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Standard
Test Method

Laboratory Corrosion Testing of Metals in Static Chemical Cleaning Solutions at Temperatures Below 93°C (200°F)

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Foreword

This standard was written to address a number of testing parameters involved in the laboratory corrosion testing of clean metal test specimens in static chemical cleaning solutions at temperatures below 93°C (200°F). Specifically, this standard addresses those parameters not covered in ASTM[(1)] D 3263,[1] including surface-to-volume ratio, inhibitor handling, localized corrosion and pitting, and the reporting procedure, and is for use specifically by those involved in the industrial cleaning industry. The intent is that these factors will make the reported corrosion rates more useful for comparing chemical cleaning solutions and inhibitors.

Because chemical cleaning solutions are used over a wide range of applications, no universal test method to cover all cases is possible. This standard is intended to be used to obtain data relevant to the cleaning of industrial equipment, such as boilers, heat exchangers, piping systems, and tanks. Note that these tests use clean coupons in a clean solution and that the severity of corrosion obtained in these tests will not be the same as if actual deposits were present.

This NACE standard test method was originally prepared in 1993 by NACE Task Group T-3M-5, a component of Unit Committee T-3M on Chemical Cleaning, and was revised in 2000 by T-3M. It is published by NACE International under the auspices of Group Committee T-3 on Corrosion Science and Technology.

In NACE standards, the terms *shall, must, should* and *may* are used in accordance with the definitions of these terms in the NACE Publications Style Manual, 3rd ed., Paragraph 8.4.1.8. *Shall* and *must* are used to state mandatory requirements. *Should* is used to state that which is considered good and is recommended but is not absolutely mandatory. *May* is used to state that which is considered optional.

(1) American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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Contents

Section 1: General

1.1 This standard describes a simple method for measuring the relative corrosiveness of solutions used for chemical cleaning in a static system at temperatures below 93°C (200°F). The tests described are conducted with corrosion test specimens in the clean condition (i.e., no deposits). The tests consist of exposing metallic test specimens to cleaning solutions typically for 6 hours under controlled conditions. The test specimens are weighed before and after the test and the corrosion rate is calculated from the mass loss. Localized corrosion such as pitting is also evaluated. Procedures for test specimen handling and reporting the results for a better comparison of data among laboratories are also included.

1.2 Measurements of corrosion rates in cleaning solutions obtained by this method should not be extrapolated directly to predict corrosion rates for metal surfaces in an operating system. A number of variables encountered in the chemical cleaning of industrial equipment, such as the nature and amount of deposit, are not readily controlled and can affect corrosion of the materials exposed to the chemical cleaning solutions. The tests described in this standard are designed to exclude the variables that can occur when duplicating field conditions because these conditions are difficult to reproduce in the laboratory and can make agreement among different laboratories difficult to obtain. In laboratory tests, care should be taken to ensure that test conditions can be controlled and fully described, thus enabling them to be repeated in different laboratories. The measurements described in this standard give the corrosion rate of the metal under the conditions tested. Corrosion rates are useful for comparison of results among laboratories.

Section 2: Test Equipment and Apparatus

2.1 A versatile and convenient apparatus should be used; it should consist of a test vessel of suitable size (such as a beaker, test tube, or reaction flask), a reflux condenser, and a constant-temperature bath. The choice of test vessel is dependent on the purpose and conditions of the test.

2.2 At elevated temperatures, a reflux condenser is desirable to prevent loss of solution by evaporation. The use of a reflux condenser limits the choice of test vessel to a test tube, reaction flask, or another type of vessel that can be sealed and then fitted with a condenser.

2.3 For tests at or near room temperature, beakers are satisfactory. The condenser can be connected to a water trap and then to a water seal to permit tests to be conducted under controlled cover gases.

2.4 Test vessel size should be based on the test specimen size and the specific test specimen surface-area-to-solution-volume (S/V) ratio that is to be maintained for the test. For comparative results, the S/V ratio should be 0.35 cm^2/cm^3. Other S/V ratios may be used to match the S/V ratio of a test to a specific application for which the cleaning solution is intended. For example, chemical cleaning solutions may also be tested at a typical S/V ratio of 0.6 cm^2/cm^3 for drum boilers or 1.3 cm^2/cm^3 for once-through boilers. S/V ratios for specific equipment can be calculated by the investigator. It is important, however, that the test S/V ratio be recorded and maintained during the test.

2.5 These suggested components can be modified, simplified, or made more sophisticated to meet the specific needs of a particular investigation. The suggested apparatus is basic, and the apparatus is limited only by the judgment of the investigator. The primary purpose of the apparatus is to meet and maintain the proper exposure conditions for the test.

Section 3: Test Solution

3.1 Reagent grade chemicals and distilled or deionized water should be used in all tests. Distilled water shall conform to Type III reagent water of ASTM D 1193.[2] Unless otherwise indicated, all reagents shall conform to the specifications[3] of the Committee on Analytical