Poly-Coat Systems, Inc.
Leaders in Composite Transports
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Recommendations for Inspecting DOT- SP12516 FRP Cargo Tank Trailers

FRP composite cargo tanks will experience various signs of "normal" wear depending on the chemical service they are used in.

The following are recommendations given consideration to practical implementation as well as the intention of HM-183 annual inspection requirements to ensure a minimal safety standard for composite FRP DOT 407/412 specification cargo tanks.

1. Visual inspection for delamination or hollow spots in the liner (corrosion barrier) including secondary bonds around nozzles, blisters, fiber wicking or exposed dry fibers, cracking, or other abnormality such as bulging, softening of the surface, or resin degradation. If no flaws are found, then the unit would pass the visual inspection and be returned to service.

2. Should any defects be found, additional inspection is required and a detailed description including photographs of the defect both before and after repairs should be included in the inspection report and maintained by the owner. If any defects are found that are beyond the corrosion barrier or that would affect the structural integrity of the cargo tank, the unit should be inspected by the manufacture.

3. Cargo Tankers fabricated with a conductive layer behind the lining or corrosion barrier may be spark tested at 10,000-15,000 volts to determine integrity of the lining in addition to the visual inspection. Generally, symptoms due to ageing will pass a spark test well after symptoms are visible. Conditions that are not severe in nature and do not interfere with normal operation of the tanker such as fiber clogging valves should be ok to return to service if no sparking is found. However, common sense should be used and the manufacture notified if any serious defects are found even if the tanker passes a spark test.

NOTE: It is possible for a conductive layer to have small void spaces that will not spark. For this reason, it is important that a thorough visual inspection be performed by a qualified person in addition to a spark test. Any defects should be photographed and reviewed by the manufacture of the equipment.

Additional Inspection Procedures:

A. Cracks

Small surface cracks are not uncommon in sodium hypochlorite service and are allowable as long as there is no evidence of dry fiber blooming, wicking, or degradation of surface veils. Large cracks longer

than 1.5" should be examined to determine depth. This should be done by grinding the crack until they disappear. If more than one crack is present and all appear similar in nature, only a random sampling needs to be inspected in this manner. Cracks completely through the liner would indicate that the cargo tank requires a new liner. All cracks inspected in this manner should be repaired according to a written specification obtained from the manufacture before being returned to service. Large structural cracks should be evaluated by the manufacture and only repair by the manufacture of the cargo tank is allowed. Cargo tanks with conductivity DO NOT need to be inspected in this manner assuming they pass a spark test. However, the manufacture should be consulted.

B. Blisters

Blisters are a normal part of much common acid service, especially small molecule acids such as hydrochloric acid. Once liquid is bleeding out of the blisters an inspection should be performed by grinding of a blister. Inspection of 1 blister is considered to be representative of the condition of the corrosion barrier. Inspected area shall be repaired according to a written specification obtained from the manufacturer. Blisters that exceed the corrosion barrier require a new corrosion barrier be installed before returning to service.

C. Fiber Bloom, Veil and Resin Degradation

Fiber bloom, veil and resin degradation are characterized by resin dryness on the surface of the corrosion barrier and is a result of wear in most cases. Veil is sometimes missing in spots and exposed fiber is present. If the affected areas do not have visible loose fiber or delamination then a photographic record shall be taken and cargo tank may be returned to service. Minimal loose fiber that does not interfere with normal operations of the cargo tank should be referred to the manufacture for recommendation. This can be done with a photographic record and description of the chemical service of the cargo tank.

D. Barcol Hardness Test

A barcol hardness test is recommended to be performed to determine the retention of physical properties of the cargo tank after 1 year of service to establish the degree of cure and effects of service. Barcol hardness should be 80% of the original resin specification. Test instrument should be calibrated with test discs before testing. A small portion of the test area may be sanded to remove chemically exposed resin and fiber to obtain an accurate reading. Corrosion barriers that test below 80% should be reported to the manufacture for further review. Barcol testing is only a tool to be used in addition to a visual inspection. Low reading beyond 1 yr. of service are not meaningful.

NOTE: Some products can produce lower barcol levels at the surface, yet still continue to provide adequate chemical resistance for a long period of time. These situations must be evaluated on a case by case basis with consideration given if the tanker is in dedicated service, and product is well know to have a slow rate of degradation to the resin system. The material manufacture can be consulted to assist with this evaluation.

E. Structural Cracks or defects.

Any crack or other defect that extends beyond the corrosion barrier will be deemed to be structural and require the original cargo tank manufacture to perform inspection and necessary repairs.

F. Photographic Record

All E/SP-DOT cargo tanks found to have any defects or excessive wear shall be required to have a photographic record included in the inspection. This record shall be sent to the manufacture for review.

NOTE: Any sign of fiber exposure should be photographed and reviewed by the manufacturer. Any fiber determined to be a structural fiber must be repaired by the manufacture. **ALL** tankers must be photographed and reviewed by the manufacturer **PRIOR** to re-lining.

NOTE: For any cargo tanker equipped with a conductive layer….Passing a spark test would in most cases supersede any other form of testing when done in conjunction with a visual inspection. The results of a spark test and any questions regarding the visual inspection should be reviewed with the manufacture to determine suitability for service **except in cases where resin degradation and fiber bloom is severe and likely to cause operational issues or lining failure. In these cases, the cargo tanker should not be returned to service.**

Typical issues found in FRP cargo tank trailers.

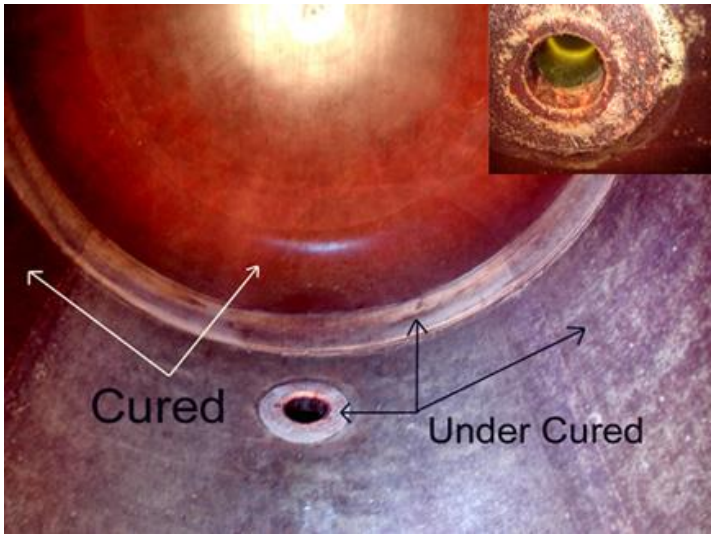
Blisters:

Typical small blisters common in small molecule acid service such as hydrochloric acid. This is a normal part of aging in these type services. Eventually, the blistering will progress to a state where the acid will "leak" out of the blisters. Tankers that have conductivity will likely pass a spark test for several years after blisters are noticed. Even in advanced cases, tankers may pass annual spark test inspections without migration into the conductive zone depending on the thickness of the liner.

Once acid has migrated into the conductive zone carbon fiber veil used as a conductive material offers a high degree of protection to the structural fibers as an additional level of safety. However, any tanker that fails a spark test should be removed from service and relined. Conductive carbon veil should NOT be relied on for product containment in this situation.

Under Cured Lining:

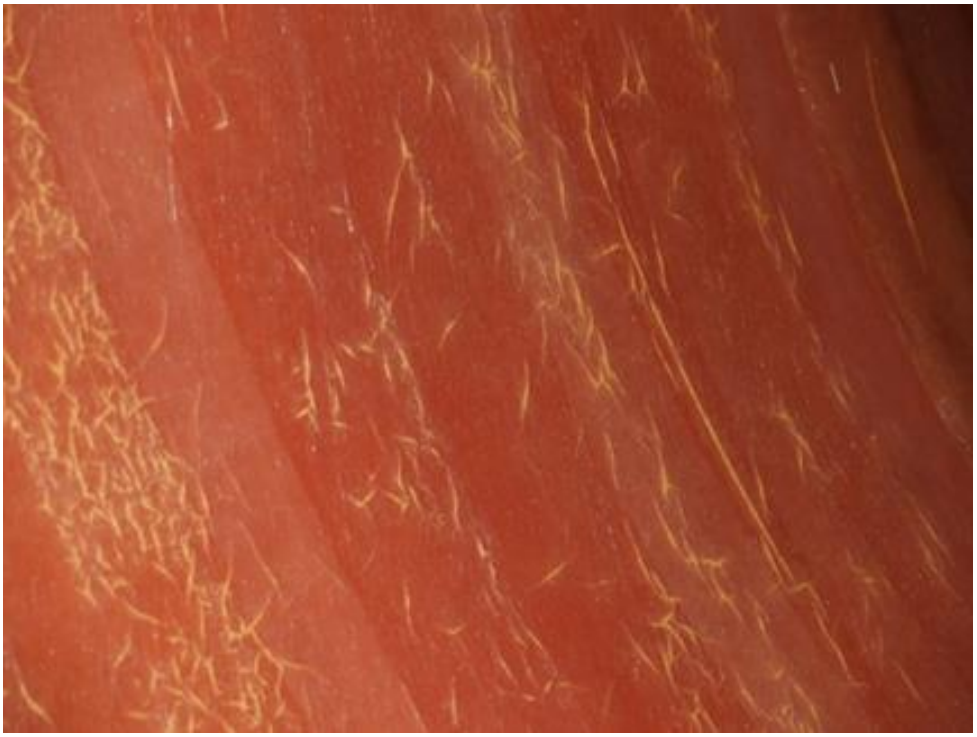
Severe degradation of the veil layers exposing the glass mat fibers below. These fibers will be attacked by exposure to sodium hypochlorite, hcl, and other products that are known to be incompatible with glass fibers. While the effects are in need of repair, they don't pose an immediate threat of failure. Tankers that are capable of being spark tested and pass this inspection would not be required to be removed from service since the fiber is not interfering with normal operations. Relining or repair of localized area as shown in the nozzle should be considered to be conservative.



Significant attack of the surface veil layers extending to the underlying glass fibers. Very predominate fiber exposure. This will cause a wicking effect within the laminate and provide a pathway to the structural fibers that could result if shell failure if left unchecked. Commonly referred to as "Fiber Bloom". This is an advanced stage of attack and because the nozzle cap is completely deteriorated the tanker should be removed from service and relined. Caution should be noted in these cases that chemical products have not contaminated the critical structural fibers. If this is the case, the tanker should NOT be relined and instead returned to the manufacture for inspection.

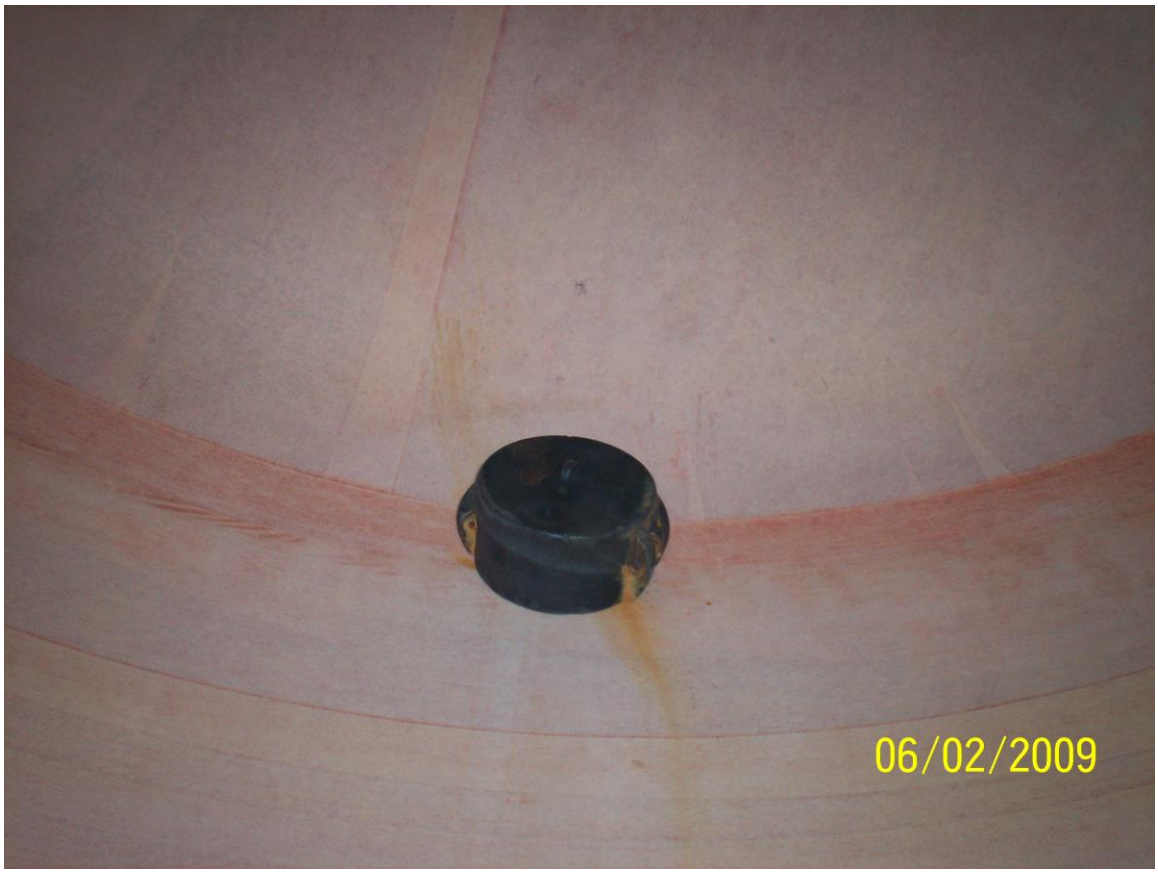
Stress Corrosion Cracking or Micro Cracking:

Typical sign of stress corrosion cracking in the surface layers. This is caused by highly oxidizing chlorine environments specifically. This is produced by the decomposition of sodium hypochlorite solutions in the vapor phase. Characterized by hundreds of small cracks that are more prevalent in the resin rich areas. In time they can allow product to migrate into the glass mat fibers and will cause what is known a fiber bloom. The process is somewhat slow reaching these underlying glass layers but progress should be monitored. Tankers that have conductivity capability are able to monitor the extent of migration to the conductive layer and it's possible the tanker could operate for many years in this condition without interfering with the normal operation. This is a good example why conductivity is an important tool for accessing liner condition and management of repairs.



Surface Dryness:

Some products will cause the resin rich layer to deteriorate exposing the surfacing veils to direct product contact. This is predominately seen in alkaline or caustic applications especially where hot products are involved.



Manway Inspection:

During the annual inspection, please make sure to include the manway lid. Inspect for any visible signs of cracking.

Please see attached photo for instructions on performing a soap test.

Begin by filling your unit completely full with water (to the brim of the 10” fill) and prepare for a pressure test.

Place a restraining device of the fill lid cover (the top most hinged area of the 10” fill) to prevent any blowout.

Set the pressure to 5 PSI and spray soap and water, as instructed by the attached pictures around the 10” fill lid area.

Slowly increase the pressure in 5 PSI increments and spray at every increment, checking for bubbling or any leaks. Do not place any part of your body directly over the lid. Increase to 52.5 PSI and spray again to assure that no area has been missed.

If you find any amount of bubbling form the soap test, even if it is at low pressure, immediately take the following steps:

Remove this unit from service and contact Poly-Coat Systems, Inc. at 281-245-3393 for further information.

Normal Lining, No Defects:

Condition of fully cured lining after 2 years of hypochlorite service where no stress corrosion cracking has occurred.

Please contact Poly-Coat Systems, Inc. with any question you have regarding inspections of FRP Cargo Tank Trailers.

Per the terms of the Special Permit, any repairs or re-linings require authorization from Poly-Coat Systems, Inc. Structural repairs over 2 sq. ft are required to be preformed by the manufacturer. Please contact Poly-Coat Systems, Inc before performing any corrosion barrier repairs, lining repairs, re-linings or modifications.

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