



**SPECIFICATION:**  
**THIS ISSUE:**  
**DATE:**  
**REPLACES:**

**RW-2534**  
**3**  
**Jan' 2013**  
**2**

## **UV-SCE UV RESISTANT IDENTIFICATION**

### **1.0 SCOPE**

This specification sheet defines the product requirements and performance of the UV-SCE Identification system. This system is designed for identifying wires and cables where some exposure to UV may be expected. UV-SCE identification is for use in permanent marking applications, up to 200°C, and also exhibits good chemical resistance.

### **1.1 Markers**

The Markers are supplied flattened and mounted on a carrier in a ladder configuration fabricated from radiation crosslinked modified polymer tubing.

### **1.2 System Equipment**

The marker system comprises specific printers and ribbons (details of approved printers and ribbons are given in document reference 411-121005 which is available from TE Connectivity on request). Compliance to this specification can only be guaranteed if TE approved printers and ribbons are used.

## **2. APPLICABLE DOCUMENTS**

This specification takes precedence over documents referenced herein. Unless otherwise specified, the latest issue of the referenced documents applies. The following documents form part of this specification to the extent specified herein.

### **2.1 British Standards**

BS EN 60068-2-11 Environmental Testing - Test Methods - Tests - Test Ka - Salt Mist.

### **2.2 Military**

MIL DTL 83133	Turbine fuel, Aviation, Kerosene type JP-8 (NATO F-34), NATO F-35 and, JP-8+100 (NATO F-37)
MIL PRF 5606	Hydraulic Fluid, Petroleum based; Aircraft, Missile and Ordnance
MIL PRF 7808	Lubricating oil, Aircraft Turbine Engine, Synthetic Base
MIL PRF 83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO code number H-537
MIL-STD-202	Test Methods for Electronics and Electrical Component Part; Method 215K Solvent Resistance

### **2.3 International Electrotechnical Commission (IEC)**

IEC 60068-2-5 Simulated Solar Radiation at Ground Level and Guidance for Solar Radiation Testing

### **2.4 Society of Automobile Engineers (SAE)**

SAE AS5942	Marking of Electrical Insulating Materials
SAE AS1424	Deicing / Anti-Icing Fluid, Aircraft, SAE Type 1

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- 2.5 Under writers Laboratory standards (UL)**  
UL 224 Extruded Insulating Tubing
- 2.6 French Standards**  
NF T 46-019 Vulcanised or Thermoplastic Rubber – Resistance to Cracking – Static Elongation Test
- 2.7 American Society for Testing and Materials (ASTM)**  
ASTM D 570 Test Method for Water Absorption of Plastics.  
ASTM D 660 Test Method for Evaluating Degree of Checking of Exterior Paints.  
ASTM D 661 Test Method for Evaluating Degree of Cracking of Exterior Paints.  
ASTM D 876 Test Method for Dielectric Breakdown, Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.  
ASTM D 2671 Test Methods for Heat-Shrinkable Tubing for Electrical use.  
ASTM D 4214 Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films .  
ASTM G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Non-Metallic Materials.  
ASTM E 162 Test Method for Surface Flammability of Materials using a Radiant Heat Energy Source.  
ASTM E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials.  
ASTM E 1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products using an Oxygen Consumption Calorimeter.

### 3. REQUIREMENTS

#### 3.1 MATERIAL

The sleeving shall be fabricated from irradiated, thermally-stabilized, modified polyvinylidene fluoride compound. It shall be homogeneous and essentially free from flaws, defects, pinholes, bubbles, seams, cracks or inclusions.

#### 3.2 COLOR

The markers shall be white or yellow.

#### 3.3 FORM

The sleeves shall be cut lengths mounted on a carrier in a ladder configuration in accordance with Figure 1 and shall be suitable for automatic marking with commercially available printers.

#### 3.4 PROPERTIES

The sleeves shall meet the requirements of Table 3.

### 4. QUALITY ASSURANCE PROVISIONS

#### 4.1 CLASSIFICATION OF TESTS

##### 4.1.1 Qualification Tests

Qualification tests are those performed on finished markers or marker material submitted for qualification as a satisfactory product and shall consist of all tests listed in this specification.

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**4.1.2 ACCEPTANCE TESTS**

Acceptance tests are those performed on finished markers submitted for acceptance under contract. Acceptance tests shall consist of the following:

Dimensions  
Longitudinal Change  
Mark Adherence

**4.2 SAMPLING INSTRUCTIONS****4.2.1 QUALIFICATION TEST SAMPLES**

Qualification test samples shall consist of approximately 15m (50 feet) of continuous marker material and the appropriate number of finished markers necessary to run all tests. Qualification of any one size shall qualify all sizes.

**4.2.2 ACCEPTANCE TEST SAMPLES**

Acceptance test samples shall consist of the appropriate number of finished markers necessary to run the specified tests.

**4.3 TEST PROCEDURES**

Unless otherwise specified, the markers shall be removed from the carrier and recovered for 3 minutes at  $200 \pm 5^{\circ}\text{C}$  ( $392 \pm 9^{\circ}\text{F}$ ) for testing. All ovens shall be of the mechanical convection type. Where required by test method limitations, testing shall be done on continuous marker material.

**4.3.1 Dimensions and Longitudinal Change**

Test three markers in accordance with ASTM D 2671 for dimensions as supplied, dimensions as recovered and longitudinal change. Recover the specimens for 3 minutes at  $200 \pm 5^{\circ}\text{C}$  ( $392 \pm 9^{\circ}\text{F}$ ).

**4.3.2 Tensile Strength and Ultimate Elongation**

Test three specimens for tensile strength and ultimate elongation. The specimens shall be in accordance with ASTM D 2671, using 25.4mm (1 inch) bench marks and a 50.8mm (1 inch) initial jaw separation, and a jaw separation speed of 50mm/minute (2 inches/min.).

**4.3.3 Specific Gravity**

Measure the specific gravity of a minimum of three recovered samples in accordance with ASTM D 2671.

**4.3.4 Low Temperature Flexibility**

Prepare test strips as follows: Recover three 150mm (6 inch) long sections of tubing, and while they are still hot, slit longitudinally, and flatten between metal plates. Cool to room temperature, remove the metal plates, and cut into 6mm (1/4 inch) wide strips.

Place the specimens in a cold chamber with a 19.1mm (3/4 inch) mandrel at  $-55 \pm 2^{\circ}\text{C}$  ( $-67 \pm 4^{\circ}\text{F}$ ) for 4 hours. While still in the cold chamber, and at this same temperature, wrap the specimens around the mandrel not less than 360 degrees in approximately 2 seconds.

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**4.3.5 Heat Shock**

Mark six specimens per Section 4.3.6 and remove from the carrier. Condition the specimens for 4 hours at 250 ± 3°C (482 ± 5°F). Remove the specimens from the oven, cool to room temperature and bend three specimens through 90 degrees, in approximately 2 seconds, over a 19.1mm (3/4 inch) mandrel. Visually examine the specimens for evidence of dripping, flowing or cracking. Disregard any side cracking caused by flattening of the specimens on the mandrel. Test the other three specimens for print performance in accordance with Section 4.3.6.2.

**TABLE 1  
Suggested stranded wire size for heat aging & temperature cycling**

Product Size	Suggested Stranded Wire Size	
	AWG Size	Stranding
1/4" (6.4mm)	12	19/25
1/2" (12.7mm)	8	7 x 19/29

**4.3.6 Heat Aging**

Mark specimens per Section 4.3.6. as follows: For sizes through 12.7mm (1/2"), recover six specimens over a stranded wire as described in Table 1. For sizes above 12.7mm (1/2") supplied diameter, cut six 6.35mm (1/4") wide strips from the marked, recovered specimens. Condition all specimens for 168 hours at 200 ± 3°C (392 ± 6°F) and examine for cracks.

Test three specimens shrunk on the stranded wire for print performance in accordance with Section 4.3.6.2. Bend the other three specimens through 90 degrees, in approximately 2 seconds over a 3/4-inch (19.1-mm) mandrel, and examine for cracks. Test three specimens in strip form for print performance in accordance with Section 4.3.6.2 and bend three through 90 degrees over a 19.1mm (3/4 inch) mandrel and examine for cracks.

**4.3.7 Print Performance**

Mark nine finished markers with an appropriate Marking System in accordance with Section 1.2. Print random characters across the length of each marker to within 6.35mm (1/4") of both ends. Remove the specimens from the carrier and recover them for 3 minutes at 200 ± 5°C (392 ± 9°F).

**4.3.7.1 Mark Adherence**

Test three of the printed specimens for mark adherence to SAE AS5942, section 3.4.1, using a total of 100 rubs. Examine the specimens for legibility at a distance of 355mm (14").

Note: to remove potential test variability the print is rubbed using a modified Crockmeter rather than manual pressure.

**4.3.7.2 Solvent Resistance**

Test three specimens for solvent resistance in accordance with MIL-STD-202 Method 215, except perform the number of strokes specified in Table 3. Examine the specimens for legibility at a distance of 355mm (14").

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**4.3.8 Thermal Cycling**

Mark specimens per Section 4.3.6. as follows: For sizes through 6.4mm (1/2"), recover six specimens over a stranded wire as described in Table 1. For sizes above 6.4mm (1/2"), cut six 6.35mm (1/4") wide strips from the marked, recovered specimens. Subject all specimens to six temperature cycles. One cycle shall be as follows: 30 minutes immersed in a freezer at  $-55 \pm 2^{\circ}\text{C}$  ( $-67 \pm 4^{\circ}\text{F}$ ) followed immediately by 30 minutes in a  $200 \pm 5^{\circ}\text{C}$  ( $392 \pm 4^{\circ}\text{F}$ ) forced air oven. After the final cycle, allow the specimens to stabilize to room temperature.

Test three specimens shrunk on the stranded wire for print performance in accordance with Section 4.3.7. Bend the other three specimens through 90 degrees, in approximately 2 seconds over a 19.0mm (3/4") mandrel, and examine for cracks. Test three specimens in strip form for Mark adherence in accordance with Section 4.3.7 and bend three through 90 degrees over a 19.0mm (3/4") mandrel and examine for cracks.

**4.3.9 Dielectric Strength**

Test for dielectric strength on three tube samples in accordance with ASTM D 2671

**4.3.10 Volume Resistivity**

Test for volume resistivity on three tube samples in accordance with ASTM D 2671

**4.3.11 Corrosive effect**

Test recovered tubing samples to the copper mirror corrosion test detailed in ASTM D 2671.

**4.3.12 Water Absorption**

Calculate the average water absorption of three samples cut from recovered tube by testing them to ASTM D570.

**4.3.13 Flammability Characteristics****4.3.13.1 Flammability**

Test continuous tubing samples in accordance with UL224 section 5.11, VW-1 procedure.

**4.3.13.2 Flame Spread Index**

The surface flammability is to be measured using 25.4mm supplied diameter tube. The tube is recovered on to cement board strips prior to testing to created a flat surface for testing in accordance with ASTM E 162.

**4.3.13.3 Smoke Generation**

Samples of tubing are tested for smoke generation in accordance with ASTM E 662.

**4.3.13.4 Heat Release**

The heat release of tube samples is measured in accordance with ASTM E 1354.

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#### **4.3.14 UV Resistance**

##### **4.3.14.1 ARTIFICIAL WEATHERING**

Three samples printed as given in 4.3.6 are exposed to artificial UV-A light in accordance with ASTM G 154 in the fully recovered state. A further five recovered sample 120mm (4.75") are also mounted in the artificial weathering machine conditioned. The samples are exposed to continuous cycling of 8hr UV-A 340µm, panel temperature 60°C followed by 4hr condensation at 50°C panel temperature. UV irradiance level is 1.35 W/m<sup>2</sup>/nm.

Examine the printed specimens for legibility at a distance of 355mm (14") and assess for chalking, cracking and crazing should be assessed to ASTM D 660, ASTM D 661 & ASTM D 4214 respectively.

After the cycling period test the printed specimens for Mark Adherence in accordance with Section 4.3.7. Examine the specimens for legibility at a distance of 355mm (14"). The 120mm recovered samples should be tested for Tensile Strength and Ultimate Elongation in accordance with section 4.3.2 above.

##### **4.3.14.2 Xenon Arc**

Three samples printed as given in 4.3.6 are exposed to simulated solar radiation (Xenon arc) in accordance with IEC 60068-2-5, procedure B. After the exposure test the specimens for Mark Adherence in accordance with section 4.3.7. Examine for legibility at a distance of 355mm (14").

##### **4.3.15 Ozone**

Three samples printed as given in 4.3.6 are exposed to ozone in accordance with NFT N46-019, method A. After the exposure test the specimens for Mark Adherence in accordance with section 4.3.7. Examine for legibility at a distance of 355mm (14").

##### **4.3.16 Salt Spray test**

Four samples printed as given in 4.3.6 are recovered in the oven and then conditioned in accordance with BS EN 60068-2-11 for 96 hours. Samples were conditioned for 24 hours at 23°C and 50% relative humidity prior to testing.

After exposure to the salt spray the mark and tube were visibly assessed and the subject to Mark Adherence in accordance with section 4.3.7. Using an eraser with 4kg load on the Crockmeter (100 rubs).

##### **4.3.17 Fluid Resistance**

Completely immerse three specimens, marked and prepared in accordance with Section 4.3.6, in each fluid listed in Table 3 for 24 hours at 23 ± 3°C (73 ± 5°F). The volume of the fluid shall be not less than 20 times that of the specimens. After immersion, lightly wipe the specimens and allow to air dry for 30-60 minutes at room temperature. Test the specimens for Mark Adherence in accordance with Section 4.3.7.1.

#### **4.4 Rejection and Retest**

Failure of any sample to conform to any of the requirements of this specification sheet shall be cause for rejection of the lot represented. Markers which have been rejected may be replaced or reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and action taken to correct the defects shall be furnished to the inspector.

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**5. PREPARATION FOR DELIVERY**

**5.1 Form**

Markers shall be supplied on a carrier, figure 1, either wound on spools, or in strips.

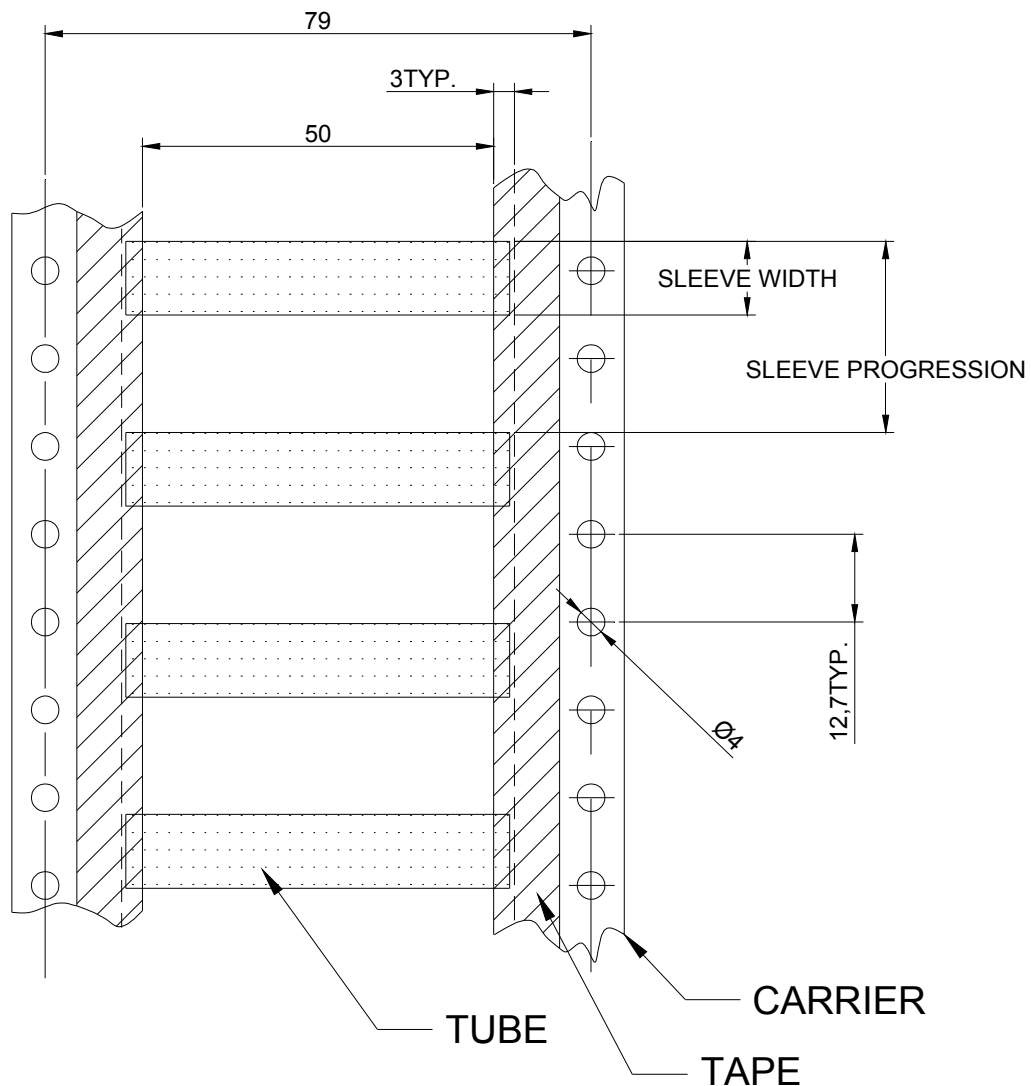
**5.2 Packaging**

Packaging shall be in accordance with good commercial practice.

**5.3 Marking**

Each container of markers shall be identified with the product designation, size, quantity, manufacturer's identification and lot number.

**Figure 1: Product layout**



All dimension shown are nominal  
 Dimensions in millimeters  
 TYP. = Typical dimension

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**TABLE 2**  
**Marker Dimensions and Configuration**

Part description	Minimum Expanded I.D.		Maximum Recovered I.D.		Minimum Expanded Sleeve Width		Recovered Wall Thickness $\pm 0.08\text{mm}$ ( $\pm 0.003$ inch)		Nominal Sleeve Progression	
	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.
UV-SCE-3/32	2.36	0.093	0.79	0.031	4.32	0.17	0.38	0.015	12.70	0.50
UV-SCE-1/8	3.17	0.125	1.57	0.062	5.84	0.23	0.38	0.015	12.70	0.50
UV-SCE-3/16	4.74	0.187	2.36	0.093	8.00	0.315	0.38	0.015	12.70	0.50
UV-SCE-1/4	6.35	0.250	3.18	0.125	10.70	0.42	0.38	0.015	17.00	0.67
UV-SCE-3/8	9.52	0.375	4.74	0.187	15.49	0.61	0.38	0.015	25.40	1.00
UV-SCE-1/2	12.70	0.500	6.35	0.250	20.30	0.80	0.38	0.015	29.70	1.17
UV-SCE-3/4	19.05	0.750	9.53	0.375	30.50	1.20	0.38	0.015	42.40	1.67
UV-SCE-1	25.40	1.000	12.70	0.500	40.40	1.59	0.43	0.017	50.80	2.00
UV-SCE-1-1/2	38.10	1.500	19.05	0.750	60.20	2.37	0.43	0.017	71.90	2.83

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**TABLE 3**  
**Requirements**

PROPERTY	UNIT	REQUIREMENT	TEST METHOD
<b>PHYSICAL</b>			
Dimensions as supplied	mm (inches)	In accordance with Table 2	Section 4.3.1 ASTM D 2671
Recovered Dimensions 3 minutes at 200 ± 5°C (392 ± 5°F)	mm (inches)	In accordance with Table 2	
Longitudinal Change 3 minutes at 200 ± 5°C (392 ± 5°F)	Percent	20 maximum	
Tensile Strength	MPa (psi)	10.4 (1500) minimum	Section 4.3.2
Ultimate Elongation	Percent	200 minimum	ASTM D 2671
Specific Gravity	---	1.8 maximum	Section 4.3.3 ASTM D 2671
Low Temperature Flexibility 4 hours at -55 ± 2°C (-67 ± 4°F)	---	No cracking	Section 4.3.4
Heat Shock 4 hours at 250 ± 3°C (482 ± 5°F) Followed by test for: Mark Adherence	---	No dripping, flowing, or cracking	Section 4.3.5
	Rubs	50 minimum, legible	Section 4.3.7.1
Heat Aging 168 hours at 200 ± 2°C (392 ± 5°F) Followed by test for: Mark Adherence	---	No dripping, flowing or cracking	Section 4.3.6
	Rubs	50 minimum, legible	Section 4.3.7.1 SAE-AS-5942
Print Performance			Section 4.3.7
SAE-AS-5942	Rubs	100 minimum, legible	Section 4.3.7.1
MIL-STD-202	Strokes	100 minimum, legible	Section 4.3.7.2
Thermal Cycling 6 cycles of: 0.5 hr at -55 ± 2°C (-67 ± 4°F) 0.5 hr at 200 ± 3°C (392 ± 5°F) Followed by test for: Mark Adherence	---	No cracking	Section 4.3.8
	Rubs	50 minimum, legible	Section 4.3.7.1 SAE-AS-5942
<b>ELECTRICAL</b>			
Dielectric Strength	kV/mm (Volts/mil)	23.6 (600) minimum	Section 4.3.9 ASTM D 2671
Volume Resistivity	ohm-cm	10 <sup>12</sup> minimum	Section 4.3.10 ASTM D 2671
<b>CHEMICAL</b>			
Corrosive Effect 16 hours at 200 ± 2°C (392 ± 4°F)	---	Non-corrosive	Section 4.3.11 ASTM D 2671 Procedure A
Water Absorption	%	1 maximum	Section 4.3.12 ASTM D 570
Flammability			
UL 224 VW-1	---	Pass	Section 4.3.13.1 UL 224 section 5.11

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**TABLE 3**  
**Requirements (continued)**

PROPERTY	UNIT	REQUIREMENT	TEST METHOD
<b>CHEMICAL (continued)</b> Flammability Flame Spread Index		35 Maximum	Section 4.3.13.2 ASTM E 162
Smoke Generation		Ds (1.5) 100 maximum Ds (4.0) 200 maximum	Section 4.3.13.3 ASTM E 662
Heat release	MJ/kg	No Requirement, results given for fire evaluation purposes. Typical value 0.32MJ/kg	Section 4.3.13.4 ASTM E 1354
<b>UV Resistance</b> Artificial Weathering  Followed by: Mark Adherence  Tensile Strength Ultimate Elongation	  Rubs  MPa (psi) %	3000hr of 8hr UV-A / 4hr condensation cycling  100 minimum, legible  10.4 (1500)minimum 150 minimum	Section 4.3.14.1 ASTM G 154  Section 4.3.7.1 SAE-AS-5942 Section 4.3.2
Xenon arc  Followed by Mark Adherence	  Rubs	1000hr exposure  20, legible	Section 4.3.14.2 IEC 60068-2-5, procedure B SAE AS 5942
<b>Ozone resistance</b>  Followed by Mark Adherence	  ---	No Cracking  20 Legible	Section 4.3.15 NF T 46-019  Section 4.3.7.1 SAE-AS-5942

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<b>Ozone resistance</b>  Followed by Mark Adherence	  ---	No Cracking  20 Legible	Section 4.3.15 NF T 46-019  Section 4.3.7.1 SAE-AS-5942
<b>Salt Spray test</b>  Followed by: Mark Adherence	  Rubs	96hr Exposure  100 minimum, legible	Section 4.3.15 BS EN 60068-2-11  Section 4.3.7.1 SAE-AS-5942

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<p><b>Fluid Resistance</b>                  24 hours at 23 ± 3°C (73 ± 5°F) in:                  JP-8 Fuel (MIL-T-5624)                  Diesel                  Hydraulic Fluid (MIL-H-5606)                  Skydrol* 500 B4                  IRM 902                  Salt Water (5% salt)                  IPA                  Detergent                  Followed by test for:                  Print permanence</p>	<p>---</p>	<p>---</p>	<p>Section 4.3.16</p>
<p>Print permanence</p>	<p>Rubs</p>	<p>20 minimum, legible</p>	<p>Section 4.3.7.1</p>

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