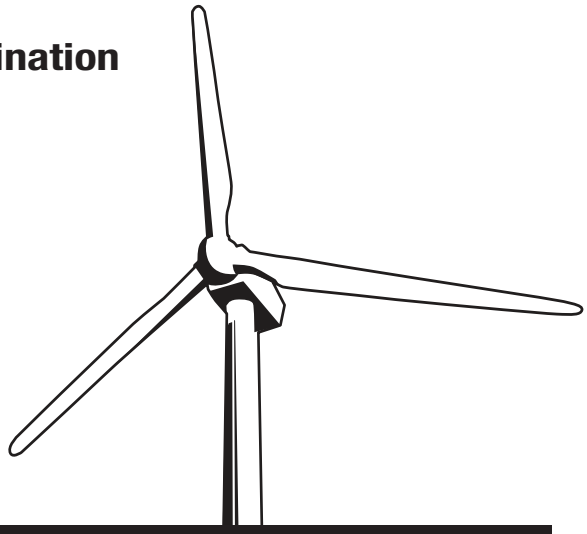
Why Choose
Lincoln for Welding Wind Towers?

Lincolnweld® Submerged Arc Flux and Wire Combination Designed for Wind Tower Manufacturing

Lincoln Electric has over 70 years of experience in submerged arc consumable design and manufacture, which helps make Lincolnweld® flux and electrode the industry leader in wind tower welding solutions. Wind tower fabrication demands welds with high impact toughness in harsh environments. The Lincolnweld® family of submerged arc consumables has over 10 flux and electrode combinations capable of exceeding these requirements. For a consumable solution designed specifically for high quality, consistency and performance in wind tower welding applications – choose Lincolnweld®.



COMPETITIVE ADVANTAGES

	 Lincolnweld® WTX™ and L-61	Lincoln	ESAB®	 ESAB® OK 10.72 and Spoolarc 81
Diffusible Hydrogen Levels	3 - 4 mL/100g Weld Deposit (Without Baking)	☑	☐	6 - 7 mL/100g Weld Deposit (After Baking 2 Hours)*
Actual Test Certificate Availability	Actual Certificate of Chemistry Available for Each Flux Lot and Each Wire Lot	☑	☐	No Actual Certificates of Chemistry for Each Lot
Charpy V-Notch Impact Toughness (AWS A5.17)	84 J (62 ft•lbf) @ -62°C (-80°F)	☑	☐	24 J (32 ft•lbf) @ -51°C (-60°F) (Test Temperature Unclear Due To Conflicting Data on Certificate)*
Packaging	Plastic Bag with Thermal Seal	☑	☐	Paper Bag with Inner Plastic Bag Tied Closed

*See reverse side for details.

LINCOLN® ELECTRIC
THE WELDING EXPERTS®

Why Choose Lincoln for Welding Wind Towers?

The Lincoln Electric Company
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFICATE OF CONFORMANCE
(APPLIES ONLY TO U.S. PRODUCTS)

LINCOLN ELECTRIC

Product: Lincolnweld WTX Flux /L-61 Electrode [1 Year]
Classification: F7A8-EM12K-H8
Specification: AWS A5.17-97, ASME SFA-5.17
Test Completed: January 6, 2009

This is to certify that the product named above and supplied on the referenced order number is of the same classification, manufacturing process, and material requirements as the material which was used for the test that was concluded on the date shown, the results of which are shown below. All tests required by the specifications shown for classification were performed at that time and the material tested met all requirements. It was manufactured and supplied according to the Quality System Program of the Lincoln Electric Company, Cleveland, Ohio, U.S.A., which meets the requirements of ISO9001, NCA3800, ANSI/AWS A5.01, and other specification and Military requirements, as applicable. The Quality System Program has been approved by ASME, ABS, and VdTUV.

Operating Settings	AWS/ASME Requirements	Results
Electrode Size	5/32 inch	5/32 inch
Polarity		DC+
Voltage, V	27 - 30	28
Wire Feed Speed, cm/min (in/min)		107 (42)
Current, amps	475 - 575	525
Contact Tip to Work Distance, mm (in.)	(1 - 1 1/2)	32 (1 1/4)
Travel Speed, cm/min (in/min)	(15 - 17)	41 (16)
Passes/Layers		17/8
Preheat Temp, °C (°F)	(60 – 325)	20 (66)
Interpass Temp, °C (°F)	(275 – 325)	150 (300)

Mechanical properties of the weld deposit (in the as-welded condition).

Tensile Strength, MPa (ksi)	(70 - 95)	540 (78)
Yield Strength, 0.2% Offset, MPa (ksi)	(58 min.)	430 (63)
Elongation, %	22 min.	31
Average Hardness Rockwell B	Not Required	86
Charpy V-notch Impact Properties Avg. Joules @ -62 °C (ft-lbf @ -80 °F)	(20 min.)	**84** (62) **83, 84, 85** (61, 62, 63)
Diffusible Hydrogen (mL/100g) per AWS A4.3 **Absolute Humidity** (grains moisture/lb dry air)	8.0 max.	3.3 29

Chemical composition of the weld deposit and electrode

Analysis (weight %)	Deposit Requirements	Deposit Results	EM12K Electrode Requirements	EM12K Electrode Results
C		0.05	0.05 – 0.15	0.11
Mn		1.84	0.80 – 1.25	0.92
Si	Not Required	0.45	0.10 – 0.35	0.21
S		0.010	0.030 max	0.010
P		0.013	0.030 max	0.004
Cu (Total)		0.07	0.35 max.	0.08

Radiographic Test: Met requirements.
Test assembly constructed of ASTM A36 steel.
This certificate complies to the requirements of EN 10204, Type 2.2.

Results below the detection limits of the instrument or lower than the precision required by specification are reported as zero. Strength values in SI units are reported to the nearest 10 MPa converted from actual data. Preheat and interpass temperature values in SI units are reported to the nearest 5 degrees.

James R. Fogle, Certification Supervisor — Jan 8, 2009 Date

David A. Fink, Manager, Compliance Engineering, Consumable R&D Department — 08 Jan. 2009 Date

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Charpy V-notch Impact Properties Avg. Joules @ -62°C (ft•lbf @ -80°F)	**84** (62) **83, 84, 85** (61, 62, 63)
Diffusible Hydrogen (mL/100g) per AWS A4.3	3.3

ESAB **ESAB Welding & Cutting Products**

CERTIFICATE OF CONFORMANCE
TO SPECIFICATION REQUIREMENTS
FOR WELDING ELECTRODES AND FL XES

SUPPLIED TO QUANTITY
DIAMETER
HEAT
FLUX LOT

This is to certify that Spoolarc 81 electrode, Classification EM12K a
flux, AWS/ASME Classification F7A8-EM12K-H8, as supplied on th
manufacturing process and material requirements as the flux-wire cor

All tests required by Specification AWS /ASME SFA5 17 (F-No
performed The materials tested met all the requirements for Cl ification F7A8-EM12K-H8 The chemica
composition of the electrode and mechanical properties of the deposited weld metal were as follows

CHEMICAL COMPOSITION OF ELECTRODE

C	Mn	Si	S	P	Cu	Total Other Elements
10	1 02	25	006	007	4	< 50

CHEMICAL COMPOSITION OF DEPOSITE WELD METAL (A No 1)

07	1 51	50	006	13

WELD TEST NO 071205-1AW AS-WELDED

Tensile Test
Yield Strength, ksi (MPa) 74 3 (512)
Tensile Strength, ksi (MP 87 1 (600)
Elongation, 2-in % 27 5

Radiography Test Met requirements

Welding Conditions
Arc Voltage 28
Amperage 540 DCEP
Travel Speed 16 ipm
Diameter 5/32 in

CHARPY V-NOTCH

Ft-lbs @ -80°F	(Joules @ -51°C)
30	(40)
18	(24)
21	(28)
28	(38)
23	(31)
24 (avg 3)	(32) (avg 3)

Base Plate A515/516, 1 in Thick
Set-up 30° incl angle, 1/2 in Root gap
No of Layers 6 layers of 2 passes, 1 of3
Preheat 60 - 325°F
Interpass 300 ± 25°F

WELD METAL DIFFUSIBLE HYDROGEN
ml/100g (Flux baked @ 550° F for 2 hours)
7 3, 6 4, 6 9, 6 3 (6 7 avg)

Winfred Stewart, Materials Standards Specialist

COMPANY: ESAB Welding & Cutting Products
ADDRESS: 3325 Middle Road, Ashtabula, OH 44005-0710
PHONE: 843 673 7765
FAX: 843 673 7766

Charpy V-notch Impact Properties Avg.[1] **Joules @ -51°C** (ft•lbs @ -80°F)	**32** (24) **40, 24, 28, 38, 31** (30, 18, 21, 28, 23)
Weld Metal Diffusible Hydrogen (ml/100g) (Flux baked @ 550°F for 2 hours)	6.7

[1] Due to the discrepancy in test temperature on the ESAB certificate, actual test temperature is unknown.
NOTE: Certificate obtained from www.esabna.com in March 2009.
NOTE: ESAB® and ESAB® OK 10.72 are registered trademarks of the ESAB® Welding and Cutting Products Company.

CUSTOMER ASSISTANCE POLICY

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

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.

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199
PH: 216-481-8100 • www.lincolnelectric.com

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