P223 FLUX AWS A5.17-97: F7A4-EM12K and A5.23-97: F8A2-EA1-A2

Lincolnweld® P223 flux is an industry standard for spiral pipe welding on up to X80 grade pipe, especially where good impact properties are required. It is also well-suited for longitudinal seam welding on pipe, producing a low bead profile with very straight edges, while minimizing undercuts. Its fast freezing slag makes it ideal for even small diameter pipe. In most cases, the slag is self-peeling. For these same reasons, P223 is an excellent choice for many two-pass welding applications. While designed for two-pass welding applications, P223 is a neutral flux which is also suitable for use in multiple pass welding with mild steel and low alloy electrodes.

ADVANTAGE LINCOLN

- The weld deposits of neutral P223 flux are extremely resistant to procedural variations.
- Fast solidification of weld metal and slag for excellent bead appearance.
- Low dust levels make handling at the work station clean and easy.
- Excellent weld profiles with straight and consistent weld bead edges.
- Fast freezing slag makes P223 suitable for smaller diameter pipe.
- Slag is self-peeling on most applications.
- Designed to deliver Charpy V-Notch impact properties that exceed most line pipe requirements.
- Low diffusible hydrogen levels.
- Manufactured under a quality system certified to ISO 9001.

TYPICAL APPLICATIONS

- Oil and gas line pipe fabrication through X-80 grades.
- Single pass or multiple pass welding.
- Single arc or multiple arc (up to 3 arc tandem welding).
- Straight seam or spiral seam welding.

PRODUCT INFORMATION

- Basicity Index: 1.60
- Particle Size:
  +12 Mesh 2% max.
  -12/+100 Mesh 96% min.
  -100 Mesh 2% max.
- Density: 1.3 g/cm^3

CONFORMANCES

For Mild Steel:

Lincolnweld® L-61
AWS A5.17-97: F7A4-EM12K
ASME SFA-5.17

For Low Alloy Steel:

Lincolnweld® L-70
AWS A5.23-97: F8A2-EA1-A2
ASME SFA-5.23

RECOMMENDED ELECTRODES

Single Pass or Two-Pass Welds:

Lincolnweld® L-61, AWS EM12K

Lincolnweld® L-70, AWS EA1 (intended for applications requiring robust Charpy impact properties).

Tested on Pipe

***MECHANICAL PROPERTIES*[(1)] –** *Two-pass seam weld on 0.688" wall X-65 pipe AC/AC two-wire tandem arc procedure*

Flux/Wire Combination	Charpy V-Notch ft•lbf (Joules) @ 0ºF (-18ºC)	Charpy V-Notch ft•lbf (Joules) @ -20ºF (-29ºC)	Charpy V-Notch ft•lbf (Joules) @ -40ºF (-40ºC)	Charpy V-Notch ft•lbf (Joules) @ -60ºF (-51ºC)
Actual Test Results As-welded P223/L-61	75 (101)	76 (103)	87 (117)	45 (61)
Actual Test Results As-welded P223/L-70	113 (153)	101 (136)	99 (134)	82 (111)

[(1)]Mechanical property results obtained on single pass or two-pass welds will vary with base plate composition, welding procedure, heat input, etc. These results are shown only to demonstrate the potential for the products being used.

Tested per AWS

MECHANICAL PROPERTIES – *As Required per AWS A5.17-97/A5.23-97*

	Yield Strength psi (MPa)	Tensile Strength psi (MPa)	Elongation (%)	Charpy V-Notch ft•lbf (Joules) @ -40ºF (-40ºC)
Requirements				
P223/L-61	58,000	70,000-95,000	22	20
AWS F7A4-EM12K	(400)	(483-655)		(27)
AWS A5.17-97	min.		min.	min.
As-welded				
Actual Test Results	63,400	77,300	31	93
	(437)	(533)		(126)
Requirements				**@ -20ºF (-29ºC)**
P223/L-70	68,000	80,000-100,000	20	20
AWS F8A2-EA1-A2	(469)	(552-689)		(27)
AWS A5.23-97	min.		min.	min.
As-welded				
Actual Test Results	79,800	93,900	25	39
	(550)	(647)		(53)

NOTE: The multiple pass procedure shown above is specified in AWS A5.17-97/AWS A5.23-97 and was employed only for the purpose of AWS classification. The testing results and AWS classification shown should not be used to determine the suitability of this flux/wire combination for service in limited pass applications. Actual procedural tests should be conducted to verify the mechanical properties obtained on these applications.

DEPOSIT COMPOSITION - *As Required per AWS A5.17-97/A5.23-97*

	%C	%Mn	%Si	%S	%P	%Mo	%Cu
Requirements							
P223/L-61							
AWS F7A4-EM12K			Not Specified				
AWS A5.17-97							
Actual Test Results	0.08	1.38	0.43	0.003	0.011	—	0.06
Requirements							
P223/L-70	0.12	1.40	.80	0.030	0.030	0.40-0.65	0.35
AWS F8A2-EA1-A2	max.	max.	max.	max.	max.		max.
AWS A5.23-97							
Actual Test Results	0.08	1.33	0.38	0.009	0.014	0.51	0.09

DIFFUSIBLE HYDROGEN
- As Tested per AWS A4.3-93

	(mL/100g weld deposit)
Requirements	
AWS F7A4-EM12K	Not Specified
Actual Test Results	
P223/L-61	3.7
Requirements	
AWS F8A2-EA1-A2	Not Specified
Actual Test Results	
P223/L-70	4.2

PACKAGING

Lincolnweld® Flux	50 lb. (23 kg) Paper Bag
P223	EDS30636

TYPICAL OPERATING PROCEDURES – *Two-run seam weld on 0.688" wall X-65 pipe AC/AC two-wire tandem arc procedure. 0.25" centered land, 90˚ included angle each side, 5˚ push lead arc, 20˚ push angle trail arc.*

Diameter Polarity CTWD[1] Lead/Trail Spacing	Approx. Wire Feed Speed in/min (m/min)	Arc Voltage (volts)	Current (amps)	Travel Speed in/min (m/min)
Side 1				
Lead Arc – P223/L-61 or L-70 5/32" (4.0 mm) AC 1-1/2" (38.1 mm) 5/8" (15.88 mm)	90 (2.3)	35	920	41 (1.04)
Trail Arc – P223/L-61 or L-70 5/32" (4.0 mm) AC 1-1/2" (38.1 mm) 5/8" (15.88 mm)	50 (1.3)	36	640	41 (1.04)
Side 2				
Lead Arc – P223/L-61 or L-70 5/32" (4.0 mm) AC 1-1/2" (38.1 mm) 5/8" (15.88 mm)	100 (2.5)	36	980	38 (.97)
Trail Arc – P223/L-61 or L-70 5/32" (4.0 mm) AC 1-1/2" (38.1 mm) 5/8" (15.88 mm)	48 (1.2)	41	620	38 (.97)

[1] CTWD (Contact Tip to Work Distance). Subtract 1/4" to calculate Electrical Stickout.

TEST RESULTS

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

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

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.

LINCOLN® ELECTRIC
THE WELDING EXPERTS

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Ave., Cleveland, OH 44117-1199 • 216.481.8100 • www.lincolnelectric.com