Avoiding Environmental Cracking in Amine Units

API RECOMMENDED PRACTICE 945
THIRD EDITION, JUNE 2003

REAFFIRMED, JULY 2020

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Downstream Segment

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1 Scope

This recommended practice discusses environmental cracking problems of carbon steel equipment in amine units. Stress corrosion cracking of stainless steels in amine units is beyond the scope of this document although there have been isolated reports of such problems. This practice does provide guidelines for carbon steel construction materials including their fabrication, inspection, and repair to help assure safe and reliable operation. The steels referred to in this document are defined by the ASTM designation system, or are equivalent materials contained in other recognized codes or standards. Welded construction is considered the primary method of fabricating and joining amine unit equipment. See 3.1 and 3.2 for the definitions of weld and weldment.

This document is based on current engineering practices and insights from recent industry experience. Older amine units may not conform exactly to the information contained in this recommended practice, but this does not imply that such units are operating in an unsafe or unreliable manner. No two amine units are alike, and the need to modify a specific facility depends on its operating, inspection, and maintenance history. Each user company is responsible for safe and reliable unit operation.

2 References

2.1 REFERENCED PUBLICATIONS

The following publications are referenced by number in this recommended practice.

1. H. W. Schmidt et al., "Stress Corrosion Cracking in Alkaline Solutions," *Corrosion,* 19[illegible], Volume 7, No. 9, p. 295.

2. G. L. Garwood, "What to Do About Amine Stress Corrosion," *Oil and Gas Journal,* July 27, 1953, Volume 52, p. 334.

3. P. G. Hughes, "Stress Corrosion Cracking in an MEA Unit," Proceedings of the 1982 U.K. National Corrosion Conference, Institute of Corrosion Science and Technology, Birmingham, England, 1982, p. 87.

4. H. P. McHenry et al., "Failure Analysis of an Amine Absorber Pressure Vessel," *Materials Performance,* 1987. Volume 26, No. 8, p. 18.

5. J. Gutzeit and J. M. Johnson, "Stress Corrosion Cracking of Carbon Steel Welds in Amine Service," *Materials Performance,* 1986, Volume 25, No. 7, p. 18.

6. J. P. Richert et al., "Stress Corrosion Cracking of Carbon Steel in Amine Systems," *Materials Performance,* 1988, Volume 27, No. 1, p. 9.

7. A. J. Bagdasanian et al., "Stress Corrosion Cracking of Carbon Steel in DEA and 'ADIP' Solutions," *Materials Performance,* 1991, Volume 30, No. 5, p. 63.

8. R. J. Horvath, Group Committee T-8 Minutes, Sec. 5.10—Amine Units, Fall Committee Week/93, September 29, 1993. NACE International.

9. R. N. Parkins and Z. A. Foroulis, "The Stress Corrosion Cracking of Mild Steel in Monoethanolamine Solutions" (Paper 188), *Corrosion/87,* NACE International, Houston, 1987.

10. H. U. Schutt, "New Aspects of Stress Corrosion Cracking in Monethanolamine Solutions" (Paper 159), *Corrosion/88,* NACE International, Houston, 1988.

11. M.S. Cayard, R.D. Kane, J. Kaley and M. Prager, "Research Report on Characterization and Monitoring of Cracking in Wet H2S Service," *API Publication 939,* American Petroleum Institute, Washington, D.C., October 1994.

12. T. G. Gooch, "Hardness and Stress Corrosion Cracking of Ferritic Steel," *Welding Institute Research Bulletin,* 1982, Volume 23, No. 8, p. 241.

13. C. S. Carter and M. V. Hyatt, "Review of Stress Corrosion Cracking in Low Alloy Steels with Yield Strengths Below 150 KSI," *Stress Corrosion Cracking and Hydrogen Embrittlement of Iron Base Alloys,* NACE International, Houston, 1977, p. 524.

2.2 REFERENCED CODES AND STANDARDS

The following codes and standards are directly referenced (not numbered) in this recommended practice. All codes and standards are subject to periodic revision, and the most recent revision available should be used.

API

API 510	*Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration*
API 570	*Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-Service Piping Systems*
RP 572	*Inspection of Pressure Vessels*
RP 574	*Inspection Practices for Piping System Components*
RP 579	*Fitness-for-Service*
RP 580	*Risk-Based Inspection*
RP 582	*Welding Guidelines for the Chemical, Oil, and Gas Industries*
Publ 2217A	*Guidelines for Work in Inert Confined Spaces in the Petroleum Industry*