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**American Water Works
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ANSI/AWWA D102-17
(Revision of ANSI/AWWA D102-14)

AWWA Standard

Coating Steel Water- Storage Tanks

Effective date: Dec. 1, 2017.

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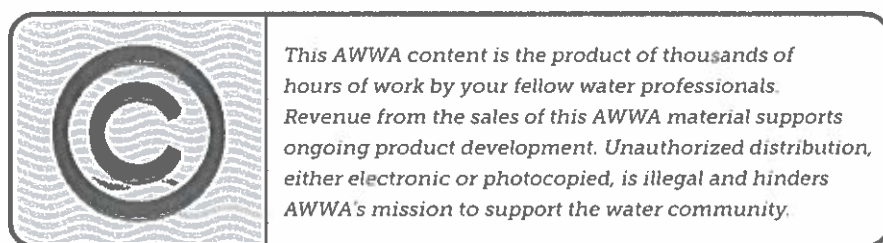
AWWA Standard

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Committee Personnel

The Revision Task Force, which developed this edition of ANSI/AWWA D102, consisted of the following personnel:

Joe W. Davis, *Chair*

General Interest Members

R. Boswell, Boswell's Consulting Testing Services, Round Rock, Texas	(AWWA)
E. Brackman, RFI Consultants LLC, Phoenix, Ariz.	(AWWA)
R.A. Kufas, Norske Corrosion & Inspection Services Ltd., Surrey, B.C., Canada	(AWWA)
G.R. Stein, Tank Industry Consultants, Indianapolis, Ind.	(AWWA)
S.C. Vidika, Dixon Engineering Inc., Medina, Ohio	(AWWA)
D.J. Zienty, Short Elliott Hendrickson Inc., St. Paul, Minn.	(AWWA)

Producer Members

C.S. Bull, Landmark Structures, Fort Worth, Texas	(AWWA)
J.W. Davis, Tesla NanoCoatings Inc., Massillon, Ohio	(AWWA)
T. Enoch, Induron Protective Coatings, Ottsville, Penn.	(AWWA)
R. Hasak, Tnemec Company Inc., North Kansas City, Mo.	(AWWA)
T.D. Ippoliti, Sherwin-Williams Company, Indianapolis, Ind.	(AWWA)
M.L. Jones, International Paint LLC, Greenwood, Ind.	(AWWA)
L.D. Scott, Paso Robles Tank—Brown-Minneapolis Tank Inc., Paso Robles, Calif.	(AWWA)
C. Spoelstra, Caldwell Tanks Inc., Urbandale, Iowa	(AWWA)

User Members

R.R. Wawrzyniakowski Jr., Pennsylvania American Water, Wampum, Penn.	(AWWA)
--	--------

The AWWA Standards Committee on Steel and Composite Water Storage Tanks, which reviewed and approved this standard, had the following personnel at the time of approval:

Stephen W. Meier, *Chair*

Gregory R. Stein, *Vice-Chair*

General Interest Members

D.M. Algranti, Albert A. Webb Associates, Riverside, Calif.	(AWWA)
J.W. Birkhoff, Birkhoff, Hendricks & Carter LLP, Dallas, Texas	(AWWA)

J.D. Brock, Consulting Services Logistics, Toledo, Ohio	(AWWA)
M.M. Coleman,* Standards Council Liaison, Wade Trim Associates Inc., Detroit, Mich.	(AWWA)
E. Darrimon, Bay Area Coating Consultants Inc., Denair, Calif.	(AWWA)
W.J. Dixon, Dixon Engineering Inc., Lake Odessa, Mich.	(AWWA)
R.E. Gell, O'Brien & Gere Engineers, Syracuse, N.Y.	(AWWA)
M.L. Hickey, Murray, Smith & Associates Inc., Portland, Ore.	(AWWA)
F.S. Kurtz,* Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
S.W. Meier, Tank Industry Consultants, Indianapolis, Ind.	(AWWA)
R.L. Moore, St. Louis, Mo.	(AWWA)
G.R. Stein,† Tank Industry Consultants, Indianapolis, Ind.	(AWWA)
J.I. Strand, CBS Squared Inc., Chippewa Falls, Wis.	(AWWA)
T.A. Tovey, CH2M, Bellevue, Wash.	(AWWA)

Producer Members

G.A. Burke, Caldwell Tanks Inc., Louisville, Ky.	(AWWA)
W.J. Czaska, CB&I Inc., Plainfield, Ill.	(AWWA)
J.W. Davis, Tesla NanoCoatings Inc., Massillon, Ohio	(AWWA)
K.T. Fuller, Phoenix Fabricators & Erectors Inc., Avon, Ind.	(AWWA)
J. Grendzinski,* Landmark Structures, Wheaton, Ill.	(AWWA)
B.E. Kromer, Tank Builders Inc., Euless, Texas	(AWWA)
K. McGuire, CST Storage, Parsons, Kan.	(AWWA)
R. Pawski, Landmark Structures, Wheaton, Ill.	(AWWA)
L.D. Scott, Paso Robles Tank—Brown-Minneapolis Tank Inc., Paso Robles, Calif.	(AWWA)

User Members

J. Camarena, East Bay Municipal Utility District, Oakland, Calif.	(AWWA)
T.M. Dawson, Emerald Coast Utilities Authority, Pensacola, Fla.	(AWWA)
M. Gaffey, Naval Facilities Expeditionary Warfare Center, Washington, D.C.	(AWWA)
R.E. McCuller, City of Grand Prairie, Grand Prairie, Texas	(AWWA)
N.J. Meder, Connecticut Water Co., Clinton, Conn.	(AWWA)
J.L. Ortiz, San Francisco Public Utilities Commission, San Francisco, Calif.	(AWWA)
R.B. Potts, Louisville Water Company, Louisville, Ky.	(AWWA)
G. Terrell, Birmingham Water Works Board, Birmingham, Ala.	(AWWA)

* Liaison, nonvoting

† Alternate

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA D102.

I. Introduction

I.A. *Background.* The purpose of this standard is to provide an outline of methods and coating systems that can be used for coating or recoating steel tanks for water storage. Immediately after the final approval of ANSI/AWWA D102-14, the AWWA Standards Committee on Steel Elevated Tanks, Standpipes, and Reservoirs directed the D102 Revision Task Force to start work on this edition. The final standards committee letter ballot on this edition closed on March 16, 2017.

I.B. *History.* The first edition of this standard was prepared by a joint committee of AWWA and the New England Water Works Association (NEWWA) and was approved as tentative on May 9, 1952. Revisions were made on June 2, 1953, May 24, 1954, and Aug. 5, 1955. The second edition of this standard was approved as tentative on Jan. 23, 1962, and was approved by the AWWA Board of Directors on Feb. 11, 1964. The third edition was approved on Jan. 28, 1978, and subsequently withdrawn on June 23, 1991. ANSI/AWWA D102 was reissued as the fourth edition and subsequently approved on Feb. 2, 1997. The fifth edition was approved on Jan. 19, 2003; the sixth edition on June 11, 2006; the seventh edition on June 12, 2011; the eighth edition on June 8, 2014; and this ninth edition on June 11, 2017.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.[†] Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

† Persons outside the United States should contact the appropriate authority having jurisdiction.

effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. Specific policies of the state or local agency.
2. Two standards developed under the direction of NSF International:^{*} NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.
3. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*,[†] and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, “Toxicology Review and Evaluation Procedures,” to NSF/ANSI 61 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of “unregulated contaminants” are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA D102 does not address additives requirements. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by all parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues.

Volatile organic compound (VOC) emission and extractable regulations continue to become more restrictive and vary greatly from state to state and within states. The user of this AWWA standard should review current federal, state or provincial, and local regulations when selecting products in this standard.

III. Use of This Standard. It is the responsibility of the user of this AWWA standard to determine that the products described in this standard are suitable for use in the particular locale and application being considered.

^{*} NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

[†] Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20001.

III.A. *Purchaser Options and Alternatives.* The following items should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA D102, Coating Steel Water-Storage Tanks, of latest revision.
2. Size, style, height, and location of structure.
3. Required coating systems (including finish color) to be used for interior and exterior surfaces (Section 4).
4. Details of other federal, state or provincial, and local requirements in addition to or superseding the requirements of this standard (Sec. 4.1).
5. Required documentation of paint test or field service data (Sec. 4.3.1, 4.4.1).
6. ANSI/AWWA D102 contains a default checklist of optional requirements that the purchaser may incorporate into the project documents (see appendix C).

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major revisions made to the standard in this revision include the following:

1. The definition of *inaccessible areas* has been revised (Section 3).
2. Minimum dry thickness criteria have changed for outside coating systems OCS-2, OCS-3, OCS-5, and OCS-6 (Sec. 4.3), and inside coating systems ICS-3, ICS-4, and ICS-5 (Sec. 4.4).
3. A new inside coating system, ICS-6, has been added (Sec. 4.4.7 and Sec. A.3.6).
4. The section on surface preparation (Sec. 4.6) has numerous major changes.
5. References to standards ISO 12944-2 and ISO 12944-5 have been added to appendix A as guidance documents on establishing exposure conditions and selecting coating systems based on exposure conditions (Sec. A.1).
6. Guidance on dissimilar metals has been added to appendix A (Sec. A.4).
7. Guidance on inaccessible areas has been expanded in appendix A (Sec. A.5).
8. Guidance on undersides of tank bottoms has been modified (Sec. A.5.4).
9. Roof construction options have changed (Sec. A.5.6 and Table A.1).

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX 303.795.7603; write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email at standards@awwa.org.

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ANSI/AWWA D102-17
(Revision of ANSI/AWWA D102-14)

AWWA Standard

Coating Steel Water-Storage Tanks

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes coating systems for coating and recoating the inside and outside surfaces of steel tanks used for potable water storage in water supply service. Coating systems for new bolted steel tanks are not described in this standard (see ANSI/AWWA D103).

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for coating steel water-storage tanks, including materials, coating systems, surface preparation, application, and inspection and testing.

Sec. 1.3 Application

This standard can be referenced in purchase documents for coating steel water-storage tanks. The requirements of this standard apply when this document has been referenced and then only to coating steel water-storage tanks.

SECTION 2: REFERENCES

This standard references the following documents. These documents in the edition specified, or the latest edition if not specified, form a part of this standard

to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

AAMA* 2604—Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

ANSI†/AWWA C210—Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

ANSI/AWWA C222—Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.

ANSI/AWWA D103—Factory-Coated Bolted Carbon Steel Tanks for Water Storage.

ASTM D4141—Standard Practice for Conducting Black Box and Solar Concentrating Exposures of Coatings.

ASTM G90—Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight.

NACE‡ SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

NSF§/ANSI 61—Drinking Water System Components—Health Effects.

SSPC¶-PA 2—Procedure for Determining Conformance to Dry Coating Thickness Requirements.

SSPC-Paint 20—Zinc-Rich Coating (Type I—Inorganic, and Type II—Organic).

SSPC-Paint 28 (2013)—Water-Borne Epoxy Primer for Steel Surfaces.

SSPC-Paint 36—Two-Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based.

SSPC-Paint 101 (2013)—Aluminum Alkyd Paint Leafing (Type I) and Non-Leafing (Type II).

SSPC-PS 24.00 (2013)—Latex Painting System for Industrial and Marine Atmospheres, Performance-Based.

SSPC-PS 27.00 (2013)—Alkyd Coating System Materials Specification, Performance-Based.

* American Architectural Manufacturers Association, 1827 Walden Office Square, Suite 550, Schaumburg, IL 60173.

† American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

‡ NACE International, 1440 South Creek Drive, Houston, TX 77084.

§ NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

¶ SSPC: The Society for Protective Coatings, 40 24th Street, Sixth Floor, Pittsburgh, PA 15222.

- SSPC-SP 6/NACE No. 3—Commercial Blast Cleaning.
- SSPC-SP 7/NACE No. 4—Brush-Off Blast Cleaning.
- SSPC-SP 10/NACE No. 2—Near-White Blast Cleaning.
- SSPC-SP 11—Power Tool Cleaning to Bare Metal.
- SSPC-SP 15—Commercial Grade Power Tool Cleaning.
- SSPC-SP WJ-1/ NACE WJ-1—Waterjet Cleaning of Metals—Clean to Bare Substrate.
- SSPC-SP WJ-2/ NACE WJ-2—Waterjet Cleaning of Metals—Very Thorough Cleaning.
- SSPC-SP WJ-3/ NACE WJ-3—Waterjet Cleaning of Metals—Thorough Cleaning.
- SSPC-SP WJ-4/NACE WJ-4—Waterjet Cleaning of Metals—Light Cleaning.
- SSPC-TU 3—Overcoating.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Coating*: Liquid, powder, or mastic composition that has been converted to a solid, durable, and functional adherent film after application.
2. *Constructor*: The party that provides the work and materials for placement or installation.
3. *Exterior surfaces*: Exterior surfaces, excluding inaccessible areas, of the tank roof, shell, pedestal, legs, accessories, and appurtenances that are exposed to the elemental atmosphere.
4. *Inaccessible areas*: Areas of the finished structure that, by virtue of the configuration of the completed structure, cannot be accessed to perform surface preparation or coating application (with or without the use of scaffolding, rigging, or staging). Inaccessible areas include such areas as the contact surfaces of roof plate lap joints, underside of roof plates where they cross supporting members, top surface of rafters directly supporting roof plates, contact surfaces of bolted connections, underside of column base plates, contact surfaces of mating parts not intended to be removed or disassembled during routine operation or maintenance of the tank, underside of the tank bottom for ground-supported flat-bottom tanks, and inside surfaces of risers and other inflow/outflow appurtenances of less than a nominal 36-in. inside diameter and more than one pipe diameter from an open end of the pipe.

5. *Interior dry surfaces:* Interior surfaces of the finished structure, excluding inaccessible areas, that are not exposed to the elemental atmosphere, the stored water, or its vapor. Examples are the interior of the access tube, interior of the pedestal, and underside of a suspended bottom within the pedestal.

6. *Interior wet surfaces:* Interior surfaces, excluding inaccessible areas, of the tank roof, shell, bottom, accessories, and appurtenances that are exposed to the stored water or its vapor. Examples are the interior of the roof, shell, bottom, and exterior of the access tube within the tank.

7. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

8. *Potable water:* Water that is safe and satisfactory for drinking and cooking.

9. *Pot life:* The period of time, after mixing the components together, that the coating remains usable with no decrease in the desired properties or performance.

10. *Preconstruction primer:* Primers shop applied at relatively thin (0.75–2.0 mils) dry film thickness designed to protect the blast-cleaned steel during the fabrication, transportation, and erection processes.

11. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.

12. *Stripe coat:* A coat of paint applied to specified areas such as edges or welds before or after a full coat is applied to the entire surface.

13. *Tank:* As defined in this standard, the term *tank* includes steel standpipes, reservoirs, and elevated tanks.

14. *Top capacity level (TCL):* Elevation of the lip of the overflow.

SECTION 4: REQUIREMENTS

Sec. 4.1 Materials.

Materials shall comply with federal, state or provincial, and local requirements.

Sec. 4.2 Data to Be Provided

The following data are to be provided:

4.2.1 *Coatings manufacturer.* The name of the company that manufactures the coatings to be applied.

4.2.2 *Application method.* The application method for inside and outside coatings—that is, brushing, rolling, or spraying, and whether the use of

dehumidification equipment is required during blast-cleaning and coating operations for interior coating systems.

4.2.3 *Materials.* The identification of each coating material intended for use on the project.

4.2.4 *Material safety data sheets.* Current material safety data sheets (SDSs) for each product to be used.

Sec. 4.3 Outside Coating Systems

4.3.1 *General.* This section describes coating systems for the exterior, weather-exposed surfaces of steel tanks. When coating materials are referenced to technical standards, the reference shall define the general type and quality required but shall not limit acceptable materials to an exact formulation. Proprietary formulations will be acceptable provided the coating is of the same generic type and that the performance of the formulation offered meets or exceeds the performance of the formulation defined in the referenced coating standard.

4.3.1.1 *Shop priming.* Primers or prime coats for the exterior systems outlined in this section may be shop applied. On surfaces where weld quality might be affected, the shop-applied primer may be eliminated or applied at reduced thickness within 4 in. of the area to be welded. When the shop priming option is used, fieldwork after the tank is erected consists of spot cleaning and spot priming exposed weld margins and primer abrasions. Refer to Sec. 4.6.2.4 regarding cleaning of shop-applied prime coats prior to application of finish coats.

4.3.1.2 *Preconstruction priming.* If specified, a fully compatible preconstruction primer shall be shop applied. Preconstruction primers specially formulated for welding may be applied without weld margins (see Sec. 4.3.1.1). Full removal of preconstruction primers is not required if (1) allowed by the specification and (2) compatible with the paint system primer. However, a full field coat of the primer specified for the selected outside system shall be applied over the spot-cleaned bare steel and remaining preconstruction primer. Field surface preparation for compatible preconstruction primers not requiring full removal is the same as for standard shop primers. Refer to Sec. 4.6.2.4 regarding cleaning of shop-applied prime coats prior to application of finish coats. Surfaces with incompatible preconstruction primers shall be prepared in accordance with Sec. 4.6.2.1.

4.3.1.3 *Weld-related shop primer requirements.* When the coating system primer or preconstruction primer is shop applied, refer to the applicable product-specific AWWA standard(s) for further information regarding weld-related shop primer requirements.

4.3.2 *Outside coating system No. 1 (OCS-1).* This is a three-coat or optional four-coat system consisting of one or two prime coats of rust-inhibitive pigmented alkyd primer, followed by an intermediate coat of alkyd coating and a finish coat of alkyd or silicone alkyd enamel. The following systems are included:

System Designation	Intermediate Coat	Finish Coat
OCS-1-A	Aluminum	Aluminum
OCS-1-B	Aluminum (colored)	Aluminum (colored)
OCS-1-C	Alkyd	Alkyd
OCS-1-D	Alkyd	Silicone Alkyd

4.3.2.1 *Materials.* The prime coat shall be red iron oxide, zinc oxide, oil, and alkyd primer without lead or chromate pigments in accordance with the performance requirements of SSPC-PS 27.00 (2013).

For system OCS-1-A, the aluminum intermediate and finish coats shall be aluminum alkyd in accordance with the performance requirements of SSPC-Paint 101 (2013).

For system OCS-1-B, the aluminum intermediate and finish coats shall be a nonleafing aluminum alkyd in accordance with the performance requirements of SSPC-Paint 101 (2013) tinted with phthalocyanine blue or green.

For system OCS-1-C, the intermediate and finish coats shall be gloss alkyd enamel in accordance with the performance requirements of SSPC-PS 27.00 (2013).

For system OCS-1-D, the intermediate coat shall be alkyd coating in accordance with the performance requirements of SSPC-PS 27.00 (2013). The finish coat shall be high-gloss silicone-alkyd coating.

4.3.2.2 *Thickness.* Minimum dry film thickness, in mils, of the OCS-1 coating system shall be as follows:

System	Primer 1	Primer 2* (Optional)	Intermediate Coat	Finish Coat	Total System	
OCS-1-A	2.0	(1.5)	1.0	1.0	4.0	(5.5)
OCS-1-B	2.0	(1.5)	1.0	1.0	4.0	(5.5)
OCS-1-C	2.0	(1.5)	1.5	1.5	5.0	(6.5)
OCS-1-D	2.0	(1.5)	1.5	1.0	4.5	(6.0)

NOTE: Consult the coating manufacturer for coating thickness limitations.

* Numbers in parentheses indicate thickness when optional second prime coat is used.

4.3.3 *Outside coating system No. 2 (OCS-2).* This is a three-coat system consisting of a single-component moisture-cure polyurethane zinc-rich primer, an intermediate coat of single-component moisture-cure polyurethane (normally pigmented with micaceous iron oxide), and a finish coat of single-component moisture-cure polyurethane coating.

4.3.3.1 *Materials.* The primer shall be a zinc-rich primer in accordance with SSPC-Paint 20, type II, chemically cured. The organic zinc-rich primer may be single-package or multipackage with the zinc dust packaged separately. The finish coat shall be in conformance with SSPC-Paint 36, level 1.

4.3.3.2 *Thickness.* Minimum dry film thickness, in mils, of the OCS-2 coating system shall be as follows:

System	Primer	Intermediate Coat	Finish Coat	Total System
OCS-2	2.5	3.0	1.5	7.0

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.3.4 *Outside coating system No. 3 (OCS-3).* This is a three-coat system consisting of an inorganic or an organic zinc-rich primer and an intermediate coat and finish coat of a single-component water-based industrial acrylic or modified acrylic emulsion.

4.3.4.1 *Materials.* If an inorganic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type I-B or type I-C. If an organic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type II, chemically cured. The zinc-rich primer may be single-package or multipackage with the zinc dust packaged separately. The intermediate and finish coats shall be in accordance with SSPC-PS 24.00 (2013). If a shop-applied inorganic zinc-rich primer is specified for new tanks, field touch-up shall be performed using the organic zinc-rich primer followed by a complete finish coat of water-based industrial acrylic or modified acrylic emulsion.

4.3.4.2 *Thickness.* Minimum dry film thickness, in mils, of the OCS-3 coating system shall be as follows:

System	Primer	Intermediate Coat	Finish Coat	Total System
OCS-3	2.5	2.0	2.0	6.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.3.5 Outside coating system No. 4 (OCS-4). This is a three-coat system consisting of an inorganic or organic zinc-rich primer, an intermediate coat of an aliphatic polyurethane, and a finish coat of two-component aliphatic fluorourethane. If a shop-applied inorganic zinc-rich primer is specified for new tanks, field touch-up shall be performed using the organic zinc-rich primer followed by a complete intermediate coat of aliphatic polyurethane and a complete finish coat of aliphatic fluorourethane.

4.3.5.1 Materials. If an inorganic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type I-B or type I-C. If an organic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type II, chemically cured. The organic zinc-rich primer may be single-package or multi-package with the zinc dust packaged separately. The intermediate coat shall be a two-component aliphatic polyurethane coating in accordance with SSPC-Paint 36, level 1. The finish coat shall be a two-component aliphatic fluoroethylene/vinyl ether fluorourethane coating conforming to the weathering requirements of AAMA 2604 and a 95 percent gloss retention after a minimum of 1,252 MJ/m² of UV spectrum exposure in accordance with ASTM D4141 (Procedure C) and ASTM G90 (Cycle 1).

4.3.5.2 Thickness. Minimum dry film thickness, in mils, of the OCS-4 coating system shall be as follows:

System	Primer	Intermediate Coat	Finish Coat	Total System
OCS-4	2.5	2.0	2.0	6.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.3.6 Outside coating system No. 5 (OCS-5). This is a three-coat system consisting of a first coat and an intermediate coat of two-component epoxy and a finish coat of a two-component aliphatic polyurethane coating. The epoxy first coat may be formulated with or without rust-inhibitive pigments.

4.3.6.1 Materials. The first and intermediate coats shall be a two-component epoxy coating in accordance with ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.3.1. The first coat shall be considered as the prime coat. The finish coat shall be a two-component aliphatic polyurethane coating in accordance with SSPC-Paint 36, level 1.

4.3.6.2 Thickness. Minimum dry film thickness, in mils, of the OCS-5 coating system shall be as follows:

System	First Coat	Intermediate Coat	Finish Coat	Total System
OCS-5	2.5	2.0	2.0	6.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.3.7 Outside coating system No. 6 (OCS-6). This is a three-coat system consisting of an inorganic or organic zinc-rich primer, an intermediate coat of two-component epoxy, and a finish coat of two-component aliphatic polyurethane coating. If a shop-applied inorganic zinc-rich primer is specified for new tanks, field touch-up shall be performed using the organic zinc-rich primer followed by a complete intermediate coat of epoxy and a complete finish coat of aliphatic polyurethane.

4.3.7.1 Materials. If an inorganic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type I-B or type I-C. If an organic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type II, chemically cured. The organic zinc-rich primer may be single-package or multipackage with the zinc dust packaged separately. The intermediate coat shall be a two-component epoxy coating in accordance with ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.3.1. The finish coat shall be a two-component aliphatic polyurethane coating in accordance with SSPC-Paint 36, level 1.

4.3.7.2 Thickness. Minimum dry film thickness, in mils, of the OCS-6 coating system shall be as follows:

System	Primer	Intermediate Coat	Finish Coat	Total System
OCS-6	2.5	2.0	2.0	6.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.3.8 Outside coating system No. 7 (OCS-7). This is a three-coat system consisting of a first coat and an intermediate coat of two-component water-based epoxy and a finish coat of a two-component water-based aliphatic polyurethane coating.

4.3.8.1 Materials. The first and intermediate coats shall be two-component water-based epoxy coatings in accordance with the performance requirements of SSPC-Paint 28. The first coat shall be considered as the prime coat. The finish coat shall be a two-component water-based aliphatic polyurethane coating in accordance with level 1 weathering requirements of SSPC-Paint 36.

4.3.8.2 *Thickness.* Minimum dry film thickness, in mils, of the OCS-7 coating system shall be as follows:

System	First Coat	Intermediate Coat	Finish Coat	Total System
OCS-7	2.0	2.0	2.0	6.0

NOTE: Consult the coating manufacturer for coating thickness limitations.

Sec. 4.4 Inside Coating Systems

4.4.1 *General.* This section describes coating systems for the interior of steel tanks. The selected coating systems for interior wet surfaces and interior dry surfaces are not required to be the same. Unless otherwise specified, the interior dry surfaces shall be coated with inside coating system No. 1 (ICS-1).

When coating materials are referenced to technical standards, the reference shall define the general type and quality required but shall not limit acceptable materials to an exact formulation. Proprietary formulations will be acceptable provided the coating is of the same generic type and that the performance of the formulation offered meets or exceeds the performance of the formulation defined in the referenced coating standard. Each coat color shall be specified to be contrasting to the underlying coat color.

Coatings used on interior wet surfaces of the tank shall have been tested and certified for potable water contact in accordance with NSF/ANSI 61. They shall have been evaluated for long-term freshwater resistance, and the system shall have demonstrated satisfactory service in freshwater for at least 18 months. Any coating that cannot meet these requirements, whether or not included in this standard, shall not be used.

4.4.1.1 *Shop priming.* Primers or prime coats for the interior systems outlined in this section may be shop applied. On surfaces where weld quality might be affected, the shop-applied primer may be eliminated or applied at reduced thickness within 4 in. of the area to be welded. When the shop-priming option is used, fieldwork after the tank is erected consists of spot cleaning and spot priming exposed weld margins and primer abrasions, as required for the particular coating system. Refer to Sec. 4.6.2.4 regarding cleaning of shop-applied prime coats prior to application of finish coats.

4.4.1.2 *Preconstruction priming.* If specified, a fully compatible preconstruction primer shall be shop applied. Preconstruction primers specially formulated for welding may be applied without weld margins (see Sec. 4.4.1.1). Full

removal of preconstruction primers is not required if (1) allowed by the specification, (2) compatible with the paint system primer, and (3) the paint system with the preconstruction primer has been tested and certified for potable water contact in accordance with NSF/ANSI 61. However, a full field coat of the primer specified for the selected inside system shall be applied over the spot-cleaned bare steel and remaining preconstruction primer. Field surface preparation for compatible preconstruction primers not requiring full removal is the same as for standard shop primers. Refer to Sec. 4.6.2.4 regarding cleaning of shop-applied prime coats prior to application of finish coats. Surfaces with incompatible preconstruction primers shall be prepared in accordance with Sec. 4.6.2.2.

4.4.1.3 Weld-related shop primer requirements. When the coating system primer or preconstruction primer is shop applied, refer to the applicable product-specific AWWA standard(s) for further information regarding weld-related shop primer requirements.

4.4.2 *Inside coating system No. 1 (ICS-1).* This is a two-coat two-component epoxy coating system.

4.4.2.1 Materials. The materials shall be a two-coat system of either a two-component epoxy material in accordance with ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.4.1, and consist of a prime coat and finish coat or, alternatively, two coats of the same epoxy coating without the use of a separate primer.

4.4.2.2 Thickness. Minimum dry film thickness, in mils, of the ICS-1 coating system shall be as follows:

System	Prime Coat	Finish Coat	Total System
ICS-1	3.0	5.0	8.0

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.4.3 *Inside coating system No. 2 (ICS-2).* This is a three-coat two-component epoxy coating system.

4.4.3.1 Materials. The materials shall be a three-coat system of either a two-component epoxy material in accordance with ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.4.1, and consist of a prime coat and two finish coats or, alternatively, three coats of the same epoxy coating without the use of a separate primer.

4.4.3.2 Thickness. Minimum dry film thickness, in mils, of the ICS-2 coating system shall be as follows:

System	Prime Coat	Intermediate Coat	Finish Coat	Total System
ICS-2	3.0	4.0	5.0	12.0

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.4.4 Inside coating system No. 3 (ICS-3). This is a one- or two-coat system, consisting of an optional two-component epoxy primer, inorganic zinc-rich primer or organic zinc-rich primer, and a high-solids two-component epoxy finish coat.

4.4.4.1 Materials. If a two-component epoxy primer is specified, it shall meet the performance requirements outlined in ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.4.1 when tested as a primer under the high-solids, two-component epoxy finish coat. If an inorganic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type I-B or type I-C. If an organic zinc-rich primer is specified, it shall be in accordance with SSPC-Paint 20, type II, chemically cured. The two-component epoxy finish coat shall have a minimum volume solids content of 96 percent and shall comply with the performance requirements outlined in ANSI/AWWA C210.

4.4.4.2 Thickness. Minimum dry film thickness, in mils, of the ICS-3 coating system shall be as follows:

System	Primer* (Optional)	Finish Coat	Total System*
ICS-3	(2.5)	20.0	20.0 (22.5)

NOTE: Consult the coating manufacturer for coating thickness limitations.

*Numbers in parentheses indicate thickness when optional prime coat is used.

4.4.5 Inside coating system No. 4 (ICS-4). This is a single-coat thermoset polymer that is the reaction product of a polyisocyanate resin that includes 100 percent-solids polyurethane and/or polyurea technologies.

4.4.5.1 Materials. The materials shall consist of a two-component, 100 percent-solids fast-setting polyurethane or polyurea that is cured to touch in under 30 minutes. The material shall be in accordance with ANSI/AWWA C222. A manufacturer-recommended primer may be used.

4.4.5.2 Thickness. Minimum dry film thickness, in mils, of the ICS-4 coating system shall be as follows:

System	Primer* (Optional)	Finish Coat	Total System*
ICS-4	(2.5)	25.0	25.0 (27.5)

NOTE: Consult the coating manufacturer for coating thickness limitations.

* Numbers in parentheses indicate thickness when optional prime coat is used.

4.4.6 *Inside coating system No. 5 (ICS-5).* This is a three-coat system consisting of an organic zinc-rich primer and intermediate coat and finish coat of two-component epoxy.

4.4.6.1 *Materials.* The prime coat shall be an organic zinc-rich primer in accordance with SSPC-Paint 20, type II, chemically cured. The organic zinc-rich primer may be single-package or multipackage with the zinc dust packaged separately. The intermediate and finish coats shall be a two-component epoxy material in accordance with ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.4.1.

4.4.6.2 *Thickness.* Minimum dry film thickness, in mils, of the ICS-5 coating system shall be as follows:

System	Primer	Intermediate Coat	Finish Coat	Total System
ICS-5	2.5	4.0	4.0	10.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

4.4.7 *Inside coating system No. 6 (ICS-6).* This is a two-coat system consisting of an organic zinc-rich primer and a finish coat of a two-component epoxy.

4.4.7.1 *Materials.* The organic zinc-rich primer shall be in accordance with SSPC-Paint 20, type II, chemically cured. The organic zinc-rich primer may be single-package or multipackage with the zinc dust packaged separately. The two-component epoxy finish coat shall comply with the performance requirements outlined in ANSI/AWWA C210 or a proprietary epoxy formulation in accordance with the requirements of Sec. 4.4.1.

4.4.7.2 *Thickness.* Minimum dry film thickness, in mils, of the ICS-6 coating system shall be as follows:

System	Primer	Finish Coat	Total System
ICS-6	2.5	10.0	12.5

NOTE: Consult the coating manufacturer for coating thickness limitations.

Sec. 4.5 Coating Materials

4.5.1 *General.* Coatings used on the interior and exterior surfaces of the tank shall be merchantable and suitable for the intended service and shall be delivered in unopened containers. Coating materials shall be those that have been selected for the specific service in accordance with Sec. 4.3.1 and Sec. 4.4.1.

4.5.2 *Labels.* The containers in which coating materials are delivered shall be marked with the manufacturer's name, product name or number, identification of components shipped in separate containers, date of manufacture or expiration-of-shelf-life date, batch number, and safety precautions.

4.5.3 *Product information.* The following manufacturer's information shall be provided for each product. The product information may be printed on the label or package or provided in an accompanying instruction sheet.

4.5.3.1 *Mixing instructions.* Complete mixing instructions shall be provided.

4.5.3.2 *Thinning.* The maximum allowable quantity and type of thinner recommended shall be listed for each application method.

4.5.3.3 *Percent solids.* The percent solids by volume for liquid materials shall be listed; in the case of two-component materials, the mixed solids by volume.

4.5.3.4 *Spreading rate.* The theoretical spreading rate in square feet per gallon at 1-mil dry film thickness, unthinned as packaged, shall be provided.

4.5.3.5 *Weight.* The unit weight per US gallon for component materials shall be provided.

4.5.3.6 *Application, drying, and cure time.* Recommended minimum and maximum drying times between coats and cure time before immersion shall be provided. The drying time shall be stated as the number of hours at 75°F ±2°F (24°C ±1°C) and 50 percent relative humidity and at the upper and lower limits of recommended application temperature and humidity.

4.5.3.7 *Pot life.* The pot life of plural component coatings shall be stated. (See definition of *pot life* in Section 3.) A description of variations caused by changes in temperature, humidity, or other ambient conditions shall be stated.

4.5.3.8 *Application method.* The method or methods by which the coating may be applied shall be listed.

4.5.3.9 *Shelf life.* The period of time, marked by an expiration date, during which the manufacturer certifies that the product will perform as intended if applied as directed shall be listed.

Sec. 4.6 Surface Preparation

4.6.1 *General.* This section describes surface preparation for all coating systems. These surface preparation requirements shall be followed unless the coating manufacturer has more stringent requirements, in which case the more stringent requirements shall prevail. Additionally, if the use of dehumidification

equipment during the surface preparation operations is required, it must be specified in the purchase documents.

4.6.2 *New tanks.*

4.6.2.1 Exterior surfaces and interior dry surfaces. Exterior surfaces and interior dry surfaces shall be cleaned in accordance with SSPC-SP 6/NACE No. 3. Blast-cleaned surfaces shall have a surface profile that is appropriate for the specific primer and coating system as recommended by the manufacturer of the coating.

4.6.2.2 Interior wet surfaces. Interior wet surfaces shall be cleaned in accordance with SSPC-SP 10/NACE No. 2. Blast-cleaned surfaces shall have a surface profile that is appropriate for the specific primer and coating system as recommended by the manufacturer of the coating.

4.6.2.3 Areas of damaged shop coating. After field welding has been completed, accessible areas on which the shop coating has been damaged by abrasion, welding, handling, or other causes shall be cleaned as follows:

4.6.2.3.1 Exterior and interior dry surfaces. Exterior and interior dry surfaces shall be cleaned in accordance with SSPC-SP 6/NACE No. 3.

4.6.2.3.2 Interior wet surfaces. Interior wet surfaces shall be cleaned in accordance with SSPC-SP 10/NACE No. 2.

4.6.2.4 Field preparation of shop-primed surfaces. Accessible shop-primed surfaces shall be cleaned of dirt, dust, mud, oil, grease, and foreign materials. When required by the coating manufacturer's written instructions for the product, shop-primed surfaces shall be scarified prior to application of the field-applied coats.

4.6.3 *Existing tanks.*

4.6.3.1 Exterior surfaces and interior dry surfaces.

4.6.3.1.1 Spot repair. When existing coatings have not deteriorated extensively, corrosion products and deteriorated coatings shall be removed by spot cleaning in accordance with SSPC-SP 15 or SSPC-SP 6/NACE No. 3. Exposed steel surfaces shall have a surface profile that is appropriate for the specific primer and coating system in accordance with the coating manufacturer's recommendations. The specified coating system shall then be spot applied in accordance with Sec. 4.3 and Sec. 4.7.

4.6.3.1.2 Overcoating. When existing coatings have not deteriorated extensively and additional barrier or ultraviolet (UV) protection is desired, overcoating may be an option, depending on the condition of the existing coating system. Determine the condition of the existing coating system and, if applicable,

conduct a test patch with the candidate overcoat system or systems in accordance with SSPC-TU 3. When the new coating system will adhere to and is compatible with the existing coating, all corrosion products and deteriorated coatings on exterior surfaces and interior dry surfaces shall be spot cleaned in accordance with Sec. 4.6.3.1.1, and the remainder of the surfaces shall be cleaned and scarified in accordance with SSPC-SP 7/NACE No. 4 prior to coating application. If specified, in lieu of spot cleaning in accordance with Sec. 4.6.3.1.1 and the abrasive blast-cleaning processes referenced above, exterior surfaces may be cleaned of dirt, mud, oil, grease, coating/paint chalk, and foreign matter in accordance with SSPC-SP WJ-4/NACE WJ-4.

4.6.3.1.3 Full removal. Existing coatings shall be removed and all exterior surfaces and interior dry surfaces blast cleaned in accordance with SSPC-SP 6/NACE No. 3 or, if specified, SSPC-SP 10/NACE No. 2 when (1) the existing coatings have deteriorated extensively, (2) the existing coating system is determined not to be a candidate for overcoating when evaluated in accordance with SSPC-TU 3, or (3) the candidate overcoat system or systems are not compatible with the existing coating system. When and where specified, the use of pressurized water, as defined in SSPC-SP WJ-2/NACE WJ-2 and SSPC-SP WJ-3/NACE WJ-3, may be used in lieu of dry abrasive blasting.

4.6.3.2 Interior wet surfaces.

4.6.3.2.1 Spot repair. When existing coatings have not deteriorated extensively, corrosion products and deteriorated coatings shall be removed by spot cleaning in accordance with SSPC-SP 11 or SSPC-SP 10/NACE No. 2. Exposed steel surfaces shall have a surface profile that is appropriate for the specific primer and coating system in accordance with the coating manufacturer's recommendations. The specified coating system shall then be spot applied in accordance with Sec. 4.4 and Sec. 4.7.

4.6.3.2.2 Overcoating. When existing coatings have not deteriorated extensively and additional barrier protection is desired, overcoating may be an option depending on the condition of the existing coating system. Determine the condition of the existing coating system and, if applicable, conduct a test patch with the candidate overcoat system or systems in accordance with SSPC-TU 3. When the new coating system will adhere to and is compatible with the existing coating, all corrosion products and deteriorated coatings on interior wet surfaces shall be spot cleaned in accordance with Sec. 4.6.3.2.1, and the remainder of the

interior wet surfaces with intact coating shall be cleaned and scarified in accordance with SSPC-SP 7/NACE No. 4 prior to the coating application.

4.6.3.2.3 *Full removal.* Interior wet surfaces shall have existing coatings removed and be blast cleaned in accordance with SSPC-SP 10/NACE No. 2 when (1) the existing coatings have deteriorated extensively, (2) the existing coating system is determined not to be a candidate for overcoating when evaluated in accordance with SSPC-TU 3, or (3) the candidate overcoat system or systems are not compatible with the existing coating system.

Sec. 4.7 Application

4.7.1 *General.* The requirements of the coating manufacturer's written instructions shall be followed with regard to shelf life, storage of coatings and thinner, mixing and thinning, application of shop and field coating, and drying/curing of applied coatings. The finish coat color shall be specified and shall contrast to the underlying coat color. Additionally, if the use of dehumidification equipment during the coating operations for interior coating systems is required, it must be specified in the purchase documents.

4.7.2 *Prime coat.* Coating materials shall be applied after surface preparation, before any surface rusting occurs, and before any dust or soil has accumulated. Prime coats for exterior surfaces and interior dry surfaces may be applied by any method recommended by the coating manufacturer that achieves a coating film that meets the requirements of the purchase documents. Interior wet surfaces shall be sprayed with the exception that difficult-to-coat areas may be additionally stripe coated with a brush or roller. Difficult-to-coat areas include pitted surfaces, weld seams, edges, corners, irregular shapes, and exposed portions of fasteners.

When plates have been shop primed with the specified coating system primer (not a preconstruction primer), all accessible areas on which shop primer was not applied or has been damaged shall be cleaned in accordance with Sec. 4.6.2.3 and primed with the same primer applied to the same dry film thickness as the shop coat. An exception to this is found in Sec. 4.3.4 and Sec. 4.3.7 (OCS-3 and OCS-6). When plates have been primed with a preconstruction primer, refer to Sec. 4.3.1.2 and Sec. 4.4.1.2.

4.7.3 *Intermediate and finish coats.* Intermediate and finish coats for exterior surfaces and interior dry surfaces may be applied by any method that achieves a coating film that meets the requirements of the purchase documents. Interior wet surfaces shall be sprayed with the exception that difficult-to-coat areas may be additionally stripe coated with a brush or roller. Difficult-to-coat areas include

pitted surfaces, weld seams, edges, corners, irregular shapes, and exposed portions of fasteners.

4.7.4 *Touch-up and repair coats.* Touch-up and repair coats for interior and exterior surfaces may be applied by any method that achieves a coating film that meets the requirements of the purchase documents.

4.7.5 *Ventilation.* Ventilation shall be provided for worker safety and proper curing of the coating system.

4.7.6 *Lighting.* Provide sufficient lights and intensity to allow proper abrasive blasting, coating application, inspection, and worker safety.

Sec. 4.8 Safety Precautions

4.8.1 *General.* Applicable federal, state or provincial, and local regulations shall be followed.

SECTION 5: VERIFICATION

Sec. 5.1 Inspection and Testing

5.1.1 *General.* Before the primer coating is applied, verify that the required surface preparation parameters as outlined in Sec. 4.6 have been satisfied. The wet film thickness of each coat shall be measured during application. Before application of successive coats, the dry film thickness shall be measured for compliance.

5.1.2 *Film thickness.* The dry film thickness of the total system shall be measured in accordance with SSPC-PA 2.

5.1.3 *Holiday testing.* For inside coating systems, the coating on interior wet surfaces below the top capacity level (TCL) shall be tested and identified in accordance with NACE SP0188. Locations where holidays are detected shall be retested after repair work has been completed.

5.1.4 *Test report.* When specified, results of quality control tests and records shall be provided.

Sec. 5.2 First-Anniversary Inspection

5.2.1 *General.* When specified, the interior surfaces and exterior surfaces of the tank shall be inspected within one year after coating work has been completed to determine whether any repair work is necessary.

5.2.2 *Arrangements.* The method of inspection to be used shall be specified in the purchase documents. The date of the inspection shall be established and notification given at least 30 days in advance.

5.2.3 *Remedial work.* Any location where layers of coating have peeled off, bubbled, or cracked and any location where rust breakthrough is evident shall be considered to be a failure of the coating system. Rust stains emanating from inaccessible areas, such as unwelded roof plate lap joints and where roof plates cross supporting members, are acceptable as the rust stains do not affect the integrity of the coating surface. Repairs shall be made at points where failures are observed by removing the deteriorated coating, cleaning the surface, and recoating with the same or approved compatible coating system. If a compatible coating system is to be used for interior wet surfaces, the proposed coating system shall meet the testing and certification requirements of Sec. 4.4.1. The manufacturer's cure time requirements for coating repair shall be met. If a portion of the coated tank surface demonstrates either (1) a concentrated 25 percent or higher coating failure of the area of a portion of the tank surface or (2) a 5 percent or higher coating failure evenly dispersed over the area of a portion of the tank surface, then for that portion, the entire coating system shall be removed and that section recoated. For purposes of determining the need for complete recoating, portions of the tank surface and any accessories not specifically identified in Table 1 shall each be considered independently.

5.2.4 *Inspection report.* An inspection report covering the first-anniversary inspection shall be prepared. The report shall state the number and type of failures observed, if any, the percentage of the surface area where failure has occurred, the names of the persons making the inspection, and the type and location of recommended coatings repairs. Color photographs illustrating each type of failure shall be included in the report.

SECTION 6: AFFIDAVIT OF COMPLIANCE

Sec. 6.1 Affidavit Statement

When specified by the purchaser, an affidavit that materials and work provided comply with applicable requirements of this standard shall be provided.

Table 1 Portions of the tank surface considered for recoating

	Ground-Supported Flat-Bottom Tanks	Single-Pedestal Elevated Tanks	Multilegged Elevated Tanks
Interior wet surfaces			
Wet riser (36-in. diameter and larger), inside surfaces	N/A	X	X
Dry risers, access tubes, dry wells	N/A	X	X
Floor or suspended bottom	X	X	X
Cone, bell	N/A	X	X
Shell, upper knuckle, roof plates below the TCL	X	X	X
Roof support rafters, girders, and columns	X	N/A	N/A
Knuckle, roof plates, and roof stiffeners above the TCL	X	X	X
Interior dry surfaces			
Wet riser (outside surfaces within pedestal)	N/A	X	X
Dry riser, access tube, dry well	N/A	X	X
Pedestal	N/A	X	N/A
Floor or suspended bottom	N/A	X	X
Cone, bell	N/A	X	X
Exterior surfaces			
Wet riser, dry riser	N/A	X	X
Pedestal or leg	N/A	X	X
Floor or suspended bottom	N/A	X	X
Cone, bell	N/A	X	X
Shell and upper knuckle	X	X	X
Roof	X	X	X

"N/A" indicates areas that are not applicable to a particular style of tank.

"X" indicates areas that are to be considered separately for purposes of determining the need for complete recoating.

APPENDIX A

Selection and Use of Coating Systems

This appendix is for information only and is not a part of ANSI/AWWA D102.

SECTION A.1: GENERAL

Several generic types of coating systems are included in ANSI/AWWA D102 because it has been determined that no single coating system is best suited for all service exposures or application conditions. The coating systems presented are not equivalent in terms of expected service life or initial and long-term costs. A coating system's service life is dependent on many factors that include, but are not limited to, site-specific service conditions, quality of the surface preparation and application of the coating system, periodic inspections, and scheduled maintenance. As an aid in selecting a coating system for particular site-specific requirements and climate conditions, it is recommended that the purchaser or specifier contact a coating manufacturer's representative to provide assistance with a life-cycle cost analysis in conjunction with other factors presented above.

Because it is impractical for an occasional purchaser of coatings to make sufficient laboratory tests to determine whether coating constituents meet the requirements of this standard, it is recommended that the coatings be purchased from a manufacturer the products of which have proven performance for the intended service through in-place use or satisfactory evidence of laboratory-tested equivalency.

Some primers dry hard and glossy, notably those containing certain epoxy vehicles. When these primers are shop applied, surface preparation of the prime coat, in order to accept the first field-applied coat, should be in accordance with the coating manufacturer's recommendations, which may include scarification of the surface (brush-off blast). These primers are suitable for field application, provided that the second coat is applied as soon as the primer is sufficiently dry or cured in accordance with the coating manufacturer's recommendations. The coating manufacturer's recommendations for surface preparation of the prime coat should be followed.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

For information on establishing exposure conditions, the purchaser may refer to ISO 12944-2, Paints and Varnishes—Corrosion Protection of Steel Structures by Protective Paint Systems—Part 2: Classification of Environments. For information on the selection of coating systems based on exposure conditions, the purchaser may refer to ISO 12944-5, Paints and Varnishes—Corrosion Protection of Steel Structures by Protective Paint Systems—Part 5: Protective Paint Systems. Other industry recognized resources are available and the purchaser should consult a coatings professional to assist with coating system selection based on site-specific exposure conditions.

SECTION A.2: OUTSIDE COATING SYSTEMS

Outside coating system No. 1 (OCS-1) may blister or fail prematurely when applied to water tank exteriors that are subjected to frequent condensation (“sweating”) as a result of cold substrate temperatures (i.e., tanks containing cold well water) and being located in areas of high humidity. Other outside coating systems provide superior performance when this condition is encountered.

Sec. A.2.1 Outside Coating System No. 1 (OCS-1)

This is a three-coat or optional four-coat alkyd system that provides reasonable and durable protection in mild environments (OCS-1-A, OCS-1-B, OCS-1-C, and OCS-1-D). The four-coat system includes a second coat of primer that upgrades corrosion protection and service life. System OCS-1-B has a pleasing appearance; in some locations, however, the color tends to change to light gray with weathering. System OCS-1-D uses a silicone alkyd finish coat that provides improved color and gloss retention when compared with non-silicone alkyd enamels. For optimum color and gloss retention, it should be specified that the silicone content be a minimum of 30 percent of the total resin binder.

Sec. A.2.2 Outside Coating System No. 2 (OCS-2)

This is a three-coat single-component moisture-cure polyurethane system that provides very good protection in mild to moderately severe environments. Color and gloss retention of the finish coat are similar to that provided by two-component aliphatic polyurethane. The primary distinguishing characteristics of this system are the relatively wide range of temperature and humidity conditions within which it can be successfully applied. The primer is also relatively surface tolerant. The polyurethane finish coat is generally graffiti resistant in that

selected solvents or commercial cleaners can be used to remove graffiti from the surface without damaging the completely cured finish coat. Coatings making up this system cure by reaction with moisture. Therefore, thickness in excess of the manufacturer's recommendations may result in poor adhesion, blistering, pinholes, or solvent entrapment.

Sec. A.2.3 Outside Coating System No. 3 (OCS-3)

This is a three-coat system consisting of an inorganic or an organic zinc-rich primer and an intermediate coat and finish coat of a single-component water-based industrial acrylic or modified acrylic emulsion coating that exhibits corrosion resistance comparable to OCS-1. The zinc-rich primer will provide increased corrosion protection compared with a barrier-type prime coat. Acrylic emulsion coatings generally dry faster and provide improved color and gloss retention when compared with alkyd enamels.

Sec. A.2.4 Outside Coating System No. 4 (OCS-4)

This is a three-coat system composed of an inorganic or an organic zinc-rich primer, an aliphatic urethane intermediate coat, and a fluorourethane finish coat. This system provides gloss and color retention exceeding that of aliphatic polyurethane finish coats. The zinc-rich primer will provide increased corrosion protection compared with a barrier-type prime coat. The coating manufacturer should be consulted regarding recoat parameters and unique application characteristics. Applicators should be specifically trained in the application of the fluorourethane finish coat. The fluorourethane finish coat is generally graffiti resistant in that selected solvents or commercial cleaners can be used to remove graffiti from the surface without damaging the completely cured finish coat.

Sec. A.2.5 Outside Coating System No. 5 (OCS-5)

This system consists of two-component epoxy prime and intermediate coats and a two-component aliphatic polyurethane finish coat. This system provides very good color and gloss retention and is highly abrasion resistant to windblown debris. The polyurethane finish coat is generally graffiti resistant in that selected solvents or commercial cleaners can usually be used to remove graffiti from the surface without damaging the completely cured urethane finish coat. The addition of a clear aliphatic polyurethane coating containing UV absorbers can further enhance the long-term color and gloss retention of bright-colored logos, designs, or graphics on tank exteriors. Care should be taken when applying clear coats because their long-term performance depends greatly on film thickness and uniform coverage. Typically, clear coats

are not easily touched up and require the reapplication of the underlying polyurethane coat for uniform appearance. The coating manufacturer should be consulted for clear-coat application parameters and film thickness requirements.

Sec. A.2.6 Outside Coating System No. 6 (OCS-6)

This system consists of an inorganic or an organic zinc-rich primer and the same two-component epoxy intermediate coat and two-component aliphatic polyurethane finish coat as OCS-5. The zinc-rich primer provides improved corrosion protection compared with a barrier-type prime coat. The polyurethane finish coat is generally graffiti resistant in that selected solvents or commercial cleaners can be used to remove graffiti from the surface without damaging the completely cured finish coat. The addition of a clear aliphatic polyurethane coating containing UV absorbers can further enhance the long-term color and gloss retention of bright-colored logos, designs, or graphics on tank exteriors. Care should be taken when applying clear coats because their long-term performance depends greatly on film thickness and uniform coverage. Typically, clear coats are not easily touched up and require the reapplication of the underlying polyurethane coat for uniform appearance. The coating manufacturer should be consulted for clear-coat application parameters and film thickness requirements.

Sec. A.2.7 Outside Coating System No. 7 (OCS-7)

This system consists of a two-component water-based epoxy primer and intermediate coat and a two-component water-based aliphatic polyurethane finish coat. This three-coat high-performance system provides very good color and gloss retention and can provide performance comparable to solvent-borne epoxy/polyurethane systems. The system can generally be applied by spray, brush, or roller. This system has a low VOC content and low odor, is nonflammable, offers water cleanup, and can be applied at temperatures as low as 40°F (4.4°C). The addition of a clear aliphatic polyurethane coating containing UV absorbers can further enhance the long-term color and gloss retention of bright-colored logos, designs, or graphics on tank exteriors. Care should be taken when applying clear coats because their long-term performance depends greatly on film thickness and uniform coverage. Typically, clear coats are not easily touched up and require the reapplication of the underlying polyurethane coat for uniform appearance. The coating manufacturer should be consulted for clear-coat application parameters and film thickness requirements.

SECTION A.3: INSIDE COATING SYSTEMS

If a cathodic protection system is provided for additional corrosion protection below the TCL for any inside coating system, it should meet the requirements of ANSI/AWWA D104 or ANSI/AWWA D106.

If the use of dehumidification equipment during the preparation and/or coating operations for interior coating systems is required, it must be specified in the purchase documents.

If temperatures at the time of application of any of the inside coating systems are below the minimums specified by the coating manufacturer, indirect heating may be considered. Heat input must be sufficient to raise both the ambient and, most important, the substrate temperatures to a level within the range recommended by the coating manufacturer. Specified ambient and substrate temperatures shall be maintained for the duration of the application and cure of the coating system. For temperatures near or below 35° to 40°F (1.6° to 4.4°C), temporary exterior insulation may be required to maintain acceptable substrate temperature levels. A heating plan, including a heat transfer analysis by qualified personnel, may be necessary to determine the optimum combination of heat input and insulation required for a given low temperature environment.

Sec. A.3.1 Inside Coating System No. 1 (ICS-1)

This is a two-coat two-component epoxy system for normal service. To obtain curing with some two-component epoxy products, surface and ambient temperatures of 50°F (10°C) and higher are required. Two-component epoxy products are available with factory-applied accelerators (or packaged separately) that allow curing below 50°F (10°C). Consult the manufacturer's recommendation for minimum and maximum temperature requirements. This coating is generally self-priming and should be applied directly to the properly prepared steel surface.

Sec. A.3.2 Inside Coating System No. 2 (ICS-2)

This is a three-coat two-component epoxy system for extended service compared with ICS-1. To obtain curing with some two-component epoxy products, surface and ambient temperatures of 50°F (10°C) and higher are required. Two-component epoxy products are available with factory-applied accelerators (or packaged separately) that allow curing below 50°F (10°C). Consult the manufacturer's recommendation for minimum and maximum temperature requirements. This

coating is generally self-priming and should be applied directly to the properly prepared steel surface.

Sec. A.3.3 Inside Coating System No. 3 (ICS-3)

This is a single-coat two-component epoxy system with a minimum volume solids content of 96 percent. This single-coat system is usually field applied but can be used as a finish coat over optional field- or shop-applied NSF/ANSI 61–certified epoxy primers or NSF/ANSI 61–certified zinc-rich primers. Consult the coating manufacturer for specific coating system recommendations.

Sec. A.3.4 Inside Coating System No. 4 (ICS-4)

This is a single-coat, direct-to-steel, thick-film, 100 percent–solids coating based on polyurethane and/or polyurea technology. This material provides increased film build in a single-coat multipass technique allowing for higher film-build coverage over deteriorated or pitted steel. Because of rapid cure characteristics, plural-component or specially designed equipment is required. The use of this system in elevated water storage tanks may require the use of additional staging equipment. The application of the coating should be completed by individuals who have been trained by the manufacturer in the application of the coating being applied.

Sec. A.3.5 Inside Coating System No. 5 (ICS-5)

This is a three-coat organic zinc-rich primer, two-component epoxy intermediate coat, and two-component epoxy finish coat system. It uses the same two-component epoxy intermediate and finish coatings as ICS-1 and ICS-2. The use of an organic zinc-rich primer provides additional benefits compared with barrier-type primers such as epoxies. These benefits can include “dry-fall” application characteristics, corrosion protection through the use of sacrificial pigmentation, and extended recoat time minimizing the need for scarification prior to topcoating in the field. The coating manufacturer should be consulted regarding “dry-fall” characteristics and maximum recoat time of its NSF/ANSI 61–certified organic zinc-rich primers. To obtain curing with some two-component epoxy products, surface and ambient temperatures of 50°F (10°C) and higher are required. Two-component epoxy products are available with factory-applied accelerators (or packaged separately) that allow curing below 50°F (10°C). Consult the manufacturer’s recommendation for minimum and maximum temperature requirements.

Sec. A.3.6 Inside Coating System No. 6 (ICS-6)

This is a two-coat organic zinc-rich primer and two-component epoxy finish coat system. The use of an organic zinc-rich primer provides additional benefits

compared with barrier-type primers such as epoxies. These benefits can include “dry-fall” application characteristics, corrosion protection through the use of sacrificial pigmentation, and extended recoat time minimizing the need for scarification prior to topcoating in the field. The coating manufacturer should be consulted regarding “dry-fall” characteristics and maximum recoat time of its NSF/ANSI 61–certified organic zinc-rich primers. To obtain curing with some two-component epoxy products, surface and ambient temperatures of 50°F (10°C) and higher are required. Two-component epoxy products are available with factory-applied accelerators (or packaged separately) that allow curing below 50°F (10°C). Consult the manufacturer’s recommendation for minimum and maximum temperature requirements.

SECTION A.4: DISSIMILAR METALS

For tank components exposed to stored water, construction with dissimilar metals more noble (stainless steel, copper, brass) than the carbon steel tank components to which they are attached is currently prohibited by AWWA carbon steel tank standards (ANSI/AWWA D100, ANSI/AWWA D103, and ANSI/AWWA D107) unless those dissimilar metal components are electrically isolated from the carbon steel tank at all points of connection.

When dissimilar metal internal components are not electrically isolated and they are in contact with the water or condensation, corrosion of the carbon steel tank will occur. Experience has also shown that even exposure of nonisolated dissimilar metals above the liquid level on open top tanks can be subject to accelerated dissimilar metals corrosion.

In most cases, dissimilar metal components can be isolated from the carbon steel tank using alternate connection details. In cases where it is believed that they cannot be isolated from the tank, check with tank manufacturers and consultants for alternate details that can provide isolation.

In cases where electrical isolation of dissimilar metal internal components below the overflow level has been determined to not be possible, it is recommended that the dissimilar metal components be lined and coated with a suitable dielectric coating. It is the responsibility of the owner or specification writer, not the painting contractor, to determine whether any dissimilar metals exist and, if so, how the dissimilar metals are to be treated with respect to the coating system.

It should be noted that the solutions to dissimilar metals corrosion generally are contained in the details and configuration of the construction of the tank and

its components. The coating specification cannot change those details, but it can address how and where to apply dielectric coatings to reduce the exposed cathodic surface, thereby reducing the effects of dissimilar metals corrosion.

SECTION A.5: INACCESSIBLE AREAS

Sec. A.5.1 Background on Inaccessible Areas

This standard defines *inaccessible areas* as “areas of the finished structure that, by virtue of the configuration of the completed structure, cannot be accessed to perform surface preparation or coating application (with or without the use of scaffolding, rigging, or staging).”

Inaccessible areas in the completed tank structure that are not hermetically sealed can result in corrosion. In some cases, the corrosion may only be cosmetic. In other instances, when the inaccessible areas exist inside the tank container, corrosion in these areas can develop at rates that require more frequent or more rigorous maintenance routines and may lead to a shortened recoat interval for those areas of the tank and result in significant long-term corrosion of the tank components. Although there are a few exceptions, when inaccessible areas exist, they are most often found in the details of roof support structure and stiffening elements.

With only one exception, current AWWA standards for welded carbon steel tanks (ANSI/AWWA D100 and ANSI/AWWA D107) do not allow inaccessible areas (excluding small-diameter inflow/outflow appurtenances) inside the tank below the top capacity level (TCL). If joints below the TCL are encountered on existing tanks that are not seal welded, it is highly recommended that they be corrected before maintenance or recoating activities are performed. The minimum requirements for those standards do not prohibit construction details that can result in inaccessible areas above the TCL. Although these minimum requirements have proven satisfactory for many decades in many regions and circumstances, they may not be universally successful, so the tank owner may wish to specify additional requirements to improve conditions for coating, to extend coating life, and to reduce future maintenance costs for these areas. Tanks exposed to water with levels of chlorine in excess of levels for potable water distribution or to water that may contain high sulfur concentrations or other corrosive compounds are examples where the minimum requirements of the standard may not be sufficient.

This section provides guidance regarding the issues to be considered when developing a plan for treatment of inaccessible areas, including the restrictions and limitations that apply to how these areas can be treated on different types of tank construction. These issues should be addressed by the tank owner before issuing a specification for coating work on either existing tanks or tanks to be newly constructed. Because of the inherent differences in the options available for existing tanks as compared with tanks scheduled to be constructed, special attention is required in preparation of project specifications for existing tanks to ensure the specified requirements are achievable.

ANSI/AWWA D102 does not require surface preparation or coating application on inaccessible areas as defined in this standard. For new construction, some inaccessible areas may be primed or coated before erection of the tank. However, for surfaces that were primed or coated before erection of the tank and that become inaccessible after erection of the tank, touch-up or repair of burned, abraded, damaged, or deteriorated coatings is not possible. Also, weld holdback zones for coatings on surfaces primed or coated before erection of the tank will result in some inaccessible areas void of any coating at all, even if shop priming or shop coating was specified. Weld holdback zones are required for safety and to prevent compromising the structural integrity of the weld. After erection, repair or touch-up of inaccessible surfaces that were primed or coated before erection of the tank is not possible.

Sec. A.5.2 Inaccessible Areas Where Coatings Are Restricted or Prohibited

The following inaccessible areas cannot be coated because of structural design and safety considerations:

1. Structural design codes prohibit coating of the faying surfaces (contact surfaces) of bolted connections unless the connections are designed as bearing-type connections.
2. Structural design codes and safety regulations restrict coatings in and around joints to be welded.

Sec. A.5.3 Inaccessible Areas of Risers and Inflow/Outflow Appurtenances

Interior surfaces of riser pipes and other inflow/outflow appurtenances, such as regular nozzles, extended nozzles, directional nozzles, piping manifolds, and high inlets, that are constructed of pipe less than 36-in. nominal diameter are considered inaccessible for surface preparation and coating application because of physical size constraints limiting the ability to properly perform the work. In addition, larger pipe

assemblies might be considered inaccessible because of the configuration or geometry of the assembly. Consultation is recommended to ensure the intended work plan is feasible and can fit within the project budget.

For new construction, some of these inflow/outflow components could have interior surface preparation and coating application completed in the shop. However, field-welded joints, if any, might not be accessible for surface preparation and coating touch-up on the interior surfaces, thereby leaving these more susceptible to corrosion than the surrounding areas that were successfully shop painted. Although this condition by itself would not necessarily preclude this approach from suitable use, it would require that the condition be carefully considered in light of the overall corrosion protection plan for interior surfaces and the potential for isolated corrosion in these uncoated areas.

When nozzles in the tank shell, floor, or roof are of relatively short length (6 in. for small-diameter pipes or one pipe diameter for pipes over 6-in. nominal diameter), the surface preparation and coating application on the interior surfaces can be more easily accomplished than for longer assemblies.

If surface preparation and coatings are desired on the interior surfaces of any of these types of inflow/outflow appurtenances, the specifier should carefully consider how the work will be accomplished in a safe manner. For existing tank projects, consideration must also be given to how the components can be disassembled, rigged, lifted, and manipulated if any of those actions would be necessary to accomplish the surface preparation and coating application on the interior surfaces.

Sec. A.5.4 Underside of Ground-Supported Flat-Bottom Tanks

For ground-storage reservoirs and standpipes, it is seldom considered necessary to apply protective coatings to the underside of flat tank bottoms resting on well-drained granular material, on a concrete ringwall foundation with treated sand cushion, or on a concrete slab. The bottoms should slope gently downward from the center of the tank to the perimeter. The foundation ringwall should be maintained sufficiently above grade to prevent water infiltration and should be sloped downward from the edge of the bottom plate to the outside edge of the ringwall. If there is no ringwall, a water diversion ditch should be constructed. Refer to Section 12 of ANSI/AWWA D100 regarding recommended materials and methods of the base construction.

The underside of the tank bottom for ground-supported flat-bottom tanks, by definition, is not considered part of the exterior surfaces of the tank; therefore, neither surface preparation nor coating application is required by ANSI/AWWA D102.

For tanks to be newly constructed, if the undersides of the tank bottom plates are only specified to be primed or coated before construction, the resulting structure will have uncoated joints on these surfaces with the adverse consequence of concentrating potential corrosion along all of the uncoated joints. For tanks to be newly constructed, specifying complete coating systems for the underside of the bottom plates for ground-supported flat-bottom tanks to be newly constructed will add significant cost. If the undersides of the tank bottom plates are specified to be coated after construction of the tank bottom, a substantial falsework system will have to be constructed to support the bottom plates for construction and painting, adding substantial cost to the construction of the tank bottom. Also, for this option, the coatings on the underside of the tank bottom just beneath the tank shell will be burned and damaged when the tank shell is welded to the bottom plates. If corrosion of the underside of the tank bottom of ground-supported flat-bottom tanks is of concern, consideration should be given to installing an under-tank cathodic protection system.

For new tanks, if coating of the underside of flat tank bottoms is desired, a detailed specification must be developed with consideration given to the following:

1. Selection of a coating system suitable for the intended service conditions.
2. Method of construction of the tank floor.
3. Sequencing of the coating operations during construction of the floor.
4. Details of the weld joints on the tank floor.
5. Whether the underside of the floor must be coated at the weld joints after welding.
6. Detailed requirements for surface preparation and coating of the underside of the floor on the underside of the tank bottom.
7. Allowable methods for surface preparation and coating application on the areas surrounding the weld joints.

Sec. A.5.5 Inaccessible Areas of Column-Supported Roof Structures

Column-supported roofs on ground-supported flat-bottom tanks can be built in many configurations. The most economical construction for these roofs usually results in the largest percentage of inaccessible areas. See special requirements in AWWA D100 regarding tubular structural members for new construction and inaccessible areas of column base plates for column supported roofs.

Sec. A.5.6 Options for Roof Construction on New Tanks

If corrosion of roof interior surfaces is of significant concern for new tank construction, consideration of alternate roof details of construction is warranted. Most of these alternate details will increase the cost of construction of the tank but should result in better coating life and reduced maintenance costs. The following is a partial listing of alternate details to enhance the conditions for surface preparation and coating application and to reduce long-term maintenance costs for interior surfaces of tank roofs. The alternates are listed in order of cost of roof construction from least expensive (and potentially more difficult to coat) up to most expensive (and potentially easier to coat). See also Table A.1 and corresponding footnotes for disadvantages of each alternative and to which tank type each listed alternative applies.

Option 1. Except for weld zones, specify prior-to-erection priming (shop or field) of all bearing-type bolted connections, tops of all rafters, and underside of roof plates.

Option 2. Except for weld zones, specify prior-to-erection coating (shop or field) of complete interior coating system to all bearing-type bolted connections, tops of all rafters, and underside of roof plates.

Option 3. The coating of option 1 or option 2 above, plus: Caulking of accessible interior roof plate lap joints, perimeter joints, and tee joints with suitable NSF/ANSI 61–certified caulking material compatible with the coating system. NOTE: Unless rafters are intermittent welded to the roof plates, caulking of the roof plate to rafters is not included because the differential movement between them makes this joint not suitable for caulking.

Option 4. The coating of option 1 or option 2 above, plus: Seal welding of accessible interior roof plate lap joints, perimeter joints, and tee joints.

Option 5. For small-diameter tanks (generally up to about 40-ft diameter), use unstiffened self-supported cone roofs with all joints seal welded.

Option 6. For medium-size tanks (generally up to about 75-ft diameter), use unstiffened self-supported dome or umbrella roofs with all joints seal welded.

Option 7. Seal welding of interior roof plate lap joints, accessible interior perimeter joints, and accessible rafter-to-roof plate joints with tank being constructed so that all such joints are accessible.

Option 8. Seal welding of interior roof plate lap joints, interior roof plate perimeter joints, and rafter-to-roof plate joints with tank being constructed so that all such joints are accessible.

Table A.1 Roof construction options for new tanks

Option	Disadvantages of This Option	Applies to	
		FBTs*	ELEVs†
1. Except for weld zones, specify prior-to-erection priming (shop or field) of all bearing-type bolted connections, tops of all rafters, and underside of roof plates.‡	<ul style="list-style-type: none"> • Roof plate lap joints are not sealed. • Roof-plate-to-rafter joints are not sealed. • Contact surfaces of roof plate laps are uncoated. • Bottom surface of roof plates at rafters is uncoated within the weld zone. • Top surface of rafters receives only a prime coat. • Bottom surface of roof plates at rafters receives only a prime coat. 	X	
2. Except for weld zones, specify prior-to-erection application (shop or field) of complete interior coating system to all bearing-type bolted connections, tops of all rafters, and underside of roof plates.‡	<ul style="list-style-type: none"> • Roof plate lap joints are not sealed. • Roof-plate-to-rafter joints are not sealed. • Contact surfaces of roof plate laps are uncoated. • Bottom surface of roof plates at rafters is uncoated within the weld zone. 	X	
3. The coating of option 1 or option 2 above, plus: Caulking of accessible interior roof plate lap joints, roof perimeter joints, and tee joints with suitable NSF/ANSI 61-certified caulking material compatible with the coating system. NOTE: Unless rafters are intermittent welded to the roof plates, caulking of the roof plate to rafters is not included because the differential movement between them makes this joint not suitable for caulking.	<ul style="list-style-type: none"> • Caulking may need to be replaced over time before the roof is recoated. • Incomplete caulking at inaccessible lap joints or deteriorated caulking may permit rust bleed from the uncoated contact surfaces of roof plate laps. • Bottom surface of roof plates at rafters is uncoated within the weld zone. • If caulk separates from the roof plate because of expansion and contraction of the roof plates, it may lead to a damming effect, trapping water between the roof plates in the lap joint. 	X	X

* For purposes of this table, flat-bottom tanks (FBTs) are considered to be ground-supported reservoirs or standpipes. Some options for column-supported roofs may not be practical for tall standpipes.

† For purposes of this table, elevated tanks (ELEVs) represent multilegged elevated tanks, fluted-column elevated tanks, slender-pedestal elevated tanks, and composite elevated tanks.

‡ The configurations described in options 1 and 2 assume a conventional column-supported roof structure with the roof plate laid over, but not attached to, the rafters in a pattern consisting of rectangular plates in the midfield and pattern-cut sketch plates at the perimeter.

§ For roof configurations that will include seal welding, the appropriate roof thickness to control distortion should be evaluated.

(Table continued next page)

Table A.1 Roof construction options for new tanks (continued)

Option	Disadvantages of This Option	Applies to	
		FBTs [*]	ELEVs [†]
4. The coating of option 1 or option 2 above, plus: Seal welding [§] of accessible interior roof plate lap joints, roof-perimeter joints, and tee joints.	<ul style="list-style-type: none"> • Contact surfaces of roof plate laps are uncoated. • Bottom surface of roof plates at rafters is uncoated within the weld zone. 	X	
5. For small-diameter tanks (generally up to about 40-ft diameter), use self-supported cone roofs with all joints seal welded. [§]	• None	X	X
6. For medium-size tanks (generally up to about 75-ft diameter), use self-supported dome or umbrella roofs with all joints seal welded. [§]	• None	X	X
7. Seal welding [§] of accessible interior roof plate lap joints, accessible interior perimeter joints, and accessible rafter- or stiffener-to-roof plate joints.	• None	X	
8. Seal welding [§] of interior roof plate lap joints, interior perimeter joints, and rafter- or stiffener-to-roof plate joints with tank being constructed so that all such joints are accessible.	• None	X	X
9. Roof construction using external structural members with all internal and external plate joints and structure-to-plate joints seal welded. [§]	• None	X	
10. For large-diameter tanks, use self-supported stiffened dome or stiffened umbrella roof with all internal and external plate joints and structure-to-plate joints seal welded. [§]	• None	X	X

^{*} For purposes of this table, flat-bottom tanks (FBTs) are considered to be ground-supported reservoirs or standpipes. Some options for column-supported roofs may not be practical for tall standpipes.

[†] For purposes of this table, elevated tanks (ELEVs) represent multilegged elevated tanks, fluted-column elevated tanks, slender-pedestal elevated tanks, and composite elevated tanks.

[‡] The configurations described in options 1 and 2 assume a conventional column-supported roof structure with the roof plate laid over, but not attached to, the rafters in a pattern consisting of rectangular plates in the midfield and pattern-cut sketch plates at the perimeter.

[§] For roof configurations that will include seal welding, the appropriate roof thickness to control distortion should be evaluated.

Option 9. Roof construction using external structural members with all internal and external plate joints and structure-to-plate joints seal welded.

Option 10. For large-diameter tanks, use self-supported stiffened dome or stiffened umbrella roof with all internal and external plate joints and structure-to-plate joints seal welded.

Sec. A.5.7 Options for Roof Structures on Existing Tanks

If roof corrosion is of significant concern for existing tanks, consideration of optional treatment of the tank roof prior to recoating is warranted. These optional treatments will increase the cost over recoating alone but should result in better coating life and reduced maintenance costs. The following is a listing of optional treatments to enhance the conditions for surface preparation and coating application and to reduce long-term maintenance costs for tank roofs. The optional treatments are listed in order of cost of roof treatment from least expensive up to most expensive (but most beneficial for coating application).

1. Caulking of accessible interior roof plate lap joints, perimeter joints, and tee joints with suitable NSF/ANSI 61-certified caulking material compatible with the coating system.
2. Seal welding of accessible interior roof plate lap joints, perimeter joints, and tee joints.
3. Seal welding of accessible interior roof plate lap joints, perimeter joints, tee joints, and rafter-to-roof plate joints.

Sec. A.5.8 Cautions Regarding Specifications for Coating of Inaccessible Areas

Details of construction differ between ground-supported flat-bottom tanks and elevated tanks; and, in fact, details differ among the various styles of elevated tanks. For this reason, the specifier must give special attention and thought to the coatings specifications if inaccessible areas are to receive any surface preparation or coating application prior to erection on new tank construction projects. Specifications should not make a simple statement such as “areas of the tank made inaccessible after erection shall be coated prior to erection” because the requirement is vague, does not address the important issues identified above, and will create confusion and controversy during execution of the work.

For existing tanks, purchase documents should be reviewed and revised to eliminate ambiguous or confusing language regarding coating of inaccessible areas that, by definition, cannot be coated.

For new construction, purchase documents should clearly provide requirements for pre-erection priming or coating on surfaces that will be inaccessible after construction, allowances for weld holdback zones, exemptions of bolted joints where coatings are prohibited, exemption or details of coatings for the underside of flat tank bottoms, and the specific treatment of precoated areas damaged during handling and erection of the tank.

SECTION A.6: INSIDE OF NONWATER-CONTAINING ELEVATED TANK PEDESTALS

Although the interior dry surfaces of elevated tank pedestals are part of the interior surfaces of the structure, they are not exposed to the elemental atmosphere or the stored water or its vapor, but they may be subject to condensation. Some of the inside coating systems are considered to be high-performance systems intended for the aggressive conditions of immersion service, beyond what is required for the interior dry surfaces. Therefore, the additional expense of these systems is not considered justified for this relatively mild environment. And although some outside coating systems might be suitable for these conditions, many of them are not suitable because of the exposure to continual condensation. Accordingly, ANSI/AWWA D102 requires that interior dry surfaces are to be coated with inside coating system No. 1 (ICS-1), a two-coat epoxy system, unless otherwise specified. If it is desired to use other than ICS-1 for these surfaces, it is recommended that a specification be developed in close consultation with the coating manufacturer for recommendations that will provide satisfactory service for the anticipated conditions of the specific project.

SECTION A.7: SURFACE PREPARATION

Sec. A.7.1 General

Proper surface preparation has a critical impact on the effective service life of a coating. SSPC-SP 6/NACE No. 3 and SSPC-SP 10/NACE No. 2 should be referenced for proper surface preparation. When environmental conditions such as humidity, dew point, and surface and ambient temperatures are such that appropriate surface preparation and application of the specified inside coating system

cannot be achieved, climate control equipment (i.e., for heating, cooling, or dehumidification) may be used. Coatings applied over mill scale are subject to a short and uneconomical life. Mill scale should be removed completely by blast cleaning. Coatings should not be applied over unacceptable sharp gouges and pits, sharp welds, weld arc strikes, burrs, welding and torch-cut slag, welding flux, spatter, and so forth. These unacceptable areas should be remedied before blast cleaning. Filling of gouges or other unacceptable areas may be required. Prior to coating application, the steel surfaces must meet the surface preparation requirements for the coating system being applied.

Sec. A.7.2 Containment Systems

If a containment system for surface preparation operations of the structure to be coated is to be required, the type and level of containment must be specified in the purchase documents.

Sec. A.7.3 New Tanks

Mill scale should be removed completely from the accessible surfaces to be coated in accordance with the specified blast-cleaning standards for fabricated parts of new steel tanks either in the shop or in the field. When the mill scale is removed, the steel must be primed before rusting or surface soiling occurs. Accessible welded joints should be cleaned and weld slag and weld spatter removed by grinding, sanding, or wire brushing before surface preparation by blast cleaning. For newly constructed tanks, the tank constructor should be assigned the responsibility for repairing unacceptable sharp gouges and removing burrs, weld slag, weld spatter, slivers, laminations, and other unacceptable imperfections.

Sec. A.7.4 Existing Tanks

Before purchase documents are prepared for the recoating of an existing tank, the tank should be drained and inspected to determine the condition of the existing coating. See appendix B for environmental issues and hazardous material considerations.

For tanks that have been previously coated with wax-grease-type coatings and for which a recoat with a different type of coating system is desired, all traces of the former coating must be removed. The wax-grease-type coatings can be properly removed and the surfaces recoated with most of the inside coating systems referenced in ANSI/AWWA D102. It is usually necessary to chemically clean or steam clean wax-grease-coated surfaces both before and after abrasive blast cleaning to ensure adhesion of newly applied non-wax-grease-type coatings.

Whenever new coatings are to be applied to tank exteriors without removing the old coating, dust, chalk, and other surface contaminants on existing intact coating should be removed by washing with an appropriate cleaner using the methods described in SSPC-SP COM or in accordance with SSPC-SP WJ-4/NACE WJ-4 as applicable for the surfaces to be coated. Rust and remaining loose coating should be removed by spot power-tool cleaning according to SSPC-SP 15 or by spot abrasive blast cleaning conforming to SSPC-SP 6/NACE No. 3. Areas cleaned to bare steel should be primed before any visible rusting takes place. The use of pressurized water, as defined in SSPC-SP WJ-3/NACE WJ-3, may be used as an alternative in lieu of SSPC-SP 15 and SSPC-SP 6/NACE No. 3 (see Sec. 4.6.3.1.3). New coatings must be compatible with the existing coating system. Consult the coating manufacturer for specific recommendations.

Purchasers should be aware that old tanks may contain contaminated steel surfaces from prior service. The purchaser should consult NACE 6G186, *Surface Preparation of Soluble Salt Contaminated Steel Substrates Prior to Coating*, for information on the detection of and removal of soluble salt surface contaminants.

It should be expected on older tanks that some corrosion and pitting will have occurred. Tanks with substantial pitting in structural steel members or in primary plate components should be inspected and analyzed by a qualified engineer to determine suitability for continued service. When it has been determined that pitting has not reduced the strength of the tank components beyond acceptable limits, the recommendations contained in this document generally result in acceptable coating system performance. Pits should be addressed by back rolling, pit filling, or welding to produce a holiday-free coating. Shallow pits (typically up to 25 percent of steel thickness) can be made holiday-free by back rolling the paint after it has been spray applied. Deeper pits may need to be filled with a pit filler or weld material to eliminate holidays. This is true even of shallower pits where the diameter of the pit is larger than the diameter of the pit opening. The enlarged pit with a smaller opening has hidden surfaces under the steel adjacent to the pit opening.

Pit-filling material should be applied in accordance with the manufacturer's and specifier's requirements. The filler should be supplied by the same manufacturer as the interior coating system used and compatible with that system. Pit filler is generally applied by putty knife or trowel. If the pits have a larger diameter than the pit opening diameter, care must be taken to work the material into the pits without leaving voids.

Sec. A.7.5 Degree of Cleaning

The cost of surface preparation is proportional to the cleaning effort required. Blast cleaning conforming to SSPC-SP 10/NACE No. 2 has proven successful for application of interior coatings. Commercial blast cleaning to SSPC-SP 6/NACE No. 3 has proven successful for most exterior coatings; in severe environments, however, cleaning to SSPC-SP 10/NACE No. 2 may extend the coating life of exterior coatings because of the improved degree of surface cleanliness. Pictorial surface preparation standards illustrating the various degrees of surface preparation are available from SSPC-VIS 1 and ASTM D2200.

A.7.5.1 Spot repair versus total coating removal. Spot repainting involves a number of potential contractual issues, including cost. To control cost, it is best to have the tank out of service so that the constructor has full knowledge of where the coating needs repair. Because of insurance and operational problems, this may not be possible. In that case, the contract documents must define where repairs are required and how much repair must be performed. It is more expensive to rig and repair the roof than a much larger area of easily accessible surfaces.

There are several factors to consider when debating spot repair versus total coating removal. The following discussion identifies some of the potential factors to be considered for both interior and exterior systems, but there may be other factors unique to a specific project: mobilization costs; location and extent of the coating failure; age and condition of the existing system; the presence of regulated heavy metals in the existing system; condition of the steel substrate; adhesion of coatings to the steel substrate and each other; compatibility of the coatings; presence of surface contaminants; application conditions; whether the tank has cathodic protection; size of the tank; geographical location of the tank; and the overall project costs.

For interior wet surfaces, additional considerations apply. If the existing inside system is generally in good condition on the roof and fluctuation zone and the deterioration is in the lower tank area, cathodic protection can delay the need to repaint in most cases until total removal would be appropriate. If the inside coating system has failed on the roof, the extent of failure should be considered. It may be possible to paint only the roof structural support, or it may be necessary to paint the entire roof. When the inside of the roof is painted in a reservoir, the constructor may need to cut an access hole in the sidewall, and the floor could be damaged by the equipment loads applied. On elevated tanks, the cost-benefit of spot repair only may be negligible because of rigging costs and costs to repair coatings that may become

damaged by equipment moving across the structure. There may be cost savings with spot repair; however, if the tank is small, the savings may decrease.

The decision to spot paint versus total removal involves many factors, and the evaluation of these factors should be considered only after a thorough inspection and testing for compatibility and a cost–benefit comparison. For additional guidance and information, refer to SSPC-TU 3.

A.7.5.2 Abrasive blast cleaning versus water cleaning/jetting. There are methods to remove a coating or a complete coating system that rely on the use of pressurized water being applied onto a surface. These methods differ from methods that rely on the impact of abrasives (such as those found in SSPC-SP 10/NACE No. 2) in several ways.

The Society for Protective Coatings (SSPC) and NACE International (NACE) have issued joint surface preparation standards that reflect levels of waterjet cleaning of metals. These waterjetting methods prescribe the use of water, without the addition of solid abrasives, to remove coatings, corrosion, and other water-soluble materials that may hinder adhesion and the long-term performance of selected outside coating systems (OCSs).

Users of this standard should use their own experience with high- and ultra-high pressurized water equipment, its efficacy and methods, and input from industry professionals in deciding if and how to apply this equipment recommendation to their specific coating project. If desired, “flash rust inhibitors” may be metered into the waterjetting equipment supply lines so that no surface rusting occurs after coatings are removed and steel is exposed. The coating manufacturer should be consulted to provide assurance that their coating system is compatible with the “flash rust inhibitors” to be used.

Advantages of these waterjetting methods include the removal of coatings and many water-soluble contaminants found in pits of corroded steel, and the ability to remove these without generating dust caused by abrasive blasting operations. These methods may limit the amount and degree of containment required to surround a tank during surface preparation. Limitations of waterjetting include potential flash rusting of the steel and an inability to produce a surface profile.

Flash rust inhibitors may be used to reduce the potential for flash rust development. The coating manufacturer should be consulted to provide assurance that the coating system is compatible with the flash rust inhibitor to be used.

During surface inspection after the use of pressurized water, an evaluation of exterior surfaces and construction documents (if available) should be conducted

and surface profile measurements should be made to determine that an adequate existing profile exists. If no existing surface profile or an inadequate profile exists, additional surface preparation methods such as dry abrasive blasting may be required.

Users of this standard considering the use of pressurized water for surface preparation should seek input from industry professionals for guidance on proper implementation.

Sec. A.7.6 Sealing Lap Joints

Seal welding of accessible interior roof plate lap joints and contact surfaces of roof plates on supporting members is not required by ANSI/AWWA D100. Consequently, some rusting occurs in these joints. Seal welding of these joints should provide an improved condition for coating and extends the service life of the coating system. However, seal welding may increase tank erection costs significantly and may cause severe distortion and roof plate wrinkles. In cases where seal welding of the open joint area of intermittent welded joints is cost prohibitive or expected steel deformation is considerable, caulking the open joint with an approved nonsag sealant may be specified.

SECTION A.8: COATING APPLICATION

Sec. A.8.1 Brushing

An advantage of brushing is that the coating may be worked into voids or irregular surfaces. When applying coating along welds, seams, and irregular surfaces, brushing is more effective than other application methods and should be performed in multiple directions. When coating has been formulated for spraying, brush application may be unacceptable. Coated surfaces must be free of dust, soil, and moisture or the brushed material may lie on top of the contaminants and not adhere tightly to the surface. Brush application is usually more costly than other methods. Some coatings may require additional coats to achieve the specified thickness when applied by brush.

Sec. A.8.2 Stripe Coating (Striping)

A stripe coat is defined as “a coat of paint applied to specified areas such as edges or welds on steel structures before or after a full coat is applied to the entire surface.” The stripe coat is intended to give those areas sufficient film build to resist corrosion. When stripe coating after primer application, the stripe coat should be

applied with the prime coat material; or when approved, the material specified for the next coat may be applied as a stripe coat.

Sec. A.8.3 Spraying

Spraying is a rapid method of coating application. To be effective, coated surfaces must be free of dust, soil, and moisture or the sprayed material will lie on top of the contaminant and not adhere tightly to the surface. When spraying, it is difficult to fill cracks and to cover uniformly along edges and inside angles. It is recommended to use a brush around rivets, welds, edges, and inside angles before spraying when coating formulation allows. A serious objection to spraying exterior surfaces is that the overspray can carry some distance and cause damage to property. This is especially a problem with slower-drying coatings such as long-oil alkyds, epoxies, and polyurethanes.

Sec. A.8.4 Roller Application

Many coatings may be applied to smooth surfaces by rollers. To be effective, coated surfaces must be free of dust, soil, and moisture or the rolled material will lie on top of the contaminant and not adhere tightly to the surface. Rollers are available as either fed by coating under pressure or replenished by the use of the bucket-screen method. By the proper selection of roller material and suitable manipulation of the roller, which usually involves rolling in two directions for each coat, a fairly uniform coat may be applied over smooth surfaces. It is recommended that sharp corners, inside angles, welds, and rivets be brushed and allowed to dry before the remaining surfaces are rolled.

NOTE: Most coatings formulated for proper flow and leveling during roller application cannot be roller applied to achieve single-coat dry film thickness greater than 2 to 3 mils. The number of coats versus total dry film thickness specified for a particular coating system may only be achievable by spray application. If roller application is used, additional coats may be required to achieve the minimum total dry film thickness specified.

Sec. A.8.5 Containment Systems

If a containment system for the structure to be coated is to be required, the type and level of containment must be specified in the purchase documents.

Sec. A.8.6 Climate Control

When environmental conditions such as humidity, dew point, surface temperature, and ambient temperature are such that appropriate surface preparation and application of the specified inside coating system cannot be achieved, climate

control equipment may be used (heating, cooling, or dehumidification). If the use of climate control equipment during the surface preparation and coating operations is to be required, the parameters of climate control must be specified in the purchase documents. For information regarding dehumidification, see NACE 6A192/SSPC TR 3.

Sec. A.8.7 Ventilation

Design ventilation for abrasive dust and solvent vapor removal. The tank configuration, the location and size of openings, the placement of blowers and ducts, the rate and method of coating application, and weather conditions will determine the required ventilation. A combination of forced and natural ventilation should be continued after coating application is completed to ensure complete curing and solvent removal. Coating life may be shortened if there is inadequate ventilation during the curing period, and residual coatings solvent may contribute to taste-and-odor problems and to violations of drinking water standards in stored water. Lower temperature or higher humidity may extend the time that ventilation is necessary. Heating can be used to shorten the forced ventilation period in accordance with the manufacturer's recommendations. Heat sources that emit hydrocarbon fumes into the tank should not be used. Where negative pressure ventilation is employed, the tank should be adequately vented to avoid structural damage.

Sec. A.8.8 Shelf Life

If the shelf-life date has expired, the coating material should be segregated from the material acceptable for use and the manufacturer consulted for possible shelf-life extension. If the shelf life extension is granted, the extended shelf-life date should be certified in writing by the coating manufacturer.

SECTION A.9: TANK LETTERING AND LOGOS (SIGNAGE)

The purchaser should specify the number, size, font style, and color of all signs and logos required. If not otherwise specified, the contractor will use a block letter font. Detailed logos will require the purchaser to provide a scaled drawing for the logo to be accurately replicated. Costs for signage will vary depending on the number of applications, size, complexity, and detail. The following are some key points of which to be aware:

1. Signs should be located near the equator (midpoint) on spheres or spheroid tanks to minimize distortion due to plate curvature. Signage located on the tank bottom will be extremely distorted.
2. Detailed logos may require the use of a pattern. This pattern cannot be used in excessive winds (12 mph or greater). Pattern logos are usually the most costly because of labor intensity and downtime because of wind.
3. Multicolor logos will require additional time to complete. Assume one color per day can be applied.
4. Signage costs are most economical when included in the project specifications. Late project changes can be costly, especially when a pattern is required.
5. Organic pigments are used to create bright coating colors, which are then applied as logos, designs, or graphics on tank exteriors. The tendency of these colors to fade is more pronounced relative to the background color(s) of the tank. For this reason, water tank designers, specifiers, and owners often choose to select coatings systems that include fluorourethanes or the optional clear aliphatic polyurethane coatings for logos, designs, or graphics.

SECTION A.10: TESTING AND INSPECTION

Testing of the work as it progresses is important to ensure appropriate procedures are being used. When making film thickness measurements, remember that some variation in film thickness is normal. The requirements of SSPC-PA 2 indicate methods of coating measurements and minimum allowable coating thicknesses.

Inspection should be used to verify that the surface preparation and coating application have been completed in accordance with the purchase documents. The purchaser should identify which party will be responsible for making the dry film thickness measurements. The purchaser should identify which party will be responsible for performing the holiday testing.

Sec. A.10.1 Wet Film Thickness

Wet film thickness is a rough measure of whether the proper quantity of coating is being applied. Because repair of the coating is done more easily while the coating is wet, it is practical to measure wet film thickness frequently.

Sec. A.10.2 Dry Film Thickness

Dry film thickness measurements are used to determine acceptability of the coating system thickness (see SSPC-PA 2). If the total dry film is less than the specified thickness, additional coats must be applied to bring the coating system to the specified thickness. Ordinarily, between coats, it is possible to make enough dry film thickness measurements to obtain reasonable assurance that the specified thickness has been applied without access to all parts of the tank. Coating application and testing must be scheduled to provide a mutually agreeable time interval for testing before removing the access rigging. Each coating material and manufacturer has a certain maximum thickness per coat and for the total system so that the total system will perform as intended. The manufacturer of the coating should be consulted to determine if there is a maximum permissible thickness for the coating system.

Sec. A.10.3 Holiday Testing

Holiday testing is used to detect faults in a coating film that allow electrical current to flow to the base metal. Holiday testing is not effective when metal-filled coatings are used in the system. Holiday testing is very effective on smooth and flat surfaces. The interface between roof rafters and roof plates, faying surfaces, bolted flanges, and other joints that have not been continuously welded or sealed with mastic are difficult to cover with coating well enough so that they will pass a holiday test. In fact, it may be impossible for some joints to pass the holiday test if the joint is not continuously welded or sealed with mastic. For this reason, this standard does not require holiday testing for interior wet nonimmersed surfaces above the TCL and other nonimmersed surfaces such as the interior dry surfaces and exterior surfaces. If holiday testing interior surfaces above the TCL or other nonimmersed surfaces is desired, it must be specified.

SECTION A.11: FIRST-ANNIVERSARY INSPECTION

First-anniversary inspections are conducted to determine whether the coating system is performing properly. Inspections may be performed by dive inspections, by inspection using remotely operated underwater vehicles, by floating drain-down inspection, or by draining the tank. If inspection methods other than draining the tank are used, special safety personnel and sanitary precautions may be required. Regardless of the inspection method used, trained personnel using proper tools

and equipment following safety precautions pertinent to the inspection method employed should perform the inspection. The purchaser should identify which party will be responsible for making the tank ready for inspection; for providing the necessary access, staging, scaffolding, and lighting; and for performing the inspection. The life of the coating system will be extended if the defective areas, if any exist, are repaired at this time.

AWWA Manual M42, *Steel Water-Storage Tanks*, provides additional information regarding inspection options. Refer to ANSI/AWWA C652 for information regarding disinfection requirements for in-service inspections.

SECTION A.12: PLACING IN SERVICE

After interior coatings have been cured in accordance with the coating manufacturer's recommendations and project purchase documents, all inside surfaces should be flushed with potable water. Water, dirt, and foreign material accumulated in the cleaning process should be discharged from the facility. The tank should then be disinfected, using one of the methods described in ANSI/AWWA C652, before placing the tank in service. Water quality sampling and testing of the contents in accordance with Sec. 5.1 of ANSI/AWWA C652 may be specified.

SECTION A.13: CATHODIC PROTECTION SYSTEM CONSIDERATIONS

When an impressed-current cathodic protection system is installed, it is recommended that the system not be energized until after the first-anniversary inspection. When a sacrificial cathodic protection system is used, it is recommended that the anodes not be activated until after the first-anniversary inspection. Applying these recommendations rules out the possibility that the cathodic protection system could be the cause of coating system defects discovered during the first-anniversary inspection.

SECTION A.14: BIBLIOGRAPHY

The following documents are referenced in appendix A:

ANSI/AWWA C652—Disinfection of Water-Storage Facilities.

ANSI/AWWA D100—Welded Carbon Steel Tanks for Water Storage.

ANSI/AWWA D103—Factory-Coated Bolted Carbon Steel Tanks for Water Storage.

ANSI/AWWA D104—Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Storage Tanks.

ANSI/AWWA D106—Sacrificial Anode Cathodic Protection Systems for the Interior Submerged Surfaces of Steel Water Storage Tanks.

ANSI/AWWA D107—Composite Elevated Tanks for Water Storage.

ASTM* D2200—Standard Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces.

AWWA Manual M42—*Steel Water-Storage Tanks*.

ISO 12944-2—Paints and Varnishes—Corrosion Protection of Steel Structures by Protective Paint Systems—Part 2: Classification of Environments.

ISO 12944-5—Paints and Varnishes—Corrosion Protection of Steel Structures by Protective Paint Systems—Part 5: Protective Paint Systems.

NACE 6A192/SSPC TR 3—Dehumidification and Temperature Control During Surface Preparation, Application, and Curing for Coatings/Linings of Steel Tanks, Vessels, and Other Enclosed Spaces.

NACE 6G186—Surface Preparation of Soluble Salt Contaminated Steel Substrates Prior to Coating.

NSF/ANSI 61—Drinking Water System Components—Health Effects.

SSPC†-PA 2—Procedure for Determining Conformance to Dry Coating Thickness Requirements.

SSPC Painting Manual Vol. 2—*Systems and Specifications*.

SSPC-SP 6/NACE No. 3—Commercial Blast Cleaning.

SSPC-SP 10/NACE No. 2—Near-White Blast Cleaning.

SSPC-SP 15—Commercial Grade Power Tool Cleaning.

SSPC-SP COM—Surface Preparation Commentary for Steel and Concrete Substrates.

SSPC-SP WJ-3/ NACE WJ-3—Waterjet Cleaning of Metals—Thorough Cleaning.

* ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

† SSPC: The Society for Protective Coatings, 40 24th Street, Sixth Floor, Pittsburgh, PA 15222.

SSPC-SP WJ-4/NACE WJ-4—Waterjet Cleaning of Metals—Light Cleaning.

SSPC-TU 3—Overcoating.

SSPC-VIS 1—Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.

The following documents are not referenced in this appendix but may be useful. Caution and discretion should be used in the application of the provisions of the following references as these recommendations are considered above minimum industry standards and can significantly increase the cost of the coating system. Because these references are not written as specifications, these references should not be used without a detailed specification that identifies which portions of the reference are to be used and how these portions are to be implemented as requirements on the specific project. Users of this standard should use their own experience with coating projects and input from industry professionals in deciding how or if to apply the recommendations in any of the references listed below.

NACE SP0178—Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to Be Lined for Immersion Service.

SSPC-SP 1—Solvent Cleaning.

SSPC-SP 2—Hand Tool Cleaning.

SSPC-SP 3—Power Tool Cleaning.

SSPC-SP 5/NACE No. 1—White Metal Blast Cleaning.

SSPC-SP 11—Power Tool Cleaning to Bare Metal.

APPENDIX B

Environmental Concerns

This appendix is for information only and is not a part of ANSI/AWWA D102.

Most of the regulatory requirements pertinent to coating operations can be classified by the following broad categories:

1. Drinking water contamination.
2. Air pollution by volatile compounds and fugitive dusts.
3. Hazardous wastes.
4. Hazardous chemical content of new and old coatings (lead, chromium, and other materials).
5. Water pollution.

Over the years, thousands of raw materials have been used in coatings. While many of these materials are innocuous, others are considered hazardous as determined by evolving government and private company findings. For example, a typical environmental regulation enacted since the early 1970s by the US Environmental Protection Agency (USEPA) is one that involves coatings the rust-inhibitive qualities of which were based on pigments that contained lead. Lead can no longer be used in coatings that will be in direct contact with potable water. Coating manufacturers responded with reformulated or alternative coatings.

Similarly, when limitations were placed on solvent usage, the coatings industry reformulated its products to meet regulatory requirements. More recent air pollution regulations in many states require that volatile organic compound (VOC) content of coatings be reduced to meet specific limitations. The coatings industry is striving to meet these additional government regulations while maintaining a high level of coatings standards and performance.

Environmental and occupational officials are concerned about the composition and waste from old coatings being removed from structures in preparation for recoating. Removal of these coatings by abrasive blasting may produce airborne concentrations of hazardous materials greater than the maximum amount allowed by USEPA and the Occupational Safety and Health Administration (OSHA). In addition, the coating and abrasive particles may have been deposited on residences, public buildings, roadways, waterways, and adjacent ground. The extent to which these particles pose a health hazard is subject to much study. Steps must be taken

to protect not only those doing the abrasive blasting but also those who are allied with the blasting and coating operations, as well as people, vegetation, animals, fowl, and fish in the vicinity of the abrasive and particulate matter fallout.

One of the methods used to minimize air, water, and ground pollution has been the attachment of shrouds, draping, or other means of enclosing tanks and their supporting towers. The attachment of shrouds, draping, or other enclosures must be done only when consideration is given to the additional local and total structure loads imposed by such attachments. The use of shrouds, draping, and so on can significantly increase the cost of the painting project.

An additional potential problem associated with abrasive blasting of coatings containing hazardous materials is disposal of the spent abrasive. If regulated heavy metals are present in the existing coating, the disposal of the spent cleaning debris falls under USEPA's Resource Conservation and Recovery Act (RCRA) and applicable state or provincial regulatory guidelines on solid waste disposal. Laboratory analysis may be required to determine the hazardous or nonhazardous nature of the waste, and to determine acceptable methods of its proper on-site storage, transportation, treatment, and disposal.

Purchasers and constructors of tanks and other steel structures should investigate the disposal of waste abrasive and industrial residue of old coating films prior to their removal.

Another concern relates to coatings that are spilled or scattered about the jobsite. Partly full or empty containers that contain solvents or coatings must be cleaned and stored in a secured location. Spills must be cleaned up, including any earth contaminated by the spill.

The previous paragraphs discuss various conditions that deserve attention, but the list is not complete. Every effort should be made to be aware of and adhere to federal, state, and provincial environmental, health, and safety regulations.

APPENDIX C

Default Checklist

This appendix is for information only and is not a part of ANSI/AWWA D102.

The following default checklist is intended to assist the user when specifying a coating system using this standard. The following checklist summarizes the options and the corresponding default for each option if no further direction is provided.

Standard Section	Option	Default
4.2.2	Specify the use of dehumidification equipment for interior blasting and coating operations	Not required
4.3.1	Specify documentation of paint test data or field service data applicable to performance	Not required
4.3.1.1	Specify field application of primer	Shop priming allowed
4.3.1.2	Specify use of fully compatible preconstruction primer	Not allowed
4.4.1	Specify coating system for interior dry surfaces	Inside coating system No. 1 (ICS-1)
4.4.1.1	Specify field application of primer	Shop priming allowed
4.4.1.2	Specify use of fully compatible preconstruction primer	Not allowed
4.4.4.1	Specify direct-to-steel application of finish coat	Primer allowed
4.4.5.1	Specify direct-to-steel application of finish coat	Primer allowed
4.6.1	Specify the use of dehumidification equipment for interior blasting operations	Not required
4.6.2.1	Specify SSPC-SP 10/NACE No. 2	SSPC-SP 6/NACE No. 3
4.6.3.1.2	Specify SSPC-SP WJ-4/NACE WJ-4, Waterjet Cleaning of Metals—Light Cleaning, for exterior surfaces to be overcoated	SSPC-SP 15 or SSPC-SP 6/NACE No. 3
4.6.3.1.3	Specify SSPC-SP 10/NACE No. 2	SSPC-SP 6/NACE No. 3
4.6.3.1.3	Specify SSPC-SP WJ-2/NACE WJ-2, SSPC-SP WJ-3/NACE WJ-3	SSPC-SP 6/NACE No. 3

4.7	For new construction, specify application of the coating system primer, or the full coating system, where possible and allowable, to surfaces that will be inaccessible after construction. Specific instructions must be provided for each type of inaccessible area anticipated. NOTE: See Sec. A.5 for cautionary notes and guidance.	None required
4.7.1	Specify the use of dehumidification equipment for interior coating operations	Not required
5.1.2	Specify number of dry film thickness measurements	SSPC-PA 2
5.1.4	Provide results of quality control tests and records	Not required
5.2.1	Specify first-anniversary inspection	Not required
5.2.2	Establish first-anniversary inspection date within 11 months after coating completion	Inspection waived
6.1	Specify affidavit of compliance	Not required

The following checklist is intended to identify sections of the commentary that address specific topics where users of the standard should consider if their particular project may require more than the minimum requirements of this standard. Because commentary language only provides background information and contains no requirements, if the user wishes to adopt any special requirements, the special requirements must be addressed in a project specification.

Appendix Section	Option	Default
A.3	Specify the use of dehumidification equipment for blasting and coating operations	Not required
A.5.4	Specify coating the underside of tank bottom for ground-supported flat-bottom storage tanks NOTE: See Sec. A.5 for cautionary notes and guidance.	Not required
A.6	Specify interior dry coating system	Use interior wet surface coating system
A.7.1	Specify use of surfacer or filler	Not required
A.7.2	Specify the use of a containment system for blasting operations	Not required
A.7.6	Specify use of caulking	Not required
A.8.5	Specify the use of a containment system for coating operations	Not required

A.8.6	Specify the use of a climate control system for blasting and coating operations	Not required
A.9	Specify tank lettering and logos (signage)	Not required
A.10.3	Specify holiday testing on nonimmersed surfaces	Not required
A.12	Specify water sampling	Not required



American Water Works Association

6666 West Quincy Avenue
Denver, CO 80235-3098
T 800.926.7337
www.awwa.org



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