The June 2014 Penetrant Professor from Met-L-Chek®

What Is The Smallest Crack You Can Find

The proof of the pudding that this newsletter is driven by its readers is much more obvious to us than perhaps to the readers. But a sterling example has just occurred, as a reaction to a recent article in the May 2014 PENETRANT PROFESSOR. The reader wrote as follows:

"There are many like me who have been long time readers and benefit from the wisdom of the professor so I thought I would pass a bit of info regarding POD and NASA to you in the event your readers need to deal with how small a crack you can find. **NASA STD 5009** contains a table of flaw sizes that can be found with the "standard" penetrant process as defined in the standard. I believe the standard is in the public domain and could be passed along as reference material for the inquisitive test lab."

This note prompted us to immediately Google™ **NASA STD 5009**, which we found extremely interesting. It is basically a tutorial, but it lists the sizes of the smallest defects that can be found using various NDT methods. However, there are cautionary notes, as an experienced inspector might expect. The following quotes are from the document:

Flag Day 14th
Fathers Day 15th

ASTM meeting
Toronto Canada
June 22-June 25 2014

"Nondestructive inspections of fracture critical hardware are required to detect the initial crack sizes used in the damage tolerance fracture analyses with a reliability of 90/95 (90% probability of detection at a 95% confidence level). The minimum detectable crack sizes for the Standard NDE methods shown in Table 1 (U. S. Customary Units) or Table 2 (Syteme International (SI) Units) meet the 90/95 capability requirement. The crack size data in Table 1 or 2 are based principally on an NDE capability study that was conducted on flat, fatigue cracked 2219-T87 aluminum panels early in the Space Shuttle program. Although many other similar capability studies and tests have been conducted since, none have universal application, neither individually nor in combination. Conducting an ideal NDE capability demonstration where all of the variables are tested is obviously unmanageable and impractical.

The components geometry features, such as sharp radii, fillets, recesses, surface finishes, and cleanliness, material selection, and other conditions, can influence the capability of the applied Standard NDE method. When this occurs, the method shall be evaluated to ensure that the Standard NDE detection capability is not reduced (see section 4.2.3). The conditions and their evaluation shall be documented in the NDE Summary Report."

As one might expect, there is no clear cut answer to the question of how small a defect can be found. There are data that describe what has been found on flat aluminum panels, but relating those findings to other situations and materials is not a simple task. The NASA standard recognizes this and is clear that different situations must be evaluated to ensure the capability of locating defects.

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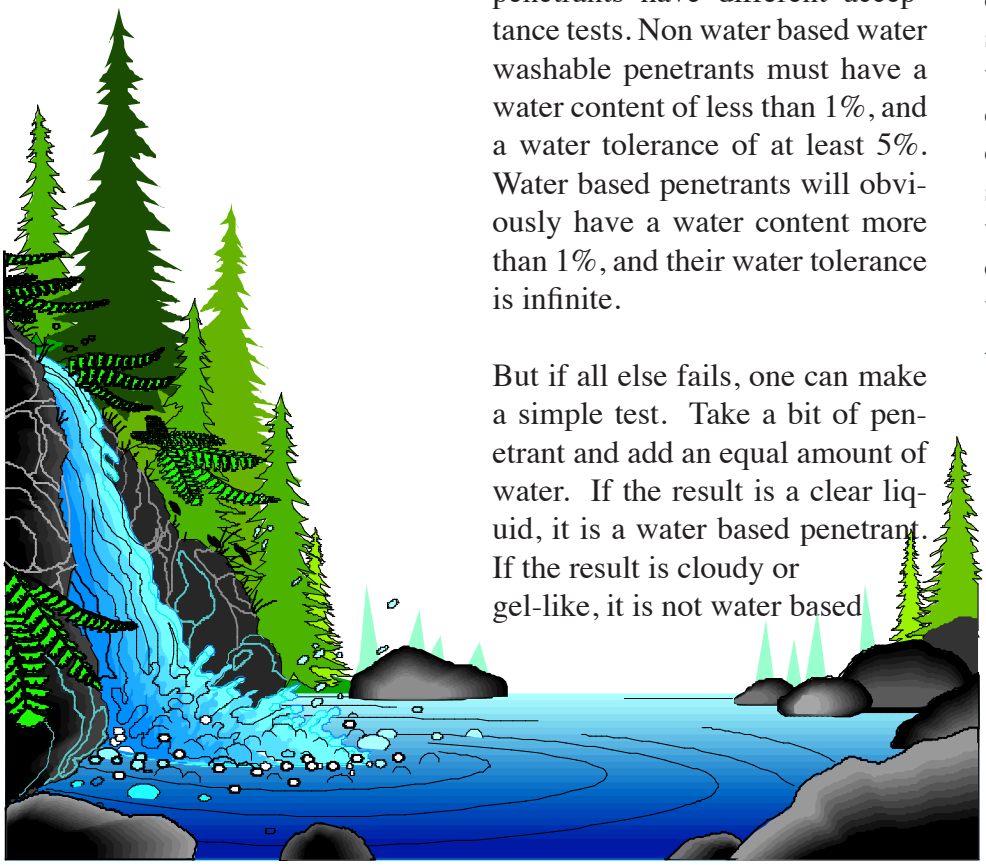
Is Water Washable The Same As Water Based?

We recently had a customer call who was being pressed by an auditor to prove that the level 3 water washable penetrant he was using, (Met-L-Chek **FP-923**), was not a water-based penetrant. Being pressed by an auditor is nothing new to hear about but this question came out of left field. It brings up the comparison of water washable and water-based penetrants, and how to easily tell which is which.

The easiest way is to read either the label, the product data sheet, or the certification that came with the penetrant, and to compare the product designation with the designation listed on the QPL. A water based penetrant will be identified as such. The label and product data sheet will also have instructions concerning the concentration of water that is correct to insure that the sensitivity is maintained at the level specified by the QPL. These data may also be accompanied by a concentration chart. All of these items are only used for water based penetrants. In contrast, penetrants that are non-water based are used as they are supplied, and do not have any instructions on the label or product data sheet concerning the concentration required to meet the required sensitivity level.



But one could go further by reviewing the certificate of analysis of the penetrant, since water based penetrants and non water based penetrants have different acceptance tests. Non water based water washable penetrants must have a water content of less than 1%, and a water tolerance of at least 5%. Water based penetrants will obviously have a water content more than 1%, and their water tolerance is infinite.

But if all else fails, one can make a simple test. Take a bit of penetrant and add an equal amount of water. If the result is a clear liquid, it is a water based penetrant. If the result is cloudy or gel-like, it is not water based

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Penetrant Additives

Another faithful reader and customer asked if there was an additive that could be used to facilitate the electrostatic spraying of penetrant. While the question was innocently made, the person either forget or did not understand that the penetrant in use was a QPL approved material under **AMS-2644**. As such, its composition is frozen and may not be changed without renaming the material and then having it requalified. This is a time consuming and laborious process. Adding something to the approved penetrant can have unexpected results. The sensitivity level might change, the washability characteristics may also change, and the formulation might change to be either toxic or corrosive. One cannot tell beforehand, which is why the formulations are essentially frozen to be identical with what was approved under the **AMS 2644** qualification tests.

The Penetrant Professor