

Agenda Item 650-2051 – Liquid Penetrant Test (PT) allowed to be substituted for Vacuum Box Test

Title: PT used instead of Vacuum Box

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Revision: 2

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Rev 0 of the item was handled by Rick Simmons

Purpose: Use of PT as a substitute for Vacuum Box

Source: Rick Simmons

Impact: Positive allowance overall cost and schedule and convenience.

Discussion (Rev 2 changes marked in green)

1. This proposed addition to API is for allowing a no-indication PT leak test alternative to Vacuum Box or Solution Film Testing for weld seam locations which are difficult to access (or where it is inconvenient or uneconomical to perform currently specified Vacuum Box or Solution Film testing). ~~There is no need to limit the areas where~~ This substitution may be utilized, as it may be considered equivalent or better than vacuum box /solution film, and further it would be cost prohibitive to use PT excessively since it is far more expensive than vacuum box /solution film. It is proposed to simultaneously revise API 620 and API 653 via Agenda Items 620-2048 and 653-2041 respectively.
2. Storage Tank Manufacturers have for many years proposed and utilized PT instead of vacuum box for difficult to access areas, even though it has not actually been allowed by API, except for very limited special cases /situations.
3. PT with its usual acceptance criteria per ASME is considered more of a surface quality 'structural' check, as opposed to a leak test. Therefore, acceptance criteria for the alternative leak tightness use of PT is more stringent, in order to significantly increase the leak tightness probably of the tested weld, as ANY surface flaw could indicate a through thickness leak path.
4. ~~Precedent. Refer to API 650 paragraph 7.3.4 item 4) for sumps, where PT with 'no indications' is allowed as an alternative to Vacuum Box, SFT, or penetrating oil.~~
5. Rev 1: Applicability updated to cover tank components which ~~are known to~~ have impractical surface configurations for vacuum box testing.

Proposed Changes:

Rev 2 (Rev 2 changes marked in green)

Section 7:

7.3.8 Testing of the Roof

7.3.8.1 Upon completion, the roof of a tank designed to be gas-tight (except for roofs designed under 7.3.8.2, F.4.4, and E.7.5) shall be tested by one of the following methods.

a) Applying internal air pressure not exceeding the weight of the roof plates and applying to the weld joints a bubble solution or other material suitable for the detection of leaks.

b) Vacuum testing the weld joints in accordance with 8.6 to detect any leaks. ~~When vacuum box testing is impractical due to the surface configuration,~~ Alternatively, ~~no-indication liquid penetrant examination may be substituted for vacuum box examination.~~

Section 8:

8.4.4 Acceptance standards and the removal and repair of defects shall be in accordance with Section VIII, Annex 8, Paragraphs 8-3, 8-4, and 8-5, of the ASME Code. ~~Where no-indication liquid penetrant examination is specified, the acceptance criteria shall require examined surface to be completely free of indications, including linear, round, or crack-like.~~

Annex C:

C.3.6 Compartments

Compartment plates are radial or circumferential dividers forming compartments that provide flotation for the roof (see C.3.4). All internal compartment plates (or sheets) shall be single-fillet welded along all of their edges, and other welding shall be performed at junctions as required to make each compartment leak tight. Each compartment weld shall be tested for leak tightness using internal pressure or a vacuum box and a soap solution or penetrating oil. ~~When vacuum box testing is impractical due to the surface configuration, or no-indication liquid penetrant examination. may be substituted for vacuum box examination.~~

Annex H:

H.6.4 Any flotation compartment that is completely shop-fabricated or assembled in such a manner as to permit leak testing at the fabricating shop shall be leak tested at the shop as well as retested in the field by the floating roof erector for all accessible seams. In the field assembly yard or in the erected position, the erector shall spot leak test 10 % of the flotation compartments, whether shop- or field-fabricated. The Purchaser may select the specific compartments to test and the test location, based on his visual inspections for indications of damage or potential leaks(see the Data Sheet, Line 34). Any leaking compartments shall be repaired and re-tested by the roof Manufacturer. If the testing finds any leaks in compartments tested, except for those damaged by shipping, then 100 % of the roof compartments shall be leak tested. Unless prohibited by safety concerns, leak testing of cylindrical sections shall be at an internal pressure of 20 kPa to 55 kPa (3 lbf/in.² to 8 lbf/in.²) gauge using a soap solution or commercial leak detection solution. For other compartment shapes, each compartment weld shall be tested for leak tightness

using internal pressure (pressure to be agreed between the Purchaser, roof manufacturer, and roof erector) or a vacuum box and a soap solution, or penetrating oil, ~~or when other testing methods are impractical due to the surface configuration, no-~~ indication liquid penetrant examination.

Annex T:

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Air Test	Shop fabricated compartments (pontoons). Test in shop and field. Welds may be tested using vacuum box, penetrating oil or no-indication liquid penetrant examination. when other testing methods are impractical due to surface configuration.	H.6.4
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Pen. Oil	Compartment welds of external floating roofs not tested with internal pressure or VB or no-indication liquid penetrant examination. when other testing methods are impractical due to surface configuration.	C.3.6
...
VB	Welds of roofs designed to be gas-tight if not air tested or no-indication liquid penetrant examination. when other testing methods are impractical due to surface configuration.	7.3.8.1
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Acceptance Standards:

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 PT: ASME Section VIII, Appendix 8 (paragraphs 8-3, 8-4, 8-5), where no-indication liquid penetrant examination is specified, the acceptance criteria shall require examined surface to be completely free of indications, including linear, round, or crack-like.
