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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Chemical Resistance of Protective Linings[1]

This standard is issued under the fixed designation C 868; 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.

ε[1] NOTE—The safety caveat was updated and Keywords were added in September 1995.

1. Scope

1.1 This test method covers a procedure for evaluating the chemical resistance of a protective lining applied to a steel substrate. The method closely approximates the service conditions, including the temperature differential between the external and internal surfaces of the equipment, which may accelerate permeation of the lining by a corrosive media. This test method may be used to simulate actual field use conditions insofar as a qualitative evaluation of the lining system after a predetermined period of exposure.

1.2 *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:*

A 36/A 36M Specification for Carbon Structural Steel[2]

A 285/A 285M Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength[2]

C 267 Test Method for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings[3]

D 471 Test Method for Rubber Property—Effect of Liquids[4]

D 714 Test Method for Evaluating Degree of Blistering of Paints[5]

D 785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials[6]

D 1474 Test Methods for Indentation Hardness of Organic Coatings[5]

D 2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor[7]

2.2 *NACE Standard:*

TM-01-70 Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive[8]

2.3 *Steel Structures Painting Council Standard:*

SSPC No. 5 Blast Cleaning to "White" Metal[9]

3. Significance and Use

3.1 The results obtained by this test method should serve as a guide in, but not as the sole basis for, selection of a lining material for particular application. Simple chemical-resistance evaluations of the lining materials may be performed more conveniently by other pertinent methods as a prescreening test for this procedure in accordance with Test Methods C 267 and D 471.

4. Apparatus

4.1 *Four-Neck Cylindrical, Borosilicate-Type Glass Test Cell*, similar to the unit shown in Fig. 1.

4.1.1 Where an additional inlet is needed for a thermocouple or thermistor to control temperature, a five-neck cell should be used.

4.2 *Heating Equipment*:

4.2.1 The corrosive media may be heated by an electrical-resistant coil fitting inside the test cell. This is protected by a glass immersion tube. The heater shall be controlled through the use of a rheostat or thermostat to produce the desired temperature ±4°F (2°C).

4.2.2 An electrical heating tape may be wrapped around the exterior of the test cell but not around the test panels and may not touch the test panels.

4.3 *Reflux Water Condenser*, to maintain a constant level and concentration of this test solution.

4.4 *Gaskets*, of a chemically resistant material, capable of withstanding the chemical environment. The gaskets shall also provide a tight seal between the test cell and test specimen. Neoprene, Hypalon, or Viton "A" gaskets (Shore "A" durometer of 60) are generally adequate. The gasket material shall be selected so that it does not contaminate the test solution.

4.5 *Air or Gas Bubbler*—Normally, it will be necessary to include an air or gas bubbler to agitate or aerate the solution.

[1] This test method is under the jurisdiction of ASTM Committee C-3 on Chemical-Resistant Nonmetallic Materials and is the direct responsibility of Subcommittee C03.01 on Test Methods.

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[2] *Annual Book of ASTM Standards*, Vol 01.04.

[3] *Annual Book of ASTM Standards*, Vol 04.05.

[4] *Annual Book of ASTM Standards*, Vol 09.01.

[5] *Annual Book of ASTM Standards*, Vol 06.01.

[6] *Annual Book of ASTM Standards*, Vol 08.01.

[7] *Annual Book of ASTM Standards*, Vol 08.02.

[8] Available from the National Association of Corrosion Engineers (NACE), P.O. Box 218340, Houston, TX 77218.

[9] Available from the Steel Structures Painting Council (SSPC), 4400 Fifth Ave., Pittsburgh, PA 15213.

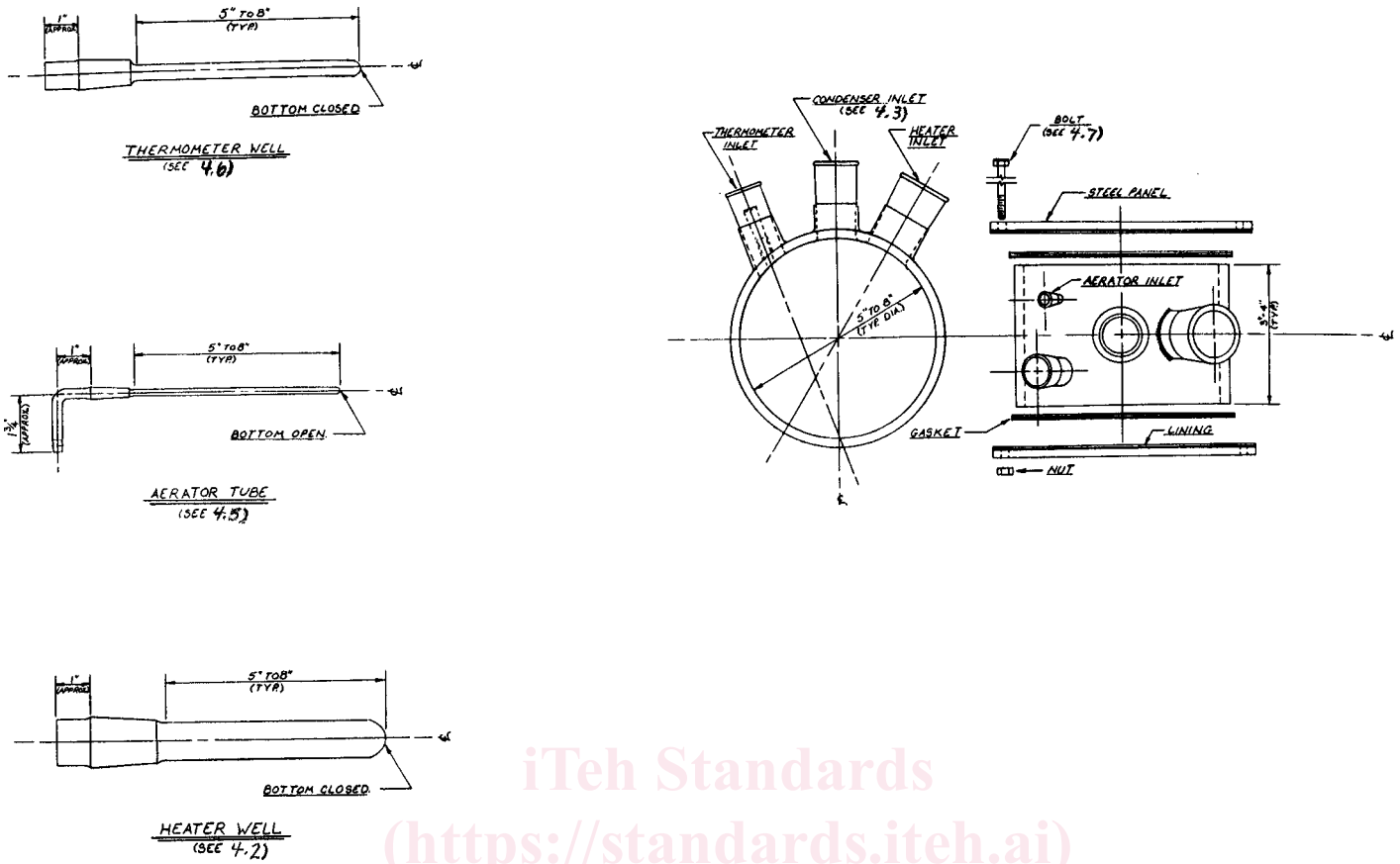

FIG. 1 Four-Neck Cylindrical, Borosilicate-Type Glass Test Cell and Accessories

4.5.1 At solution temperatures below boiling, agitation is required to maintain temperature uniformity. Where the service solution is considered to be aerated, air should be bubbled into the solution. In cases where the solution will be air or oxygen depleted, nitrogen or other suitable inert gas should be used for agitation.

4.5.2 Insert a bubbler for air or other gas through the utility opening in the test cell. The bubbler shall consist of a piece of fluorocarbon or glass tubing ⅛ in. (3 mm) in inside diameter, attached to the ground-glass fitting in the utility opening, and extending almost to the bottom of the test cell.

4.6 *Thermometer or Thermocouple*, to fit the prescribed thermowell, capable of registering the temperature range involved in the test.

4.7 *Mounting Equipment (Alternatives)*:

4.7.1 Mount the test panels on the test cell with a minimum of three carbon steel bolts, ¼ or ⅜ in. (6 or 9 mm) in diameter, using wing nuts for easy removal.

4.7.2 "C" clamp fixtures or stainless steel band clamps or other suitable means can be used to mount the test panels to the test cell.

4.7.3 Use clamping pressures sufficient to seal the opening, but not so great as to destroy the test panel or damage the test coating.

4.8 *Cell Test Area*:

4.8.1 The cells should be maintained in an open, well ventilated area with temperature controlled to 73 ± 4°F (23 ± 2°C).

4.8.2 The preferred method to ensure the free movement of air past the surfaces is to utilize grills or grating to support the cells with several inches of clearance beneath the grating to allow air flow past the plate surfaces. If this type of support is employed, cells should be at least 6 in. away from one another or any heat source.

4.8.3 If open grating support is not used, cells should be at least 12 in. from one another or from any potential source of heat. They should be placed on an open shelf or bench top in such a way that free convective cooling of the unlined side of the test panels may occur.

5. Test Specimens

5.1 *Substrate*:

5.1.1 Panels shall be commercial quality, unused, hot-rolled carbon steel (Specifications A 36/A 36M or A285/A 285M) ¼ by 8 by 8 in. (6 by 200 by 200 mm).

5.1.2 This test method can also be used for evaluation of linings on other metallic substrates such as stainless steel or other alloys, copper, aluminum, etc.

5.1.3 With appropriate modifications and procedures, this method can be used to evaluate linings on concrete or other substrates.

5.2 Prepare one side of the panels according to the surface conditions of NACE Standard No. 1 TM-01-70 or Steel Structures Painting Council SSPC No. 5. Measure the average profile depth using a Keane-Tator comparator, profile depth gage, or other suitable instrument.