

Agenda Item 620-2048 – Liquid Penetrant Test (PT) allowed to be substituted for Vacuum Box and Solution Film Test

Title: PT used instead of Vacuum Box or Solution Film Test

Date: 16 May 2022

Revision: 2

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Rev 0 of the item was handled by Rick Simmons

Purpose: Use of no-indication PT as a leak test substitute for Vacuum Box and Solution Film Testing

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 650 and API 653 via Agenda Items 650-2051 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 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 ~~such as weld around a large penetration in the roof liner.~~

Proposed Changes:

Rev 2 (Rev 2 changes marked in green. Note, dropped proposed changes to Q.5.8.3 and R.5.9.4 in Rev 2):

Section 7:

7.15.4.4 The acceptance standards, defect removal, and repair shall be in accordance with Section VIII, Appendix 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 P:

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VB	Annex Q: All welds of bottom, wall, and roof metallic liners of concrete containers, When vacuum box testing is impractical due to the surface configuration, Alternatively, no-indication liquid penetrant examination may be substituted for vacuum box examination.	Q.5.8.7
...
VB	Annex R: All welds of bottom, wall, and roof metallic liners of concrete containers. When vacuum box testing is impractical due to the surface configuration, Alternatively, no-indication liquid penetrant examination may be substituted for vacuum box examination.	R.5.9.6
...

Acceptance Standards:

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PT: ASME Section VIII, Appendix 8, (Paragraph 8-3, 8-4, 8-5), ~~when 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 Q:

Q.5.8.7 All welds of bottom, wall, and roof metallic liners of concrete containers shall be examined by applying a solution film to the welds and applying a partial vacuum of between 3 lbf/in.² and 5 lbf/in.² gauge above the welds by means of a vacuum box with transparent top. Where single pass lap welds less than 3/16 in. are used for wall liners, a second partial vacuum of at least 8 lbf/in.² shall be applied. ~~When vacuum box testing is impractical due to the surface configuration,~~ Alternatively, no-indication liquid penetrant examination may be substituted for vacuum box examination.

Annex R:

R.5.9.6 All welds of bottom, wall, and roof metallic liners of concrete containers shall be examined by applying a solution film to the welds and applying a partial vacuum of between 3 lbf/in.² and 5 lbf/in.² gauge above the welds by means of a vacuum box with transparent top. Where single pass lap welds less than 3/16 in. are used for wall liners, a second partial vacuum of at least 8 lbf/in.² shall be applied. ~~When vacuum box testing is impractical due to the surface configuration,~~ Alternatively, no-indication liquid penetrant examination may be substituted for vacuum box examination.