

# AQUA√CHEK™ FLUORESCENT PENETRANT PROCEDURES

*Method A, Level 1 and 2 Fluorescent Penetrants  
QPL-25135 & AMS-2644 Listed*



## GENERAL PROCEDURES AND INSTRUCTIONS FOR MAINTAINING WATER CONTENT

Aqua√Chek™ WB-100 and WB-200 are offered either in ready-to-use solutions or as "concentrates" to be diluted with water. The concentrates, labeled Aqua√Chek™ "WB-100C" and "WB-200C," offer savings in freight and storage charges, as well as some savings in material costs.

### **DILUTING CONCENTRATES — WB-100C & WB-200C**

Prior to use, Aqua√Chek™ concentrates are to be diluted by volume with equal parts of water. One 55 gallon drum of either concentrate makes 110 gallons of finished product. Potable tap water is a satisfactory diluent, although de-ionized water is preferred.

Aqua√Chek™ concentrates readily mix with water and require minimal stirring. There is no mandatory mixing procedure. However, adding the concentrate slowly to the water while stirring is the most efficient mixing method. Stir with minimum agitation to avoid foaming.

### **VERIFYING MIXTURE OF CONCENTRATE AND WATER**

A refractometer can be used to verify that the two liquids are adequately mixed and homogenous. First, make a laboratory mixture of 50% concentrate and 50% water by volume. Take a refractometer reading of the laboratory mixture.

Seek this same reading from the production mixture by taking readings from more than one location in the tank. When the readings closely match the laboratory reading as well as each other, the mixture is ready for use. (See instructions on page 3.)

### **WATER CONTENT**

Whether using ready-to-use WB-100 or WB-200, or mixing from concentrate, it is necessary to check water content regularly, as the water constituent is volatile and will evaporate. This can be done with a refractometer. How to use the refractometer and how to adjust the water-to-penetrant ratio are described on page 3 of this bulletin.

The recommended operating water content range is 45% to 54% water. A lower water percentage increases indication visibility, while higher water percentage reduces indication visibility.

Aqua√Chek™ Penetrants are formulated to be stable with water content as high as 62%. Above that percentage there will be separation, or layering, of the penetrant. Adding water or penetrant, as appropriate, will restore the water-to-penetrant balance.

While the refractometer is a practical tool to measure water content, a more precise reading can be obtained by distillation. When testing by distillation, it should be noted that, in addition to the 50% water added as diluent, the concentrated formula contains 3% water by volume as a basic constituent, which will be reflected in the distillation results. Therefore, Aqua√Chek™ in ready-to-use form actually contains 52-54% water.

### **TANK GEOMETRY**

Although nonflammable, Aqua√Chek™ Penetrants are still considered volatile because the water portion evaporates. The rate of evaporation depends on atmospheric conditions; the hotter and dryer the conditions, the faster the water evaporates.

The evaporation rate from the immersion tank depends also on the tank's shape, or geometry, as well as on surface area exposure and the open tank space above the liquid. Water will evaporate far slower from Aqua√Chek™ in a narrow, deep, partially filled tank than from a broad, shallow tank filled to the brim.

It is recommended that the tank be covered when not in use.

### **BIODEGRADABILITY**

The effluent or rinse water of Aqua√Chek™ Penetrants is readily biodegradable. It does not contain petroleum solvents or distillates. The effluent consists of biodegradable surfactants and water. Except for having fluorescent color, Aqua√Chek™ Penetrants could be considered in the same category as liquid detergents and, although acceptance will vary with sanitation districts, their effluent is more likely to be accepted

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## SPECIAL PROCESSING CONSIDERATIONS

The essential difference between a conventional oil-base, water-washable penetrant and a water-base penetrant is that one uses a light petroleum oil as a diluent, 50-60% of the formula, and the other uses water. Both employ nonionic surfactants, dyestuffs and couplers as active constituents. Nevertheless, **Aqua√Chek™** processing techniques may differ from techniques normally employed with conventional oil-base, water-washable penetrants.

### **PENETRANT DWELL**

With water-base penetrants, the full time allotted for penetrant to dwell should be spent in "drain-dwell mode:" i.e., outside the penetrant tank; not immersed in penetrant. This differs slightly from instructions for oil-base penetrants which, typically, permit one-half the dwell time to be an immersion dwell.

During the drain-dwell, some of the water constituent of the **Aqua√Chek™ Penetrant** coating the part will evaporate. Since the **Aqua√Chek™ Penetrant** is exposed to the atmosphere in a thin layer, water evaporation will be relatively rapid. As the water evaporates the penetrant coating concentrates and, as a result, both sensitivity and reliability increase.

Tests indicate that under average conditions with a 5-minute dwell, WB-200 readily meets Level 2 sensitivity requirements of AMS-2644. At the same time, while it has not been qualified as such, with a 30-minute drain dwell, WB-200's response is similar to Level 3 penetrants in intensity of indications and ability to display tight, fatigue defects.

### **SURFACE PENETRANT REMOVAL AND DRYING**

Techniques for removing surface penetrant and for surface drying are the same as for conventional penetrants. A spray wash at tap pressure, 30-40 lbs., and inspection under black light are recommended. An immersion rinse, however, is not recommended.

Also, take care not to allow water to puddle and remain on the surface. The drying procedure should be performed without unnecessary delay, as water remaining on the surface, as with conventional water-washable penetrants, tends to leach penetrant from defects.

### **DEVELOPER APPLICATION**

**Aqua√Chek™ Penetrants** have excellent—demonstrably superior in some instances—self-developing properties. This is one of the advantages of **Aqua√Chek™ Penetrants**.

Performance with nonaqueous developers, e.g., **Dubl-Chek™ D-100** and **D-106**, and with water-base or wet suspendable developers, e.g., **Dubl-Chek™ D-110A.1**, is equivalent to that of other Level 1 or 2 penetrants. Using water-soluble developers, such as **Dubl-Chek™ D-113G.1**, with water-washable (Method A) penetrants, including **Aqua√Chek™ Penetrants**, is not permitted under prevailing specifications.

Dry powder developers, such as **Dubl-Chek™ D-90G** or **D-90G.1**, are permitted. However, dry powder developers are innately hydrophobic; if they were not, they would absorb water from the atmosphere becoming clumpy and non-performing. Being hydrophobic, their affinity for water compositions is less than for oil compositions.

While **Aqua√Chek™ Penetrants**, with a 5 minute drain-dwell, meet performance requirements with dry powder developers, their performance with dry powder developer is enhanced with longer drain-dwell times, say 20 minutes. As the water content is reduced by evaporation, the affinity of the penetrant for the powder increases, and the performance of the **Aqua√Chek™ Penetrant** with powder developer is improved.

## OTHER CONSIDERATIONS

**Frequency of Readings:** Refractometer readings should be made as frequently as experience dictates, or according to governing specifications. However, considering the simplicity of the test and how quickly it can be performed, it is not impractical to take readings at the beginning of each shift.

**Frequency of Water-Addition:** Loss of water does not adversely affect the performance of **Aqua√Chek™ Penetrants**. On the contrary, both sensitivity and reliability improve as water content diminishes and the penetrant becomes more concentrated. However, as water content decreases, penetrant viscosity also increases. And increased viscosity leads to increased drag-out, and, consequently, increased penetrant consumption.

**Rate of Evaporation:** Water evaporation will vary with climatic conditions; it will be more rapid in hot, dry climates. Local conditions will determine frequency of water replacement. A rule of thumb might be to add water when water loss equals

# MAINTAINING WATER CONTENT OF AQUA√CHEK™ PENETRANTS

The following instructions apply to Aqua√Chek WB-100 and to Aqua√Chek WB-200.

The water content of water-base penetrants must be monitored and adjusted to maintain consistent performance. Water lost due to evaporation must be replaced. And, although unlikely, if water content increases by drag-in from wet parts or from inadvertent splashing, penetrant concentrate must be added.

## Maintaining Correct Water Percentage of In-Use Aqua√Chek Penetrants

After filling the tank to working volume with ready-to-use Aqua√Chek Penetrant, or with equal volumes of thoroughly mixed Aqua√Chek Penetrant concentrate and water, read the refractive index of the solution. Using a Misco\* hand-held refractometer, Model #10431, the reading should be 38.5 +/-1. If not, follow the procedure below to establish the proper water-to-penetrant balance.

Regularly determine the water content of the in-use penetrant using the refractometer. Use the accompanying graph to determine the water-to-penetrant ratio. If the reading shows a need to add water, determine the quantity as follows:

1. Measure in inches the length and width of the penetrant tank and the actual depth of the penetrant solution in the tank. Convert inches to feet by dividing by 12.
2. Multiply the length, width, and depth to determine the cubic feet occupied by penetrant.
3. Multiply the cubic measurement by 7.48 (the number of gallons in a cubic foot) to obtain the number of gallons of penetrant solution in the tank.
4. Compare the refractometer reading to the graph to find the percentage of water in the tank mixture.
5. Multiply the water percentage by the number of gallons in the tank to find the gallons of water in the tank. Subtract the gallons of water from the total gallons to obtain the gallons of concentrated penetrant.
6. Add sufficient water to raise water content to equal the concentrated penetrant gallons. See the examples below.

### Example: Adding Water...

Assume the internal measurements of the tank are 44" wide and 68" long, and the depth of the solution is 18". Dividing by 12, the respective measurements in feet would be 3.67', 5.67' and 1.5'. The cubic feet would be 31.21. With 7.48 gallons per cubic foot, the tank contains 233 gallons.

Assume a refractive index reading of 42.0. The graph shows that the mixture contains 45% water and 55% concentrated Aqua√Chek Penetrant, or 104.85 gallons of water and 128.15 gallons of penetrant. (45% of 233 = 104.85; and 55% of 233 = 128.15.)

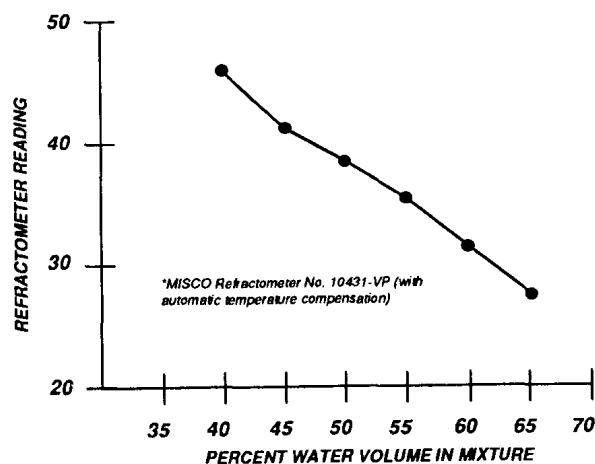
To re-establish the 50/50 mixture, add 23.3 gallons of water, so the water content will equal the concentrated penetrant volume of 128.4 gallons. (128.15 - 104.85 = 23.3) Observe the mixing instructions.

### Example: Adding Penetrant...

Although it would be unusual, should the water content of the in-use penetrant exceed the concentrated Aqua√Chek Penetrant, it will be necessary to add Aqua√Chek Concentrate.

Assume a refractometer reading of 35, indicating 55% water content by volume and 45% concentrated Aqua√Chek Penetrant. Using the same volumes as in the example above, adjust the mixture by adding 23.5 gallons of Aqua√Chek Concentrate. Observe mixing instructions.

REFRACTOMETER\* READINGS FOR WB-100 & WB-200 AT 70° F



\*Other refractometers may give slightly different readings, in which case a graph similar to the one shown here will have to be developed. Misco Model #10431 is available from Sherwin Incorporated, Fax 562-923-8370, phone 562-861-6324, or from Misco Company, 3401 Virginia Road, Cleveland, OH 44122.

## **AQUA√CHEK™ FLUORESCENT PENETRANTS**

- **AMS-2644 and MIL-I-25135-E Listed**
- **Reduced Shipping and Storage Costs**
- **Reduced Materials Costs**
- **Easy On-Site Maintenance**
- **Less Hazardous Effluent**
- **Effluent Readily Biodegradable**
- **Self-Developing Properties**

### **PRECAUTIONARY INFORMATION**

The materials described on this Product Summary should be used in accordance with instructions. Avoid contact with skin. Do not get in eyes. In case of skin or eye contact, flush thoroughly with water. Do not take internally. Consult the MSDS forms.

The products listed are for industrial use by qualified personnel only. Like all nondestructive testing methods, the penetrant process has limitations, and no penetrant manufacturer claims that the use of these materials will show all dangerous cracks or defects under all conditions.

### **LIMITED WARRANTY**

Buyer agrees that if the product proves to be defective, the manufacturer's and seller's only obligation shall be to replace the the product or refund its purchase price.