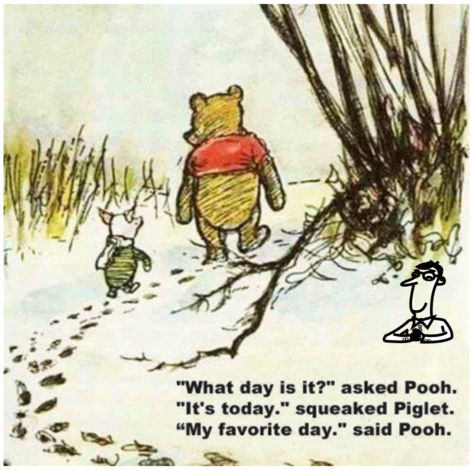


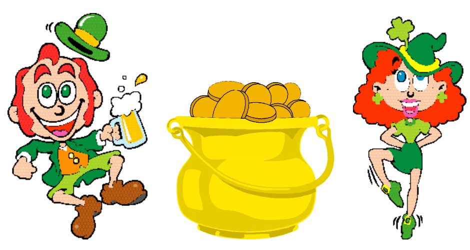
The March 2016 Penetrant Professor from Met-L-Chek®

Battery Powered Inspection

ASTM E-07- met in Ft Lauderdale January 25-28 2016. Principle discussions centered around **LED UV-A** inspection lights and more contentiously over battery powered lights. Comments made were that these lights have high initial intensity when turned on and then lose 20% intensity before stabilizing, and then as the batteries drains the intensity drops. No actual data were presented to show this but it does stand to reason that with battery drainage intensity would be effected.

The issue is between the academics and the practitioners. When do you test the lights brightness to ensure you have proper intensity for good inspection? Not only when, but how often, in view of the fact that users will no doubt be turning the lights on and off as they inspect. How often are you going to require the inspector to measure the intensity and record the results? One could spend all day turning the light on, measuring the intensity, recording the result, make an inspection turn the light off and then start all over again. What is practical? There are those who proposed an automatic indicator on the light to show that it is above the minimum intensity requirement. Nice idea, but how do you confirm and assure calibration of this device? There were those that felt it was the level 3's responsibility to allow use for a set amount of time between intensity checks to facilitate increased productivity, with the caveat that if the intensity was found low, one would have to go back and re-inspect parts processed after the last passing intensity check.

Nothing was resolved over this issue which requires more data from the light manufacturers and user input. Similar issues exist with battery powered MPI yokes but that too needs more data.



Known Defect Test Piece

Test blocks with known defects are very common in NDT. They are used in UT, ECT, MPI, RT and PT to assist in inspection set up and detectability of known flaws of varying sizes.

The **ASME Pressure Vessel and Boiler** code Section V, article 6 appendix III describes a quench cracked aluminum block to be used for qualifying nonstandard techniques of PT such as high or low temperature inspection.

Comparison of two visible penetrant systems on a quench cracked Aluminum block

ASTM E-1417 ¶7.8.3 "The penetrant system's overall performance shall be checked as specified in Table 1. The check shall be performed by processing a known defect standard through the system using in-use penetrant, emulsifier (if used) and developer and appropriate processing parameters. The resulting indications will then be compared to the indications obtained using unused penetrant, emulsifier(if used) and developer". "note 3- This test is not for determining the absolute sensitivity of the penetrant or determining the sensitivity level of the penetrant neither of which can be performed using a starburst-type panel."

The specification does not say anything about measuring the indications or photographs, simply making a comparison of results.

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AMS-2647 ¶4.2.1 System Performance Check, **"This check shall be performed by using known ...defect standard... The quantity and size of the defects in the defect standard shall be capable of demonstrating an unsatisfactory performance."**

¶4.2.1.1 It is permissible to use a defect standard, which contains five individual cracks or manufactured indications with each of the cracks or manufactured indications generally appearing as a star burst radiating outward from a localized center. The fluorescent indications produced by the cracks or manufactured indications when using a Level 4 Method D penetrant on the panel shall range in size as shown in Table 1:

Indication	Indication Size
A	0.38 to 0.81 mm (0.015 to 0.032 inches)
B	1.17 to 1.57 mm (0.046 to 0.062 inches)
C	1.90 to 2.36 mm (0.075 to 0.093 inches)
D	3.18 to 4.34 mm (0.125 to 0.171 inches)
E	4.57 to 6.35 mm (0.180 to 0.250 inches)

NOTE: Indication "A" may appear as a pin point instead of a star burst.

¶4.2.1.2 It is permissible to use Low Cycle Fatigue (LCF) specimens as defect standards provided the following conditions are met.

¶4.2.1.2.1 They shall contain multiple cracks having a range in size that will allow the user to discriminate between different sensitivity levels.

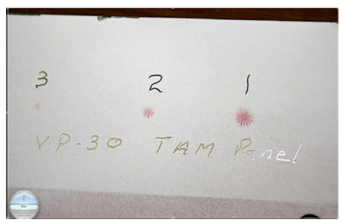
4.2.1.2.2 The smallest cracks shall be within the range specified for Crack "A" in Table 1.

The panel described above is based on the **Pratt & Whitney** TAM drawing 146040. The TAM panel was designed several decades ago as a tool to determine that a penetrant line was performing as designed.

The initial intent was a go no go test piece. A panel was run with fresh materials to the standard processing parameters to establish a base performance. How many indications (stars) showed and were the indications strong or weak. When the panel, after cleaning, was run through the system with in-use materials the results should appear similar to the base run, in number of indications and relative appearance.

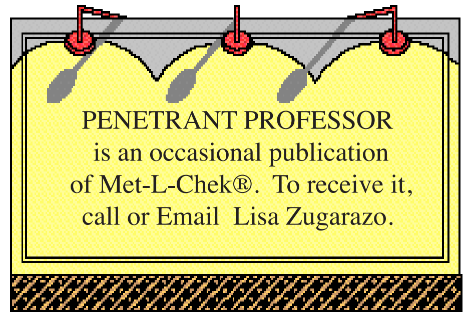
So far so good!

Then some cubical workers decided that sensitivity could be determined using the panels. A level 4 penetrant would give 5 stars, a level 3 penetrant would give 4 stars and a level 2 penetrant would give 3 stars. This scenario even appeared in documents from some well known aerospace OEM's. Every sober level 3 knows this is not the case. No two panels are the same. Running several panels though a system will give differing results in number of indications and appearance. Even a visible penetrant can show 3 stars.



Some auditing bodies thought it a good idea to start measuring the size of the indications and taking pictures to ensure consistency in comparisons. Here is where the use of the panel went off the road of practicality. The measuring of the indications is not easy, and in view of the fact that indications grow with developer time, when they are measured will affect the results. The film thickness of the developer will also affect the results, so what do the numbers mean. Very little in regard to penetrant system control.

In **2008** along came **George Hopman**, current chairman of the **ASTM E-07** committee and a well known consultant and level 3 on penetrant testing. George performed a series of tests that were designed to test the panel's ability to find penetrant systems that were degraded. He added nitric acid to the penetrant, he over washed panels and added water to water washable penetrants. He made every no-no mistake



that could happen on a real penetrant line. Alas, in every case the TAM panel failed to detect that the system was out of control. So George contacted **Sam Robinson**, then technical director of Sherwin Inc., who manufactured the panels. Sam replied, in writing and on Sherwin Inc. letterhead that these panels could not be used to detect system performance degradation because they did not work.*

This has recently been backed up by statements from a prominent aerospace OEM Corp. level 3, pointing out that in his years of auditing suppliers, not one single instance of a penetrant line failing had been found as a result of the use of the TAM panel. This real life experience, George's work and the Robinson statement seemingly have had no effect on the use of the panels, which continue to be required in some industry specifications. We have heard that the dimensional specifications for the cracks on the panel are being revised and tightened up. We're not too clear on how this is going to make things any better and more likely worse.

We have also been told that one of the approved manufacturers of the TAM panel has decided to stop making the panels because of the inability to make consistent panels.

*See George's article in **MATERIALS EVALUATION**, November 2008

Sherwin Inc. PSM-5 panel with photo

The inability to make the panels, per the specification requirements, on a consistent basis has driven up costs and reduced availability. This is a hardship for those forced to use the TAM panel.

The TAM panel is initially evaluated for acceptance with a level 4 PE penetrant, Method D, developer form "a" the indications measured and or photographed. What good is a photo of a panel with level 4 PE penetrant if you are using level 2 water washable penetrant? The developer film and development time will effect the indication size. Repeatedly running the same panel will give differing results on each indication, what is the statistically acceptable variance? The inability to measure the indications reliably and consistently makes this effort meaningless. It is our contention, that way too much emphasis is put on the actual indication measurements in regard to them being a meaningful indicator of system performance. Indication or no indication would be a bit more reasonable as a sign that something is wrong. Even this is not fool proof because more times than not this is an indication of poor panel cleaning rather than a system performance failure.

There have been "non authorized" panels on the market that claim to be made to the TAM drawing specifications but there is evidence that they do not always have star patterns within the defined TAM or **AMS-2647** parameters. May be usable as a test piece but not really what they claim to be.

A new source of a star burst test piece is coming out of Europe. A different design than the TAM panel but every bit as usable as a known defect test piece. **The Hoffman Precision Star Panel** is distributed in the USA by **NDT Supply.com** (1-913-685-0675). We have been told that the new design makes it possible to increase manufacturing yields of a more consistent panel. This would be very helpful to the penetrant community. We have evaluated one panel which produced five clear star patterns. We have no idea if these panels are any more or less reproducible than the others on the market. We do not know if the auditing bodies will find these acceptable or not, but they seem to meet the requirements of **AMS-2647**. More availability and competition can only be beneficial to the penetrant system operators. Our contention is all these panels are known defect standards, The real issue is making too much out of measuring the indications and their meaningfulness. It's a **go no go tool** and that is all.

Hoffman Precision Star Panel case with indication photos and dimensions

March 8, 2016 International Women's Day
March 13, 2016 Daylight savings time
March 17, 2016 St Patrick's Day
March 20, 2016 Spring Begins(equinox)
March 27, 2016 Easter

Can Gun Light

Speaking about battery powered LED UV-A inspection lights, Met-L-Chek has available a clever light that fits on a can gun for aerosol cans. The can gun may be attached to an aerosol can of fluorescent MPI materials such as **MPI-1400B** or penetrant developer such as **D-70.** The light can also be removed from the can gun to be used in tight recesses and other difficult inspection situations.

Some of the big features of this little light are:

- High intensity, 7,000 $\mu W/cm^2$ at 38 cm/15 inches, over 15 cm (6 inches) diameter inspection area.
- Certified wavelength of 365nm (+5).- bulb life up to 50,000 hours.
- Low visible light emission (< 2 foot candles / < 20 lx).
- Compact design 11 cm by 2.8 cm; weight 160 g.
- Low power consumption (< 2W)
- Environmental case dust and water resistant.
-Specification compliance to intensity requirements of ASTM, ASME, AMS, ISO specifications for fluorescent penetrant and magnetic particles inspection.

Contact us for more information.

The Penetrant Professor