



Standard Practice for Laboratory Screening of Metallic Containment Materials for Use With Liquids in Solar Heating and Cooling Systems¹

This standard is issued under the fixed designation E712; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers several laboratory test procedures for evaluating corrosion performance of metallic containment materials under conditions similar to those that may occur in solar heating and cooling systems. All test results relate to the performance of the metallic containment material only as a part of a metal/fluid pair. Performance in these laboratory test procedures, taken by itself, does not necessarily constitute an adequate basis for acceptance or rejection of a particular metal/fluid pair in solar heating and cooling systems, either in general or in a particular design. This practice is not intended to preclude the use of other screening tests, particularly when those tests are designed to more closely simulate field service conditions.

1.2 This practice describes apparatus and procedures for several tests, any one or more of which may be used to evaluate the deterioration of the metallic containment material in a metal/fluid pair. The procedures are designed to permit simulation, heating, and cooling systems including (1) operating full flow, (2) stagnant full, (3) stagnant partial fill, and (4) stagnant empty. Particular attention should be directed to properly reflecting whether the system is open or closed to atmosphere.

1.3 This practice covers the following six tests:

Practice A	Basic Immersion Test at Atmospheric Pressure
Practice B	Heat-Rejecting Surface Test at Atmospheric Pressure
Practice C	High-Pressure Test
Practice D	Repeated Dip Dry Test at Atmospheric Pressure
Practice E	Crevice Test at Atmospheric Pressure
Practice F	Tube Loop Test at Atmospheric Pressure

1.4 Practice A is concerned with the interaction of metal and fluid when both are at the same temperature with no heat transfer from one to the other. It is regarded as useful for plumbing, pumps, tanking, etc., but of less significance, taken by itself, for collector panels. Practices B and F are concerned with the deterioration of the metal when there is transfer of heat

from the metal into the heat transfer fluid. These practices are especially applicable to the collector panel. Practice C permits a variety of tests but is especially useful in relation to systems that experience high temperatures, or are closed to the atmosphere. Practices D and E evaluate specific corrosion problems that may be associated with particular metal/fluid pairs and particular designs of systems and components.

1.5 *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:*²

G48 Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution

3. Significance and Use

3.1 At this time, none of these tests has been demonstrated to correlate with field service.

3.2 It is essential that consideration be given to the appropriate pairing of metal and fluid since these procedures do not restrict the selection of either the containment material or the fluid for testing. Likewise, knowledge of the corrosion protection mechanism and the probable mode of failure of a particular metal is helpful in the selection of test conditions and the observation, interpretation, and reporting of test results.

3.3 The design of solar heating and cooling systems strongly affects the applicability of the results of the laboratory screening tests. Therefore, the results of these laboratory procedures should be confirmed by component and systems testing under actual or simulated service conditions.

3.4 **Table 1** is provided to assist in an orderly consideration of the important factors in testing. It is expected that the user

¹ This practice is under the jurisdiction of ASTM Committee E44 on Solar, Geothermal and Other Alternative Energy Sources and is the direct responsibility of Subcommittee E44.05 on Solar Heating and Cooling Systems and Materials.

Current edition approved April 1, 2009. Published June 2009. Originally approved in 1980. Last edition approved in 2003 as E712 – 80(2003). DOI: 10.1520/E0712-80R09.

² 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.