

MANGO Welding Procedure No. 1

Specification for Shielded Metal Arc Welding with Class E6010 Lincoln Fleetweld 5P+ electrodes

Procedure Qualification Record Nos: MANGO 1104 1-1(04-25-00),MANGO 1104 1-2(04-25-00), MANGO 1104 1-3(04-26-00), MANGO 1104 1-4(04-26-00),MANGO 1104 1-5(04-26-00), MANGO 1104 1-6(04-26-00), MANGO 1104 1-7(04-25-00), MANGO 1104 1-8(04-25-00), MANGO 1104 1-9(04-25-00) MANGO 1104 1-10(04-25-00), MANGO 1104 1-11(07-28-00), MANGO 1104 1-12(07-28-00),MANGO 1104 1-13(07-28-00).

Application: Use this procedure on all systems and pressures.

Procedure:

A. **PROCESS:** The welding shall be done with the Shielded Metal Arc Welding (SMAW) process.

B. **PARENT METALS:** The materials to which the procedure applies are identified below:

- Existing Unknown Steel (24,000psi)
- ASTM: A53, A106
- API 5L: Grade A25 through X56 (Note limit* on less than 3/16" wall thickness)

Which fall into the two following groups:

- Specified minimum yield strength less than or equal to 42,000 pounds per square inch.
- Specified minimum yield strength greater than 42,000 pounds per square inch through 56,000 pounds per square inch.

C. **DIAMETER AND WALL THICKNESS:** This procedure shall apply to all diameters through 48" and wall thicknesses identified in the following groups:

- Nominal pipe wall thickness less than 3/16 inch.*(Existing Unknown Steel, ASTM:A53, A106, API 5L: Grade A25 through X42 only)
- Nominal pipe wall thickness from 3/16 inch through 3/4 inch.

D. JOINT DESIGN:

- BUTT: Bevel the welding ends to an angle of 30°, +5°, -0°, with a root face of 1/16", +/- 1/32". The bevel shall form a V groove with an included angle of 60°+10/-0. The root opening shall be 1/16", +/- 1/32".
- FILLET: Bevel the welding ends to an angle between 50° and 90° as required for various branch diameter ratios, with a root face of 1/16", +/- 1/32". The bevel shall form a V groove with an included angle of approximately 50°. The root opening shall be 1/16", +/- 1/32".

E. **FILLER METAL:** The filler metal shall be Lincoln Electric Co. Fleetweld 5P+ conforming to AWS Classification E-6010.

F. **SIZE OF ELECTRODES AND NUMBER OF BEADS:**

Wall Thickness(Inches)	Electrode Size in Inches		Minimum Number of Passes
	Stringer Bead and Hot Pass	Fill and Cap	
0 - 0.186	3/32	1/8	3
0.187 - 0.249	1/8	5/32	3
0.250 - up	5/32	5/32	3

NOTE: The welding rod diameter may be increased or decreased by one size as needed.

G. **ELECTRICAL CHARACTERISTICS:** Use only DC reverse polarity (electrode positive) welding current.

Rod Diameter	Amperage	Voltage
3/32"	40-70	20-26
1/8"	65-130	22-28
5/32"	90-175	24-30
3/16"	140-200	24-30

H. **DIRECTION OF WELDING:** Welding shall proceed downward from the top center, or any point on the side to the bottom center.

I. **NUMBER OF WELDERS:** When the nominal diameter is less than 16", one welder may be used to complete the root pass and all successive passes. When the nominal diameter is 16" or larger, two welders are required to complete the root pass. One welder may complete all successive passes. However, the Company reserves the right to require additional welders for the root pass. It is the

opinion of the Company that additional welders will be required if there exists any danger of stringer bead cracking or if slow progress is experienced.

- J. **SPEED OF TRAVEL:** The speed of travel for all passes shall be within the range of 5 to 15 inches per minute, inclusive.
- K. **TIME LAPSE BETWEEN PASSES:** The second pass shall follow the first pass within five minutes, except when unavoidable circumstances prevail which make this requirement impractical. If 5 minutes are exceeded, follow the preheat requirements listed in O. of this procedure. Complete all welds on the same day they are started.
- L. **TYPE OF LINE UP CLAMP:** For nominal diameters less than 12", external line up clamps may be used. For 12" and larger nominal diameters on contract jobs, internal line up clamps should be used for all but tie in welds. For small jobs on 12" and larger pipe, external clamps may be used.
- M. **REMOVAL OF LINE UP CLAMP:** For nominal diameters less than 12", the line up clamps may be removed when the joint has been tack welded sufficiently to maintain root space and to prevent development of hi-low. For nominal diameters 12" and larger, the line up clamp may be removed after 50% of the root pass (stringer bead) is completed. At no time may the line up clamp be removed while welding is in progress or while the weld metal is above 400°F. The Company may require that the line up clamp be left in place until 100% of the stringer bead is completed.
- N. **CLEANING:** All rust, dirt and foreign matter shall be removed from the bevel surface before welding. The bevel surface includes that area on the inside and outside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the weld bead surface before the next bead is applied. Stringer beads shall be ground and cleaned with power tools. Grind out all holes. The finished weld and adjacent outside surface of the pipe shall be cleaned of all flux, smoke and weld spatter.
- O. **PREHEAT:** Preheat shall be required when the ambient or parent metal temperature is below 40°F. The pipe shall be preheated evenly around the pipe circumference. The preheat temperature shall be 250°F for 3" on both sides of the weld. The preheat temperature shall be monitored and controlled before and during welding using a temperature indicating crayon or pyrometer or equivalent device. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form before welding is completed.
- P. **POSTHEAT:** Postheat is not required.
- Q. **POSITION:** The welding position may be fixed or rolled.

MANGO NO. 1 Welding Procedure Specification

Welding: Procedures

After several revisions and numerous test welds, MANGO has an approved welding procedure. This welding procedure will be known as MANGO WELD PROCEDURE #1. MANGO WELD PROCEDURE #1 was qualified by performing 13 different test welds (below) which yielded positive test results. This procedure may be used to qualify welders and used in production welding.

Test Weld No.	Date Welded	Type of Weld	Pipe Grade	Wall Thickness (Group)	O.D.
1	04/25/00	Butt	X42	.154"(Less Than 3/16")	2.375"
2	04/25/00	Butt	X42	.250" (3/16" & Greater)	12.750
3	04/26/00	Butt (60min.between1 st /2 nd)	X56	.375" (3/16" & Greater)	12.750
4	04/26/00	Fillet (extra)	X42 x X42	.154" (Less Than 3/16")	2.375
5	04/26/00	Fillet	X42 x X42	.250" (3/16" & Greater)	12.750
6	04/26/00	Fillet	X56 x X56	.375" (3/16" & Greater)	12.750
7	04/25/00	Fillet (extra)	GrB x X42	.133" x .250"	3/4 x 12.75
8	04/25/00	Butt	Gr.A	.410" (3/16" & Greater)	12.750
9	04/25/00	Butt	Gr. B	.133" (Less Than 3/16")	1.315
10	04/25/00	Butt	Gr. B	.133" (Less Than 3/16")	1.315
11	07/28/00	Butt (Rolled)	X56	.375" (3/16 & Greater)	12.750
12	07/28/00	Butt (Rolled)	X42	.250 (3/16" & Greater)	6.625
13	07/28/00	Butt (Rolled)	X42	.156" (Less Than 3/16")	4.50

Review MANGO WELD PROCEDURE #1 and the test documentation. Participating operators will need this procedure and documentation if the intent is to adopt the procedure for qualifying welders. Since there was a lot of discussion about Section E, Filler Metal of the Welding Procedure, it was recommended that the final consensus be reviewed. The consensus was that Section E would read as follows:

Section E. FILLER METAL: The filler metal shall be Lincoln Electric Company, Fleetwood 5 pt. conforming to AWS Classification E-6010.

Therefore the procedure remains as written and is to be used for MANGO qualification purposes and production welds in some companies. If a company wants to use a different electrode out of Group 1 of API 1104 for **production welding**, per the PSC, this is permissible. If a company chooses to allow another electrode from Group 1, they must note this allowance in their company weld procedure. However, as far as qualification of welders to MANGO Procedure No. 1, they must abide by the electrode specified in Section E (above). Special Note: