DEFENSE LOGISTICS AGENCY
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January 6, 2016

MEMORANDUM FOR VAI (LSA)

SUBJECT: Dated Engineering Practices Study To Solicit User Input To Determine Whether A Proposed Modification To Add A Vacuum Aided Dye Detection Examination To The Radioisotope Wet Gross Leak Test Should Be Added To MIL–STD–750–1, Test Method 1071, Condition A. Project Number 5961–2015–080.

The findings and recommendations on Engineering Practices Study, dated 6 January 2016, are enclosed.

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/ Signed /

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ENGINEERING PRACTICE STUDY

PROJECT NUMBER: 5961–2015–080

TITLE: MIL–STD–750–1, TEST METHOD 1071v14, CONDITION A PROPOSED MODIFICATION TO ADD A VACUUM AIDED DYE DETECTION EXAMINATION TO THE RADIOISOTOPE WET GROSS LEAK TEST

6 JANUARY 2016

FINAL REPORT

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I. OBJECTIVES: The objective of this EP study was to solicit user input to determine whether the proposed vacuum aided dye detection visual examination step to the radioisotope wet gross leak test should be incorporated into condition A of test method 1071 of MIL–STD–750–1.

II. BACKGROUND: Test condition A of test method 1071 of MIL–STD–750–1 cover the requirements for determining gross leak rate using a wet ^{85}Kr radioisotope procedure. This test condition is currently limited to device packages with an internal free cavity volume less than $0.05cm^3$.

The following issues with the current requirements have been identified:

1. When batch testing, isolating gross leakers can be difficult.

2. Leak path size and orientation can reduce the amount of red dye present within the device cavity. Without adequate red dye within the device cavity, the ^{85}Kr gas will not getter effectively; which can lead to test escapes.

3. False failures

The test procedure modifications being proposed are designed to increase the detection of gross leakers. The current condition A test procedure includes the following steps:

1. Device immersion and pressurization in red dye penetrant.

2. Red die penetrant removal from device(s) exterior (acetone cleaning).

3. Visual examination for evidence of red dye exiting from leaking device(s).

4. ^{85}Kr/air mixture pressurization.

5. ^{85}Kr reading utilizing a well crystal counting station.

A vacuum aided inspection step is being proposed between steps 3 and 4 above (between steps 1 and 2 in the test method). After visual examination for red dye; the device(s) shall be placed (lid down) on a white surface and evacuated in ambient air to 26 inches Hg for ten minutes. This additional step in the test sequence will detect any gross leakers via a red dye ring on the white surface.

The summary of condition A issues (attachment 1), justifying examples (attachment 2) and proposed modification (attachment 3) to condition A are included.

III. RESULTS: An initial draft of the EP Study project was posted on the DLA Land and Maritime website. Inputs were solicited from all currently listed parties on DLA Land and Maritime's FSC 5961 stock class email distribution list, which included military services, manufacturers, original equipment manufacturers, and the user community. No records of any response or interest are available to support the addition of the proposed methodology.

IV. CONCLUSIONS: The results of this EP Study do not support the addition of the proposed methodology covering the vacuum aided dye detection visual examination step into condition A of test method 1071 of MIL–STD–750–1.

V. RECOMMENDATIONS: Work with all interested parties to create another proposal that warrants justification for adding the proposed methodology.

ATTACHMENT 1

RADIOISOTOPE WET GROSS LEAK TEST PROCEDURE ISSUES

1. Isolating gross leakers in a batch of devices is difficult when red dye effervescences. If a failure is missed during the initial visual inspection screening it will be more difficult to identify a gross leaker during the second visual inspection due to cross contamination.

2. Depending on the free internal cavity volume, orientation and size of the gross leak path(s), it is possible to completely drain a gross leaker leaving only a trace amount of red dye incapable of acting as an effective Kr85 getter during re-pressurization.

3. Not all devices with "leaking" red dye are non-hermetic. Ceramic devices/lids can contain worm holes capable of retaining red dye. Lid solder seals can have dead end solder voids that retain red dye.

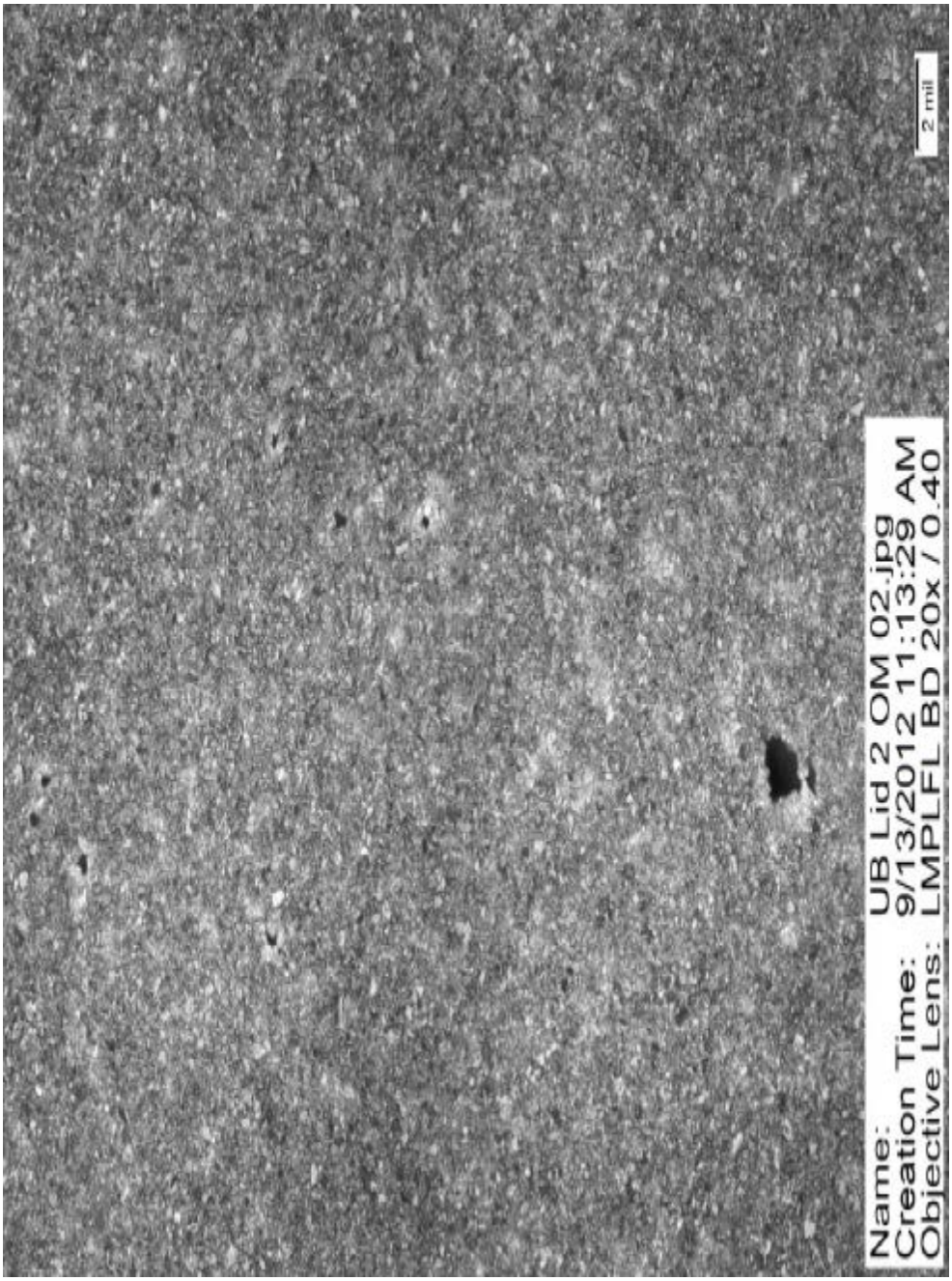
ATTACHMENT 2

EXAMPLES OF "DIFFICULT TO FIND" RED DYE LEAKING DEVICES

1. Dead end voids. This is an example of a solder void capable of entrapping red dye without breaching hermeticity:

ATTACHMENT 2 – Continued.

2. Ceramic worm hole voids. This is an example of a void in a ceramic lid which is capable of entrapping red dye without breaching hermeticity:



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ATTACHMENT 3

MODIFIED RADIOISOTOPE WET GROSS LEAK TEST PROCEDURE.

Key for the proposed modification MIL–STD–750–1, test method 1071, paragraph 4.2:

New text to be added is identified in yellow highlighting. Example of text to be added.

Text to be deleted is identified by red text, highlighted light blue with strike-out. ~~Example of text to be deleted.~~

4.2 Procedure. The following ~~four~~ five steps shall be followed:

Step 1: The devices shall be immersed in the red dye penetrant solution and evacuated to a pressure of 100 mm of Hg or less for 10 minutes and then pressurized with air for 10 minutes minimum at 45 psia (310 kPa) minimum. The devices shall be removed from the red dye penetrant solution and placed in a fine-screen basket and flushed with acetone by applying a fine-spray of acetone to remove the surface film of the solution. It is recommended that the devices in the fine-screen basket be held over funnel, with the funnel inserted into a large Erlenmeyer flask, (thus minimizing the acetone vapors released into the room). Do not allow any acetone to contaminate the red dye penetrant solution. Immediately following the wash, the devices shall be emptied onto a white surface (such as paper towels), and examined carefully for evidence of red dye penetrant solution exiting from any leaking devices. Any devices with red dye penetrant solution leaking from them shall be rejected as gross leakers.

Step 2: All devices post visual inspection shall be placed on a white surface (lid down) and evacuated in ambient air to 26 in Hg for 10 minutes. Any gross leak devices will be easily visible via a red dye ring on the white surface and shall be rejected as gross leakers.

Step ~~2~~ 3: The devices shall then be placed in the radioisotope pressurization tank, (with all excess free volume displaced with aluminum filler blocks), and the tank evacuated to a pressure of 0.5 mm of Hg. The devices shall then be pressurized to a minimum of three atmospheres absolute pressure of ^{85}Kr/air mixture for 12 minutes minimum. The gas mixture shall then be transferred to storage until a pressure of 2.0 mm of Hg maximum exists in the tank. This transfer shall be completed in 2 minutes maximum. The tank shall then be filled with air, and the devices immediately removed from the tank and measured within 5 minutes after gas exposure, with a scintillation “well” crystal equipped counting station. It is recommended that batch sizes be kept small enough to allow all devices to be measured within 5 minutes. Any device indicating 500 counts per minute (cpm) or greater above the ambient background of the counting station shall be considered a gross leaker. If all of the devices cannot be measured within 5 minutes, they shall be retested starting at the beginning of step ~~2~~ 3.

Step ~~3~~ 4: Failing devices may cross contaminate compliant devices with red dye penetrant solution. Devices which contain red dye penetrant solution may effervesce after being pressurized with ^{85}Kr and may lose the ^{85}Kr trapped within them. The devices shall be emptied onto a white surface (such as paper towels), and examined carefully for any red dye penetrant solution exiting from any leaking devices. Any devices with red dye penetrant solution leaking from them shall be rejected as gross leakers. Gross leak failures with a internal free cavity volume less than 0.05 cm^3 shall be visually inspected at 30X to confirm that the red dye penetrant solution is actually leaking from the device.

Step ~~4~~ 5: If any devices are rejected by steps 1 through ~~3~~ 4, the procedure (starting with step ~~2~~ 3) shall be repeated until no more gross leakers are found.