



**NACE SP0178-2007**  
**(formerly RP0178-2003)**  
**Item No. 21022**

## **Standard Practice**

# **Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service**

This NACE International 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 NACE International 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. NACE International assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official NACE International interpretations issued by NACE International in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this NACE International 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 NACE International 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 NACE International 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**CAUTIONARY NOTICE:** NACE International standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with NACE technical committee procedures. NACE International 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 NACE International standards may receive current information on all standards and other NACE International publications by contacting the NACE International FirstService Department, 1440 South Creek Dr., Houston, Texas 77084-4906 (telephone +1 281/228-6200).

Revised 2007-03-10  
Reaffirmed 2003-03-17  
Reaffirmed September 1995  
Reaffirmed March 1991  
Revised 1989  
Approved 1978  
NACE International  
1440 South Creek Drive  
Houston, Texas 77084-4906  
+1 281/228-6200  
ISBN 1-57590-167-6  
© 2007, NACE International

---

## Foreword

When specifying tanks and vessels that are to be internally lined to control corrosion and prevent product contamination, special design, fabrication, and surface finishing practices must be considered to obtain the desired performance of these linings for immersion service. As the corrosiveness of the product increases, the design and fabrication of the tank or vessel becomes more critical relative to the performance of the lining.

This standard presents standard practices for the design, fabrication, and surface finish of metal tanks and vessels that are to be lined for corrosion resistance and to prevent product contamination. The standard explains how the standard practices govern the quality of lining applications. Appendix A contains illustrations depicting both good and bad practices for tanks and vessels to be lined, and Appendix B contains a list of recommended responsibilities to ensure that an acceptable lining application is achieved. Appendix C contains written and graphic descriptions of five degrees of surface preparation of welds in tanks and vessels that may be specified prior to lining.<sup>(1)</sup>

This standard is intended for use or reference by end users, lining specifiers, lining applicators, lining manufacturers, and contracting authorities involved in the surface preparation or lining installation in tanks and vessels intended for chemical immersion service.

This standard practice was originally prepared in 1978 by NACE International Task Group (TG) T-6A-29, a component of Unit Committee T-6A on Coating and Lining Materials for Immersion Service, in collaboration with Unit Committee T-6H on Application and Use of Coatings for Atmospheric Service. The standard was revised in 1989 by TG T-6G-27, a component of Unit Committee T-6G on Surface Preparation for Protective Coatings, and was reaffirmed in 1991 and 1995. It was reaffirmed in 2003 by Specific Technology Group (STG) 04 on Coatings and Linings, Protective: Surface Preparation. The standard was revised in 2007 by TG 295 on Lining, Tanks and Vessels for Immersion Service: Fabrication Details, Surface Finish Requirements, and Proper Design Considerations—Review of NACE Standard RP0178-2003. This TG is administered by STG 04. It is also sponsored by STG 02 on Coatings and Linings, Protective: Atmospheric; STG 03 on Coatings and Linings, Protective: Immersion and Buried Service; and STG 43 on Transportation, Land. This standard is issued by NACE International under the auspices of STG 04.

---

<sup>(1)</sup> The visual comparator mentioned in Appendix C is a molded plastic replica that illustrates various degrees of surface finishing for welds prior to coating or lining. Full-seam welds, skip welds, butt welds, lap welds, and others are depicted. For more information contact the NACE FirstService Department, 1440 South Creek Drive, Houston, TX 77084-4906.

**SP0178-2007**

NACE International gratefully acknowledges the contributions of the following companies in the preparation of the welding samples and the fabrication of the die from which the plastic replicas have been molded:

Ausimont USA, Inc.,<sup>(2)</sup> Thorofare, NJ  
CenterPoint Energy,<sup>(3)</sup> Houston, TX  
S.G. Pinney & Associates, Inc.,<sup>(4)</sup> Port St. Lucie, FL  
The Sherwin-Williams Company,<sup>(5)</sup> Cleveland, OH

NACE also gratefully acknowledges the assistance of KTA-Tator Inc.,<sup>(6)</sup> Pittsburgh, PA, in developing the weld pattern that was used to mold the plastic replica of weld samples.

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*, 4th ed., Paragraph 7.4.1.9. *Shall* and *must* are used to state mandatory requirements. *Should* is used to state something considered good and is recommended but is not mandatory. *May* is used to state something considered optional.

---

<sup>(2)</sup> Ausimont USA, Inc., 10 Leonards Lane, Thorofare, NJ 08086.

<sup>(3)</sup> CenterPoint Energy, P.O. Box 1325, Houston, TX 77251-1325.

<sup>(4)</sup> S.G. Pinney & Associates, Inc., Corporate Office, 1326 S.W. Biltmore St., Port St. Lucie, FL 34983.

<sup>(5)</sup> The Sherwin-Williams Company, 101 Prospect Avenue N.W., Cleveland, OH 44115.

<sup>(6)</sup> KTA-Tator, Inc., 115 Technology Drive, Pittsburgh, PA 15275.

---

## NACE International Standard Practice

### Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service

#### Contents

1. General.....	1
2. Definitions.....	1
3. Design Practices.....	1
4. Fabrication Practices .....	3
5. Surface Finish Practices.....	3
Bibliography .....	4
Appendix A: Illustrations of Design, Fabrication, and Surface Finish Practices for Metal Tanks and Vessels to Be Lined for Immersion Service .....	5
Appendix B: Recommended Responsibilities .....	11
Appendix C: Written and Graphic Descriptions of Various Degrees of Surface Finishing of Welds That May Be Specified in Preparation for Lining of Tanks and Vessels ....	12

---

**SP0178-2007**

---

## Section 1: General

1.1 This standard presents standard practices for the design, fabrication, and surface finish of tanks and vessels to be lined for immersion service. Tanks and vessels may be lined for corrosion control or to prevent product contamination.

1.1.1 Appendix A (mandatory) contains illustrations depicting both good and bad practices for tanks and vessels to be lined for immersion service.

1.1.2 Appendix B (nonmandatory) contains a list of recommended responsibilities of the purchaser (user), designer, fabricator, lining applicator, and inspector to ensure that an acceptable lining application is achieved.

1.1.3 Appendix C (nonmandatory) contains written and graphic descriptions of five degrees of surface preparation of welds in tanks and vessels that may be specified prior to lining. The written descriptions of the five degrees of surface preparation of welds in Appendix C take precedence over the graphics and the companion visual comparator. The graphics are only

pictorial representations of welds and grinding finishes and are not intended to be representative of the integrity of the welds. The "weld condition prior to finishing" is not a typical weld; it is only intended to illustrate defects in welds that must be corrected prior to lining.

1.2 Good welding practices and welding codes govern the integrity of the tank and vessel welds; this standard only addresses surface preparation of the welds for the purpose of lining the tank or vessel for immersion service.

1.3 Other design and construction codes or standards may be used to complement the details given here. When applicable, the requirements of such other codes or standards shall be considered. A partial list of such codes and standards can be found in the Bibliography.

1.4 These standard practices may be used in the design, fabrication, and surface finish of tanks and vessels for services other than immersion, such as dry bulk storage of solid materials.

---

## Section 2: Definitions

**Lining:** A coating or layer of sheet material adhered to or in intimate contact with the interior surface of a container used to protect the container against corrosion by its contents and/or to protect the contents of the container from contamination by the container material. For the purposes of this standard, *lining* refers to a surface barrier, usually a thin film less than 500 µm (20 mil) thick applied as either a lining or a coating. In common usage, the terms *coating* and *lining* are interchangeable, but in this standard, only the term *lining* is used. The requirements contained herein may or may not apply to heavier, thick-film linings, sheet linings, trowel-applied and pumped-into-place finishes, plasma,

flame-sprayed linings, fiber-reinforced plastic linings, or similar lining materials.

**Surface Finish:** The degree of smoothness of a surface produced by the removal of sharp edges and the appropriate surface preparation of welds and other rough areas. The term *surface finish* is also used to characterize the degree of smoothness that is necessary to attain a surface to which the lining can be applied satisfactorily in accordance with the lining specification.

---

## Section 3: Design Practices

### 3.1 Accessibility

3.1.1 All surfaces of the tank or vessel interior shall be readily accessible for surface preparation and lining application (see Figures A1 through A10, Appendix A).

3.1.2 The manway diameter for working entrance and safety reasons during the lining application shall be as large as practical for the tank or vessel being lined.

3.1.2.1 If possible, at least one manway shall be located near ground (working) level, except in

tanks or vessels designed to be buried below grade.

3.1.3 Additional manways and openings should be provided as needed to facilitate ventilation. These must meet safety requirements.

### 3.2 Joints

3.2.1 Continuous butt-welded joints shall be used whenever possible (see Figure A5, Appendix A).