



COLORADO

**Energy and Carbon
Management Commission**

Department of Natural Resources

ECMC OPERATOR GUIDANCE

RULES 608.A & F AND 609: TANK INSPECTION GUIDANCE

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Background

Purpose:

The purpose of this Tank Inspection guidance is to provide operators with guidelines on how to comply with rules, 608.a, 608.f, and 609 of the Colorado Energy and Carbon Management Commission (ECMC), which regulates installation, reclamations, operations, maintenance, repair and abandonment of upstream Tanks. ECMC created this guidance in response to the “200 – 600 Mission Change” rulemaking.

For reference rule 608.a was previously rule 605.a. Similarly, rule 608.f was previously rule 605.e. These rules by-in-large underwent changes to include usage beyond just oil and condensate tanks, from the previous ruleset.

Rule 609 is new as of this Mission Change rulemaking and applies published industry standards to both newly installed and existing in-service tanks. With the adoption of applicable inspection standards, the periodic inspections attempt to standardize inspection schedules to align with ECMC’s mission change that protects public health safety, including protection of environment and wildlife resources.

In general the two API standards, 653 and 12R1, differentiate inspections by tank size and those under the ECMC’s jurisdiction are primarily 12R1.

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New Facility Installation:

The following best practices are recommended for all new Facilities installations:

- Shop and field welds are per 12D and 12F, both of which are governed by Section IX of the ASME Boiler and Pressure Vessel Code
- Tanks must be tested in accordance with the respective specification, with the testing medium listed in each specification (note: welded tanks typically require other NDE per the respective specification).
 - 12B: N/A
 - 12F: with air at 1.5x design pressure
 - 12D: with water for 12 hours and roof via pressure or vacuum at joints; or the same as 12F if agreed upon.
 - 12P: with water for 1 hour (unless failed, then repaired and then for 2 hours)
 - 650: with water for 24 hours to max test height
 - Additional testing: visual (fillet and butt); radiographic (butt);
Base: vacuum, tracer gas, bottom-up hydro
 - UL 142: with water for 2 minutes at 25 psi

Existing Facility Installation:

The following best practices, are recommended for all existing tank facilities to ensure these are maintained in good physical condition per 609. Depending on tank spec, in-service inspections should generally follow:

- Facilities are to have routine in-service visual inspections by the owner/operator on a monthly basis per the following checklists:
 - API 653 6.3.1.2
 - API 12R1 6.3.2
- Facilities are to have external inspections (and examinations) by the appropriate personnel at the correct Inspection Schedules and Personnel in the later sections:
 - API No. 653 6.3.2.1 and Annex C-1
 - API 12R1 6.3.3 for external examination and Annex B
 - API 12R1 6.3.5.6 for external inspection and Annex B
- Facilities are to have internal inspections (and examinations) by the appropriate personnel at the correct Inspection Schedules and Personnel in the later sections:
 - API 653 6.3.2.1 and Annex C-2
 - API 12R1 6.3.3 for internal examination and Annex C
 - API 12R1 6.3.5.7 for internal inspection and Annex C

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STI Inspection Schedules and Personnel

STI standard SP001 separates both personnel and inspection types. Personnel are defined separately as the owner's inspector and a Certified Inspector. The owner's inspector is able to perform Periodic inspections, while the Certified Inspector can provide less periodic (but defined) external and/or internal inspections. *The qualifications of the owner's inspector are relatively minimal*, but these individuals should be generally experienced with the facility infrastructure in addition to the facility storage operations, the type of aboveground storage tanks and the spill control system used at each facility. STI does have online resources (Tank Integrity Management program) available to standardize the knowledgebase of the owner inspectors. This is not a specific certification.

Owner's inspector may also perform Leak tests. These tests may include gas pressure decay, gas pressure soap bubble test, gas tracers, soil tracers, mass measurement level measurement, and hydrostatic test.

STI defines Certified Inspectors under two options:

- API 653 Authorized Inspector w/ STI SP001 Adjunct Certification or
- SP001 Tank System Inspector

It should be noted that STI defines Formal Internal Inspections (FII) meet or exceed the requirements of Formal External Inspections (FEI).

Lastly, STI defines the NDT Examiner Qualifications must be in accordance with American Society for Nondestructive Testing's document SNT-TC-1A.

STI has a clearly defined Table of Inspection Schedules. Given the ECMC's secondary containment requirements of 603.o (via berm, steel, or other engineered material with an impervious liner), Category 1 and 2 are the primary schedules that needs to be fulfilled. Although there may be circumstances where older production facilities have not been retrofitted to meet current standards. In those cases, the more stringent Category 3 schedules may need to be met.

For the brevity of this document, only the Category 1 schedule will be covered. In addition to the schedules defined by configuration, the schedule is also split by volumes of shop-fabricated tanks. It should be noted that the timetable for Periodic inspections by the owner's inspector is not clearly defined, but STI does give an example "Monthly Inspection Checklist". Category 1 is as follows:

- 0-1100 gallons:
 - Category 1: Periodic
- 1101-5000:
 - Category 1: Periodic
 - Category 2: Periodic; Exterior and Leak every 10 years

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- 5001-30000:
 - Category 1: Periodic; Exterior every 20 years
 - Category 2: Periodic:
 - Exterior every 10 years and Interior every 20 years or
 - Exterior every 5 years and Leak every 10 years
- 30001-75000:
 - Category 1: Periodic; Exterior every 20 years
 - Category 2: Periodic; Leak and Exterior every 5 Years; Internal every 15 years

For field-welded tanks, the schedules are not split by volumes. It should be noted that corrosion rates may govern the internal inspection interval to be shorter (every 30 years for Category 1 and every 20 years for Category 2 tanks). Otherwise, the intervals are as follows (Category 3 omitted for brevity):

- Category 1: Periodic; Exterior every 5 years; and Internal every 10 years
- Category 2: Periodic; Exterior and Leak Detection every 5 years; and Internal every 10 years

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API 12R1 Inspection Schedules and Personnel

Similar to STI SP001, API standard 12R1 separates inspection personnel and inspection types. Personnel are defined separately as operations personnel, a Qualified Condition Examiner and Qualified Inspector. The recommended qualifications for the latter two are outlined in this standard. The lesser of the two, Qualified Condition Examiner, recommends at least a high school graduate, 5 years of oilfield experience, and familiarity of the requirements and recommendations of 12R1. Qualified Inspector needs to have a minimum of 1 year experience with tanks inspection, plus a combination of formal education and construction, repair, operation or inspection experience. More simply a Qualified Inspector could be a certified API 653 inspector.

This standard makes the distinction between three types of examinations/inspections: Routine operational examination, Condition Examination, and Condition Inspection. For Routine operation examinations, the owner/operator performs these at least monthly.

Condition Examinations are conducted by either Qualified Condition Examiners or Qualified Inspectors. This examination type is split into both External and Internal types. . Internal Examinations/Inspections are required to follow proper isolation, venting, and cleaning prior to entry per 12R1; this aligns with rule 609.c (which also requires OOSLAT and a wildlife barrier).

- External Condition Examinations are prescribed every 5 years or as part of an operational alert.
- Internal Condition Examinations usually performed based on the corrosion rate life or a risk-based assessment per API 580. Findings from external examinations may trigger an internal examination.
 - Additionally a scheduled internal examination is recommended in the following scenarios
 - if a tank is cleaned as part of normal operation
 - 5 years since the previous internal examination or inspection
 - if the tank is relocated
 - if the tank requires entry for maintenance or modifications
 - or if the service has changed more than 5 years after the last inspection.

Conditions Examinations can only be conducted by Qualified Inspectors. Similar to Qualified Condition Examinations, they are split into both External and Internal types.

- External Inspections are when the corrosion rate life dictates or in 20 year (or less) intervals. Additionally, the results of a Condition Examination may warrant an Inspection.

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- Internal Inspections or at the end of $\frac{3}{4}$ of the corrosion rate life or in 20 year (or less) intervals. Additionally, the results of a Condition Examination may warrant an Inspection.

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API 653 Inspection Schedules and Personnel

Similar API standard 12R1, API 652 separates inspection personnel and inspection types. The main distinction between these standards are the size definitions used by each. In general, the tanks specified by API 650 (inspection-governed by 653) are larger than those specified by API 12B, 12D, 12F, and 12P (inspection-governed by 12R1). However, in some cases these specifications call for somewhat large tanks (eg. 12D up to 55 ft. diameter and 24 ft. tall).

The personnel differences between API 12R1 and 653 are minute. The one extra allowance (in lieu of the formal education requirements) for the 653 certification is 5 years of experience in design, construction, inspection, operation or repair of aboveground storage tanks. One of those years must be in a supervisory role.

Given the ECOMC's role as an upstream regulator of oil and gas, it's not expected there is much use of these types of tanks (API 650). One difference relative to inspections between these standards is the data driven approach to inspection intervals used by 653.

Similar to 12R1 and STI SP001, there are Routine In-Service Inspections. For 653 these are conducted by owner/operator and with a frequency of no less than monthly. Much like that of 12R1 the personnel requirements for this type are minimal, but do include familiarity of the tank and product being stored. However, where 653 deviates is that there is no intermediate examination level conducted by partially qualified, but non-API 653 certified inspectors.

For external inspection, the minimum is every 5 years or by the formula outlined in section 6.3.2. In addition to tank conditions, external appurtenances such as grounding systems also need to be part of these external inspections.

While the data-driven approach outlined in API 653 is extensive, internal inspection intervals can be extended through simple engineering decision making. Primarily these credits revolve around the care of the tank bottom (eg. stainless steel tank bottoms, internal film coating, additional steel thickness, cathodic protection, etc.).

The minimum bottom thickness (or minimum remaining thickness) is outline by formula in section 4.4.5.1.

Corrosion rate procedures and risk based inspections
Risk based inspections (RBI) need application of API RP 580 plus considerations outlined in section 6.4.2.2.2. In addition to frequency, RBI needs to consider the methods of inspection as well. The review of the RBI assessment needs to be evaluated and approved every 10 years or less. RBI prohibits the use of Ultrasonic

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Spot Testing as a means for determining corrosion rates. Some of the likelihood and consequence factors from RP 580 are outlined in this document.

Despite the credit allowances, the maximum interval for internal inspections cannot run longer than 30 years, (or 20 without a release prevention barrier).

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Guidance Disclaimer

The guidelines set out in this document are intended solely as guidance. This document does not contain rules or otherwise binding requirements. Nothing in this document creates any substantive or procedural right enforceable by or in favor of any person or entity. The Director reserves the right to vary its activities from this guidance document at any time and in its discretion. The Director may change this guidance document from time to time.

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Appendix A – Reference Specifications

ECMC referred to the bulleted list of industry specifications shown below during creation of this guidance. Some of the information, concepts, specifications and practices identified can be applied to produced water, condensate, and crude oil tanks. The following list of references is provided to assist operators in the of tank inspection protocol.

American Petroleum Institute (API)

- API 650, Welded Steel Tanks for Oil Storage, 13th Edition (March 2020, effective September 1, 2020);
- API 12B, Specification for Bolted Tanks for Storage of Production Liquids, 16th Edition (November 2014, effective May 1, 2015);
- API 12D, Specification for Field Welded Tanks for Storage of Production Liquids, 12th Edition (June 2017, effective December 1, 2017); or
- API 12F, Specification for Shop-Welded Tanks for Storage of Production Liquids, 13th Edition (January 2019, effective July 2019).
- API 12P, Specification for Fiberglass Reinforced Plastic Tanks, 4th Edition (February 2016, effective August 1, 2016).
- API 653, Tank Inspection Repair, Alterations and Reconstruction, 5th Edition (November 2014).
- API 12R1, Installation, Operation, Maintenance, Inspection, and Repair of Tanks in Production Service, 6th Edition (March 2020)

Steel Tank Institute (STI)

- STI SP001, Standard for the Inspection of Aboveground Storage Tanks, 6th Edition (January 2018)

Underwriters Laboratories, Inc (UL)

- Underwriters Laboratories, Inc., No. UL-142, Standard for Steel above ground Tanks for Flammable and Combustible Liquids, 10th Edition (May 17, 2019)

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