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Changes Contained in the 10th Edition of API 510, Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration

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The 10th Edition of API 510 was issued May 2014 and replaces the 9th Edition. The following summarizes several of the key changes. Please refer to the original document for details.

Section 1 – Scope

- Vessels that have been abandoned in place and no longer an asset of record from a financial/accounting standpoint are no longer covered by API 510. This relieves the owner from continuing to include these vessels in its overall inspection program. However, should it be decided later to put the vessel back into service, then its condition must be evaluated and meet API 510 requirements.
- A new paragraph indicates that the inspection program should provide reasonably accurate and timely assessments to determine if any changes could compromise continued safe operation. It further requires owner/users to respond to any inspection results that require corrective actions. These areas should have been obvious and automatically included in any inspection/maintenance program.

Section 2 – Normative References

The title of this section has been changed, but its intent has not. Several additional references have been added (e.g., API RP 583, RP 584, RP 585, RP 939-C, ASME PPC-2, etc.)

Section 3 – Terms, Definitions, Acronyms and Abbreviations

Here again, the title of this section has changed but its intent has not. There are now 73 definitions vs. the previous 62, and commonly used acronyms and abbreviations have been added.

Section 4 – Owner/User Inspection Organization

- New paragraphs have been added that require management to ensure that inspectors have an annual vision test and can meet specified requirements.
- Para. 4.1.3 – New paragraph covers Management of Change (MOC) and makes the owner/user responsible for implementing and executing an effective MOC process that reviews and controls changes to the process and the hardware. Items to be included in the MOC process are specified.

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Work Highlights

Materials Engineering

- *Performed a Cold Eyes Review of the current inspection program and strategy being used at a major US refinery for its adequacy considering current industry practices, equipment maintenance, and piping system reliability. Our report identified areas of strength, concern, and opportunities for improvement, with discussion provided for each of these areas. The refinery staff is following-up on implementing these recommendations.*

Process, Operations & Safety

- *Provided onsite FLEXICOKER health assessment and classroom training in South America and miscellaneous technical consulting performed under a technical service agreement.*

- Para. 4.1.4 – New paragraph covers Integrity Operating Windows (IOWs). The owner/user is responsible for implementing and maintaining an effective program for creating, establishing, and monitoring IOWs. IOWs make the connection between physical and chemical process parameters and their potential impact on equipment integrity if not properly controlled.
- Para. 4.6 – Other Personnel. This has been expanded and now provides examples of potential issues that may affect vessel integrity that “other personnel” should notify the inspector or engineer about.
- Para 4.7 – New paragraph requires that each owner/user organization be periodically audited to determine if the authorized inspection agency is meeting API 510 requirements. The audit team should typically be from another owner/user plant site, a central office, or an experienced third party organization.

Section 5 – Inspection, Examination, and Pressure Testing Practices

- Para. 5.1.2.2 – Additional sources of data to be considered in determining required inspection intervals have been added (e.g., extent of previous examination, recent operating history, MOC records, RBI assessments).
- Para. 5.2.1 – Mentions that identifying IOWs for key process variables is a useful adjunct to RBI.
- Para 5.2.2 – Has additional factors to be considered in an RBI probability assessment (e.g., both the pressure retaining and structural requirements, past and projected operating conditions).
- Para. 5.2.5 – Has been edited to also require that an RBI assessment be updated anytime an unanticipated failure occurs due to a damage mechanism.
- Para. 5.3.4 – Covers vessel entry and has several additional requirements that mention following site and jurisdictional safe entry requirements, inspector responsibilities to know and follow safe entry procedures, etc.
- Para. 5.4.1 – Now makes direct reference to API 571 regarding common damage mechanisms, and expands the list of examples that are identified.
- Para. 5.4.4 – New paragraph provides considerations for evaluation of vessels that are in cyclic service.
- Para. 5.5.1 – Added that “operator surveillance” be included in inspection plans. It also now requires that damage identified during inspections “shall be characterized, sized and evaluated.” By this last addition, should there have been a doubt before, inspection results cannot be just filed and forgotten but must be evaluated.
- Para. 5.5.2.1 – Now permits properly qualified personnel other than inspector (e.g., NDE examiner) to assist, but not replace, the inspector for internal vessel inspection. Inspections done from a manway or inspection port may only be done when the vessel cannot be safely entered.
- Para. 5.5.3.2 – Lists issues that could limit the effectiveness of using external, onstream inspection techniques to identify internal damage.
- Para. 5.5.4.2 – Additional considerations are provided with respect to the excavation and external inspection of buried pressure vessels.
- Para. 5.5.5.3 – Now explicitly states that the inspector shall review the results of the thickness inspection data to look for possible anomalies.
- Para. 5.5.6.1 – Adds duplex stainless steel material and associated temperature range for its susceptibility to CUI. Reduces maximum temperature for austenitic stainless steel CUI susceptibility from 400°F to 350°F.
- Para. 5.5.6.2 – Adds reference to API 583 for more detailed information on CUI.
- Para. 5.5.6.3 – Additional considerations for insulation removal to inspect for CUI are added.
- New Para. 5.5.7 – Highlights operator surveillance during their normal duties as a means to identify to the unit inspector anything unusual associated with pressure vessels and pressure relieving devices. This is comparable to what API-653 requires for aboveground atmospheric storage tanks.
- Para 5.6.2.4 – Adds reference to API 579-1/ASME FFS-1 in cases where detailed thickness reading grids are needed to perform FFS assessments of metal loss.



- Para. 5.6.3 – Provides additional guidance for the selection, number, and placement of CMLs.
- Para 5.7.1.1 – Adds hardness measurements and advanced ultrasonic backscatter examination as possible examination techniques to consider. It also references API 572 and API 577 for additional information.
- Para. 5.8.5.1 – A caution was added to ensure that all instruments and components that will be subjected to the hydrotest pressure are either designed for it or blinded off from the test.
- Para. 5.8.5.2 – More details are provided for cases where a hydrotest will be done on equipment having components of Type 300 stainless steel.
- Para. 5.8.6 – Adds reference to ASME PCCC-2 for pneumatic test procedures.
- New Para. 5.8.7.3 – Requires that the water temperature not exceed 120°F when hydrotesting solid or clad austenitic stainless steel vessels to prevent possible chloride stress corrosion cracking.
- Para. 5.8.8.1 – Advises that an FFS assessment to identify critical flaw size(s) should be conducted to specify acceptance criteria when NDE is used as an alternative to pressure testing for repairs or alterations.
- Para. 5.11.2, 5.11.4 and 5.11.5 – Have additional details regarding the inspection and repair of flanged joints.

Section 6 – Interval/Frequency and Extent of Inspection

- Para. 6.2.1.1 – Adds a requirement that if vessel damage is found during inspection done at the time of installation, it be documented and recommendations made for appropriate repairs or engineering assessment.
- New Para. 6.3.4 – Requires that RBI assessments be per API RP 580.
- Para. 6.4.2 – Adds external inspection requirements for equipment that is retired and abandoned in place.
- New Para. 6.5.2.4 – Provides inspection requirements when comparing vessels having the same or similar service. This approach could be considered in order to use onstream inspection instead of internal inspection.
- Para. 6.6.2.1 – Adds a requirement that the QA manual for an organization that repairs pressure relieving devices include requirements for shop auditing for adherence to the QA process.
- New Paras. 6.7, 6.8, and 6.9 – Provide requirements for deferral of inspection due dates, deferral of inspection repair recommendation due dates, and review of inspection repair recommendations.

Section 7 – Inspection Data Evaluation, Analysis, and Recording

- Para. 7.1.1.2 – Has been expanded to provide considerations to determine what corrosion rate should be used for determining remaining life and next inspection due date.
- Para. 7.4.2.2 – Adds criteria that must be met in order to use thickness averaging to evaluate corroded areas of a considerable size.
- Para. 7.4.2.4 – Has been expanded to provide thickness averaging requirements near structural discontinuities, not just for near nozzles as was the case before.
- Para. 7.4.3 – Now adds reference to API 579-1/ASME FFS-1 for pitting evaluation.

Section 8 – Repairs, Alterations, and Rerating of Pressure Vessels

- Para. 8.1.5 – Adds cautions if need to weld carbon steel having a carbon content over 0.30%. It also indicates that PMI should be specified if the inspector has any questions about material verification documents.
- A new Figure 8.2 – Provides a sample additional nameplate (or stamping) that must be installed in a rerated pressure vessel.

About the Author

Vincent Carucci, President of Carmagen Engineering, Inc., also provides mechanical engineering expertise in the areas of pressure vessels, heat exchangers, piping systems, and storage tanks to the process and power industries, insurance companies, and attorneys. If you would like more information, please contact Vince at vcarucci@carmagen.com.

