



Standard Guide for Corrosion-Related Failure Analysis¹

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1. Scope

1.1 This guide covers key issues to be considered when examining metallic failures when corrosion is suspected as either a major or minor causative factor.

1.2 Corrosion-related failures could include one or more of the following: change in surface appearance (for example, tarnish, rust, color change), pin hole leak, catastrophic structural failure (for example, collapse, explosive rupture, implosive rupture, cracking), weld failure, loss of electrical continuity, and loss of functionality (for example, seizure, galling, spalling, swelling).

1.3 Issues covered include overall failure site conditions, operating conditions at the time of failure, history of equipment and its operation, corrosion product sampling, environmental sampling, metallurgical and electrochemical factors, morphology (mode) or failure, and by considering the preceding, deducing the cause(s) of corrosion failure.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 3 Methods of Preparation of Metallographic Specimens²

E 1459 Guide for Physical Evidence Labeling and Related Documentation³

E 1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory³

G 1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens⁴

G 46 Guide for Examination and Evaluation of Pitting Corrosion⁴

3. Significance and Use

3.1 This guide is intended to assist those encountering

corrosion or possible corrosion as a causative factor in a failure analysis.

3.2 This guide is not an absolute plan that will identify the cause of corrosion in all failure analyses.

3.3 This guide is intended to help an investigator identify significant sources and types of corrosion information that may be available for failure analysis.

3.4 Appendix X1 contains a checklist that is intended to assist in corrosion-related failure evaluations.

4. Organizing the Analysis

4.1 Early recognition of corrosion as a factor in a failure analysis is critical to any such investigation. Therefore, it is generally desirable to conduct the analysis as soon as possible after the apparent failure. It is *always* desirable to protect the physical evidence until the analysis can begin. Much important corrosion information can be lost if a failure scene is altered or changed before appropriate observations can be made.

4.2 A written plan for the detailed analysis should be prepared. The plan may include methods of documentation (photographs before and during analysis, sketches, statements), responsibilities of parties, reporting needs, and scheduling.

4.3 If the capability (corrosion knowledge and experience) of in-house personnel and availability of resources are inadequate to make the analysis in a timely manner, it may be expedient to seek third party services.

5. Failure Site Conditions

5.1 When possible, an overall examination of the conditions at a failure site prior to cleaning, moving, or sampling debris should be conducted. Impressions as to physical arrangements, odors, colors, textures, and conditions of adjacent structures can provide important clues as to active corrosion processes.

5.2 Photographs or videotapes serve as documentation of the observations. Color photographs are preferable. It is helpful to include labels and indications of size, location, and orientation in the photographs. Photographs before, during, and after sampling are recommended.

5.3 Sketches and drawings with notes as to detailed observations can be beneficial for later evaluations. Locations of samples and photographs may be shown.

5.4 Interviews with those who were present or nearby when the failure occurred would be appropriate. Information on time,

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² Annual Book of ASTM Standards, Vol 03.01.

³ Annual Book of ASTM Standards, Vol 14.02.

⁴ Annual Book of ASTM Standards, Vol 03.02.