



DIRECT DEPOSITION WELDING

D-23.1

Asset Type: Gas Transmission and Distribution

Function: Design and Construction

Issued by: [REDACTED]

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Rev. #01: This document replaces Revision #00. For a description of the changes, see Page 2.

Purpose and Scope

This numbered document provides the requirements for performing direct-deposition weld repairs on pressurized pipelines, as permitted in [Utility Standard S4134](#).

Acronyms

API: American Petroleum Institute
 ATS: Applied Technology Services
 PRCI: Pipeline Research Council International
 SMAW: shielded metal arc welding
 SMYS: specified minimum yield strength

References

Document

Arc Welding Procedure Requirement – All Stress Levels	D-22
Arc Welder Qualification for Working on Pipelines That Operate at Over 20% of SMYS	D-30.2
Welder Qualification for In-Service Welding	D-30.4
Weld Inspection	D-40
Selection of Steel Gas Pipeline Repair Methods	Utility Standard S4134

General Information

1. Welding of unpressurized pipelines for repair of corrosion damage shall be performed using conventional welding procedures under the requirements of [Numbered Document D-22](#).
2. Welding procedures for direct-deposition welding on pressurized pipelines shall conform to API 1104 and to the PRCI for work specified in this numbered document.
3. Welders who perform direct-deposition welding on pressurized pipe shall be qualified according to [Numbered Document D-30.4](#).
4. Contact the responsible engineer before performing any direct-deposition welding.
5. Based on the information gathered in the "Preparation" section of this numbered document, a qualified welding engineer shall determine the necessary welding technique using the guidelines contained in PRCI Report L51782, "Guidelines for Weld Deposition Repair on Pipelines." Subsequent industry reports and guidelines based on PRCI Report L51782 may also be used. The resulting welding procedure shall be documented and approved by the manager of pipeline engineering or the manager of system integrity before use.
6. Direct-deposition welding shall not be used within 3" of any defect (gouges, laminations, etc.) in the pipe which exceeds 1/3 of the nominal wall thickness in depth and/or 1/4 of the nominal pipe diameter in length. Any number of closely-spaced, adjacent defects shall be treated as one defect of a size and depth encompassing all the defects included.

Preparation

7. The following information shall be determined before welding.
 - A. The chemical composition of the pipe and the fittings for calculating the percentage of carbon and carbon equivalents. To gain this information, analyze the metal filings removed from the pipe or the fitting.

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Alternatively, the potential, maximum, carbon content and the carbon equivalents may be calculated from the material specifications.

- B. The expected gas-flow rate at the time of welding.
- C. An accurate mapping of the corrosion damage to be repaired, including measuring the remaining pipe wall. Verify the pipe-wall thickness with ultrasonic thickness instruments at all portions of the pipe within 1-1/2" of where the weld metal will be deposited. The extent of the area to be repaired shall be plotted and marked on the pipe. If it is difficult to get consistent readings using simple, ultrasonic, thickness-measurement instruments, ultrasonic flaw-detection equipment shall be used to determine the remaining wall thickness and to verify the absence of volumetric defects.
- D. If welds will be deposited on existing welds other than double-submerged arc welds, all portions of the weld within 1-1/2" of where the new weld metal will be deposited shall be inspected by using radiography or ultrasonic flaw examination.

Evaluation of Burn-Through Potential

- 8. A qualified welding engineer shall perform an evaluation of the burn-through potential, if welding is needed on a pipe less than or equal to 1/4" thick. The evaluation may be based on the Battelle welding-heat-flow computer model or on applicable test results.
- 9. Document any restrictions on the electrode size, welding-heat input, or other welding conditions found to be necessary as a result of the evaluation.

Welding Procedures for Direct-Deposition Welding

- 10. A B31.G or RSTRENG calculation of the permitted line pressure shall be performed before welding. During welding, the maximum-permitted line pressure shall not exceed 80% of the B31.G or RSTRENG, calculated, permitted, line pressure.
- 11. The minimum-permitted, local, wall thickness that may be repaired is 0.156".
- 12. All pipe coating shall be removed for a minimum of 6" around the area to be repaired. The surface shall be cleaned to permit visual inspection and ultrasonic thickness verification of the area.
- 13. A visual inspection of the area to be repaired shall be conducted before welding.
- 14. All remaining coating and corrosion products shall be removed from the area to be welded. Ensure that there is no significant reduction of the remaining wall. Sharp transitions between corroded and uncorroded pipe should be ground to allow the deposition of sound weld metal. The prepared area shall extend a minimum of 2" beyond the area requiring repair.
- 15. Once the necessary welding technique has been determined, the qualified welding engineer shall select the proper Company welding procedure to use with the technique.
- 16. When low-hydrogen SMAW electrodes are specified for welding, the electrodes shall be maintained in the manufacturer's unopened, air-tight container until immediately before use.
- 17. Use preheating to dry the surface for welding when surface condensation is present. Reduce flow, if necessary, to prevent surface condensation, provided that the flow reduction will not affect the selection of the welding procedure. Preheating is usually not required except when specified by the qualified welding engineer.
- 18. The completed repair shall be inspected visually and by magnetic particle examination.

Revision Notes

Revision 01 has the following changes:

- 1. Updated the "Acronyms" section.
- 2. Added the hyperlinks to all references.
- 3. Revised Item 4 in the "General Information" section on Page 1.
- 4. This document is part of Change 61.

