

Laboratory Test to Evaluate the Vapor-Inhibiting Ability of Volatile Corrosion Inhibitor Materials for Temporary Protection of Ferrous Metal Surfaces

© 2024 Association for Materials Protection and Performance (AMPP). All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise) without the prior written permission of AMPP.

Laboratory Test to Evaluate the Vapor-Inhibiting Ability of Volatile Corrosion Inhibitor Materials for Temporary Protection of Ferrous Metal Surfaces

This AMPP standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. Its acceptance does not in any respect preclude anyone, whether he or she has adopted the standard or not, from manufacturing, marketing purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this AMPP standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. AMPP assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official AMPP interpretations issued by AMPP in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this AMPP standard are responsible for reviewing appropriate health, safety, environmental, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This AMPP standard may not necessarily address all potential health and safety problems, or environmental hazards associated with the use of materials, equipment, and/or operations detailed or referred to within this standard. Users of this AMPP standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities, if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: AMPP standards are subject to periodic review and may be revised or withdrawn at any time in accordance with AMPP technical committee procedures. AMPP requires that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication and subsequently from the date of each reaffirmation or revision. The user is cautioned to obtain the latest edition. Purchasers of AMPP standards may receive current information on all standards and other AMPP/NACE/SSPC publications by contacting AMPP Customer Support, 15835 Park Ten Place, Houston, Texas 77084-5145 (Tel: +1-281-228-6200, email: customersupport@ampp.org).

Document History:

2024-04-04: Revised by AMPP Standards Committee (SC) 13, Corrosion Monitoring and Measurement

2011-05-29: Revised by NACE International Task Group (TG) 215, "Volatile Corrosion Inhibitors (VCIs)."

2013-03-16: Revised by NACE TG 215, "Volatile Corrosion Inhibitors (VCIs)."

2008-03-15: Approved as TM0208 by NACE TG 215, "Volatile Corrosion Inhibitors (VCIs)."

AMPP values your input. To provide feedback on this standard, please contact: standards@ampp.org

NACE TM0208-2024

©2024 Association for Materials Protection and Performance (AMPP). All rights reserved.

Laboratory Test to Evaluate the Vapor-Inhibiting Ability of Volatile Corrosion Inhibitor Materials for Temporary Protection of Ferrous Metal Surfaces

Foreword, Scope, Rationale	4
Referenced Standards and Other Consensus Documents	5
Section 1 General	5
Section 2 Definitions	5
Section 3 Test Apparatus, Equipment, and Materials.....	6
3.1 Test Apparatus.....	6
3.2 Other Equipment and Materials	7
3.3 Number of Jars Required.....	9
3.4 Cleaning of Jar-Test Apparatus.....	9
Section 4 Specimens, Preparation, and Cleaning.....	9
4.1 Test Specimens.....	9
4.2 Test Specimen Preparation.....	9
4.3 Specimen Cleaning.....	13
Section 5 Test Solution.....	14
Section 6 Test Procedure.....	14
6.1 Setup of Jar Test for VCI Film, VCI Paper, or Other Flat, Solid VCI Materials.....	14
6.2 Setup of Jar Test for VCI Powder, VCI Pellets, VCI Liquid, and VCI Pellets in Pouches.....	15
6.3 Test Setup Options for Eliminating Desiccation Effects	17
6.4 Conditioning of Steel Specimens	17
6.5 Visual Observation.....	18
6.6 Rating System for Steel Specimens.....	18
6.7 Evaluation of Desiccation Effects.....	19
6.8 Record Keeping.....	20
Section 7 Test Report.....	20
Other Reference Documents.....	20
Bibliography.....	21
FIGURES	
Figure 1 Jar-Test Apparatus Assembly.....	7
Figure 2 Jar Lid.....	7
Figure 3a Datalogger Inside the Jar-Test Apparatus, Held with Low-Acid Transparent Adhesive Tape	8

Figure 3b	Example of a Plastic Sample Holder.....	9
Figure 4	Rotating Table with Handheld Plug.....	11
Figure 5	Custom Wheel Fixture of Anodized Aluminum for Firmly Holding Several Metal Specimens.....	13
Figure 6	Pistons are Lowered and the Wheel and Sandpaper Platen Turns in Counter Rotation.....	14
Figure 7	VIA-Ferrous Test Jar Lid (Internal View) Showing Steel Specimen Inserted in the End of the Silicone Tubing with VCI Sample Strips Held in Place with Low-Acid Transparent Adhesive Tape.....	15
Figure 8	Examples of Sample Holders for Powder, Pellet, and Liquid Forms of VCI Materials.....	16
Figure 9	Typical Visual Patterns for Rating the Group of Specimens According to Paragraph 6.6.....	19

TABLES

Table 1	Examples of the Volumes of Glycerin and Distilled Water Required to Prepare the Desired Volume of Glycerin-Water Mixture.....	14
---------	-------------------------------------------------------------------------------------------------------------------------------	----

Foreword

Volatile corrosion inhibitor (VCI) materials provide temporary corrosion protection for the surfaces of metal parts that are not in contact with the inhibitor. Temporary protection is afforded as long as there is a moderately sealed enclosure containing the metal parts and the source of the VCI, which may be in the packaging package itself. The duration of protection may be months to years before the parts are removed from the enclosure and put to use, or before a more “permanent” coating such as paint is applied. A referenced NACE Standard Practice SP0487 includes VCI in the context of guidance and best practices for users of interim or temporary corrosion protection methods.

The purpose of this basic test of VCI function is to provide a repeatable one-day assessment of the Vapor Inhibiting Ability (VIA) of VCI materials to protect ferrous metal surfaces from corrosion (rusting), including protection of ferrous metal afforded by components of VCI classified for multi-metal protection. The essence of the test is to: (1) prescribe simple standard conditions of enclosure with vapor transport across a gap containing air, warm water vapor, and the VCI molecules, and (2) provide qualitative visual grading of the efficacy of corrosion protection of standardized low carbon steel specimens, as generally representative of ferrous metals. The method is derived from the military methods in U.S. MIL-STD-3010¹⁻⁴ propagated since the 1970s. It describes practices used for relatively high throughput VIA testing by industrial producers and users of VCI for quality control and comparisons in product development among competing VCI materials. Provision is also made to test for possible confounding effects of VCI and water absorption (desiccant effects) of VCI paper materials. Several other closely derived test standards were also propagated since the 1970s in other international regions, e.g., German military⁵⁻⁶ and Japanese JIS standards. The variation among these methods can result in different outcomes.⁷⁻⁸ The apparatus and grading scale of the test method are also used in comparisons of VCIs with corrosive contaminants.⁹ Considerations of possibly analogous VIA testing for protection of non-ferrous metals have not proved feasible.¹⁰

Scope

This standard test method evaluates the vapor-inhibiting ability (VIA) of various forms of VCI materials for temporary corrosion protection of ferrous metal surfaces, which is also called the “VIA-Ferrous” test.

Rationale

This VIA test method is for the purpose of qualifying materials that provide VCI functionality using current commercial practices for reproducibility and productivity. This revision no longer includes details that duplicate the 2013 revision of Reference 1 used for military procurement qualification. In particular, this revision no longer includes a Grade 4 level of “no corrosion” by microscopic inspection. It also removes a test in Reference 1 that determines if copper is stained or corroded in contact with VCI materials, since VCI chemistries for which that test was developed are now essentially obsolete.