



American Welding & Tank

Epoxy polyester liquid coating

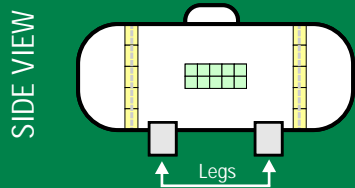
Overall Rating: 4.8

Key

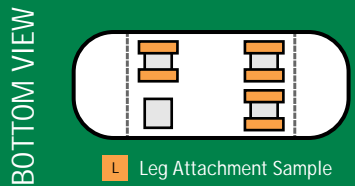
low high

S Tank Side Sample
W Weld Seam Sample
L Leg Attachment Sample

Overall Sample (O)
in Holidays (H)
Vapor Phase (V)
Immersion Phase (I)
No Change (Green)
Minor (Yellow)
Moderate (Orange)
Severe (Red)
1-4 Blister Size (4=largest)



W Weld Seam Sample
S Side Sample



Testing Process

Tank Manufacturer

Delivery

Group 1 Samples

Pre-Environmental Mechanical Testing

Group 2 Samples

Accelerated Weathering

Chemical Immersion

Thermal Cycling

Post-Environmental Exposure Mechanical Testing

Mechanical Durability

Pre-Environmental Exposure	Post-Environmental Exposure				
	Nitric Acid	Sodium Chloride	Sodium Hydroxide	Sodium Bicarbonate	Distilled Water
Impact Resistance	W, S, L	S, W, L	W, L ^v , L ⁱ , S	W, L ^v , S ^v , L ⁱ	S, W, L
Adhesion Resistance	W, S, L	S ⁱ , L ⁱ , W ^v , L ^v	W, L ^v , S ^v , W ^v , L ^v	W, S, W ^v , L	S, W, L, W ^v , L ^v
Coating Hardness	S, W, L	Immersion samples deteriorated, S ^v , W ^v , L ^v	S, W, L ^v	S, W ^v , L ⁱ	S ^v , W ^v , L ⁱ
Abrasion Resistance	S, W, L	S, W, L	S ^v , W, L	S, W, L	S ^v , W, L

*In some cases the mechanical properties improved after exposure, which may be related to hardening or softening of the coating, or variations in coating thickness across the samples.

Environmental Exposure Testing

Accelerated Weathering—250 hours

No color change or gloss reduction on most samples; rust spots

Chemical Immersion—90 Days

Tank Area and Results	Nitric Acid	Sodium Chloride	Sodium Hydroxide	Sodium Bicarbonate	Distilled Water
Side Wall					
Color & Gloss	Red	Red, Yellow, Orange, Green	Green, Red, Yellow, Orange	Green, Yellow, Orange	Red
Rusting	Green, Orange, Red, Yellow	Green, Yellow	Green, Orange	Green	Green, Orange, Yellow
Blistering	4 Green, 4 Orange, 4 Red	1 Green	1 Yellow, 1-2 Orange, 1 Red	2 Red, 1 Yellow	2 Yellow, 1 Red
Weld Seam					
Color & Gloss	Red	Green, Yellow, Orange	Red	Green, Yellow, Orange, Red	Red
Rusting	Yellow	Yellow	Green	Green	Yellow
Blistering	4 Red	Green	Green	2 Red, 1 Yellow, 1 Red	3 Red, 2 Yellow, 1 Red
Leg Attachment					
Color & Gloss	Red	Green, Yellow, Orange	Green, Red	Yellow, Green	Green
Rusting	Yellow	Green	Yellow	Yellow	Yellow
Blistering	4 Yellow, 1 Red	4 Green	3 Yellow, 1 Red	1 Green, 3 Red	3 Red

Thermal Cycling—30 24-hour cycles

Sodium chloride weld seam
Rusting: along Weld

Sodium hydroxide weld seam
Color & Gloss: color lightening and gloss reduction

Distilled water weld seam
Blistering: 2 Red

Nitric acid side wall
Rusting: at site of broken blisters

Sodium chloride side wall
Rusting: Green

Sodium hydroxide side wall
Blistering: 2 Yellow

Distilled water side wall
Rusting: Green

Nitric acid leg attachment
Fractured blisters and rust

Research was provided by KTA-Tator Inc. under PERC Docket 12469, *Testing and Evaluation of Underground Propane Tank Coatings*. The information provided in this document is intended only as a summary of the tank coating performance results; for more detailed findings, please reference the full report.

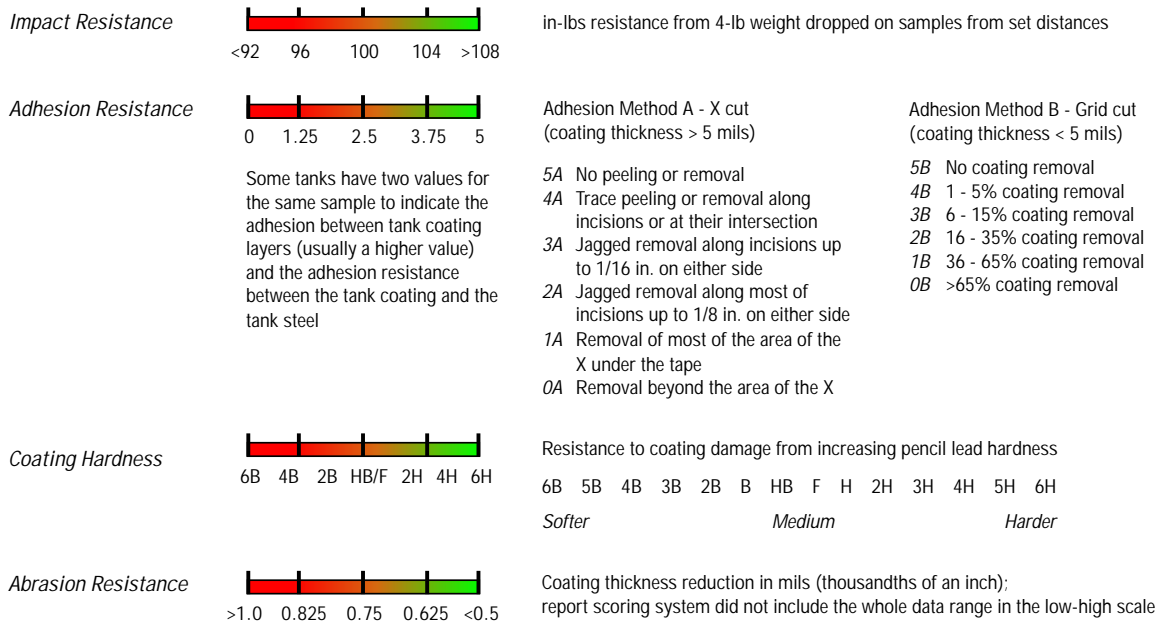
The ranking of the seven propane tanks used in this study on the basis of performance points should not be misinterpreted. Nothing in this report should be construed to suggest that the tanks that have received the lowest number of performance points and the lowest ranking overall, or in any category, are defective, dangerous, or subject to withdrawal from the market or from use in their intended application. Nothing in this report should be construed to suggest that any type of underground propane tank, or any underground propane tank with a particular type of coating, should not be used in the propane industry.

The tank evaluation results have been summarized through the following methods.

Mechanical Durability:

The front page of this document provides a side-by-side comparison of tank performance both before and after environmental exposure (accelerated weathering, chemical immersion, and thermal cycling). KTA-Tator provided pre- and post-environmental exposure test data for tank samples taken from the tank weld seam, side wall, and leg attachment.

The low-to-high scales indicate the performance range unique to each test. Raw performance data was used to rank each sample on the appropriate test's scale:



Chemical Immersion:

The report includes data for 30-day, 60-day, and 90-day chemical immersion periods. The 90-day results are summarized in this document to demonstrate the longer-term effects of chemical immersion. Color and gloss changes, rusting, and blistering are classified as minor, moderate, or severe for visual purposes using the following scales:

Color and gloss change

- Severity was labeled as minor, moderate, or severe in the report.

Rusting

- Evaluated according to SSPC VIS 2/ASTM D 610, "Evaluating Degree of Rusting on Painted Steel Surfaces."
 - In some cases, rusting was classified as minor/moderate/severe within the report.
 - In other cases, the following numbers were used: 10 (<0.03%); 9 (0.03%); 8 (0.1%); 7 (0.3%); 6 (1%); 5 (3%); 4 (10%); 3 (16%); 2 (33%); 1 (50%).
 - These frequencies are visually conveyed through the following system:

- ✓ No change Rusting at holidays=minor; corrosion undercutting at perimeter of holidays=moderate; rusted through holidays=severe
- 8-10 = Minor Rust creep and rust along the weld indicate the presence of rust but is unable to be classified as minor, moderate, or severe
- ▲ 4-7 = Moderate
- 1-3 = Severe

Blistering

- Blister sizes given in report: 2, 4, 6, 8, according to ASTM D 714, "Evaluating the Degree of Blistering of Paints."
 - Blister sizes given in the report indicated 8 as the smallest blister size and 2 as the largest blister size.
 - To aid presentation, these ratings were inversed to a 1-4 scale to show a larger number as a larger blister size.
- Blister frequencies given in report: Few, Medium, Medium Dense, Dense for blister density, according to ASTM D 714.

These frequencies are visually conveyed through the following system:

- ✓ No change = no blistering
- Few = minor
- ▲ Medium = moderate
- ▲-■ Medium Dense = moderate-severe
- Dense = severe