TRI-MARK®

HOBART®

Metal Core Wires & Fluxes for Submerged Arc Welding

Metal Cored Wires & Fluxes f

(Composite Electrodes)

Principles of Operation

The submerged arc welding process introduced in the early 1930's was originally developed to weld longitudinal seams in large pipe. The process was developed to provide high quality weld metal deposits by shielding the arc and the molten weld puddle from the contaminating effects of the air through the melting of a blanket of granular flux.

Sub Arc Advantages

- High deposition and travel speed
- High quality welds
- Minimal arc visibility
- Easily automated
- Good weld bead shapes and toe lines
- Excellent chemical and mechanical properties

The submerged arc process is widely used in heavy plate fabrication. This includes the welding of:

- Structural – bridge, building, and structure manufacturing
- Pipe – both longitudinal seams and circumferential welds
- Vessels and tanks for pressure storage use
- Heavy machine components
- Railcar manufacturing
- Heavy construction/mining/crane

Welded metal thickness ranges from a minimum of 1/16" (1.6mm) up to unlimited for single pass welds and unlimited metal thickness on multi-pass welds using the proper joint preparation and electrode flux combination.

Benefits of Metal Core Wire vs. Solid Wire

- Increased deposition rates, typically 15-30% higher (See Table 1)
- Increased travel speeds
- Higher wire burnoff rates
- Higher quality weld deposits
- A wider broader shaped penetration and fusion pattern
- Greater tolerance to gaps, poor fit up, and burn through
- Easily modified for special applications

Similar to welding with gas shielded metal core, in most submerged arc applications, the maximum productivity and quality benefits are realized when stepping up one wire diameter from the current solid wire size.

Deposition Rate % Increases with Metal Core versus Solid Wire

Diameter	Amperage (DCEP)	Voltage	Approx Wire Feed Speed IPM		Deposition Rate Lbs/hr (Kg/hr)				Deposition Rate % Increase
			Metalloy	Solid	Metalloy		Solid		
5/64"	200	29	71	63	4.9	(2.2)	4.8	(2.2)	**2.08**
(2.0mm)	250	30	89	80	6.5	(2.9)	6.3	(2.8)	**3.17**
	300	31	115	96	8.4	(3.8)	8.1	(3.7)	**3.70**
	350	32	154	114	11.0	(4.9)	9.4	(4.3)	**17.02**
	400	33	190	137	13.7	(6.2)	11.3	(5.1)	**21.24**
	450	34	233	167	16.6	(7.5)	13.6	(6.2)	**22.06**
	500	36	284	199	20.5	(9.3)	16.0	(7.3)	**28.13**
3/32"	300	29	85	70	8.7	(3.9)	8.1	(3.7)	**7.4**
(2.4mm)	350	30	105	80	10.7	(4.9)	9.2	(4.2)	**16.3**
	400	30	125	89	12.9	(5.9)	10.6	(4.8)	**21.7**
	450	32	150	103	15.4	(7.0)	12.6	(5.7)	**22.2**
	500	37	175	121	17.8	(8.1)	14.8	(6.7)	**20.2**
	550	37	210	139	21.1	(9.6)	16.6	(7.5)	**27.1**
	600	38	240	156	24.3	(11.0)	18.9	(8.6)	**28.6**
1/8"	450	31	76	60	12.1	(5.5)	11.8	(5.4)	**2.5**
(3.2mm)	500	32	87	68	14.7	(6.7)	13.1	(5.9)	**12.2**
	550	32	100	75	17.3	(7.8)	14.5	(6.6)	**19.3**
	600	35	116	80	20.0	(9.1)	15.6	(7.1)	**28.2**
	650	36	135	86	23.0	(10.4)	17.6	(8.0)	**30.7**
	700	37	153	94	25.7	(11.7)	19.3	(8.7)	**33.2**
5/32"	400	30	45	37	11.2	(5.1)	10.9	(4.9)	**2.7**
(4.0mm)	500	33	58	47	15.5	(7.0)	14.0	(6.4)	**10.7**
	600	35	69	55	19.5	(8.8)	17.2	(7.8)	**13.4**
	700	38	90	64	23.8	(10.5)	19.6	(8.9)	**21.4**
	800	40	113	75	29.8	(13.5)	23.5	(10.7)	**26.8**
	900	42	143	88	38.7	(17.6)	28.2	(12.8)	**37.2**

Table 1

for Submerged Arc Welding

Classification for Carbon Steel Electrodes and Fluxes

Example: F7A8-EC1 per AWS A5.17

FXXX – ECXXX

- "F" indicates a Submerged arc welding flux
- Indicates the minimum Tensile Strength (in increments of 10,000 psi)
- Designates the condition of heat treatment. "A" for as-welded and "P" for postweld heat treated
- Indicates the temperature in °F at which the impact strength of the weld metal meets or exceeds 20 ft-lbs
- "E" indicates electrode and "C" indicates composite electrode (refer to Table 2 of AWS A5.17)

Product	Composite Electrode Class	Chemical Composition Requirements for Weld Metal
CARBON WELD METAL		
Metalloy EM13K-S	EC1	Carbon Steel
Metalloy EM13K-S MOD	EC1	Carbon Steel
CHROMIUM-MOLYBDENUM WELD METAL		
Metalloy B2-S	ECB2	1.00 - 1.50% Chromium, .40 - .65% Molybdenum
Metalloy B3-S	ECB3	2.00 - 2.50% Chromium, .90 - 1.20% Molybdenum
NICKEL-MOLYBDENUM WELD METAL		
Metalloy F2-S	ECF2	.40 - .80% Nickel, .40 - .65% Molybdenum
Metalloy 100F3-S	ECF3	.70 - 1.10% Nickel, .40 - .65% Molybdenum
MANGANESE-NICKEL-MOLYBDENUM WELD METAL		
Metalloy 92-S	ECM1	.60 - 1.60% Manganese, 1.25 - 2.00% Nickel, .35% Molybdenum
Metalloy 112-S	ECM3	.90 - 1.80% Manganese, 1.80 - 2.60% Nickel, .20 - .70% Molybdenum
Metalloy 120-S	ECM4	1.30 - 2.25% Manganese, 2.00 - 2.80% Nickel, .30 - .80% Molybdenum
NICKEL WELD METAL		
Metalloy N1-S	ECNi1	.75 - 1.10% Nickel
WELD METAL FOR WEATHERING STEELS		
Metalloy W-S	ECW	Chromium, Copper & Nickel Alloy for Weathering Steel

Classification for Low-Alloy Steel Electrodes and Fluxes

Example: F7A8-ECNi1-Ni1 per AWS A5.23

FXXX - ECXX - XX

- "F" indicates a Submerged arc welding flux
- Indicates the minimum Tensile Strength (in increments of 10,000 psi)
- Designates the condition of heat treatment. "A" for as-welded and "P" for postweld heat treated
- Indicates the temperature in °F at which the impact strength of the weld metal meets or exceeds 20 ft-lbs
- Indicates the chemical composition of the weld metal obtained with the flux and the electrode
- Indicates the chemical composition of the electrode
- "E" indicates electrode and "C" indicates composite electrode

(A5.17) Table for Electrode/Flux Classifications

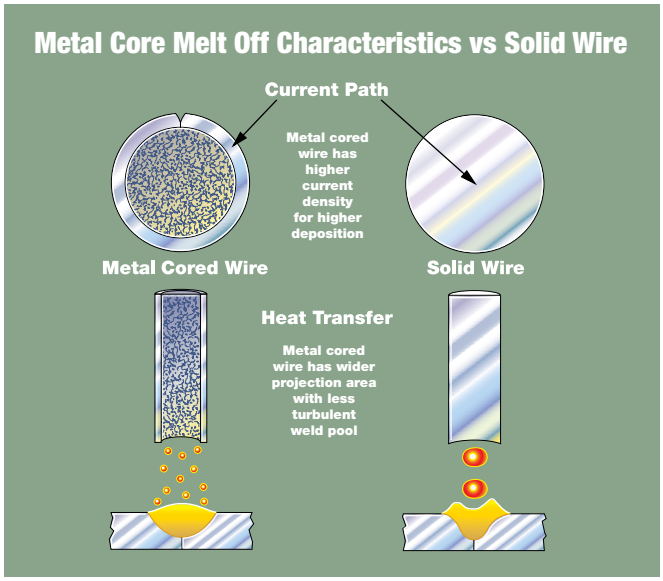
TRI-MARK COMPOSITE WIRES	HOBART FLUX	ELECTRODE/FLUX	APPROVALS
Metalloy EM13K-S	HA-495	F7A4-EC1	CWB F49A4-EC1
Metalloy EM13K-S	HN-511	F7A10-EC1 F7P8-EC1	CWB F49A7-EC1 CWB F43P7-EC1
Metalloy EM13K-S	HN-590	F7A8-EC1 F7P8-EC1	ABS TO AWS F7A8-EC1 CWB F49A6-EC1 CWB F43P6-EC1
Metalloy EM13K-S MOD	HN-511	F7A8-EC1 F7P4-EC1	
Metalloy EM13K-S MOD	HN-590	F7A8-EC1 F7P4-EC1	

(A5.23) Table for Electrode/Flux Classifications

Metalloy N1-S	HN-511	F7A8-ECNi1-Ni1 F6P10-ECNi1-Ni1	
Metalloy N1-S	HN-590	F7A10-ECNi1-Ni1 F6P10-ECNi1-Ni1	
Metalloy W-S	HN-590	F8A4-ECW-W	
Metalloy 92-S	HN-511	F8A8-ECM1-M1 F8P8-ECM1-M1	
Metalloy 92-S	HN-590	F8A8-ECM1-M1 F8P8-ECM1-M1	
Metalloy F2-S	HN-511	F9A8-ECF2-F2 F9P6-ECF2-F2	
Metalloy F2-S	HN-590	F9A8-ECF2-F2 F9P6-ECF2-F2	
Metalloy B2-S	HN-511	F9P*-ECB2-B2	
Metalloy B3-S	HN-511	F9P*-ECB3-B3	
Metalloy 112-S	HN-511	F11A8-ECM3-M3 F10P4-ECM3-M3	
Metalloy 100F3-S	HN-511	F10A6-ECF3-F3 F10P6-ECF3-F3	
Metalloy 100F3-S	HN-590	F10A4-ECF3-F3 F10P2-ECF3-F3	
Metalloy 120-S	HN-511	F11A10-ECM4-M4	ABS F11A10-ECM4-M4 H10

** Contact Hobart Brothers for Charpy V-Notch Toughness*

Submerged Arc Welding



Metalloy Wire Diameter Offerings

• Metalloy EM13K-S	AWS: EC1	5/64", 3/32", 1/8", 5/32"
• Metalloy EM13K-S MOD	AWS: EC1	3/32", 1/8", 5/32"
• Metalloy N1-S	AWS: ECNi1	3/32", 1/8", 5/32"
• Metalloy W-S	AWS: ECW	3/32", 1/8", 5/32"
• Metalloy F2-S	AWS: ECF2	5/64", 3/32", 1/8", 5/32"
• Metalloy 92-S	AWS: ECM1	3/32", 1/8", 5/32"
• Metalloy 100F3-S	AWS: ECF3	3/32", 1/8", 5/32"
• Metalloy 112-S	AWS: ECM3	3/32", 1/8", 5/32"
• Metalloy 120-S	AWS: ECM4	3/32", 1/8", 5/32"
• Metalloy B2-S	AWS: ECB2	5/64", 3/32", 1/8", 5/32"
• Metalloy B3-S	AWS: ECB3	5/64", 3/32", 1/8", 5/32"

Standard Packaging: 60lb (27.2 Kg) coils and 600lb (272 Kg) drums
• Contact Hobart Brothers for additional available diameters.

Diameter Conversions:

5/64"= 2.0mm 3/32"= 2.4mm 1/8"= 3.2mm 5/32"= 4.0mm

Hobart Fluxes:

Neutral and active agglomerated fluxes are now available to provide a single source for both flux and wire. These fluxes are high in performance, quality, and generate weld deposits with excellent mechanical properties. Flux particle size is uniform through controlled mesh screening. The flux is free flowing with consistent weld puddle degassing due to the minimum number of fines.

Electrode/Flux – Cross Reference

Submerged Arc Wire

TriMark	Composite Wire AWS Class	Composite Wire AWS Class	Lincoln	ESAB
Metalloy EM13K-S	EC1	EM13K	L-50 L-61	SPOOLARC 29S SPOOLARC 81
Metalloy N1-S	ECNi1	ECNi1	LA-75	SPOOLARC 75
Metalloy F2-S	ECF2	EF2	LA-82	
Metalloy W-S	ECW			
Metalloy 92-S	ECM1			
Metalloy 100F3-S	ECF3	EF3	LA-84	
Metalloy 112-S	ECM3			
Metalloy 120-S	ECM4			
Metalloy B2-S	ECB2		LAC-B2	SPOOL ARC U515
Metalloy B3-S	ECB3	EB3	LA-93	

Submerged Arc Flux

HOBART	LINCOLN	ESAB
HN-590	860	OK Flux 429, OK Flux 10.71
HN-511	880M, 8500	OK Flux 10.62
HA-495	761, 780	OK Flux 231, OK Flux 350

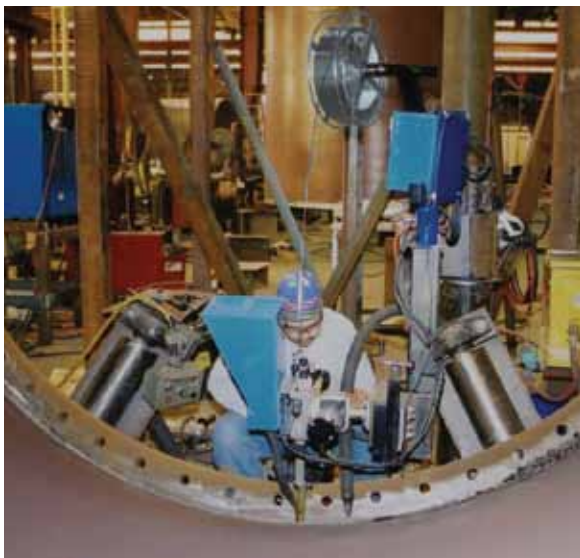
Available flux types:

Hobart Brand		Packaging	Part Number
• HN-590	N=Neutral	55lb (25kg) bag	S669610-055
• HN-511	N=Neutral	55lb (25kg) bag	S669310-055
• HA-495	A=Active	55lb (25kg) bag	S669410-055

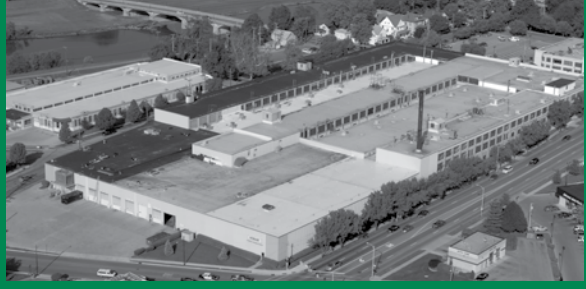
See product data sheets for AWS deposited weld metal class, weld metal chemistry, and mechanical properties with specific flux/wire combinations.

Please remember there is no AWS class for flux!! AWS classifies flux/wire combinations with a deposited weld metal classification system under A5.17 for carbon (mild) steel filler metals and A5.23 for low alloy filler metals.

Examples: A5.17:F7A6-EC1, A5.23:F7A10-ECNi1-Ni1



History of HOBART BROTHERS



After 90 years in the business, Hobart Brothers is Welding. And Welding is Hobart Brothers.

Much has changed in industry since 1920; Hobart Brothers was there every step of the way. You might even say the company did more than simply keep up with new technologies and processes.

It helped forge them.

Hobart has become a world leader in the field. Today you can find the broadest selection of filler metals in the United States. HOBART® & TRI-MARK® are well known brands of Hobart Brothers.

Training and expertise are key to Hobart Brothers.

Such a respectable past can only be built by knowledgeable people. That's why, whether you have a question on technique, materials or applications, you know who to call. **1-800-532-2618**

The company who started that first spark over 90 years ago.

Hobart Brothers has served major metal fabrication markets as a top-quality manufacturer of stick, flux-cored and metal-cored wires for over 25 years. Throughout that time, we've consistently focused our efforts on welding research and product development and, as a result, now offer one of the most complete product lines in the industry today. Recognized worldwide as the "specialists in flux-cored and metal-cored wires," Hobart Brothers features over 52 different products for welding carbon and low alloy steels, in addition to special formulations for applications in the ship-building, infrastructure construction, offshore oil, and heavy equipment industries.

Hobart Distributors

To locate your nearest Hobart distributor call 1-937-332-4000 or 1-937-332-5188 or visit our Web site www.hobartbrothers.com

Headquarters
Hobart Brothers Company 101 Trade Square East Troy, OH 45373 Phone: 937-332-4000 Fax: 937-332-5700

International Headquarters
Phone: 937-332-5188
FAX: 937-332-5064

Regional Office - Canada
Canadian Welding Products Group
Phone: (519)-537-6291
Fax: (519)-421-0480

Regional Office - Middle East
Phone: +971-4299-6621
FAX: +971-4299-6681
E-mail: itwme@emirates.net.ae

Regional Office - India
Phone: +91-222520-7388
FAX: +91-222520-7389
E-mail: itwweldi@satyam.net.in

Regional Office - Asia
Phone: 65-6552-1223
FAX: 65-6552-1929
E-mail: vmarta@millerwelds.com

Beijing Miller Electric
Phone: +86-10-8739-7900
FAX: +86-10-8739-7600
E-mail: lisa.li@millerchina.com

Regional Office - Brazil
Phone: +55-11-5514-3366
FAX: +55-11-5891-7679
E-mail: itwsoldagem@osite.com.br
Web site: www.itwsoldagem.com.br

Regional Office - France
Phone: +33-1-6004-1166
FAX : +33-1-6004-8860
E-mail: miller@itw-welding.fr
Web site: www.miller-france.com

Regional Office - Italy
Phone: +39-02-9829-0218
FAX : +39-02-9828-1552
E-mail: millerit@itw-welding.it

Regional Office - Netherlands
Phone: +311-866-41456
FAX : +311-866-49020
E-mail: info@itw-welding.nl
Web site: www.itw-welding.com

Regional Office - Mexico
Phone: +52-55-5366-7370
FAX : +52-55-5366-7376
E-mail: jflore@millerwelds.com
Web site: www.itwweldingmexico.com

Welding Industries of Australia
Phone: +61-1300-300-884
FAX: +61-8-827-66327
E-mail: intc@welding.com.au
Web site: www.welding.com.au

Weldwell New Zealand
Phone: +64-6-834-1600
FAX: +64-6-835-4568
E-mail: admin@weldwell.co.nz
Web site: www.weldwell.co.nz

Regional Office - Northern Europe
Phone: 46-031-726-4600
FAX: 46-031-726-4700
E-mail: per.gelang@itw-welding.se
Web site: www.elga.se

Regional Office - Russia
Phone: +7-812-961-5481
E-mail: infosvarka@itw-welding.ru
Web site: www.itw-welding.ru

Regional Office - Spain
Phone: 34-963935398
FAX: 34-963629516
E-mail: vcubero@itw-welding.es

Regional Office - Africa
Phone: +44-7770562799
FAX: +44-1204-473039
E-mail: Andy.Foster@itw-welding.co.uk
Web site: www.itw-welding.co.uk

Regional Office for:

Colombia, Venezuela, Trinidad & Tobago, Panama
Phone: 920-968-7508
FAX: 920-735-4125
E-mail: mferna@millerwelds.com

Ecuador, Peru, Bolivia, Chile, Argentina, Uruguay, Paraguay
Phone: 920-968-7508
E-mail: mferna@millerwelds.com

Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Belize
Phone: 525553667370
FAX: 525553667388
E-mail: ventas@itwwelding.com.mx

Bahamas, Barbados, Dominican Republic, Jamaica, Puerto Rico, Virgin Islands
Phone: 937-332-5188
FAX: 937-332-5064
E-mail: quafile@hobartbrothers.com

Manufacturers:

Tien Tai Electrode Co., LTD
Phone: 886-6-2663721
Fax: 886-6-2664301
Web site: www.tientai.com

Tien Tai Electrode (Kun Shan) Co.
Phone: 86-51257446669
FAX: 86-51257448416
E-mail fuhu.chen@tientai.com.cn
Web site: www.tientai.com

Elga AB
Phone: +46-31-726-46 00
FAX: +46-31-726-47-00
Web site: www.elgawelding.com

Miller
www.MillerWelds.com | 800-4-A-MILLER (800-426-4553)

SMITH EQUIPMENT
www.smithequipment.com | 800-843-7912

BERNARD®
www.bernardwelds.com | 800-946-2281

WELD CRAFT®
www.weldcraft.com | 800-752-7620

Tempil®
www.tempil.com | 800-757-8301

jetline® engineering
www.jetline.com | 949-951-1515

MAGNAFLUX®
www.magnaflux.com | 847-657-5300

HOBART INSTITUTE OF WELDING TECHNOLOGY
www.welding.org | 800-332-9448 937-332-5000

Tregaskiss
www.tregaskiss.com | 877-737-3111 519-737-3000