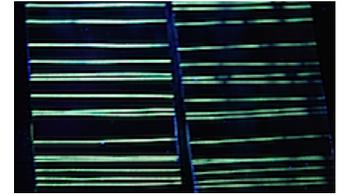


The Penetrant Professor from

Met-L-Chek®



© 2015 Met-L-Chek®

A Room Full of Experts!

In June 2015 [ASTM E-07](#) met in Anaheim California for the annual summer gathering. The principle area of discussion was LED UVA lights for NDT use.

This article is not about the lights but rather about a seemingly simple question that was raised, regarding developer application time following penetrant removal and drying. With a room full of experienced level 3's, technicians, auditor types, and other self proclaimed experts, there was no consensus and referring to the Specification [ASTM E-1417](#) only compounded the dilemma.

How could this be? Well to start with what seems to be an easy question is in fact not all that simple. It somewhat depends on ones situation or perspective. Individuals with considerable aerospace experience would be viewed as being far more restrictive than individuals with more general industrial exposure, such as rough casting inspection for relatively large indications. Some participants are familiar with unique applications and needs and base their input on their experiences. SO, how to write a penetrant processing specification that is broad enough to cover most application needs, and not be overly restrictive for special situations. That's what is done in a room full of experts biannually when [E-07](#) meets. Many of these participants are also members of [SAE/AMS Committee K](#) which works on penetrant inspection specifications, more narrowly focussed on aerospace and more specifically engine inspection.

*30µ chrome cracked panels, Level 3 Method A & C penetrant, minimal processing.
Left photo panels no developer after 2 hours bleed out time. Right photo panels, after application of "form a" developer and 10 minutes developer time.*

A look at what the [AMS-2647](#) and [ASTM E-1417](#) specifications say will shed some light on how the question can be more complicated than initially assumed.

[AMS-2647 Rev E](#) is entitled "**Fluorescent Penetrant Inspection Aircraft and Engine Component Maintenance**".

§ [3.4.11](#) addresses "Developing"

§ [3.4.11.1](#) "Use dry developer except where aqueous soluble/suspendable or nonaqueous developer (NAWD) is specified.

§ [3.4.11.2](#) "Developer shall be applied within **2 hours of penetrant removal** to prevent excessive bleed-out".

§ [3.4.11.4](#) "Allow part to develop for not less than 10 minutes."

§ [3.4.11.5.4](#) "Parts shall be cleaned and reprocessed **if time after development exceeds 4 hours**".

§ [3.4.11.5.2](#) "Apply dry developer to a dry part...."

The specification goes on to address the use of the other forms of developers and specific dwell or development times. This discussion will only be in regard to dry powder developer use.

The questions begin with [§3.4.11.2](#) which states "2 hours after penetrant removal". Does this include the time in the drier? The time to air dry, or the time after the part is dry? If one waits 2 hours after the part is dry to apply the developer, then they have 4 hours in which to inspect the part before it has to be reprocessed in accordance with [§ 3.4.11.5.4](#); this could be over 6 hours from the time the penetrant was removed.

So what does [ASTM E-1417](#) "**Standard Practice for liquid Penetrant Testing**" say about developing?

§ [7.4](#) "Drying-The components shall be dried prior to the application of dry developer,..."

§ [7.5](#) Developing- Unless otherwise specified developer shall be utilized for penetrant examination. Type **I** penetrants that are qualified to [AMS 2644](#) may be used without developer under either one of the following conditions: manufacturing examination of aluminum and magnesium castings classified by [AMS 2175A](#) as Class 3 or 4, or with the expressed approval of the cognizant engineering organization. **Minimum and maximum penetrant bleedout times without developer shall be 10 min and 2 hr respectively.** When developer is used, components that are not inspected before the maximum bleedout time shall be cleaned and reprocessed. When developer is not used,

Met-L-Chek Company, 1639 Euclid Street, Santa Monica, California, 90404, U.S.A.

Phone: 310-450-1111 Fax 310-452-4046 Email: info@met-l-chek.com Web: www.met-l-chek.com

components that are not inspected before the maximum bleed out time shall be reprocessed.

§7.5.1 Dry Developers—Components shall be dry before the developer is applied. Dry developer shall be applied in such a manner as to contact all surfaces to be inspected. Excess dry developer may be removed after the development time by lightly tapping or light air blow-off not exceeding 5 psi [34 kPa]. **Minimum and maximum developer dwell times shall be 10 min. and 4 hr., respectively.**

So, what do we know?



Both specifications agree that dry powder developer should be applied after part is dry. Seems reasonable!

AMS-2647 is a bit fuzzy on bleed out time to developer application since it states 2 hours from penetrant removal and not from time part is dry. It is very clear that development time is 10 minutes to 4 hours.

ASTM E-1417 refers to a bleed out time maximum of 2 hours without developer and then states the part must be inspected before the 2 hour bleed out time if developer is used. This is followed by the statement that dry powder development times are 10 minutes to 4 hours. Not consistent with regard to the bleed out time.

PENETRANT PROFESSOR

is an occasional publication of

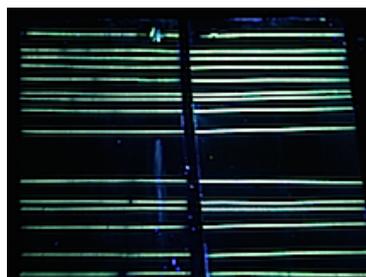
Met-L-Chek®.

To receive it, call or Email Lisa Zugarazo.

Sept 2015

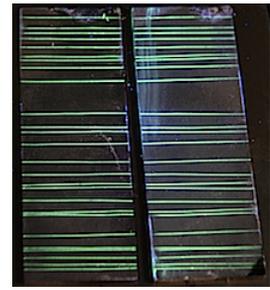
The experts pretty much understand the intent but written communication has gotten a bit vague in areas because of word choices and multiple editorial adjustments over time. It's a case of being too close to the subject and reading what one thinks it says rather than what it actually states.

In comes the Level 3, who must make sense of the numerous specifications, in developing processing for specific parts. Parts may be rough or smooth, large or tiny, with simple or complex geometry, and the inspection or flaw size detection requirements can vary greatly. Now add an outside auditor who may or may not be well versed in the process, or have their own interpretation and you have the makings for a migraine. No small task being a Level 3.



30μ chrome cracked panels, Level 3 Method A & C penetrant, minimal processing. Left photo panel after 2 hours bleed out time, "form a" developer and 10 minutes development time.. Right photo panel, after 4 hours bleed out time, "form a" developer and 10 minutes development time.

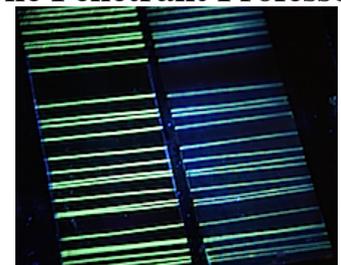
We made some down and dirty tests to see what would show up with extended bleedout times and then development. The test used



30μ chrome cracked panels, Level 3 Method A & C penetrant, minimal processing. Left photo panel after 2 hours bleed out time, "form a" developer and 10 minutes development time.. Right photo panel, after 16 hours bleed out time, "form a" developer and 10 minutes development time.

smooth 30μ chrome cracked panels, level 3 Method A & C penetrant, 10 minute penetrant dwell, a 10 second rinse, and wipe drying to try and minimize the effects of processing. Development time was 10 minutes from time of developer application. As "everyone knows" indications become more blurry and dimmer with time but in this limited study not quite as fast or detrimental as first anticipated. Bear in mind we were not dealing with background or very small indications. We saw nothing that would reduce or tighten the times indicated in the specifications. Depending upon the inspection criteria, the times could actually be expanded. We trust the experts will address the wording in the specifications to clarify the areas in doubt.

The Penetrant Professor



30μ chrome cracked panels, Level 3 Method A & C penetrant, minimal processing. Left photo panel after 2 hours bleed out time, "form a" developer and 10 minutes development time. Right photo panel, after 24 hours bleed out time, "form a" developer and 10 minutes development time.