

VI. In-Service Welding

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A. General

This section applies to welding to be performed on "live" gas lines.

Approved welding procedures [SM-102](#) through [SM-127](#) shall be used for welding on "live" gas lines larger than 2.375" OD. The use of these welding procedures on lines 2.375" OD and smaller (i.e., [SM-101](#)) shall be determined by specific pipe and flow conditions.

The welding of piping in accordance with this section shall be performed by qualified welders using qualified procedures. The surfaces to be welded shall be smooth, uniform, and free of fins, laminations, tears, scale, slag, grease, paint, and other deleterious material that might adversely affect the welding. The joint design and spacing between abutting ends shall be in accordance with the welding procedure specification to be used.

Particular consideration should be given to the fillet weld used to join a sleeve to a carrier pipe because the fillet weld is prone to underbead or delayed hydrogen cracking. With welds on pressurized and flowing piping systems, success has been achieved using low-hydrogen welding processes. The cracking process is related to the hydrogen absorbed by the hot weldment. A slow cooling rate is necessary to permit diffusion and elimination of hydrogen. Proper attention should be given to fit up and to the carbon equivalent factor and chemical composition of both the sleeve and carrier pipe.

B. Low Hydrogen Welding Rod Care

The use of low hydrogen electrodes (E-XX18) requires that special attention be given to electrode care and handling requirements. Low hydrogen electrodes are highly susceptible to absorbing moisture from the air. This moisture turns into hydrogen during the welding process and may cause hydrogen cracking during the cooling process.

Unopened, hermetically sealed, containers provide excellent protection in good storage conditions. Moisture resistant electrodes denoted with an "R" suffix have a coating with higher resistivity to moisture absorption. Low hydrogen AWS classification designators of "H4, H8 or H16" suffixes denote the volume (mL) of diffusible hydrogen per 100grams of weld metal.

Electrodes that are coming from an unopened hermetically sealed container shall be allowed to be kept exposed for up to four (4) hours before going into a preheated rod oven or being discarded only if the electrodes are labeled with the following designations: moisture resistant "R" and containing less than or equal to 4mL of hydrogen per 100grams of weld metal "H4". Opened containers or individual electrodes are to be stored in a preheated rod oven at 150-300°F. These electrodes shall remain in a heated state until either used or discarded. Re-drying of low hydrogen electrodes is not allowed. Once removed from the rod oven, an electrode is to be used or discarded. Questionable low hydrogen electrodes shall not be used to weld on pipeline facilities.

C. Alignment

1. Offset

The offset between the abutting edges for grooved welds should not exceed 1/8 (0.125)". For sleeve and saddle welds, the gap between the sleeve or saddle and the carrier pipe should not be excessive. To obtain proper fit-up, clamping devices should be used, or misaligned surfaces can be built up with weld metal.

2. Root Opening (Complete Encirclement Fittings)

The root opening, the space between abutting surfaces, should be sufficient to permit 100 percent penetration. Joints paralleling the axis of the carrier pipe may be fitted with a suitable tape or mild steel backup strip to prevent the weld metal from being fused to the surfaces of the carrier pipe.

D. Bevels

Edges of the pieces to be joined may be beveled by a machine tool or may be cut by an oxygen cutting process. The beveled edges shall be smooth and uniform, and dimensions shall be in accordance with the qualified WPS.

E. Weather Conditions

Welding shall not be done when the quality of the completed weld would be impaired by the prevailing weather conditions, including but not limited to airborne moisture, blowing sands, or high winds estimated to be in excess of 30 mph or as determined that could be detrimental to the weld. Shields or other protective devices may be used when practical. The Company representative, or designee, shall decide if weather conditions are suitable for welding.

F. Clearance

When bell holes are used, they shall be of sufficient size to provide the welder(s) ready access to the work.

G. Cleaning

Remove all rust, dirt and other foreign matter before starting a weld. Scale and slag shall be removed from each bead and groove before starting the next bead. The root bead shall be ground as much as practical while all other passes are to be brushed. Cleaning may be done with either hand or power tools.

H. Welding Sequence

Suggested welding sequences are shown in [Section X](#), figures [4](#) through [9](#). Detailed sequences of beads are shown in [Section X](#), Figures [2](#) and [3](#).

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Procedure performed to make repair fittings permanent infrastructure on the gas pipeline involves seal welding of all potential external leak paths to give the fitting a secondary pressure seal in case of primary seal failure. See procedures [SM-134](#) and [SM-135](#) (procedure under development).

(UNCONTROLLED IF PRINTED)