



Standard Practices for Detecting Susceptibility to Intergranular Attack in Ferritic Stainless Steels¹

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1. Scope*

1.1 These practices cover the following four tests:

1.1.1 *Practice W*—Oxalic acid etch test for detecting susceptibility to intergranular attack in stabilized ferritic stainless steels by classification of the etching structures (see Sections 3 – 10).

1.1.2 *Practice X*—Ferric sulfate-sulfuric acid test for detecting susceptibility to intergranular attack in ferritic stainless steels (Sections 11 – 16).

1.1.3 *Practice Y*—Copper-copper sulfate-50 % sulfuric acid test for detecting susceptibility to intergranular attack in ferritic stainless steels (Sections 17 – 22).

1.1.4 *Practice Z*—Copper-copper sulfate-16 % sulfuric acid test for detecting susceptibility to intergranular attack in ferritic stainless steels (Sections 23 – 29).

1.2 The following factors govern the application of these practices (1-6)²:

1.2.1 Practice W, oxalic acid test, is a rapid method of identifying, by simple electrolytic etching, those specimens of certain ferritic alloys that are not susceptible to intergranular corrosion associated with chromium carbide precipitation. Practice W is used as a screening test to avoid the necessity, for acceptable specimens, of more extensive testing required by Practices X, Y, and Z. See Table 1 for a listing of alloys for which Practice W is appropriate.

1.2.2 Practices X, Y, and Z can be used to detect the susceptibility of certain ferritic alloys to intergranular attack associated with the precipitation of chromium carbides or nitrides.

1.2.3 Practices W, X, Y, and Z can also be used to evaluate the effect of heat treatment or of fusion welding on susceptibility to intergranular corrosion.

1.2.4 Table 2 lists the identification ferritic stainless steels for which data on the application of at least one of the standard practices is available.

1.2.5 Some stabilized ferritic stainless steels may show high rates when tested by Practice X because of metallurgical factors not associated with chromium carbide or nitride precipitation. This possibility must be considered in selecting the test method. Combinations of alloys and test methods for which successful experience is available are shown in Table 1. Application of these standard tests to the other ferritic stainless steels will be by specific agreement between producer and user.

1.3 Depending on the test and alloy, evaluations may be accomplished by weight loss determination, microscopical examination, or bend test (Sections 30 and 31). The choices are listed in Table 1.

1.4 *This standard does not purport to address all of the safety problems, 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.* For specific safety precautionary statements, see 3.2.5, Section 7, 13.1, and 19.1.

2. Referenced Documents

2.1 *ASTM Standards*:³

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

3. Apparatus

3.1 *Apparatus for Practice W, Oxalic Acid Etch Test:*

3.1.1 *Source of DC*—Battery, generator, or rectifier capable of supplying 15 V and 20 A.

3.1.2 *Ammeter*, range 0 to 30 A.

3.1.3 *Variable Resistance*, for control of specimen current.

3.1.4 *Cathode*—One-litre stainless steel beaker or suitable piece of stainless steel.

3.1.5 *Electric Clamp*, to hold etched specimen.

¹ These practices are under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and are the direct responsibility of Subcommittee A01.14 on Methods of Corrosion Testing.

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² The boldface numbers in parentheses refer to the list of references appended to these practices.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.