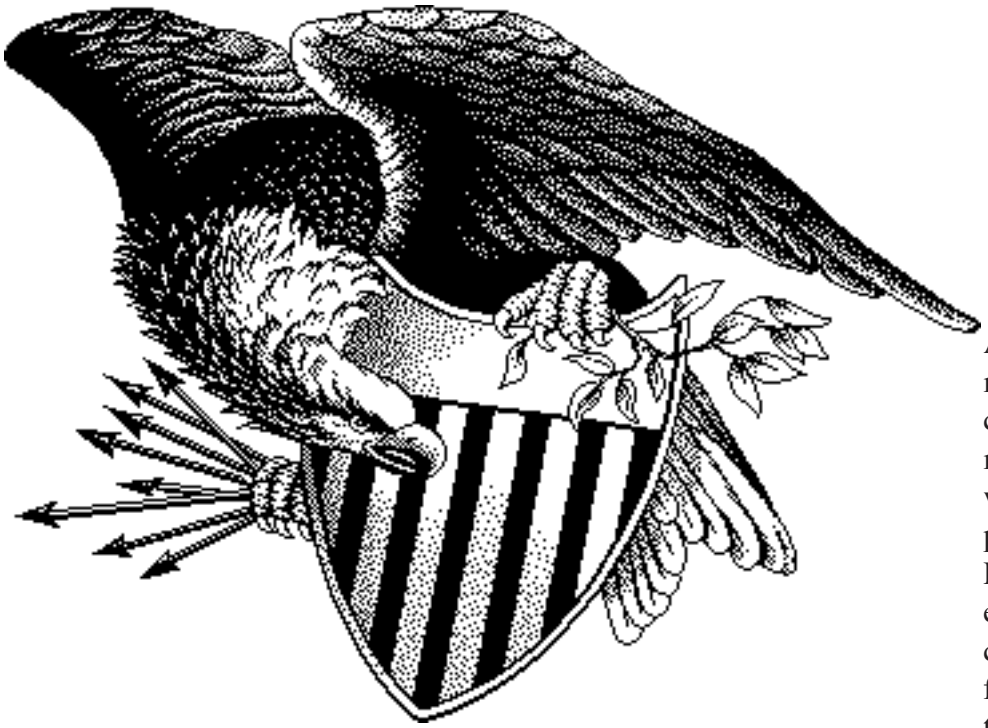
The Penetrant Professor
from Met-L-Chek®



Flag Day 14th
Fathers Day 19th
First Day of Summer 21st

Hydrophilic Emulsifier Concentration

This subject comes up from time to time and it is time to discuss it again. The hydrophilic emulsifier is used in method D post emulsifiable penetrant inspection. It is supplied as a concentrate, and needs to be diluted with water. This is where problems can arise. Met-L-Chek E-58D was qualified and listed on the QPL at a concentration of 20%. Most specifications require the emulsifier to have a concentration between 17 % and 20 % and to be tested periodically to insure that this range is adhered to.

OK, you have just received a drum of E-58D and you want to make up a tank of emulsifier at 20% concentration. The math is simple. If you combine one drum of E-58D with 4 drums of water, the result will be one drum of E-58D in 5 drums of total solution, and 1/5 equals 20%. The same logic holds for any sized container. One gallon of E-58D plus four gallons of water is also a 20% solution. With this recipe, people still can get confused and make errors. For example, we have had users who use the correct ratio of one and four, but they get it backwards and use one part of water and four parts of E-58D, and this results in an 80% concentration instead of a 20% concentration. Fortunately, we do not see this very often.

The other circumstance where people can make mistakes involves testing the solution to make sure that it is at the proper concentration, which is usually between 17 to 20%.

A refractometer is used for this measurement, together with a concentration chart. Here is where one must be careful and keep in mind what is going on. For example, suppose that a person mixes one part of E-58D with four parts of water, as explained above. Then the person checks the concentration with a refractometer, but possibly a different type of refractometer, and gets an answer of 30%, or some other value that is very different than the 20% that the person wants. Some people might decide to add more water, to reduce the concentration, but in reality this is a time to do a bit of thinking. If the mixture *really* consists of one part of emulsifier and four parts of water, the concentration **must be 20%**, and something is wrong with the instrument measurement..

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

The first thing to do is to verify that one part of emulsifier has been mixed with four parts of water, and that an error has not been made in measuring the quantities of E-58D and water. If these are verified to be correct, the mixture might not have been well mixed in the tank, and one should mix the solution more and then test the concentration again. But if the proportions of emulsifier and water have been determined to be accurate, and the solution has been well mixed, then it is appropriate to suspect the way that the concentration was measured. Perhaps the wrong kind of instrument was used, and if the instrument was different than a Brix refractometer, then the readings can give incorrect values. If the correct refractometer type is used, and the mixture has been accurately measured and mixed, the readings should give a value that is close to 20%.

What we suggest for those users who have a laboratory making these measurements is that they make their own concentration chart for each new batch of emulsifier that they receive. The manufacturing process is accurate, but small differences in the raw materials used can cause minor changes in the chart from one batch to another. To make this chart, and to have it focus on the range of concentrations desired the lab should make up several samples of diluted E-58D from

PENETRANT PROFESSOR
is an occasional publication
of **Met-L-Chek**®.
To receive it, call or Email
Beverly Clarke.

about 10% to about 25% concentration, measuring the emulsifier and water accurately. Then the refractometer can be used to determine the reading that one gets at each of these concentrations and the results plotted on graph paper as a linear relationship. This will be the standard against which the emulsifier in the tank will be checked, and if the tests of the material in the tank show some weird value that is not the same as what was measured in the lab, it will be clear that there is a problem with either the proportions used, the mixing, or the way in which the measurement was made.

See pages 3 & 4 for examples of batch variations on graph values using the same Brix refractometer. Different refractometers may shift graph values right or left of those represented here.

The Care of Hydrophilic Emulsifiers

The specifications advise about the concentration and use of the hydrophilic emulsifier, but there are other precautions that must be observed in order to maintain a properly functioning system. These precautions have to do with maintaining the health of the emulsifier. As it turns out, the essential components of the emulsifier are a very desirable food for some organisms, such as algae and fungi, whose spores can sometimes be found floating through the shop air. If these organisms get into the emulsifier, they are likely to grow by consuming those components that they enjoy for dinner (and breakfast and lunch). The results are not what one wants in a properly functioning system. First, the rapidly multiplying bugs will form clumps of sticky gooey stringy matter that are prone to float on the surface and that often smell bad. These will absorb fluorescent dyes and can give false indications during inspection. But because the bugs have consumed part of the emulsifier components, it no longer functions as intended. When a situation like this is encountered, corrective action must be taken. This involves discarding the infected emulsifier that is in the tank, cleaning and sterilizing the tank, and then refilling it with fresh emulsifier. Discarding the contaminated emulsifier is simple. Cleaning and sterilizing the tank is more involved, because you want to be sure that none of the bugs survive this step, because if they do, the new emulsifier can become infected.

The steps are as follows. First scrub the empty tank of anything that is left. Next, if possible, steam clean the tank, being sure to clean any and all of the piping involved. Then, fill the tank with water, add a couple of swimming pool chlorine tablets and let this stay overnight. Finally, drain the tank and rinse it to flush out any remaining water that still might have traces of chlorine in it. Then add a fresh charge of emulsifier. It helps if the tank can be covered when it is not in use, so that anything floating in the air will not land in it.

The Penetrant Professor