

## Standard Practice

# Control of Corrosion Under Thermal Insulation and Fireproofing Materials—A Systems Approach

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## Foreword

This NACE standard practice provides the current technology and industry practices for mitigating corrosion under thermal insulation and fireproofing materials, a problem termed *corrosion under insulation (CUI)* in this standard. Because this corrosion problem has many facets and impacts several technologies, a systems approach has been adopted. This standard is intended for use by corrosion-control personnel and others concerned with corrosion under insulation and/or fireproofing of equipment.

This standard is organized into sections by function. Each section was written by specialists in that subject. These specialists are industry representatives from firms producing, specifying, designing, and/or using thermal insulation and fireproofing products on refinery and petrochemical equipment.

This standard was originally prepared in 1998 by NACE Work Group T-5A-30a, "Corrosion Protection Under Insulation," with the assistance of Task Group (TG) T-6H-31, "Coatings for Carbon and Austenitic Stainless Steel Under Insulation," and ASTM<sup>(1)</sup> Committee C16.40.3, "Corrosion Under Insulation." Work Group T-5A-30a supported NACE TG T-5A-30, "Corrosion Under Thermal Insulation," a component of NACE Unit Committee T-5A, "Corrosion in Chemical Processes." The standard was reaffirmed in 2004 by Specific Technology Group (STG) 36, "Process Industry: Materials Performance in Chemicals." It was revised in 2010 by TG 325, "CUI: Revision of NACE Standard RP0198, The Control of Corrosion Under Thermal Insulation and Fireproofing Materials—A Systems Approach," with the assistance of Technology Exchange Group (TEG) 255X, "Coatings, Thermal-Spray for Corrosion Protection." TG 325 is sponsored by STG 03, "Coatings and Linings, Protective—Immersion and Buried Service," and STG 04, "Coatings and Linings, Protective—Surface Preparation." This standard is issued by NACE International under the auspices of STG 36.

<p>In NACE standards the terms <i>shall</i>, <i>must</i>, <i>should</i>, and <i>may</i> are used in accordance with the definitions of these terms in the <i>NACE Publications Style Manual</i>. The terms <i>shall</i> and <i>must</i> are used to state a requirement, and are considered mandatory. The term <i>should</i> is used to state something good and is recommended, but is not considered mandatory. The term <i>may</i> is used to state something considered optional.</p>
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**Contents**

1. General.....	1
2. Corrosion Mechanisms .....	2
3. Mechanical Design.....	9
4. Protective Coatings.....	20
5. Insulation, Fireproofing, and Accessory Materials .....	27
6. Inspection and Maintenance .....	31
References.....	37
Bibliography .....	39
<b>FIGURES</b>	
Figure 1: Effect of Temperature on Steel Corrosion in Water.....	4
Figure 2: Typical Vessel Attachments Where Water May Bypass Insulation.....	11
Figure 3: Attachment to Piping Where Water May Bypass Insulation.....	12
Figure 4: Vessel Insulation Support Ring—the Problem (a) and the Solution (b). .....	13
Figure 5: Vertical Vessel Bottom Support Ring Minimizing Water Accumulation.....	13
Figure 6: Vessel-Stiffening Ring Insulation Detail.....	14
Figure 7: Center Nozzle at Top Head of Vessel.....	14
Figure 8: Common Nameplate Insulation Detail.....	15
Figure 9: Seal-Welded Cap on Insulation for Personnel Protection.....	15
Figure 10: Double-Pipe Heat Exchanger Insulation Penetrated by C-Channel Support..	16
Figure 11: Protrusions Through Jacketing.....	16
Figure 12: Pipe Supports Without Protrusions.....	17
Figure 13: Cold Service Pipe Support Without Continuous Vapor Barrier.....	18
Figure 14: Cold Service Pipe Support with Continuous Vapor Barrier.....	18
Figure 15: Pipe Insulation Penetrated by Column Fireproofing.....	19
<b>TABLES</b>	
Table 1: Typical Protective Coating Systems for Austenitic and Duplex Stainless Steels Under Thermal Insulation.....	22
Table 2: Typical Protective Coating Systems for Carbon Steels Under Thermal Insulation and Fireproofing.....	25

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## Section 1: General

1.1 Corrosion under insulation (CUI) has been occurring for as long as hot or cold equipment has been insulated for thermal protection, energy conservation, or process stabilization. The destructive results and nature of the corrosion mechanism were not mentioned in the literature until the 1950s. As more problems have been experienced, concern and interest have built around this subject. Many articles and symposium papers have been published since 1983 as interest and activity in CUI have increased. The increased activity was driven largely by many occurrences of severe CUI resulting in major equipment outages, production losses, and unexpected maintenance costs in refineries, gas plants, and chemical plants.

1.2 To correct these problems, companies have developed their own criteria and approaches to the prevention of CUI. When comparing the various approaches, it is evident that there are many similarities, some differences, some new ideas, and some old ideas that have stood the test of performance. This standard incorporates the experience of many companies throughout the oil, gas, and chemical industries.

1.3 The first ASTM standard relevant to CUI was ASTM C692,<sup>1</sup> adopted in 1971 and originally titled "Evaluating the Influence of Wicking Type Thermal Insulations on the Stress Corrosion Cracking Tendency of Austenitic Stainless Steels."

1.4 A symposium was held jointly by NACE, ASTM, and Materials Technology Institute (MTI)<sup>(2)</sup> on this subject with speakers from industries worldwide in October 1983. The papers were published in 1985 as ASTM Publication STP 880.<sup>2</sup>

1.5 The first NACE state-of-the-art report on CUI was written in 1987 by Task Group T-6H-31 and issued as NACE Publication 6H189.<sup>3</sup> NACE Task Group T-5A-30 was organized shortly thereafter to serve as a forum for further discussion regarding CUI. In addition to reviews of the corrosion mechanisms, perspectives on such CUI topics as methods for mitigation, insulation materials, and inspection were often exchanged. While corrosion engineers were becoming knowledgeable about CUI, ASTM Committee C16 on Thermal Insulation was preparing standards for testing insulation with a propensity to cause chloride stress corrosion cracking (SCC) of austenitic stainless steel. These two groups interacted but proceeded to develop their standards and information separately.

1.6 In this standard, the term *equipment* includes all objects in a facility with external metal surfaces that are insulated or fireproofed and subject to corrosion.

1.7 In previous editions of this standard, carbon steel and austenitic stainless steels were the primary metals addressed. Because of their increased usage in applications where CUI is a concern, duplex stainless steels have been more explicitly addressed in this revision.

1.8 Although most of the attention has been focused on corrosion under thermal insulation, fireproofing materials also function, at least in part, as insulation applied to protect equipment during a potential fire. Other fire protection mechanisms initiated as endothermic reactions within the fireproofing material during a fire are not covered in this standard. Corrosion mechanisms, the root cause of failure, and corrosion prevention are the same for corrosion under fireproofing as for corrosion under insulation.

1.9 Whenever CUI is a consideration, a protective coating or coating system should be applied to the equipment before it is insulated. Protective coatings or coating systems may have service lives that are shorter than the anticipated operational life of the equipment, and thus may require inspection and maintenance to effectively maintain integrity and to minimize the threat of CUI.

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