FLUORESCENT PENETRANT MATERIALS

DUBL-CHEK PENETRANT PROCESS

MIL-I-25135 - TYPE 1

PRODUCT SUMMARY

Fluorescent penetrants show surface cracks and porosity as glowing lines or dots in a darkened area under "black" (ultra-violet) light. A developing agent is not always necessary but is generally required to amplify the glowing lines or dots.

Fluorescent penetrants come in two basic formulas: "water-washable" and "nonwater-washable." Water-washable penetrants have an integral emulsifying agent and can be removed from the surface by washing with plain water. Nonwater-washable penetrants are not water-miscible and, while a plain water pressure wash will mechanically remove most of the penetrant, a separate emulsifying step is needed for a clean surface.

Water-washable fluorescent penetrants are classified under MIL-I-25135 as Type 1, Method A, while nonwater-washables are classified as Type 1, Method B and/or Method D, depending upon whether a lipophilic (oil base) or hydrophilic (water base) emulsifier is designated. Both water-washable and nonwater-washable penetrants can be classified as Method C, as this solvent wipe-off method is effective with both.

Fluorescent penetrants are also classified according to their "sensitivity," or their ability to detect the smallest flaws, with Level 1/2 being the least sensitive and Level 4 being the highest. The presecribed sensitivity level depends on manufacturing specifications.

WATER-WASHABLE PENETRANTS - METHOD A and C

SENSITIVITY LEVEL 1/2

HM-1 Fluorescent Penetrant — (approved Group V, MIL-I-25135-D & E) For relatively noncritical work. Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Low cost.

SENSITIVITY LEVEL 1

HM-2D Fluorescent Penetrant — (approved Group V, MIL-I-25135-D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Recommended for magnesium and aluminum castings with difficult surfaces.

HM-220 Fluorescent Penetrant — (approved Group V, MIL-I-25135-C, D & E) Flash Point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Very free rinsing for extremely difficult surfaces. Does **not** contain petroleum distillates and **more** likely to be accepted by sewage treatment facilities.

SENSITIVITY LEVEL 2

HM-3A Fluorescent Penetrant — (approved Group V, MIL-I-25135-C, D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Versatile, general purpose material; used extensively on aluminum and magnesium castings. Competitively priced.

HM-406 Fluorescent Penetrant — (approved Group VI, MIL-I-25135-C, D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Well recognized penetrant, approved and used by prime aerospace contractors on magnesium, aluminum and titanium castings and extrusions. More sensitive than HM-3A.

HM-412 Fluorescent Penetrant — (approved Group V, MIL-I-25135-D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. General purpose penetrant, used on aluminum, magnesium, and titanium castings and extrusions. More sensitive than HM-406.

HM-440 Fluorescent Penetrant — (approved Group VI, MIL-I-25135-C, D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Free rinsing. Does **not** contain petroleum distillates and **more** likely to be accepted by sewage treatment facilities.

SENSITIVITY LEVEL 3

HM-420C Fluorescent Penetrant — (approved Group V, MIL-I-25135-D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Low viscosity, Level 3 penetrant designed for machined, smooth surfaces.

HM-430 Fluorescent Penetrant — (approved Group V, MIL-I-25135-D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. High sensitivity penetrant, formulated for rough surfaces; the four wheel drive penetrant for rough terrain.

HM-604 Fluorescent Penetrant — (approved Group VI, MIL-I-25135-C, D & E) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Where water-washable Level 3 penetrant is designated, **HM-604** is favored, as it does not leave an interfering fluorescent background. Competitively priced! Does **not** contain petroleum distillates and **more** likely to be accepted by sewage treatment facilities.

SHERWIN INCORPORATED
5530 Borwick Ave.
South Gate, CA 90280

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SENSITIVITY LEVEL 3

HM-430 Fluorescent Penetrant — Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. High sensitivity penetrant, formulated for rough surfaces; the four wheel drive penetrant for rough terrain.

HM-604 Fluorescent Penetrant — (Group VI) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Where water-washable Level 3 penetrant is designated, **HM-604** is favored, as it does not leave an interfering fluorescent background. Competitively priced! Does **not** contain petroleum distillates and is more likely to be accepted by sewage treatment facilities. Resists over-washing.

HM-607 Fluorescent Penetrant — (Group VI) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Similar to HM-604 in formulation but more sensitive, not quite as free rinsing, and somewhat more expensive. Does **not** contain petroleum distillates and is more likely to be accepted by sewage treatment facilities. Resists over washing.

SENSITIVITY LEVEL 4

HM-704 Fluorescent Penetrant — Flash Point 200°F, OSHA Class IIIB. Low sulfur and low halogen. Ultra-high sensitivity penetrant used on very smooth surfaces. Does **not** contain petroleum distillates and is more likely to be accepted by sewage treatment facilities.

NONWATER-WASHABLE PENETRANTS - METHODS B, & D, and C

The following nonwater-washable penetrants, RC-29, RC-50, RC-65 and RC-77, are approved as Method B with ER-85 Emulsifier, Method D with ER-83A Emulsifier, or as Method C with any approved "cleaner/ remover."

SENSITIVITY LEVEL 1

RC-29 Fluorescent Penetrant — (Group V) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Competitively priced.

SENSITIVITY LEVEL 2

RC-50 Fluorescent Penetrant — (Group V) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Approved by major turbine engine manufacturers in addition to DoD.

SENSITIVITY LEVEL 3

RC-65 Fluorescent Penetrant — (Group VI, VIA, & VII) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Approved by major turbine engine manufacturers in addition to DoD.

SENSITIVITY LEVEL 4

RC-77 Fluorescent Penetrant — (Group VI, VIB, & VII) Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Approved by major turbine engine manufacturers in addition to DoD.

RC-88 Fluorescent Penetrant — Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. Ultra-high sensitivity penetrant formulated for critical inspections; increases the visibility of microscopic flaw indications.

EMULSIFIERS FOR FLUORESCENT PENETRANTS - METHODS B & D

Two emulsifiers are offered. One, a lipophilic type, or Method B, is oil based and used full strength. The other, a hydrophilic type, or Method D, is detergent based and used highly diluted with water.

ER-85 Emulsifier (lipophilic): Method B Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. For use with all of the above listed nonwater-washable, fluorescent penetrants. Used in the post-emulsification process. Relatively viscous. Minimizes over-emulsification risk by slow diffusion properties.

ER-83A Emulsifier (hydrophilic): Method D Flash point over 200°F, OSHA Class IIIB. Low sulfur and low halogen. For use with all of the above listed nonwater-washable, fluorescent penetrants. Used in the pre-wash hydrophilic emulsifier process. **ER-83A** is "non-aggressive" with minimum solvent action. It provides greater reliability. A majority of major turbine engine manufacturers have selected **ER-83A** together with RC-77 Penetrant for use on their most critical rotating parts.

ER-83A is diluted with water before use. As shown on the Qualified Products List, **ER-83A** Emulsifier may be used at a solution strength as high as 30% in water by volume. Normally, it is used at a lower strength than the 30% maximum, and for immersion applications, a 20% solution strength is typical. In the spray mode, the solution strength varies from less than 1% to no higher than 5%. (See Product Bulletin **ER-83A** for details.)

Note: QPL-25135 and AMS-2644 specifications do not establish a minimum emulsifier solution concentration, only a maximum. The maximum for **ER-83A** is 30% when used with all of the nonwater-washable penetrants listed above. User established minimum concentrations vary according to surface conditions and pre-wash completeness. For example, smooth surfaces, which accommodate effective pre-washes, may only require a 5% solution.

CLEANER/REMOVERS FOR FLUORESCENT PENETRANTS - METHOD C

Two standard "Remover/Cleaners" are provided. They are nonchlorinated solvents and are flammable

DR-60 Cleaner/Remover: Clear solvent. Method C, Class 2 Remover (nonchlorinated). Flash point about 110°F. Used both for cleaning prior to penetrant application and for penetrant removal by wipe-off method. Evaporates clean without residue. Meets applicable codes and specifications.

DR-62 Cleaner/Remover: Clear solvent. Method C, Class 2 Remover (nonchlorinated). Used both for cleaning before penetrant application and for penetrant removal by wipe-off method. Evaporates more rapidly than DR-60. Leaves no residue. Meets applicable codes and specifications.

Special Note: In accordance with MIL-I-25135/AMS-2644 and MIL-STD-6866/ASTM E-1417, the Class 1 and Class 2 Removers are outside of the "family," or same brand, concept. Sherwin's Cleaner/Removers DR-60, and DR-62 may be used with any QPL-approved penetrants.

DEVELOPERS FOR FLUORESCENT PENETRANTS

Dry Powder

D-9OG Developer: Approved "form a." Low sulfur and low halogen. Excellent surface cling.

NonAqeous Developers

Sherwin Incorporated offers two nonaqueous (volatile solvent carrier) developers. One, **D-100,** uses alcohol as the carrier, and is flammable, but gives higher sensitivity performance. The other, **D-106,** is a non- chlorinated solvent carrier formulation, and flammable. It dries more rapidly than the alcohol solvent carrier developer.

D-100 Developer: Approved for both Type I and Type II penetrants. Adsorbent white particles suspended in volatile solvent (alcohol). Maximum sensitivity performance. Lays on surface in thinner, more uniform coat. Flash point about 60°F. Apply by spraying. Meets all applicable codes and standards.

D-106 Developer: Approved for Type I and II penetrants. Adsorbent white particles suspended in volatile solvent. Lays on surface in thinner, more uniform coat. Apply by spraying. Meets all applicable codes and standards.

Water Soluble

D-113G.1 Developer (water soluble): Approved "form b." Low sulfur and low halogen. A powder which dissolves completely in water, typically one pound per gallon. After application and drying, it forms a uniform, thin white coat on the surface. Normally, only used with nonwater-washable penetrants.

Water Suspendable

D-110A.1 Developer—approved "form c" developer. Low sulfur and low halogen. A powder typically mixed with water at one pound per gallon to form a suspension. After application and drying, **D-110A.1** leaves a uniform, thin, white coating on the surface. Exercise care in choosing the proper circulating equipment for keeping developer particles in suspension.

Special Note: In accordance with MIL-I-25135/AMS-2644, MIL-STD-6866, and ASTM E-1417, developers are outside of the "family," or same brand, concept. All Sherwin developers may be used with any QPL-approved penetrant systems.

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FLUORESCENT PENETRANT MATERIALS

PRODUCT SUMMARY

PRECAUTIONARY INFORMATION

The materials described on this Product Summary should be used in accordance with instructions. Use with adequate ventilation and away from sparks, fire and open flame. Avoid contact with skin. Avoid breathing vapors or spray mist. Do not get in eyes. Do not take internally.

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.