Extend the Service Life of Water Storage Tanks …using the revised ANSI/AWWA D102 Standard

BTW …

• AWWA D102 Revision Task Group:

  Revises and Updates Existing Edition. Discusses changes to improve the Standard.

  Has a “3 year revision” goal.
Examples of Revisions:

- RTG adopted performance requirements for proposed future Inside & Outside Coating Systems
- Added Pre-Construction Primers (4.3.1.2)
- Added 2 new coating systems in 2006 (ICS No.4 & OCS No. 4)
- Additions for 2011: ICS No. 3 = Epoxy, OCS No. 7 = WB E / WB E / WB U

AWWA D102 Purpose:

- Sec. 1.1: “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.”
Remember!

• “An AWWA Standard is not a specification, nor [does it] certify products.”  
  AWWA Manufacturers Advisory Council

• **What you desire must be specified**

???

• If D102 is a *minimum* Standard, how are determinations of extended Service Life derived?
EXPECTED SERVICE LIFE AND COST CONSIDERATIONS FOR MAINTENANCE AND NEW CONSTRUCTION PROTECTIVE COATING WORK.

Note: 40 Contributing Authors

Kirk Wroous
KTA-TATOR, Inc.
115 Technology Drive
Pittsburgh, PA 15225

ABSTRACT

This paper is a significant update to “Costing Considerations for Maintenance and New Construction Coating Work” on protective coating costing and selection co-authored by M. F. McElmy, M. F. Kenn and K. R. Shields in 1998.

Designed to assist the coatings engineer or specifier in identifying suitable protective coating systems for specific industrial environments, this paper provides guidelines for calculating approximate installed costs of coating systems, expected coating service lives for each system identified, and methods for determining the most cost-effective systems to use. The effect of maintenance sequences on long-term costs and system life is included.

Included in the paper are 1) most commonly used generic coating systems in typical service environments, 2) service life for each, 3) current material costs, and 4) current field and shop painting costs. Guidelines for developing long-term life-cycle costs and number of paintings for the expected life of the structure are included.
This guide supplies system life estimates for a "Practical" maintenance approach. Practical life is considered to be the time until 5 to 10% coating breakdown occurs (SSPC-Vis 2 Rust Grade 4), and active rusting of the substrate is present.

**TABLE 1A**

Estimated Service Life for Practical Maintenance Coating Systems for Atmospheric Exposure

(in years before first maintenance painting)
TABLE 1B
Estimated Service Life for Practical Maintenance Coating Systems for Immersion Exposure
(in years before first maintenance painting)

**Most Popular Coating Systems**

- **ICS No. 1 & 2**
  Two-coat / Three-coat Epoxy

- **ICS No. 4**
  Polyurethane / Polyurea

- **ICS No. 5**
  Zinc / Epoxy / Epoxy

- **OCS No. 4**
  Zinc / Urethane / Fluorourethane

- **OCS No. 5**
  Epoxy / Epoxy / Urethane

- **OCS No. 6**
  Zinc / Epoxy / Urethane
Emerging Systems & Where Used

- ICS No. 4 w/Elastomer
  eg: 4 welded steel NJ tanks (2011 & 2012), 7 MMG AZ concrete tank, & 2+ bolted tanks (CO, IN)

- ICS No. 3 w/100% solids epoxy
  eg: 4 PA, 4 (2011) & 6 (2012) NJ, NY, 3 CA, 1 CT

Outside Coating Systems:

- Alkyd
- Acrylic
- Urethane
- Fluorourethane
- *Others being introduced*
(Old) Acrylic System

- AWWA D102 Standard has an acrylic exterior coating system

- OCS No. 3:
  - **WB Rust-inhibitive Primer** 2.0 mils
  - **WB Acrylic Topcoat** 2.0 mils
  - **WB Acrylic Topcoat** 2.0 mils

  ("Dryfall" versions acceptable)

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(New) Acrylic System

- AWWA D102 Revision Task Group has revised the acrylic exterior coating system of the D102 (Tank) Standard

- OCS No. 3:
  - **OZ Primer** 2.0 mils
  - **WB Acrylic Topcoat** 2.0 mils
  - **WB Acrylic Topcoat** 2.0 mils

  ("Dryfall" versions acceptable)
Note: Acrylic System

• “Acrylic emulsion coatings generally **dry faster and provide improved color and gloss retention**, when compared to alkyd enamels.”

• These systems **include** WB Dryfall coatings (for repaint projects in crowded neighborhoods, for example)

Proprietary Examples:

• Pro-Cryl/Sher-Cryl
  (1st-of-its-kind cross-linking acrylic. Tank & Logo.)

• Sher-Clear
  (1st-of-its-kind UV-resistant Clear Topcoat to extend Color & Gloss up to 5X)

• Fast Clad HB Acrylic
  (2 – 3 coats DFT in 1!)

Waterborne coatings help seal joints in pipes (DFT) and provide a clean, protective finish to the outside of water tanks (above).
Z / U / Fl-Ur System

- AWWA D102 Revision Task Group has added a fluorourethane exterior coating system to the revised D102 (Tank) Standard

- OCS No. 4:
  
<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Zinc-Rich Primer</td>
<td>2.0 mils</td>
</tr>
<tr>
<td>Aliphatic Urethane Intermediate</td>
<td>3.0 mils</td>
</tr>
<tr>
<td>Fluoro-Urethane Topcoat</td>
<td>2.0 mils</td>
</tr>
</tbody>
</table>

Note: Fluoro-Urethane

- “This system provides gloss and color retention exceeding that of aliphatic polyurethane finish coats.”
OCS No. 4:

- ZRP / Urethane / Fluorourethane

Proprietary Example:

- GalvaPac / Acrolon 218 HS / Fluoro-Kem, B65 Series
System Comparison:

- **OCS No. 5**
  - Epoxy Primer: 2.0 mils
  - Epoxy Intermediate: 2.0 mils
  - Urethane Topcoat: 2.0 mils

- **OCS No. 6**
  - ZR Primer: 2.0 mils
  - Epoxy Intermediate: 2.0 mils
  - Urethane Topcoat: 2.0 mils

Service Life Comparison:

<table>
<thead>
<tr>
<th></th>
<th>OCS No. 5 E / E / U</th>
<th>OCS No. 6 Z / E / U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primer</td>
<td>E</td>
<td>Z</td>
</tr>
<tr>
<td>Intermediate</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Topcoat</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Service Life</td>
<td>~ 15 yrs</td>
<td>~ 22 yrs</td>
</tr>
</tbody>
</table>
WB Epoxy / Urethane System

- AWWA D102 Revision Task Group has introduced an E / E / U waterborne exterior coating system to the D102 Standard.

- OCS No. 7:
  
<table>
<thead>
<tr>
<th>Coating Type</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB Epoxy Primer</td>
<td>2.0 mils</td>
</tr>
<tr>
<td>WB Epoxy Intermediate</td>
<td>2.0 mils</td>
</tr>
<tr>
<td>WB Urethane Topcoat</td>
<td>2.0 mils</td>
</tr>
</tbody>
</table>

- Harmless water is the main “solvent”

- **WB Acrolon 100** exceeds the color & gloss retention of standard SB exterior systems

- Part of SW’s **INFINITANK™** program
OCS No. 7
(finished!)

Inside Coating Systems:

- Epoxy / Epoxy
- Epoxy / Epoxy / Epoxy
- Zinc / Epoxy / Epoxy
- Polyurea
- Others being introduced
Existing Epoxy Systems

- **ICS No. 1** – “normal service”
  - Epoxy / Epoxy @8.0 mils DFT
  - Service Life = 10 yrs?
    (NACE 08279 – Corrosion 2008)

- **ICS No. 2** – “extended service”
  - E / E / E @12.0 mils DFT
  - Service Life = 12+?
    (NACE 08279 – Corrosion 2008)

Revised Epoxy System

- **ICS No. 3**
  - 100% Solids epoxy @20.0+ mils DFT (not including primer)
  - Service Life estimated @20 - 25 yrs!
ICS No. 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 topcoat.”

SW Proprietary Epoxies:

• Macropoxy 646 PW / Macropoxy 846 NSF / Tank Clad HS / DP 235 PW / DP UHS / SherPlate PW

• OAP available
ICS No. 3 Example:

- Labor savings (high DFT in 1 coat)
- SW’s is Edge-Retentive

34,000,000 gallons!
SW / US Navy Study:

Standard Epoxy @36 months    SW’s ER Epoxy @32 months

Increased Coating Service Life*

*2006 US Navy Submarine Preservation Conference
MIL-PRF-23236C  
(para 3.8.1)

“The retained percent average coating retention on a 90-degree outside edge of no less than three specimens shall be an average minimum of 70 percent of the measured dry film thickness on the flat areas of the test specimen. There shall be no pin holes, cracks or other defects along the edge that extends more than 10 percent into the thickness of the coating on the edge, nor shall any defect extend completely to the metal of the test specimen.”

Proprietary Example:  
SherPlate PW™

- Exceeds DFT of 3-coat ICS No. 2 in ONE COAT saving labor $$
- SherPlate PW™ is Edge-Retentive [Mil-PRF-23236 w/QPL number]
- 24-hour Return-to-Service
Water Tank Edges

May eliminate pit welding & pit filling

Without QPL Edge Retention
it’s just “marketing”
Urea / Urethane / Hybrid System

• AWWA D102 Revision Task Group has added an “elastomeric” interior coating system to the D102 (Tank) Standard

• ICS No. 4:
  
  Primer (Optional)  
  1.0 mils

  P / PU / Hybrid  
  25.0 mils

Note: ICS No. 4

• “This is a single coat, thick film, 100 percent solids coating based on urea / urethane chemistry. This material provides increased film build, particularly designed to handle pitted or deteriorated steel. The thick film properties allow flexing over bolted or irregular weld seams.”

• “Dehumidification is usually required for proper installation. Applicators should be specifically trained in the application of this system.”
Polyurea Example:
Z / E / E System

- AWWA D102 Revision Task Group has added a ZRP / E / E inside coating system to the D102 (Tank) Standard

- ICS No. 5:
  
  Organic ZR Primer 2.0 mils
  Epoxy Intermediate 4.0 mils
  Epoxy Topcoat 4.0 mils

Note on ICS No. 5

- “Interior surfaces, above and below the top capacity level are to be coated with this system. It uses the same two-coat epoxy intermediate and finish coatings as ICS-2.”
Testing Z/E/E Technology:

- ZRP / NSF 61 Epoxy / NSF 61 Epoxy
- ICS No. 5
- JPCL article
- Evaluation on-going

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...using the revised ANSI/AWWA D102 Standard

- Presented by Tony Ippoliti, Water Storage Business Development Manager
  The Sherwin-Williams Company, Protective & Marine Division,
  6535 E. 82nd Street, Suite 206, Indianapolis, IN 46250 / ph: (317) 594-0083

- SSPC Protective Coatings Specialist & SSPC Instructor
- NACE Certified Coatings Inspector
- Member & Instructor: Steel Tank Institute
- Member AWWA D102 & 198 Committees
- Contributing Author, AWWA: “Handbook on Steel Potable Water Storage Tanks”
- Affiliate Member of ASCE & ICRI