Maintenance inspection of steel storage tanks

Qualified and systematic inspection may prolong the life of old steel tanks

In-service defects such as corrosion, cracking, deformation and a number of other similar operational defects may lead to leakages and structural break downs of old steel storage tanks.

Focus is on protection of the environment and owners of oil steel storage tanks are required to regularly perform qualified inspection and condition assessment of existing tanks and documentation must be submitted to the authorities.

More than 50 years of operation in Denmark as well as internationally has provided FORCE Technology with extensive know-how within **"qualified and systematic inspection of steel tanks"**, and this has contributed to FORCE Technology having:

- Gathered great insight into decomposition issues, especially characteristic for steel tanks
- Gained huge experience on prevention and repair of in-service defects to ensure the tanks' continued structural and operational integrity.

Get a qualified and systematic inspection:
As a tank owner, you receive these advantages:

- Observation of ongoing operational deterioration or defects that may have significant influence on the tanks' continued leak-safety and bearing capacity
- Financial optimisation of on-going and future tank maintenance
- Life time extension of old steel tanks
- Complying with the authorities' documentation requirements for verifying the tanks fitness for continued service.

You will limit the risk of leaks and structural break downs, which may have huge financial consequences due to product and operational losses, and you may maintain a stable supply guarantee toward your customers.

The technical basis for a tank inspection
Regulatory requirements for the owners of tanks with oil products may be addressed as "terms for environmental approval" and the following domestic announcements will often appear as references:

- Guideline from the Danish Environmental Protection Agency, No. 2, 2011: Guideline on environmental requirements for large oil stores
- Olietankbekendtgørelsen, BEK Nr. 1611 af 10.12.2015, bilag 9.

In these announcements, the authorities' requirements for oil storage tanks are described, and they refer to recognised international codes of practice for execution, assessment and qualification for tank maintenance inspections:

- API 653: Tank Inspection, Repair, Alteration and Reconstruction
- EEMUA 159: Users guide to inspection, maintenance and repair of above ground flat bottomed storage tanks.

Toolbox with recommendations
The mentioned codes of practice comprise the ultimate technical toolbox when performing tank maintenance inspections and they include the following recommendations and tools:

Tank bottom seen from the inside

Automated UT-thickness measuring of tank shell – Equipment: Silverwing scorpion crawler

- Extent and methods when performing the inspection
- Description of the various decomposition issues and risk elements
- Criteria for accept/rejection when assessing detected damages/deviations
- Instruction for remaining life time assessments
- Models for RBI (Risk Based Inspection)
- Directions for repair of detected damages/deviations and qualification and control when performing repairs
- Proposals for subsequent inspection intervals.

Tank inspection methods
Tank inspections are performed with a wide range of inspection methods and equipment, including:

- Optical equipment and measuring tools when determining the geometric deviations of the tanks, e.g. foundation settlements and deformation of primary steel elements
- NDT methods for detecting and observing operational damages on the tanks' steel parts, primarily corrosion, cracks and leaks, on the directly visible parts of the tanks as well as on the on the soil side of the tank bottoms.

FORCE Technology possesses and operates the newest and most advanced and automated NDT- and measuring equipment, proposed by international inspection guidelines, with the following advantages:

- May be performed at high speed
- Flexible accessibility, as the NDT-equipment is remotely controlled
- Provides high degree of coverage
- Great reliability of the inspection results
- Significant reduction in the out-of-service duration
- A broader technical basis for assessing the tanks' condition.

The profit for the tank owner is:

- Financial savings on tank maintenance inspections
- Greater safety for the structural- and the operational integrity of the tanks.

Example of heavy underside corrosion on tank cut out from a tank bottom

Guarantee for a qualified tank inspection

To ensure a comprehensive basis for assessing the condition of the tanks, it is paramount that the inspections be performed and managed by especially trained and certified tank inspectors with extensive knowledge of structural standards for tanks and not least special insight into the various decomposition issues for tanks.

When you make use of FORCE Technology for storage tank inspection, you are guaranteed a qualified and systematic inspection, which is planned and performed by certified and experienced tank inspectors.

Occupational health and safety

FORCE Technology inspectors are trained to operate in areas with hazardous and inflammable products, and execution of gas tests to assess the atmosphere in the tanks, prior to and after an inspection, is an integrated part of the safety measures when carrying out tank inspections.

Prior to inspection, the working condition – special security and safety issues applying at the actual plant - must be addressed and settled by the site manager and FORCE Technology inspectors.

Always "back-up" by huge experience

When performing the inspections, FORCE Technology tank inspectors are continuously supported by back-up from experienced tank engineers with the following areas of responsibility and tank competences:

- Preparing of specific inspection plans, based on actual tank design, which will determine the relevant areas of inspection and their extent:
  - Partly from the directions in EEMUA 159 and API 650
  - Partly based on FORCE Technology's own experience
  - Partly adjusted to the requirements of the tank owner
- Contact to the authorities to obtain approval of the tanks for "continued operation"
- Preparation of a detailed report of the collected measuring results and a subsequent qualified analysis and assessment of the condition of the tanks, including remaining life assessments, and completed by a recommendation of service interval until the next inspection.
- "Fitness-for-service assessment", determining whether it is necessary to perform a hydrotest of a specific tank in connection with execution of repairs, which are characterized as "major repair".

Through thickness corrosion on shell plate

- Listing of proposals for repair of proven damages/deviations, including a description of:
  - o design
  - o material requirements
  - o quality requirements
  - o qualification requirements
  - o control and documentation, with reference to relevant standards and own experience, within steel repairs as well as surface treatment quality requirements.

Based on the above FORCE Technology may be considered a market leader on maintenance inspection and consultancy of steel storage tanks - at a national as well as a global basis - and when you use FORCE Technology, you only need one supplier, we cover all aspects of maintenance inspecting of steel tanks, no matter where your storage tanks are located.

Tank bottom with an example of a marking with underside corrosion after completed tank bottom MFL-screening.

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