PAINT A TANK IN A DAY!

- 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
- SSPC Protective Coatings Specialist #201-106-0359 & SSPC Instructor
- NACE Certified Coatings Inspector #3066
- 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

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

- AWWA D-100 – Welded Steel Tanks
- AWWA D-102 – Coatings for Welded Steel
- AWWA D-103 – Bolted Tanks
- AWWA D-104 (IC) / D-106 (Anodes)
- AWWA D-110 – Concrete Tanks
- AWWA D-115 – Concrete Tanks
- AWWA D-107 – Composite Tanks (CET)

ANSI/AWWA Standard for Disinfection

- AWWA C-652
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*
Approved in 2006

• Section 4.4.1.2:

“… a fully compatible preconstruction primer may be shop applied. Most of these primers are formulated and tested for compatibility with the weld processes so that they may be applied edge to edge without weld margins … Preconstruction primers used on interior surfaces … shall have been tested and certified for potable water contact in accordance with NSF / ANSI 61, Drinking Water System Components-Health Effects, by an ANSI-accredited laboratory.”

History of Pre-Construction Primers

• One of the most important innovations in marine coatings technology

• Designed to protect steel during the shipbuilding process and in-service

• Suitable for service above and below waterline
Think about this …

• What caused the Titanic to sink?
  The iceberg … the ship speed … the steel plate metalurgy…
  … and RIVETED CONNECTIONS

• ALL marine vessels - and the longest-lasting steel water storage tanks - are now WELDED

Galva-Plate™ Pre-Primed Plate
Performance Requirement:

• All proposed 2k exterior Polyurethanes

Meet minimum SSPC Guidelines (Paint 36) for *performance-based* Aliphatic Polyurethanes in Accelerated Weathering & Change of Color testing

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.”
Important parts of ANSI/AWWA D102-11

- Coating Systems (4.3 & 4.4)
- Surface preparation (4.6)
- Ventilation (A.7.6)
- Holiday detection (A.9.3)

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?
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.

- Original Painting
- Spot Touch-Up and Repair
- Maintenance Repaint (spot prime and full coat)
- Full Repaint (total coating removal and replacement)
### TABLE 1A
Estimated Service Life for Practical Maintenance Coating Systems for Atmospheric Exposure

(in years before first maintenance painting)

<table>
<thead>
<tr>
<th>Coating System</th>
<th>Years Before First Maintenance Painting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>Epoxies</td>
<td>2</td>
</tr>
<tr>
<td>Epoxy</td>
<td>2</td>
</tr>
<tr>
<td>Epoxy-Zinc</td>
<td>11</td>
</tr>
<tr>
<td>Epoxy-Zinc/Polyurethane</td>
<td>13</td>
</tr>
<tr>
<td>Epoxy-Zinc/Phenolic</td>
<td>15</td>
</tr>
</tbody>
</table>

### TABLE 1B
Estimated Service Life for Practical Maintenance Coating Systems for Immersion Exposure

(in years before first maintenance painting)

<table>
<thead>
<tr>
<th>Coating System</th>
<th>Years Before First Maintenance Painting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>Epoxies</td>
<td>2</td>
</tr>
<tr>
<td>Epoxy</td>
<td>2</td>
</tr>
<tr>
<td>Epoxy-Zinc</td>
<td>11</td>
</tr>
<tr>
<td>Epoxy-Zinc/Polyurethane</td>
<td>13</td>
</tr>
<tr>
<td>Epoxy-Zinc/Phenolic</td>
<td>15</td>
</tr>
</tbody>
</table>

NOTES:
1. Service 1: for time until 1%
2. Blasting: resistance to 15 to 20% of the surface area is present.
3. Surface preparation: resistant to 15 to 20% of the surface area is present.
4. Service Life: resistant to 15 to 20% of the surface area is present.
5. Maintenance: resistant to 15 to 20% of the surface area is present.
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
Moisture Cured Urethane System

- AWWA D102 Revision Task Group has added a MCU exterior coating system of the D102 (Tank) Standard

- OCS No. 2:
  - MCU Zinc-Rich Primer 3.0 mils
  - MCU MIO Intermediate 3.0 mils
  - MCU Aliphatic Topcoat 1.5 mils

Note: MCU System

- “The primary distinguishing characteristics of this system is a relatively wide range of temperature and humidity conditions within which it can be successfully applied.”
Proprietary Example:

- 36+ Water Storage Tanks painted *IN-SERVICE* since Y2000!

MCU Examples:
English Station Tank - 10MM
Louisville Water Company
Built in 1975 w/ LBP
Example:

Rolls Royce - Indianapolis
Repainted IN-SERVICE
Another MCU Example:

Additional MCU benefits …

• *Rapid Return-to-Service:*
  MCU Zinc / MCU Coal Tar
  (immersion in non-potable water)
(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)
(New) Acrylic System

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

• OCS No. 3:

<table>
<thead>
<tr>
<th>OZ Primer</th>
<th>2.0 mils</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB Acrylic Topcoat</td>
<td>2.0 mils</td>
</tr>
<tr>
<td>WB Acrylic Topcoat</td>
<td>2.0 mils</td>
</tr>
</tbody>
</table>

(“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!)

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>Product</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</th>
<th>OCS No. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E / E / U</td>
<td>Z / E / U</td>
</tr>
<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>
OCS No. 5
Proprietary Example:

- Copoxy or Macropoxy 646 PW / urethane topcoat
- Copoxy & Macropoxy have 1 year recoat window!

OCS No. 6
Proprietary Example:
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>Product 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>

Outside Coating System No. 7

- 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:
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!

---

Proposed 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.”

Frenchburg, KY
Caldwell Tanks, 2007
AWWA D102 ICS No. 4 & OCS. No 4
Frenchburg, KY
Caldwell Tanks, 2007
AWWA D102 ICS No. 4 & OCS. No 4

Polyurea Example:
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*

The End

Thank You!