TANKBOTTOM MAINTENANCE introduction 4138

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1. Introduction

The degree of corrosion within storage tanks, especially those used for the storage of crude oil has often been underestimated. This is reflected by the large number of serious corrosion problems encountered in various tank farms for crude oil storage. Storage tanks which have not been adequately protected by proper coating systems exhibit tank bottoms and a few meters up the sidewalls which suffer from severe corrosion. During inspections following years of continuous service high overall steel consumption and in many cases severe pitting corrosion is observed. The corrosion problems can be so severe that local perforation of tank bottoms is likely. This situation requires special attention as serious soil contamination due to leakage of crude oil (or other loading) from the storage tank could lead to environmental problems. Besides the contamination risk it is evident that severe leakage of crude oil or other loads may also lead to considerable financial loss.

The corrosion processes which occur within crude oil storage tanks are numerous. However, the main corrosive action is enhanced by the acidic nature of the crude oil and chloride containing water which separates from the crude oil during storage. Especially, this combined with the elevated temperatures at which crude oils are normally stored ensures that the corrosion process becomes highly active. Further corrosive action is attributed to sulphate reducing bacterial species which may generate corrosive products under anaerobic conditions which occur during long static crude oil storage periods.

Confronted with the serious damage observed to the bottoms of crude oil storage tanks, many tank farm owners realize that adequate maintenance of these areas is required. Maintenance procedures sometimes include steel renewal and filling deep pits by welding and steel patching procedures, but above all quality conscious tank farm owners will invest in proper protective coating systems which will result in a considerable life time extension of their storage tanks. In this way reducing the maintenance periods and restricting the risk of perforation of the tanks to a minimum.

Carrying out a high quality coating application at the new building phase is preferred. It will overcome costly maintenance activities such as steel renewal, pit filling by welding, intensive surface preparation by grit blasting and coating processes when the tanks are in service. Above all, the down time during service of the tanks is considerably reduced and more flexibility in service is obtained.

When the tank farm owner decides to maintain the internals of heavily corroded tank bottoms various important aspects have to be taken into consideration. Proper cleaning of the tanks is a prerequisite for effective blast cleaning to an acceptable standard of cleanliness (in most cases ISO-Sa2½). Steel repair by welding, plate renewal, or steel plate patching have to be properly executed.

The coating system to be applied should not be used to camouflage or to reinforce an unacceptable structural state of a tank. It is however important that the right choice of coating system is made so that long lasting protection of the upgraded tank internal is established. It should be realized that the cost of the coating system itself is insignificant compared to the cost which is involved in pre-treating the corroded substrate to an acceptable standard required for application of a paint system.

The following criteria are to be considered by the tank owner when selecting the most suitable coating system:

- The expected chemical to be stored in the tank
- Flexibility i.e. future changes of service
- The application conditions during which the maintenance job has to be carried out (ventilation conditions, substrate temperature, etc.)
- Available application equipment and skill of paint (sub) contractor
- The time available for realization of the tank coating job (number of coats and curing period before service)
- Potential contamination risk of tank load by coating material
- Preference for light colors for easier inspection and application
- Required flexural strength in case of existing deformation of tank bottom
- Legislation on solvent emission
- Required certificates
- Overall condition of the steel (for heavily affected steel, heavy duty solvent free lining systems are preferred)
- Economics
- Due to smooth gloss of final coat easy cleaning and gas freeing

2. General procedure for a storage tank maintenance job

Before starting maintenance a well considered plan should be created in which all necessary procedures are carefully scheduled. If done properly the quality of the job generally improves as unexpected shortages for particular parts of the job will be less likely.

The most common steps in a maintenance job are detailed briefly in the following paragraphs.

2.1 Cleaning of the tank

Before starting to remove cargo residues which are left in the tank after discharge, the tank should be ventilated to establish a gas free status.

The removal of residues is normally done by means of high pressure water washing in combination with suitable detergents, steam cleaning etc. Subsequent to this cleaning, a fresh water rinse is required to ensure that all water soluble residues are removed properly. The presence of water soluble material is detrimental to any kind of coating system which is subjected to continuous immersion situations.

2.2 Inspection and repair of steel work

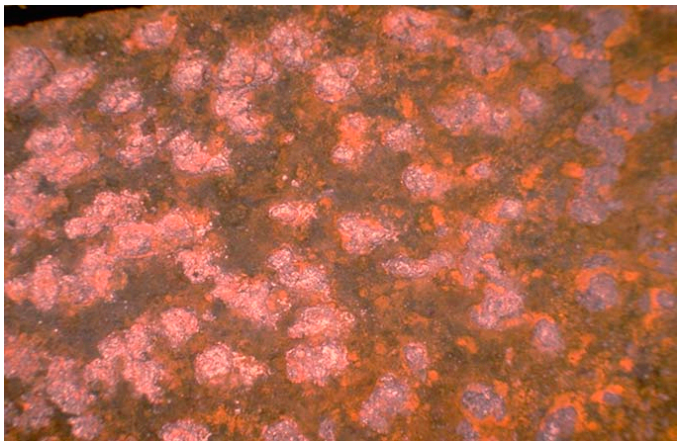
The internal of the tank is inspected for adequate steel thickness, possible steel perforations and deep corrosion pits. Tanks should be prepared in such a way that they comply with prevailing regulations and specification. Where necessary repair is carried out by means of steel renewal, pit filling by welding or alternatively by welding steel patches on the pitted area. In particular cases it will also be possible to fill pits with suitable fillers or scrape layers of solvent free coating material. As many types of corrosion pits occur this is further explained in sheet 4139 paragraph 2.7.4 pit repair.

In many cases it is preferable to carry out a pre-blast in advance of steel inspection as the blasting operation shows up steel defects present in the tanks.

2.3 Blasting

Tanklining systems perform best on adequately blasted steel with high cleanliness standard. Therefore grit blasting to a roughness grade of R_Z 50-100 µm (2-4 mils) and cleanliness grade of at least ISO-Sa2½ (ISO 8501-1 and SSPC-SP10) is recommended.

In a storage tank several rust grades can be encompassed as for instance on depicted picture below.



This rust grade is corresponding with rust grade D as described in SSPC-VIS 1. In this standard reference photographs illustrate four initial rust conditions before surface preparation, covering the range from intact mill scale to rusted and pitted steel. For tank bottom maintenance rust grades greater than B is mostly observed. Corroded tanks with a rust grade greater than B should have a surface pretreatment as is also mentioned in SSPC-VIS-1.

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2.4 Tanklining system

This tank maintenance manual contains of two sections describing how to carry out maintenance to protect the asset from corrosion.

This section of the manual is especially dedicated to the upgrading of pitted tank bottoms, highlights a number of paint systems specifically designed for this purpose. The selected paint systems are described in system sheets 4140-4145 and are all based on two component epoxy coatings which are known for the combination of excellent anticorrosive properties and wide resistance to a variety of chemicals.