

Specification for Shielded Metal Arc Welding with low hydrogen (Class 7018) electrodes.

Procedure Qualification Record No.: MANGO#2LH-11/9-10/2015

Application: Use this procedure on hot taps, stopple fittings, welded split sleeves, patches and any other welding on lines pressurized to 100 psig or more, on lines with a high flow rate that will quench the weld and cause “sweating” or on lines that contain liquid. Low hydrogen welding methods may need to be used on lines pressurized at less than 100 psig also.

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

B. PARENT METALS: The metals shall conform to one of the following specifications:

ASTM: A53, A105, A106, A234 or A192

API 5L: Grade A through X65

Carbon Equivalent Levels of Vintage Pipe (Pre 1973 manufactured pipe)

C. DIAMETER AND WALL THICKNESS: This procedure shall apply to all diameters and wall thicknesses.

D. JOINT DESIGN: For branch connections, the branch shall be beveled so as to allow a full penetration fillet weld to be made. For all sleeve and stopple fitting ends, patches, wear pads, shunts or saddle pads, the bevel shall be a 90° square edge preparation. Butt weld sleeve and stopple fitting side seams shall be beveled 30°, +7.5°, -0° or, if lapped over, a 90° preparation. The leg length fillet welds onto pipe is limited to the wall thickness of the pipe to which it is applied or the thickness of the added material, whichever is smaller with a tolerance of +1/8” - 0”. For longitudinal butt welds of full encirclement sleeves, when 100% penetration is required, the root opening (space between abutting edges) should be sufficient. These joints should be fitted with a mild steel back-up strip or suitable tape to prevent penetration of the weld into the carrier pipe. Root Face: 0” minimum to 3/32” maximum. See table 2.0 for each joint design.

E. FILLER METAL: The filler metal shall conform to AWS Classification E-7018.

F. SIZE OF ELECTRODE AND NUMBER OF BEADS: Low Hydrogen electrodes will be 3/32” or 1/8” diameters. Only one water tight pass is required on wear pads, wear sleeves and shunts. The minimum number of beads required for all other fillet welds is as follows in Table 1.0.

Note: When welding on wall thicknesses .188 or less 3/32" electrodes shall be used.

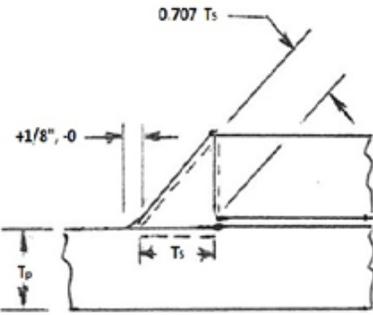
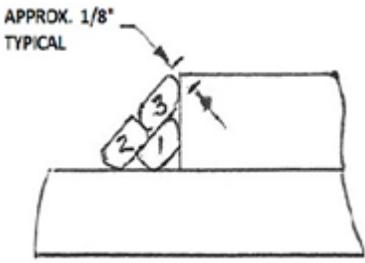
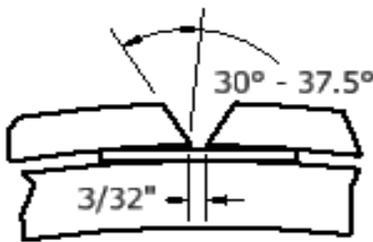
Table 1.0 Number of Beads

Wall Thickness (Inches)	Minimum Number of Beads
0 - .188	2
.189 - .499	3
.500 - up	4

A. STAGERING BEADS: The starts and stops must be staggered when using multiple beads.

G. ELECTRICAL CHARACTERISTICS: Use only DC reverse polarity (electrode positive) welding current. See Table 2.0 for each joint design.

Table 2.0 Joint Design, Electrode and Electrical Characteristics

Joint Design: <u>Fillet Weld</u>						
						
Electrode and Electrical Characteristics: Fillet Weld						
Bead	Electrode Size, In.	Electrode	Voltage Range	Amperage Range	Minimum Heat Input kJ/Inch	Travel Speed Range ipm
Root	3/32"	E7018	21 – 31	88 -109	14	3 – 9
Cover	3/32"	E7018	20 – 31	84 - 113	14	3 – 9
	1/8"	E7018	19 – 28	111 - 133	14	3 – 9
Joint Design: <u>Groove Weld</u>						
						
Electrode and Electrical Characteristics: Groove Weld						
Bead	Electrode Size, In.	Electrode	Voltage Range	Amperage Range	Minimum Heat Input kJ/Inch	Travel Speed Range ipm
Root	3/32"	E7018	21 - 29	78 -97	14	3 – 9
Hot Pass	3/32"	E7018	21 - 28	77 - 97	14	3 – 9
Cover	3/32"	E7018	21 - 27	77 - 105	14	3 – 9

$$\text{Heat Input(kJ/in)} = (\text{Amps} \times \text{Volts} \times 60) / [\text{Travel Speed(in/Min)} \times 1000]$$

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

I. NUMBER OF WELDERS: One welder may complete the entire weld.

J. SPEED OF TRAVEL: The speed of travel for all passes shall be within the ranges shown in Table 2.0.

K. TIME LAPSE BETWEEN PASSES: The time lapse between the completion of the root bead or first pass and the start of the second pass shall not exceed 5 minutes. All welds started should be welded continuously without interruption until they are completed.

L. TYPE OF LINE UP CLAMP: For branch connections, line up clamps are not normally used but the use of spacing tools will help maintain proper bevel spacing. For sleeves, stopple fittings, patches and wear pads, a method of holding them in intimate contact with the pipe is required. Various devices such as "C" clamps or hydraulic jacks and chains are suggested. Saddle pads and shunts can usually be properly tacked while held by hand.

M. REMOVAL OF LINE UP CLAMPS: If an external clamp is used, it shall remain in place until 50% of the longitudinal root beads are complete.

N. CLEANING: Remove all rust, dirt, and foreign matter from the bevel surface and the area on the outside of the pipe where welding will take place and that will be covered by the sleeve, patch, etc. After cleaning, check the fit before tacking in place. Grind the bead and remove the slag, especially in areas of undercut, with power tools before applying the successive beads. Clean the finished weld and adjacent areas of all slag, smoke and weld spatter.

Note: To prevent the tendency of low hydrogen electrodes to undercut, deposition of filler metal shall be closely controlled. Ensure that undercut notches are cleaned or ground out to prevent burying slag with successive passes. If, after completion of the last bead, any such defect exists, it shall be repaired.

O. WELDING SEQUENCE: For split sleeves and stopple fittings, weld side seams on an alternating basis, then weld one end completely and then the other end. For saddle pads, weld the pad to the run pipe first and then to the branch pipe. For split tees or full encirclement saddles, weld the longitudinal seams on an alternating basis, then the circumferential fillet welds. Reference API 1104, Appendix B, Figures B-6 thru B-11.

P. HANDLING OF ELECTRODES: The handling of Electrodes shall follow the AWS Standard D1.1

Q. PREHEAT/POST HEAT: Preheat shall be required when the ambient or parent metal temperature is below 40°F or if moisture is present on the parent metal. 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 maintained before and during welding. Post weld heat is not required.