Agenda Item 653-2041 – No Indication Liquid Penetrant Test (NI-PT) allowed to be substituted for Vacuum Box Test or Solution Film Test

Title: PT in lieu of Vacuum Box or Solution Film

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Revision: 1

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Rev 0 of the time was handled by Rick Simmons

Purpose: Use of PT as a substitute for Solution Film or Solution Film Leak Tests.

Source: Rick Simmons

Impact: Positive allowance overall cost and schedule and convenience.

Discussion:

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 650 and API 653 via Agenda Items 620-2048 and 650-2051 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 a surface quality 'structural' check, not 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 1:

Section 12:

12.1.10 Floating Roofs

12.1.10.1 Repair Work to Steel Floating Roofs

After repair work is complete:

a) perform a visual examination from the top and bottom side of the floating roof;

b) perform an air leak, vacuum box, penetrating oil, tracer gas, or no-indication liquid penetrant examination when other examination methods are impractical due to surface configuration to ~~or other applicable non destructive~~ test of the repaired welds (see Annex F).

As an alternative to Item b), conduct a flotation test of the repaired roof.

Examination and acceptance criteria for NDE shall be in accordance with 12.1.

Annex F:

…	….	….
Pen. Oil	Floating roof deck seams and other joints required to be liquid tight or vapor tight. Air leak test, vacuum box, tracer gas or no-indication liquid penetrant examination when other examination methods are impractical due to surface configuration.	API 650, H.6.2, C.3.6 and C.4.2 API 653, 12.1.10.1
…	….	….

Acceptance Standards:
….
MTPT: 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
….

Rev 0 (for reference – balloted Spring 2020):

Since API 653 refers to API 650 as 'normative', and Agenda Items 650-2051 (and 620-2048 for API 620) propose to add the optional allowance to utilize no-indication PT as an option to the Solution Film or Vacuum Box Leak Testing, a change to API 653 is not absolutely mandatory, but would certainly add clarity and completeness.

Proposed additions are therefore as follows:

12.1.6.1 New welding on the shell-to-bottom joint shall be examined for its entire length by using a right-angle vacuum box and a solution film***, by no-indication PT per API 650 8.6.1,*** or by applying light diesel oil. Additionally, the first weld pass shall be examined by applying light diesel oil to the side opposite the first weld pass made. The oil shall be allowed to stand at least 4 hours (preferably overnight) and then the weld examined for wicking action. The oil shall be removed before the weld is completed.

12.1.7.1 Upon completion of welding on a tank bottom, the plates and the entire length of new welds for tank bottom plates shall be examined visually for any potential defects and leaks. Particular attention shall apply to areas such as sumps, dents, gouges, three-plate laps, bottom plate breakdowns, arc strikes, temporary attachment removal areas, and welding lead arc burns. Visual examination acceptance and repair criteria are specified in API 650, Section 8.5. In addition, all new welds, including the weld attaching a patch plate to the bottom, the areas of bottom plate restored by welding, and the restoration of welds found with defects during an internal inspection shall be examined by one of the methods specified in API 650, Section 7.3.3 ***or no-indication PT per 8.6.1.*** Leaking areas shall be repaired by grinding and rewelding as required, and the repaired area shall be retested.

12.1.7.3 In addition to the requirements in 12.1.7.1, areas of bottom plate repaired by welding shall be examined by the magnetic particle method or the liquid penetrant method. In addition, the repaired area shall also be tested using a vacuum box and solution***, ~~or~~*** a tracer gas and detector***, or no-indication PT per API 650 8.6.1***.

12.1.9 Fixed Roofs

Newly welded roof joints and repairs shall be examined in accordance with API 650, Section 7.3.2.2 and Section 7.3.8 ***(no-indication PT per API 650 8.6.1 is allowed as an alternative to vacuum box).***

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a) perform a visual examination from the top and bottom side of the floating roof;

b) perform an air leak, vacuum box ***(or no-indication PT per API 650 8.6.1)***, penetrating oil, tracer gas, or other applicable non destructive test of the repaired welds (see Annex F).

As an alternative to Item b), conduct a flotation test of the repaired roof.