

Application of a Coating System to Interior Surfaces of New and Used Rail Tank Cars in Concentrated (90 to 98%) Sulfuric Acid Service

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Foreword

A large number of commercial 93 to 98% sulfuric acid (H_2SO_4) shipments in the United States and Canada are transported by rail in carbon steel tank cars. Concentrated sulfuric acid (93-98%) is an oxidizing agent and a desiccant. The major problems in its handling and storage relate to its hygroscopic nature (absorption of atmospheric humidity), its exothermic reactivity with water on dilution, and velocity effects that erode the otherwise protective films of corrosion products.

Corrosion rates of approximately 0.25 mm/y (0.010 in/y) have been measured in static storage tanks and tank cars that haul concentrated sulfuric acid. To cope with this uniform corrosion over a 40-year service life, 10 mm (0.4 in) of extra wall thickness would be required on a tank car. The addition of this extra wall thickness would add substantially to the tank car's weight and result in severe reductions in carrying capacity.

An even more serious problem is that uniform corrosion is invariably accompanied by severe localized corrosion in the top halves of tank cars. This localized corrosion, called hydrogen grooving, produces deep vertical grooves in localized bands that extend along the sides and across the heads of tank cars. Hydrogen grooves can progress through the steel far more rapidly than uniform corrosion and can cause substantial damage after short periods of service. Extra wall thickness is not sufficient to cope with hydrogen grooving. Painting the exterior surfaces of the tank cars with a heat-reflecting color to keep the acid temperature as low as possible has reduced corrosion rates but has not eliminated the problem. Anodic protection is another option that is sometimes considered.

This standard practice provides guidelines for a high-quality surface preparation, application, inspection, and testing of coating systems for the interior surfaces of tank cars carrying shipments of concentrated sulfuric acid at ambient temperatures.

Scope

This standard is intended for use by tank car owners, coating systems suppliers, and coating system applicators for the auditing of the facilities, equipment, and personnel that satisfy the requirements for tank car coating systems in sulfuric acid service.

Rationale

Industry consensus points to interior coating systems as a necessary protective measure for tank cars transporting concentrated sulfuric acid and to ensure product purity. Many shippers of sulfuric acid apply a protective coating system (usually a baked phenolic) to the interior surfaces of tank cars and specify a nominal steel corrosion allowance of 3.2 mm (0.13 in) in the event of coating failure. The life expectancies of these coating systems are highly dependent on the quality of the surface preparation, coating application, and quality control/quality assurance (QC/QA). For this reason, the proper application and inspection of interior coating systems is very important to the maintenance of tank cars hauling sulfuric acid.

In AMPP standards, the terms *shall* and *must* are used to state requirements and are considered mandatory. The term *should* is used to state something that is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.