fabrication and repair
- Cryogenic tanks
- Shipbuilding and other high strength structural aluminum applications
- Bicycle frames

Conformances

AWS A5.10/A5.10M: 1999	ER5183
ASME SFA-A5.10:	ER5183
ABS:	IACS W26 Grade WC
Lloyd's Register:	WC/I-1 S
DNV Grade:	5183
GL:	RAlMg4,5
BV Grade:	WC
CWB/CSA W48-06:	ER5183

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

DIAMETERS / PACKAGING

Diameter in (mm)	16 lb (7.3 kg) Plastic Spool
3/64 (1.2)	EDS28437
1/16 (1.6)	EDS28438

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5183	Remainder	0.40 max.	0.40 max.	0.10 max.	0.50 - 1.00
Typical Performance[2]	Remainder	0.03	0.13	0.001	0.65
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5183	4.30 - 5.20	0.05 - 0.25	0.25 max.	0.15 max.	0.0008 max.
Typical Performance[2]	4.99	0.10	0.02	0.07	0.0006

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 5356

AWS ER5356 • Aluminum

Conformances

AWS A5.10/A5.10M: 1999	ER5356
ASME SFA-A5.10:	ER5356
ABS:	IACS W26 Grade WB
Lloyd's Register:	WB/I-1 S
DNV Grade:	5356
GL:	RAlMg4
BV Grade:	WB
CWB/CSA W48-06:	ER5356

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

Key Features

- General purpose filler alloy for welding 5XXX series alloys

Typical Applications

- Automotive bumpers and supports
- Structural frames in the shipbuilding industry
- Bicycle frames
- Formed truck panels

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.4 kg) Plastic Spool 20 lb (9.1 kg) Master Carton	16 lb (7.3 kg) Platic Spool	20 lb (9.1 kg) Plastic Spool	300 lb (136 kg) Accu-Pak® Box	300 lb (136 kg) Gem-Pak™ Box
0.035 (0.9)	ED030312	ED028385		ED033178[a]	ED034722
3/64 (1.2)	ED030314		ED030282	ED031826[b]	ED034550
1/16 (1.6)			ED030283	ED030985[b]	ED034551

[a]This part number is Made-To-Order. [b]Wire payoff kit K2860-1 sold separately.

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5356	Remainder	0.25 max.	0.40 max.	0.10 max.	0.05 - 0.20
Typical Performance[2]	Remainder	0.05	0.09	0.03	0.12
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5356	4.50 - 5.50	0.05 - 0.20	0.10 max.	0.06 - 0.20	0.0008 max.
Typical Performance[2]	4.56	0.08	< 0.01	0.15	0.0007

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 5356 TM™

Aluminum • AWS ER5356

Key Features

- Unparalleled bead profile and appearance which are critical for groove and fillet welds on aluminum trailer beds.
- SuperGlaze® 5356 TM™ has an engineered chemical composition developed specifically to outperform standard ER5356 electrodes and gives the operator unprecedented control.
- Proprietary manufacturing processes give SuperGlaze® 5356 TM™ the smoothest surface finish in the industry, making it ideal for automatic applications on formed truck panels.

Typical Applications

- High speed groove welds on formed truck panels
- Multi-pass fillet and lap welds on 6XXX series base materials
- Robotic fillet welds on trailer tanks requiring minimal post-weld clean up

Conformances

AWS A5.10/A5.10M: 1999	ER5356
ASME SFA-A5.10:	ER5356
CWB/CSA W48-06:	ER5356

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

DIAMETERS / PACKAGING

Diameter in. (mm)	1 lb (0.4 kg) Plastic Spool 20 lb (9.1 kg) Master Carton	16 lb (7.3 kg) Steel Spool	20 lb (9.1 kg) Plastic Spool	275 lb (125 kg) Gem-Pak™
0.035 (0.9)	ED034064	ED034067	—	ED034723
3/64 (1.2)	ED034065	ED034068	ED034070	ED034724
1/16 (1.6)	ED034066	ED034069	ED034071	ED034729

WIRE COMPOSITION – *As required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5356	Remainder	0.25 max.	0.40 max.	0.10 max.	0.05 - 0.20
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5356	4.50 - 5.50	0.05 - 0.20	0.10 max.	0.06 - 0.20	0.0008 max.

SuperGlaze® 5554

AWS ER5554 • Aluminum

Conformances

AWS A5.10/A5.10M: 1999 ER5554
ASME SFA-A5.10: ER5554
CWB/CSA W48-06: ER5554

Key Features

- Matching filler alloy for welding 5454 base alloys
- Low magnesium content to closely match the base material chemistry

Welding Positions

All

Typical Applications

- 5454 base alloys
- Automotive wheels
- Transportation applications such as over-the-road trailers and rail tank cars
- Chemical storage tanks

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

DIAMETERS / PACKAGING

Diameter in (mm)	16 lb (7.3 kg) Plastic Spool
3/64 (1.2)	ED029573

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5554	Remainder	0.25 max.	0.40 max.	0.10 max.	0.50 - 1.00
Typical Performance[2]	Remainder	0.06	0.13	0.03	0.51
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5554	2.40 - 3.00	0.05 - 0.20	0.25 max.	0.06 - 0.20	0.0008 max.
Typical Performance[2]	2.41	0.06	< 0.01	0.09	0.0006

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 5556

Aluminum • AWS ER5556

Key Features

- Provide matching tensile strengths for 5XXX alloys
- Increased amounts of magnesium and manganese

Typical Applications

- 5XXX alloys, such as 5083 and 5654
- Pressure vessels
- Storage tanks

Conformances

AWS A5.10/A5.10M: 1999	ER5556
ASME SFA-A5.10:	ER5556
ABS:	IACS W26 Grade WC

Welding Positions

All

Shielding Gas

100% Argon
Argon / Helium Mixtures
Flow Rate: 30 - 50 CFH

Note

- Typical Operating Procedures on pg. 480-481

DIAMETERS / PACKAGING

Diameter in (mm)	16 lb (7.3 kg) Plastic Spool	300 lb (136 kg) Gem-Pak™ Box
3/64 (1.2)	EDS29581	
1/16 (1.6)	EDS29582	ED034731

WIRE COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5556	Remainder	0.25 max.	0.40 max.	0.10 max.	0.50 - 1.00
Typical Performance[2]	Remainder	0.03	0.13	0.001	0.65
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5556	4.70 - 5.50	0.05 - 0.20	0.25 max.	0.05 - 0.20	0.0008 max.
Typical Performance[2]	5.00	0.10	0.02	0.07	0.0006

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 4043

AWS ER4043 • Aluminum

Conformances

AWS A5.10/A5.10M: 1999 ER4043
ASME SFA-A5.10: ER4043

Welding Positions

All

Key Features

- Use on many weldable cast and wrought aluminum alloys
- Generally recommended for welding 5052, any 6XXX series alloys and castings
- Embossed on each end for easy identification after use

Typical Applications

- Bicycle frames
- Pressure vessels
- Electrical bus bars

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/16 (1.6)	ED031111
3/32 (2.4)	ED031112
1/8 (3.2)	ED031113

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER4043	Remainder	4.50-6.00	0.80 max.	0.30 max.	0.05 max.
Typical Performance[2]	Remainder	5.01	0.13	0.008	0.009
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER4043	0.05 max.	Not Specified	0.10 max.	0.20 max.	0.0008 max.
Typical Performance[2]	0.03	—	0.002	0.007	0.0002

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

SuperGlaze® 5356

Aluminum • AWS ER5356

Key Features

- Aluminum-magnesium alloy for use on many weldable cast and wrought aluminum alloys
- Generally recommended for welding any 5XXX or 6XXX series aluminum alloys
- Excellent for color matching after anodizing
- Embossed on each end for easy identification after use

Conformances

AWS A5.10/A5.10M: 1999 ER5356
ASME SFA-A5.10: ER5356

Welding Positions

All

Typical Applications

- Architectural structures
- Armored vehicles
- Gun mount bases

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/16 (1.6)	ED031108
3/32 (2.4)	ED031109
1/8 (3.2)	ED031110

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.10/A5.10M: 1999*

	%Al	%Si	%Fe	%Cu	%Mn
Requirements - AWS ER5356	Remainder	0.25 max.	0.40 max.	0.10 max.	0.05 - 0.20
Typical Performance[2]	Remainder	0.06	0.09	0.02	0.12
	%Mg	**%Cr**	**%Zn**	**%Ti**	**%Be**
Requirements - AWS ER5356	4.05 - 5.5	0.05 - 0.20	0.10 max.	0.06 - 0.20	0.0008 max.
Typical Performance[2]	4.84	0.12	0.001	0.09	0.0002

[1]Typical all weld metal. [2]See test results disclaimer on pg. 18.

Ferroweld®

AWS ESt • Cast Iron

Conformances

AWS A5.15/A5.15M: 1990 ESt
ASME SFA-A5.15 ESt

Key Features

- Deposits may be finished by grinding
- Cost effective option for repairing cast iron

Welding Positions

All

Typical Applications

- Repairing pits and small cracks in castings

DIAMETERS / PACKAGING

Diameter in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
1/8 (3.2)	ED031542	ED03382

TYPICAL OPERATING PROCEDURES

Electrode	Electrode Polarity	Current (Amps)
Ferroweld®	DC+/AC	80 - 120

Notes

PIPELINER®

Stick (SMAW) Electrode

Mild Steel, Cellulosic
Pipeliner® 6P+ 384

Mild Steel, Low Hydrogen
Pipeliner® 16P 385

Low Alloy, Cellulosic
Pipeliner® 7P+ 386
Pipeliner® 8P+ 387
Pipeliner® Arc 80 388

Low Alloy, Low Hydrogen
Pipeliner® 18P 390
Pipeliner® LH-D80 391
Pipeliner® LH-D90 392
Pipeliner® 19P 393
Pipeliner® LH-D100 394

MIG (GMAW) Wire

Mild and Low Alloy Steel Pipe
Pipeliner® 70S-G 395
Pipeliner® 80S-G 396
Pipeliner® 80Ni1 397

Flux-Cored Self-Shielded (FCAW-S) Wire

Low Alloy, All Position
Pipeliner® NR®-207+ 398
Pipeliner® NR®-208-XP 399

Flux-Cored Gas-Shielded (FCAW-G) Wire

Low Alloy, All Position
Pipeliner® 81M 400
Pipeliner® 101M 401
Pipeliner® 111M 402

Additional Information

Electrode Selection Guide 404
LH-D80/90/100 Welding Guidelines 407
EN and ISO Classifications 408
Agency Approvals 410

Pipeline® 6P+

Mild Steel, Cellulosic • AWS E6010

Key Features

- High operator appeal and control
- Easy slag removal
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Standard in the pipe welding industry

Welding Positions

All

Typical Applications

- Cross country and in-plant pipe welding
- Root pass on up to X80 grade pipe
- Hot, fill and cap pass on up to X60 grade pipe

Conformances

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-A5.1:	E6010
ABS:	E6010
CWB/CSA W48-06:	E4310

DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open 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[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6010	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results[3] - 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
Requirements - AWS E6010	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results[3] - As-Welded	0.11-0.20	0.51-0.77	0.15-0.32	0.006-0.016	0.005-0.011

	%Ni	%Cr	%Mo	%V
Requirements - AWS E6010	0.30 max.	0.20 max.	0.30 max.	0.08 max.
Typical Results[3] - As-Welded	0.01-0.04	0.01-0.04	0.01-0.02	≤ 0.01

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[4]	2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)
DC+	50-85	75-135	100-175
DC-	50-85	75-135	100-175

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first.

Pipeline® 16P

AWS E7016 H4 • Mild Steel, Low Hydrogen

Typical Applications

- Root pass welding of up to X100 grade pipe

Conformances

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

Welding Positions

All

Key Features

- Hot, fill and cap pass welding up to X60
- Low hydrogen, vertical up capability on X60 grade pipe
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- DC- (DCEN) is the recommended polarity for root pass welding on pipe

DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	12 lb (5.4 kg) Easy Open Can 36 lb (16.3 kg) Master Carton
2.5 (3/32)	14 (350)	ED033835	
3.2 (1/8)	14 (350)	ED033836	
4.0 (5/32)	18 (450)		ED033837

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E7016 H4	400 (58) min.	490 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3] - 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
Requirements - AWS E7016 H4	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results[3] - As-Welded	0.04-0.08	1.10-1.60	0.39-0.67	0.005-0.020	0.004-0.012	< 0.07

	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)
Requirements - AWS E7016 H4	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.
Typical Results[3] - As-Welded	0.01-0.07	0.01-0.03	0.01-0.02	1.14-1.71	1-4

TYPICAL OPERATING PROCEDURES

Polarity[4]	Current (Amps) 2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)
DC±[5]	55-105	75-135	120-170
AC	60115	80-150	120-185

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Preferred polarity is listed first. [5]DC- for root pass on pipe; DC± for general welding.

Pipeline® 7P+

Low Alloy, Cellulosic, Pipe • AWS E7010-P1

Key Features

- High productivity in vertical down and out-of-position pipe welding
- Deep penetration
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Clean, visible weld puddle
- Superior puddle control

Welding Positions

All

Typical Applications

- Root pass welding of up to X80 grade pipe
- Hot, fill and cap pass of up to X65 grade pipe
- Vertical down welding

Conformances

AWS A5.5/A5.5M: 2006	E7010-P1
ASME SFA-A5.5:	E7010-P1
ABS:	E7010-P1

DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	50 lb (22.7 kg) Easy Open Can
3.2 (1/8)	350 (14)	ED031611
4.0 (5/32)	350 (14)	ED031612
5.0 (3/16)	350 (14)	ED031613

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E7010-P1	415 (60) min.	490 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3] - As-Welded	455-515 (66-75)	525-635 (76-92)	23-29	49-92 (36-68)	31-85 (23-63)

DEPOSIT COMPOSITION[1]

	%C	%Mn	%Si	%P	%S
Requirements - AWS E7010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.
Typical Results[3] - As-Welded	0.09-0.20	0.44-0.83	0.06-0.31	0.01-0.02	0.01-0.02
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E7010-P1	1.00 max.	0.30 max.	0.50 max.	0.10 max.	
Typical Results[3] - As-Welded	0.58-0.90	0.02-0.05	0.04-0.21	≤ 0.01	

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity	**3.2 mm (1/8 in)**	**4.0 mm (5/32 in)**	**5.0 mm (3/16 in)**
DC+	65-130	100-165	130-210

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: This product contains micro-alloying elements. Additional information available upon request.

Pipeliner® 8P+

AWS E8010-P1 • Low Alloy, Cellulosic, Pipe

Typical Applications

- Root pass welding of up to X80 grade pipe
- Hot, fill and cap pass of up to X70 grade pipe

Conformances

AWS A5.5/A5.5M: 2006	E8010-P1, E8010-G
ASME SFA-A5.5:	E8010-P1, E8010-G
ABS:	E8010-P1
CSA/CWB W48-06:	E5510-P1

Key Features

- High productivity in vertical down and out-of-position pipe welding
- Deep penetration
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Clean, visible weld puddle
- Superior puddle control

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
3.2 (1/8)	14 (350)	ED030826
4.0 (5/32)	14 (350)	ED030827
5.0 (3/16)	14 (350)	ED030828

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E8010-P1	460 (67) min.	550 (80) min.	19 min.	27 (20) min.	Not Specified
Typical Results[3] - As-Welded	475-545 (69-79)	560-670 (81-97)	20-32	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
Requirements - AWS E8010-P1	0.20 max.	1.20 max.	0.60 max.	0.03 max.	0.03 max.
Typical Results[3]	0.09-0.20	0.55-0.98	0.07-0.27	0.01-0.02	0.01-0.02
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements - AWS E8010-P1	1.00 max.	0.30 max.	0.50 max.	0.10 max.	
Typical Results[3]	0.73-1.00	0.02-0.05	0.13-0.22	0.01 max.	

TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps) 3.2 mm (1/8 in)	4.0 mm (5/32 in)	5.0 mm (3/16 in)
DC+	65-120	100-165	130-210

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeliner® Arc 80

Low Alloy, Cellulosic, Pipe • AWS E8010-P1, E8010-G

Key Features

- Excellent impact properties without the initial addition of Boron.
- High productivity in vertical down and out-of-position pipe welding
- Deep penetration
- Q2 Lot® Control and Tested – Certificate showing actual deposit chemistry per lot available online.
- Clean, visible weld puddle
- Superior puddle control

Typical Applications

- Root pass welding of up to X80 grade pipe
- Hot, fill and cap pass welding on up to X70 grade pipe

Conformances

AWS A5.5/A5.5M: 2006	E8010-P1, E8010-G
ASME SFA-A5.5:	E8010-P1, E8010-G
CSA/CWB W48-06:	E5510-P1, E5510-G

Welding Positions

All

DIAMETERS / PACKAGING

Diameter	Length in (mm)	50 lb. (22.7 kg) Easy Open Can
4.0 mm (5/32 in)	14 (350)	ED034456
3/16 in[1]	14 (350)	ED034458
5.0 mm	14 (350)	ED034457

[1] Manufactured to US standard units.

Pipeliner® Arc 80

(AWS E8010-P1)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements AWS E8010-P1	460 (67) min.	550 (80) min.	19 min.	27 (20) min.	Not Specified
Typical Results[3] 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
Requirements AWS E8010-P1	0.20 max.	1.20 max.	0.60 max.	0.30 max.	0.03 max.
Typical Results[3]	0.09 - 0.20	0.55 - 0.98	0.07 - 0.27	0.01 - 0.02	0.01 - 0.02
	%Ni	**%Cr**	**%Mo**	**%V**	
Requirements AWS E8010-P1	1.00 max.	0.30 max.	0.50 max.	0.10 max.	
Typical Results[3]	0.73 - 1.00	0.02 - 0.05	0.13 - 0.22	0.01 max.	

TYPICAL OPERATING PROCEDURES

Polarity[4]	Current (Amps) 4.0 mm (5/32 in)	Current (Amps) 3/16 in[5]	Current (Amps) 5.0 mm
DC+	100-165	125-205	130-210

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer below. [4] Preferred polarity is listed first. [5] Manufactured to US standard units.
NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeline® 18P

Low Alloy, Low Hydrogen, Pipe • AWS E8018-G H4

Key Features

- Low hydrogen, vertical up capability on X70 grade pipe
- Charpy V-Notch impact toughness tested to -46°C (-50°F)
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online

Typical Applications

- Fill and cap pass welding of up to X70 grade pipe

Conformances

AWS A5.5/A5.5M: 2006	E8018-G H4
ASME SFA-A5.5:	E8018-G H4
ABS:	E8018-G

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

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

MECHANICAL PROPERTIES[1]

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E8018-G H4	460 (67) min.	550 (80) min.	19 min.	Not Specified	Not Specified
Typical Results[3] - 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	%Si	%P	%S	%Ni[4]
Requirements - AWS E8018-G H4	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 min.
Typical Results[3]	0.04-0.06	1.28-1.42	0.44-0.58	0.01-0.02	≤ 0.01	0.76-0.85

	%Cr[4]	%Mo[4]	%V[4]	%Cu[4]	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E8018-G H4	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4.0 max.
Typical Results[3]	0.04-0.06	0.17-0.39	< 0.01	< 0.02	1-4

TYPICAL OPERATING PROCEDURES

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy requirements of the "G" Designation, the undiluted weld metal shall have the minimum of at least one of the elements listed. [5]Preferred polarity is listed first.

Pipeliner® LH-D80

AWS E8045-P2 H4R • Low Alloy, Low Hydrogen, Pipe

Typical Applications

- Fill and cap pass welding on up to X70 grade pipe
- Pipe repair
- Hot tapping

Conformances

AWS A5.5/A5.5M: 2006	E8045-P2 H4R
ASME SFA-A5.5:	E8045-P2 H4R
CWB/CSA W48-06:	E8045-P2 H4R

Welding Positions

Vertical Down

Key Features

- Low hydrogen, vertical down capability on up to X70 pipe
- High productivity
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Touch start tapered tip
- Meets H4R diffusible hydrogen level and moisture resistance

DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
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[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E8045-P2 H4R	460 (67) min.	550 (80) min.	19 min.	27 (20) min.	Not Specified
Typical Results[3] - 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
Requirements - AWS E8045-P2 H4R	0.12 max.	0.90-1.70	0.80 max.	0.03 max.	0.03 max.
Typical Results[3] - As-Welded	0.04-0.06	1.10-1.25	0.35-0.50	≤ 0.01	≤ 0.01

	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E8045-P2 H4R	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4.0 max.
Typical Results[3] - As-Welded	≤ 0.04	≤ 0.05	≤ 0.02	≤ 0.01	2-4

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeliner® LH-D90

Low Alloy, Low Hydrogen, Pipe • AWS E9045-P2 H4R

Key Features

- Low hydrogen, vertical down capability on up to X80 pipe
- High productivity
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Touch start tapered tip
- Meets H4R diffusible hydrogen level and moisture resistance

Typical Applications

- Fill and cap pass welding of up to X80 grade pipe
- Pipe repair
- Hot tapping

Conformances

AWS A5.5/A5.5M: 2006	E9045-P2 H4R
ASME SFA-A5.5:	E9045-P2 H4R
CWB/CSA W48-06:	E9045-P2 H4R

Welding Positions

Vertical Down

DIAMETERS / PACKAGING

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

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E9045-P2 H4R	530 (77) min.	620 (90) min.	17 min.	27 (20) min.	Not Specified
Typical Results[3] - As-Welded	550-600 (80-87)	625-670 (91-97)	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
Requirements - AWS E9045-P2 H4R	0.12 max.	0.90-1.70	0.80 max.	0.03 max.	0.03 max.
Typical Results[3] - As-Welded	0.04-0.06	1.15-1.35	0.35-0.55	≤ 0.01	≤ 0.01

	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E9045-P2 H4R	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4.0 max.
Typical Results[3] - As-Welded	0.25-0.30[4] / 0.80-1.00[5]	≤ 0.05	0.15-0.25	≤ 0.01	2-4

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Range for 3.2 mm (1/8 in) 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.

Pipeline® 19P

AWS E10018-G H4R • Low Alloy, Low Hydrogen, Pipe

Typical Applications

- Fill and cap pass welding of up to X80 grade pipe

Conformances

AWS A5.5/A5.5M: 2006	E10018-G H4R
ASME SFA-A5.5:	E10018-G H4R

Welding Positions

All, except vertical down

Key Features

- Low hydrogen, vertical up capability on X80 grade pipe
- Charpy V-Notch impact toughness tested to -46°C (-50°F)
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online

DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3.2 (1/8)	14 (350)	ED032622
4.0 (5/32)	14 (350)	ED032623

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E10018-G H4R	600 (87) min.	690 (100) min.	15 min.	Not Specified	Not Specified
Typical Results[3] - 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	%Si	%P	%S	%Ni[4]
Requirements - AWS E10018-G H4R	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 min.
Typical Results[3] - As-Welded	0.03-0.05	1.44-1.78	0.34-0.57	0.01-0.02	≤ 0.01	1.92-2.36

	%Cr[4]	%Mo[4]	%V[4]	%Cu[4]	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E10018-G H4R	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4.0 max.
Typical Results[3] - As-Welded	0.02-0.07	0.37-0.47	0.01-0.02	0.01-0.07	2-3

TYPICAL OPERATING PROCEDURES

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [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.
[5]Preferred polarity is listed first.

Pipeliner® LH-D100

Low Alloy, Low Hydrogen, Pipe • AWS E10045-P2 H4R

Key Features

- Low hydrogen, vertical down capability on up to X90 pipe
- High productivity
- Q2 Lot® - Certificates showing actual deposit chemistry and mechanical properties available online
- Touch start tapered tip
- Meets H4R diffusible hydrogen level and moisture resistance

Typical Applications

- Fill and cap pass welding of up to X90 grade pipe
- Pipe repair
- Hot tapping

Conformances

AWS A5.5/A5.5M: 2006	E10045-P2 H4R
ASME SFA-A5.5:	E10045-P2 H4R
CWB/CSA W48-06:	E10045-P2 H4R

Welding Positions

Vertical Down

DIAMETERS / PACKAGING

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

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -46°C (-50°F)
Requirements - AWS E10045-P2 H4R	600 (87) min.	690 (100) min.	16 min.	27 (20) min.	Not Specified
Typical Results[3] - 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
Requirements - AWS E10045-P2 H4R	0.12 max.	0.90 - 1.70	0.80 max.	0.03 max.	0.03 max.
Typical Results[3] - As-Welded	0.04-0.06	1.25-1.65	0.35-0.55	≤ 0.01	≤ 0.01
	%Ni	**%Cr**	**%Mo**	**%V**	**Diffusible Hydrogen (mL/100g weld deposit)**
Requirements - AWS E10045-P2 H4R	1.00 max.	0.20 max.	0.50 max.	0.05 max.	4.0 max.
Typical Results[3] - As-Welded	0.70-1.00	≤ 0.08	0.40-0.50	≤ 0.01	2-4

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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.
NOTE: This product contains micro-alloying elements. Additional information available on request.

Pipeline® 70S-G

AWS ER70S-G • Mild & Low Alloy Steel Pipe

Conformances

AWS A5.18/A5.18M: 2005	ER70S-G
ASME SFA-A5.18:	ER70S-G
EN ISO 14341-B:	G 49A Z C SZ

Welding Positions

All

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
Flow Rate: 30 - 50 CFH

Key Features

- Root pass capability up to API Grade X100 and hot, fill and cap pass up to X70 grade pipe
- Good back bead shape on STT® root passes
- Q2 Lot® - Certificates showing actual wire composition and actual mechanical properties available online
- Low silicon level for minimal clean-up
- ProTech® packaging system

Typical Applications

- Root pass welding of up to X100 grade pipe
- Hot, fill and cap pass welding of up to X70 grade pipe

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED030904	ED030905

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS ER70S-G As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	Not Specified
Typical Results[3] As-Welded with 100% CO_2	405-425 (59-62)	510-40 (74-78)	24-26	54-81 (40-60)

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P	%Cu
Requirements - AWS ER70S-G	Not Specified					
Typical Results[3]	0.05-0.15	0.80-1.40	0.30-0.60	≤0.02	≤0.02	≤0.02

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.1 mm (0.045 in), DC+	12-19 (1/2-3/4)	3.2-12.7 (125-500)	19-30	145-340	1.5-6.0 (3.4-13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD (Contact Tip to Work Distance). Subtract 1/4 in. (6.4 mm) to calculate Electrical Stickout.

Pipeline r® 80S-G

Mild & Low Alloy Steel Pipe • AWS ER80S-G

Key Features

- Root pass capability up to X100 and hot, fill and cap pass up to X80 grade pipe
- Impact toughness tested to -29°C (-20°F)
- Q2 Lot® - Certificates showing actual wire composition and actual mechanical properties available online
- MicroGuard® Ultra provides superior feeding and arc stability
- ProTech® packaging system

Welding Positions

All

Typical Applications

- Root pass welding of up to API Grade X100 grade pipe
- Hot, fill and cap pass welding of up to X80 grade pipe

Conformances

AWS A5.28/A5.28M: 2005	ER80S-G
ASME SFA-A5.28:	ER80S-G
EN ISO 16834-B:	G 59A 3 M 4M31

Shielding Gas

100% CO_2
75-95% Argon / Balance CO_2
Flow Rate: 30 - 50 CFH

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	30 lb (13.6 kg) Plastic Spool (Vacuum Sealed Foil Bag)
0.045 (1.1)	ED031493	ED031494

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS ER80S-G As-Welded with 100% CO_2	Not Specified	550 (80) min.	Not Specified	Not Specified
Typical Results[3] As-Welded with 100% CO_2	585-620 (85-90)	620-690 (90-100)	22-24	27-54 (20-40)
As-Welded with 80% Ar/20% CO_2	620-690 (90-100)	690-760 (100-110)	20-24	110-150 (80-110)

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Mn	%Si	%S	%P	%Cu
Requirements - AWS ER80S-G	Not Specified					
Typical Results[3]	0.05-0.15	1.40-1.60	0.40-0.70	≤0.02	≤0.02	≤0.02

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.1 mm (0.045 in), DC+	12-19 (1/2-3/4)	3.2-12.7 (125-500)	19-30	145-340	1.5-6.0 (3.4-13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout.

Pipeliner® 80Ni1

AWS ER80S-G • Mild & Low Alloy Steel Pipe

Conformances

AWS A5.28/A5.28M: 2005	ER80S-G
ASME SFA-5.28:	ER80S-G
EN ISO 14341-A:	G 50A 3 M 3Ni1
ABS:	5YQ500 H5
Llyod's Register:	V Y50MS H5
DNV:	5Y50S H5

Shielding Gas

75-95% Argon / Balance CO_2
100% CO_2

Key Features

- Root pass capability up to API Grade X100 and hot, fill and cap pass up to X80 grade pipe
- Q2 Lot® - Certificates showing actual wire composition and actual mechanical properties available online
- ProTech® packaging system

Typical Applications

- Excellent wire placement for narrow groove welding
- Offshore

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	33 lb (15 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1.0 (0.040)	ED033121	ED033119
1.2 (0.047)	ED033122	ED033120

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -50°C (-58°F)
Requirements - AWS ER80S-G As-Welded with 100% CO_2	Not Specified	550 (80) min.	Not Specified	Not Specified	Not Specified
Typical Results[3]					
As-Welded 100% CO_2	585-620 (85-90)	620-690 (90-100)	28-29	72-92 (53-68)	34-61 (25-45)
As-Welded 80% Ar/20% CO_2	620-690 (90-100)	690-760 (100-110)	27-28	99-119 (73-88)	69-95 (51-70)

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Mn	%Si	%Ni[4]	%Ti	%S
Requirements - AWS ER80S-G[4]	Not Specified	Not Specified	Not Specified	≥0.50	Not Specified	Not Specified
EN ISO 14341-A-G 3Ni1	0.06-0.14	1.00-1.60	0.50-0.90	0.80-1.50	≤0.15	≤0.020
Typical Results[3]	0.07-0.08	1.50-1.60	0.65-0.75	0.85-0.95	≤0.10	≤0.015
	%P	**%Cu**	**%Cr**	**%Mo**	**%V**	**%Al**
Requirements - AWS ER80S-G	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified
EN ISO 14341-A-G 3Ni1	≤0.020	≤0.35	≤0.15	≤0.15	≤0.03	≤0.02
Typical Results[3]	≤0.015	≤0.20	≤0.05	≤0.01	≤0.01	≤0.01

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.0 mm (0.040 in), DC+ 75-95% Ar/Balance CO_2	12-19 (1/2-3/4)	2.5-14.0 (100-550)	19-31	105-320	1.0-5.2 (2.1-11.5)
1.2 mm (0.047 in), DC+ 75-95% Ar/Balance CO_2	12-19 (1/2-3/4)	3.2-12.7 (125-500)	19-31	145-360	1.7-6.5 (3.7-14.3)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]To meet the ER80S-G classification, weld deposit must have minimum of 1 or more of the following: 0.50% Ni, 0.30% Cr or 0.20% Mo.
[5]For Electrical Stickout (ESO) subtract 6.4 mm (0.25 in.) from CTWD. [6]For 100% CO_2 shielding gas add 1 - 2 volts to recommended procedures.

Pipeline® NR®-207+

Low Alloy, All Position • AWS E71T8-K6

Key Features

- Vertical down hot, fill and cap pass welding of up to X70 grade pipe
- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -29°C (-20°F)
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties available online
- High deposition rates
- ProTech® hermetically sealed packaging

Typical Applications

- Hot, fill and cap pass welding of up to X70 grade pipe

Conformances

AWS A5.29/A5.29M: 2005 E71T8-K6
ASME SFA-A5.29: E71T8-K6

Welding Positions

All, except vertical up

DIAMETERS / PACKAGING

Diameter in (mm)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
5/64 (2.0)	ED030924

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E71T8-K6	400 (58) min.	485-620 (70-90)	20 min.	27 (20) min.
Typical Results[3] - As-Welded	425-470 (62-68)	540-565 (78-82)	29-31	119-205 (88-151)

DEPOSIT COMPOSITION[1] - *As Required per AWS A5.29/A5.29M: 2005*

	%C	%Mn	%Si	%P	%S
Requirements - AWS E71T8-K6	0.15 max.	0.50-1.50	0.80 max.	0.030 max.	0.030 max.
Typical Results[3]	0.04-0.06	1.18-1.33	0.24 - 0.28	≤ 0.01	≤ 0.01
	%Ni[4]	**%Cr[4]**	**%Mo[4]**	**%V[4]**	**%Al[4]**
Requirements - AWS E71T8-K6	0.40-1.00	0.20 max.	0.15 max.	0.05 max.	1.8 max.
Typical Results[3]	0.78-0.93	0.02-0.03	0.01-0.02	< 0.01	0.9-1.2

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
5/64 in (2.0 mm), DC-	19 (3/4)	1.7-3.3 (70 -130)	18-21	210-305	2.0-3.7 (4.3-8.1)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]For electrical stickout (ESO) subtract 6.4 mm (1/4 in) from contact tip to work distance (CTWD).
NOTE: This product contains micro-alloying elements. Additional information available upon request.

Pipeliner® NR®-208-XP

AWS E81T8-G • Low Alloy, All Position

Typical Applications

- Hot, fill and cap pass welding of up to X80 grade pipe
- Cold temperature cross country pipe applications

Conformances

AWS A5.29/A5.29M: 2005 E81T8-G
ASME SFA-A5.29: E81T8-G

Welding Positions

All, except vertical up

Key Features

- Vertical down hot, fill and cap pass welding of up to X80 grade pipe
- Capable of producing weld deposits with impact toughness exceeding 153 - 302 J (113 - 223 ft•lbf) @ -29°C (-20°F)
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties available online
- ProTech® hermetically sealed packaging

DIAMETERS / PACKAGING

Diameter mm (in)	14 lb (6.4 kg) Coil 56 lb (25.4 kg) Hermetically Sealed Pail
2.0 (5/64)	ED031968

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength[4] MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E81T8-G	470 (68) min.	550 - 690 (80 - 100)	19 min.	Not Specified
Typical Results[3] - As-Welded	485 - 515 (70 - 75)	550 - 585 (80 - 85)	27 - 29	153 - 302 (113 - 223)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M: 2005*

	%C	%Mn[4]	%Si	%P	%S
Requirements - AWS E81T8-G	Not Specified	0.50 min	1.00 max.	0.030 max.	0.030 max.
Typical Results[3]	≤ 0.02	2.10-2.20	0.12-0.13	0.004-0.007	< 0.003
	%Ni[4]	**%Cr[4]**	**%Mo[4]**	**%V[4]**	**%Al[4]**
Requirements - AWS E81T8-G	0.50 min.	0.30 min.	0.20 min.	0.10 min.	1.8 max.
Typical Results[3]	0.74-0.80	0.04-0.05	0.01-0.03	< 0.004	0.9-1.1

TYPICAL OPERATING PROCEDURES

Diameter, Polarity	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
2.0 mm (5/64 in), DC-	19 (3/4)	1.7-3.3 (70-130)	17-20	195-295	1.8-3.5 (4.0-7.6)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]In order to meet the alloy requirements of the "G" group, the undiluted weld metal shall have not less than the minimum of at least one of the elements listed. [5]For electrical stickout (ESO) subtract 6.4 mm (1/4 in) from contact tip to work distance (CTWD).

Pipeline® 81M

Low Alloy, All Position • AWS E81T1-GM

Key Features

- Designed for optimal performance in automated pipe welding applications where a consistent arc length is critical.
- Flat bead shape, fast freezing slag provides consistent puddle support all the way around the pipe.
- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F).
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties per lot available online.
- ProTech® foil bag packaging

Typical Applications

- Hot, fill and cap pass welding on up to X70 grade pipe
- Fully automated pipe welding
- Meets requirements for NACE applications

Conformances

AWS A5.29/A5.29M: 2010	E81T1-GM
ASME SFA-5.29	E81T1-GM
ISO 17632: 2006	ISO 17632-B-T554T1-1MA-N1-UH5

Welding Positions

All

Shielding Gas

75 - 85% Argon / Balance CO_2
Flow Rate: 40 - 50 CFH

DIAMETERS / PACKAGING

Diameter mm (in)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1.2 (0.047)	ED033320	ED033321

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M: 2010*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)	Charpy V-Notch J (ft•lbf) @-40°C (-40°F)
Requirements - AWS E81T1-GM	470 (68) min.	550-690 (80-100)	19 min.	Not Specified	Not Specified
Typical Results[3] As-Welded with 75% Ar/25% CO_2	510-560 (74-81)	580-620 (84-90)	25-29	83-149 (61-110)	66-131 (49-97)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M: 2010*

	%C	%Mn	%Si	%P
Requirements - AWS E81T1-GM	Not Specified	0.50[4]	1.00[4]	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.06-0.07	1.54-1.68	0.34-0.37	0.010-0.015

	%S	%Ni	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E81T1-GM	0.030 max.	0.50[4]	Not Specified
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.010-0.020	0.85	4-5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.2 mm (0.047 in), DC+, 75-85% Ar/ balance CO_2	19 (3/4)	4.4-10.2 (175 - 400)	23-30	130 - 275	1.8-4.1 (3.9-9.0)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]In order to meet the requirements of the G group, the undiluted weld metal shall have not less than the minimum specified for one or more of the elements listed. [5]Strength and elongation properties were obtained from a 0.500 in. tensile specimen artificially aged at 104°C (220°F) for 48 hours as permitted by AWS A5.29:2005. NOTE: This product contains micro-alloying elements. Additional information available upon request.

Pipeline® 101M

AWS E101T1-GM • Low Alloy, All Position

Typical Applications

- Hot, fill and cap pass welding on up to X80 grade pipe
- Fully automated pipe welding
- Semi-automatic pipe welding
- Meets requirements for NACE applications

Conformances

AWS A5.29/A5.29M: 2010	E101T1-GM
ASME SFA-A5.29	E101T1-GM
ISO 18276: 2006	ISO 18276-B-T694T1-1MA-N2M2-UH5

Shielding Gas

75-80% Argon / Balance CO_2
Flow Rate: 40-60 CFH

Key Features

- Designed for optimal performance in automated pipe welding applications where a consistent arc length is critical
- Fast freezing slag provides consistent puddle support all the way around the pipe
- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F)
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties per lot available online.
- ProTech® foil bag packaging

Welding Positions

All

DIAMETERS / PACKAGING

Diameter mm (in)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1.2 (0.047)	ED033807	ED033808

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M: 2010*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-40°C (-40°F)
Requirements - AWS E101T1-GM	610 (88) min.	690-830 (100-120)	16 min.	Not Specified
Typical Results[3] As-Welded with 75% Ar/Balance CO_2	660-670 (95-97)	700-720 (101-104)	23-25	61-91 (45-68)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M: 2010*

	%C	%Mn	%Si	%P
Requirements - AWS E101T1-GM	Not Specified	0.50[4]	1.00 max.	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.06	1.48-1.61	0.29-0.31	0.008

	%S	%Ni	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E101T1-GM	0.030 max.	0.50[4]	0.20[4]	Not Specified
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.007	0.76-0.84	0.34-0.36	4-5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.2 mm (0.045 in), DC+, 75-80% Ar/ balance CO_2	19 (3/4)	4.4-10.2 (175-400)	23-30	130-275	1.8-4.1 (3.9-9.0)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]In order to meet the requirements of the G group, the undiluted weld metal shall have not less than the minimum specified for one or more of the elements listed. [5]Strength and elongation properties were obtained from a 0.500 in. tensile specimen artificially aged at 104°C (220°F) for 48 hours as permitted by AWS A5.29: 2010. **NOTE: This product contains micro-alloying elements. Additional information available upon request.**

Pipeline® 111M

Low Alloy, All Position • AWS E111T1-GM

Key Features

- Designed for optimal performance in automated pipe welding applications where a consistent arc length is critical.
- Fast freezing slag provides consistent puddle support all the way around the pipe.
- Capable of producing weld deposits with impact toughness exceeding 27 J (20 ft•lbf) at -40°C (-40°F).
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties per lot available online.
- ProTech® foil bag packaging

Typical Applications

- Hot, fill and cap pass welding on X80 to X100 grade pipe
- Fully automated pipe welding
- Semi-automatic pipe welding

Conformances

AWS A5.29/A5.29M: 2010	E111T1-GM
ASME SFA-5.29	E111T1-GM
ISO 18276: 2006	ISO 18276-B-T764T1-1MA-G-H5

Welding Positions

All

Shielding Gas

75 - 85% Argon / Balance CO_2
Flow Rate: 40-60 CFH

DIAMETERS / PACKAGING

Diameter mm (in)	10 lb (4.5 kg) Plastic Spool (Vacuum Sealed Foil Bag)	25 lb (11.3 kg) Plastic Spool (Vacuum Sealed Foil Bag)
1.2 (0.047)	ED033745	ED033746

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.29/A5.29M: 2010*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-40°C (-40°F)
Requirements - AWS E111T1-GM	680 (98) min.	760-900 (110-130)	15 min.	Not Specified
Typical Results[3] As-Welded with 75% Ar/25% CO_2	680-810 (98-118)	760-900 (110-130)	19-23	48-63 (36-47)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.29/A5.29M: 2010*

	%C	%Mn	%Si	%P
Requirements - AWS E111T1-GM	Not Specified	0.50[4]	1.00[4]	0.030 max.
Typical Results[3] As-Welded with 75% Ar/25% CO_2	0.06-0.07	1.40-1.80	0.27-0.34	≤0.010

	%S	%Ni	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E111T1-GM	0.030 max.	0.50[4]	0.20[4]	Not Specified
Typical Results[3] As-Welded with 75% Ar/25% CO_2	≤0.010	1.90-2.60	0.65-0.85	4-5

TYPICAL OPERATING PROCEDURES

Diameter, Polarity, Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
1.2 mm (0.047 in), DC+, 75-85% Ar/ balance CO_2	19 (3/4)	4.4-10.2 (175 - 400)	23-30	130 - 275	1.8-4.1 (3.9-9.0)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer below. [4]In order to meet the requirements of the G group, the undiluted weld metal shall have not less than the minimum specified for one or more of the elements listed. [5]Strength and elongation properties were obtained from a 0.500 in. tensile specimen artificially aged at 104°C (220°F) for 48 hours as permitted by AWS A5.29: 2010. **NOTE: This product contains micro-alloying elements. Additional information available upon request.**

Additional Information

Additional Information

Electrode Selection Guide 404
LH-D80/90/100 Welding Guidelines 407
EN and ISO Classifications 408
Agency Approvals 410

Pipe Grades

Pipe Grades

Pipe grades are classified in accordance with API 5L specification. The specification established requirements for two product specification levels – PSL 1 and PSL 2. Reference API 5L for full specifications.

PSL 1: Includes requirements for chemistry, ductility, minimum yield strength, and minimum tensile strength.

PSL 2: Adds requirements for maximum yield strength, and maximum tensile strength.

API Specification 5L, 44th Edition

Requirements for the Results of Tensile Tests for PSL 1 Pipe

Grade	Yield Strength Minimum		Ultimate Tensile Strength Minimum	
	MPa	ksi	MPa	ksi
A25	175	25	310	45
A25P	175	25	310	45
A	210	31	335	49
B	245	36	415	60
X42	290	42	415	60
X46	320	46	435	63
X52	360	52	460	67
X56	390	57	490	71
X60	415	60	520	75
X65	450	65	535	78
X70	485	70	570	83

API Specification 5L, 44th Edition

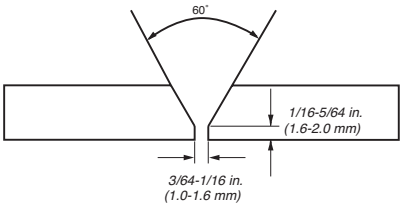
Requirements for the Results of Tensile Tests for PSL 2 Pipe

Grade	Yield Strength Minimum		Yield Strength Maximum		Ultimate Tensile Strength Minimum		Ultimate Tensile Strength Maximum	
	MPa	ksi	MPa	ksi	MPa	ksi	MPa	ksi
B	245	36	450	65	415	60	760	110
X42	290	42	495	72	415	60	760	110
X46	320	46	525	76	435	63	760	110
X52	360	52	530	77	460	67	760	110
X56	390	57	545	79	490	71	760	110
X60	415	60	565	82	520	75	760	110
X65	450	65	600	87	535	78	760	110
X70	485	70	635	92	570	83	760	110
X80	555	81	705	102	625	91	825	120
X90	625	91	775	112	695	101	915	133
X100	690	100	840	122	760	110	990	144
X120	830	120	1050	152	915	133	1145	166

Pipe Grades

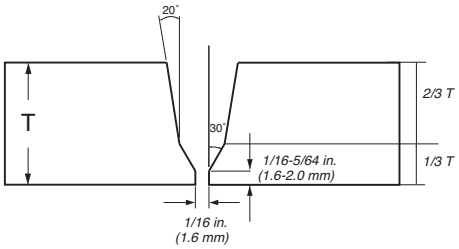
Common Pipe Joint Designs

A common weld joint for thinner walled pipe is the “API” fitup with a 60 degree included angle, a 1.6 mm (1/16 in) and 1.6 mm (1/16 in).



Wall thickness <3/4 in (<20 mm)

As an alternative, for thicker-walled pipe [>20 mm (>3/4 in)], a compound bevel can be used. The amount of material required to fill a compound bevel joint is less than that for a 60 degree included angle preparation, so productivity may be increased.



Wall thickness >3/4 in (>20 mm)

Electrode Selection Guide

ELECTRODE SELECTION GUIDE

Products	AWS Classification	Low Strength				High Strength		
		<X60	X60	X65	X70	X80	X90	X100
MANUAL ELECTRODES								
Stick (SMAW) Electrodes - Cellulosic								
Pipeliner® 6P+	E6010	R+F	R+F	R	R	R		
Pipeliner® 7P+	E7010-P1		R+F	R+F	R	R		
Pipeliner® 8P+	E8010-P1		R+F	R+F	R+F	R		
Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up								
Pipeliner® 16P	E7016 H4	R	R	R	R	R	R	R
Pipeliner® 18P	E8018-G H4R		F	F	F			
Pipeliner® 19P	E10018-G H4R			F	F	F	F	
Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Down								
Pipeliner® LH-D80	E8045-P2 H4R		F	F	F			
Pipeliner® LH-D90	E9045-P2 H4R			F	F	F		
Pipeliner® LH-D100	E10045-P2 H4R				F	F	F	
SEMIAUTOMATIC / AUTOMATIC								
MIG (GMAW) Wires - Solid								
Pipeliner® 70S-G	ER70S-G	R+F	R+F	R+F	R+F	R	R	R
Pipeliner® 80S-G	ER80S-G		R+F	R+F	R+F	R+F	R	R
Pipeliner® 80Ni1	ER80S-G		R+F	R+F	R+F	R+F	R	R
Flux-Cored (FCAW-S) Wires - Self-Shielded								
Pipeliner® NR®-207+	E71T8-K6	F	F	F				
Pipeliner® NR®-208-XP	E81T8-G		F	F	F			
Flux-Cored (FCAW-G) Wires - Gas-Shielded								
Pipeliner® 81M	E81T1-GM	F	F	F	F			
Pipeliner® 101M	E101T1-GM		F	F	F	F		
Pipeliner® 111M	E111T1-GM					F	F	F

R = Root Pass Only R+F = Root & Fill Passes F = Fill Pass Only

LH-D80/90/100

Welding Guidelines

Pipeliner® LH-D Welding - Helpful Hints

Pipeliner® LH-D80, LH-D90 and LH-D100 are low hydrogen, high deposition electrodes specially designed for the vertical down welding of pipe. They are recommended for fill and cap pass welding of up to X70, X80 and X90 pipe, as well as pipe repair and hot tapping applications. For low diffusible hydrogen, high productivity and operator appeal — choose Pipeliner® LH-D electrodes.

Use Recommended Starting and Stopping Techniques
Porosity can be the result of incorrect starting or stopping techniques. Refer to Diagram #2 and #5 below.

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity	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

Make Sure Operating Procedures are Correct
Pipeliner® LH-D electrodes recommended operating ranges are in the table below.

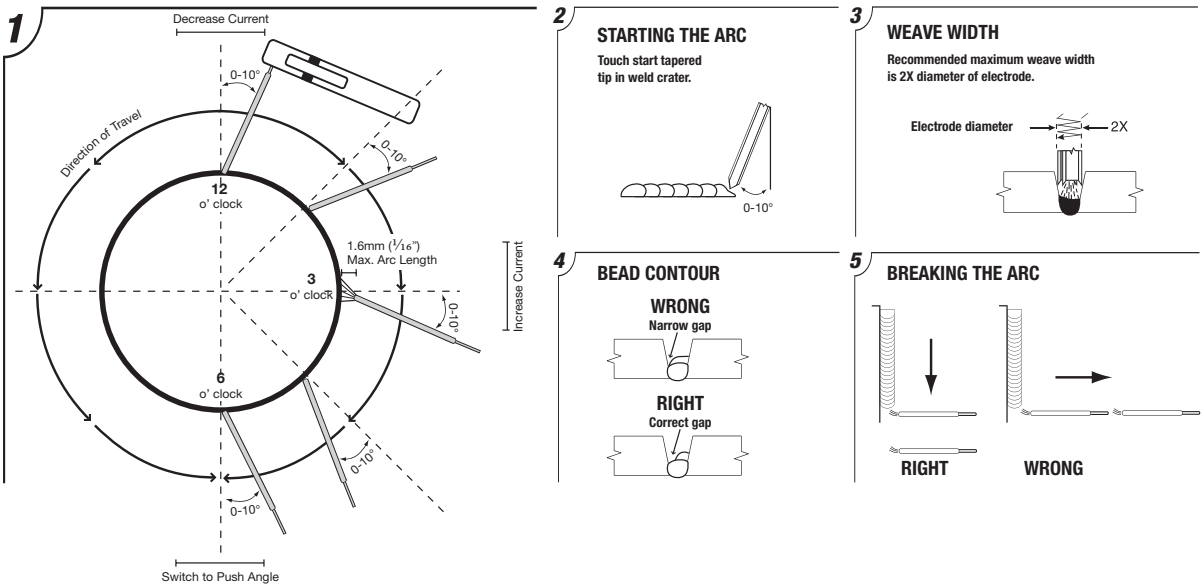
Do Not Re-Strike Electrode
If arc does not initiate on first try, discard electrode and start with a new one.

Technique Tips for Weld Positions

12 o'clock	Decreased current and rod angle will reduce spatter.
3 o'clock	Increased current will help hold weld puddle up.
6 o'clock	A push angle and weave will help flatten bead.

Use the Recommended Weaving Technique
Weaving too wide can cause undercutting and slag entrapment. Use a maximum weave width of approximately 2 times electrode diameter. Refer to Diagram #3 below for directions.

Welding Guidelines Diagram



NOTE 1: This table indicates common welding electrodes by API 5L pipe grade. Final product selection should be project specific. The specific electrode recommendation depends on project specifications, including strength overmatch and minimum toughness requirements. For help in selecting the appropriate consumables and other technical questions, please contact our Pipe Welding Application Group at +1.866.635.4709 or email appengr@lincolnelectric.com.

NOTE 2: Please note that the welding consumable recommendations in this table are based on weld metal strength matching the nominal pipe strength based upon API 5L minimum requirements. Recommended consumables in this chart are based upon these standards and not actual strength of pipe.

EN and ISO Classifications

ELECTRODE SELECTION GUIDE

Products	EN Classification	ISO Classification
Stick (SMAW) Electrodes - Cellulosic		
Pipeliner® 6P+	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 38 3 C 2 5 ISO 2560-B-E 43 10 C 2 5	ISO 2560-A-E 38 3 C 2 5 ISO 2560-B-E 43 10 C 2 5
Pipeliner® 7P+	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 42 3 Z C 2 5 ISO 2560-B-E 49 10-G A U	ISO 2560-A-E 42 3 Z C 2 5 ISO 2560-B-E 49 10-G A U
Pipeliner® 8P+	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 46 4 Z C 25 ISO 2560-B-E 55 10-G A U	ISO 2560-A-E 46 4 Z C 2 5 ISO 2560-B-E 55 10-G A U
Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Up		
Pipeliner® 16P	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 42 4 B 1 2 H5 ISO 2560-B-E 49 16 A U H5	ISO 2560-A-E 42 4 B 1 2 H5 ISO 2560-B-E 49 16 A U H5
Pipeliner® 18P	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 50 6 Mn1Ni B 3 2 H5 ISO 2560-B-E 57 18-G A H5	ISO 2560-A-E 50 6 Mn1Ni B 3 2 H5 ISO 2560-B-E 57 18-G A H5
Pipeliner® 19P	**EN 757**	**ISO 18275**
	EN 757 - E 69 5 Mn2NiMo B 3 2 H5	ISO 18275-A-E 69 5 Mn2NiMo B 3 2 H5 ISO 18275-A-E 83 18-G A H5
Stick (SMAW) Electrodes - Basic, Low Hydrogen, Vertical Down		
Pipeliner® LH-D80	**EN ISO 2560**	**ISO 2560**
	ISO 2560-A-E 46 4 B 4 5 H5 ISO 2560-B-E 55 15 G A H5	ISO 2560-A-E 46 4 B 4 5 H5 ISO 2560-B-E 55 15 G A H5
Pipeliner® LH-D90	**EN 757**	**ISO 18275**
	EN 757 - E 55 4 Z B 45 H5	ISO 18275-A-E 55 4 Z B 4 5 H5 ISO 18275-B-E 62 15 G A H5
Pipeliner® LH-D100	**EN 757**	**ISO 18275**
	EN 757 - E 62 4 Mn1NiMo B 45 H5	ISO 18275-A-E 62 4 Mn1NiMo B 4 5 H5 ISO 18275-B-E 69 15 G A H5

NOTE: The presented EN and ISO classifications are only the approximate classifications based on available test results. Specific EN and ISO classification tests were not performed in most cases.

EN and ISO Classifications

ELECTRODE SELECTION GUIDE

Products	EN Classification	ISO Classification
MIG (GMAW) Wires - Solid		
Pipeliner® 70S-G	**EN ISO 14341**	**ISO 14341**
	ISO 14341-A-G 38A 3 M G2Si ISO 14341-B-G 49A 3U M G6	ISO 14341-A-G 38A 3 M G2Si ISO 14341-B-G 49A 3U M G6
Pipeliner® 80S-G	**EN ISO 14341**	**ISO 14341**
	ISO 14341-A-G 50A 3 M G4Mo ISO 14341-B-G 57A 3U M G4M31	ISO 14341-A-G 50A 3 M G4Mo ISO 14341-B-G 57A 3U M G4M31
Pipeliner® 80Ni1	**EN ISO 14341**	**ISO 14341**
	ISO 14341-A-G 3Ni1	ISO 14341-A-G 3Ni1
Flux-Cored (FCAW-S) Wires - Self-Shielded		
Pipeliner® NR®-207+	**EN ISO 17632**	**ISO 17632**
	ISO 17632-A-42 3 1Ni Y N 5 H15 ISO 17632-B-49 3 Ni1 T8 N 1 U H15	ISO 17632-A-42 3 1Ni Y N 5 H15 ISO 17632-B-49 3 Ni1 T8 N 1 U H15
Pipeliner® NR®-208-XP	**EN ISO 17632**	**ISO 17632**
	ISO 17632-A-46 3 Z Y N 5 H15 ISO 17632-B-55 3 G T8 N1 U H15	ISO 17632-A-46 3 Z Y N 5 H15 ISO 17632-B-55 3 G T8 N1 U H15
Flux-Cored (FCAW-G) Wires - Gas-Shielded		
Pipeliner® 81M	**EN ISO 17632**	**ISO 17632**
	ISO 17632-A-T46 4 Mn1Ni PM 1 H5 ISO 17632-B-T554T1-1MA-N1-UH5	ISO 17632-A-T46 4 Mn1Ni PM 1 H5 ISO 17632-B-T554T1-1MA-N1-UH5
Pipeliner® 101M	**EN ISO 18276**	**ISO 18276**
	ISO 18276-A-T 62 4ZPM 1 ISO 18276-B-T694T1-1MA-N2M2-UH5	ISO 18276-A-T 62 4ZPM 1 ISO 18276-B-T694T1-1MA-N2M2-UH5
Pipeliner® 111M	**EN ISO 18276**	**ISO 18276**
	ISO 18276-A-T 69 4Z PM1- H5 ISO 18276-B-T764T1-1MA-G-H5	ISO 18276-A-T 69 4Z PM1- H5 ISO 18276-B-T764T1-1MA-G-H5

NOTE: The presented EN and ISO classifications are only the approximate classifications based on available test results. Specific EN and ISO classification tests were not performed in most cases.

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade	GL
Stick Electrode						
Pipeliner® 6P+	A5.1/A5.1M: 2004	E6010	E6010	-	-	-
Pipeliner® 16P	A5.1/A5.1M: 2004	E7016 H4	-	-	-	-
Pipeliner® 7P+	A5.5/A5.5M: 2006	E7010-P1	E7010-P1	-	-	-
Pipeliner® 8P+	A5.5/A5.5M: 2006	E8010-P1, E8010-G	E8010-P1	-	-	-
Pipeliner® Arc 80	A5.5/A5.5M: 2006	E8010-P1, E8010-G	-	-	-	-
Pipeliner® 18P	A5.5/A5.5M: 2006	E8018-G, E8018-G H4	E8018-G	-	-	-
Pipeliner® LH-D80	A5.5/A5.5M: 2006	E8045-P2 H4R	-	-	-	-
Pipeliner® LH-D90	A5.5/A5.5M: 2006	E9045-P2 H4R	-	-	-	-
Pipeliner® 19P	A5.5/A5.5M: 2006	E10018-G H4R	-	-	-	-
Pipeliner® LH-D100	A5.5/A5.5M: 2006	E10045-P2 H4R	-	-	-	-
MIG & TIG						
Pipeliner® 70S-G	A5.18/A5.18M: 2005	ER70S-G	-	-	-	-
Pipeliner® 80S-G	A5.28/A5.28M: 2005	ER80S-G	-	-	-	-
Pipeliner® 80Ni1	A5.28/A5.28M: 2005	ER80S-G	5YQ500 H5	V Y50MS H5	5Y50S H5	-
MIG & TIG						
Pipeliner® NR®-207+	A5.29/A5.29M: 2005	E71T8-K6	-	-	-	-
Pipeliner® NR®-208-XP	A5.29/A5.29M: 2005	E81T8-G	-	-	-	-
Pipeliner® 81M	A5.29/A5.29M: 2010	E81T1-GM	-	-	-	-
Pipeliner® 101M	A5.29/A5.29M: 2005	E101T1-GM	-	-	-	-
Pipeliner® 111M	A5.29/A5.29M: 2005	E111T1-GM	-	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

BV Grade	CWB/CSA	DB	TUV	Military
Stick Electrode				
-	E4310	-	-	-
-	-	-	-	-
-	-	-	-	-
	E5510-P1	-	-	-
	E5510-P1, E5510-G	-	-	-
-	-	-	-	-
-	E8045-P2 H4R	-	-	-
-	E9045-P2 H4R	-	-	-
-	-	-	-	-
-	E10045-P2 H4R	-	-	-
MIG & TIG				
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
MIG & TIG				
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Notes

CONSUMABLE PRODUCT PORTFOLIO

POWER GENERATION & NUCLEAR

Stick (SMAW) Electode

Mild Steel

Excalibur® 7018 MR® N* 416

Low Alloy Steel

Excalibur® 8018-B2 MR® 418
Excalibur® 9018-G MR® N 420

MIG (GMAW) Wire

Mild Steel

SuperArc® L-56® N* 422

Low Alloy Steel

SuperArc® LA-75* 424

Stainless Steel

Blue Max® MIG 308L N* 426
Blue Max® MIG 309L N* 428
Blue Max® MIG 316L N* 430
Blue Max® LNM 4462 N* 432

TIG (GTAW) Cut Lengths

Mild Steel

Lincoln® ER70S-2* 433

Low Alloy Steel

Lincoln® ER100S-1.....434

Stainless Steel

Lincoln® ER308/308L N* 435
Lincoln® ER309/309L N* 436
Blue Max® LNT 4462 N* 437

Orbital TIG (GTAW) Wire Precision Layer Wound Spools

Mild Steel

SuperArc® Orbital TIG L-56® N* 438
SuperArc® Orbital TIG L-52 N* 439

Gas-Shielded (FCAW-G) Wire

Mild Steel

UltraCore® 71A85* 440
UltraCore® SR-12H 442

Submerged Arc (SAW) Flux & Wire Combinations

Low Alloy Steel

Lincolnweld® MIL800-H &
Lincolnweld® LA-84 444
Lincolnweld® MIL-800-H &
Lincolnweld® LA-100 445

Stainless Steel

Lincolnweld® P2007™ &
Lincolnweld® 308/308L 446
Lincolnweld® P2007™ &
Lincolnweld® 309/309L 447
Lincolnweld® P2007™ &
Lincolnweld® 316/316L 448

*These products are available as Batched Managed Inventory

Power Generation & Nuclear

Lincoln Electric gives customers the ability to view Lot numbers of a specific product online by going to the Certificate Center under the Support tab and entering the product number.

ACCOUNT CENTER

INVENTORY STATUS

10/12/2012 9:29:21 AM US Eastern Time Zone

Partner Number(SoldTo):	
Sales Organization(SoldTo):	Lincoln Electric Cleveland - US10
Distribution Channel(SoldTo):	Domestic - 10

	Product Number	Description	Kit Product	Requested Quantity	Available Quantity	Ship From	Notes
☑	ED033842	.035 SUPERARC L-56 N 33# SP (Q2)		33 LB	5,676.00 LB	2012 - CLEVELAND OH US LOT NO 1068D	

SELECT ALL CLEAR ALL

Quantities displayed represent existing inventory at time of page view. These quantities are subject to change (as additional products are manufactured and new orders are processed). Inventory for International orders may require transit time.

CHECK PRICE

Customers can then view Q2 Lot Certs by Lot number prior to placing an order.

CERTIFICATE CENTER

CERTIFICATE CENTER

Global Agency Certifications | FEMA Certificates | AWS D1.8 Certificates | AWS D1.1 Certificates

Q2 Certified and Tested Lot Controlled Materials

Search by Lot Number Search

Lot Number	Product Size	Product Name
1068D	.035 in.	SUPERARC L-56 N

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

STATEMENT OF TEST

Q2 Lot® 1068D of .035 SuperArc® L-56 N was manufactured under Lot Control per ASME Section IIc SFA 5.01 / AWS A5.01 Class S3 and ASME Section III NB-2400.

The following tests were performed on this Lot in accordance with ASME Section III NB-2400 and ASME Section IIc SFA 5.01 / AWS A5.01 Schedule K to the requirements of ASME Section IIc SFA 5.18 / AWS A5.18 classification ER70S-6. This test report is in accordance with EN10204 type 3.1 and ISO 10474 3.1.B.

The product stated herein was manufactured and supplied in accordance with the Quality System Program of The Lincoln Electric Company, Cleveland, Ohio, U.S.A. as outlined in the Quality System Manual. The Quality System Program of the Lincoln Electric Company is certified to ISO 9001, is approved by VdTUV, and is accredited by ASME as evidenced by QSC-489, QSC-489-1 and QSC-489-2.

Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications please contact the Lincoln Electric Special Order Department to receive a CMTR meeting all requirements of NCA-3820.

Test Conditions

Electrode Size	.035
Electrode Polarity	DC+
Current (amps)	230
Arc Voltage (volts)	28
Preheat / Interpass Temp °C (°F)	26/183 (78/325)
Shielding Gas	75% Ar / 25% CO_2
Heat #	C94707

Mechanical Properties		AWS A5.18:2005
Yield Strength, .2% offset method MPa (ksi)	490 (71)	400 MPa (58 ksi min.)
Tensile Strength MPa (ksi)	600 (87)	480 MPa (70 ksi min.)
Elongation %	29	22% min.
Impacts Properties		
Average	153 (113)	27.Joules (20ft.-lbs.) min.
Joules @ -29°C (ft-lbs ave @ -20°F)	146, 157, 155 (108, 116, 114)	
Average	99 (73)	Report Only
Joules @ -40°C (ft-lbs ave @ -40°F)	91, 89, 110 (67, 66, 67)	
Wire Chemistry		
% Carbon	0.10	0.05-0.15
% Manganese	1.44	1.40-1.85
% Silicon	0.85	0.80-1.15
% Phosphorous	0.006	0.025 max.
% Sulfur	0.005	0.035 max.
% Nickel	0.01	0.15 max.
% Chromium	0.03	0.15 max.
% Molybdenum	<0.01	0.15 max.
% Vanadium	<0.01	0.03 max.
% Copper (Total)	0.19	0.50 max.
Diffusible Hydrogen		
Per AWS A4.3 (ml/100g weld metal)	1.3, 1.2, 1.7, 1.5 =1.4 Average	REPORT ONLY

This is to certify that the contents of this report are correct and accurate as contained in the records of The Lincoln Electric Company.

Radiographic Test: Met Requirements
Test assembly constructed of ASTM A36

Ed Lisko Quality Assurance Mgr. — Date
Tim Peck Special Products Mgr. — Date

To place and order please contact your Lincoln Electric representative to order a specific Lot of product.

NUCLEAR PRODUCT PORTFOLIO

Nuclear Products are designated with an “N” suffix in the product name. These products have modified chemical composition and/or mechanical properties in the as welded or stress relieve condition to meet (but not limited to) specific requirements for the nuclear industry.

"N" Designators:

- **Excalibur® 7018 MR® N** - Design modified to meet properties after 48 hours stress relief.
- **SuperArc® L-52 N and SuperArc® L-56® N** - Design modified to meet properties after stress relief.
- **Stainless Products with N Suffix** - Cobalt restriction of 0.05% max.

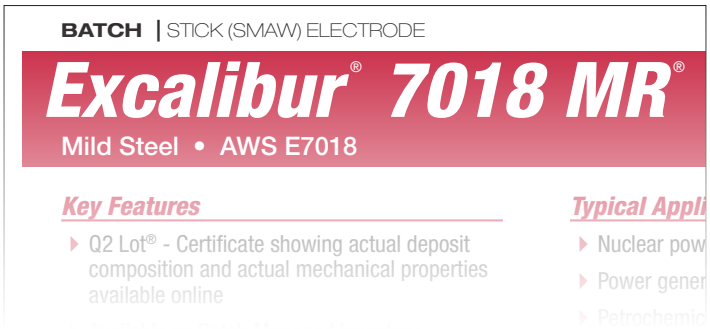
WHAT IS BATCH MANAGEMENT?

Batch Management is lot controlled and tested products with full traceability throughout the manufacturing process. All batch managed products have actual certified material test reports (CMTR) for each Q2 Lot® number. Q2 Lot® certificates can be downloaded from the certificate center on the Lincoln Electric website. Order a specific lot of material, as well as order a single lot or multiple lots of material that best meet your application requirements.

Lincoln Electric’s Batch Managed Inventory Program includes a complete portfolio of Q2 Lot® products: SMAW, GMAW, GTAW, Orbital TIG, and FCAW-G wires.

- EXCALIBUR®
- LINCOLN®
- SUPERARC®
- ULTRACORE®
- BLUE MAX®

Batch Managed products are represented with the words "batch" in the top left corner of the product page.



Excalibur® 7018 MR® N

Mild Steel • AWS E7018

Key Features

- Q2 Lot® - Certificate showing actual deposit composition and actual mechanical properties available online
- Available as Batch Managed Inventory
- "N" Designator - design modified to meet properties after 48 hours stress relief
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal
- Minimal spatter for enhanced operability and clean weld surface
- Impact toughness tested to -46°C (-50°F)
- Capable of exceeding AWS minimum requirement of 480 MPa (70 ksi) tensile and 400 MPa (58 ksi) yield strength after 48 hours of stress relieving at 590-620°C (1100-1150°F)
- Capable of meeting drop weight testing requirements as commonly required for nuclear applications
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860.
- Each rod is marked with AWS classification and LOT number

Typical Applications

- Nuclear power plant construction and maintenance
- Power generation
- Petrochemical
- Pressure vessels
- Pressure piping
- Fill and cap pass welding of up to X65 grade pipe

ASME IX Qualification

ASME IX Qualification:	QW432 F-No 4, QW442 A-No 1

Conformances

AWS A5.1/A5.1M: 2004:	E7018 H4R, E7018-1 H4R
ASME SFA-A5.1:	E7018 H4R, E7018-1 H4R

Welding Positions

All, Except Vertical Down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (300)	ED033940	
1/8 (3.2)	14 (350)		ED033838
5/32 (4.0)	14 (350)		ED033839

Excalibur® 7018 MR® N

(AWS E7018)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	@ -46°C (-50°F)	@ -50°C (-60°F)
Requirements AWS E7018-1 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.	27 (20) min.	Not Specified
Typical Results[3] As-Welded	440-530 (64-77)	540-630 (79-91)	27-29	90-135 (67-233)	28-177 (21-131)	32-210 (24-155)
Stress Relieved 48 hrs @ 620°C (1150°F)	410-470 (59-68)	500-560 (72-81)	29-31	172-352 (127-260)	–	23-284 (17-210)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.1/A5.1M: 2004*

	%C	%Mn	%Si	%P	%S
Requirements AWS E7018-1 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.35 max.
Typical Results[3]	0.06 - 0.08	0.78 - 1.16	0.16 - 0.38	≤0.01	≤0.01

	%Ni	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
Requirements AWS E7018-1 H4R	0.30 max.	0.20 max.	0.30 max.	4.0 max.
Typical Results[3]	≤0.02	≤0.03	0.20 - 0.25	1 - 3

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[4]	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	70-110	90-160	130-210
AC	80-120	100-160	140-210

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

Excalibur® 8018-B2 MR®

Low Alloy Steel • AWS E8018-B2 H4R

Key Features

- Designed for welding 1.25% chromium, 0.50% molybdenum steel
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal
- Capable of exceeding AWS minimum requirement of 550 MPa (80 ksi) tensile strength after 8 hours of stress-relieving at 690°C (1275°F)
- Meets AWS minimum requirement of 550 MPa (80 ksi) tensile and 470 MPa (68 Ksi) yield strength after 48 hours of stress-relieving at 590-620°C (1100-1150°F) as typical in nuclear applications
- Each rod is marked with AWS classification and LOT number.

Welding Positions

All, Except Vertical Down

Typical Applications

- Power generation
- Petrochemical
- Pressure vessels
- Process piping
- Nuclear steam generators and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 4, QW442 A-No 3

Conformances

AWS A5.5/A5.5M: 2006:	E8018-B2 H4R
ASME SFA-A5.5:	E8018-B2 H4R
CWB/CSA W48-06:	E5518-B2

DIAMETERS / PACKAGING

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

Excalibur® 8018-B2 MR®

(AWS E8018-B2 H4R)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.5/A5.5M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements AWS E8018-B2 H4R	460 (67) min.	550 (80) min.	19 min.	Not Specified
Typical Results[3] - As-Welded				
Stress-Relieved 1 hr @ 690°C (1275°F)	540-585 (78-85)	640-685 (93-99)	24-26	71-127 (52-94)
Stress-Relieved 8 hrs @ 690°C (1275°F)[4]	495-540 (72-78)	605-640 (88-93)	25-28	64-127 (47-83)
Stress-Relieved 48 hrs @ 621°C (1150°F)[4]	560-580 (81-84)	660-680 (96-99)	24-25	28-197 (21-145)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P
Requirements AWS E8018-B2 H4R	0.05-0.12	0.90 max.	0.80 max.	0.03 max.
Typical Results[3]	0.08-0.11	0.65-0.80	0.35-0.55	≤ 0.02
	%S	**%Cr**	**%Mo**	**Diffusible Hydrogen (mL/100g weld metal)**
Requirements AWS E8018-B2 H4R	0.03 max.	1.00-1.50	0.40-0.65	4.0 max.
Typical Results[3]	≤ 0.01	1.05-1.30	0.40-0.60	2-4

TYPICAL OPERATING PROCEDURES

	Current (Amps)		
Polarity[5]	**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

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry Specific Data (Not AWS Requirement). [5]Preferred polarity is listed first.

Excalibur® 9018-G MR N

Low Alloy Steel • AWS E9018-G H4R

Key Features

- Q2 Lot® - Certificate showing actual deposit composition and actual mechanical properties available online
- "N" Designator - design modified to meet properties after 48 hours stress relief
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal
- Capable of exceeding AWS minimum requirement of 620 MPa (90 ksi) tensile and 540 MPa (68 ksi) yield strength after 48 hours of stress relieving at 590-620°C (1100-1150°F)
- Capable of meeting drop weight testing requirements as commonly required for nuclear applications
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Each rod is marked with AWS classification and LOT number

Typical Applications

- Nuclear power plant components
- High strength steel, such as HY-80, HY-90 and ASTM A514, A508, A533
- DC welding
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification:	QW432 F-No 4, QW442 A-No 10

Conformances

AWS A5.5/A5.5M: 2006:	E9018-G H4R
ASME SFA-A5.5:	E9018-G H4R

Welding Positions

All, Except Vertical Down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton
3/32 (2.4)	12 (300)	ED033897	
1/8 (3.2)	14 (350)		ED033898
5/32 (4.0)	14 (350)		ED033865

Excalibur® 9018-G MR N

(AWS E9018-G H4R)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.1/A5.1M: 2004*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)	Charpy V-Notch J (ft•lbf) @ -50°C (-60°F)
Requirements AWS E9018-G H4R	620 (90) min	530 (77) min.	17 min.	Not Required	Not Required
Typical Results[3] As-Welded	590-680 (85-98)	680-770 (99-112)	21-26	74-130 (55-96)	51-111 (38-82)
Stress Relieved 48 hrs @ 620°C (1150°F) on HY-80	540-590 (78-85)	630-670 (91-97)	25-28	33-123 (25-91)	27-98 (20-73)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.5/A5.5M: 2006*

	%C	%Mn	%Si	%P	%S	%Ni
Requirements[4] AWS E9018-G H4R	Not Required	1.00 min.	0.80 min.	0.03 max.	0.03 max.	0.50 min.
Typical Results[3]	0.09 - 0.12	0.79 - 1.22	0.22 - 0.43	≤0.01	≤0.01	1.54 - 1.79

	%Cr	%Mo	%V	%Cu	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E9018-G H4R	0.30 min.	0.20 min.	0.10 min.	0.20 min.	4.0 max.
Typical Results[3]	≤0.03	0.29 - 0.31	≤0.02	≤0.02	1 - 3

TYPICAL OPERATING PROCEDURES

Polarity[4]	Current (Amps) 3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	70-110	90-160	130-210
AC	80-120	100-160	140-210

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. (4)In order to meet the alloy requirements of the "G" designation, the undiluted weld metal shall have the minimum of at least one of the elements listed.

SuperArc® L-56® N

Mild Steel • AWS ER70S-6

Key Features

- Q2 Lot® - Certificates showing actual wire composition and mechanical properties available online
- Available as Batch Managed Inventory
- "N" Designator - design modified to meet properties after stress relief
- Uniquely alloyed product to obtain higher strength levels
- High levels of manganese and silicon deoxidizers tolerate medium to heavy mill scale surfaces
- Excellent toe-wetting provides optimal bead appearance
- Copper coated for long contact tip life
- Supports short-circuiting, globular, axial spray and pulsed spray transfer
- MicroGuard® Ultra provides superior feeding and arc stability
- Each spool is identified with AWS classification and LOT number

Typical Applications

- Nuclear power plant construction and maintenance
- Medium to heavy mill scale base material
- Robotic or hard automation
- Structural steel

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6

Conformances

AWS A5.18/A5.18M: 2005: ER70S-6
ASME SFA-A5.18: ER70S-6

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Plastic Spool
0.035 (0.9)	ED033842
0.045 (1.1)	ED033843

SuperArc® L-56® N

(AWS ER70S-6)

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.035 max.	0.025 max.
Typical Results[3]	0.08-0.10	1.42-1.60	0.81-0.87	0.006-0.010	0.004-0.010
	%Cr	**%Ni**	**%Mo**	**%V**	**%Cu (Total)**[4]
Requirements - AWS ER70S-6	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results[3]	0.01-0.05	≤ 0.04	≤ 0.01	< 0.01	0.17-0.22

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.18/A5.18M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS ER70S-6 As-Welded with 100% CO_2	400 (58) min.	485 (70) min.	22 min.	27 (20) min.	Not Specified
Typical Results[3] As-Welded with 100% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	440 (64) 395 (57)	560 (81) 510 (74)	29 29	71 (52) 95 (70)	61 (45) 68 (50)
As-Welded with 75% Ar/25% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	460 (67) 415 (60)	565 (82) 540 (78)	27 31	82 (60) 140 (103)	72 (53) 122 (90)
As-Welded with 90% Ar/10% CO_2 Stress Relieved 1 hr. @ 621°C (1150°F)	470 (68) 440 (64)	580 (84) 550 (80)	28 32	119 (88) 183 (135)	78 (57) 156 (115)
As-Welded with 98% Ar/2% O_2 Stress Relieved 1 hr. @ 621°C (1150°F)	455 (66) 415 (60)	565 (82) 545 (79)	27 34	122 (90) 190 (140)	108 (80) 176 (130)

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	9-12 (3/8-1/2)	2.5 (100) 3.8 (150) 6.4 (250)	18 19 22	80 120 175	0.7 (1.6) 1.1 (2.4) 1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375) 12.7 (500) 15.2 (600)	23 29 30	195 230 275	2.7 (6.0) 3.6 (8.0) 4.4 (9.6)
0.045 in (1.1 mm), DC+					
Short Circuit Transfer 100% CO_2[6]	12-19 (1/2-3/4)	3.2 (125) 3.8 (150) 5.1 (200)	19 20 21	145 165 200	1.5 (3.4) 1.8 (4.0) 2.5 (5.4)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	8.9 (350) 12.1 (475) 12.7 (500)	27 30 30	285 335 340	4.2 (9.2) 5.7 (12.5) 6.0 (13.2)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Industry specific data, not required by AWS. [5]Preferred polarity is listed first.
NOTE: Additional test data available upon request.

SuperArc® LA-75

Low Alloy Steel • AWS ER80-Ni1

Key Features

- Q2 Lot® - Certificates showing actual wire composition and mechanical properties available online
- Available as Batch Managed Inventory
- Capable of producing weld deposits with 550 MPa (80 ksi) tensile strength
- High toughness at low temperatures with a nominal 1% Ni or less
- MicroGuard® Ultra provides superior feeding and arc stability
- Supports short-circuiting, globular, axial spray and pulsed spray transfer

Typical Applications

- ASTM A588 weathering steel requiring good atmospheric corrosion resistance
- NACE applications
- Nuclear power plant construction and maintenance

ASME IX Qualification

ASME IX Qualification:	QW432 F-No 6, QW442 A-No 10

Conformances

AWS A5.28/A5.28M: 2005	ER80S-Ni1
ASME SFA-A5.28:	ER80S-Ni1
AWS A5.17/A5.17M: 1997	ENi1K
ABS:	ER80S-Ni1
CWB/CSA W48-06:	ER55S-Ni1 (ER80S-Ni1)
EN ISO 14341-B:	G 55A 4 A SN2

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Plastic Spool
0.035 (0.9)	ED033949

SuperArc® LA-75

(AWS ER80-Ni1)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.28/A5.28M: 2005*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)	@ -45°C (-50°F)	@ -57°C (-70°F)
Requirements - AWS ER80S-Ni1 As-Welded with 98% Ar/2% O_2	470 (68) min.	550 (80) min.	24 min.	Not Specified	27 (20) min.	Not Specified
Typical Results[3]						
As-Welded with 90% Ar/10% CO_2	475 (69)	580 (84)	28	119 (88)	82 (60)	35 (26)
Stress Relieved 1 hr. @ 621°C (1150° F)	450 (65)	565 (82)	32	- -	127 (93)	112 (82)
As-Welded with 75% Ar/25% CO_2	495 (72)	595 (86)	27	49 (36)	54 (40)	- -
Stress Relieved 1 hr. @ 621°C (1150° F)	440 (64)	560 (81)	31	127 (94)	114 (84)	54 (40)
As-Welded with 98% Ar/2% O_2	490 (71)	580 (84)	30	- -	103 (76)	- -

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

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

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr (lb/hr)
0.035 in (0.9 mm), DC+					
Short Circuit Transfer 75% Ar/25% CO_2 [6]	9-12 (3/8-1/2)	2.5 (100)	17	80	0.7 (1.6)
		3.8 (150)	18	120	1.1 (2.4)
		6.4 (250)	22	175	1.8 (4.0)
Spray Transfer 90% Ar/10% CO_2	12-19 (1/2-3/4)	9.5 (375)	23	195	2.7 (6.0)
		12.7 (500)	29	230	3.6 (8.0)
		15.2 (600)	30	275	4.4 (9.6)

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

Blue Max® MIG 308L N

Stainless Steel • AWS ER308/ER308L

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Meets the low Si levels typically required in the nuclear industry
- Meets the low cobalt levels typically required in the nuclear industry.
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Composition controlled to meet nuclear and power generation requirements
- Each spool is identified with AWS classification and LOT number

Typical Applications

- Nuclear power plant components, maintenance and construction
- Power and process industry related piping
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER308, ER308L
ASME SFA-A5.9: ER308, ER308L

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool
0.035 (0.9)	ED033848
0.045 (1.1)	ED033849

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER308/308L	Not Specified			
Test Results[3] - As-Welded	430 (62)	615 (89)	37	13

Blue Max® MIG 308L N

(AWS ER308/ER308L)

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER308L	0.03[2] max.	19.5 - 22.0	9.0 -11.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	20.2	9.2	0.03	1.6
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER308L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.44	0.02	0.02	0.11	0.03

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

Blue Max® MIG 309L N

Stainless Steel • AWS ER309/ER309L

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Meets the low Si levels typically required in the nuclear industry
- Meets the low cobalt levels typically required in the nuclear industry.
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Capable of meeting drop weight testing requirements as commonly required for nuclear applications
- Composition controlled to meet nuclear and power generation requirements
- Each spool is identified with AWS classification and LOT number

Typical Applications

- Nuclear power plant components, maintenance and construction
- Power and process industry related piping
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER309, ER309L
ASME SFA-A5.9: ER309, ER309L

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool
0.035 (0.9)	ED033850
0.045 (1.1)	ED033851

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER309Si, ER309LSi	Not Specified			
Test Results[3] - As-Welded	450 (65)	595 (86)	35	14

Blue Max® MIG 309L N

(AWS ER309/ER309L)

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER309L	0.03[2] max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	23.7	13.9	0.04	1.8
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER309L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.51	0.02	0.01	0.05	0.06

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

Blue Max® MIG 316L N

Stainless Steel • AWS ER316/ER316L

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Meets the low Si levels typically required in the nuclear industry
- Meets the low cobalt levels typically required in the nuclear industry.
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Composition controlled to meet nuclear and power generation requirements
- Each spool is identified with AWS classification and LOT number

Typical Applications

- Nuclear power plant components, maintenance and construction
- Power and process industry related piping
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER316, ER316L
ASME SFA-A5.9: ER316, ER316L

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Steel Spool
0.035 (0.9)	ED033852
0.045 (1.1)	ED033853

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER316Si, ER316LSi	Not Specified			
Test Results[3] - As-Welded	405 (59)	560 (81)	40	10

Blue Max® MIG 316L N

(AWS ER316/ER316L)

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER316L	0.03[2] max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5
Test Results[1]	0.02	18.7	11.8	2.3	1.7
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER316L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.52	0.02	0.01	0.10	0.30

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Deposition Rate kg/hr (lb/hr)
Short Circuit Transfer					
0.035 in (0.9 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	3.0 (120)	19-20	55	0.9 (2.0)
	13 (1/2)	4.6 (180)	19-20	85	1.4 (3.0)
	13 (1/2)	5.8 (230)	20-21	105	1.8 (3.9)
	13 (1/2)	7.6 (300)	20-21	125	2.3 (5.0)
	13 (1/2)	8.9 (350)	21-22	140	2.7 (5.9)
	13 (1/2)	10.2 (400)	22-23	160	3.1 (6.7)
0.045 in (1.1 mm), DC+ 90% He / 7-1/2% Ar / 2-1/2% CO_2	13 (1/2)	2.5 (100)	19-20	100	1.1 (2.8)
	13 (1/2)	3.2 (125)	19-20	120	1.5 (3.5)
	13 (1/2)	3.8 (150)	21	135	1.7 (4.2)
	13 (1/2)	4.4 (175)	21	140	2.0 (4.8)
	13 (1/2)	5.6 (220)	22	170	2.6 (6.1)
	13 (1/2)	6.4 (250)	22-23	175	2.9 (6.9)
	13 (1/2)	7.0 (275)	22-23	185	3.2 (7.6)
Axial Spray Transfer					
0.035 in (0.9 mm), DC+ 98% Ar/2% O_2	13 (1/2)	10.2 (400)	22	180	3.1 (6.7)
	13 (1/2)	10.8 (425)	23	190	3.3 (7.1)
	13 (1/2)	11.4 (450)	23	200	3.5 (7.5)
	13 (1/2)	12.1 (475)	23	210	3.7 (8.0)
0.045 in (1.1 mm), DC+ 98% Ar/2% O_2	13 (1/2)	6.1 (240)	23	195	2.8 (6.6)
	13 (1/2)	6.6 (260)	24	230	3.0 (7.2)
	13 (1/2)	7.6 (300)	24	240	3.5 (8.3)
	13 (1/2)	8.3 (325)	25	250	3.8 (9.0)
	13 (1/2)	9.1 (360)	25	260	4.2 (10.0)

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

Blue Max® LNM 4462 N

Stainless Steel • AWS ER2209

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Premium performance and quality
- Designed for joining duplex stainless steels
- Provides high resistance to general corrosion, pitting and stress corrosion
- Composition is controlled to produce consistent mechanical properties
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meet all requirements of NCA-3860.

Welding Positions

All

Typical Applications

- Nuclear power plant construction and maintenance
- Alloy 2205: UNS S31803, UNS S31500
- Alloy 2304: UNS S32304, UNS S31200
- Air pollution control systems for coal fired power plants
- Power and process industry components and piping
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9-93: ER2209

ASME SFA-A5.9: ER2209

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Plastic Spool
0.035 (0.9)	ED033955
0.045 (1.2)	ED033956

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9-93*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS ER2209	Not Specified			
Test Results[3] As-Welded with 98% Ar / 2% CO_2	625 (91)	810 (118)	28	105 (78)

WIRE COMPOSITION[1] – *As Required per AWS Similar to AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER2209	0.030 max.	21.5-23.5	7.5-9.5	2.5-3.5	0.5-2.0
Test Results[3]	0.018	22.7	8.5	3.0	1.5
	%Si	**%P**	**%S**	**%Cu**	**%N**
Requirements - AWS ER2209	0.90 max.	0.03 max.	0.03 max.	0.75 max.	0.08-0.20
Test Results[3]	0.45	0.03	0.03	0.30	0.15

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m³ maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

Lincoln® ER70S-2

AWS ER70S-2 • Mild Steel

Typical Applications

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

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6

Conformances

AWS A5.18/A5.18M: 2005: ER70S-2
ASME SFA-A5.18: ER70S-2
CWB/CSA W48-06: ER49S-2

Key Features

- Q2 Lot® - Certificate showing actual wire composition and actual mechanical properties available online
- Available as Batch Managed Inventory
- Contains zirconium, titanium, and aluminum in addition to silicon and manganese
- Produces x-ray quality welds over most surface conditions
- Recommended for TIG welding on all grades of steel
- Excellent choice for PWHT applications
- Capable of exceeding 482 MPa (70 ksi) tensile and 400 MPa (58 ksi) yield strength after 8 hours of stress relieving at 590-620°C (1100-1150°F)
- Product is marked every 4 in. (101.6 mm) with AWS classification and LOT number for easy identification

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
1/16 (1.6)	ED033952
3/32 (2.4)	ED033953
1/8 (3.2)	ED033954

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%S	%Si	%P	%Cu	%Cr
Requirements - AWS ER70S-2	0.07 max.	0.90-1.40	0.035 max.	0.40-0.70	0.025	0.50 max.	(1)
Typical Results[2]	0.04	1.08	0.005	0.55	0.003	0.20	0.08
	%Ni	**%Mo**	**%V**	**%Al**	**%Ti**	**%Zr**	
Requirements - AWS ER70S-2	(1)	(1)	(1)	0.05-0.15	0.05-0.15	0.02-0.12	
Typical Results[2]	0.08	0.08	< 0.002	0.08	0.10	0.07	

[1]Total 0.50% maximum, combined. [2]See test results disclaimer on pg. 18.

Lincoln® ER100S-1

Low Alloy Steel • AWS ER100S-1

Key Features

- A low carbon, high manganese wire with nickel and molybdenum designed to weld high strength steels such as HY-80 and HSLA-80
- Delivers yield strength greater than 690 MPa (100 ksi)
- Capable of producing welds with 690 MPa (100 ksi) tensile strength
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Product is marked every 4 in. (101.6 mm) with AWS classification and LOT number for easy identification

Typical Applications

- HY-80 base material
- ASTM A514, A543, A724 and A782 quenched and tempered plate
- Various heat input conditions
- Military low alloy applications
- Nuclear Steam Generators and other components

Welding Positions

All

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6
QW432 A-No 10

Conformances

AWS A5.28/A5.28M: 2005: ER100S-S1, ER110S-S1
ASME SFA-A5.28: ER100S-S1, ER110S-S1
MIL-E-23765/2: MIL-100S-1

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Carton
3/32 (2.4)	ED034097
1/8 (3.2)	ED034098

WIRE COMPOSITION – *As Required per AWS A5.28/A5.28M: 2005*

	%C	%Mn	%Si	%Ni	%Mo
Requirements - AWS ER100S-1	-	-	-	(A)	(A)
Typical Results[3]	0.05-0.06	1.63-1.69	0.46-0.50	1.88-1.96	0.43-0.45
	%Cr	**%S**	**%P**	**%V**	**%Al**
Requirements - AWS ER100S-1	(A)	-	-	-	-
Typical Results[3]	0.04-0.06	0.002-0.005	0.005-0.009	≤ 0.01	≤ 0.01
	%Ti	**%Zr**	**%Cu**		
Requirements - AWS ER100S-1	-	-	-		
Typical Results[3]	0.03-0.04	≤ 0.01	0.11-0.14		

[1]Total 0.50% maximum, combined. [2]See test results disclaimer on pg. 18.

Lincoln® ER308/308L N

AWS ER308/ER308L • Stainless Steel

Typical Applications

- Nuclear power plant components, maintenance and construction
- Sheet metal on the corresponding stainless steel base metals
- High pressure piping and tubing
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER308, ER308L
ASME SFA-A5.9: ER308, ER308L

Welding Positions

All

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- "N" Designator - cobalt restriction of 0.05% max
- Available as Batch Managed Inventory
- Use on base metals of similar composition
- Meets the low cobalt levels typically required in the nuclear industry
- Dual classification ensures the maximum carbon content is 0.03%
- 0.03% carbon content increases resistance to intergranular corrosion
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Product is marked every 4 in. (101.6 mm) with AWS classification and LOT number for easy identification

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master
3/32 (2.4)	ED033854
1/8 (3.2)	ED033855

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER308L	0.03[2] max.	19.5 - 22.0	9.0 -11.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	20.2	9.2	0.03	1.6
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER308L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.44	0.02	0.02	0.11	0.03

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]See test results disclaimer on pg. 18. [2]Requirements for ER308 is 0.08% max. carbon.

Lincoln® ER309/309L N

Stainless Steel • AWS ER309/ER309L

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Use for welding dissimilar alloys in wrought or cast form
- Meets the low cobalt levels typically required in the nuclear industry
- Occasionally used for welding "18-8" base metals when severe corrosion conditions exist or dissimilar metals
- 0.03% carbon content increases resistance to intergranular corrosion
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meets all requirements of NCA-3860
- Product is marked every 4 in. (101.6 mm) with AWS classification and LOT number for easy identification

Typical Applications

- Nuclear power plant components, maintenance and construction
- Sheet metal on the corresponding stainless steel base metals
- High pressure piping and tubing
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER309, ER309L
ASME SFA-A5.9: ER309, ER309L

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master
3/32 (2.4)	ED033856
1/8 (3.2)	ED033857

WIRE COMPOSITION – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER309L	0.03[2] max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5
Test Results[1]	0.02	23.7	13.9	0.04	1.8
	%Si	**%P**	**%S**	**%Cu**	**Total Others**
Requirements - AWS ER309L	0.30 - 0.65	0.03 max.	0.03 max.	0.75 max.	0.50 max.
Test Results[1]	0.51	0.02	0.01	0.05	0.06

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]See test results disclaimer on pg. 18. [2]Requirements for ER309 is 0.12% max. carbon.

Blue Max® LNT 4462 N

AWS ER2209 • Stainless Steel

Typical Applications

- Nuclear power plant construction and maintenance
- Alloy 2205: UNS S31803, UNS S31500
- Alloy 2304: UNS S32304, UNS S31200
- Air pollution control systems for coal fired power plants
- Power and process industry components and piping
- Pressure Vessels

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Conformances

AWS A5.9/A5.9M: 2006: ER2209
ASME SFA-A5.9: ER2209

Welding Positions

All

Key Features

- Q2 Lot® - Certificate showing actual wire composition and calculated ferrite number (FN) available online
- Available as Batch Managed Inventory
- "N" Designator - cobalt restriction of 0.05% max
- Premium performance and quality
- Designed for joining duplex stainless steels, such as type 2205, for applications with service temperatures up to 250°C (480°F) and down to -40°C (-40°F).
- Provides high resistance to general corrosion, pitting and stress corrosion
- Composition is controlled to produce consistent mechanical properties

DIAMETERS / PACKAGING

Diameter in (mm)	10 lb (4.5 kg) Plastic Tube 30 lb (13.6 kg) Master
3/32 (2.4)	ED033957
1/8 (3.2)	ED033958

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -20°C (-4°F)	Charpy V-Notch J (ft•lbf) @ -60°C (-75°F)
Requirements - AWS ER2209	Not Specified				
Test Results[2] - As-Welded	600 (87)	800 (116)	28	60 (44)	45 (33)

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C	%Cr	%Ni	%Mo	%Mn
Requirements - AWS ER2209	0.030 max.	21.5-23.5	7.5-9.5	2.5-3.5	0.5-2.0
Test Results[3]	0.018	22.7	8.5	3.0	1.5
	%Si	**%P**	**%S**	**%Cu**	**%N**
Requirements - AWS ER2209	0.90 max.	0.03 max.	0.03 max.	0.75 max.	0.08-0.20
Test Results[3]	0.50	0.03	0.03	0.30	0.15

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18.

SuperArc® Orbital TIG L-56® N

Mild Steel • AWS ER70S-6

Key Features

- Q2 Lot® - Certificate showing actual wire composition available online
- Available as Batch Managed Inventory
- "N" Designator - design modified to meet properties after stress relief
- A PLW product which has been treated to minimize weld defects that can be seen in the use of MIG wires for the automatic TIG process.
- Provides a consistent and exceptionally stable arc for automatic TIG welding
- High levels of manganese and silicon deoxidizers tolerate medium to heavy mill scale surfaces
- Excellent toe-wetting provides optimal bead appearance
- Each spool is identified with AWS classification and LOT number

Typical Applications

- Nuclear power plant construction and maintenance
- Power and process industry related piping
- Medium to heavy mill scale base material
- Robotic or hard automation

Welding Positions

All

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 1

Conformances

AWS A5.18/A5.18M: 2005: ER70S-6
ASME SFA-A5.18: ER70S-6

DIAMETERS / PACKAGING

Diameter in (mm)	2 lb (1 kg) Plastic Spool 8 lb (3.6 kg) Master Carton	10 lb (4.5 kg) Plastic Spool
0.035 (0.9)	ED033840	ED033841

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

	%C	%Mn	%Si	%S	%P
Requirements - AWS ER70S-6	0.06-0.15	1.40-1.85	0.80-1.15	0.035 max.	0.025 max.
Typical Results[3]	0.08-0.09	1.42-1.60	0.81-0.87	0.006-0.010	0.004-0.010
	%Cr	**%Ni**	**%Mo**	**%V**	**%Cu (Total)**[4]
Requirements - AWS ER70S-6	0.15 max.	0.15 max.	0.15 max.	0.03 max.	0.50 max.
Typical Results[3]	0.01-0.05	≤ 0.04	≤ 0.01	< 0.01	0.17-0.22

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. [5]CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. [6]Procedures in these areas are procedures for short circuiting mode using 100% CO_2. When using 75% Argon, 25% CO_2 for short circuit transfer, reduce voltage by 1 to 2 volts.

SuperArc® Orbital TIG L-52 N

AWS ER70S-2 • Mild Steel

Typical Applications

- Nuclear power plant construction and maintenance
- Power and process industry related piping
- Medium to heavy mill scale base material
- Robotic or hard automation

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 1

Conformances

AWS A5.18/A5.18M: 2005: ER70S-2
ASME SFA-A5.18: ER70S-2

Welding Positions

All

Key Features

- Q2 Lot® - Certificate showing actual wire composition available online
- Available as Batch Managed Inventory
- "N" Designator - design modified to meet properties after stress relief
- A PLW product which has been treated to minimize weld defects that can be seen in the use of MIG wires for the automatic TIG process
- Provides a consistent and exceptionally stable arc for automatic TIG welding
- Contains zirconium, titanium, and aluminum in addition to silicon and manganese
- Produces x-ray quality welds over most surface conditions
- Recommended for TIG welding on all grades of steel
- Excellent choice for PWHT applications
- Each spool is identified with AWS classification and LOT number

DIAMETERS / PACKAGING

Diameter in (mm)	2 lb (1 kg) Plastic Spool 8 lb (3.6 kg) Master Carton	10 lb (4.5 kg) Plastic Spool
0.035 (0.9)	ED033947	ED033948

WIRE COMPOSITION – *As Required per AWS A5.18/A5.18M: 2005*

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

(1)Typical all weld metal. (2)Measured with 0.2% offset. (3)See test results disclaimer on pg. 18. (4)Copper due to any coating on the electrode plus the copper content of the filler metal itself, shall not exceed the stated 0.50% max. (5)CTWD (Contact Tip to Work Distance). Subtract 1/4 in (6.4 mm) to calculate Electrical Stickout. (6)Procedures in the shaded areas are procedures for short circuiting mode using 75% Argon, 25% CO_2. NOTE: For 100% CO_2 procedures, add 1 to 2 volts for short circuit transfer and 2 to 3 volts for globular transfer.

UltraCore® 71A85

Mild Steel • AWS E71T-1M-H8, E71T-9M-H8

Key Features

- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties available online
- Available as Batch Managed Inventory
- Fast freezing slag for out-of-position welding
- Designed for welding with 75-85% Argon/ balance CO_2 shielding gas
- Premium arc performance and bead appearance
- Meets AWS D1.8 seismic lot waiver requirements
- Each spool is identified with AWS classification and LOT number

ASME IX Qualification

ASME IX Qualification:	QW432 F-No 6, QW442 A-No 1

Conformances

AWS A5.20/A5.20M:	E71T-1M-H8, E71T-9M-H8
ASME SFA-A5.20:	E71T-1M-H8, E71T-9M-H8
ABS:	3YSA H10
Lloyd's Register:	3YS H10
DNV Grade:	III YMS H10
CWB/CSA W48-06:	E491T-9M H8
EN ISO 17632-B:	T493T1-1MA-H10
FEMA 353	
AWS D1.8	

Typical Applications

- Shipbuilding
- Seismic structural fabrication
- General fabrication
- Nuclear power plant construction and maintenance

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	33 lb (15 kg) Plastic Spool
0.045 (1.1)	ED033950
1/16 (1.6)	ED033951

UltraCore® 71A85

(AWS E71T-1M-H8, E71T-9M-H8)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/A5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -18°C (0°F)	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements[4] AWS E71T-1M-H8, AWS E71T-9M-H8	400 (58) min.	480-655 (70-95)	22 min.	27 (20) min.	Not Specified
				Not Specified	27 (20) min.
Typical Results[3] As-Welded with 75%-85% Ar/balance CO_2	550-600 (80-88)	600-650 (87-94)	24 - 26	64-115 (47-85)	43-95 (32-70)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/A5.20M*

	%C	%Mn	%Si	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements[4] AWS E71T-1M-H8, E71T-9M-H8	0.12 max.	1.75 max.	0.90 max.	0.03 max.	0.03 max.	8.0 max.
Typical Results[3] As-Welded with 75%-85% Ar/balance CO_2	0.03-0.04	1.43-1.56	0.52-0.59	<0.01	0.01	6-8

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[5] mm (in)	Wire Feed Speed m/min	Wire Feed Speed (in/min)	Voltage (volts)	Approx. Current (amps)	Melt-Off Rate kg/hr	Melt-Off Rate (lb/hr)	Deposition Rate kg/hr	Deposition Rate (lb/hr)	Efficiency (%)
0.045 in (1.1 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	4.4	(175)	21-26	125	1.8	(4.0)	1.6	(3.5)	86-88
		6.4	(250)	22-27	150	2.6	(5.7)	2.3	(5.0)	
		7.6	(300)	23-28	165	3.1	(6.8)	2.7	(6.0)	
		8.9	(350)	23-29	190	3.6	(8.0)	3.2	(7.0)	
		10.2	(400)	25-30	205	4.1	(9.1)	3.6	(8.0)	
		11.4	(450)	26-31	225	4.7	(10.3)	4.1	(9.0)	
		12.7	(500)	27-32	245	5.2	(11.4)	4.5	(10.0)	
		14.0	(550)	28-33	265	5.7	(12.5)	5.0	(10.9)	
		15.2	(600)	28-34	280	6.2	(13.7)	5.4	(11.9)	
1/16 in (1.6 mm), DC+ 75%-85% Ar/ balance CO_2	25 (1)	3.2	(125)	20-25	185	2.4	(5.3)	2.1	(4.6)	86-88
		4.4	(175)	21-26	215	3.3	(7.4)	2.9	(6.4)	
		5.1	(200)	22-27	235	3.8	(8.4)	3.3	(7.3)	
		5.7	(225)	23-28	265	4.3	(9.5)	3.7	(8.2)	
		6.4	(250)	24-29	285	4.8	(10.5)	4.2	(9.2)	
		7.6	(300)	25-30	315	5.7	(12.6)	5.0	(11.0)	
		8.3	(325)	26-31	335	6.2	(13.7)	5.4	(11.9)	
		8.9	(350)	27-32	365	6.7	(14.7)	5.8	(12.8)	
		10.2	(400)	28-33	385	7.6	(16.8)	6.6	(14.6)	

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]As-Welded with 75%-85% Argon/Balance CO_2 [5]To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD.
NOTE 1: FEMA and AWS D1.8 structural steel seismic supplement test data can be found on this product at www.lincolnelectric.com. NOTE 2: This product contains micro-alloying elements. Additional information available upon request.

UltraCore® SR-12H

Mild Steel • AWS E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4

Key Features

- Capable of producing weld deposits with impact toughness of 70 - 110 ft•lbs @ -40°F (as welded and after 8 hrs. PWHT @ 1150°F).
- Meets H4 diffusible hydrogen levels
- Q2 Lot® - Certificate showing actual deposit chemistry and mechanical properties per lot available online
- Prior to using this material for ASME Boiler and Pressure Vessel Code Section III applications, please contact the Lincoln Electric Specials Department to receive a Certified Material Test Report (CMTR) which meet all requirements of NCA-3860

Typical Applications

- Nuclear applications
- Applications requiring PWHT of mild steel

Welding Positions

All

ASME IX Qualification

ASME IX Qualification:	QW432 F-No 6, QW442 A-No 1

Conformances

AWS A5.20/5.20M:	E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4
ASME SFA-5.20	E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4

Shielding Gas

75-80% Argon / Balance CO_2

DIAMETERS / PACKAGING

Diameter in (mm)	15 lb (7 kg) Plastic Spool 60 lb (28 kg) Carton
0.045 (1.2)	ED034122

UltraCore® SR-12H

(AWS E71T-1M-JH4, E71T-9M-JH4, E71T-12M-JH4)

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.20/5.20M*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -40°C (-40°F)
Requirements - AWS E71T-12M-JH4 As-Welded with 75% Ar / 25% CO_2	400 (58) min.	480-620 (70-90)	22 min.	27 (20) min.
Test Results[3] As-Welded with 75% Ar / 25% CO_2 Stress-Relieved for 8 hrs. @ 620°C (1150°F)	510-550 (74-80) 450 (65)	570-600 (83-87) 540 (78)	25-32 30	110-200 (80-150) 100-150 (70-110)

DEPOSIT COMPOSITION[1] – *As Required per AWS A5.20/5.20M*

	%C	%Mn	%Si	%Ni
Requirements - AWS E71T-12M-JH4 As-Welded with 75% Ar / 25% CO_2	0.12 max.	1.60 max.	0.90 max.	0.50 max.
Test Results[3] As-Welded with 75% Ar / 25% CO_2	0.03-0.06	1.27-1.60	0.27-0.45	0.34-0.41

	%S	%P	Diffusible Hydrogen (mL/100g weld deposit)
Requirements - AWS E71T-12M-JH4 As-Welded with 75% Ar / 25% CO_2	0.03 max.	0.03 max.	4 max.
Test Results[3] As-Welded with 75% Ar / 25% CO_2	<0.01	<0.01	1-4

TYPICAL OPERATING PROCEDURES

Diameter, Polarity Shielding Gas	CTWD[4] mm (in)	Wire Feed Speed m/min (in/min)	Voltage (Volts)	Approx. Current (Amps)	Melt-Off Rate kg/hr (lb/hr)	Deposition Rate kg/hr (lb/hr)	Efficiency (%)
0.045 in. (1.1 mm), DC+ 75-80% Ar / balance CO_2	22 (7/8)	4.4 (175) 5.7 (225) 7.0 (275) 8.3 (325) 9.5 (375) 10.8 (425) 12.1 (475)	22-24 22-24 23-25 23-25 24-26 25-27 26-28	125 145 165 185 205 225 245	1.8 (4.0) 2.3 (5.1) 2.9 (6.3) 3.4 (7.4) 3.9 (8.6) 4.4 (9.7) 4.9 (10.9)	1.5 (3.4) 2.0 (4.4) 2.5 (5.5) 2.9 (6.4) 3.4 (7.5) 3.8 (8.4) 4.3 (9.5)	88

[1] Typical all weld metal. [2] Measured with 0.2% offset. [3] See test results disclaimer on pg. 18. [4] To estimate ESO, subtract 1/4 in. (6.0 mm) from CTWD.
Note: This product contains micro-alloying elements. Additional information available upon request.

Lincolnweld® MIL800-H™ & LA-84

Low Alloy Steel • AWS F9P6-EF3-F3-H2

Key Features

- Capable of exceeding AWS minimum requirement of 620 Mpa (90 ksi) tensile strength after 48 hours of stress relieving at 1100-1150°F.
- Capable of meeting drop weight testing requirements as commonly required for nuclear applications.
- Each coil is identified with AWS classification and LOT number.

Typical Applications

- Nuclear reactor vessels and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6

DIAMETERS / PACKAGING - FLUX

50 lb (22.7 kg) Hermetically Sealed Pail
ED020925

DIAMETERS / PACKAGING - WIRE

Diameter in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED034211
3/32 (2.4)	ED031871
1/8 (3.2)	ED033323
5/32 (4.0)	ED034212

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Ni	%Mo	%S	%P	%Cu
Lincolnweld® LA-84	0.10-0.18	1.75-2.20	0.2	0.80-1.0	0.45-0.60	0.010-0.020	0.010-0.020	0.05-0.15

FLUX COMPOSITION[1]

	$\%SiO_2$	%MnO	%MgO	$\%CaF_2$	$\%Na_2O$	$\%Al_2O_3$	%CaO	$\%K_2O$	% Metal Alloys
Lincolnweld® MIL800-H™	13	1	34	23	1	16	8	1	1 max.

[1]See test results disclaimer on pg. 18.

Lincolnweld® MIL800-H™ & LA-100

AWS F10A6-EM2-M2-H2 • Low Alloy Steel

Typical Applications

- Nuclear reactor vessels and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6

Key Features

- Capable of exceeding AWS minimum requirement of 620 Mpa (90 ksi) tensile strength after 48 hours of stress relieving at 1100-1150°F.
- Capable of meeting drop weight testing requirements as commonly required for nuclear applications.
- Each coil is identified with AWS classification and LOT number.

DIAMETERS / PACKAGING - FLUX

50 lb (22.7 kg) Hermetically Sealed Pail
ED020925

DIAMETERS / PACKAGING - WIRE

Diameter in (mm)	60 lb (27.2 kg) Coil
1/16 (1.6)	ED010996
5/64 (2.0)	ED011002
3/32 (2.4)	ED010999
1/8 (3.2)	ED010998
5/32 (4.0)	EDS11001

WIRE COMPOSITION[1] - *As Required per AWS A5.23/A5.23M:2007*

	%C	%Mn	%Si	%Cr	%Ni	%Mo	%Ti
Lincolnweld® LA-100	0.10	1.25-1.80	0.20-0.60	0.30	1.40-2.10	0.25-0.55	0.10
	%Zr	**%Al**	**%V**	**%S**	**%P**	**%Cu**	
Lincolnweld® LA-100	0.10	0.10	0.05	0.015	0.010	0.25	

FLUX COMPOSITION[1]

	$\%SiO_2$	%MnO	%MgO	$\%CaF_2$	$\%Na_2O$	$\%Al_2O_3$	%CaO	$\%K_2O$	% Metal Alloys
Lincolnweld® MIL800-H™	13	1	34	23	1	16	8	1	1 max.

[1]See test results disclaimer on pg. 18.

Lincolnweld® P2007™ & 308/308L

Stainless Steel • AWS ER308/ER308L

Key Features

- Versatile design to weld several types of austenitic stainless steels
- Produces sound welds with excellent slag removal and bead appearance
- Designed combination to recover nearly all of the wire chromium in the deposit
- Balanced ferrite level for high resistance to hot cracking
- Low carbon content to reduce risk of sensitization of the weld

Typical Applications

- Nuclear reactor vessels and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

DIAMETERS / PACKAGING - FLUX

50 lb (22.7 kg) Plastic Bag
ED033159

DIAMETERS / PACKAGING - WIRE

Diameter in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033147
3/32 (2.4)	ED033148
1/8 (3.2)	ED033149
5/32 (4.0)	ED033150

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER308, ER308L	Not Specified			
Test Results[3, 5] - As-Welded	380 (55)	565 (82)	42	15

WIRE & DEPOSIT COMPOSITION[1]

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER308L	0.03 max.	19.5 - 22.0	9.0 - 11.0	0.75 max.	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
Wire Composition	0.02	20.1	9.8	0.10	1.8	0.50
All Weld Metal Composition[5]	0.02	19.0 - 19.5	9.8	0.10	1.5 - 1.9	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter in (mm)	Wire Feed Speed m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER308 is 0.08% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

Lincolnweld® P2007™ & 309/309L

AWS ER309/ER309L • Stainless Steel

Typical Applications

- Nuclear reactor vessels and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

Key Features

- Designed to weld stainless steel to mild or low alloy steel
- Produces sound welds with excellent slag removal and bead appearance
- Designed combination to recover nearly all of the wire chromium in the deposit
- Balanced ferrite level for high resistance to hot cracking
- Low carbon content to reduce risk of sensitization of the weld

DIAMETERS / PACKAGING - WIRE

Diameter in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033151
3/32 (2.4)	ED033152
1/8 (3.2)	ED033153
5/32 (4.0)	ED033154

DIAMETERS / PACKAGING - FLUX

50 lb (22.7 kg) Plastic Bag
ED033159

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER309, ER309L	Not Specified			
Test Results[3, 5] - As-Welded	400 (58)	575 (83)	35	8

WIRE & DEPOSIT COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER309L	0.03 max.	23.0 - 25.0	12.0 - 14.0	0.75 max.	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
Wire Composition	0.02	23.9	13.0	0.15	1.8	0.50
All Weld Metal Composition[5]	0.03	23.1 - 23.6	13.0	0.15	1.5 - 2.0	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter - in (mm)	Wire Feed Speed - m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER309 is 0.12% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

Lincolnweld® P2007™ & 316/316L

Stainless Steel • AWS ER316/ER316L

Key Features

- Designed to weld stainless steels for higher pitting corrosion resistance
- Produces sound welds with excellent slag removal and bead appearance
- Designed combination to recover nearly all of the wire chromium in the deposit
- Balanced ferrite level for high resistance to hot cracking
- Low carbon content to reduce risk of sensitization of the weld

Typical Applications

- Nuclear reactor vessels and other components

ASME IX Qualification

ASME IX Qualification: QW432 F-No 6, QW442 A-No 8

DIAMETERS / PACKAGING - FLUX

50 lb (22.7 kg) Plastic Bag
ED033159

DIAMETERS / PACKAGING - WIRE

Diameter in (mm)	60 lb (27.2 kg) Coil
5/64 (2.0)	ED033155
3/32 (2.4)	ED033156
1/8 (3.2)	ED033157
5/32 (4.0)	ED033158

MECHANICAL PROPERTIES[1] – *As Required per AWS A5.9/A5.9M: 2006*

	Yield Strength[2] MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Ferrite Number
Requirements - AWS ER316, ER316L	Not Specified			
Test Results[3, 5] - As-Welded	380 (55)	550 (80)	42	9

WIRE COMPOSITION[1] – *As Required per AWS A5.9/A5.9M: 2006*

	%C[4]	%Cr	%Ni	%Mo	%Mn	%Si
Requirements - AWS ER316L	0.03 max.	18.0 - 20.0	11.0 - 14.0	2.0 - 3.0	1.0 - 2.5	0.30 - 0.65
Typical Performance[3]						
As-Welded	0.02	19.0	11.9	2.2	1.8	0.50
All Weld Metal Composition[5]	0.02	17.8 - 18.4	11.9	2.2	1.6 - 2.0	0.50 - 0.80

TYPICAL OPERATING PROCEDURES

Diameter - in (mm)	Wire Feed Speed - m/min (in/min)	Voltage (volts)	Current (amps)
5/64 (2.0)	2.0-6.1 (80-240)	24-30	190-500
3/32 (2.4)	1.5-5.3 (60-210)	26-32	195-575
1/8 (3.2)	0.9-2.8 (35-110)	28-34	200-700
5/32 (4.0)	0.8-1.9 (30-75)	30-36	320-775

IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED

Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m^3 maximum exposure guideline for general welding fume. BEFORE USE, READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER.

[1]Typical all weld metal. [2]Measured with 0.2% offset. [3]See test results disclaimer on pg. 18. [4]AWS Requirement for ER316 is 0.08% max. carbon.
[5]Results shown correspond with the recommended Lincolnweld® and Blue Max® fluxes listed above, but not required per AWS A5.9-93.

PACKAGING

Options
Tubes, Cans & Cartons 450
Reels & Stem 452
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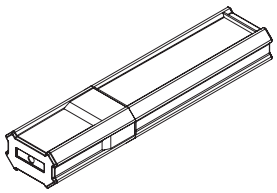
Drums & Pails 458

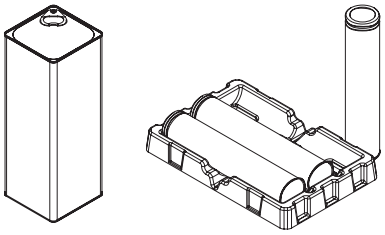
Storage and Handling
Stick Electrode..... 460
Metal-Cored & Flux-Cored Wire..... 462
Submerged Arc Flux & Wire..... 463

Tubes, Cans & Cartons

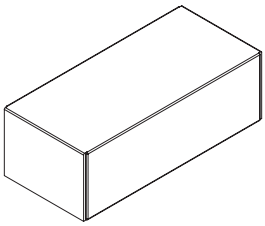
5 lb Plastic Tube



Easy Open (EO) Hermetic Cans
25 & 50 lb EO Can 8 & 10 lb EO Can



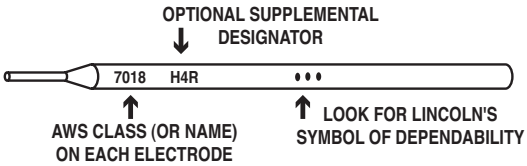
5, 10, 50 lb Cardboard Carton



TUBES, CANS & CARTONS

Package Type	Weight (lbs)	Width (in) / Diameter (in)	Height (in)
Tubes			
Tubes	1	1.16	8.3
	5	2.18	14.45
Hermetic Cans			
Easy Open (EO) Cans	8	3	12.62
	10	3	14.62
	25	5	12.62
	50	5	14.62
Carton			
Cardboard Carton	5	1.25	14.25
	10	2.25	14.25
	50	4.75	14.56

Notes: Electrodes come in 12, 14 & 18 inches (300, 350 & 450 mm) lengths.



Tubes, Cans & Cartons

STICK

Easy Open Cans
10 lb & 50 lb

Plastic Tubes
5 lb

Cardboard Carton
5, 10, 50 lb

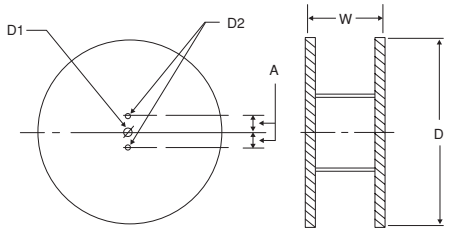
Plastic Tube
1 lb

Reels & Stem

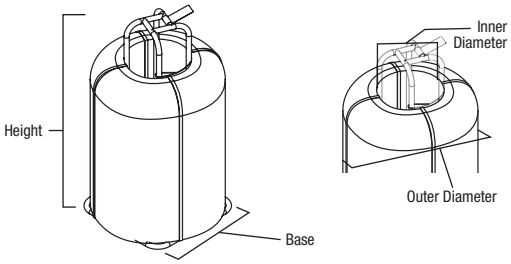
REELS

Wire Type	Weight (lbs)	Wire Diameter Specifications	"D" Outer Diameter (in)	"W" Outer Width (in)	"D1" Arbor Hole Diameter (in)	"D2" Pin Hole Diameter (in)	"A" Pin Hole Distance from Axis (in)
Speed-Feed® Reels							
Solid	300	-	30	12.75	1.31	0.68	2.5
	750	≤ 1/16 in	30	12.75	1.34	0.75	2.5
	750	≥ 5/64 in	30	12.75	1.31	0.68	2.5
	1000	≤ 1/16 in	30	12.75	1.34	0.75	2.5
	1000	≥ 5/64 in	30	12.75	1.31	0.68	2.5
Flux-Cored	300	-	23.75	11.25	1.31	0.68	2.5
	600	≤ 1/16 in	30	12.75	1.34	0.75	2.5
	600	≥ 5/64 in	30	12.75	1.31	0.68	2.5
	900	-	30	12.75	1.31	0.68	2.5
Precise-Trak® Reel							
Solid	1000	-	30	19.5	1.31	0.68	2.5
Speed-Feed® SlimReel							
Solid	250	-	29.75	6.18	1.31	1.31	8.75

Reels



Stem



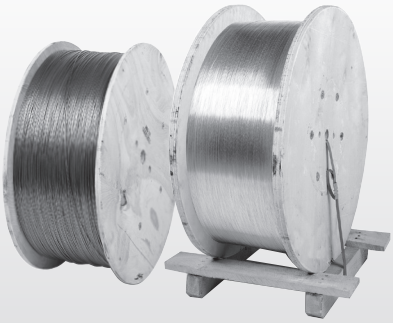
STEM

Wire Type	Weight (lbs)	Base	Stem Height (in)	Wire Stack (in) Inner Diameter	Wire Stack (in) Outer Diameter
Speed-Feed® Stem					
Solid	2200-3000	27.4 x 27.4	54	16	32 - 34

Reels & Stems

REELS

Precise-Trak® Reel with
Rotary Dispenser



Vertical Speed-Feed®(1) Reel
left: Flux-Cored, right: Solid

Speed-Feed®(1) Reel
left: Flux-Cored, right: Solid

Speed-Feed®(1) SlimReel™
Solid

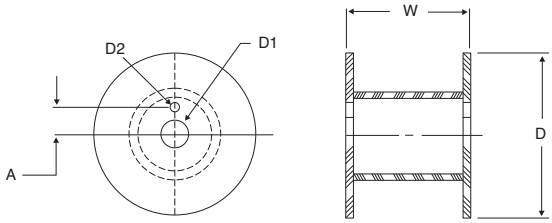
STEM

Speed-Feed®(1) Stem
Solid

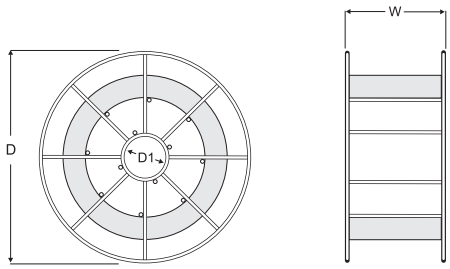
(1) Needs to be rotated to payoff wire

Spools

Plastic/Fiber Spools



Steel Spools

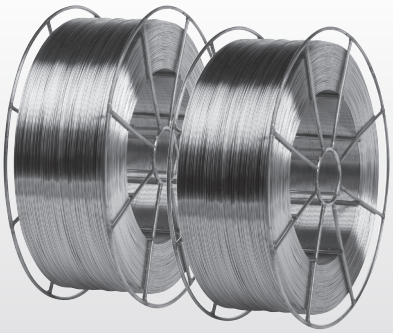


SPOOLS

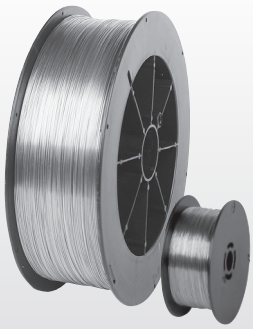
Wire Type	Weight (lbs)	"D" Outer Diameter (in)	"D1" Inner Diameter (in)	"W" Wound Reel Outer Width (in)	"D1" Arbor Hole Diameter (in)	Pin Hole "D2" Diameter (in)	Pin Hole "A" Distance from Axis (in)
Steel Spools							
Solid or Flux-Cored	25	11.81	2.05	4.25	-	-	-
	33	11.81	2.05	4.25	-	-	-
	44	11.81	2.05	4.25	-	-	-
Plastic Spools							
Solid (Mild Steel)	2	4.00	-	1.75	0.63	-	-
	10	8.00	-	2.16	2.03	0.44	1.75
	11	8.00	-	2.16	2.03	0.44	1.75
	12.5	8.00	-	2.16	2.03	0.44	1.75
	33	12.00	-	4.19	2.03	0.44	1.75
Solid (Aluminum)	1	4.00	-	1.75	0.28	-	-
	16	11.88	-	4.00	2.00	0.47	1.75
	20	11.88	-	4.00	2.00	0.47	1.75
Flux-Cored/ Metal-Cored	10	8.00	-	2.16	2.03	0.44	1.75
	15	8.00	-	3.00	2.03	0.44	1.75
	25	12.00	-	4.00	2.03	0.44	1.75
	33	12.00	-	4.00	2.03	0.44	1.75
Fiber Spools							
Solid	44	12.00	-	4.30	2.03	0.44	1.75
	60	14.00	-	4.30	2.03	0.44	1.75
Flux-Cored	33	12.00	-	4.30	2.03	0.44	1.75
	50	14.00	-	4.30	2.03	0.44	1.75

Spools

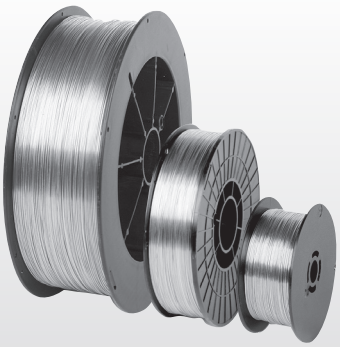
SPOOLS



Steel Spool
Solid & Flux-Cored - 33 lb



Plastic Spool
Flux-Cored - 25 lb, 1 lb



Plastic Spool
Solid, Mild Steel - 33 lb, 12.5 lb, 2 lb

Plastic Spool
Solid, Aluminum - 16 lb, 1 lb

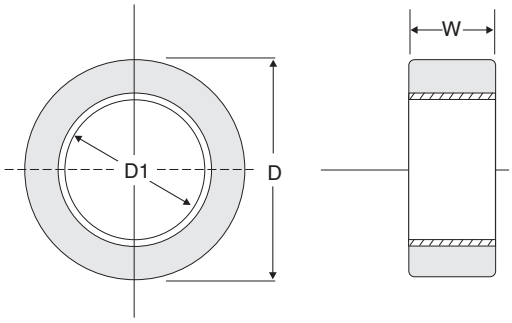
Fiber Spool
Solid, Mild Steel - 60 lb, Flux-Cored - 33 lb, 50 lb

Coils, Boxes & Bags

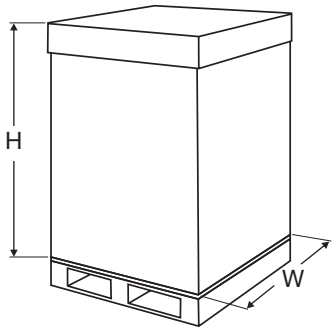
COILS

Wire Type	Weight (lbs)	Wire Diameter Specifications	"D" Outer Diameter (in)	"D1" Inner Diameter (in)	"W" Wound Reel Outer Width (in)
Coils					
Solid	60	≤ 1/16 in	16.50	12.00	4.40
	60	≥ 5/64 in	16.50	12.00	4.60
Flux-Cored	13.5 & 14	-	9.50	6.70	3.00
	14 (56 lb HS Pail)	-	9.50	6.70	3.00
	50 & 60	-	16.50	12.00	4.60

Coils



Boxes



BOXES

Wire Type	Weight (lbs)	Outside Dimensions L x W x H (in)	Core Dimensions (in)
Accu-Pak® Box			
Solid (Aluminum)	275 x 300	24 x 24 x 32	14
Solid (Mild Steel)	500	21 x 21 x 28	-
	1000	24 x 24 x 32	-

BAGS

Wire Type	Weight (lbs)	Dimensions (in)
Paper Bag / Plastic Bag		
Flux	50	-
Bulk Bag		
Flux	2600 - 3000	43 x 43 x 48[1]

[1]Values are maximums.

Coils, Boxes & Bags

COILS

Flux-Cored
13.5 lb. Coil (54 lb HS Pail)

Flux-Cored
60 lb

Solid Wire
60 lb

BOXES

Accu-Pak® Boxes
1000 & 500 lb

BAGS

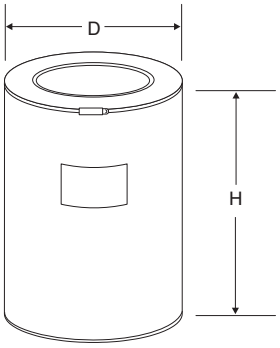
Paper Bag

Plastic Bag

Bulk Bag

Drums & Pails

Drums



DRUMS

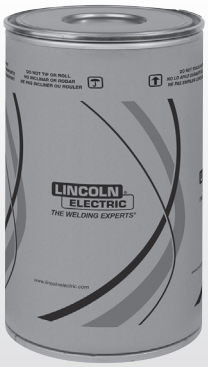
Wire Type	Weight (lbs)	Outer Diameter (in)	Outer Height (in)	Core Inside Diameter	Core Height
Speed-Feed® Drum					
Solid	300	23.4	17.8	16	17
	600	23.4	34.8	16	34
	1000	23.4	34.8	16	34
Flux-Cored	125	23.4	11.1	16	10
	300	23.4	17.8	16	17
	500 and 600	23.4	34.8	16	17
Accu-Trak® Drum					
Solid	250	23.4	19.7	-	-
	500	20.4	32.6	-	-
	1000	23.4	34.8	-	-
Flux-Cored	300, 400 and 500	20.4	32.6	8.4	31.5
	500 and 600	23.4	34.8	8.4	34
Metal-Cored	500	20.4	32.6	8.4	31.5
Steel Drum					
Flux	550	22.75	33.50	-	-

PAILS

Wire Type	Weight (lbs)	Outer Diameter (in)	Outer Height (in)	Core Inside Diameter	Core Height
Hermetically Sealed Pail					
Flux	50	12	14.75	-	-

Drums & Pails

DRUMS



Accu-Trak®/Speed-Feed®[1] Drums

Steel Drum[2]

PAIL

Hermetically Sealed Pail

Pail as Master

[1] Needs to be rotated to payoff wire. [2]This product does not come on a pallet. If your application requires a pallet, please contact your local Lincoln Electric sales representative.

Storage & Handling

Stick Electrodes

Storing Low Hydrogen Electrodes

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

Moisture resistant electrodes with an "R" suffix have a high resistance to coating moisture pick-up.

However, 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. Specific code requirements may indicate exposure limits different from these guidelines.

Depending on the amount of moisture absorbed and other factors, moisture pickup can degrade weld quality in various ways:

1. Moisture in low hydrogen electrodes may cause porosity. This porosity could be completely subsurface and require x-ray inspection or destructive testing. The porosity could also be visible, external porosity.
2. High moisture can also lead to excessive slag fluidity, a rough weld surface, and difficult slag removal.
3. Excessive moisture in low hydrogen electrodes will lead to elevated levels of diffusible hydrogen which, in turn, can lead to hydrogen-induced weld cracking and/or underbead cracking.

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 370°-430°C (700°-800°F) range. This minimizes the possibility of oxidation of alloys in the coating which would result 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.

Storing Cellulosic 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 40° to 50°C (100° to 120°F).

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 40° to 50°C (100° to 120°F). DO NOT use higher temperatures.

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.

Storage & Handling

Stick Electrodes

RE-DRYING CONDITIONS - LOW HYDROGEN

Condition	Pre-drying Temperature[1]	Final Re-drying Temperature
Electrodes exposed to air for less than one week; no direct contact with water.	—	370° - 430°C (700° - 800°F)
Electrodes which have come in direct contact with water or which have been exposed to high humidity.	80 - 105°C (180° - 220°F)	370° - 430°C (700° - 800°F)

RE-DRYING CONDITIONS - NON-LOW HYDROGEN

Electrode	Electrode Group	Final Re-drying Temperature	Time
E6010: E6011: E7010-A1[1]: E7010-G[1]: E8010-G[1]: E9010-G[1]:	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: E6027:	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 90°C to 110°C (200°F to 230°F) before final drying to minimize cracking of the coating.	200° - 260°C (400° - 500°F)	30 - 45 minutes
E6013: E7014: E6022:	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 90°C to 110°C (200°F to 230°F) before final drying to minimize cracking of the coating.	150° - 180°C (300° - 350°F)	20 - 30 minutes

[1]Pre-dry for 1-2 hours.

Stainless Steel

Storing Stainless Steel Electrodes

Excalibur® stainless steel covered electrodes should be handled and stored as if they were low hydrogen electrodes for welding low steels. They should be protected from moisture pickup. The consequences of moisture pickup with Excalibur® stainless electrodes do not include cold cracking, as would be the case with low alloy steels, unless they are used for dissimilar metal joining. But if Excalibur® stainless electrodes are exposed for extended periods a humid environment, the coating can pick up enough moisture to cause starting porosity and/or centerline porosity. The electrodes should be stored in sealed cans, or stored in an oven at about 120°C (250°F). If they are exposed to the point that porosity occurs, they can be restored to like-new condition by baking one hour at 345 to 425°C (650 to 800°F).

Storage & Handling

Metal-Cored & Flux-Cored Wire

Shelf Life

As a general rule, The Lincoln Electric Company estimates maximum storage time for mild and low alloy steel consumables to be 3 years. This estimate is for material in the original, undamaged packages that is stored indoors at up to ~70% relative humidity and that are protected from the weather or other adverse conditions. Packages should be stored under conditions that minimize the likelihood of temperature variations that cause moisture condensation on the consumables.

These estimates are based on what we know about the packaging materials and the frequency of product improvements. Since actual storage conditions vary widely across geographical regions and from one customer to another, it is not possible to be more specific. For packages that are not hermetically sealed, a shorter storage time is advisable under sustained severe humidity conditions but is not possible to estimate. Note that product stored for longer than 3 years, may still be suitable for use. It depends on the product and the condition it is in.

Dispose of any wire or rod that has visible signs of rust.

Customers are not encouraged to store consumables for extended periods of time. It is advisable to maintain turnover in inventory to ensure the products are as close to their as manufactured conditions as can be reasonably expected. The general guidelines above are provided for those unplanned instances where product is stored longer than originally anticipated.

Storage of Unopened Packages

FCAW products should be stored in the original, unopened packaging until ready to use. To maintain the integrity of these products, electrodes must be protected from the atmosphere. All flux cored electrodes, regardless of package, should be protected from condensation, including rain or snow. To ensure that condensation does not form on the product, it is recommended that the electrode be stored in an environment that is kept above the dew point temperature for a given relative humidity. Minimizing temperature variation will also help to protect the electrode from moisture condensation. It is advisable to maintain turnover in inventory to ensure the product is as close to the manufactured condition as possible.

For applications in which the weld metal hydrogen must be controlled (usually 8 mL/100g or lower), or where shipping and storage conditions are not controlled or known; only hermetically sealed packaging is recommended.

Storage & Handling

Submerged Arc Flux and Wire

Handling of Wires out of the Package

The following minimum precautions should be taken to safeguard the wire after opening the original package:

1. It is recommended to use wires within one week of opening the original package.
2. Open wires should not be exposed to damp moisture conditions or extremes in temperature and/or humidity where surface condensation can occur.
3. When not in use, wires should be placed in original packaging and sealed as best as possible.
4. If exposed to moisture conditions, discard any rusty wire.
5. After exposure, hydrogen levels can be reduced by conditioning the wire. Wires may be conditioned at a temperature of 212°F ± 25°F (100°C ± 4°C) for a period of 6 to 12 hours, cooled and then stored in a sealed poly bags (4 mil minimum thickness) or equivalent. Wire on plastic spools should not be heated at temperatures in excess of 150°F (65°C).

When to Dispose of Product

It is advisable to dispose of any wire that has visible signs of rust on the wire where the package integrity has been compromised. When proper storage procedures are not followed, consumables may show signs of high moisture. High moisture can result in rough bead surface or slag that is unusually difficult to remove. In addition, it can also result in visible and/or internal porosity in the weld deposit, increase spatter, and decreased puddle control which can increase chances of slag entrapment. Oxidation (rust) of either the surface of the wire or internal fluxing agents increases the oxygen content of the wire that can lead to changes in alloy recovery. This, in turn, can deteriorate the mechanical properties of the weld metal.

Submerged Arc Flux / Wire and MIG Wire

STORAGE FOR SUBMERGED ARC FLUX

Flux Package Type[1]	Flux Storage Conditions for General Welding Applications	Flux Storage for Applications Requiring Diffusible Hydrogen Control
Plastic or Multi-Wall Plastic/Paper Bag	Store indoors at < 90% RH Protect from condensation	Store indoors at < 70% RH and 5°C - 50°C (40°F - 122°F). Protect from condensation
Bulk Bag with Liner	Store indoors at < 90% RH Protect from condensation	Store indoors at < 70% RH and 5°C - 50°C (40°F - 122°F). Protect from condensation
Steel Drum	Protect from rain or snow	Protect from rain or snow
Plastic Pail	Protect from rain or snow	Protect from rain or snow

STORAGE FOR MILD AND LOW ALLOY STEEL MIG AND SUBARC WIRES

Wire Package Type[1]	Wire Storage Conditions for All Welding Applications
Any Type	Protect from rain or snow. Protect from condensation. Do not use wire with visible signs of rust.

[1]For other package types, consult your Technical Representative.

Storage & Handling

Submerged Arc Flux and Wire

Re-Drying & Recycling Flux

Lincoln Electric submerged arc welding flux can be used directly from its original, undamaged package, if it has been stored according to the conditions listed in the chart above.

When proper procedures are not followed, flux may show signs of moisture. These can include porosity, a rough bead surface or slag that is unusually difficult to remove. In many instances these fluxes can be re-dryed in general welding applications.

Re-Drying Flux

To re-dry fluxes other than MIL800-H & MIL800-HPNi

- Remove flux from its original packaging and place in a clean oven set between 260°-480°C (500°-900°F).
- Leave in oven long enough to raise the temperature of the entire bulk of flux to your set temperature for a minimum of one hour.
- For ovens in which heating rods are inserted into the flux, do not let the temperature of flux adjacent to the rods exceed 480°C (900°F).

For MIL800-H and MIL800-HPNi fluxes

Follow all previous procedures, with the following changes:

- Set temperature between 120°-205°C (250°-400°F).
- For ovens in which heating rods are inserted into the flux, do not let the temperature of flux adjacent to the rods exceed 205°C (400°F).

For all other fluxes requiring diffusible Follow all previous procedures, with the following changes:

- Set temperature at approximately 425°C (800°F).

Recycling Flux

Non-consumed flux may be collected from the finished weld and recycled.
To do so, please follow these procedures:

- Remove slag, metal, mill scale, and any other contaminants from the flux.
- Prevent damage to the flux from heavy impingement in flux transport systems.
- Avoid the separation of different sized particles in cyclones or “dead” corners.
- Remove excess fines from recycled fluxes.
- For optimal welding characteristics, it is recommended to add at least 20% new flux by weight to recycled flux.

APPENDIX

AWS Classification System

Stick 466
MIG, TIG & Metal-Cored 467
Flux-Cored 468
Submerged Arc 470

General Information

Stick Electrode

Types of Coating & Current 474
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Submerged Arc

Flux Types & General Characteristics 476
Selecting Flux/Wire Combinations 477

Hardfacing

Cross Checking 479

Aluminum

Typical Operating Procedures 480
Typical Joint Designs 482

Innershield®

Wire Selection Guide 483

Agency Approvals 485

Safety Guidelines 504

AWS Classification System

Stick (SMAW)

Mild & Low Alloy Steel per AWS A5.1/A5.1M: 2004 and AWS A5.5/A5.5M: 2006

Classification Designators per AWS A5.1 & A5.5

EXXXX

Designates an electrode.

Designates the minimum tensile strength in ksi of the weld metal when produced with the test assembly preparation procedure of this specification.

Designates the welding position in which electrodes are usable, the type of coating, and the polarity to operate.

EXXXXM

Military requirements such as: greater toughness, lower moisture content and mandatory diffusible hydrogen limits for weld metal.

EXXXX-1 HZ R

AWS A5.1

Designates that the electrode meets the requirements of the absorbed moisture test.

Diffusible hydrogen designator (H4, H8, H16) in mL of diffusible hydrogen per 100 grams of weld metal.

Designates that the electrode meets the requirements for improved toughness – ductility.

Classification Designators per AWS A5.5 Only

EXXXX-XX HZ R

AWS A5.5

Designates the chemical composition of the undiluted weld metal produced by the electrode using shielded metal arc welding.

Additional Classifications

Stainless Steel - Per AWS A5.4

EXXX-15 The three digits that follow the "E" indicate the American Iron and Steel Institute type of stainless steel. The last two digits indicate the current and the welding position in which it is used:

-15 fast freezing slag for out-of-position welding
-16 stable arc and out-of-position welding capability
-17 smooth arc transfer in the flat and horizontal welding positions.

AWS Classification System

MIG (GMAW), TIG (GTAW) & Metal-Cored (GMAW-C)

Mild & Low Alloy Steel per AWS A5.18 /A5.18M: 2005 and AWS A5.28/A5.28M: 2005

Classification Designators per AWS A5.18 & A5.28

ERXXX-X HZ

EXXX-X HZ

- Designates an electrode (E) or rod (ER).
- Designates the minimum tensile strength in ksi of the weld metal when produced with the test assembly preparation procedure of this specification.
- Indicates whether the filler metal is solid (S) or composite (C).
- Indicates the chemical composition of a solid electrode or the chemical composition of the weld metal produced by a composite electrode. The use of the "GS" suffix designates filler metals intended for single pass applications only.
- Diffusible hydrogen designator (H4, H8, H16) in mL of diffusible hydrogen per 100 grams of weld metal.

Additional Classifications

Aluminum – Per AWS A5.10/A5.10M
ERXXXX
The first digit following "E" or "ER" indicates the principle alloying element or elements (4 – Silicon, 5 – Magnesium). If the second digit following "E" or "ER" is different from zero, it denotes a modification to the original alloy. The last two digits are used to identify the specific alloy.

Stainless – Per AWS A5.9/A5.9M
ERXXXLSi
The three digits following "E" or "ER" specify the chemical composition of the filler metal with a series of numbers. In some cases, chemical symbols for the letter L (low carbon), Si (high silicon), or H (high carbon) will follow to designate modifications of basic alloy types.

Nickel Alloy – Per AWS A5.14/A5.14M
ERXXXX-X
The chemical symbol "Ni" appears in the designations immediately after "E" or "ER" to identify the filler metal as a nickel-based alloy. Other symbols such as Cr and Mo in the designation are intended to group the filler metals according to their principal alloying elements. The number at the end of the designation separates one composition from another within a group.

AWS Classification System

Flux-Cored (FCAW)

Mild & Low Alloy Steel per AWS A5.20/A5.20M: 2005 and AWS A5.29/A5.29M: 2005

Classification Designators per AWS A5.20 & A5.29

E X X T - X X - J X H X

- **E** — Designates an electrode.
- **XX** — Designates the minimum tensile strength in ksi when multiplied by 10 of the weld metal when produced with the test assembly preparation procedure of this specification.
- **X** — Designates the position in which the electrode is usable: “0” for flat and horizontal positions only, or “1” for all positions.
- **T** — Designates the electrode as tubular.
- **XX** — Designates the usability of the electrode with some number from 1 through 14 or the letter “G” (or “GS”). An “S” is used after the “G” to indicate that the electrode is suitable only for single pass welding.
- **X** — Designates the type of shielding gas used for classification: “C” indicates 100% CO_2. “M” indicates 75-80% Argon/balance CO_2 shielding gas. When no designator appears in this position, it indicates that the electrode being classified is self-shielded and that no external shielding gas was used.
- **H X** — Optional supplemental diffusible hydrogen designator (H4, H8, H16) in mL of diffusible hydrogen per 100 grams of weld metal.
- **X** — The letter “D” or “Q” in this position indicates that the weld metal meets supplemental mechanical property requirements when welding with low heat input, fast cooling rate procedures or using high heat input, slow cooling rate procedures.
- **J** — The letter “J” in this position designates that the electrode meets the requirements for improved toughness and will deposit weld metal with Charpy V-Notch properties on up to 27 J (20 ft•lbs) at -40°C (-40°F).

AWS Classification System

Flux-Cored (FCAW)

Mild & Low Alloy Steel per AWS A5.20/A5.20M: 2005 and AWS A5.29/A5.29M: 2005

Classification Designators per AWS A5.29 Only

Designates the usability of the electrode with the number 1, 4, 5, 6, 7, 8, or 11. The letter "G" in this position indicates that the polarity and general operating characteristics are not specified.

Two, three or four digits are used to designate the chemical composition of the deposited weld metal. The letter "G" indicates that the chemical composition is not specified.

E X X T X - X X - J X H X

Additional Classifications

Stainless Steel - Per AWS A5.22/A5.22M

EXXXTX-X The three digits that follow "E" designate the chemical composition of the weld metal. The digit following "T" designates the position in which the electrode is usable: "0" for flat and horizontal positions only, or "1" for all positions.

AWS Classification System

Submerged Arc (SAW) Flux & Electrode

Mild & Low Alloy Steel - Per AWS A5.17/A5.17M: 1997 and AWS A5.23/A5.23M: 2007

Classification Designators per AWS A5.17 & A5.23

Designates a flux. If followed by the letter "S," the flux is a crushed slag or a blend of crushed slag with unused (virgin) flux.

Designates the minimum tensile strength in ksi when multiplied by 10 of the weld metal deposited with the flux and some classification of electrode.

Designates the condition of heat treatment in which the tests were conducted: "A" is for as-welding and "P" is for postweld heat treated.

Indicates the temperature in °F at or above which the weld metal meets the requirement for Charpy V-Notch impact toughness of 27 J (20 ft•lbf). Two digits are used for test temperatures of -100°F or lower.

The letter "E" at the beginning of each classification stands for electrode. The letter "C" will follow the "E" if it is a composite electrode.

Indicates whether the electrode is L – low manganese, M – medium manganese or H – high manganese.

The classification is based upon low dilution weld metal obtained with a particular flux. The numerical suffix refers to the approximate carbon content in hundredths of one percent.

Indicates that the electrode is made from a heat of silicon-killed steel.

Optional supplemental diffusible hydrogen designator (H4, H8, H16) in mL of diffusible hydrogen per 100 grams of weld metal.

F X P X - E C M X X K - H Z

F X P X - E C X X X - H Z

Classification Designators per AWS A5.23 Only

Indicates the chemical composition of a solid electrode or the undiluted weld metal obtained with a composite electrode and particular flux. Usually a combination of letters, numbers and elements (see next page).

MILD STEEL EXAMPLES

F7A6-EM12K is a complete designation for a flux-electrode combination. It refers to a flux that will produce weld metal which, in the as-welded condition, will have a tensile strength of 70,000 to 95,000 psi and Charpy V-Notch impact strength of at least 20 ft•lbf at -60°F when produced with an EM12K electrode under the conditions called for in this specification. The absence of an "S" in the second position indicates that the flux being used is a virgin flux. **F7P4-EC1** is a complete designation for a flux-composite electrode combination when the trade name of the electrode used in the classification is indicated as well. It refers to a virgin flux that will produce weld metal with that electrode which, in the postweld heat treated condition, will have a tensile strength of 70,000 to 95,000 psi and Charpy V-Notch energy of at least 20 ft•lbf at -40°F under the conditions called for in this specification.

LOW ALLOY STEEL EXAMPLES

F9P0-EB3-B3 is a complete designation for a flux-electrode combination. It refers to a flux that will produce weld metal which, in the postweld heat treated condition, will have a tensile strength of 90,000 to 110,000 psi and Charpy V-Notch impact strength of at least 20 ft•lbf at 0°F when produced with an EB3 electrode under the conditions called for in this specification. The composition of the weld metal will meet the requirements for a B3 designation.

AWS Classification System

Submerged Arc (SAW) Flux & Electrode

Classification Descriptions for AWS A5.17 & A5.23

The electrode classification identifies the chemical composition of the electrode. The following paragraphs highlight the differences between these electrodes and electrode groups and indicate typical applications.

Mild Steel Electrodes

EL8, EL8K, EL12, EM11K, EM12, EM12K, EM13K, EM14K, EM15K, EH10K, EH11K, EH12K and EH14 – Carbon steel electrodes which vary from one another in their carbon, manganese, and silicon contents. EM14K electrodes also contain small additions of titanium, although they are considered carbon steel electrodes.

Low Alloy Electrodes

EA1, EA2, EA3, EA3K, and EA4 (C-Mo Steel) – Similar to the medium manganese and high manganese carbon steel electrodes shown above except that 0.5% molybdenum is added.

EB1, EB2, EB2H, EB3, EB5, EB6, EB6H, EB8, and EB9 (Cr-Mo Steel) – Produce weld metal containing between 0.5% and 10% chromium and between 0.5% and 1% molybdenum.

The letter "R" when added as a suffix to the EB2 or EB3 electrode classification or to the B2 or B3 weld metal designation is an optional supplemental designator indicating that the electrode will meet the reduced residual limits necessary to meet "X" factor requirements for step cooling applications.

Since all Cr-Mo weld deposits will air harden in still air, both preheat and postweld heat treatment (PWHT) are required for most applications.

EB9 is a 9% Cr-I % Mo electrode modified with niobium (columbium) and vanadium designed to provide improved creep strength, and oxidation and corrosion resistance at elevated temperatures.

ENi1, ENi1K, ENi2, and ENi3 (Ni Steel) – Designed to produce weld metal with increased strength without being hardenable or with increased notch toughness at temperatures as low as -100°F (-73°C) or lower. They have been specified with nickel contents which fall into three nominal levels of 1 % Ni, 2.5% Ni, and 3.5% Ni.

ENi4, ENi5, EFI, EF2, and EF3 (Ni-Mo Steel) – Contain between 0.5% and 2% nickel and between 0.25% and 0.5% molybdenum.

EF4, EF5, and EF6 (Cr-Ni-Mo Steel) - A combination of Cr, Ni, and Mo develop the strength levels and notch toughness required for a number of high-strength, low-alloy or micro-alloyed structural steels.

EM2, EM3, and EM4 (High-Strength, Low Alloy Steel) – May contain a combination of Cr, Ni, Mo, Ti, Zr and Al.

EW (Weathering Steel) – Designed to produce weld metal that matches the corrosion resistance and the coloring of the ASTM weathering-type structural steels. These special properties are achieved by the addition of about 0.5% copper to the weld metal.

EG (General Low-Alloy Steel) – Indicates that the electrode is of a general classification. It is general because not all of the particular requirements specified for each of the other classifications are specified for this classification.

AWS Classification System

Submerged Arc (SAW) Electrode

Mild & Low Alloy Steel per AWS A5.36/A5.36M: 2012

Classification Designators per AWS A5.36

EXXTX-XXX-J-XHX

- **E** — Designates an electrode.
- **XX** — Designates the minimum tensile strength in ksi when multiplied by 10 of the weld metal deposited with the electrode under the welding conditions specified in this specification.
- **T** — Designates the position in which the electrode is usable: “0” for flat and horizontal positions only, or “1” for all positions.
- **X** — Designates the usability of the electrode, the letter “T” followed by some number from 1 through 17 or the letter “G.” The letter “T” identifies the electrode as a flux-cored electrode or metal-cored electrode. An “S” is used after the “G” to indicate that the electrode is suitable only for single pass welding.
- **X** — Designates the type of shielding gas, if any, used for classification. The letter “Z” in this position indicates that the shielding gas composition is agreed upon between supplier and purchaser. When no designator appears in this position, it indicates that the electrode is self-shielded and that no external shielding gas is used.
- **X** — Designates the condition of heat treatment in which the tests were conducted: “A” is for as-welding and “P” is for postweld heat treated. This designator omitted when the electrode being classified is intended for single pass welding only.
- **XX** — Indicates the temperature in °F at or above which the weld metal meets the requirement for Charpy V-Notch impact toughness of 27 J (20 ft•lbf). Two digits are used for test temperatures of -100°F or lower.
- **J** — Designates the composition of the deposited weld metal using one, two or three characters. The letter “G” indicates that the chemical composition is not specified. No designator used in this position when the electrode being classified is a single pass electrode.
- **H** — Optional, supplemental diffusible hydrogen designator.
- **X** — For flux-cored electrodes, the letter “D” or “Q” when present in this position indicates the weld metal will meet supplemental mechanical property requirements.

AWS Classification System

Stick Electrode

Types of Coating & Current

Mild Steel per AWS A5.1

TYPES OF COATING & CURRENT

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

Low Alloy Steel per AWS A5.5

TYPES OF COATING

Suffix	%C	%Mn	%Si	%P	%S	%Ni	%Cr	%Mo	%V
A1	0.12	0.60	0.40	0.03	0.03			0.40 - 0.65	
B2	0.05 - 0.12	0.90	0.80	0.03	0.03		1.00 - 1.50	0.40 - 0.65	
B3	0.05 - 0.12	0.90	0.80	0.03	0.03		2.00 - 2.50	0.90 - 1.20	
C1	0.12	1.25	0.80	0.03	0.03	2.00 - 2.75			
C3	0.12	0.40 - 1.25	0.80	0.03	0.03	0.80 - 1.10	0.15	0.35	0.05
D2	0.15	1.65 - 2.00	0.80	0.03	0.03	0.90		0.25 - 0.45	
G[1]		1.00 min.	0.80 min.	0.03	0.03	0.50 min.	0.30 min.	0.20 min.	0.10 min.
P1	0.20	1.20	0.60	0.03	0.03	1.00	0.30	0.50	0.10
P2	0.12	0.90 - 1.70	0.80	0.03	0.03	1.00	0.30	0.50	0.05

[1] Only one of the listed elements is required.

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

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
Fleetweld® 5P+
Fleetweld® 35
Fleetweld® 35LS
Fleetweld® 180
Fleetweld® 37
Fleetweld® 22
Shield-Arc® 85
Shield-Arc® 90
Shield-Arc® HYP+
Fleetweld® 47
Jetweld® 1
Jetweld® 2
Shield-Arc® 70+
Pipeliner® 6P+
Pipeliner® 7P+
Piperliner® 8P+

Stick Electrode

ASME Boiler & Pressure Vessel Code

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	A1
		Jetweld® 1	A1
		Excalibur® 7028	A1
F-2	EXX12, EXX13, EXX14, EXX13-X	Fleetweld® 37	A1
		Fleetweld® 47	A1
F-3	EXX10, EXX11, EXX10-X, EXX11-X	Fleetweld® 5P	A1
		Fleetweld® 5P+	A1
		Pipeliner® 6P+	A1
		Fleetweld® 35	A1
		Fleetweld® 35LS	A1
		Fleetweld® 180	A1
		Shield-Arc® 85	A2
		Shield-Arc® 70+	–
		Shield-Arc® 90	A11
		Shield-Arc® HYP+	–
		Pipeliner® 7P+	–
		Pipeliner® 8P+	–
F-4	EXX15, EXX16, EXX18, EXX45-X, EXX15-X, EXX16-X, EXX18-X	Jetweld® LH-70	A1
		Jet-LH® 78	A1
		Lincoln® 7018AC	A1
		Excalibur® 7018 MR	A1
		Excalibur® 7018-1 MR	A1
		Excalibur® 7018-A1 MR	A2
		Excalibur® 8018-B2 MR	A3
		Excalibur® 8018-C1 MR	A10
		Excalibur® 8018-C3 MR	A10
		Excalibur® 9018-B3 MR	A4
		Excalibur® 9018M MR	A10
		Excalibur® 10018-D2 MR	A11
		Excalibur® 11018M MR	–
		Pipeliner® 16P	A1
		Pipeliner® 18P	A10
		Pipeliner® 19P	A10
		Pipeliner® LH-D80	A1
		Pipeliner® LH-D90	–
		Pipeliner® LH-D100	–

Submerged Arc Fluxes

Flux Types and General Characteristics

The Lincoln Electric Company manufactures three general types of submerged arc fluxes:

- Active fluxes
- Neutral fluxes
- Alloy fluxes

With all submerged arc fluxes, variations in arc voltage change flux consumption. Higher arc voltages and the resulting longer arc length increase the amount of flux melted or consumed. Consequently, when a flux contains an alloy as an ingredient, increasing the arc voltage increases the amount of alloy recovered in the weld deposit.

Types and General Characteristics

Active Fluxes

American Welding Society (AWS) defines active fluxes as those which contain small amounts of manganese, silicon, or both. These deoxidizers are added to the flux to provide improved resistance to porosity and weld cracking caused by contaminants on or in the base metal.

The primary use for active fluxes is to make single pass welds, especially on oxidized base metal.

Alloy in the weld deposit will vary with changes in the arc voltage. An increase in deposit alloy increases the strength level of the weld metal, but might lower the impact properties. For this reason, voltage must be more tightly controlled for multiple pass welding with active fluxes than when using neutral fluxes. Because of this, Lincoln Electric does not recommend using active fluxes (our 700 series) for multiple pass welding of plates over 25 mm (1 in) thick.

Neutral Fluxes

AWS defines neutral fluxes as those which will not produce any significant change in the all-weld metal composition as a result of a large change in the arc voltage, and thus, the arc length.

Neutral fluxes are used in multiple pass welding, especially when the base plate exceeds 25 mm (1 in) in thickness. They are also used for general welding on clean steel. Note the following considerations concerning neutral fluxes:

1. Since neutral fluxes contain little or no alloy, they have little resistance to cracking and/or porosity caused by contaminants, especially on single pass welds. For this reason, active fluxes are usually the best choice for single pass welding.
2. Even when a neutral flux is used to maintain the weld metal composition through a range of welding voltage, weld properties, such as strength level and impact properties, can change because of changes in cooling rate, penetration, heat input and number of passes.

Alloy Fluxes

AWS defines alloy fluxes as those which can be used with a plain carbon steel electrode to make an alloy weld deposit. The alloys for the weld deposit are added as ingredients in flux.

The primary use of alloy fluxes is hardfacing applications.

Since the alloy level in the weld deposit is dependent upon the correct arc voltage, and thus arc length, it is very important that the voltage is carefully controlled to ensure that the intended alloy is reached in the deposit.

Submerged Arc Flux/Wire

Selecting Flux/Wire Combinations

Guidelines for Selecting a Submerged Arc Flux/Wire Combination

Lincolnweld® submerged arc electrode and flux combinations come with certificates of conformance. To access these certificates, follow the directions below.

1. Go to the Lincoln Electric home page at www.lincolnelectric.com.
2. Click on the 'Support' tab and select 'Certificate Center' from the drop down. (Image 1)
3. Under 'Certificates of Conformance,' you can choose a Product or a Flux Combination. This will bring up the most recent Certificate of Conformance. (Image 2)

How to look for flux/wire combinations that meet your required mechanical properties:

Tensile Strength

1. In the second box under 'Certificates of Conformance,' you can 'Search by Name/ Cert # / Classification.'
2. Enter F#P or F#A. Where # is 10X the required Tensile Strength in ksi. P= Stress Relieved, A= As-Welded.
   a. **For example, entering F7P would mean you are looking for a flux/wire combination with 70 ksi Tensile Strength in the Stress Relieved Condition.**

Impact Requirements

1. In the list of matches for your required Tensile Strength, you can see which Flux/Wire Combinations also meet your Impact Property Requirements.
2. If you need to meet Impact Requirements at a certain value, note that the digit following the "A" or "P" in the classifications shows the temperature at which the weld metal achieves a minimum of 27 J (20 ft•lbf).
   a. **For example, a classification beginning with F7P2 would mean that the flux/wire combination meets 70 ksi Tensile Strength in the Stress Relieved Condition and Impact Requirements of 27 J (20 ft•lbf) @ -29°C (-20°F).**

In general, if you are familiar with one of the listed fluxes, you might want to choose that option. From an operator's standpoint, it is easier to change electrodes than to reset procedures for a new flux.

If you are welding high strength or highly restrained steel, you might want to choose a Flux/Wire Combination with a lower diffusible hydrogen level, which is designated by the number following -H in the flux/wire classification.

If you have limits on the compositions of the electrode or the weld metal, click on a Flux/Wire Combination to see the test results. Remember that these results represent undiluted weld metal from a standardized test and may be different from your application, especially if variations in base metal, heat input or pass sequence are present.

Your Lincoln Electric Technical Sales Representatives are there to help you make the best flux/wire selection for your application. Please contact them with any questions.

Submerged Arc Flux/Wire

Selecting Flux/Wire Combinations

Guidelines for Selecting a Submerged Arc Flux/Wire Combination

Image 1:

At the Lincoln Electric home page select "Certificate Center from the drop down menu under the 'Support" tab.

Image 2:

At the Certificate Center, enter a product name or search by Name, Cert #, or Classification. Search results will appear below.

Image 1

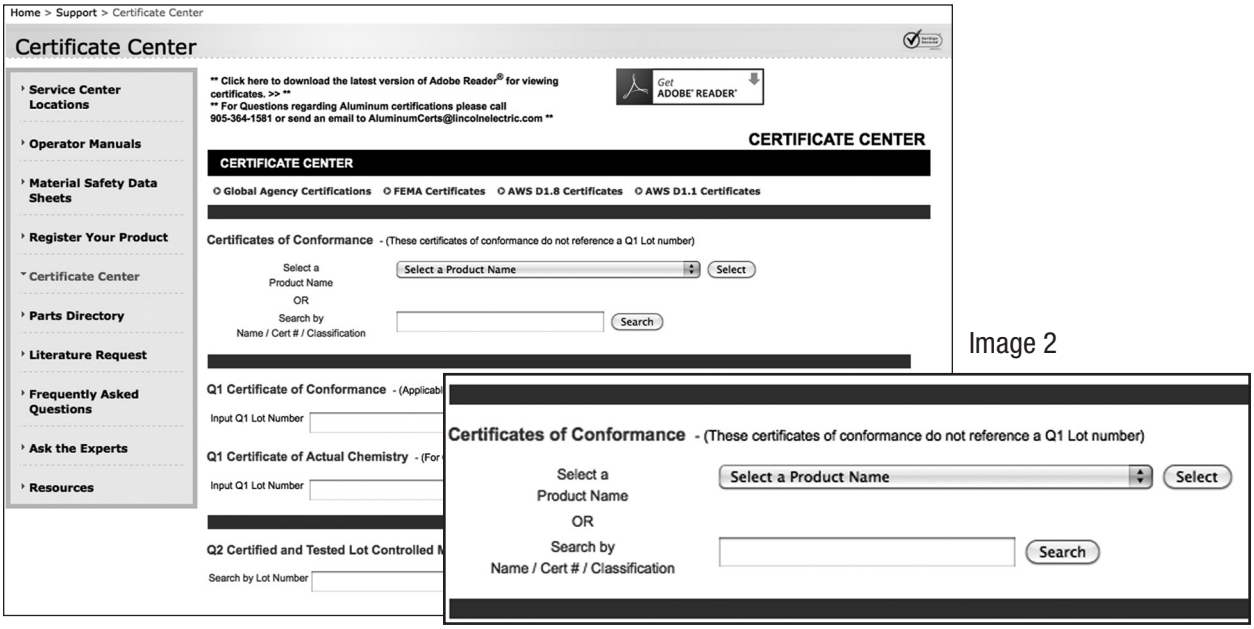


Image 2

Hardfacing

Cross Checking

Special precautions should be taken with any build-up or hardfacing product on applications that are inherently crack sensitive, such as high carbon or alloy steels, previously hardfaced parts, highly stressed parts, and work hardened parts. The hardfacing of heavy cylinders, massive parts and parts having complex shapes are all examples of applications exhibiting high internal stresses that may result in delayed cracking.

These applications may require one or more of the following:

- Higher preheat temperatures
- Higher interpass temperatures
- Controlled slow cooling between passes and/or layers
- Stress relieving
- Minimizing layer thickness

The table below will help determine if special precautions need to be taken with specific Lincore® wires:

SPECIAL PRECAUTIONS

	Lincore® Products								
Product	**55**	**55-G**	**65-0**	**60-0**	**30-S**	**32-S**	**35-S**	**40-S**	**42-S**
Higher Preheat Temp.[1] 150°C - 260ºC (300°F - 500ºF)	✓	✓	✓	✓					
200°C - 260ºC (400°F - 500ºF)					✓	✓	✓	✓	✓
Higher Interpass Temp. 200°C - 320ºC (400°F-600ºF)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controlled Cooling Between Passes/Layers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stress Relieving 430°C - 480ºC (800°F - 900ºF)[2] Every 6.4 mm (1/4 in) Thickness of Deposit	✓	✓							
Every 10-13 mm (3/8 - 1/2 in) Thickness of Deposit			✓	✓	✓				
Minimize Layer Thickness			✓		✓	✓	✓	✓	

[1]Preheat depends on the base material chemistry and thickness, as well as the weld metal chemistry.
[2]Stress relieving in temperatures in excess of 482°C (900°F) will result in a "softening" of the deposit.

Aluminum

Typical Operating Procedures for Aluminum MIG Welding

TYPICAL OPERATING PROCEDURES FOR GROOVE WELDING

Metal Thickness (in)	Weld Position[1]	Edge Preparation[2]	Joint Spacing (in)	Weld Passes	Electrode Diameter (in)
1/16	F	A	None	1	0.030
	F	G	3/32	1	0.030
1/8	F, V, H	A	0 - 3/32	1	0.030 - 3/64
	F, V, H, O	G	3/16	1	0.030 - 3/64
3/16	F, V, H	B	0 - 1/16	1F, 1R	0.030 - 3/64
	F, V, H	F	0 - 1/16	1	3/64
	O	F	0 - 1/16	2F	3/64
	F, V	H	3/32 - 3/16	2	3/64 - 1/16
	H, O	H	3/16	3	3/64
1/4	F	C-90°	0 - 3/32	1F, 1R	3/64 - 1/16
	F	F	0 - 3/32	2	3/64 - 1/16
	V, H	F	0 - 3/32	3F, 1R	3/64
	O	F	0 - 3/32	3F, 1R	3/64 - 1/16
	F, V	H	1/8 - 1/4	2 - 3	3/64 - 1/16
	O, H	H	1/4	4 - 6	3/64 - 1/16
3/8	F	C-90°	0 - 3/32	1F, 1R	1/16
	F	F	0 - 3/32	2F, 1R	1/16
	V, H	F	0 - 3/32	3F, 1R	1/16
	O	F	0 - 3/32	5F, 1R	1/16
	F, V	H	1/4 - 3/8	4	1/16
	O, H	H	3/8	8 - 10	1/16
3/4	F	C-60°	0 - 3/32	3F, 1R	3/32
	F	F	0 - 1/8	4F, 1R	3/32
	V, H, O	F	0 - 1/16	8F, 1R	1/16
	F	E	0 - 1/16	3F, 3R	1/16
	V, H, O	E	0 - 1/16	6F, 6R	1/16

TYPICAL OPERATING PROCEDURES FOR GROOVE WELDING

Metal Thickness[4] (in)	Weld Position[1]	Weld Passes[5]	Electrode Diameter (in)	DC+ Current[3] (Amps)
1/8	F,	1	0.030 - 3/64	125 - 150
	V, H	1	0.030	110 - 130
	O	1	0.030 - 3/64	115 - 140
3/16	F	1	3/64	180 - 210
	V, H	1	0.030 - 3/64	130 - 175
	O	1	0.030 - 3/64	130 - 190
1/4	F	1	3/64 - 1/16	170 - 240
	V, H	1	3/64	170 - 210
	O	1	3/64 - 1/16	190 - 220
3/8	F	1	1/16	240 - 300
	V, H	3	1/16	190 - 240
	O	3	1/16	200 - 240
3/4	F	4	3/32	360 - 380
	V, H	4-6	1/16	260 - 310
	O	10	1/16	275 - 310

[1]F - Flat, V = Vertical, H = Horizontal, O = Overhead. [2]See joint designs on page 322. [3]For 5XXX series wires, use a welding current on the high side of the range and an arc voltage in the lower portion of the range. For 1XXX, and 4XXX series wires, use the lower currents and higher arc voltages. [4]Metal thickness of 3/4 in or greater for fillet welds sometimes employs a double vee bevel of 50° or greater included vee with 3/32 in to 1/8 in land thickness on the abutting member. [5]Number of weld passes and electrode consumption given for weld on one side only.

Aluminum

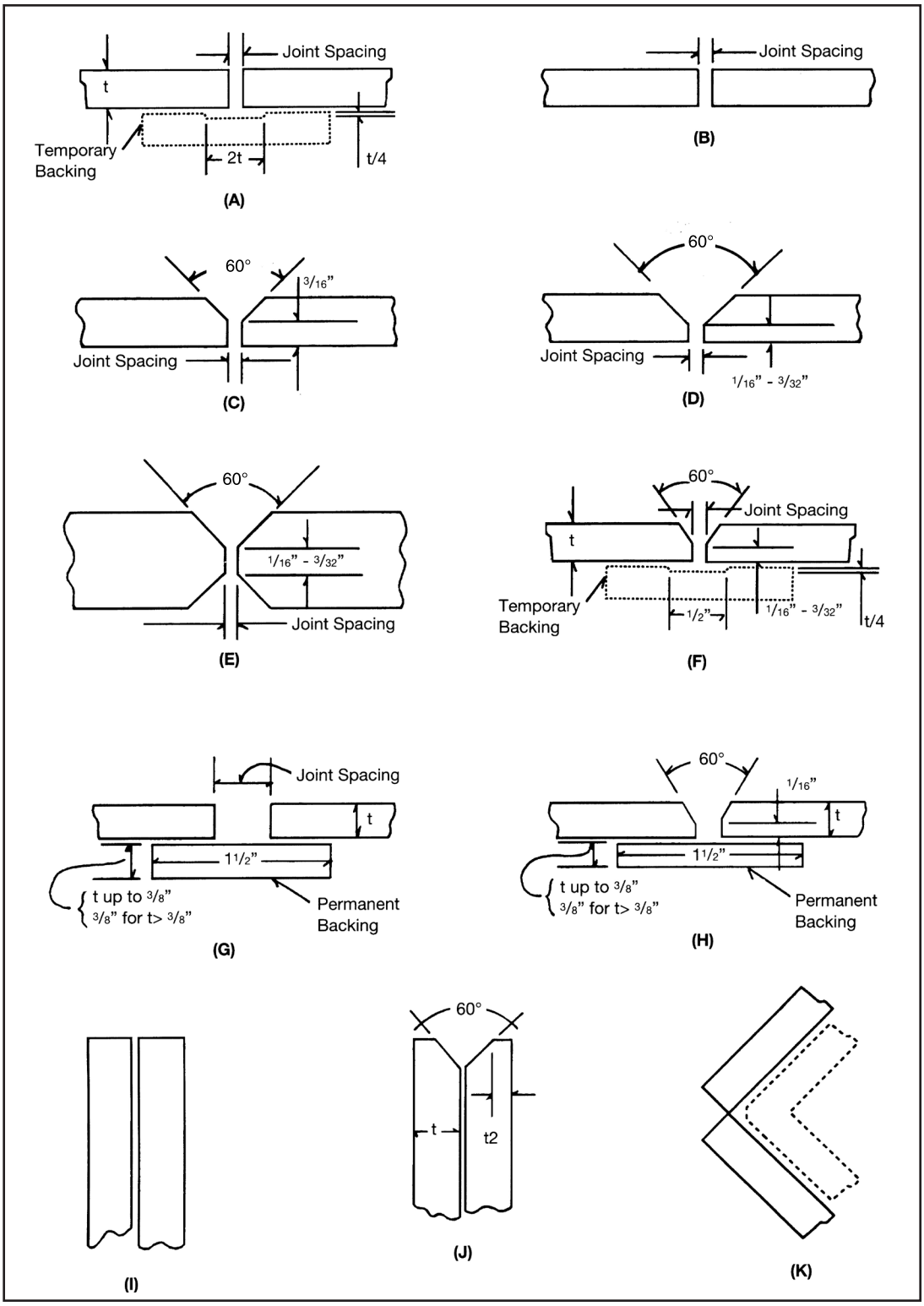
Typical Operating Procedures for Aluminum MIG Welding

DC+ Current[3] (Amps)	Arc Votlage[3] (Volts)	Argon Gas Flow (cfh)	Arc Travel Speed (ipm/pass)	Approx. Electrode Consump. (lb/100 ft)
70 - 110	15 - 20	25	25 - 45	1.5
70 - 110	15 - 20	25	25 - 45	2
120 - 150	20 - 24	30	24 - 30	2
110 - 135	19 - 23	30	18 - 28	3
130 - 175	22 - 26	35	24 - 30	4
140 - 180	23- 2 7	35	24 - 30	5
140 - 175	23 - 27	60	24 - 30	5
140 - 185	23 - 27	35	24 - 30	8
130 - 175	23 - 27	60	25 - 35	10
175 - 200	24 - 28	40	24 - 30	6
185 - 225	24 - 29	40	24 - 30	8
165 - 190	25 - 29	45	25 - 35	10
180 - 200	25 - 29	60	25 - 35	10
175 - 225	25 - 29	40	24 - 30	12
170 - 200	25 - 29	60	25 - 40	12
225 - 290	26 - 29	50	20 - 30	16
210 - 275	26 - 29	50	24 - 35	18
190 - 220	26 - 29	55	24 - 30	20
200 - 250	26 - 29	80	25 - 40	20
210 - 290	26 - 29	50	24 - 30	35
190 - 260	26 - 29	80	25 - 40	50
340 - 400	26 - 31	60	14 - 20	50
325 - 375	26 - 31	60	16 - 20	70
240 - 300	26 - 30	80	24 - 30	75
270 - 330	26 - 30	60	16 - 24	70
230 - 280	26 - 30	80	16 - 24	75

Arc Votlage[3] (Volts)	Argon Gas Flow (cfh)	Arc Travel Speed (ipm/pass)	Approx. Electrode Consump.[5] (lb/100 ft)
20 - 24	30	24 - 30	2
19 - 23	30	24 - 30	2
20 - 24	40	24 - 30	2
22 - 26	30	24 - 30	4.5
21 - 25	35	24 - 30	4.5
22 - 26	45	24 - 30	4.5
24 - 28	40	24 - 30	7
23 - 27	45	24 - 30	7
24 - 28	60	24 - 30	7
26 - 29	50	18 - 25	17
24 - 27	60	24 - 30	17
25 - 28	85	24 - 30	17
26 - 30	60	18 - 25	66
25 - 20	70	24 - 30	66
25 - 29	85	24 - 30	66

Aluminum

Typical Joint Designs for Aluminum MIG Welding



Innershield®
Wire Selection Guide

LOW TEMPERATURE IMPACT PROPERTIES

Name	AWS Classifications	Diameter in (mm)
All Position		
NR® -203MP	E71T-8J	0.068 (1.7) 5/64 (2.0)
NR®-203 Nickel (1%)	E71T8-Ni1	5/64 (2.0)
NR®-440Ni2	E71T8-Ni2-JH8	5/64 (2.0)
NR®-203 Ni C Plus H	E71T8-K2	5/64 (2.0)
NR®-232	E71T-8	0.068 (1.7) 0.072 (1.8) 5/64 (2.0)
NR®-233	E71T-8	1/16 (1.6) 0.072 (1.8) 5/64 (2.0)
Flat and Horizontal		
NR®-305	E70T-6	5/64 (2.0) 3/32 (2.4)
NR®-311 Ni	E70T-7-K2	5/64 (2.0) 3/32 (2.4) 7/64 (2.8)
NR®-FAB-70	E70T7-G	3/32 (2.4)

HIGH DEPOSITION WITH NO LOW TEMPERATURE IMPACT PROPERTIES

Name	AWS Classifications	Diameter in (mm)
Flat and Horizontal		
NR®-311	E70T-7	5/64 (2.0) 3/32 (2.4) 7/64 (2.8)
NS-3M	E70T-4	5/64 (2.0) 3/32 (2.4) 0.120 (2.8)

PIPE FABRICATION

Name	AWS Classifications	Diameter in (mm)
All Position		
NR®-207	E71T8-K6	0.068 (1.7) 5/64 (2.0)
NR®-208-H	E91T8-G-H8	5/64 (2.0)
Pipeliner®		
All Position		
NR®-208-XP	E81T8-G	5/64 (2.0)
NR®-207+	E71T-8-K6	5/64 (2.0)

FEMA 353 AND AWS D1.8 COMPLIANT

Name	AWS Classifications	Diameter in (mm)
Flat and Horizontal		
NR®-311 Ni	E70T-7-K2	3/32 (2.4)
NR®-FAB-70	E70T7-G	3/32 (2.4)
NR®-305	E70T-6	5/64 (2.0) 3/32 (2.4)
All Position		
NR®-232	E71T-8	0.068 (1.7) 0.072 (1.8) 5/64 (2.0)
NR®-233	E71T-8	1/16 (1.6) 0.072 (1.8) 5/64 (2.0)

SINGLE PASS ONLY WITH NO LOW TEMPERATURE IMPACT PROPERTIES

Name	AWS Classifications	Diameter in (mm)
Flat and Horizontal		
NR®-5	E70T-3	3/32 (2.4) 0.0120 (3.0)
NR®-131	E70T-10	3/32 (2.4)
NR®-152	E71T-14	1/16 (1.6) 0.068 (1.7)

GENERAL FABRICATION WITH NO LOW TEMPERATURE IMPACT PROPERTIES

Name	AWS Classifications	Diameter in (mm)
All Position		
NR®-211-MP	E71T-11	0.030 (0.8) 0.035 (0.9) 0.045 (1.1) 0.068 (1.7) 5/64 (2.0) 3/32 (2.4)
NR®-212	E71TG-G	0.045 (1.1) 0.068 (1.7) 5/64 (2.0)

Innershield®

Wire Selection Guide

POSITION OF WELDING, POLARITY AND APPLICATION REQUIREMENTS

AWS Classifications	Welding Position[1]	Current	Application[2]
E70T-3	H and F	DC+	S
E70T-4	H and F	DC+	M
E70T-6	H and F	DC+	M
E70T-7	H and F	DC-	M
E71T-8	H, F, VU, OH	DC-	M
E70T-10	H and F	DC-	S
E71T-11	H, F, VD, OH	DC-	M
E71T-14	H, F, VD, OH	DC-	S
E71T-G	VU, OH	Not Specified	M

[1] H = Horizontal position
F = Flat position
OH = Overhead position
VU = Vertical-Up position
VD = Vertical-Down position
[2] S = Single pass only
M = Single or Multiple pass

For everything you need to know about welding in seismic zones

To assist structural fabricators, erectors, inspectors and specifying engineers, Lincoln Electric created this D1.8 Resource Center with tools to understand seismic welding guidelines and links to Lincoln Electric consumables tested to meet the AWS D1.8 and FEMA 353 requirements. The development of Lincoln Electric's D1.8 Resource Center is just one more way Lincoln sets the standard for the welding industry, worldwide.

FEDERAL EMERGENCY MANAGEMENT AGENCY FEMA 353

AWS D1.8 Structural Welding Code Seismic Supplement

www.lincolnelectric.com/d1.8

Agency Approvals

Consumables Qualifications Guide

The notes and codes listed below are also repeated throughout the catalog where applicable.

- **American Bureau of Shipping (ABS)** approvals are issued subject to the Bureau's Rule requirement for Materials and Welding Part 2. Tests are conducted in the company's plant, under supervision of an ABS surveyor to determine if electrodes conform to ABS grades or AWS specifications previously judged satisfactory by ABS for welding vessels. The Bureau publishes a list of approved electrodes giving their class and approved operating positions for each size. Sometimes, where there is no approved specification, approval may be given on the basis that each individual shipyard or contractor will qualify the procedure and electrode subject to Part 2, Section 3, paragraph 2/3C.3.2.c.

- **American Society of Mechanical Engineers (ASME)** has issued specifications covering construction of nuclear facilities. Each lot of welding consumables to be used must be individually tested to ASME SFA specifications.

- **American Welding Society (AWS)** specifications and classifications are established by the Society to provide standards for different types of electrodes throughout the industry. AWS does not test or approve any electrodes. The manufacturer certifies that their electrode conforms to a certain class.

- **Canadian Welding Bureau (CWB)** approvals are based on tests witnessed by a CWB representative. Approvals listed in this booklet are for products manufactured in the USA. Products manufactured in Canada are approved separately. In general, CWB specifications are similar to AWS specifications. Copies of approvals are maintained in Cleveland and are available upon request.

- **Lloyd's Register (LR), Det Norske Veritas (DNV), Germanischer Lloyd (GL), Bureau Veritas (BV), Controlas, and Nippon Kaiji Kyokai (NKK)** issue approvals for electrodes used worldwide in shipbuilding, offshore structures and pressure vessels. Products approved under the rules of these classification societies require annual requalification under the supervision of their surveyors.

- **TÜV (TUV)** is a German agency very similar to ASME. Projects manufactured under TUV rules must be welded with consumable approved by TUV. Initial approvals are obtained based on testing completed under TUV supervision. Approvals are maintained subject to Quality Assurance audits completed every two years.

- **Deutche Bahn (DB)** is the approval agency for German railroads. Approvals are based on tests specified by DB, and witnessed by an authorized third party.

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Stick Electrode					
Fleetweld® 5P	A5.1/A5.1M: 2004	E6010	E6010	3M	-
Fleetweld® 5P+	A5.1/A5.1M: 2004	E6010	E6010	-	-
Fleetweld® 180	A5.1/A5.1M: 2004	E6011	-	-	-
Fleetweld® 35	A5.1/A5.1M: 2004	E6011	E6011	3M	-
Fleetweld® 35LS	A5.1/A5.1M: 2004	E6011	-	-	-
Fleetweld® 37	A5.1/A5.1M: 2004	E6013	E6013	3M	1
Fleetweld® 22	A5.1/A5.1M: 2004	E6022	-	-	-
Fleetweld® 47	A5.1/A5.1M: 2004	E7014	E7014	1M	1
Jetweld® 2	A5.1/A5.1M: 2004	E6027	E6027	3M	3
Jetweld® 1	A5.1/A5.1M: 2004	E7024-1	E7024-1	1M	1
Excalibur® 7018 MR®	A5.1/A5.1M: 2004	E7018, E7018 H4R	3Y H5	3YM H5	3 YH5
Jetweld® LH-70	A5.1/A5.1M: 2004	E7018 H4R	E7018, 3Y	3YM H5	3 Y40H5
Jet-LH® 78 MR®	A5.1/A5.1M: 2004	E7018 H4R	E7018	3YM H5	3 YH5
Lincoln® 7018AC	A5.1/A5.1M: 2004	E7018 H8	-	-	-
Excalibur® 7018-1 MR®	A5.1/A5.1M: 2004	E7018-1, E7018-1 H4R	3Y H5	3YM H5	3 YH5
Excalibur® 7028	A5.1/A5.1M: 2004	E7028 H8	E7028, 3Y H10 (Fillet Only)	3YM H10	3 YH10
Shield-Arc® HYP+	A5.5/A5.5M: 2006	E7010-P1, E7010-G	E7010-P1	-	-
Shield-Arc® 85	A5.5/A5.5M: 2006	E7010-A1	E7010-A1	-	-
Shield-Arc® 70+	A5.5/A5.5M: 2006	E8010-G, E8010-P1	E8010-G	-	-
Shield-Arc® 90	A5.5/A5.5M: 2006	E9010-G	-	-	-
Excalibur® 7018-A1 MR®	A5.5/A5.5M: 2006	E7018-A1 H4R	E7018-A1 H4R	-	-
Excalibur® 8018-B2 MR®	A5.5/A5.5M: 2006	E8018-B2 H4R	-	-	-
Excalibur® 8018-C1 MR®	A5.5/A5.5M: 2006	E8018-C1 H4R	-	-	-
Excalibur® 8018-C3 MR®	A5.5/A5.5M: 2006	E8018-C3 H4R	E8018-C3 H4R	-	-
Pipeliner® 18P	A5.5/A5.5M: 2006	E8018-G, E8018-G H4	E8018-G	-	-
Excalibur® 9018-B3 MR®	A5.5/A5.5M: 2006	E9018-B3 H4R	-	-	-
Excalibur® 9018M MR®	A5.5/A5.5M: 2006	E9018M H4R	E9018M H4R	-	-
Excalibur® 10018-D2 MR®	A5.5/A5.5M: 2006	E10018-D2 H4R	3YQ620 H5	3Y62 H5	3Y62 H5
Excalibur® 11018M MR®	A5.5/A5.5M: 2006	E11018M H4R	4YQ690 H5	-	4 YM69 H5
Chromet® 1X	A5.5	E8018-B2 H4	-	-	-
Chromet® 2X	A5.5	E9018-B3	-	-	-
Chromet® 9-B9	A5.5	E9015-B9	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

GL	BV Grade	CWB/CSA	DB	TUV	Military
Stick Electrode					
-	-	E4310	-	EN ISO 2560-A: E 42 3 C25	-
-	-	E4310	-	EN ISO 2560-A: E 42 3 C25	-
-	-	E4311	-	-	-
-	-	-	-	-	-
-	-	E4311	-	-	-
1	1	E4313	-	-	-
-	-	-	-	-	-
1	1	E4914	-	-	-
3	3	E4327	-	-	-
1	1	E4924-1	-	-	-
3YH5	3YHHH	E4918	-	-	-
3YH5	3YHHH	E4918-1	-	-	MIL-E-22200/1: MIL-7018
3YH5	3YHHH	E4918-1	-	-	-
-	-	E4918-H8	-	-	-
3YH5	3YHHH	E4918-1	-	DIN EN ISO 2560-A:E	-
-	-	E4928 H8	-	-	-
-	-	E4910-P1	-	DIN EN ISO 2560-A:E	-
-	-	E4910-A1	-	DIN EN ISO 2560-A:E	MIL-E-22200/7: MIL-7010-A1
-	-	E5510-G	-	DIN EN ISO 2560-A:E	-
-	-	-	-	-	-
-	-	E4918-A1	-	-	-
-	-	E5518-B2	-	-	-
-	-	E5518-C1	-	-	-
-	-	E5518-C3	-	-	-
-	-	-	-	-	-
-	-	E6218-B3	-	-	-
-	-	E6218-M H4R (9018M H4R)	-	-	-
-	-	E6918-D2	-	-	-
-	-	E7618-M H4R	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
MIG & TIG					
SuperGlide® S3	A5.18/A5.18M: 2005	ER70S-3	-	-	-
SuperGlide® S6	A5.18/A5.18M: 2005	ER70S-6	-	-	-
SuperArc® L-50®	A5.18/A5.18M: 2005	ER70S-3	3YSA	3YS H15	III YMS
SuperArc® L-56®	A5.18/A5.18M: 2005	ER70S-6	3YSA	3YS H5	III YMS
SuperArc® L-59®	A5.18/A5.18M: 2005	ER70S-6	3YSA (100% CO_2 & Mixed)	-	III YMS H5 (Mixed)
SuperArc® LA-75	A5.28/A5.28M: 2005	ER80S-Ni1	ER80S-Ni1	-	-
SuperArc® LA-90	A5.28/A5.28M: 2005	ER80S-D2 (100% CO_2) ER90S-D2 (Mixed)	-	-	-
SuperArc® LA-100	A5.28/A5.28M: 2005	ER100S-G (ER110S-G)	4YQ550SA	-	-
Lincoln® ER70S-2	A5.18/A5.18M: 2005	ER70S-2	-	-	-
Lincoln® ER70S-6	A5.18/A5.18M: 2005	ER70S-6	-	-	-
9CrMoV-N	A5.28	ER905-B9	-	-	-
Metal-Cored Wire					
Metalshield® MC-6®	A5.18/A5.18M: 2005	E70C-6M-H4	-	-	-
Metalshield® MC®-706	A5.18/A5.18M: 2005	E70C-6M-H4	E70C-6M H8	-	-
Metalshield® MC-710XL®	A5.18/A5.18M: 2005	E80C-Ni1 H4	-	-	-
Metalshield® MC®-80Ni1	A5.28/A5.28M: 2005	E70C-6M-H8, E70C-G-H8	-	-	-
Metalshield® MC®-90	A5.28/A5.28M: 2005	E90C-K3 H4	-	-	-
Metalshield® MC®-110	A5.28/A5.28M: 2005	E110C-K4 H4	-	-	-
Flux-Cored Wire (Self-Shielded)					
Innershield® NR®-5	A5.20/A5.20M: 2005	E70T-3	-	-	-
Innershield® NS-3M	A5.20/A5.20M: 2005	E70T-4	-	-	-
Innershield® NR®-305	A5.20/A5.20M: 2005	E70T-6-H16	-	-	-
Innershield® NR®-311	A5.20/A5.20M: 2005	E70T-7	E70T-7	-	-
Innershield® NR®-131	A5.20/A5.20M: 2005	E70T-10	-	-	-
Innershield® NR®-152	A5.20/A5.20M: 2005	E71T-14	-	-	-
Innershield® NR®-211-MP	A5.20/A5.20M: 2005	E71T-11	E71T-11	-	-
Innershield® NR®-203MP	A5.20/A5.20M: 2005	E71T-8-JH16	3YSA	3YS H15	III YMS H10
Innershield® NR®-232	A5.20/A5.20M: 2005	E71T-8-H16	3YSA	3YS H15	III YMS H15
Innershield® NR®-233	A5.20/A5.20M: 2005	E71T-8-H16	E71T-8-H16	-	-
Innershield® NR®-311 Ni	A5.29/A5.29M: 2010	E70T7-K2-H16, E80T-G-K2	2YSA	2YS	II YMS
Innershield® NR®-212	A5.29/A5.29M: 2005	E71TG-G	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

GL	BV Grade	CWB/CSA	DB	TUV	Military
MIG & TIG					
-	-	ER49S-3	-	-	-
-	-	ER49S-6	-	-	MIL-E-23765/1: MIL-70S-6
-	-	ER49S-3	-	-	MIL-E-23765/1: MIL-70S-3
-	-	ER49S-6	EN 440 G3Si1	EN 440 G3Si1	MIL-E-23765/1: MIL-70S-6
	SA3YHHH (Mixed)	ER49S-6	-	-	-
-	-	ER55S-Ni1 (ER80S-Ni1)	-	-	-
-	-	ER55S-D2 (ER80S-D2), ER62S-D2 (ER90S-D2)	-	-	MIL-E-23765/2: MIL-80S-3
-	-	ER69S-G (ER100S-G)	EN 12534 T 69 5 Mn3Ni1, 5 Mo	EN 12534 T 69 5 Mn3Ni1, 5 Mo	MIL-E-23765/2: MIL-100S-1
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Metal-Cored Wire					
-	-	E491C-6MJ-H4	-	-	-
-	-	E492C-6MJ-H4	-	-	-
-	-	E491C-6M-H8	-	-	-
-	-	E55C-Ni1 H4 (E80C-Ni1 H4)	-	-	-
-	-	E62C-K3 H4 (E90C-K3 H4)	-	-	-
-	-	E76C-K4 H4 (E110C-K4 H4)	-	-	-
Flux-Cored Wire (Self-Shielded)					
-	-	-	-	-	-
-	-	E492T-4-H16	EN 758 T38 Z W N 3	-	-
-	-	-	-	-	-
-	-	E492T-7	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	E491T-11-H16	EN 758 T42 Z S N 1	EN 758 T42 A S N 1	-
3YH15S	SA3YMH	E491T-8 H16	-	-	-
3YH10S	SA3YMH	E491T-8 H16	EN 758 T42 3 Y N 2	EN 758 T42 3 Y N 2	MIL-E-24403/1: MIL-71T-8AS
-	-	-	-	-	-
2YS	SA2YM	-	EN 758 T42 2 1, 5Ni W N 5	-	-
-	-	E491TG-G-H16 (E71TG-G H16)	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Flux-Cored Wire (Gas-Shielded)					
Innershield® NR®-203 Nickel (1%)	A5.29/A5.29M: 2005	E71T8-Ni1-H16	3YSA	3YS H15	III YMS H10
Innershield® NR®-440Ni2	5.29/A5.29M: 2010	E71T8-Ni2-JH8	4YSAH10	4YS H10	IV YMS H10
Innershield® NR®-207	A5.29/A5.29M: 2005	E71T8-K6-H16	E71T-8-K6	-	III YMS H15
Innershield® NR®-208-H	A5.29/A5.29M: 2005	E91T8-G-H8	-	-	-
UltraCore® 71A85	A5.20/A5.20M: 2005	E71T-1M-H8, E71T-9M-H8	3YSA H10	3YS H10	III YMS H10
UltraCore® HD-M	A5.20/A5.20M: 2005	E71T-1M-H8, E71T-9M-H8	3YSA H10	3YS H10	III YMS (H10)
UltraCore® 71C	A5.20/A5.20M: 2005	E71T-1C-H8, E71T-9C-H8	E71T-1C-H8, E71T-9C-H8	3YS H10	III YMS H10
UltraCore® HD-C	A5.20/A5.20M: 2005	E71T-1C-H8, E71T-9C-H8	3YSA H10	3YS H10	III YMS H10
UltraCore® 71A75 Dual	A5.20/A5.20M: 2005	E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8	-	-	-
UltraCore® 712C	A5.20/A5.20M: 2005	E71T-1C-JH8, E71T-9C-JH8, E71T-12C-JH8	3YSA H10	3YS H10	III YMS H10
UltraCore® 712A80	A5.20/A5.20M: 2005	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8	4YSA H10	4YS H10	IV YMS H10
UltraCore® 712A80-H	A5.20/A5.20M: 2005	E71T-1M-JH8, E71T-9M-JH8, E71T-12M-JH8	4YSA H5	4YS H5	IV YMS H5
Outershield® 71 Elite	A5.20/A5.20M: 2005	E71T-1C-H8, E71T-9C-H8, E71T-1M-H8, E71T-9M-H8	3SA, 3YSA H10	3YS H10	III YMS H10
Outershield® 71 Supreme	A5.20/A5.20M: 2005	E71T-1C-H4, E71T-1M-H4 E71T-9C-H4, E71T-9M-H4	-	-	-
Outershield® 71M	A5.20/A5.20M: 2005	E71T-1C-J, E71T-9C-J, E71T-1M-J, E71T-9M-J	3YSA H15[1]	3YS H15	III YMS H10
UltraCore® 70C	A5.20/A5.20M: 2005	E70T-1C, E70T-1C-H8, E70T-9C, E70T-9C-H8	-	-	-
UltraCore® 75C	A5.20/A5.20M: 2005	E70T-5C-JH4	-	-	II YMS H15
Outershield® 70	A5.20/A5.20M: 2005	E70T-1C-H16, E70T-9C-H16	2YSA	-	II YMS H15
UltraCore® 81Ni1A75-H	A5.29/A5.29M: 2005	E81T1-Ni1M-JH4	4YQ460SA H5	4Y46S H5	IV 46MS H5
UltraCore® 81Ni1C-H	A5.29/A5.29M: 2005	E81T1-Ni1C-JH4	4YQ460SA H5	4Y46S H5	IV Y46MS H5
UltraCore® 81Ni2A75-H	A5.29/A5.29M: 2005	E81T1-Ni2M-JH4	3YSA H5	3YS H5	III Y40MS H5
UltraCore® 81Ni2C-H	A5.29/A5.29M: 2005	E81T1-Ni2C-JH4	3YSA H5	3YS H5	III Y40MS H5
UltraCore® 81K2A75-H	A5.29/A5.29M: 2005	E81T1-K2M-JH4	4YQ460SA H5	4Y46S H5	IV 46MS H5
UltraCore® 81K2C-H	A5.29/A5.29M: 2005	E81T1-K2C-JH4	4YQ460SA H5	4Y46S H5	IV 46MS H5
UltraCore® HD-12C	A5.20/5.20M:	E71T-1CJ, E71T-9CJ, E71T-12CJ H8	-	-	-

[1]Only for 0.045 in (1.1 mm), 0.052 in (1.3 mm) and 1/16 in. (1.6 mm) diameters.

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

GL	BV Grade	CWB/CSA	DB	TUV	Military
Flux-Cored Wire (Gas-Shielded)					
-	-	E491T8-Ni1 H16 (E71TG-G-H16)	EN 758 T42 3 1 Ni Y N	EN 758 T42 3 1 Ni Y N	-
	-	-	-	-	-
3YH15S	SA3YMH	-	-	-	-
-	-	-	-	-	-
-	-	E491T-9M H8	-	-	-
-	-	E491T-1M-H8, E491T-9M-H8	-	-	-
-	-	E491T-9 H8	-	-	-
-	-	E491T-9-H8	-	-	-
-	-	E491T-9 H8, E491T-9M H8	-	-	-
-	-	E491T-12J H8, E491T-9J H8	-	-	-
-	-	E491T-12MJ-H8, E491T-9MJ-H8	-	-	-
-	-	E491T-12MJ H4, E491T-9MJ H4	-	-	-
3YH10S	-	E491T-9-H8, E491T-9M-H8	-	-	-
-	-	E491T-9-H4, E491T-9M-H4	-	-	-
-	SA3YH (CO_2 only)	E491T-9, E491T-9M	-	-	MIL-E-24403/1: MIL-71T-1C, MIL-71T-1M
-	-	E492T-9 H8	-	-	-
-	-	E492T-5J H4	-	-	-
-	-	E492T-9 H16	-	EN 758 T 46 0 R C3 / M3 H10	MIL-E-24403/1: MIL-70T-1C
-	-	E551T1-Ni1M-JH4 (E81T1-Ni1M-JH4)	-	-	-
-	-	E551T1-Ni1C-JH4 (E81T1-Ni1C-JH4)	-	-	-
-	-	E551T1-Ni2M-JH4 (E81T1-Ni2M-JH4)	-	-	-
-	-	E551T1-Ni2C-JH4 (E81T1-Ni2C-JH4)	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Agency Approvals

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PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Flux-Cored Wire (Gas-Shielded)					
UltraCore® HD-12M	A5.20/5.20M:	E71T-1MJ, E71T-9MJ, E71T-12MJ H8	-	-	-
UltraCore® SR-12C	A5.20/5.20M:/ A5.36:	E71T-12C-JH8/ E71T12-C1A5-CS2-H8, E71T12-C1P5-CS2-H8	-	-	-
UltraCore® SR-12M	A5.36/5.36M:/ A5.36/5.36M:	E71T-12M J/ E71T12-M21A5-CS2-H8, E71T12-M21P5-CS2-H8	-	-	-
Outershield® 91K2-H	A5.29/A5.29M: 2005	E91T1-K2M-H8	E91T1-K2M-H8	-	-
Pipeliner® G90M	A5.29/A5.29M: 2005	E111T1-K3M-JH8	E111T1-K3MJ-H8	-	-
Cormet® 1	A5.29	E81T1-B2C/M-H4/ QW432 F-No 6, QW442 A-No 3	-	-	-
Cormet® 2	A5.29	E91T1-B3C/M-H4/ QW432 F-No 6, QW442 A-No 4	-	-	-
Supercore® F91	A5.28	E91T1-B9C/M-H4	-	-	-
Submerged Arc					
760® / L-61®	A5.17/A5.17M: 1997	F7A2-EM12K	-	-	-
761® / L-60	A5.17/A5.17M: 1997	F7A2-EL12-H8	F7A2-EL12-H8[2]	-	-
761® / L-61®	A5.17/A5.17M: 1997	F7A2-EM12K-H8	F7A2-EM12K-H8[2]	3M, 3YM	III YM
761® / L-70	A5.23/A5.23M: 2007	F9A0-EA1-G	3YM, 3YT	-	III YM, III YMT
780® / L-60	A5.17/A5.17M: 1997	F7A0-EL12-H8	F7A0-EL12-H8[2]	2M, 2YM	II YM, II YTM
780® / L-61®	A5.17/A5.17M: 1997	F7A2-EM12K	F7A2-EM12K-H8[2]	2M, 2YM	II YM, II YTM
781™ / L-50®	A5.17/A5.17M: 1997	F7A0-EM13K	-	-	III YM, III YTM
781™ / L-61®	A5.17/A5.17M: 1997	F7A0-EM12K	-	-	-
8500™ / L-61®	A5.17/A5.17M: 1997	F7A6-EM12K-H8	4YM	4YM H10	IV YM
8500™ / LA-85	A5.23/A5.23M: 2007	F8A8-ENi5-Ni5-H8	4YM, 5YQ460M	5Y46M H10	V YM46 H10
8500™ / L-S3	A5.17/A5.17M: 1997	F7A8-EH12K-H8	4YM, 4YQ420M	4YM H10	IV YM
860® / L-60	A5.17/A5.17M: 1997	F6A2-EL12-H8	F6A2-EL12-H8[2]	-	-
860® / L-61®	A5.17/A5.17M: 1997	F7A4-EM12K-H8	F7A2-EM12K-H8[2]	3M, 3YM	III YM, II YT
860® / L-70	A5.17/A5.17M: 1997	F7A2-EA1-A2-H8	-	-	-
860® / LA-85	A5.23/A5.23M: 2007	F8A4-ENi5-Ni5-H8	F8A4-ENi5-H8	-	-
880™ / LAC-Ni2	A5.23/A5.23M: 2007	F7A6-ECNi2-Ni2-H8	F7P10-ECNi2-Ni2-H8[2]	-	-
880M® / L-50®	A5.17/A5.17M: 1997	F7A8-EM13K-H8	3YM	3M, 3YM	V YM
880M® / L-56®	A5.17/A5.17M: 1997	F7A6-EH11K-H8	4YM	-	IV YM

[2]ABS to AWS Classification

Agency Approvals

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GL	BV Grade	CWB/CSA	DB	TUV	Military
Flux-Cored Wire (Gas-Shielded)					
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Submerged Arc					
-	-	-	-	-	MIL-E-23765/4: MIL-F7A2-EM12
-	-	F49A3-EL12	-	-	-
3YM	A3YM	F49A3-EM12K-H8	-	-	MIL-E-23765/4: MIL-F7A2-EM12K
-	-	F62A2-EA1-G (F9A0-EA1-G)	-	-	-
2YM, 2YTM	-	F49A2-EL12	-	-	MIL-E-23765/4: MIL-F7A0-EL12
	A2YTM	F49A3-EM12K	-	-	MIL-E-23765/4: MIL-F7A2-EM12K
-	-	F49A2-EM13K	-	-	-
-	-	F49A2-EM12K	-	-	-
4YM	-	-	-	-	-
4YM	-	-	-	-	-
4YM	-	-	-	-	-
-	-	-	-	-	MIL-E-23765/4: MIL-F6A2-EL12
3YM, 2YT	A3YM, A2YT	F49A4-EM12K	-	-	MIL-E-23765/4: MIL-F7A2-EM12K
-	-	-	-	-	MIL-E-23765/4: MIL-F7A2-EA1-A2
-	-	-	-	-	-
-	-	-	-	-	-
-	-	F49A5-EM13K	-	-	-
-	-	-	-	-	-

Agency Approvals

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PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Submerged Arc					
880M® / LA-71	A5.17/A5.17M: 1997	F7A8-EM14K-H8	5YQ460M H5	5Y46M H5	V Y46MH5
880M® / LAC-M2	A5.23/A5.23M: 2007	F11A6-ECM2-M2-H8	F11A6-ECM2-M2-H8[2]	-	-
882™ / L-61®	A5.17/A5.17M: 1997	F7A6-EM12K-H8	F7A6-EM12K-H8[2]	-	-
888™ / L-56®	A5.17/A5.17M: 1997	F8A6-EH11K-G-H4	4YQ500M H5	5Y50M H5	V Y50M H5
888™ / L-S3	A5.17/A5.17M: 1997	F7A8-EH12K-H4	4YQ420M	-	IV YM42
888™ / LA-82	A5.23/A5.23M: 2007	F10A8-EF2-F2-H4	4YQ550M H5, 4YQ620M	4Y55M H5	IV Y55M H5
888™ / LA-84	A5.23/A5.23M: 2007	F9A8-EF3-F3-H4	4YQ550M	4Y55 H5	IV Y55
888™ / LA-85	A5.23/A5.23M: 2007	F8A6-ENi5-Ni5-H4	5YQ500M H5	5Y46M H5	V Y50M H5
888™ / LA-90	A5.23/A5.23M: 2007	F9A6-EA3K-A3-H4	-	-	-
888™ / LAC-M2	A5.23/A5.23M: 2007	F12A8-ECG-G-H8	4YQ690M	-	IV YM69
888™ / LAC-690	A5.23/A5.23M: 2007	F11A10-ECG-G-H4	5YQ690M H5	5Y69MH5	VY69H5
960® / L-50®	A5.17/A5.17M: 1997	F7A2-EM13K-H8	F7A2-EM13K-H8[2]	-	-
960® / L-61®	A5.17/A5.17M: 1997	F7A2-EM12K-H8	F7A2-EM12K-H8[2]	-	-
960® / LA-75	A5.23/A5.23M: 2007	F8A2-ENi1K-Ni1-H8	-	-	-
980™ / L-50®	A5.17/A5.17M: 1997	F7A2-EM13K-H8	-	-	-
980™ / L-61®	A5.17/A5.17M: 1997	F7A2-EM12K-H8	-	-	-
980™ / LA-75	A5.23/A5.23M: 2007	F7A2-ENi1K-Ni1-H8	-	-	-
980™ / LC-72	A5.17/A5.17M: 1997	F7A2-EC1-H8	-	-	-
A-XXX 10™ / L-61®	A5.17/A5.17M: 1997	F7A4-EM12K-Ni1-H8	-	-	-
MIL800-H™ / LA-82	A5.23/A5.23M: 2007	F10A6-EF2-F2-H2	4YQM620 H5	4Y62M H5	IV YM62 H5
MIL800-H™ / LA-85	A5.23/A5.23M: 2007	F9A4-ENi5-G-H2	-	-	-
P223™ / L-S3	A5.17/A5.17M: 1997	F7A8-EH12K-H8	-	-	-
WTX™ / L-61®	A5.17/A5.17M: 1997	F7A8-EM12K-H8	-	-	-
Lincolnweld® 980™	-	-	-	-	-
Lincolnweld® L-50®	A5.17/A5.17M: 1997	EM13K	-	-	-
Lincolnweld® L-56®	A5.17/A5.17M: 1997	EH11K	-	-	-
Lincolnweld® L-60	A5.17/A5.17M: 1997	EL12	-	-	-
Lincolnweld® L-61®	A5.17/A5.17M: 1997	EM12K	-	-	-
Lincolnweld® L-70	A5.23/A5.23M: 1997	EA1	-	-	-

[2]ABS to AWS Classification

Agency Approvals

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GL	BV Grade	CWB/CSA	DB	TUV	Military
Submerged Arc					
-	-	-	-	-	-
-	-	-	-	-	-
-	-	F49A6-EM12K	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	F62A5-EA3K-A3-H4 (F9A6-EA3K-A3-H4)	-	-	-
-	-	-	-	-	-
6Y69MH5	-	-	-	-	-
-	-	-	-	-	-
-	-	F49A3-EM12K	-	-	MIL-E-23765/4: MIL-F7A2-EM12K
-	-	F55A3-ENi1K-Ni1 (F8A2-ENi1K-Ni1)	-	-	-
-	-	F49A3-EM13K	-	-	-
-	-	F49A3-EM12K	-	-	-
-	-	F55A3-ENi1K-Ni1 (F8A2-ENi1K-Ni1)	-	-	-
-	-	F49A3-EC1	-	-	-
-	-	F49A4-EM12K-Ni1 (F7A4-EM12K-Ni1)	-	-	-
-	-	-	-	-	-
-	-	F9A4-ENi5-G-H2 (F62A4-ENi5-G-H2)	-	-	-
-	-	F49A6-EH12K-H8	-	-	-
-	-	F49A6-EM12K-H8	-	-	-
-	-	-	-	-	MIL-E-23765/1E: MIL-70S-3F
-	-	-	-	-	MIL-E-23765/1D &1E: MIL-70S-3
-	-	-	-	-	MIL-E-23765/1D & 1E: MIL-70S-6
-	-	-	-	-	MIL-E-23765/4: MIL-EL12
-	-	-	-	-	MIL-E-23765/4: MIL-EM12K
-	-	-	-	-	MIL-E-23765/4: MIL-EA1

Agency Approvals

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PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Submerged Arc					
Lincolnweld® LA-100	A5.23/A5.23M: 1997	EM2	-	-	-
Lincolnweld® MIL800-H®	-	-	-	-	-
Lincolnweld® 880™	-	-	-	-	-
Lincolnweld® 842-H™	A5.17/A5.17M: 1997, A5.23/A5.23M:2011	-	5YQM420 H5, 5YQM500 H5, 5YQM550 H5 (AC/DC+)	-	VYM42 H5, VYM50 HD, VYM55 H5 (AC/DC+)
Stainless					
Excalibur® 308/308L-15	A5.4/A5.4M: 2006	E308-15, E308L-15	E308-15, E308L-15	-	-
Excalibur® 308L-16	A5.4/A5.4M: 2006	E308L-16	E308L-16	-	-
Excalibur® 308/308H-16	A5.4/A5.4M: 2006	E308-16, E308H-16	E308-16, E308H-16	-	-
Excalibur® 308/308L -17	A5.4/A5.4M: 2006	E308-17, E308L-17	-	-	-
Excalibur® 309/309L-15	A5.4/A5.4M: 2006	E309-15, E309L-15	E309-15, E309L-15	-	-
Excalibur® 309/309L-16	A5.4/A5.4M: 2006	E309-16, E309L-16	E309-16, E309L-16	-	-
Excalibur® 309/309L-17	A5.4/A5.4M: 2006	E309-17 / E309L-17	E309-17 / E309L-17	-	-
Excalibur® 316/316L-15	A5.4/A5.4M: 2006	E316-15, E316L-15	E316-15, E316L-15	-	-
Excalibur® 316/316L-16	A5.4/A5.4M: 2006	E316-16, E316L-16	E316-16, E316L-16	-	-
Excalibur® 316/316L-17	A5.4/A5.4M: 2006	E316-17, E316L-17	-	-	-
Blue Max® MIG 308LSi	A5.9/A5.9M: 2006	ER308Si/ ER308LSi	ER308Si/ ER308LSi	-	-
Blue Max® MIG 309LSi	A5.9/A5.9M: 2006	ER309Si/ ER309LSi	ER309Si/ ER309LSi	-	-
Blue Max® MIG 316LSi	A5.9/A5.9M: 2006	ER316Si/ ER316LSi	ER316Si/ ER316LSi	-	-
Blue Max® LNM 307	-	-	-	-	-
Blue Max® LNM 347Si	A5.9/A5.9M: 2006	ER347Si	-	-	-
UltraCore® FC 308L	A5.22/A5.22M: 1995	E308LT0-1, E308LT0-4, E308T0-1, E308T0-4	E308LT0-1, E308LT0-4, E308T0-1, E308T0-4	-	-
UltraCore® FCP 308L	A5.22/A5.22M: 1995	E308LT1-1, E308LT1-4, E308T1-1, E308T1-4	E308LT1-1, E308LT1-4, E308T1-1, E308T1-4	-	-
UltraCore® FC 309L	A5.22/A5.22M: 1995	E309LT0-1, E309LT0-4, E309T0-1, E309T0-4	E309LT0-1, E309LT0-4, E309T0-1, E309T0-4	-	-
UltraCore® FCP 309L	A5.22/A5.22M: 1995	E309LT1-1, E309LT1-4, E309T1-1, E309T1-4	E309LT1-1, E309LT1-4, E309T1-1, E309T1-4	-	-
UltraCore® FC 316L	A5.22/A5.22M: 1995	E316LT0-1, E316LT0-4, E316T0-1, E316T0-4	E316LT0-1, E316LT0-4, E316T0-1, E316T0-4	-	-

Agency Approvals

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GL	BV Grade	CWB/CSA	DB	TUV	Military
Submerged Arc					
-	-	-	-	-	MIL-E-23765/2D and /2E: MIL-100S-1 or MIL-100S-2 (with MIL800-H) NAVSEA Technical Publication T9074-BC-GIB-010/0200
-	-	-	-	-	MIL-E-23765/2D & 2E: MIL-100S-2F or MIL-100S-1F NAVSEA Technical Publication T9074-BC-GIB-010/0200
-	-	-	-	-	-
-	-	-	ISO 26304-A-S 55 6 FB S3Ni1Mo, ISO 1417-A-S 50 6 FBSZ, ISO 1417-A-S 46 6 FB S3Si	ISO 26304-A-S 55 6 FB S3Ni1Mo, ISO 1417-A-S 50 6 FBSZ, ISO 1417-A-S 46 6 FB S3Si	-
Stainless					
-	-	-	-	-	-
-	-	E308L-16	-	-	MIL-E-22200/2: MIL-308L-16
-	-	E308-16, E308H-16	-	-	MIL-E-22200/2: MIL-308-16
-	-	E308-17, E308L-17	-	-	-
-	-	-	-	-	-
-	-	E309-16, E309L-16	-	-	MIL-E-22200/2: MIL-309-16, MIL-309L-16
-	-	E309-17, E309L-17	-	-	-
-	-	E316-15, E316L-15	-	-	-
-	-	E316L-16	-	-	MIL-E-22200/2: MIL-316-16, MIL-316L-16
-	-	E316-17, E316L-17	-	-	-
-	-	ER308LSi	-	-	-
-	-	ER309LSi	-	-	-
-	-	ER316LSi	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	E308LT0-1, E308LT0-4	-	-	-
-	-	E308LT1-1, E308LT1-4	-	-	-
-	-	E309LT0-1, E309LT0-4	-	-	-
-	-	E309LT1-1, E309LT1-4	-	-	-
-	-	E316LT0-1, E316LT0-4	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Stainless					
UltraCore® FCP 316L	A5.22/A5.22M: 1995	E316LT1-1, E316LT1-4, E316T1-1, E316T1-4	E316LT1-1, E316LT1-4, E316T1-1, E316T1-4	-	-
Blue Max® 308/308L	A5.9/A5.9M: 2006	ER308, ER308L	ER308, ER308L	-	-
Blue Max® 309/309L	A5.9/A5.9M: 2006	ER309, ER309L	ER309, ER309L	-	-
Blue Max® 316/316L	A5.9/A5.9M: 2006	ER316, ER316L	ER316, ER316L	-	-
Lincoln® ER308/308L	A5.9/A5.9M: 2006	ER308, ER308L	-	-	-
Lincoln® ER309/309L	A5.9/A5.9M: 2006	ER309, ER309L	-	-	-
Lincoln® ER316/316L	A5.9/A5.9M: 2006	ER316, ER316L	-	-	-
Outershield® MC-409	A5.9/A5.9M: 2006	EC 409	-	-	-
PRIMALLOY™ T-409Ti	A5.9/A5.9M	EC409	-	-	-
PRIMALLOY™ T-439Ti	A5.9/A5.9M	EC439	-	-	-
Tech-Rod® 308/308H	A5.4/A5.4M: 2010	E308-16/308H-16	-	-	-
Tech-Rod® 308/308L	A5.4/A5.4M: 2010	E308-16/308L-16	-	-	-
Tech-Rod® 309/309L	A5.4/A5.4M: 2010	E309-16/309L-16	-	-	-
Tech-Rod® 310	A5.4/A5.4M: 2010	E310-16	-	-	-
Tech-Rod® 312	A5.4/A5.4M: 2010	E312-16	-	-	-
Tech-Rod® 316/316L	A5.4/A5.4M: 2010	E316-16/E316L-16	-	-	-
Tech-Rod® 317L	A5.4/A5.4M: 2010	E317L-16	-	-	-
Tech-Rod® 320LR	A5.4/A5.4M: 2010	E320LR-16	-	-	-
Tech-Rod® 330	A5.4/A5.4M: 2010	E330-16	-	-	-
Tech-Rod® 347	A5.4/A5.4M: 2010	E347-16	-	-	-
Tech-Rod® 385	A5.4/A5.4M: 2010	E385-16	-	-	-
Tech-Rod® 410	A5.4/A5.4M: 2010	E410-16	-	-	-
Tech-Rod® 410NiMo	A5.4/A4.5M: 2010	E410NiMo-16	-	-	-
Tech-Rod® 2209	A5.4/A4.5M: 2010	E2209-16	-	-	-
Tech-Rod® 2594	A5.4/A4.5M: 2010	E2594-16	-	-	-
Tech-Rod® 630	A5.4/A4.5M: 2010	E630-16	-	-	-
Techalloy® 307	-	-	-	-	-
Techalloy® 308/308H	A5.9/A5.9M: 2006	ER308H	-	-	-
Techalloy® 308/308L	A5.9/A5.9M: 2006	ER308L	-	-	-
Techalloy® 308LHS	A5.9	ER308LSi	-	-	-
Techalloy® 309/309L	A5.9/A5.9M: 2006	ER309L	-	-	-
Techalloy® 309LHS	A5.9/A5.9M: 2006	ER309LSi	-	-	-
Techalloy® 309LMo	A5.9/A5.9M: 2006	ER309LMo	-	-	-
Techalloy® 310	A5.9/A5.9M: 2006	ER310	-	-	-

Agency Approvals

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Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

GL	BV Grade	CWB/CSA	DB	TUV	Military
Stainless					
-	-	E316LT1-1, E316LT1-4	-	-	-
-	-	ER308L	-	-	-
-	-	ER309L	-	-	-
-	-	ER316L	-	-	-
-	-	-	-	-	-
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-	-	EC409	-	-	-
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Agency Approvals

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PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Stainless					
Techalloy® 312	A5.9/A5.9M: 2006	ER312	-	-	-
Techalloy® 316/316L	A5.9/A5.9M: 2006	ER316L	-	-	-
Techalloy® 316LHS	A5.9/A5.9M: 2006	ER316LSi	-	-	-
Techalloy® 317L	A5.9/A5.9M: 2006	ER317L	-	-	-
Techalloy® 320LR	A5.9/A5.9M: 2006	ER320LR	-	-	-
Techalloy® 330	A5.9/A5.9M: 2006	ER330	-	-	-
Techalloy® 347	A5.9/A5.9M: 2006	ER347	-	-	-
Techalloy® 385	A5.9/A5.9M: 2006	ER385	-	-	-
Techalloy® 409Nb	A5.9/A5.9M: 2006	ER409Nb	-	-	-
Techalloy® 410	A5.9/A5.9M: 2006	ER410	-	-	-
Techalloy® 410NiMo	A5.9/A5.9M: 2006	ER410NiMo	-	-	-
Techalloy® 630	A5.9/A5.9M: 2006	ER630	-	-	-
Techalloy® 2209	A5.9/A5.9M: 2006	ER2209	-	-	-
Techalloy® 2594	A5.9/A5.9M: 2006	ER2594	-	-	-
Supercore® 347	A5.28	E347T0-1/4	-	-	-
Supercore® 2205P	A5.22	E2209T1-1/4	-	-	-
Cast Iron					
Softweld® 55Ni	A5.15: 1990	ENiFe-CI	-	-	-
Softweld® 99Ni	A5.15: 1990	ENi-CI	-	-	-
Ferroweld®	A5.15: 1990	ESt	-	-	-
Aluminum					
SuperGlaze® 4043	A5.10/A5.10M: 1999	ER4043	-	-	-
SuperGlaze® 4047	A5.10/A5.10M: 1999	ER4047	-	-	-
SuperGlaze® 5183	A5.10/A5.10M: 1999	ER5183	IACS W26 Grade WC	WC/I-1 S	5183
SuperGlaze® 5356	A5.10/A5.10M: 1999	ER5356	IACS W26 Grade WB	WB/I-1 S	5356
SuperGlaze® 5356 TM™	A5.10/A5.10M: 1999	ER5356	-	-	-
SuperGlaze® 5554	A5.10/A5.10M: 1999	ER5554	-	-	-
SuperGlaze® 5556	A5.10/A5.10M: 1999	ER5556	IACS W26 Grade WC	-	-
SuperGlaze® 4043	A5.10/A5.10M: 1999	ER4043	-	-	-
SuperGlaze® 5356	A5.10/A5.10M: 1999	ER5356	-	-	-
Nickel					
Supercore® 625P	A5.34/A5.34M	ENiCrMo3T1-4	-	-	-
Tech-Rod® 55	A5.15/A5.15M: 1990	ENiFe-CI/ QSC-395	-	-	-
Tech-Rod® 99	A5.15/A5.15M: 1990	ENi-CI/ QSC-395	-	-	-
Tech-Rod® 112	A5.11/A5.11M: 2010	ENiCrMo-3/ QSC-395	-	-	-

Agency Approvals

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Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

GL	BV Grade	CWB/CSA	DB	TUV	Military
Stainless					
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Cast Iron					
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Aluminum					
-	-	ER4043	-	-	-
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RAlMg4,5	WC	ER5183	-	-	-
RAlMg4	WB	ER5356	-	-	-
-	-	ER5356	-	-	-
-	-	ER5554	-	-	-
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Nickel					
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Agency Approvals

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PRODUCT	AWS Code	AWS/ASME CLASS	ABS Grade	Lloyd's Register Grade	DNV Grade
Nickel					
Tech-Rod® 112LFe	A5.11/A5.11: 2010	ENiCrMo-3/ QSC-395	-	-	-
Tech-Rod® 117	A5.11/A5.11M: 2010	ENiCrCoMo-1/ SFA-A5.4 ENiCrCoMo-1	-	-	-
Tech-Rod® 122	A5.11/A5.11M: 2010	ENiCrMo-10/ SFA-A5.4 ENiCrMo-10	-	-	-
Tech-Rod® 141	A5.11/A5.11M: 2010	ENi-1/ SFA-A5.4 ENi-1	-	-	-
Tech-Rod® 182	A5.11/A5.11M: 2010	ENiCrFe-3/ SFA-A5.4 ENiCrFe-3	-	-	-
Tech-Rod® 187	A5.6/A5.6M: 2008	ECuNi/ SFA-A5.4 ECuNi	-	-	-
Tech-Rod® 190	A5.11/A5.11M: 2010	ENiCu-7/ SFA-A5.4 ENiCu-7	-	-	-
Tech-Rod® 276	A5.11/A5.11M: 2010	ENiCrMo-4/ SFA-A5.4 ENiCrMo-4	-	-	-
Tech-Rod® Weld A	A5.11/A5.11M: 2010	ENiCrFe-2/ QSC-395	-	-	-
Techalloy® 55	A5.15/A5.15M: 1990	ENiFe-CI	-	-	-
Techalloy® 99	A5.15/A5.15M: 1990	ERNi-CI	-	-	-
Techalloy® 208	A5.14	ERNi-1	-	-	-
Techalloy® 276	A5.14	ERNiCrMo-4	-	-	-
Techalloy® 413	A5.7	ERCuNi	-	-	-
Techalloy® 418	A5.14	ERNiCu-7	-	-	-
Techalloy® 606	A5.14	ERNiCr-3	-	-	-
Techalloy® 617	A5.14	ERNiCrCoMo-1	-	-	-
Techalloy® 622	A5.14	ERNiCrMo-10	-	-	-
Techalloy® 625	A5.14	ERNiCrMo-3	-	-	-
Techalloy® 718	A5.14	ERNiFeCr-2	-	-	-
Techalloy® 825	A5.14	ERNiFeCr-1	-	-	-

Agency Approvals

NOTE: Approvals are updated periodically.

Consult your Lincoln Electric representative or the latest Approval/Grade revisions.

GL	BV Grade	CWB/CSA	DB	TUV	Military
Nickel					
-	-	-	-	-	-
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-	-	-	-	-	-
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Safety Guidelines

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

For Diesel Engines	For Gasoline Engines
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.	The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

⚠ FOR ENGINE powered equipment. ⚠

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

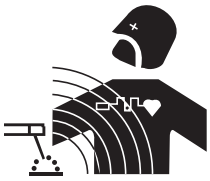
1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

Safety Guidelines



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.
In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

Safety Guidelines

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.

5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

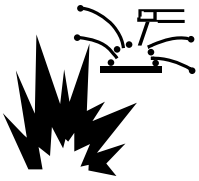
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

Safety Guidelines



WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

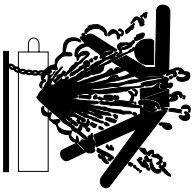
6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B “Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

Safety Guidelines



CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:
- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

Safety Guidelines

Safety Practices in Welding

⚠ WARNING

FUMES & GASES can be dangerous to your health

- **Keep fumes and gases from your breathing zone and general area.**
- **Keep your head out of the fumes.**
- **Use enough ventilation or exhaust at the arc, or both, to keep fumes and gases from your breathing zone and general area.**

Fumes and Gases

Because of the variables involved in fume and gas generation from arc welding, cutting and allied processes (such as the welding process and electrode, the base metal, coatings on the base metal, and other possible contaminants in the air), we'll have to treat the subject in a rather general way, lumping all but the more hazardous situations together. The precautions we describe will hold true for all arc welding processes.

The **fume plume** contains solid particles from the consumables, base metal, and base metal coating. For common mild steel arc welding, depending on the amount and length of exposure to these fumes, most immediate or short term effects are temporary, and include symptoms of burning eyes and skin, dizziness, nausea, and fever. For example, zinc fumes can cause metal fume fever, a temporary illness that is similar to the flu.

Long-term exposure to welding fumes can lead to siderosis (iron deposits in the lungs) and may affect pulmonary function. Bronchitis and some lung fibrosis have been reported.

Some consumables contain certain compounds in amounts which may require special ventilation and/or exhaust. These Special Ventilation products can be identified by reading the labels on the package. If Special Ventilation products are used indoors, use local exhaust. If Special Ventilation products are used outdoors, a respirator may be required. Various compounds, some of which may be in welding fume, and reported health effects, in summary, are:

Barium: Soluble barium compounds may cause severe stomach pain, slow pulse rate, irregular heart beat, ringing of the ears, convulsions and muscle spasms. In extreme cases can cause death.

Cadmium also requires extra precautions. This toxic metal can be found on some steel and steel fasteners as a plating, or in silver solder. Cadmium fumes can be fatal even under brief overexposures, with symptoms much like those of metal fume fever. These two conditions should not be confused. Overexposure to cadmium can be enough to cause fatalities, with symptoms appearing quickly, and, in some circumstances, death a few days later.

Chromium: Chromium is on the IARC (International Agency for Research on Cancer) and NTP (National Toxicology Program) lists chromium as posing a carcinogenic risk to humans. Fumes from the use of stainless steel, hardfacing and other types of consumables contain chromium and/or nickel. Some forms of these metals are known or suspected to cause lung cancer in processes other than welding and asthma has been reported. Therefore, it is recommended that precautions be taken to keep exposures as low as possible. OSHA recently adopted a lower PEL (Permissible Exposure Limit) for chromium (see Supplement 3). The use of local exhaust and/or an approved respirator may be required to avoid overexposure.

Coatings on the metal to be welded, such as paint, may also contain toxic substances, such as lead, chromium and zinc. In general, it is always best to remove coatings from the base metal before welding or cutting.

Cobalt: Exposure to cobalt can cause respiratory disease and pulmonary sensitization. Cobalt in metallic form has been reported to cause lung damage.

Copper: Prolonged exposure to copper fume may cause skin irritation or discoloration of the skin and hair.

Manganese: Manganese overexposure may affect the central nervous system, resulting in poor coordination, difficulty in speaking, and tremor of arms or legs. This condition is considered irreversible.

Nickel: Nickel and its compounds are on the IARC (International Agency for Research on Cancer) and NTP (National Toxicology Program) lists as posing a carcinogenic risk to humans.

Silica: Crystalline silica is present in respirable dust form submerged arc flux. Overexposure can cause severe lung damage (silicosis).

Zinc: Overexposure to zinc (from galvanized metals) may cause metal fume fever with symptoms similar to the common flu.

Safety Guidelines

The **gases** that result from an arc welding process also present potential hazard. Most of the shielding gases (argon, helium, and carbon dioxide) are non-toxic, but, as they are released, they **displace oxygen** in your breathing air, causing dizziness, unconsciousness, and death, the longer your brain is denied the oxygen it needs. Carbon monoxide can also be developed and may pose a hazard if excessive levels are present.

The **heat and UV radiation** can cause irritation to the eyes and lungs. Some degreasing compounds such as trichlorethylene and perchlorethylene can decompose from the heat and ultraviolet radiation of an arc. Because of the chemical breakdown of vapor-degreasing materials under ultraviolet radiation, arc welding should not be done in the vicinity of a vapor-degreasing operation. Carbon-arc welding, gas tungsten-arc welding and gas metal arc welding should be especially avoided in such areas, because they emit more ultraviolet radiation than other processes. Also, keep in mind that ozone and nitrogen oxides are formed when UV radiation passes through the air. These gases cause headaches, chest pains, irritation of the eyes, and an itchiness in the nose and throat.

There is one easy way to **reduce the risk** of exposure to hazardous fumes and gases: **keep your head out of the fume plume!** As obvious as this sounds, the failure to follow this advice is a common cause of fume and gas overexposure because the concentration of fume and gases is greatest in the plume. Keep fumes and gases from your breathing zone and general area using natural ventilation, mechanical ventilation, fixed or moveable exhaust hoods or local exhaust at the arc. Finally, it may be necessary to wear an approved respirator if adequate ventilation cannot be provided.

As a rule of thumb, for many mild steel electrode, if the air is visibly clear and you are comfortable, then the ventilation is generally adequate for your work. The most accurate way to determine if the worker exposure does not exceed the applicable exposure limit for compounds in the fumes and gases is to have an industrial hygienist take and analyze a sample of the air you are breathing. This is particularly important if you are welding with stainless, hardfacing or Special Ventilation products. All Lincoln MSDS have a maximum fume guideline number. If exposure to total fume is kept below that number, exposure to all fume from the electrode (not coatings or plating on the work) will be below the TLV.

There are also steps that you can take to identify hazardous substances in your welding environment. First, read the product label and material safety data sheet for the electrode posted in the work place or in the electrode or flux container to see what fumes can be reasonably expected from use of the product and to determine if special ventilation is needed. Secondly, know what the base metal is, and determine if there is any paint, plating, or coating that could expose you to toxic fumes and/or gases. Remove it from the metal being welded, if possible. If you start to feel uncomfortable, dizzy or nauseous, there is a possibility that you are being overexposed to fumes and gases, or suffering from oxygen deficiency. Stop welding and get some fresh air immediately. Notify your supervisor and co-workers so the situation can be corrected and other workers can avoid the hazard. Be sure you are following these safe practices, the consumable labeling and MSDS and improve the ventilation in your area. Do not continue welding until the situation has been corrected.

NOTE: The MSDS for all Lincoln consumables is available on Lincoln's website: www.lincolnelectric.com

Before we turn to the methods available to control welding fume exposure, you should understand a few basic terms:

Natural Ventilation is the movement of air through the workplace caused by natural forces. Outside, this is usually the wind. Inside, this may be the flow of air through open windows and doors.

Mechanical Ventilation is the movement of air through the workplace caused by an electrical device such as a portable fan or permanently mounted fan in the ceiling or wall.

Source Extraction (Local Exhaust) is a mechanical device used to capture welding fume at or near the arc and filter contaminants out of the air.

Safety Guidelines

Safety Practices in Welding

The ventilation or exhaust needed for your application depends upon many factors such as:

- Workspace volume
- Workspace configuration
- Number of welders
- Welding process and current
- Consumables used (mild steel, hardfacing, stainless, etc.)
- Allowable levels (TLV, PEL, etc.)
- Material welded (including paint or plating)
- Natural airflow

Your work area has adequate ventilation when there is enough ventilation and/or exhaust to control worker exposure to hazardous materials in the welding fumes and gases so the applicable limits for those materials is not exceeded. See the MSDS for the legal limits, the OSHA PEL (Permissible Exposure Limit), and the recommended guideline, the ACGIH TLV (Threshold Limit Value), for many compounds found in welding fume.

Ventilation

There are many methods which can be selected by the user to provide adequate ventilation for the specific application. The following section provides general information which may be helpful in evaluating what type of ventilation equipment may be suitable for your application. When ventilation equipment is installed, you should confirm worker exposure is controlled within applicable OSHA PEL and/or ACGIH TLV. According to OSHA regulations, when welding and cutting (mild steels), natural ventilation is usually considered sufficient to meet requirements, provided that:

1. The room or welding area contains at least 10,000 cubic feet (about 22 in x 22 in x 22 in) for each welder.
2. The ceiling height is not less than 16 feet.
3. Cross ventilation is not blocked by partitions, equipment, or other structural barriers.
4. Welding is not done in a confined space.

Spaces that do not meet these requirements should be equipped with mechanical ventilating equipment that exhausts at least 2000 CFM of air for each welder, except where local exhaust hoods or booths, or air-line respirators are used.

Important Safety Note:
When welding with electrodes which require special ventilation such as stainless or hardfacing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce hazardous fumes, keep exposure as low as possible and below exposure limit values (PEL and TLV) for materials in the fume using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, for example outdoors, a respirator may be required if exposure cannot be controlled to the PEL or TLV. (See MSDS) Additional precautions are also required when welding on galvanized steel.

Notes