

UPDATES TO API STANDARDS

John M. Lieb, P.E.
Tank Industry Consultants

April, 2004

This paper discusses recent and pending updates to American Petroleum Institute (API) Standards 650, 653 and 620. These three documents are the industry standards by which the vast majority of field-erected, welded, petroleum, chemical and petrochemical tanks are designed, constructed, inspected, repaired, altered, and sometimes re-constructed.

These standards are continually updated by volunteer committees comprised of industry experts under the guidance of API to ensure that they are consistent with state of the art technology and remain focused on providing safe and reliable tanks for the storage of potentially hazardous liquids.

These standards have existed for many years. The current edition of each is listed below.

Current Editions of Main Standards:

- 1) API 650, “Welded Steel Tanks for Oil Storage”, Tenth Edition, Addendum 3, September 2003.
- 2) API 653, “Tank Inspection, Repair, Alteration and Reconstruction”, Third Edition, Addendum 1, September 2003.
- 3) API 620, “Design and Construction of Large, Welded, Low-Pressure Storage Tanks”, Tenth Edition, February 2002.

Some significant recent updates to API Standards 650 and 653 are listed below. Recent updates to API 620 are not included in the scope of this paper because they are generally similar to those of API 650.

Some Significant Changes to API 650 in September 2003 Addendum:

- 1) Added Appendix U to prescribe the rules under which Ultrasonic Examination may be used in lieu of Radiographic Examination for the examination of butt welds.
- 2) Added requirements to ensure the weldability of materials used for structural shapes requiring welded connections.
- 3) Updated the criteria to be satisfied for a tank roof-to-shell connection to be considered frangible based on recent research work in this area.
- 4) Consolidated all references to anchor bolt design in one location and updated design requirements to be consistent with Load Resistance Factor Design approach used in most state of the art building codes.
- 5) Selected responses to requests for interpretations have been incorporated in Appendix D, along with a reference to the API web site for a more complete listing.
- 6) Added Table L-1, an index of decisions or actions which may be required of the purchaser.
- 7) Appendix P, "Allowable External Loads on Tank Shell Openings", extensively revised and expanded based on recent advanced analysis work.

Some Significant Changes to API 653 in September 2003 Addendum:

- 1) Updated to clarify that API 653 recognizes the fitness-for-service concepts of API RP 579.
- 2) Updated to expand discussion of the use of UT measurements and MFL surveys for bottom inspection.
- 3) Updated and expanded to address inspection requirements for additional welded-on plates on the tank bottom, including those in the critical zone and those outside of the critical zone.
- 4) Updated and expanded Section 12, “Examination and Testing” to include:
 - a. Minimum visual inspection of all new welds and cavities resulting from arc-gouging prior to welding.
 - b. Guidance in qualifying personnel and procedures when MFL tools are used to examine the tank bottom (i.e., new Appendix G).
 - c. Clarification of the radiographic examination requirements for new and replaced shell plate and door sheet welds.
- 5) Updated Authorized Inspector Certification Requirements to require that every six years, the Inspector must demonstrate knowledge of revisions to the standard that we instituted during the previous six years.
- 6) Selected responses to requests for interpretations have been incorporated in Appendix E, along with a reference to the API web site for a more complete listing.

- 7) Appendix F, “NDE Requirements Summary”, has been updated to include various changes to non-destructive examination requirements.
- 8) Appendix G, “Qualification of Tank Bottom Examination Procedures and Personnel”, has been added.

In addition to recently published updates, there are several items in the balloting stage. When passed to publication, they will be incorporated in future editions or addenda of the respective standards. These items are listed below.

Subcommittee Letter Ballots Currently in Committee:

API 620:

- 1) 620-229 Allowable stress for hydro-pneumatic test – sets allowable stress for test condition at $1.3 S_d$.
- 2) 620-259 Protective coating inclusion in weld procedure qualification tests – requires coatings present during welding to be included in the weld procedure qualification tests.
- 3) 620-260 WPS Qualifications for structural attachments – defines WPSQ requirements for structural attachments.
- 4) 620-263 Joint efficiency of lap-welded plates in compression – clarifies the joint efficiency to be used in evaluating lap welded plates in compression.
- 5) 620-271 Shaping of plates – proposes to allow for shaping of plates during the erection process.

API 650:

- 6) 650-464 External pressure appendix – proposes rules for the design of tanks for vacuums greater than 1” H₂O up to 1 psig.
- 7) 650-533 Clarify nozzle requirements – clarify requirements for test holes in reinforcing plates.
- 8) 650-557 Flush type cleanouts Appendix A – clarify thickness limitations for FTCO’s in Appendix A tanks.
- 9) 650-558 WPS Qualifications for structural attachments - defines WPSQ requirements for structural attachments.
- 10) 650-569 Shell design by Variable Design Point Method – clarify application of corrosion allowance for VDP Method.
- 11) 650-570 Manufacturer responsibility for product engineering – clarify responsibilities of various parties when aluminum dome roof is used on a tank.
- 12) 650-576 Nozzle projections – clarify requirements for flush trimming of nozzles on internal projection.
- 13) 650-578 Floating roof leg drainage – clarify requirements for drainage provisions on floating roof support legs.
- 14) 650-579 Vent mesh size – clarify screen mesh size for vents on tanks.
- 15) 650-582 Tolerances after hydro-testing – clarify requirements for tolerance measurements after the hydrostatic test is complete.
- 16) 650-584 Institute of Petroleum comment on Appendix H – incorporate or address comments from the Institute of Petroleum on Appendix H.

API 653:

- 17) 653-138 Provisions for stainless steel – Adds new Appendix S to API 653 to complement Appendix S in API 650 for stainless steel.
- 18) 653-141 Weld spacing evaluation – clarify requirements for evaluating weld spacing that does not comply with API 650, Seventh Edition.
- 19) 653-155 Ultrasonic inspection interval – proposes to extend the maximum UT inspection interval from 15 to 20 years.
- 20) 653-156 Are report recommendations mandatory? – clarify that recommendations are mandatory in tank inspection reports.
- 21) 653-157 Tank nameplates and certification – proposes new rules for applying nameplates to existing tanks.
- 22) 653-162 Repaired weld inspection length – clarify length of repaired weld that must be inspected.
- 23) 653-165 WPS Qualifications for structural attachments - defines WPSQ requirements for structural attachments.
- 24) 653-166 New bottom through nozzle reinforcing plate – clarify requirements when the installation of a new bottom plate intersects nozzle reinforcing plates.
- 25) 653-184 In-service inspection of seals – clarify the inspection requirements for external floating roof seals.
- 26) 653-185 Repair of tank bottoms – clarifies requirements for structural pad plates on the bottoms of tanks with internal members supported on the bottom.

- 27) 653-189 External in lieu of internal inspections – defines the requirements for performing an external inspection in lieu of an internal inspection on tanks for which the bottom is accessible for inspection.
- 28) 653-193 Inspection of floating roof repairs – clarifies the testing (including hydrostatic) and inspection requirements after floating roof repairs are made.
- 29) 653-198 Bottom replacement exemption – proposes to allow the same exemption for weld spacing requirements on tanks for which the bottom is replaced without slotting the shell as that permitted for tanks with bottom replaced by slotted-shell method.
- 30) 653-199 Brittle fracture analysis – proposes to establish 20-year service criterion to waive brittle fracture analysis.

Occasionally, an issue is significantly complex that a special task group is necessary to resolve all the details of a proposed change to the standard. There are currently a number of Special Task Groups working under the Subcommittee Pressure Vessels and Tanks. Each Task Group is typically comprised of representatives from either or both of the Subgroup Design and the Subgroup Fabrication. The current Special Task Groups are listed below.

Current Special Task Groups:

- 1) External Pressure
- 2) Seismic
- 3) Frangible Joint

- 4) Metrication
- 5) RP 575 Rewrite
- 6) Magnetic Flux Leakage Examination

For questions about individual items in the lists that appear above, please contact the author at lieb@tankindustry.com or visit the API web site, www.api.org.