

Inspection Practices for Pressure Vessels

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Inspection Practices for Pressure Vessels

1 Scope

This recommended practice (RP) supplements API 510 by providing pressure vessel inspectors with information that can improve skills and increase basic knowledge of inspection practices. This RP describes inspection practices for the various types of pressure vessels (e.g. drums, heat exchangers, columns, reactors, air coolers, spheres) used in petroleum refineries and chemical plants. This RP addresses vessel components, inspection planning processes, inspection intervals, methods of inspection and assessment, methods of repair, records and reports. API 510 has requirements and expectations for inspection of pressure vessels.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API 510, *Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration*

API Recommended Practice 571, *Damage Mechanisms Affecting Fixed Equipment in the Refining Industry*

API Recommended Practice 574, *Inspection Practices for Piping System Components*

API 579-1/ASME FFS 1¹, *Fitness-For-Service*

API Recommended Practice 580, *Risk-Based Inspection*

API Publication 2217A, *Guidelines for Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries*

ASME Boiler and Pressure Vessel Code (BPVC), Section VIII: Pressure Vessels

3 Terms and Definitions

3.1 Definitions

For the purposes of this document, the following definitions apply.

3.1.1

alteration

A physical change in any component that has design implications that affect the pressure-containing capability of a pressure vessel beyond the scope described in existing data reports. The following should not be considered alterations: any comparable or duplicate replacement, the addition of any reinforced nozzle less than or equal to the size of existing reinforced nozzles, and the addition of nozzles not requiring reinforcement.

3.1.2

cladding

A metal integrally bonded onto another metal under high pressure and temperature whose properties are better suited to resist damage from the process than the substrate material.

¹ ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.

3.1.3**condition monitoring locations****CMLs**

Designated areas on pressure vessels where periodic examinations are conducted in order to directly assess the condition of the vessel. CMLs may contain one or more examination points and utilize multiple inspection techniques that are based on the predicted damage mechanism to give the highest probability of detection. CMLs can be a single small area on a pressure vessel (e.g. a 2 in. diameter spot or plane through a section of a nozzle where recording points exist in all four quadrants of the plane).

NOTE CMLs now include but are not limited to what were previously called TMLs.

3.1.4**corrosion specialist**

A person, acceptable to the owner/user, who has knowledge and experience in corrosion damage mechanisms, metallurgy, materials selection, and corrosion monitoring techniques.

3.1.5**corrosion under fireproofing****CUF**

Corrosion of piping, pressure vessels, and structural components resulting from water trapped under fireproofing.

3.1.6**corrosion under insulation****CUI**

External corrosion of carbon steel piping, pressure vessels, and structural components resulting from water trapped under insulation. External chloride stress corrosion cracking of austenitic and duplex stainless steel under insulation is also classified as CUI damage.

3.1.7**damage mechanism**

Any type of damage encountered in the refining and chemical process industry that can result in flaws/defects that can affect the integrity of vessels (e.g. corrosion, cracking, erosion, dents, and other mechanical, physical, or chemical impacts). See API RP 571 for a comprehensive list and description of damage mechanisms.

3.1.8**damage mode**

The physical manifestation of damage (e.g. wall thinning, pitting, cracking, rupture).

3.1.9**defect**

One or more flaws whose aggregate size, shape, orientation, location, or properties do not meet specified acceptance criteria and are rejectable

3.1.10**design temperature**

The temperature used in the design of the pressure vessel per the applicable construction code.

3.1.11

examination point

recording point

measurement point

Page

test point [test point is a term no longer in use as test refers to mechanical or physical tests (e.g. tensile tests or pressure tests)]

An area within a CML defined by a circle having a diameter not greater than 3 in. (75mm) for pressure vessels. CMLs may contain multiple examination points, for example, a vessel nozzle may be a CML and have multiple examination points (e.g. an examination point in all four quadrants of the CML on the nozzle).

3.1.12

external inspection

A visual inspection performed from the outside of a pressure vessel to find conditions that could impact the vessel's ability to maintain pressure integrity or conditions that compromise the integrity of the supporting structures (e.g. ladders, platforms, supports). The external inspection may be done either while the vessel is operating or while the vessel is out of service and can be conducted as an on-stream inspection.

3.1.13

flaw

Imperfections or other discontinuities noted during inspection that may or may not exceed the applicable acceptance criteria.

3.1.14

in-service

Designates a pressure vessel that has been placed in operation as opposed to new construction prior to being placed in service or retired vessels. A pressure vessel not in operation because of a process outage is still considered an in-service pressure vessel.

NOTE Does not include pressure vessels that are still under construction or in transport to the site prior to being placed in service or pressure vessels that have been retired from service. It does include pressure vessels that are temporarily out of service but still in place in an operating site. A stage in the service life of a vessel between installation and being removed from service.

3.1.15

inspection plan

A strategy defining how and when a pressure vessel or pressure-relieving device will be inspected, repaired, and/or maintained.

3.1.16

inspector

A shortened title for an authorized pressure vessel inspector qualified and certified in accordance with API 510.

3.1.17

integrity operating window

IOW

Established limits for process variables (parameters) that can affect the integrity of the equipment if the process operation deviates from the established limits for a predetermined amount of time.

3.1.18

jurisdiction

A legally constituted government administration that may adopt rules relating to pressure vessels.