

ENGINEERING ORDER

SHEET 1 OF 2

| | | | | | | | | | |
|--|------------------------|----------------|--------------------------------|--|--|------------------------------------|--------------|-----------------------|---|
| Title: ENVIRONMENTAL STRESS SCREENING (ESS) PROCEDURE, LMS | | | | Document No.: PR 459 | | Rev. Ltr: A | | Engrg Order No.: 6166 | |
| | | | | No. of Sheets: 7 | | Size: A | | Release Date: 5/23/00 | |
| Requested By: | Name: JOHN FITZPATRICK | Date: 05/19/00 | Disposition of existing parts: | Use: | Rwk: | Scrap: | Noted Below: | Effectivity: SN 001 | Use of Form <input type="checkbox"/> Release Notice <input checked="" type="checkbox"/> Change Notice <input type="checkbox"/> Variation EO (VEO) (Doc not to be Changed) <input type="checkbox"/> Adv. Change (ACEO) <input type="checkbox"/> Use as Noted Below |
| Written By: | RANDY DAVIS | 05/19/00 | On Order | | X | | | Planner Init. | |
| Checked By: | <i>[Signature]</i> | 5/24/00 | In Process | X | | | | Used On: LMS | |
| Project Eng: | <i>[Signature]</i> | 5/22/00 | In Stock | X | | | | S.O. | |
| | <i>[Signature]</i> | 5/22/00 | Release For | <input type="checkbox"/> Prototype <input checked="" type="checkbox"/> Production | <input type="checkbox"/> Info Only <input type="checkbox"/> Other (see below) | <input type="checkbox"/> Quotation | | Customer | |
| | | | | | | | | RDC No. | |

PRODUCTION RELEASE OF REVISED PROCEDURE

PAGE 3, SECTION 5.1.4: DELETED TEXT AS SHOWN BELOW

"... ALL VISIBLE SCREWS AND RETAINERS
 HAVE BEEN STAINED WITH EPOXY..."
 ↓ DELETED

PAGE 3, SECTION 5.2: DELETED ORIGINAL SECTION 5.2.1
 WAS "APPLY STRIP COAT TO THE EXPOSED OPTICAL
 SURFACES TO PREVENT SPALLING."

RENUMBERED REMAINING SECTIONS TO REFLECT DELETION
 OF ORIGINAL SECTION 5.2.1
 (I.E. ORIGINAL SECTION 5.2.2 IS NOW NEW SECTION 5.2.1, ETC.)

| Distribution | | | Class of Change | | Reason(s) For Changes | | | CCB Approval | | |
|-------------------|----------|-------|-----------------|----------|--|--|---|--|---------|--|
| To | # Copies | Init. | Class I | Class II | <input type="checkbox"/> Cost Reduction | <input type="checkbox"/> Reliability | <input checked="" type="checkbox"/> Methods | Signed | Date | |
| Contracts Adm | 1 | PW | | | <input type="checkbox"/> Error | <input type="checkbox"/> Product Improvement | | Prod. Mgr. <i>[Signature]</i> | 5/22/00 | |
| Mfg | 1 | RS | | | <input type="checkbox"/> Tooling | <input type="checkbox"/> Other (see below) | | Mfg. <i>[Signature]</i> | 5/22/00 | |
| Mfg Engrg | | | | | AFFECTED DRAWINGS/REMARKS CHRIS, PLEASE FORWARD TO GARWARD LABS | | | Q.A. <i>[Signature]</i> | 5/22/00 | |
| Quality Assurance | | | | | | | | ENGINEERING ORDER | | |
| Buyer | 1 | CS | | | | | | KAISER ELECTRO-OPTICS, INC. | | |
| Planner | 1 | JKF | | | | | | A KAISER AEROSPACE & ELECTRONICS COMPANY | | |
| | 1 | JZ | | | FSCM NO. 66689 | | | | | |

ENGINEERING ORDER #6166 SHEET 2 OF 2

PAGE 3,

SECTION 5.2.1: TEXT IS "... 12.5 in Hg/min..."

AND

SECTION 5.2.2 WAS "... 4 psi/minute..."

PAGE 4, SECTION 5.2.14: ADDED TEXT "HOLD AT AMBIENT
FOR 1 HOUR."

PAGE 4, SECTION 5.3.3: TEXT IS "... 30 in lbs..."

WAS "... 20 in lbs..."

TEXT IS "... 20 in lbs..."

WAS "... 11 in lbs..."

PAGE 4, SECTION 5.3.5: ADDED TEXT

"THE CONTROL... (THRU)... OF THE
THREE FLANGES);"

PAGE 7: ADDED DASH NUMBER AS SHOWN BELOW

REQ P/N 111-6714-1-2 ADDED

Revisions

| Version | Description | Date | Approved |
|---------|---------------------------------------|----------------|------------|
| N/C | Production Release per EO 6090 | 4/10/00 | JKF |
| A | Production Release per EO 6166 | 5/21/00 | JKF |

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MAY 25 2000

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|------------------------------------|-------|--|--|--|--|--|--|--|--|--|--|
| Revision Status of Sheets | Rev | | | | | | | | | | |
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|------------------------------------|------------------------------|--|----------------|---------------------|
| Contract #: | | KAISER ELECTRO-OPTICS, INC. | | |
| DR: C. Volta 1/24/2000 | PE: | | | |
| CHK: J. Fitzpatrick 4/10/00 | OE: C. Volta 4/10/00 | Environmental Stress Screening (ESS) Procedure, LMS | | |
| ME: J. Fitzpatrick 4/10/00 | MFG: G. Brown 4/10/00 | | | |
| EE: | QA: A. DeLiso 4/10/00 | | | |
| | J. Zeldler 4/10/00 | Code ID: | Size: A | PR 459 |
| APD Customer: | | First Used On: | | Sheet 1 of 7 |

1. SCOPE

This procedure describes the methods to be used for environmental stress screening (ESS) of the Lightning Mapper Sensor (LMS) lens assembly. Unless otherwise specified, the procedures shall be completed in the order listed, prior to performance of the ATP. The first unit, S/N 001, will be subjected to the Qualification Vibration Levels as listed in paragraph 5.3.6, while the remainder will be tested at the Operational Level. Prior to ESS, all units will undergo Pre-ESS Functional Testing that includes measuring the on-axis and ± 0.95 full field Modulation Transfer Function and Back Focal Length. Next, all units will undergo ESS testing, and then Acceptance testing per PR 460.

2. APPLICABLE DOCUMENTS

| | |
|------------|---|
| NAS8-98236 | Contract – Lens/Filter, Lightning Mapper Sensor |
| 111-6714 | Top Assembly, LMS |
| 111-6826 | Interface Control Drawing – LMS Lens Assembly |
| PII 2001 | Internal Inspection of Optics Assemblies |
| PR 460 | Acceptance Test Procedure, LMS |

3. TEST FACILITIES

The temperature cycling procedures described herein shall be performed at Kaiser Electro-Optics Inc., Carlsbad, California. The vibration test shall be performed at a qualified environmental test facility.

4. EQUIPMENT

| | |
|---------|---|
| 5002229 | Vibration Holding Fixture |
| 5002097 | Vibration Fixture Base |
| SM-16C | Temperature/Humidity Test Chamber, Thermotron |

5. PROCEDURE

5.1 Preliminary Inspection

- 5.1.1 Note that the top assembly consists of two pieces, the Lens Subassembly and the Solar Reject Filter.
- 5.1.2 Record the S/N and date the ESS procedure is initiated on the ESS data sheet (DS-1).
- 5.1.3 Review the operation sheet to ensure all steps prior to ESS have been completed and signed off.

- 5.1.4 Inspect the LMS lens assembly for completion to the requirements of drawing 111-6714. Verify that all visible screws and retainers are per the drawing. Verify that the four vent filters are staked with epoxy as per the drawing and that excess epoxy has not blocked the breathing paths.
- 5.1.5 Verify that the optics are free of contamination and bond line defects in excess of surface quality requirements. Note or map all obvious defects. Lightly shake the assembly, and verify there are no loose components.

5.2 High/Low Temperature – Survival, and Thermal Cycle - Operational (Paragraph 3.4.2 of NAS8-98236)

- 5.2.1 Evacuate the lens assembly in the vacuum oven at a rate of 12.5 in Hg/min to achieve 25 inches minimum of mercury and hold vacuum for 5 minutes minimum.
- 5.2.2 Pressurize the lens assembly using dry nitrogen at a rate of 12.5 in Hg/min to achieve ambient pressure (14.7 psi).
- 5.2.3 Repeat steps 5.2.2 through 5.2.3 but increase pressure slightly above ambient (positive pressure) and hold for 1 minute. Remove the lens assembly from the vacuum oven and immediately proceed to the next step.
- 5.2.4 Carefully place the lens and solar reject filter on the center rack of the SM16C chamber. Ensure that the dryer switch is turned on. Record the date and time the test was started.

Survival: (Reference Figure 1)

- 5.2.5 The chamber shall be programmed to transition from ambient to +50° C at a rate of 5° C per minute.
- 5.2.6 The lens assembly shall be maintained at +50° C for 120 minutes (interval 1).
- 5.2.7 The chamber shall be programmed to transition to -35° C at a rate of 5° C per minute (interval 2).
- 5.2.8 The lens assembly will be maintained at -35° C for 120 minutes (interval 3).

Operational: (Reference Figure 1)

- 5.2.9 The chamber shall be programmed to transition to +50° C at a rate of 2° C per minute (interval 4).
- 5.2.10 The lens assembly will be maintained at +50° C for 30 minutes (interval 5).
- 5.2.11 The chamber shall be programmed to transition to -35° C at a rate of 2° C per minute (interval 6).

- 5.2.12 The lens assembly will be maintained at -35° C for 30 minutes (interval 7).
- 5.2.13 Intervals 4-7 shall be repeated for two more cycles for a total of three complete thermal cycles for the Operational portion of this procedure.
- 5.2.14 The lens shall be returned to ambient temperature at a rate of 2° C per minute. Hold at ambient for 1 hour.
- 5.2.15 Record the date and time the test was completed, and remove the lens from the chamber.
- 5.2.16 Remove the strip coating, and inspect the lens assembly as per step 5.1.4. Record the results and any comments on the data sheet.

5.3 Random Vibration (Paragraph 3.4.7 of NAS8-98236)

- 5.3.1 Cover the exposed optical surfaces and protect the unit for transport.
- 5.3.2 Transport the lens assembly, the vibration holding fixture (P/N 5002229), and the vibration base (P/N 5002097) to the qualified environmental test facility. Ensure the required mounting hardware and hand tools are included.
- 5.3.3 Install the lens assembly on the vibration holding fixture using 8 each # 10-32 by 0.75 inch long screws. Utilizing a crossing pattern, torque each screw to 30 in. lbs. Install the Solar Reject Filter on the side mounting surface of the Vibration Test Holding Fixture using 8 each # 8-32 by 7/16 inch long screws. Utilizing a crossing pattern, torque each screw to 20 in. lbs.
- 5.3.4 After the base plate is mounted to the shaker table, attach the holding fixture to it.
- 5.3.5 Attach accelerometers to the fixture and lens assembly housing. The control accelerometer is to be attached to the vibration fixture within 2 inches of the lens mounting flange. The response accelerometer is to be attached to the detector mounting flange (smallest of the three flanges).
- 5.3.6 Subject one axis of the lens assembly to the input listed, for a duration of 60 seconds. Record the time the test was started on the data sheet.

Random Vibration, Qualification Level - First Unit

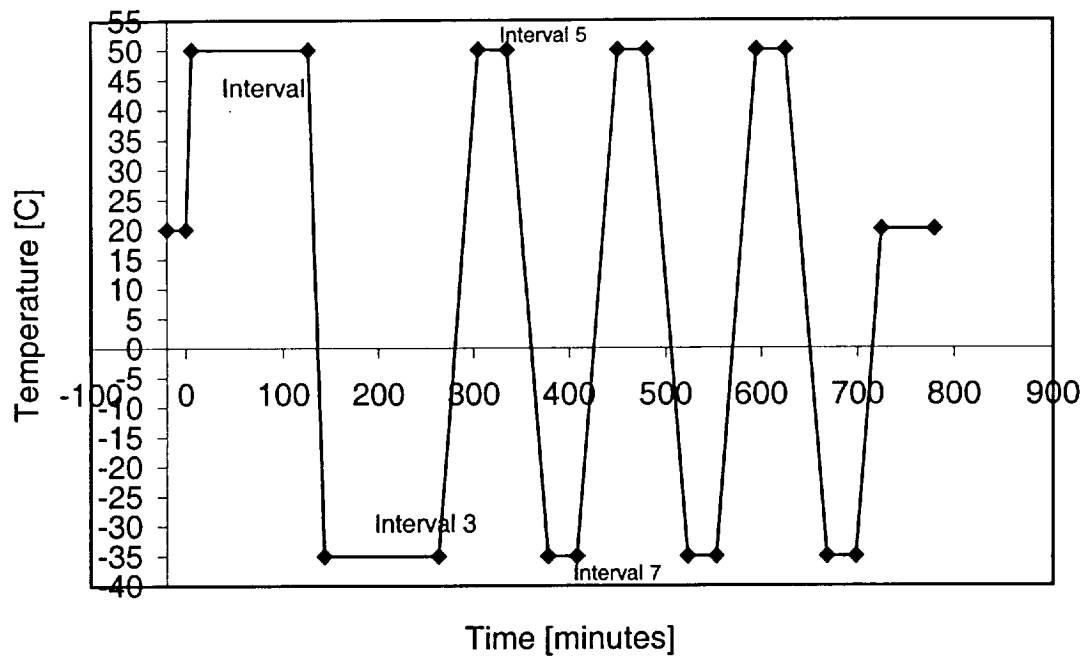
| <u>Frequency (Hz)</u> | <u>10.97 G_{RMS} g²/Hz</u> |
|-----------------------|---|
| 20 | 0.01 |
| 70 | 0.1 |
| 110 | 0.1 |
| 200 | 0.18 |
| 400 | 0.18 |
| 2000 | 0.01 |

Random Vibration, Operational Level - Second-Eighth Units

| <u>Frequency (Hz)</u> | <u>6.5 G_{RMS}</u> <u>g²/Hz</u> |
|-----------------------|---|
| 20 | 0.0081 |
| 50 | 0.05 |
| 500 | 0.05 |
| 2000 | 0.003 |

- 5.3.7 Record the time of completion, and obtain plots of the vibration input and response for each test completed.
- 5.3.8 Examine the lens and record any observations on the data sheet. Do not proceed with additional vibration cycling if evidence of failure is evident.
- 5.3.9 Repeat the test on each of the two remaining orthogonal axes.
- 5.3.10 Disassemble the apparatus and protect the lens assembly. Return the lens and fixtures to KEO.
- 5.3.11 Inspect the lens assembly as per step 5.1.4. Record the results and any comments on the data sheet.

Figure 1: LMS Thermal Cycles - Survival & Operational



5.4 Final Verification

- 5.4.1 Verify that the ESS testing has been successfully completed and properly documented. Forward the lens assembly for ATP per PR 460.

LMS ESS Data Sheet (DS-1)

KEO P/N: 111-6714-1

Rev.: _____

Date: _____

NASA P/N: _____

S/N: _____

Pre-ESS Functional Test Complete:

Stamp: _____ Date: _____

Preliminary Inspection (Sec 5.1):

Pass ☐ Fail ☐

Stamp: _____ Date: _____

High/Low Temperature – Survival, and Thermal Cycle - Operational Test (Sec 5.2)

Chamber Calibration Status: Pass ☐ Fail ☐

Test Start Date: _____ Test Start Time: _____

Test End Date : _____ Test End Time: _____

Survival temperature cycle completed: Yes ☐ No ☐

Operational temperature cycle completed: Yes ☐ No ☐

Inspection Results: Pass ☐ Fail ☐ Stamp: _____ Date: _____
(Attach Charts)

Random Vibration Test (Sec. 5.3)

Vibration Equipment Calibration Status: Pass ☐ Fail ☐

“x” Axis Test Start Time: _____ Test End Time: _____

“y” Axis Test Start Time: _____ Test End Time: _____

“z” Axis Test Start Time: _____ Test End Time: _____

Inspection Results: Pass ☐ Fail ☐ Stamp: _____ Date: _____

Comments/Observations:

REPORT DOCUMENTATION PAGE

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