

INCH-POUND

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PERFORMANCE SPECIFICATION

DETECTOR-DEWAR DT-594/UA

This specification is approved for use by USACECOM, Department of the Army and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the technical and operational performance characteristics, manufacturing, quality assurance, and test requirements for a Detector-Dewar DT-594/UA, which is one type of common module (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL-LC-LEO-E-EP, Fort Monmouth, New Jersey, 07703 by using the self-addressed Standardization document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A:

FSC 5855

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto cited in the solicitation (see 6.2).

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2.2 Other government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5093.)

2.3 Nongovernment publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS, cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

Standard Procedures for Testing Infrared Detectors and Their Performance, R. C. Jones, D. Goodwin, and G. Pullen, dated 12 September 1960, Office of the Director of Defense Research and Engineering.

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2) in the contract or purchase order, a sample shall be subjected to first article inspection in accordance with 4.4.

3.2 Materials. The Detector-Dewar shall use a 180-element detector array of photoconductive mercury-cadmium-telluride. Recovered materials shall be used to the maximum extent possible.

3.3 Design. The Detector-Dewar DT-594/UA (Detector-Dewar) is an opto-electronic device sensitive to radiation in the 7.5-to 12.0-micrometer spectral region and intended for use in infrared systems. The Detector-Dewar components shall meet the following design performance requirements.

3.3.1 Detector array. 180-elements with detector bias resistors an integral part.

3.3.2 Power source. +5.0 $\pm$ 0.2 Volts Direct Current (Vdc).

3.3.3 Electrically activated getters. At least two reusable electrically activated getters shall be an integral part of the Detector-Dewar for periodic maintenance of the vacuum (see 6.2). The getter activation current (amperes) and time (minutes) shall be provided on the label specified on Drawing SM-D-806561.

3.3.4 Detector orientation. The detector array orientation with respect to the Dewar mounting flange shall be variable through 360-degrees.

3.3.5 Operating temperature. Unless otherwise specified herein, the Detector-Dewar shall be operated at 80 (+5, -20) Kelvin (K).

3.4 Weight. The weight of the DT-594/UA shall not exceed 0.75 pound including the bias resistor.

3.5 Performance characteristics.

3.5.1 Detector-Dewar defects. The Detector-Dewar shall contain no more than 12 defective elements as defined in 6.3.2, with no more than 4 hard defects.

3.5.1.1 Central element defects. In the central 18 elements of the array there shall be no hard defects and no more than 2 soft defects. The central 36 elements shall contain no hard defects and no more than 4 soft defects. A maximum of two hard defects may be located in elements 1-72 and a maximum of two may be located in elements 109-180.

3.5.1.2 Defect separation. Hard defects shall be separated from one another by 4 elements and shall be electrically strapped to an adjacent element with common ground. Soft defects located within the central 36 elements shall be separated from any other defect by at least 4 nondefective channels. Soft defects shall not be strapped (see 6.3.3) unless the strapping is from an adjacent hard defect at the end of a group of 5 commonly grounded elements (see 6.3.2.1 and 6.3.2.2).

3.5.2 Time constant. The time constant for each detector element shall not be greater than 2 microseconds.

3.5.3 Sensitive area. The sensitive area of the detector elements shall fall within the dimensions. SM-D-806561 may be used for guidance.

3.5.4 Crosstalk. The crosstalk signal level between any two elements shall be less than -26 dB.

3.5.5 Specific detectivity (D^*). The 500K blackbody specific detectivity of all nondefective elements shall be not less than $8.5 \times 10^9 \text{ cm Hz}^{1/2}\text{W}^{-1}$. The average specific detectivity of all elements of the array, which are not hard defects shall be greater than $1.1 \times 10^{10} \text{ cm Hz}^{1/2}\text{W}^{-1}$ (see 6.3.2).

3.5.5.1 Noise. The detector noise of each element shall be not less than 2.5×10^{-9} volts rms $\text{Hz}^{-1/2}$ (see 6.3.2).

3.5.6 Detector resistance. The detector resistance of each element shall be not less than 20 ohms and not greater than 150 ohms (see 6.3.2).

3.5.7 Responsivity. The average of the 500 K blackbody responsivities of the acceptable elements shall be not less than 8.3×10^3 volts/watt nor greater than 20×10^3 volts/watt. The blackbody responsivity of each element shall not vary from the mean by more than ± 20 percent of the mean value (see 6.4).

3.5.8 Temperature sensors. At least two calibrated 2N2222 temperature sensor chips shall be installed at or near the detector array location in the Dewar to provide an electrical signal which is an analog of temperature. The temperature sensor shall have a junction voltage of 1.060, ± 0.015 volt with a 1 ma ± 0.01 mA forward current when the Detector-Dewar is operated at 77, ± 3 K. The voltage shall be recorded on the appropriate label on the detector.

3.5.9 Spectral response. Each element of the Detector-Dewar shall have a spectral sensitivity of 7.7, ± 0.3 to 11.7 ± 0.5 micrometers.

3.5.10 Detector bias. The current shall not exceed 4.0 milliamperes on any single element. The total bias power dissipated by the array shall not exceed 100 milliwatts. The detector resistor bias pack shall be operated at +5.0, ± 0.2 Vdc. Each detector element shall be biased with current flow in the same direction.

3.5.11 Dewar warm and cold shields. The clear aperture (warm shield) shall meet the following requirements: Cold shielding is optional (at the discretion of the detector manufacturer) but, when used, shall also conform to these same requirements.

a. In the direction of the axis of the array (either (1) or (2)).

(1) For each element, the cold shield(s) shall allow no vignetting of any ray to the center point on the detector surface within an angle of 18 degrees measured from and on either side of a line perpendicular to the array's axis and parallel to the optical axis.

(2) Each element shall be allowed to accept radiation from a 1.00, ± 0.05 inch diameter stop centered on the Detector-Dewar's optical axis and located a maximum of 1.60 inches behind the plane of the detectors.

b. In the direction perpendicular to the axis of the array.

The cold shield(s) shall allow for each element, no vignetting of any ray to any point on the detector surface within an angle of 23 degrees measured from and on either side of a line perpendicular to the array's axis and parallel to the optical axis.

3.5.12 Heat load. The detector heat load shall not exceed 0.40 watt when all 180 detector elements are operating at their final bias current and the Dewar is cooled to 80, ± 5 K.

3.5.13 Vacuum integrity. The Dewar shall comply with heat load requirements of paragraph 3.5.12 for a period of at least one (1) year.

3.5.14 Microphonics. When cooled to a temperature of 60-80 K, biased in accordance with paragraph 3.5.10, and vibrated in accordance with paragraph 4.6.14.1, all elements of the Detector-Dewar shall have no noise peaks above the white noise reference value greater than 8dB from 300 to 10,000 Hz, and 12dB from 10,001 to 20,000 Hz (see 6.3.2).

3.5.15 Cooldown. When mated to a cryogenic cooler (MIL-C-49175) capable of cooling a test mass of 1440 (+25, -0) Joules of copper thermal mass (300 K to 80 K) from ambient to 80 K in not less than 12 nor greater than 14 minutes, the dewar cooldown time, from ambient temperature to 80 K shall not exceed the time achieved with the test mass.

3.6 Environmental considerations.

3.6.1 Temperature shock. The Detector-Dewar shall not be damaged (see 6.3.6) by sudden changes in temperature between -54°C and +71°C.

3.6.2 High temperature. The Detector-Dewar shall not be damaged by storage or operation to +71°C.

3.6.3 Low temperature. The Detector-Dewar shall not be damaged by operation to -54°C or storage to -62°C.

3.6.4 Shock. The Detector-Dewar shall not be damaged by high intensity shocks of 100 g's peak amplitude with 11 milliseconds duration and by bench handling tests.

3.6.5 Vibration. The Detector-Dewar shall not be damaged by vibration over the frequency spectrum at the specified g levels and amplitudes shown in figure 1.

3.7 Reliability. The Detector-Dewar shall have a specified mean time between failure (MTBF) of a least 27,600 hours.

3.8 Treatment and painting. The Detector-Dewar shall be treated and painted so that it is suitable for the environment. SM-D-806561 may be used as a guide.

3.9 Preconditioning. Each Detector-Dewar shall be subjected to random vibration and temperature cycling in accordance with figure 2 prior to group A testing.

3.10 Nameplates and product marking. Unless otherwise specified, the Detector-Dewar module, parts, components, subassemblies, and assemblies thereof shall be marked for identification and reference designation markings. SM-D-806561 may be used as a guide.

3.11 Workmanship. The equipment shall be free from defects that will affect equipment serviceability, interchangeability, or appearance. MIL-HDBK-454 may be used as a guide(see 6.2).

4. VERIFICATION

4.1 Classification of inspection. Inspection shall be classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified herein, the Detector-Dewar shall meet the specified performance requirements at an ambient temperature of $+23^{\circ}\text{C}$, $\pm 5^{\circ}\text{C}$, when operated at a temperature of 80, $\pm 5\text{K}$, and biased to -5.0 , ± 0.2 Vdc.

4.3 First article inspection. When specified in the contract, the first article inspection shall be performed by the contractor on a minimum of 5 preconditioned sample Detector-Dewars. Each selected detector shall be preconditioned by subjecting it to random vibration and temperature cycling in accordance with figure 2 prior to Group A testing.

4.3.1 Inspections. All materials, parts, processes and assemblies shall be examined for conformance by visual inspection as noted in Table I.

TABLE I. Inspections.

Inspection Requirement	Requirement Paragraph	Inspection Criteria (see 6.2)
Any part or component missing or damaged	3.11	MIL-STD-252 *
Weight not as specified	3.4	MIL-STD-252 *
Marking not as specified	3.10	
Workmanship not as specified	3.11	MIL-STD-454 *
Treatment and painting not as specified	3.8	
Dimensions not as specified	3.12	
Getters and label not as specified	3.3.3	SM-D-806561 *
Detector orientation range not as specified	3.3.4	SM-D-806561 *
Sensitive area not as specified	3.5.3	SM-D-806561 *
Dewar warm and cold shields not as specified	3.5.11	SM-D-806561 *

* May be used for guidance.

4.3.2 Test. First article inspection shall be conducted upon units which have successfully completed the inspections specified in 4.3.1. Tests may be conducted in any order, except that microphonics shall be performed after shock and vibration (4.6.4 and 4.6.5). Failure of any tests shall constitute first article failure.

TABLE II. First article inspection.

Inspection	Requirement Paragraph	Test Paragraph
Detector-Dewar defects	3.5.1	4.5.1
Time constant	3.5.2	4.5.2
Sensitive area	3.5.3	4.5.3
Crosstalk	3.5.4	4.5.4
Specific detectivity	3.5.5	4.5.5
Noise	3.5.5.1	4.5.5
Detector resistance	3.5.6	4.5.6
Responsivity	3.5.7	4.5.7
Temperature sensors	3.5.8	4.5.8
Spectral response	3.5.9	4.5.9
Detector bias	3.5.10	4.5.10
Dewar warm and cold shields	3.5.11	4.5.11
Heat Load	3.5.12	4.5.12
Vacuum Integrity	3.5.13	4.5.13
Microphonics	3.5.14	4.5.14
Cooldown	3.5.15	4.5.15
Temperature shock	3.6.1	4.6.1
High temperature	3.6.2	4.6.2
Low temperature	3.6.3	4.6.3
Shock	3.6.4	4.6.4
Vibration	3.6.5	4.6.5
Reliability	3.7	4.7

4.3.3 Disposition of first article samples. First article samples shall not be considered part of the procurements quantities (see 6.2).

4.4 Conformance inspection. Every item requirement contained in Section 3 of this specification has a conformance test or inspection identified in paragraph 4.5. The subparagraph headings are traceable to the paragraph/subparagraph headings contained in Section 3.

4.4.1 Inspection. Inspection shall be as specified in 4.3.1.

4.4.2 Tests.

4.4.2.1 Group A inspection. Group A inspection shall be conducted on all Detector-Dewars following successful inspection of 4.4.1 and preconditioning of 4.8. Group A tests listed in Table III may be performed in any order except that Detector-Dewar defects (4.5.1) shall run last. Failure of any test shall be cause for rejection of that unit.

TABLE III. Group A inspection.

Inspection	Requirement Paragraph	Test Paragraph
Microphonics	3.5.14	4.5.14
Specific detectivity	3.5.5	4.5.5
Detector resistance	3.5.6	4.5.6
Responsivity	3.5.7	4.5.7
Temperature sensors	3.5.8	4.5.8
Detector bias	3.5.10	4.5.10
Heat load	3.5.12	4.5.12
Detector-Dewar defects	3.5.1	4.5.1

4.4.2.2 Group B inspection. Group B inspection is not required.

4.4.2.3 Group C inspection. Group C inspection shall be conducted on Detector-Dewars selected from units which have passed tests in 4.4.2.1. Group C inspection monthly sample size to be established based on cumulative production totals of concurrent contracts. The tests of 4.5.9, 4.5.13 and 4.5.15 shall be performed on the sample quantity. The test of 4.6.5 shall be performed prior to the Group C inspections on every third lot.

4.4.2.3.1 Sampling for group C inspection. A specified lot quantity shall be defined as one-month's production unless the contract specifies a different lot basis such as one-week's production or those units processed as a single batch. The tests of 4.5.9, and 4.5.13 and 4.5.15 shall be initially performed at a reduced sample rate of 3 percent of the specified lot or one unit, which ever is the larger quantity.

a. When zero failure occurs, the 3 percent or one unit inspection sampling shall continue.

b. Failure of any unit to pass the inspection of either 4.5.9 or 4.5.15 shall require 100 percent inspection of the entire lot for the failed attributes only, with continued follow-on lots inspected until zero failure occurs in any lot. Upon achieving zero failure at 100 percent inspection, follow-on lot inspection shall be conducted at 10 percent sampling. Thereafter, upon achievement of zero failure during 10 percent sampling, the sample rate shall be lowered to 3 percent of the specified lot or one unit, whichever is larger. However, if one or more failures occur during the 10 percent inspection sampling, the 100 percent inspection testing shall be reinstituted.

4.4.2.3.2 Group C failures. Actions required relative to Group C failures shall be as specified in the contract or purchase order.

4.4.2.3.3 Disposition of group C samples. Group C samples shall be accepted on contract subsequent to the tests of Table III.

4.4.2.4 Group D inspection. Group D inspection not required.

4.5 Performance characteristics.

4.5.1 Detector-Dewar defects. The detector array shall be checked for defects. Failure to meet requirements of 3.5.1 shall constitute failure of this test.

4.5.2 Time constant. Measurement shall be performed on 5 elements of the array each separated by at least 20 elements. The time constant is defined as the time required for the element response to reach 63 percent of its steady state value when irradiated by a 7.5 to 12 micrometer source which produces a signal-to-noise ratio not greater than 100:1. This time constant shall be considered equal to the time constant defined by the high frequency rolloff of the noise spectrum of the detector. Any measurement technique consistent with these definitions shall be considered acceptable. Failure to meet requirements of 3.5.2 shall constitute failure of this test.

4.5.3 Sensitive area. The physical area as defined in drawing SM-D-806561 shall be determined by optical microscope examination. Measurement shall be made on 3 elements of the array each separated by at least 20 elements prior to the integration of the Dewar window with the Detector-Dewar. Failure to meet requirements of 3.5.3 shall constitute failure of this test.

4.5.4 Crosstalk. Measurements shall be made on 4 elements of the array. The crosstalk shall be measured under the following conditions:

a. An element shall be irradiated by a 7.5 to 12 micrometer source having a signal level 20 times greater than the noise level for the element. The image of the source shall fall entirely within the area of that detector element.

b. The signal level of the element adjacent to and on the same ground path of the irradiated element shall be measured. The element under test shall meet the requirements of 3.5.4.

Failure to meet requirements of 3.5.4 shall constitute failure of this test.

4.5.5 Blackbody specific detectivity (D^*). Noise measurements shall be made on each element of the array under the following conditions: detector cooled to 77, ± 3 K with LN_2 , 295, ± 5 K background temperature and equivalent noise bandwidth of 9kHz ± 200 Hz with a low frequency 3-dB point (high pass) no greater than 80Hz. Using the results of these measurements and the nominal detector size (see 6.3.7), the 500K blackbody specific detectivity for each element of the array shall be calculated. Nominal detector element size is defined as 0.0016 by 0.0023 inch. Failure to meet the requirements of 3.5.5 shall constitute failure of this test.

4.5.6 Detector resistance. The resistance of each element of the array shall be measured. Failure to meet requirements of 3.5.6 shall constitute failure of this test.

4.5.7 Responsivity. Blackbody responsivity of each element of the array shall be measured when the detector is cooled to 77 ± 3 K. Nominal detector element size (see 6.3.7) shall be used in responsivity calculations and blackbody temperature shall be 500, ± 5 K. Failure to meet requirements of 3.5.7 shall constitute failure of this test.

4.5.8 Temperature sensors. The 77K calibration point shall be determined by cooling the inner Dewar with liquid nitrogen. One milliamper ± 0.01 milliamper bias shall be applied to the sensor diode and the voltage shall be monitored and recorded at the 77 K calibration point. Failure to meet requirements of 3.5.8 shall constitute failure of this test.

4.5.9 Spectral response. The spectral response of element numbers 36, 91, and 146 shall be tested per "Standard Procedures for Testing Infrared Detectors and Describing Their Performance", by R. C. Jones, D. Goodwin, and G. Pullen, dated 12 September 1960. Office of the Director of Defense Research and Engineering. If these are hard defects, an adjacent element may be substituted. The spectral sensitivity is defined as the 50-percent relative response points and shall be measured on the assembled Detector-Dewar. Failure to meet requirements of 3.5.9 shall constitute failure of this test.

4.5.10 Detector bias. The detector bias shall be tested per "Standard Procedures for Testing Infrared Detectors and Describing Their Performance", by R. C. Jones, D. Goodwin, and G. Pullen, dated 12 September 1960. Office of the Director of Defense Research and Engineering. Failure to meet requirements of 3.5.10 shall constitute failure of this test.

4.5.11 Dewar warm and cold shields. During in-process inspection, the warm and cold shields shall be measured to ensure conformance with the requirement. Alignment of the cold shield relative to detector elements shall be checked 100 percent during in-process inspection. Failure to meet requirements of 3.5.11 shall constitute failure of this test.

4.5.12 Heat load. The heat load of the Detector-Dewar shall be determined with all detectors operating at specified bias. The heat load of the Detector-Dewar shall be determined by partially filling the Dewar's inner stem with liquid nitrogen and monitoring the rate of loss of the cryogen. The heat load shall be calculated from the average or integrated loss rate of the cryogen for the last 5 minutes of the Dewar's hold-time. For calculations, cooling produced by the nitrogen phase change only shall be considered as total useful energy. If this test is performed with the detector array unbiased, the results of this test shall be added to the results of the detector bias power test to determine the heat load. Failure to meet requirements of 3.5.12 shall constitute failure of this test.

4.5.13 Vacuum integrity. Heat load shall be measured on the unbiased Detector-Dewar. The temperature of the Detector-Dewar shall then be elevated to $+71^{\circ}\text{C}$ for a period of 72 hours. At the completion of the temperature exposure and stabilization at ambient temperature, the heat load shall be measured again. Getters may not be fired during this test. Failure of the Detector-Dewar to meet requirements of 3.5.13 or a 15 percent increase in heat load between the measurement before and after temperature exposure shall constitute failure of this test.

4.5.14 Microphonics. Microphonics shall be measured while the detector is vibrated in accordance with paragraph 4.5.14.1. The Detector Dewar shall be cooled to 60 - 80 K with full operating bias applied. Mounting to the cooler shall be made by tightening the mounting screws to a torque of 10.00 ± 2.0 inch pounds. Vibrational excitation shall be measured by an accelerometer mounted on the mounting plate of the Detector-Dewar. The white noise reference level may be determined by averaging the noise of each channel from 12,000 to 20,000 Hz with vibration applied. Noise spectra shall be measured using a bandwidth between 50 Hz and 365 Hz. Failure of any channel to meet the requirements of 3.5.14 shall constitute failure of this test.

4.5.14.1 Microphonics vibration. The Detector-Dewar shall be coupled to a mechanical cryogenic refrigerator (HD-1033) that produces random vibrational excitation of the Detector-Dewar in three mutually perpendicular axis. The frequency distribution of the vibrations shall be in a range from 0 to 20,000 Hz. The RMS Sum of the three axis vibration shall be at least 2 G RMS. Each axis shall produce a minimum vibrational excitation of 0.7 G RMS. In the frequency range of 2,000 to 20,000 Hz, the RMS sum shall be at least 1.7 G RMS. The Dewar shall be mated to the cooler with a metal bellows (P/N SM-C-806033) (see 6.2).

4.5.15 Cooldown. An HD-1033 cryogenic cooler shall be mated to the standard test mass. The capacity of the HD-1033 shall be such that the 20 gram (1440 joules) test mass is cooled from ambient (296 K) temperature to $80 \pm 1/2$ K in not less than 12 nor greater than 14 minutes. This measurement shall be made using highly polished metal Dewar with no radiation shielding. This test Dewar and station shall consist of a high vacuum of less than 10 microtorr and a 20 gram copper test mass, (see MIL-C-49175B 6 March 1986, paragraph 4.5.1). The time to cool the test mass shall be recorded. The voltage output of the temperature sensor diodes in the Detector-Dewar under test shall be measured at 77 ± 1 K and at ambient temperature. The voltage output at 80 K shall then be interpolated. The cooler shall then be coupled to the Detector using thermal grease and bellows. Operating bias power shall be applied and the time

for the temperature of the diode to reach 80 K shall be recorded. Failure of the diode to cool within the requirements of 3.5.15 shall constitute failure of this test (see 6.2).

4.6 Environmental tests. The environmental tests shall be performed in accordance with MIL-STD-810 as modified by this specification. The performance tests required by MIL-STD-810 before and after each environmental test shall be those listed in Table III. During environmental test, the units need not be energized or cooled down and will not be subjected to any performance monitoring (see 6.2).

Damage criteria is defined as breakage, loosening, shifting, evidence of corrosion, of failure of any finish, hardware, connection or component; and any degradation of Detector-Dewar performance to values less than specified.

4.6.1 Temperature shock. The Detector-Dewar shall be tested in accordance with MIL-STD-810, Method 503.1, Procedure I used as a guide. The temperature of step 2 shall be -54°C and the temperature of steps 1 and 4 shall be +71°C. Failure to meet requirements of paragraph 3.6.1 and damage criteria defined above shall constitute failure of this test (see 6.2).

4.6.2 High temperature. The Detector-Dewar shall be tested in accordance with MIL-STD-810, Method 501.1, Procedure I used as a guide. The temperature in steps 4 and 5 shall be +71°C. Failure to meet the requirements of paragraph 3.6.2 and damage criteria defined above shall constitute failure of this test (see 6.2).

4.6.3 Low temperature. The Detector-Dewar shall be tested in accordance with MIL-STD-810, Method 502.1, Procedure I used as a guide except that the storage temperature of step 2 shall be -62°C and the low operating temperature of step 4 shall be -54°C. Failure to meet the requirements of paragraph 3.6.3 and damage criteria defined above shall constitute failure of this test (see 6.2).

4.6.4 Shock. The Detector-Dewar shall be tested in accordance with MIL-STD-810, Method 516.2, Procedure IV, Figure 516.2-1 (100 g's peak value at 11 milliseconds time duration) and Procedure V used as a guide. Failure to meet the requirements of paragraph 3.6.4 and damage criteria defined above shall constitute failure of this test (see 6.2).

4.6.5 Vibration. The Detector-Dewar shall be tested in accordance with MIL-STD-810, Method 514.2, Procedure I and VIII used as a guide, except that the curve shown in figure 1 of this specification shall be used in lieu of the MIL-STD-810 curves. The sinusoidal cycle time shall be 120 minutes per axis. The dwell time shall be 1/6 of the cycling time at each axis. Failure to meet the requirements of paragraph 3.6.5 and damage criteria defined above shall constitute failure of this test (see 6.2).

4.7 Reliability. A reliability prediction and math model shall be maintained by the contractor with MIL-STD-756 used for guidance. Failure of the prediction or model to explicitly delineate compliance with paragraph 3.7 shall constitute failure of the reliability requirement (see 6.2).

4.8 Preconditioning. Each Detector-Dewar shall be subjected to preconditioning environments of 3.9 and figure 2.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2) When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The Detector-Dewar is intended for use in infrared systems.

6.2 Acquisitioning requirements. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.2.2).
- c. Packaging requirements (see 5.1).
- d. First article tests are required.
 - (1) Time frame for submission of first article test reports when first article tests are required.
 - (2) Time frame for approval of first article test reports when first article tests are required.
 - (3) First article reliability testing if required.
 - (4) When first article rough handling tests are not required.
 - (5) When first article packaging inspection reports require Acquisition Activity approval prior to production unit packing.

- e. Production delivery schedule.
 - (1) Defined in terms or monthly lots.
 - (2) Actions required relative to group C failures (see 4.4.2.3.2).
- f. Deliver all first article samples to - Commander, USACECOM, ATTN: AMSEL-LC-IEW-N-TI, Fort Monmouth, NJ 07703.
- g. The microphonic requirement, 3.5.14 is required for procurement of all modules to this specification made directly by the Government. The requirement in 3.5.14 may be waived by system contractors ordering modules to this specification for use in the manufacture of completed systems if these systems meet system performance requirements which include an equivalent microphonics check.
- h. The reusable getters are to be able to withstand seven (7) firings after shipment for periodic maintenance of the vacuum (see 3.3.3).
- i. Cooler Bellows drawing number SM-C-806033 is used to mate the Dewar under test to the cryogenic cooler (see 4.5.14.1).
- j. Cryogenic Heat Load Assembly (1 Watt Integral) is required to conduct Cooldown test (see 4.5.15).
- k. Detector-Dewar, DT-594/UA drawing number SM-D-806561 is used for construction (see 3.3).
- l. MIL-C-49175, Cooler, Cryogenic, Mechanical HD-1033/UA, paragraph 4.5.1 is needed to conduct Microphonics test (see 4.5.14.1) and Cooldown test (see 4.5.15).
- m. Methods of Preservation-Packing is used for packaging inspection (see 5.1).
- n. ANSI/ASQCZ1.4, Sampling Procedures and Tables for Inspection by Attributes.
- o. MIL-STD-252, Classification of Visual and Mechanical Defects for Equipment, Electronic, Wired and Other Devices is used for inspection criteria (see 4.3.1).
- p. MIL-HDBK-454, Standard General Requirements for Electronic Equipment, are used to judge the quality of workmanship.
- q. MIL-STD-756B, Reliability Modeling and Prediction is used for the reliability prediction (see 4.7).

r. MIL-STD-810C, Environmental Test Methods is used for environmental tests (see 4.6).

6.2.1 Level B preservation. When level B preservation is specified, this level of protection will only be used under known favorable conditions during transportation, storage and handling.

6.2.2 Environmental. Environmental pollution measures are contained in the packaging material specifications referenced herein. Refer to material specifications or preparing activity for recommended disposability methods.

6.2.3 SM-D-806561 contains design and construction information.

6.3 Definitions.

6.3.1 Element. An element is defined as one channel in the i80 element detector-Dewar.

6.3.2 Defective element. A defective element is defined as an element which fails to meet any of the requirements of 3.5.5, 3.5.5.1, 3.5.6, 3.5.7, and 3.5.14. A defective element may be classified as either hard or soft.

6.3.2.1 Hard defect. A hard defect is an element which fails the requirements of 3.5.5.1, 3.5.6, 3.5.7, or 3.5.14 or which has a 500 K blackbody specific detectivity less than $6.0 \times 10^9 \text{ cm Hz}^{1/2}\text{W}^{-1}$. Two elements shorted together are considered a hard defect.

6.3.2.2 Soft defect. A soft defect is one which meets all requirements of 3.5.6, 3.5.7 and 3.5.14, and has a 500 K blackbody specific detectivity equal to or greater than $6.0 \times 10^9 \text{ cm Hz}^{1/2}\text{W}^{-1}$, but less than $8.5 \times 10^9 \text{ cm Hz}^{1/2}\text{W}^{-1}$.

6.3.3 Strapping. Strapping is defined as electrically connecting a defective element to a nondefective element. The pair of strapped elements thus formed, exhibiting 100 percent crosstalk, are considered as a single defect.

6.3.4 Array axis. The array axis is defined as a line on the surface of the array passing through the center of the projected geometrical areas of each element.

6.3.5 Optical axis. The optical axis is defined as a line perpendicular to the detector mounting plate that intersects the array axis at the mid-point of the array. One-half of the active detector elements are located on each side of the optical axis.

6.3.6 Damage. Breakage, loosening, shifting, evidence or corrosion, or failure of any finish, hardware, connection or component; and any degradation of detector-Dewar performance values less than specified herein.

6.3.7 Nominal detector element size. Defined as 0.0016 by 0.0023 inch.

6.3.8 Specified lot quantity. The specified lot quantity is one-month's production unless the contract specifies a different lot basis such as one-week's production or those units processed as a single batch.

6.3.9 Detector temperature. Detector temperature is defined as that indicated by the temperature sensor diode.

6.3.10 Existing suppliers. Suppliers who are currently supplying equipment to this specification with a minimum average monthly rate of 10 units per month over the most current 12-month period. If a supplier cannot maintain monthly average, moves their production facilities, has significant management/personnel changes, and/or has significant changes in productions methods-tooling-processes, a first article test (less reliability) performed annually will sustain the existing supplier's status when performed on five (5) units manufactured by the supplier explicitly for this test. Upon implementation of this specification, suppliers who are then supplying equipment to specification B2-28a050102, MIL-D-49172, or MIL-D-49457 with the minimum monthly delivery rate specified above, are considered as existing suppliers.

6.4 Variation of responsivity with temperature. When coupled to a cryogenic refrigerator, the temperature of the array may reach 55 K. Under those conditions the responsivity (paragraph 3.5.7) may decrease to as low as 5.6×10^3 volts/watt.

6.5 Subject term (key word) listing.

Detector-Dewar
Dewar
Infrared systems
Infrared detectors
Opto-electronic

Custodian:
Army - CR

Preparing activity
Army - CR

Project 5855-0158

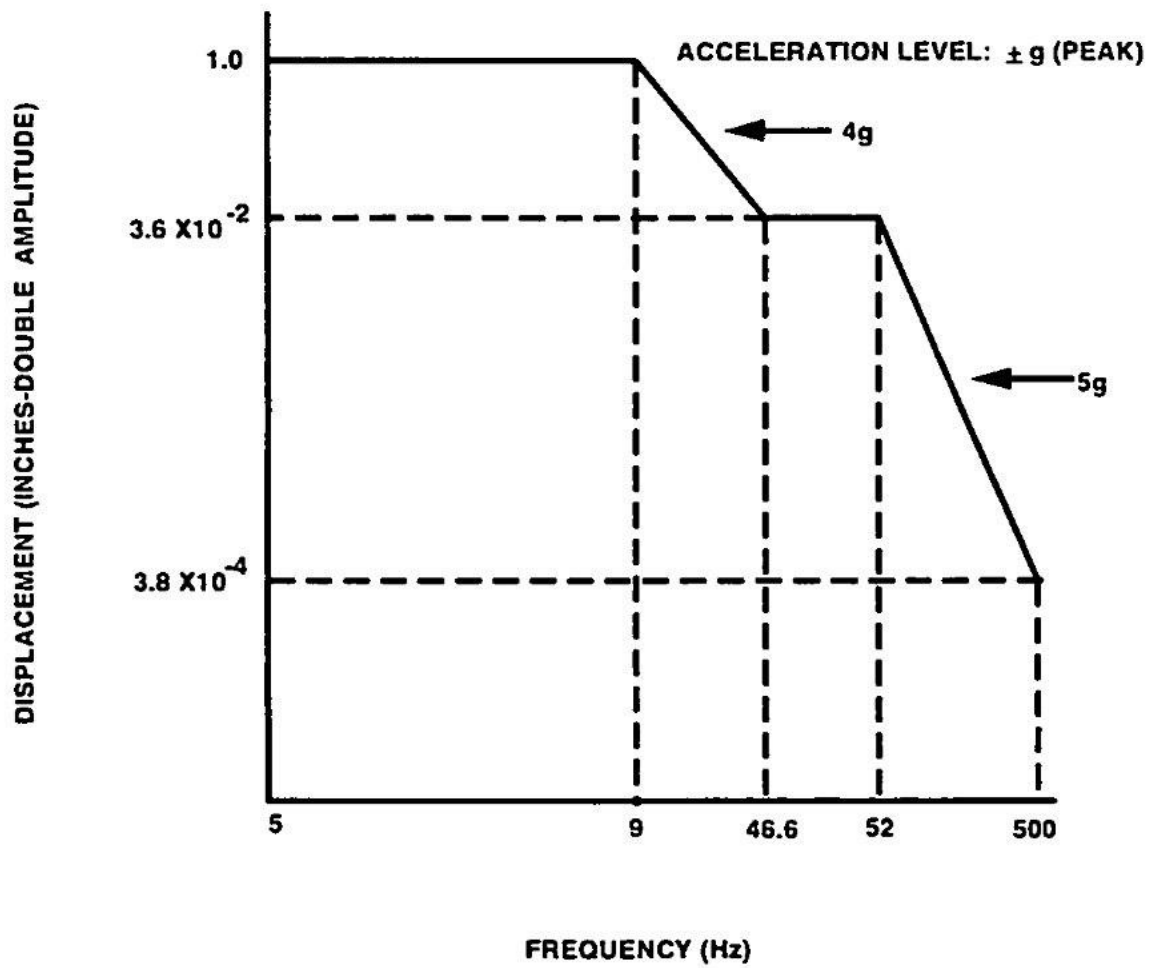
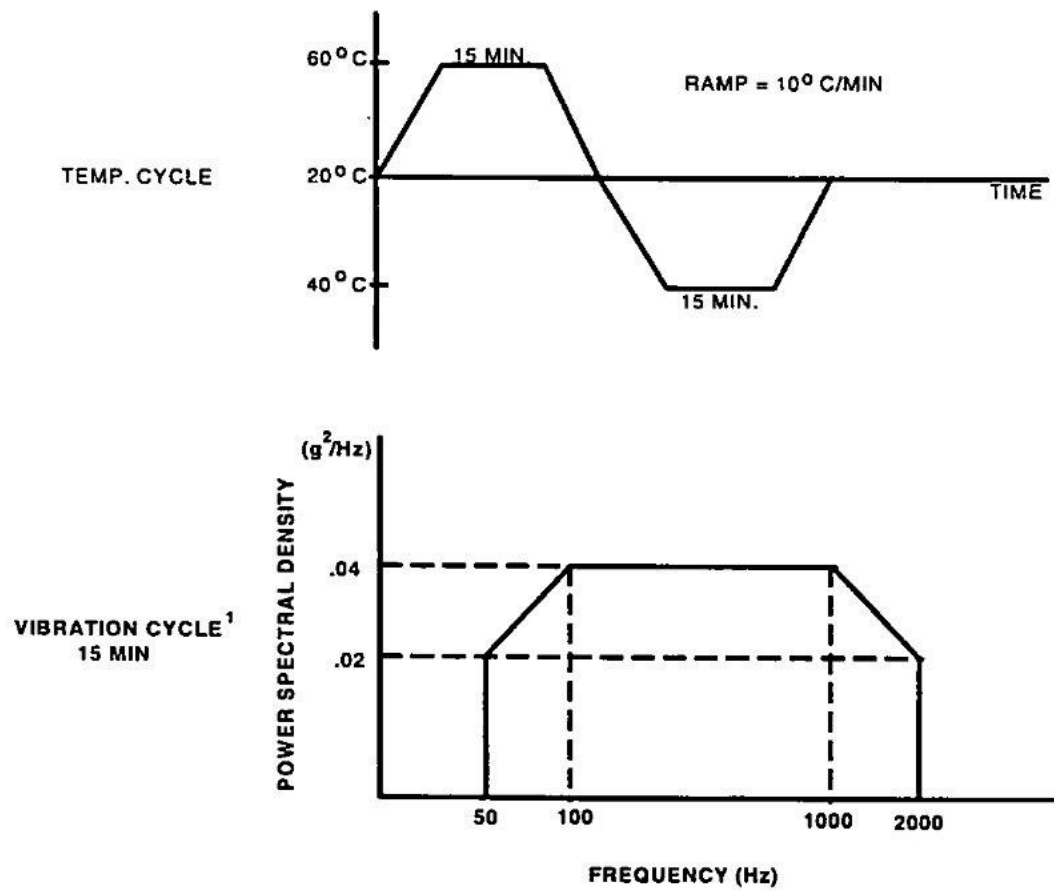


FIGURE 1. Vibration test profile.



NOTES

1. VIBRATION PERFORMED ALONG DETECTOR COLD WELL AXIS.
2. TEMP. CYCLE PRECEEDS VIBRATION CYCLE.

FIGURE 2. Preconditioning cycle.