



Submerged Arc Welding

A FULL LINE OF SUBMERGED ARC FLUX AND WIRE FOR EVERY APPLICATION, INDUSTRY AND ENVIRONMENT

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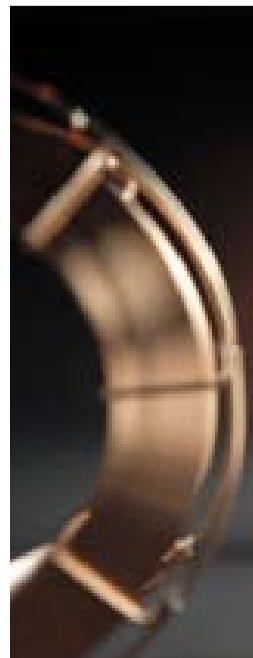
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Submerged Arc Flux and Wire Products

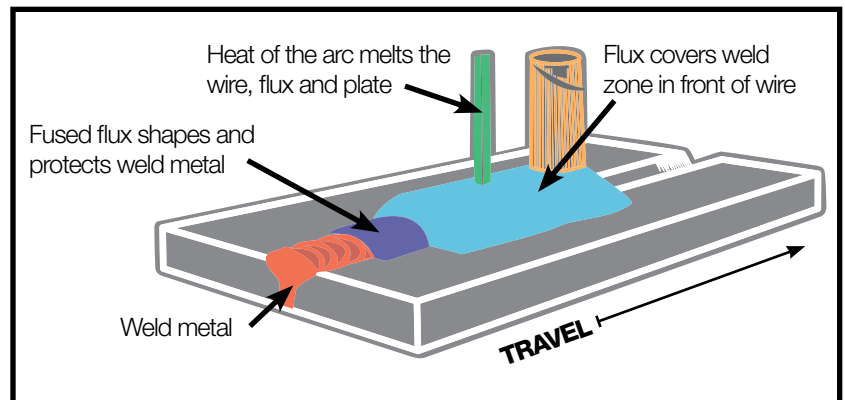


Advantages of Submerged Arc Welding:

- + High productivity with true deposition rates as high as 100 pounds per hour
- + Travel speeds up to 150 inches per minute single wire or as high as 220 inches per minute with multiple electrodes
- + Operating factor approaching 100%
- + Deepest penetration, up to 1 1/2 inches thick in a single pass
- + High operator comfort, no visible arc or spatter
- + High weld quality and repeatable results
- + Usually fully automated process, exceptional control
- + Environmentally friendly

P R O C E S S

In 1936, Union Carbide commercially introduced the submerged arc welding process under the name Unionmelt Welding. The process was developed to produce longitudinal welds on line pipe for gas transportation, but soon saw use in the manufacture of ships and other military applications. In 1989 ESAB acquired L-TEC, the welding business of Union Carbide that pioneered the development of the SAW process. Since then, ESAB has continued to provide industry-renowned expertise in Submerged Arc Welding technology. From single wire to multiple wire systems and Synergic Cold Wire technology, ESAB has been on the leading edge. With over 100 years of experience in the research and development of welding products, ESAB is the world leader in the manufacture of Submerged Arc Welding equipment and consumables.



Submerged Arc Welding (SAW) uses heat generated by an arc formed when an electric current passes between a welding wire and the workpiece. The tip of the welding wire, the arc, and the weld joint are covered by a layer of granular flux. The heat generated by the arc melts the wire, the base metal and the flux. The flux shields the molten pool from atmospheric contamination, cleans impurities from the weld metal, and shapes the weld bead. Depending on the design of the flux, it can also add alloying elements to the weld metal to alter the chemical and mechanical properties of the weld.



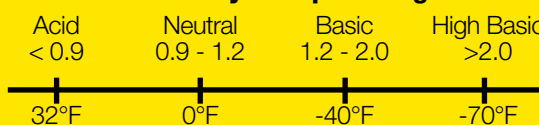
BASICITY

The term basicity is commonly used to describe the chemical and metallurgical nature of a flux. The following formula is generally used to measure the basicity of a submerged arc flux:

$$B = \frac{\text{CaO} + \text{MgO} + \text{Na}_2\text{O} + \text{K}_2\text{O} + \text{CaF}_2 + \frac{1}{2}(\text{MnO} + \text{FeO})}{\text{SiO}_2 + \frac{1}{2}(\text{Al}_2\text{O}_3 + \text{TiO}_2 + \text{ZrO}_2)}$$

This calculation defines the ratio between acid and basic oxides present in the flux and can be used to determine the usability of the flux. Basicity can be used to determine the relative impact toughness a flux can provide.

Relation of basicity to impact toughness



Influence of grain size – Grain size is usually designated by a number that signifies the range of particle sizes that signify the high and low end of the range that is within the package, for example 14X65. Each number indicates the number of openings per inch of screen. The first number indicates the largest particle permitted, while the second number indicates the smallest particle permitted. Grain size can affect how well the flux delivers through a delivery system, how well a weldment de-gases, and the wetting performance of the flux. A coarse grain size is better suited to single wire, low current applications. A fine grain size provides better edge wetting for multi-wire, high current applications.



Submerged Arc Fluxes

FUSED FLUXES

Fused Fluxes are produced by melting the raw materials into a liquid state using a high temperature electric furnace. The cooled material is then crushed or ground to the desired particle size.

Fused fluxes are typically available in multiple grain sizes to allow optimum performance by application.

Fused Flux Features:

- + Non-hygroscopic
- + Fully reacted
- + Chemically homogenous
- + Contain no metallic deoxidizers
- + Glass-like appearance, high grain strength

Fused Flux Benefits:

- + Particles are non-hygroscopic and do not absorb moisture, therefore only a low temperature (300°F/150°C) drying cycle is required to remove surface moisture/condensation, providing increased protection against hydrogen cracking.
- + Provide smooth, stable performance even at extremely high welding currents (up to 2,000 amps).
- + Flux particles are chemically identical, providing more consistent welds.
- + Fused fluxes are less susceptible to particle breakdown due to flux recycling, reducing the creation of fine dust particles.

BONDED FLUXES

Bonded fluxes are manufactured by dry mixing the ingredients and “gluing” them together with a liquid binder, such as sodium silicate. The particles are then baked and sieved to achieve the desired flux particle size. Generally one grain size is offered, which operates over a wide variety of current ranges.

Bonded Flux Features:

- + Contain metallic deoxidizers
- + May contain alloying agents
- + Flat, low gloss, or dry particle appearance
- + Each flux particle has a unique chemistry.

Bonded Flux Benefits:

- + Presence of deoxidizers provides good performance over rust and mill scale and helps prevent weld porosity.
- + Usually provides better peeling properties than fused fluxes.
- + Alloying elements can be added to provide improved chemical and mechanical properties.
- + Usually exhibit lower flux consumption than a fused flux welded at the same current and voltage.



ACTIVE FLUXES

Active fluxes are those fluxes that add manganese and silicon to the weld deposit in proportion to the arc voltage. As voltage increases, the amount of flux consumed during the welding process also increases, which leads to more Mn and Si added to the weldment. The addition of Mn and Si make active fluxes well suited to welding over rust, mill scale and light oil. They also provide excellent welder appeal. However, due to the alloying tendency of active fluxes, they can add excessive amounts of Mn and Si, which can lead to weld embrittlement and/or cracking. As a result, active fluxes are recommended only for use below 36 volts and for single or multiple pass welds up to 1-inch thickness.

Advantages of Active Fluxes:

- + Good for use over rust, mill scale, even light rust
- + Excellent slag peeling characteristics
- + High speed capability
- + Improved weld metal wetting

NEUTRAL FLUX

A neutral flux does not cause a significant change in weld chemistry as a result of changes to arc voltage or of the amount of flux consumed during welding. As with any flux, a neutral flux does affect the weld deposit chemistry. The levels of alloying elements added to the weld are generally consistent across even significant changes in voltage. Therefore, the deposit chemistry will not match the wire chemistry. Neutral fluxes can be used in multiple pass applications of unlimited plate thickness without the concern for alloy buildup, as with active fluxes. Neutral fluxes are generally not designed to handle rust and mill scale tolerance, and therefore should be used on clean plate.

Advantages of Neutral Fluxes:

- + Unlimited number of weld passes
- + Unlimited plate thickness allowed
- + Weld deposit chemistry not sensitive to changes in voltage/flux consumed

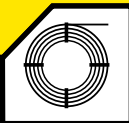


AWS Classifications

AWS Class	Flux	Wire	Weld Condition	Flux Type
F6A2-EL12	OK Flux 80	Spoolarc 80	As Welded	Neutral
F7AZ-EL12	OK Flux 231	Spoolarc 80	As Welded	Active
F7AZ-EM12K	OK Flux 282	Spoolarc 81	As Welded	Active
F7AZ-EM13K	OK Flux 282	Spoolarc 29S	As Welded	Active
F7A0-EM12K	OK Flux 281	Spoolarc 81	As Welded	Active
F7A0-EM13K	OK Flux 281	Spoolarc 29S	As Welded	Active
F7A0-EA2-A2	OK Flux 80	Spoolarc 40B	As Welded	Neutral
F7A2-EL12	OK Flux 350	Spoolarc 80	As Welded	Active
F7A2-EM12K	OK Flux 231	Spoolarc 81	As Welded	Active
F7A2-EM12K	OK Flux 350	Spoolarc 81	As Welded	Active
F7A2-EM12K	OK Flux 50	Spoolarc 81	As Welded	Neutral
F7A2-EM12K	OK Flux 80	Spoolarc 81	As Welded	Neutral
F7A2-EM12K	OK Flux 429	Spoolarc 81	As Welded	Neutral
F7A2-EM13K	OK Flux 350	Spoolarc 29S	As Welded	Active
F7A2-EM13K	OK Flux 429	Spoolarc 29S	As Welded	Neutral
F7A2-EM14K	OK Flux 10.71	Spoolarc 71	As Welded	Neutral
F7A2-EH14	OK Flux 50	Spoolarc 36	As Welded	Neutral
F7A2-EH14	OK Flux 80	Spoolarc 36	As Welded	Neutral
F7A4-EM12K	OK Flux 10.71	Spoolarc 81	As Welded	Neutral
F7A4-EM13K	OK Flux 10.71	Spoolarc 29S	As Welded	Neutral
F7A4-EH12K	OK Flux 429	Spoolarc 53	As Welded	Neutral
F7A4-ENi1-Ni1	OK Flux 10.62	Spoolarc 75	As Welded	Neutral
F7A5-EH12K	OK Flux 10.71	Spoolarc 53	As Welded	Neutral
F7A6-EM12K	OK Flux 10.62	Spoolarc 81	As Welded	Neutral
F7A6-EM14K	OK Flux 10.62	Spoolarc 71	As Welded	Neutral
F7A8-EM12K	OK Flux 10.72	Spoolarc 81	As Welded	Neutral
F7A8-EH12K	OK Flux 10.62	Spoolarc 53	As Welded	Neutral
F8A0-EA3-A3	OK Flux 80	Spoolarc 40	As Welded	Neutral
F8A2-EA2-A3	OK Flux 429	Spoolarc 40B	As Welded	Neutral
F8A4-ENi1K-Ni1	OK Flux 429	Spoolarc 75	As Welded	Neutral
F8A4-ENi1K-Ni1	OK Flux 10.71	Spoolarc 75	As Welded	Neutral
F8A4-ENi1K-Ni1	OK Flux 10.72	Spoolarc 75	As Welded	Neutral
F8A4-ENi4-Ni4	OK Flux 10.62	Spoolarc ENi4	As Welded	Neutral
F8A6-EA2-A2	OK Flux 10.62	Spoolarc 40B	As Welded	Neutral
F9A4-ENi4-Ni4	OK Flux 429	Spoolarc ENi4	As Welded	Neutral
F9A4-ENi4-Ni4	OK Flux 10.72	Spoolarc ENi4	As Welded	Neutral
F9A6-EM2-M2	OK Flux 10.62	Spoolarc 95	As Welded	Neutral
F9A8-EA3-A3	OK Flux 10.62	Spoolarc 40	As Welded	Neutral
F11A6-EM4-M4	OK Flux 10.62	Spoolarc 120	As Welded	Neutral
F12A6-EF5-G	OK Flux 10.62	Spoolarc 100	As Welded	Neutral



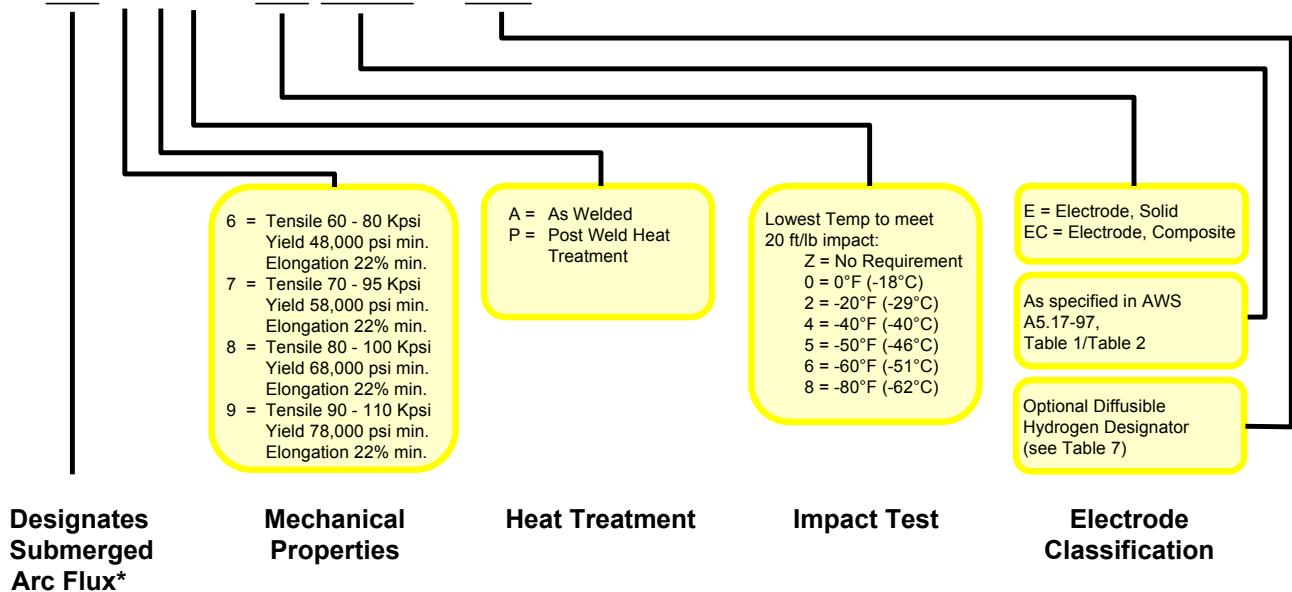
AWS Class	Flux	Wire	Weld Condition	Flux Type
F6P2-EH14	OK Flux 80	Spoolarc 36	Stress Relieved 1 hr. @ 1,150°F	Neutral
F6P4-EM12K	OK Flux 429	Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	Neutral
F6P5-EM12K	OK Flux 10.62	Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	Neutral
F6P8-EM12K	OK Flux 10.72	Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	Neutral
F6P8-EM12K	OK Flux 10.72	Spoolarc 81	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F7P0-EM14K	OK Flux 429	Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P0-EA3-A3	OK Flux 80	Spoolarc 40	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P2-EA2-A2	OK Flux 80	Spoolarc 40B	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P2-EA2-A2	OK Flux 80	Spoolarc 40B	Stress Relieved 16 hrs. @ 1,150°F	Neutral
F7P4-EM14K	OK Flux 10.71	Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P4-EM14K	OK Flux 10.71	Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F7P5-EM14K	OK Flux 10.72	Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P5-EM14K	OK Flux 10.72	Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F7P5-EH12K	OK Flux 10.71	Spoolarc 53	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P6-EM14K	OK Flux 10.62	Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	Neutral
F7P6-EM14K	OK Flux 10.62	Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F7P6-EH12K	OK Flux 10.62	Spoolarc 53	Stress Relieved 1 hr. @ 1,150°F	Neutral
F8P0-EA2-A3	OK Flux 429	Spoolarc 40B	Stress Relieved 1 hr. @ 1,150°F	Neutral
F8P2-EB2-B2	OK Flux 10.62	Spoolarc U515	Stress Relieved 1 hr. @ 1,150°F	Neutral
F8P2-EB2-B2	OK Flux 10.62	Spoolarc U515	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F8P2-EB3-B3	OK Flux 10.62	OK Autrod 13.20SC	Stress Relieved 1 hr. @ 1,275°F	Neutral
F8P4-ENi4-Ni4	OK Flux 429	Spoolarc ENi4	Stress Relieved 1 hr. @ 1,150°F	Neutral
F8P8-EB3R-B3	OK Flux 10.63	OK Autrod 13.20SC	Stress Relieved 1 hr. @ 1,275°F	Neutral
F8P8-ENi4-Ni4	OK Flux 10.62	Spoolarc ENi4	Stress Relieved 1 hr. @ 1,150°F	Neutral
F8P8-ENi4-Ni4	OK Flux 10.62	Spoolarc ENi4	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F9PZ-EB2-B2	OK Flux 80	Spoolarc U515	Stress Relieved 1 hr. @ 1,150°F	Neutral
F9PZ-EB2-B2	OK Flux 80	Spoolarc U515	Stress Relieved 8 hrs. @ 1,150°F	Neutral
F9P4-EA3-A3	OK Flux 10.62	Spoolarc 40	Stress Relieved 1 hr. @ 1,150°F	Neutral
F9P4-EA3-A3	OK Flux 10.62	Spoolarc 40	Stress Relieved 8 hrs. @ 1,150°F	Neutral



AWS Classification A5.17

Carbon Steel Wires and Fluxes for Submerged Arc Welding

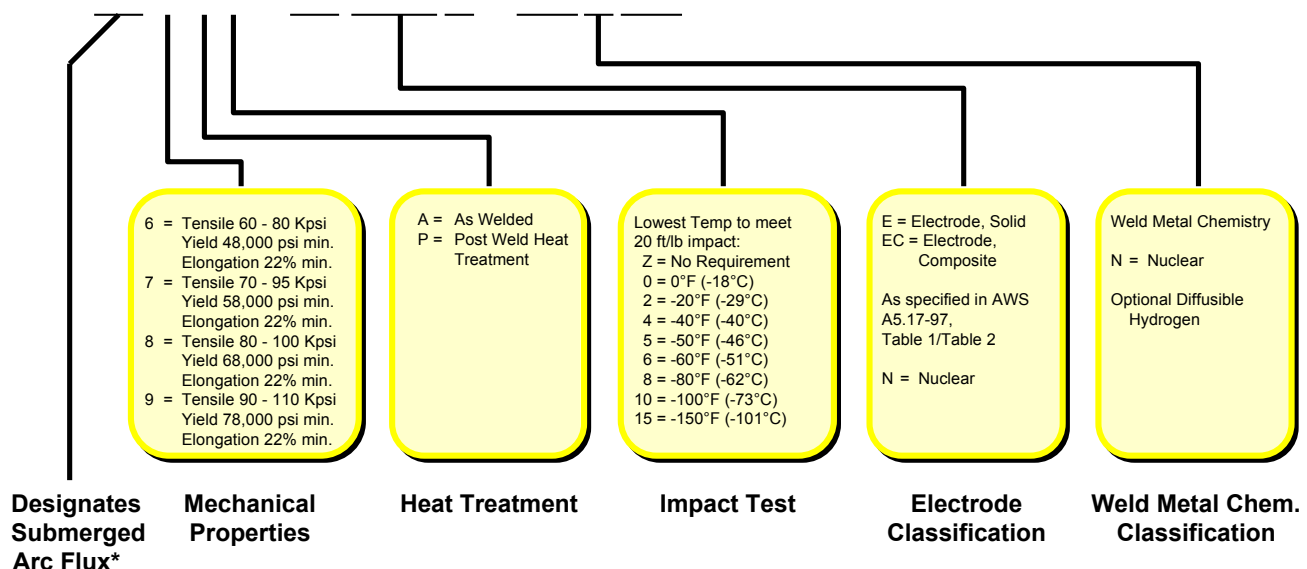
FSXXX - ECXXX - HX



AWS Classification A5.23

Low Alloy Carbon Steel Wires and Fluxes for Sub Arc Welding

FSXXX - ECXXXN - XXNHX



* Indicates the welding flux is made solely from crushed slag or is a blend of crushed slag with unused (virgin) flux. Omission of the "S" indicates the flux being classified is virgin flux only.

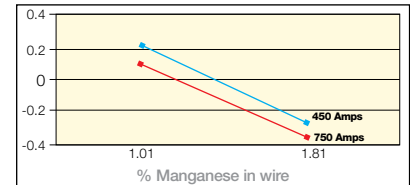


OK Flux 50 is a neutral, fused flux that performs well in a wide variety of applications. It is used for build up and hardsurfacing applications, and also for making butt and fillet welds in structural and pressure vessel steel plate. OK Flux 50 is suitable for use with AC or DC power in single or multiwire applications. It is available in two mesh sizes. The 8x48 size is recommended for build up and hardsurfacing applications at currents of up to 800 amps. The 12x150 size is suitable for use at up to 1100 amps and is recommended for all applications where the travel speed is less than 60 in./min (150 cm/min). OK Flux 50 is not recommended for use over rust or heavy mill scale.

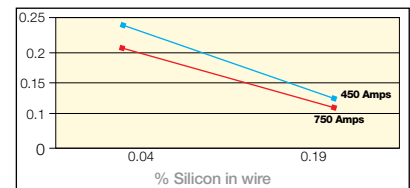
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	1.09
30	1.53
34	2.05
38	2.49

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17 F7A2-EH14
 AWS A5.17 F7A2-EM12K

Basicity Index: 0.70

Chemical Composition:

SiO ₂ + TiO ₂	40	CaO + MgO	5
Al ₂ + MnO	45	Fluorides	5

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	60	415	74	510	25	28	38	-20	-29	F7A2-EM12K
Spoolarc 36	As Welded	62	425	74	510	24	26	35	-20	-29	F7A2-EH14

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.05	1.12	0.45	0.023	0.009	—	—	—	—
Spoolarc 36	0.07	1.55	0.43	0.024	0.005	—	—	—	—



OK Flux 80

Fused Flux



OK Flux 80 is a neutral, fused flux for multipass welding of heavy plate. It is used primarily for the fabrication of pressure vessels, boilers, valves and fittings. OK Flux 80 produces good weld metal properties when used with a wide variety of carbon and alloy steel wires. There is no limit to the thickness of plate that can be successfully welded with OK Flux 80. It is suitable for use with AC or DC power in single or multiwire applications. It is available in two mesh sizes. The 12x65 size is recommended for one and two wire welding at currents of up to 800 amps. The 20x200 size is suitable for use at up to 1100 amps and is recommended for multiwire and narrow groove welding. OK Flux 80 should only be used in applications where the base plate is free of rust and mill scale.

Code and Specification Data:

AWS A5.17 F6P2-EH14
 AWS A5.17 F7A2-EH14
 AWS A5.17 F6A2-EL12
 AWS A5.17 F7A2-EM12K
 AWS A5.23 P8PZ-ECB2-B2
 AWS A5.23 P9PZ-EB2-B2
 AWS A5.23 F7P0-EA3-A3
 AWS A5.23 F8A0-EA3-A3

AWS A5.23 F7P2-EA2-A2
 AWS A5.23 F7A0-EA2-A2

Basicity Index: 0.95

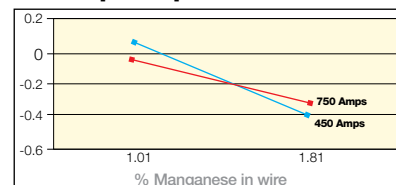
Chemical Composition:

SiO ₂ + TiO ₂	35	CaO + MgO	35
Al ₂ + MnO	20	Fluorides	5

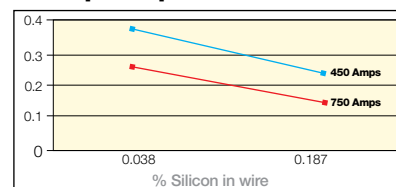
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.93
30	1.23
34	1.75
38	1.98

% Mn pick-up from flux



% Si pick-up from flux



Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 80	As Welded	57	395	67	460	28	52	70	-20	-29	F6A2-EL12
Spoolarc 81	As Welded	64	440	75	515	30	35	47	-20	-29	F7A2-EM12K
Spoolarc 36	As Welded	66	485	78	540	26	35	47	-20	-29	F7A2-EH14
Spoolarc 36	Stress Relieved 1 hr. @ 1,150°F	51	350	70	485	31	50	68	-20	-29	F6P2-EH14
Spoolarc 40B	As Welded	68	470	82	565	26	29	39	0	-18	F7A0-EA2-A2
Spoolarc 40B	Stress Relieved 1 hr. @ 1,150°F	66	455	80	550	25	25	34	-20	-29	F7P2-EA2-A2
Spoolarc 40B	Stress Relieved 16 hrs. @ 1,150°F	58	400	75	515	27	24	33	-20	-29	F7P2-EA2-A2
Spoolarc 40	As Welded	74	510	90	620	25	29	39	0	-18	F8A0-EA3-A3
Spoolarc 40	Stress Relieved 1 hr. @ 1,150°F	67	462	84	579	26	24	33	0	-18	F7P0-EA3-A3
Spoolarc U515	Stress Relieved 1 hr. @ 1,150°F	88	605	102	705	22	28	38	68	20	F9PZ-EB2-B2
Spoolarc U515	Stress Relieved 8 hrs. @ 1,150°F	78	540	92	635	22	23	31	0	-18	F9PZ-EB2-B2

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 80	0.05	0.75	0.28	0.021	0.015	-	-	-	-
Spoolarc 81	0.07	1.17	0.45	0.020	0.014	-	-	-	-
Spoolarc 36	0.08	1.59	0.42	0.020	0.014	-	-	-	-
Spoolarc 40B	0.08	1.10	0.39	0.018	0.014	-	-	0.46	0.46
Spoolarc 40	0.08	1.51	0.41	0.018	0.014	-	-	0.48	0.48
Spoolarc U515	0.06	0.90	0.42	0.014	0.014	1.2	-	0.54	0.54

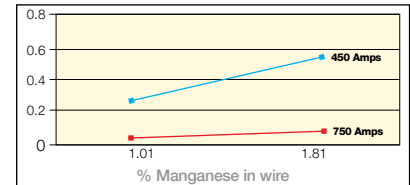


OK Flux 231 is an active, bonded flux designed for fillet and butt welding of carbon steel plate. It provides excellent tolerance of rust and mill scale so joint preparation can be minimized. This flux can produce horizontal fillets up to 3/8" (9.5 mm) leg size without undercut or rollover. The slag peeling is excellent. OK Flux 231 can be used for multipass welding, but because Mn and Si buildup is possible, welding voltage should be kept to a minimum and plate thickness should be limited to 1" (25 mm). OK Flux 231 is suitable for DC single and parallel wire welding at currents up to 1000 amps. It is used for welding rail cars, water heater tanks, ship plates, and structural steel.

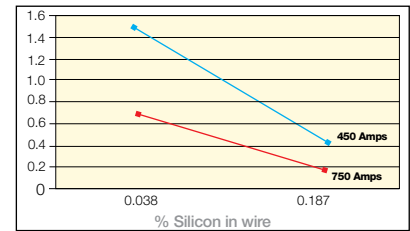
Flux Consumption
(lb. Flux / lb. Wire)

Voltage	DC+
26	0.66
30	0.91
34	0.98
38	1.51

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17 / ASME SFA 5.17 F7A2-EM12K
AWS A5.17 / ASME SFA 5.17 F7AZ-EL12

Basicity Index: 0.50

Chemical Composition:

SiO₂ + TiO₂ 25 Fluorides 10
Al₂ + MnO 60

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	67	460	81	560	27	28	38	-20	-29	F7A2-EM12K
Spoolarc 80	As Welded	65	450	74	510	28	20	27	0	-18	F7AZ-EL12

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.08	1.40	0.30	0.018	0.010	—	—	—	—
Spoolarc 80	0.07	1.00	0.30	0.020	0.010	—	—	—	—



OK Flux 281

Bonded Flux

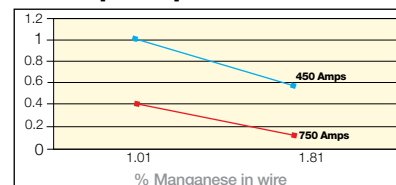


OK Flux 281 is intended for welding gauge thickness and thin steel plate (up to 3/8 in. thick) for butt, lap and fillet welds. Due to the excellent operating characteristics, quality welds with self-peeling slag and free from undercut may be achieved with welding speeds ranging from 50 to 100 inches per minute.

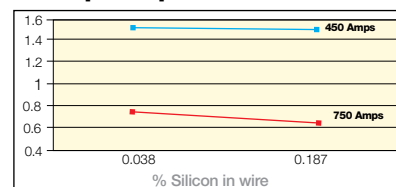
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.62
30	0.76
34	.97
38	1.35

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17 F7AO-EM13K
AWS A5.17 F7AO-EM12K

Basicity Index: 0.5

Chemical Composition:

SiO₂ + TiO₂ 25 Fluorides 5
Al₂ + MnO 50

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	78	540	92	635	25	28	20	0	-18	F7A0-EM12K
Spoolarc 29S	As Welded	89	615	99	680	22	23	31	0	-18	F7A0-EM13K

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.07	1.80	0.90	0.025	0.013	—	—	—	—
Spoolarc 29S	0.07	1.80	1.00	0.023	0.014	—	—	—	—

ESAB has more submerged arc experience than any other leading welding provider.





OK Flux 282 is an active, bonded flux designed for high speed, single pass welding of carbon steel sheet. Butt, lap and fillet welds produce good side-wall fusion and are void of undercut even at speeds up to 120 IPM (305 cm/min). It is primarily used with DC single and parallel wire systems at currents up to 1300 amps. OK Flux 282 is recommended for making high speed welds in metallic building beams, spiral pipe, storage tanks and rail cars.

Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.75
30	0.96
34	1.36
38	1.72

Code and Specification Data:

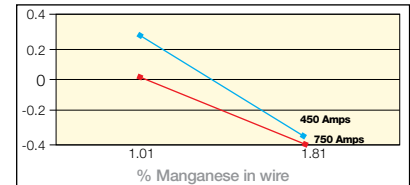
AWS A5.17 F7AZ-EM13K
 AWS A5.17 F7AZ-EM12K

Basicity Index: 0.3

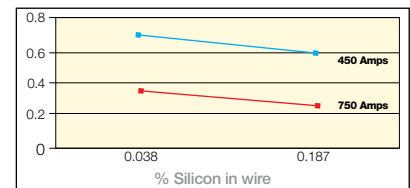
Chemical Composition:

SiO₂ + TiO₂ 30 Fluorides <5
 Al₂ + MnO 40

% Mn pick-up from flux



% Si pick-up from flux



Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	85	585	95	655	23	18	24	0	-18	F7AZ-EM12K
Spoolarc 29S	As Welded	88	605	100	690	22	14	19	0	-18	F7AZ-EM13K

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.09	1.24	0.80	0.030	0.020	—	—	—	—
Spoolarc 29S	0.09	1.15	1.00	0.028	0.014	—	—	—	—





OK Flux 350 Bonded Flux

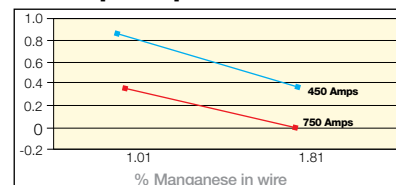


OK Flux 350 is an active bonded flux for making butt and fillet welds in carbon steel plate up to 1" (25 mm) thick. It produces a smooth weld surface with uniform edges. The slag is generally free peeling. Its performance is very good even when the plate surface is covered with rust and mill scale. OK Flux 350 is suitable for use with AC or DC power in single or multiwire applications. It is recommended for butt welding of thin wall pressure vessels, rail cars and structural steel plate. It is used for fillet welding in shipbuilding, pressure vessel and structural applications. OK Flux 350 also is widely used as a backing flux in one sided welding applications. It provides good performance at currents up to 1100 amps.

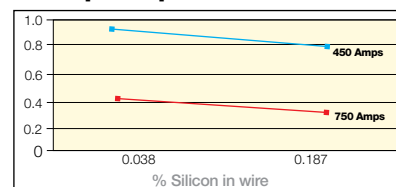
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.61
30	0.83
34	1.4
38	1.36

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17 / ASME SFA 5.17 F7A2-EM13K
AWS A5.17 / ASME SFA 5.17 F7A2-EM12K
AWS A5.17 / ASME SFA 5.17 F7A2-EL12

Basicity Index: 0.9

Chemical Composition:

SiO ₂ + TiO ₂	40	CaO + MgO	25
Al ₂ + MnO	20	Fluorides	5

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 80	As Welded	62	425	76	525	30	36	49	-20	-29	F7A2-EL12
Spoolarc 81	As Welded	66	455	80	550	26	31	42	-20	-29	F7A2-EM12K
Spoolarc 29S	As Welded	71	490	87	600	28	24	32	-20	-29	F7A2-EM13K

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 80	0.05	1.40	0.50	0.022	0.015	—	—	—	—
Spoolarc 81	0.04	1.80	0.70	0.022	0.010	—	—	—	—
Spoolarc 29S	0.04	1.90	0.90	0.023	0.015	—	—	—	—

The broadest range of **Spoolarc** subarc wires and **OK flux** products to help you achieve the best results at the lowest possible cost.



OK Flux 429 is a neutral, bonded flux intended for butt and fillet welding of carbon and low alloy steel plate. It combines good as welded and stress relieved mechanical properties with excellent performance. Its slag is generally self peeling, even in tight, narrow groove butt welds. It provides moderate tolerance of rust and mill scale. OK Flux 429 is used in offshore oil rig, bridge, ship, pressure vessel and structural fabrication. It will operate with DC and AC, single and multiwire systems at currents up to 1000 amps.

Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.73
30	1.02
34	1.33
38	1.46

Code and Specification Data:

F7A2-EM12K
 AWS A5.17 / ASME SFA 5.17
 F9A4-ENi4-Ni4
 F6P4-EM12K
 F8A2-EA2-A3
 F8A4-ENi4K-Ni1
 AWS A5.23 / ASME SFA 5.23
 F8P0-EA2-A3
 F7A4-EH12K

CERTIFIED BY C.W.B.- CSA W48

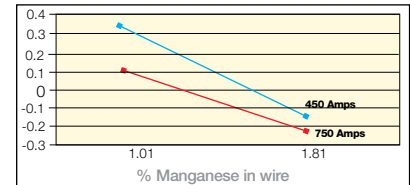
F7P0-EM14K
 F7A2-EM13K
 F8P4-ENi4-Ni4

Basicity Index: 1.1

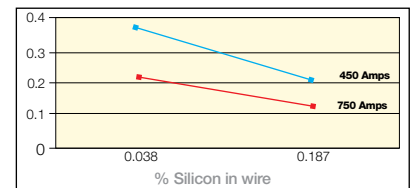
Chemical Composition:

SiO ₂ + TiO ₂	20	CaO + MgO	25
Al ₂ + MnO	40	Fluorides	10

% Mn pick-up from flux



% Si pick-up from flux



Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	66	455	79	545	28	48	65	-20	-29	F7A2-EM12K
Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	60	415	75	515	30	50	68	-40	-40	F6P4-EM12K
Spoolarc 29S	As Welded	67	460	83	570	27	38	42	-20	-29	F7A2-EM13K
Spoolarc 53	As Welded	71	490	85	585	28	30	52	-40	-40	F7A4-EH12K
Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	63	430	80	550	32	20	28	-20	-29	F7P0-EM14K
Spoolarc 40B	As Welded	77	530	88	605	25	21	28	-20	-29	F8A2-EA2-A3
Spoolarc 40B	Stress Relieved 1 hr. @ 1,150°F	75	515	88	605	26	26	35	0	-18	F8P0-EA2-A3
Spoolarc 75	As Welded	73	505	86	595	28	40	54	-40	-40	F8A4-ENiK-NiL
Spoolarc ENi4	As Welded	82	565	93	640	25	44	60	-40	-40	F9A4-ENi4-Ni4
Spoolarc ENi4	Stress Relieved 1 hr. @ 1,150°F	77	530	89	615	26	24	33	-40	-40	F8P4-ENi4-Ni4

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.06	1.40	0.45	0.020	0.015	-	-	-	-
Spoolarc 29S	0.07	1.70	0.70	0.020	0.012	-	-	-	-
Spoolarc 53	0.06	1.80	0.50	0.026	0.010	-	-	-	-
Spoolarc 71	0.06	1.58	0.58	0.018	0.009	-	-	-	-
Spoolarc 40B	0.06	1.40	0.40	0.023	0.012	-	-	0.48	0.48
Spoolarc 75	0.05	1.50	0.60	0.018	0.012	-	0.80	-	-
Spoolarc ENi4	0.06	1.30	0.40	0.021	0.009	1.7	1.79	0.15	0.15



OK Flux 10.71

Bonded Flux

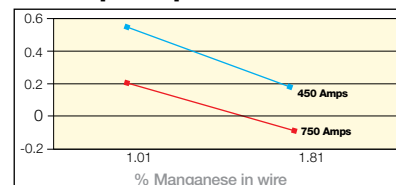


OK Flux 10.71 is a neutral, bonded flux intended primarily for multipass butt and fillet welding of carbon and low alloy steels. It combines outstanding welding performance with excellent weld properties. OK Flux 10.71 is suitable for use with AC and DC, single and multiwire systems at currents up to 1000 amps. It should not be used in applications where there is heavy rust or mill scale on the base plate. Among the many areas where OK 10.71 is used are general structural welding, bridge fabrication, heavy equipment fabrication and line pipe welding.

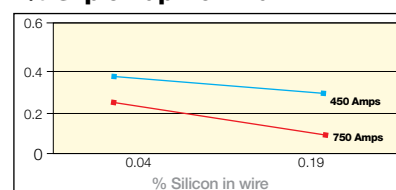
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.73
30	0.94
34	1.25
38	1.51

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17; F7P5-EH12K
 AWS A5.17; F7A5-EH12K
 AWS A5.23; F8A4-ENi1K-Ni1
 AWS A5.17; F7A2-EM14K
 AWS A5.17; F7A4-EM13K
 AWS A5.17; F7P4-EM14K
 AWS A5.17; F7A4-EM12K

Basicity Index: 1.6

Chemical Composition:

SiO ₂ + TiO ₂	20	CaO + MgO	25
Al ₂ + MnO	35	Fluorides	15

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	68	470	81	560	30	44	60	-40	-40	F7A4-EM12K
Spoolarc 29S	As Welded	73	505	87	600	30	30	41	-40	-40	F7A4-EM13K
Spoolarc 53	As Welded	77	530	91	625	28	45	61	-50	-46	F7A5-EH12K
Spoolarc 53	Stress Relieved 1 hr. @ 1,150°F	65	448	79	545	32	80	108	-50	-46	F7P5-EH12K
Spoolarc 71	As Welded	76	525	87	600	27	48	65	-20	-29	F7A2-EM14K
Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	74	510	92	635	30	38	51	-40	-40	F7P4-EM14K
Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	74	510	91	625	30	35	47	-40	-40	F7P4-EM14K
Spoolarc 75	As Welded	78	540	91	625	28	43	58	-40	-40	F8A4-ENi1K-Ni1

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.07	1.50	0.50	0.020	0.011	—	—	—	—
Spoolarc 29S	0.06	1.80	0.80	0.014	0.007	—	—	—	—
Spoolarc 53	0.07	1.80	0.50	0.022	0.010	—	—	—	—
Spoolarc 71	0.06	1.70	0.60	0.018	0.009	—	—	—	—
Spoolarc 75	0.07	1.70	0.70	0.016	0.012	—	0.90	—	—

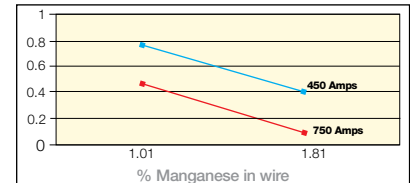


OK Flux 10.72 is a neutral, bonded aluminate-basic flux. It is primarily used for applications with toughness requirements down to -50°C in high dilution joints. It also provides excellent slag removal in narrow V-joints. It is recommended for joining structural steels, fine grained steels and creep-resistant steels. It has proved to be the world's most popular flux for wind tower productions. OK Flux 10.72 features extremely high current carrying capacity and is intended for single or multiwire procedures using DC and AC power. It can be used for single-layer and multi-layer welding of unlimited plate thickness.

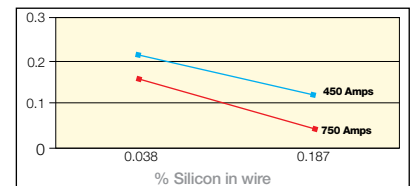
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.69
30	0.88
34	1.3
38	1.66

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.17; F6P8-EM12K
 AWS A5.23; F8A4-ENi1K-Ni1
 AWS A5.17; F7A8-EM12K
 AWS A5.23; F9A4-ENi4-Ni4
 AWS A5.17; F7P5-EM14K

Basicity Index: 1.9

Chemical Composition:

SiO ₂ + TiO ₂	20	CaO + MgO	30
Al ₂ + MnO	25	Fluorides	25

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	62	425	75	515	30	35	50	-80	-62	F7A8-EM12K
Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	59	405	74	510	32	35	50	-80	-62	F6P8-EM12K
Spoolarc 81	Stress Relieved 8 hrs. @ 1,150°F	58	400	74	510	34	120	163	-50	-46	F6P8-EM12K
Spoolarc 75	As Welded	76	550	89	655	28	110	149	-40	-40	F8A4-ENi1K-Ni1
Spoolarc ENi4	As Welded	85	585	96	680	26	115	156	-40	-40	F9A4-ENi4-Ni4
Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	72	495	88	605	30	67	91	-50	-46	F7P5-EM14K
Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	71	490	87	600	30	65	88	-50	-46	F7P5-EM14K

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.06	1.60	0.30	0.013	0.009	-	-	-	-
Spoolarc 75	0.06	1.80	0.50	0.013	0.009	-	0.90	-	-
Spoolarc ENi4	0.07	1.60	0.20	0.012	0.006	-	1.80	0.15	0.15
Spoolarc 71	0.08	1.90	0.50	0.018	0.009	-	-	-	-

OK flux 10.72 is well established in wind tower fabrication, as well as the manufacturing of pressure vessels, penstocks and in general fabrication.

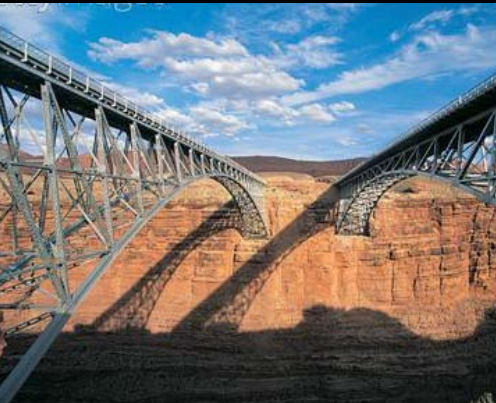


Note: Reference respective welding parameters and joint preparations on pages 32 - 34.



OK Flux 10.62

Bonded Flux



Code and Specification Data:

AWS A5.17; F7P6-EM14K
 AWS A5.23; F8A6-EA2-A2
 AWS A5.23; F8P2-EB2-B2
 AWS A5.23; F8A4-ENi4-Ni4
 AWS A5.17; F7P6-EH12K
 AWS A5.17; F7A6-EM12K
 AWS A5.17; F7A8-EH12K
 AWS A5.23; F7A4-ENi1-Ni1
 AWS A5.23; F12A6-EF5-G
 AWS A5.23; F11A6-EM4-M4
 AWS A5.17; F7A6-EM14K

ESAB OK Flux 10.62 is a fully basic bonded flux intended primarily for multipass butt welding of carbon and low alloy steel plate. OK Flux 10.62 produces weld metal that is very clean metallurgically and exhibits exceptional impact toughness at low temperatures. OK Flux 10.62 provides well-shaped beads and free peeling slag. Applications for OK Flux 10.62 include offshore oil rigs (meets CTOD requirements), fracture critical bridge members, ship construction, pressure vessels and tank cars. It is suitable for use with AC and DC, single and multiwire systems at currents up to 1000 amps. OK Flux 10.62 should only be used in applications where the base plate is free of rust and mill scale.

AWS A5.23; F9P4-EA3-A3
 AWS A5.23; F9A8-EA3-A3
 AWS A5.23; F9A6-EM2-M2
 AWS A5.23; F8P8-ENi4-Ni4
 AWS A5.23; F8P2-EB3-B3

Basicity Index: 3.4

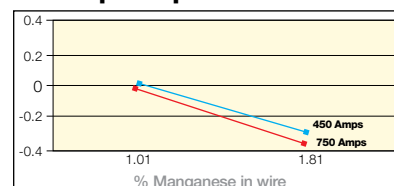
Chemical Composition:

SiO ₂ + TiO ₂	15	CaO + MgO	35
Al ₂ + MnO	20	Fluorides	25

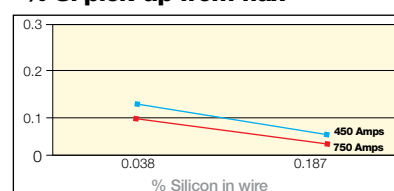
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.69
30	0.88
34	1.3
38	1.66

% Mn pick-up from flux



% Si pick-up from flux



Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
Spoolarc 81	As Welded	65	450	75	515	32	110	150	-60	-51	F7A6-EM12K
Spoolarc 81	Stress Relieved 1 hr. @ 1,150°F	54	370	70	480	32	160	217	-50	-46	F6P5-EM12K
Spoolarc 40B	As Welded	79	545	88	605	25	33	45	-60	-51	F8A6-EA2-A2
Spoolarc 53	As Welded	70	485	82	565	29	65	88	-80	-62	F7A8-EH12K
Spoolarc 53	Stress Relieved 1 hr. @ 1,150°F	63	430	77	530	31	84	114	-60	-51	F7P6-EH12K
Spoolarc 71	As Welded	75	515	85	590	28	100	136	-60	-51	F7A6-EM14K
Spoolarc 71	Stress Relieved 1 hr. @ 1,150°F	72	500	83	575	30	119	160	-60	-51	F7P6-EM14K
Spoolarc 71	Stress Relieved 8 hrs. @ 1,150°F	74	515	83	570	28	138	187	-60	-51	F7P6-EM14K
Spoolarc 75	As Welded	69	475	80	550	60	100	136	-40	-40	F7A4-ENi1-Ni1
Spoolarc ENi4	As Welded	74	510	86	595	29	97	132	-40	-40	F8A4-ENi4-Ni4
Spoolarc ENi4	Stress Relieved 1 hr. @ 1,150°F	75	515	89	610	28	47	64	-100	-73	F8P8-ENi4-Ni4
Spoolarc ENi4	Stress Relieved 8 hrs. @ 1,150°F	78	540	90	645	27	62	84	-100	-73	F8P8-ENi4-Ni4
Spoolarc 40	As Welded	87	600	102	700	27	37	50	-80	-62	F9A8-EA3-A3
Spoolarc 40	Stress Relieved 1 hr. @ 1,150°F	86	595	96	660	27	21	28	-80	-62	F9P4-EA3-A3
Spoolarc 40	Stress Relieved 8 hrs. @ 1,150°F	83	570	93	640	26	67	91	-40	-40	F9P4-EA3-A3
Spoolarc U515	Stress Relieved 1 hr. @ 1,150°F	76	520	88	610	26	121	164	-20	-29	F8P2-EB2-B2
Spoolarc U515	Stress Relieved 8 hrs. @ 1,150°F	75	515	87	600	27	140	190	-20	-29	F8P2-EB2-B2
OK Autrod 13.20SC	Stress Relieved 1 hr. @ 1,275°F	77	530	91	630	25	59	80	-20	-29	F8P2-EB3-B3
Spoolarc 95	As Welded	95	655	104	715	25	49	66	-60	-51	F9A6-EM2-M2
Spoolarc 120	As Welded	110	760	120	825	21	66	89	-60	-51	F11A6-EM4-M4
Spoolarc 100	As Welded	124	855	134	925	20	52	70	-60	-51	F12A6-EF5-G



Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Spoolarc 81	0.07	1.00	0.30	0.016	0.007	–	–	–	–
Spoolarc 40B	0.09	1.00	0.20	0.016	0.010	–	–	0.50	0.50
Spoolarc 53	0.08	1.50	0.30	0.018	0.009	–	–	–	–
Spoolarc 71	0.06	1.10	0.40	0.012	0.004	–	–	–	–
Spoolarc 75	0.07	1.00	0.50	0.009	0.005	–	0.80	–	–
Spoolarc ENi4	0.08	0.90	0.30	0.010	0.005	1.6	0.16	0.16	0.16
Spoolarc 40	0.06	1.70	0.20	0.012	0.004	–	–	0.50	0.50
Spoolarc U515	0.05	0.70	0.19	0.011	0.007	1.6	0.04	0.52	0.52
OK Autrod 13.20SC	0.08	0.60	0.20	0.010	0.005	2.0	–	0.85	0.85
Spoolarc 95	0.05	1.40	0.40	0.008	0.006	0.2	1.60	0.30	0.30
Spoolarc 120	0.07	1.60	0.30	0.006	0.013	0.3	2.30	0.50	0.50
Spoolarc 100	0.09	1.90	0.30	0.014	0.003	0.4	2.40	0.50	0.50

“ESAB **subarc** products
make me more productive.”



Note: Reference respective welding parameters and joint preparations on pages 32 - 34.



OK Flux 10.63

Bonded Flux

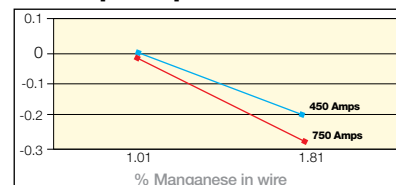


OK Flux 10.63 is a high-basic agglomerated all-mineral non-alloying flux designed primarily for the multi-run welding of creep-resistant steels in combination with low-alloy Cr-Mo wires. The very low impurity level of the flux helps to produce an exceptionally clean weld metal, with high impact properties. The weld is capable of handling a step cooling treatment and will produce weld deposits with X-Factor < 15 when used with low residual wire.

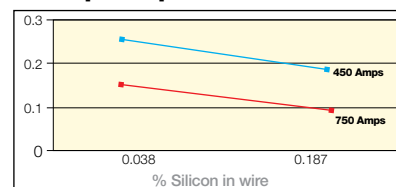
Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.77
30	0.92
34	1.3
38	1.66

% Mn pick-up from flux



% Si pick-up from flux



Code and Specification Data:

AWS A5.23; F8P4-EB2R-B2R

AWS A5.23; F8P8-EB3R-B3R

Basicity Index: 3.2

Chemical Composition:

SiO ₂ + TiO ₂	15	CaO + MgO	35
Al ₂ + MnO	20	Fluorides	25

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
OK Autrod 13.20SC	Stress Relieved 1 hr. @ 1,275°F	76	525	90	620	25	37	50	-80	-62	F8P8-EB3R-B3

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
OK Autrod 13.20SC	0.07	0.60	0.20	0.009	0.005	2.1	—	1.0	—



Real People,
Real Solutions.

OK Flux 10.93**Bonded Flux for Stainless Steel Application**

OK Flux 10.93 is a basic non-alloying agglomerated flux for the submerged arc welding of stainless steels and high-alloyed CrNiMo steels including duplex stainless steels.

Code and Specification Data:

No AWS Classification

Basicity Index: 1.7**Chemical Composition:**

SiO₂ + TiO₂ 10 Fluorides 50
Al₂ + MnO 40

Flux Consumption

(lb. Flux / lb. Wire)

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
ER308L	As Welded	58	400	81	560	38	122	90	70	20	ER308/308L
ER309L	As Welded	62	430	83	570	33	122	90	70	20	ER309/309L
ER316L	As Welded	57	390	82	565	42	136	100	70	20	ER316/316L
ER2209	As Welded	91	780	113	780	30	190	140	70	20	ER2209

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	N	FN
ER308L	0.03	1.40	0.60	0.030	0.025	20.0	10.0	–	0.75	–	8.0
ER309L	0.03	1.20	0.60	0.030	0.030	24.0	12.50	–	0.50	–	9.0
ER316L	0.03	1.40	0.60	0.030	0.025	18.50	11.50	2.70	3.00	–	8.0
ER2209	0.02	1.30	0.60	–	–	22.0	9.0	2.80	–	0.50	45.0

OK Flux 10.94**Bonded Flux for Stainless Steel Application**

OK Flux 10.94 is a basic chromium-alloying flux for the welding of stainless steels and “super duplex” stainless steels. OK Flux 10.94 is capable of producing higher ferrite in the deposited weld metal.

Code and Specification Data:

No AWS Classification

Basicity Index: 1.7**Chemical Composition:**

SiO₂ + TiO₂ 10 Fluorides 50
Al₂ + MnO 35

Flux Consumption

(lb. Flux / lb. Wire)

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
ER308L	As Welded	58	400	81	560	40	63	85	70	20	ER308L
ER2509	As Welded	91	625	120	830	28	122	90	70	20	ER2509

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	N	FN
ER308L	0.02	0.50	1.4	–	–	20.0	9.50	–	–	–	11.0
ER2509	0.04	0.50	0.50	–	–	25.0	9.50	–	–	0.20	50.0

Note: Reference respective welding parameters and joint preparations on pages 32 - 34.



OK Flux 10.95

Bonded Flux for Stainless Steel Application

OK Flux 10.95 is a basic nickel-alloying flux for welding stainless steels. OK Flux 10.95 is capable of producing low ferrite suitable for low temperature cryogenic services.

Code and Specification Data:

No AWS Classification

Basicity Index: 1.7

Flux Consumption (lb. Flux / lb. Wire)

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class	Mills L.E.
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)		
ER308L	As Welded	58	400	78	540	40	68	50	-320	-196	ER308/308L	34 mils min.
ER316L	As Welded	57	390	82	565	38	54	40	-320	-196	ER316/ER316L	22 mils min.

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	FN
ER308L	0.02	1.20	0.60	–	–	19.0	11.0	–	–	4.0
ER316L	0.02	1.20	0.60	–	–	18.0	13.0	2.50	2.70	3.0

OK Flux 10.11**Bonded Flux for Nickel Strip Cladding Application**

OK Flux 10.11 is very high basic agglomerated flux for electrosag strip cladding. The flux had low viscosity and is suitable for cladding with Ni-base, Co and fully-austenitic alloys due to its good wetting behavior. It is also suitable for welding at higher travel speeds.

Code and Specification Data:**Basicity Index:** 5.4

No AWS Classification

Typical All Weld Metal Composition (%)

Strip	Layer	C	Mn	Si	P	S	Cr	Ni	Mo	N	Nb + Ta	Fe
ERNiCrMo-3	1st	0.025	0.07	0.45	-	-	19.6	Bal.	8.1	0.01	2.9	7
ERNiCrMo-3	2nd	0.02	0.03	0.5	-	-	21.6	Bal.	8	0.01	3.2	4

OK Flux 10.16**Bonded Flux for Nickel Strip Cladding Application**

OK Flux 10.16 is an agglomerated fluoride basic, non-alloying flux for submerged arc welding specially designed for joining as well as overlay applications on Ni-based alloys.

Code and Specification Data:**Basicity Index:** 2.4

No AWS Classification

Typical All Weld Metal Composition (%)

Strip	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
ERNiCr-3	0.04	3	0.5	-	-	19	Bal.	2	-
ERNiCrMo-3	0.02	1.2	0.2	-	-	21	Bal.	9	-

OK Flux 10.90**Bonded Flux for Nickel Strip Cladding Application**

OK Flux 10.90 is an agglomerated fluoride basic flux for welding 9% Ni steels and other high-alloyed steels. The flux adds manganese, which reduces the risk of hot cracking. Good slag detachability and attractive bead appearance.

Flux Consumption
(lb. Flux / lb. Wire)

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Code and Specification Data:**Basicity Index:** 1.7

No AWS Classification

Chemical Composition:

SiO₂ + TiO₂ 10 Fluorides 45
Al₂O₃ + MnO 240

Typical Mechanical Properties

Wire	Weld Condition	Yield Strength		Tensile Strength		% Elong in 2"	CVN		Temp.		AWS Class
		ksi	(MPa)	ksi	(MPa)		ft.-lbs.	(J)	@ °F	(°C)	
ERNiCrMo-3	As Welded	64	440	104	720	33	66	90	-320	-196	ERNiCrMo-3
ERNiCrMo-4	As Welded	70	480	101	700	35	55	75	-320	-196	ERNiCrMo-4

Typical Undiluted Weld Metal Analysis (%)

Wire	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Fe
ERNiCrMo-3	0.01	2.0	0.20	0.013	0.007	21	Bal.	8.5	-	2 max
ERNiCrMo-4	0.01	1.79	0.16	0.009	0.001	15	Bal.	14.0	13.9	7 max

Note: Reference respective welding parameters and joint preparations on pages 32 - 34.



OK Flux 601

Bonded Flux for Overlay Application

OK Flux 601 is a neutral, bonded flux specifically designed for surfacing applications with type 420 and modified 420 stainless steel wires. When used with Alloy Shield 420 series wires, it produces smooth, well washed beads. The slag is self-peeling even at temperatures over 700°F (371°C). Applications include the rebuilding of continuous caster rolls, crane wheels, and pickler rolls.

Code and Specification Data:

No AWS Classification

Basicity Index: 2.1

Typical Mechanical Properties

Wire	As Welded	Stress Relieved - 7 hr @ 1050°F (565°C)
AS 420S	51 Rc	29 Rc
AS 276	37 Rc	37 Rc

Typical Undiluted Weld Metal Properties (%)

Strip	C	Mn	Si	P	S	Cr	Ni	Mo	V	Nb
AS 420S	0.2	1.2	0.3	-	-	11	-	-	-	2.9
AS 423LS	0.09	1.4	0.6	-	-	12	2	1.3	0.2	3.2



OK Flux 10.05

Bonded Flux for Cladding Application

OK Flux 10.05 is an agglomerated flux for submerged arc strip cladding. It is recommended for cladding with the Cr, CrNi and CrNiMo types of stainless strip. Slag removal and overlapping with this flux are excellent.

Code and Specification Data:

No AWS Classification

Basicity Index: 1.1

Typical All Weld Metal Composition (%) (with 309L as the initial layer)

Strip	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	N	FN
EQ308L	0.02	1	0.6	-	-	19	10.6	-	-	-	6
EQ347L	0.02	1.1	0.7	-	-	19	10.3	-	-	-	8
EQ316L	0.02	1.1	0.7	-	-	18	13	2.5	-	-	7



OK Flux 10.10

Bonded Flux for Cladding Application

OK Flux 10.10 is an agglomerated flux designed for electrosag strip surfacing. This flux is particular suitable for strip surfacing with stainless strips of the Cr, CrNi and CrNiMo types, with or without Nb stabilization. The weldability, bead appearance and slag removal of OK Flux 10.10 are excellent.

Code and Specification Data:

No AWS Classification

Basicity Index: 4.0

Typical Undiluted Weld Metal Analysis (%) (single layer)

Strip	C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe
309L Mo	0.02	1.2	0.4	-	-	18	12.5	2.8	-	6
309L Nb	0.03	1.3	0.5	-	-	19	10	-	0.4	4
309L	0.03	1.2	0.4	-	-	19	10	-	-	4



Please Note: Chemistry listed below for wire/strip are typical values only.

Spoolarc 80

EL12

Spoolarc 80 is a low manganese and silicon wire. It provides excellent ductility and crack resistance. Typical applications include lap welds, build-up, or repair welding prior to machining.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.10	0.44	0.04	0.003	0.014	-	-	-	-

Spoolarc 81

EM12K

Spoolarc 81 is a medium manganese and silicon wire with nominal rust and mill scale tolerance. Typical applications include structural steels, medium strength pressure vessels, wind tower bases, ship, barge, and offshore oil rig fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.11	0.95	0.26	0.006	0.008	-	-	-	-

Spoolarc 29S

EM13K

Spoolarc 29S is a general purpose copper-coated solid wire suitable for many carbon steel welding applications using either the MIG/Gas Metal Arc Welding (GMAW) or the Submerged Arc Welding (SAW) processes. Spoolarc 29S contains moderate amounts of manganese and silicon to provide sufficient deoxidation over light mill scale. Shielding gas choices for Spoolarc 29S in the GMAW mode are 100% carbon dioxide, argon/carbon dioxide mixtures, argon/oxygen mixtures, and other argon based mixed gas blends. In the SAW mode, Spoolarc 29S can be combined with a variety of active and neutral bonded fluxes to achieve better welding performance over Spoolarc 81 wire. Spoolarc 29S is used in a wide variety of applications including heavy equipment, automotive parts, railcars, agricultural equipment, and sheet metal welding.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.09	1.10	0.52	0.008	0.012	-	-	-	-

Spoolarc 71

EM14K

ESAB's **Spoolarc 71** is a medium manganese and silicon subarc wire that has been microalloyed with titanium. Used with 429, OK 10.62, and OK 10.71 fluxes Spoolarc 71 will produce weld deposits with a minimum 70,000 psi tensile strength in the as welded condition or after eight-hours of stress relief. When used with OK 10.62 weld deposits meet ASME A No. 1 chemistry requirements. Spoolarc 71 is used for welding pressure vessels and can be used for other applications requiring good mechanical properties after stress relieving.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.10	1.22	0.55	0.008	0.005	-	-	-	Ti0.07

Spoolarc 53

EH12K

Spoolarc 53 is designed for single or multipass welding on carbon and low alloy steels. It provides higher strength deposits and good impact toughness.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.11	1.50	0.36	0.008	0.010	-	-	-	-

Spoolarc 36

EH14

Spoolarc 36 is a high manganese wire for single or multipass welding. Typical applications include seam welding on hot water tanks, valves, fittings, and heavy vessel fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.16	1.96	0.02	0.014	0.016	-	-	-	-



Low Alloy Steel SAW Wire



Please Note: Chemistry listed below for wire/strip are typical values only.

Spoolarc 40B

EA2

Spoolarc 40B is designed for single or multipass welding of carbon and low alloy steels. Produces good as welded and stress relieved impact toughness. Weld metal tensile strength is in excess of 70 ksi (483 MPa). Applications include pressure vessel fabrication and other similar welds, which require postweld heat treatment.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.10	1.15	0.03	0.017	0.015	-	-	0.50	-

Spoolarc 40

EA3

Spoolarc 40 is designed for single or multipass wire for welding carbon and low alloy steels. Produces good as welded and stress relieved impact toughness. Weld metal tensile strength is in excess of 80 ksi (552 MPa). Applications include pressure vessel fabrication and other similar welds, which require postweld heat treatment.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.15	2	0.03	0.017	0.015	-	-	0.50	-

Spoolarc U515

EB2

Spoolarc U515 is designed for use on low alloy steels up to 1.25% Cr - 0.5% Mo. Applications include process piping, heat exchangers and pressure vessel fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.10	0.65	0.18	0.010	0.010	1.5	-	0.50	-

Autrod 13.20SC

EB3R

ESAB's **OK Autrod 13.20SC** is a copper-coated low alloy submerged arc wire designed for the welding of creep-resistant steel of the 2 1-4% Cr-1% Mo type. When combined with OK Flux 10.63, OK Autrod 13.20SC produces a metallurgically clean weld, which is capable of meeting X-factor of less than 15 and J-factor of less than 120. This combination fulfills the stringent requirements for toughness after step cooling treatment of the weld metal. OK Autrod 13.20SC can also be combined with OK Flux 10.62 for applications not requiring step cooling treatment. OK Autrod 13.20SC is used for welding process piping, heat exchangers and pressure vessel fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.10	0.55	0.15	0.005	0.006	2.25	-	0.95	-

Spoolarc 44

EF2

Spoolarc 44 is designed for single or multipass welding where high strength and impact toughness are required. Weld metal tensile strengths of 80 ksi (552 MPa) are maintainable after long-term stress relieving (50 hrs or more). The presence of Ni in the wire chemistry helps increase low temperature impact toughness. Applications include pressure vessels, structural supports and some heat treatable valves and fittings.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.13	2.05	0.05	0.010	0.010	-	0.65	0.50	-



Please Note: Chemistry listed below for wire/strip are typical values only.



Spoolarc 100 EF5

Spoolarc 100 is designed for low alloy quenched and tempered steels. Weld metal mechanical properties include high yield strength materials (exceeds 100 ksi/690 MPa) and low temperature impact toughness. Applications include heat treatable valves and fittings, structural weldments and low temperature pipe valves.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.12	1.91	0.07	0.007	0.006	0.38	2.40	0.50	Cu 0.32

Spoolarc 95 EM2

Spoolarc 95 is military-grade, high-strength wire used to weld HY-80 steels. Applications for Spoolarc 95 include military tanks, ships and submarines.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.007	1.40	0.35	0.008	0.007	0.20	1.80	0.35	-

Spoolarc 120 EM4

Spoolarc 120 is designed for welding high strength quenched and tempered steels. Weld metal mechanical properties produce high tensile strengths, in excess of 120 ksi (825 MPa). Applications for Spoolarc 120 include military tanks, ships, submarines and other similar fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.07	1.3	0.35	0.007	0.008	0.4	2.6	0.45	-

Spoolarc 75 ENi1K

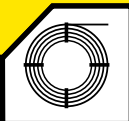
Spoolarc 75 is a copper-coated 1% nickel solid wire for carbon steel and low alloy welding applications using either the MIG/Gas Metal Arc Welding (GMAW) or Submerged Arc Welding (SAW) processes. Spoolarc 75 produces a deposit that meets the requirements of AWS D1.1 and D1.5 and is designed to weld weathering steels and/or where improved low temperature impact toughness is specified. Shielding gas choices for Spoolarc 75 are Ar/CO₂ mixtures containing a minimum of 75% Ar or the 98% Ar/2% O₂. In the SAW mode, Spoolarc 75 is typically used with a neutral flux such as ESAB OK Flux 429, 10.71, and 10.62. Spoolarc 75 is used for bridge and structural welding.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.07	1.13	0.49	0.005	0.005	-	0.90	-	-

Spoolarc ENi-4 ENi4

Spoolarc ENi-4 is designed for single or multipass welding on high steels. Produces good low temperature toughness on a variety of base materials. Weld metal tensile strengths are in excess of 90 ksi (620 MPa) in both the as welded and stress relieved conditions. Applications include pressure vessels, offshore oil rigs, bridges and other structural steel fabrication.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.14	0.71	0.20	0.004	0.009	-	1.72	0.15	-



Please Note: Chemistry listed below for wire/strip are typical values only.



OK Autrod ER308L

AWS A5.9; ER308/308L, EN 12072, S 19 9 L

A continuous, solid, corrosion-resistant, chromium-nickel wire. **OK Autrod ER308L** had good general corrosion resistance. The alloy had a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. OK Autrod ER308L can be used in combination with OK Flux 10.93, OK Flux 10.94 or OK Flux 10.95.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.02	1.80	0.40	-	-	20.0	7.0	< 0.3	8.0

Arcaloy ER308L

AWS A5.9 / ASME SFA A5.9; ER308/308L

A continuous, solid, corrosion-resistant, chromium-nickel wire. **Arcaloy ER308L** had good general corrosion resistance. The alloy had a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. Arcaloy ER308L can be used in combination with OK Flux 10.93, OK Flux 10.94 or OK Flux 10.95.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.015	1.7	0.5	-	-	20	10	0.1	9.0

Arcaloy ER308H

AWS A5.9 / ASME SFA A5.9; ER308/308H

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18% Cr-8% Ni type. **Arcaloy ER308H** had good general corrosion resistance. The alloy has high carbon content, making it suitable for applications using higher temperatures. The alloy is used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. Arcaloy ER308H can be used in combination with OK Flux 10.93 or OK Flux 10.95.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.06	1.80	0.80	-	-	20.0	10.0	0.05	7.0

OK Autrod ER309L

AWS A5.9; ER309/309L; EN 12072, S 23 12 L

A continuous, solid, corrosion-resistant, chromium-nickel wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24% Cr, 13% Ni types. **OK Autrod ER309L** had good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. OK Autrod ER309L can be used in combination with OK Flux 10.93 or OK Flux 10.94.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.02	1.50	0.40	-	-	24.0	13.0	0.1	10.0

Arcaloy ER309L

AWS A5.9 / ASME SFA A5.9; ER309/309L

A continuous, solid, corrosion-resistant, chromium-nickel wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24% Cr, 13% Ni types. **Arcaloy ER309L** had good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. Arcaloy ER309L can be used in combination with OK Flux 10.93 or OK Flux 10.94.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.02	1.70	0.50	-	-	23.0	13.0	0.1	10.0



Please Note: Chemistry listed below for wire/strip are typical values only.



OK Autrod 316L

AWS A5.9; ER316L, EN 12072, S 19 12 3 L

A continuous, solid, corrosion-resistant, chromium-nickel-molybdenum wire for welding austenitic stainless alloys of the 18% Cr-8% Ni-3% Mo types. **OK Autrod ER316L** has good general corrosion resistance. In particular, the alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in chemical and food-processing industries, as well as shipbuilding and various types of architectural structure. OK Autrod ER316L can be used in combination with OK Flux 10.93 or OK Flux 10.95.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.02	1.8	0.4	-	-	19	12	2.7	8.0

Arcaloy ER316L

AWS A5.9 / ASME SFA A5.9; ER316/316L

A continuous, solid, corrosion-resistant, chromium-nickel-molybdenum wire for welding austenitic stainless alloys of the 18% Cr-8% Ni-3% Mo types. **Arcaloy ER316L** has good general corrosion resistance. In particular, the alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in chemical and food-processing industries, as well as shipbuilding and various types of architectural structure. Arcaloy ER316L can be used in combination with OK Flux 10.93 or OK Flux 10.95.

C	Mn	Si	P	S	Cr	Ni	Mo	FN
0.02	1.9	.50	-	0.007	19.0	13.0	2.30	8.0

OK Autrod ER2209

AWS A5.9; ER2209, EN 12072, S 22 9 3 NL

A continuous, solid, corrosion-resistant, duplex wire for the GMA welding of austenitic-ferritic stainless alloys of the 22% Cr, 5% Ni, 3% Mo types. **OK Autrod 2209** ("Duplex") has high general corrosion resistance. In media containing chloride and hydrogen sulphide, the alloy has high resistance to intergranular, pitting and especially stress corrosion. The alloy is used in a variety of applications across all industrial segments. OK Autrod 2209 is usually GMAW welded with Ar/(1-3%) O₂ as the shielding gas. Former name of this product was OK Autrod 16.86.

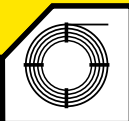
C	Mn	Si	P	S	Cr	Ni	Mo	N	Cu	FN
0.02	1.70	0.50	-	-	22.50	8.50	3.30	0.20	0.15	45.0

OK Autrod 2509

AWS A5.9; ER2594, EN 12072, S 25 9 4 NL

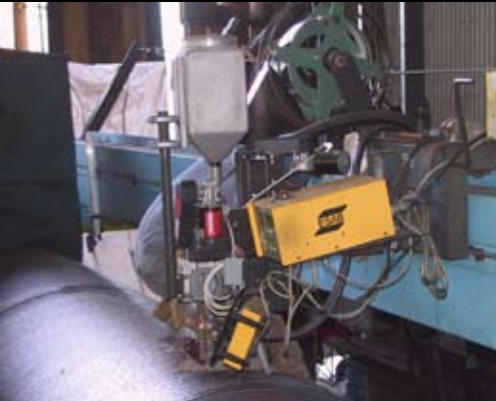
A continuous, solid, corrosion-resistant, "super duplex" wire for welding austenitic-ferritic stainless alloys of the 25% Cr, 10% Ni, 4% Mo, low C type. **OK Autrod ER2509** has high resistance to intergranular corrosion and pitting. The alloy is widely used in applications where corrosion resistance is of the utmost importance. The pulp and paper industry, offshore and gas industry are areas of interest. OK Autrod ER2509 can be used in combination with OK Flux 10.94.

C	Mn	Si	P	S	Cr	Ni	Mo	N	W	FN
0.01	0.40	0.40	-	-	25.0	9.80	4.0	0.30	< 1.0	50.0



Stainless Steel Strip

Submerged Arc Application



Please Note: Chemistry listed below for wire/strip are typical values only.

OK Band 308L

(Formerly OK Band 11.61)

AWS A5.9; EQ308L, EN 12072, S 19 9 L

OK Band 308L is a stainless welding strip designed for surfacing using the Submerged Arc Welding process. Together with OK Band 309L and OK Flux 10.05, produces a type 308L weld deposit.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.02	1.80	0.50	-	-	20.0	10.0	< 0.3	-

OK Band 309L

(Formerly OK Band 11.65)

AWS A5.9; EQ309L, EN 12072, S 19 12 3 L

OK Band 309L is a stainless welding strip intended for the initial cladded layer with OK Flux 10.05. It provides a buffer layer when used with 308L, 316L, 317L, or 347 to produce the desired analysis of the second layer.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.02	1.80	0.50	-	-	24.0	13.0	< 0.3	-

OK Band 316L

(Formerly OK Band 11.63)

AWS A5.9; EQ316L, EN 12072, S 19 12 3 L

OK Band 316L is a stainless welding strip designed for surfacing using the Submerged Arc Welding process. Together with OK Band 309L and OK Flux 10.05, produces a type 316L weld deposit.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.02	1.80	0.50	-	-	19.0	12.50	2.80	-

OK Band 317L

(Formerly OK Band 11.67)

AWS A5.9; EQ317L, EN 12072, S 19 12 4 L

OK Band 317L is a stainless welding strip designed for surfacing using the Submerged Arc Welding process. Together with OK Band 309L and OK Flux 10.05, produces a type 317L weld deposit.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.03	2.0	0.60	-	-	20.0	1.50	4.0	Cu < 1

OK Band 347

(Formerly OK Band 11.62)

AWS A5.9; EQ347L, EN 12072, S 19 9 Nb

OK Band 347 is a stainless welding strip designed for surfacing using the Submerged Arc Welding process. Together with OK Band 309L and OK Flux 10.05, produces a type 347 weld deposit.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.02	1.80	0.50	-	-	20.0	10.0	< 0.3	Nb 1.0



Please Note: Chemistry listed below for wire/strip are typical values only.



OK Band 309LNb
(Formerly OK Band 11.72)
309LNb; EN 12072, S Z 23 12 L Nb

OK Band 309LNb is a stainless welding strip designed for the electroslag welding process. Together with OK Flux 10.10, produces a type 347 weld deposit.

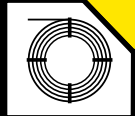
C	Mn	Si	P	S	Cr	Ni	Nb	Other
0.01	1.8	0.5	-	-	24	13	0.5	-

OK Band 309LMo
(Formerly OK Band 11.73)

309LMo; EN 12072, S Z 23 12 2 L

OK Band 309LMo is a stainless welding strip designed for the electroslag welding process. Together with OK Flux 10.10, produces a type 316L weld deposit.

C	Mn	Si	P	S	Cr	Ni	Mo	Other
0.015	1.8	0.4	-	-	20.5	13.5	3.1	-



OK Band NiCrMo-3
(Formerly OK Band 11.92)

AWS A5.14; Class ERNiCrMo-3, EN ISO 18274, B Ni 6622 (NiCr20Mn3Nb)

OK Band NiCrMo3 is a nickel-based strip for submerged arc or electroslag strip cladding. Together with OK Flux 10.11 for electroslag welding or OK Flux 10.16 for subarc welding, produces a weld overlay with good corrosion resistance and high-temperature properties.

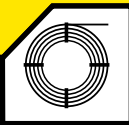
C	Mn	Si	P	S	Cr	Ni	Mo	N	Fe	Other
<0.1	0.3	0.1	-	-	22	> 58.0	9	0.05	<2.0	-

OK Band NiCr3
(Formerly OK Band 11.95)

AWS A5.14; Class ERNiCr-3

OK Band NiCr3 is a nickel-based strip for submerged arc strip cladding. Together with OK Flux 10.11 for electroslag welding or OK Flux 10.16 for subarc welding, produces a weld overlay with good resistance to stress-corrosion cracking at high temperatures.

C	Mn	Si	P	S	Cr	Ni	Nb	N	Fe	Other
<0.1	3	0.2	-	-	20	>67	4.0	0.05	< 2	< 2

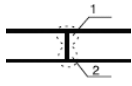
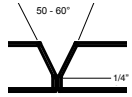
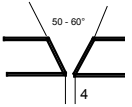


SAW Joint Preparations and Welding Parameters

Submerged Arc Application

Typical welding data and recommended joint preparations for submerged arc welding.

Non and low alloyed steels

Type of joint	Plate thickness		Wire diameter		Run no	Welding current	Arc voltage	Welding speed	
	in	mm	in	mm		A	V	in/min	cm/min
	1/4	6	1/8	3.2	1	320	32	31	80
			1/8	3.2	2	350	32		
	1/3	8	5/32	4.0	1	450	32	30	75
			5/32	4.0	2	500	32		
	3/8	10	5/32	4.0	1	550	33	28	70
			5/32	4.0	2	600	33		
	1/2	12	5/32	4.0	1	600	33	24	60
			5/32	4.0	2	650	33		
 Gap: as small as possible; in locations where gap > 1 mm: SMAW or GMAW root run.	for all procedures: 1 run from back side:								
			5/32	4.0	1	680	32	20	50
	9/16	14	5/32	4.0	1	650	26	20	50
	5/8	16	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	34	24	60
	23/32	18	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	34	20	50
	4/5	20	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	30	24	60
			5/32	4.0	3	750	34	24	60
	1	25	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	30	24	60
			5/32	4.0	3	750	30	24	60
			5/32	4.0	4 - 5	750	32	20	50
	3/16	30	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	30	24	60
			5/32	4.0	3	750	30	24	60
			5/32	4.0	4 - 5	750	32	20	50
			5/32	4.0	6 - 8	750	32	20	50
	19/32	≥ 40	5/32	4.0	1	580	26	24	60
			5/32	4.0	2	750	30	24	60
			5/32	4.0	3	750	30	24	60
			5/32	4.0	4 - 5	750	32	20	50
			5/32	4.0	6 - n	750	32	20	50
 Welded from 1 side root run: SMAW or GMAW. Thickness of root run ≥ 5 mm.	9/16	14			1	SMAW or GMAW			
			5/32	4.0	2	550	26	20	50
			5/32	4.0	3	600	30	20	50
			5/32	4.0	4	680	32	20	50
	5/8	16			1	SMAW or GMAW			
			5/32	4.0	2	550	26	20	50
			5/32	4.0	3	650	32	20	50
			5/32	4.0	4 - 5	680	32	20	50
	23/32	18			1	SMAW or GMAW			
			5/32	4.0	2	550	26	20	50
			5/32	4.0	3 - 4	650	30	20	50
			5/32	4.0	5 - 6	680	32	20	50
	4/5	20			1	SMAW or GMAW			
			5/32	4.0	2	550	26	20	50
			5/32	4.0	3 - 4	650	30	20	50
			5/32	4.0	5 - 6	750	32	20	50
			5/32	4.0	7	680	32	20	50
	7/8	22			1	SMAW or GMAW			
			5/32	4.0	2	550	26	20	50
			5/32	4.0	3 - 4	650	30	20	50
			5/32	4.0	5 - n-2	750	32	20	50
			5/32	4.0	n-1 - n	680	32	20	50

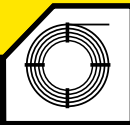


Typical welding data and recommended joint preparations for submerged arc welding.

Non and low alloyed steels

Type of joint	Throat thickness		Wire diameter		Run no	Welding current	Arc voltage	Welding speed	
	in	mm	in	mm		A	V	in/min	cm/min
	1/8	3	1 x 1/8	1 x 3.2	1	500	28	31	31
	5/32	4	1 x 1/8	1 x 3.2	1	500	28	24	60
	1/5	5	1 x 5/32	1 x 4.0	1	650	30	24	60
	9/32	7	1 x 1/8	1 x 3.2	1	500	29	20	50
			1 x 1/8	1 x 3.2	2	620	32	24	60
	5/32	4	1 x 1/8	1 x 3.2	1	600	32	39	100
	1/5	5	1 x 1/8	1 x 3.2	1	600	32	24	60
	1/4	6	1 x 1/8	1 x 3.2	1	650	32	22	55
	9/32	7	1 x 1/8	1 x 3.2	1	750	32	18	45
	Twin Arc								
	5/32	4	2 x 1/16	2 x 1.6	1	800	32	45	115
	1/5	5	2 x 5/64	2 x 2.0	1	800	32	39	100
	Cored wire								
	1/5	5	2 x 3/32	2 x 2.4	1	800	30	47	120
	Tandem DC+, AC								
	5/32	4	5/32	4.0	1 (DC+)	800	32	55	140
			5/32	4.0	1 (AC)	700	36		
	Tandem DC+, AC								
	5/32	4	5/32	4.0	1 (DC+)	800	32	55	140
			5/32	4.0	1 (AC)	700	36		
	1/5	5	5/32	4.0	1 (DC+)	800	32	35	90
			5/32	4.0	1 (AC)	700	36		

Note: If a cored wire is used, an extra 2 volts are required in the high current range (>600A) to spread the extra weld metal (25-30%).

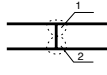
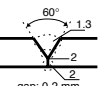
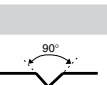
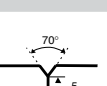


SAW Joint Preparations and Welding Parameters

Submerged Arc Application

Typical welding data and recommended joint preparations for submerged arc welding.

Stainless steels

Type of joint	Plate thickness		Wire diameter		Run No.	Welding current	Arc voltage	Welding speed	
	in	mm	in	mm		A	V	in/min	cm/min
	1/4	6	3/32	2.4	1	300	33	16	40
			3/32	2.4	2	400	34	16	40
			1/8	3.2	1	400	34	39	100
			1/8	3.2	2	500	34	51	130
	5/16	8	3/32	2.4	1	350	33	16	40
			3/32	2.4	2	450	34	16	40
			1/8	3.2	1	450	34	22	55
			1/8	3.2	2	550	34	22	55
			5/32	4.0	1	450	34	39	100
			5/32	4.0	2	550	34	51	130
	2/5	10	3/32	2.4	1	420	30	18	45
			3/32	2.4	2	420	32	16	40
			3/32	2.4	3	420	32	16	40
			1/8	3.2	1	500	30	22	55
			1/8	3.2	2	500	32	22	55
			5/32	4.0	1	550	31	26	65
			5/32	4.0	2	550	34	39	100
	1/2	12	5/32	4.0	1	600	32	24	60
			5/32	4.0	2	600	34	31	80
	4/5	20	5/32	4.0	1	575	31	24	60
			5/32	4.0	2	600	32	24	60
			5/32	4.0	3-5	600	34	26	65
	1	25	5/32	4.0	1	550	32	24	60
			5/32	4.0	2	600	34	20	50
			5/32	4.0	3	600	34	20	50
			5/32	4.0	4-8	600	34	24	60
	1/4	6	5/64	2.0	1-n	300	31	24	60
	3/8	10	1/8	3.2	1-n	380	32	26	65
	5/8	16	1/8	3.2	1-n	450	34	28	70
	5/16	8	5/32	4.0	1	450	32	35	90
			5/32	4.0	2	550	34	33	85
	3/8	10	5/32	4.0	1	500	32	26	65
			5/32	4.0	2	600	34	33	85
	1/2	12	5/32	4.0	1	500	32	24	60
			5/32	4.0	2	600	34	28	70
	9/16	14	5/32	4.0	1	550	32	24	60
			5/32	4.0	2	600	34	24	60



STORAGE

- + Unopened flux bags must be stored in maintained storage conditions as follows:
 - Temperature: 68°F, +/- 18°F (20°C, +/- 10°C)
 - Relative humidity: As low as possible - not exceeding 60% max.
- + Fluxes shall not be stored longer than 3 years.
- + The content of unheated flux hoppers must, after an 8 hours shift, be placed in a drying cabinet or heated flux hopper at a temperature of 300°F, +/- 45°F (150°C +/- 25°C).
- + Remaining flux from unopened bags must be placed at a temperature of 300°F, +/- 45°F (150°C +/- 25°C).

RE - CYCLING

- + Moisture and oil must be removed from the compressed air used in the re-cycling system.
- + Addition of new flux must be done with the proportion of at least one part new flux to one parts re-cycled flux.
- + Foreign material, such as millscale and slag, must be removed by a suitable system, such as sieving or magnetic separator.

RE - DRYING

- + When handled and stored as above, the ESAB fluxes can normally be used straight away.
- + In severe applications, stipulated by the applicable material specification, re-drying of the flux is recommended.
- + Furthermore, if the flux has somehow picked up moisture, re-drying can return the flux to its original moisture content.
- + Re-drying shall be performed as follows:
 - Agglomerated fluxes: 570°F, +/- 45°F (300°C +/- 25°C) for about 2-4 hours.
 - Fused fluxes: 390°F, +/- 90°F (200°C +/- 50°C) for about 2-4 hours.
- + Re-drying must be done either in equipment that turns the flux so that the moisture can evaporate easily or in an oven on shallow plates with a flux height not exceeding 2 in (5 cm).
- + Re-dried flux, not immediately used, must be stored at 300°F, +/- 45°F (150°C +/- 25°C) before use.

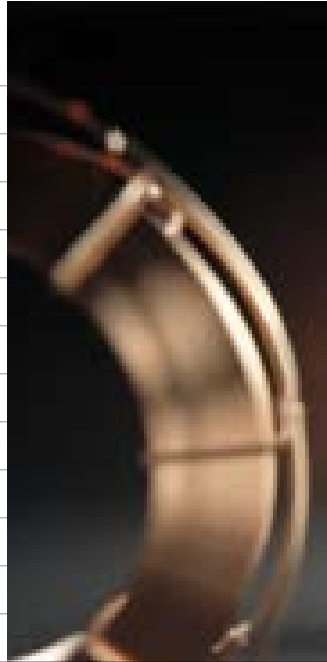
DISPOSAL

- + Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal and local regulations.
- + Please address your local disposal company for prescribed disposal.
- + Information on product and residues are given in the Safety Data Sheets available through www.esabna.com/msds.



Notes:





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Fax 52-8-350-5920

Be Safe When Welding or Cutting

Please read and understand the safety labels, instruction manuals and/or safety data sheet for your welding or cutting product before you weld or cut. Always follow safe practices and use adequate ventilation when welding or cutting. More information on welding health and safety can be found at www.esabna.com.



Call 1.800.ESAB.123