INCH-POUND

MIL-DTL-25708F
28 May 2008
SUPERSEDING
MIL-DTL-25708E
2 October 2006

DETAIL SPECIFICATION

ANTENNAS, BLADE, L-BAND, GENERAL SPECIFICATION FOR

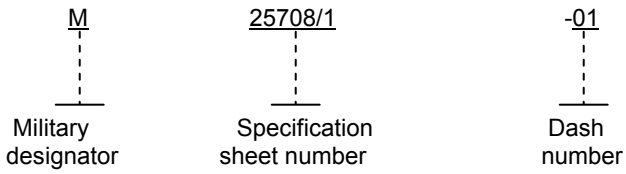
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This document covers the general requirements (for externally mounted) blade type L-band antennas (see 6.1).

1.2 Classification. Antennas covered by this document are classified by style, as specified (see 3.1).

1.3 Part or Identifying Number (PIN). PINs to be used for Antenna acquired to this specification sheet, and as an assigned dash number (see 3.1) are created as follows:



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-3643	-	Connectors, Coaxial, Radio Frequency, Series HN and Associated Fittings, General Specification for.
MIL-PRF-5606	-	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance.
MIL-DTL-5624	-	Turbine Fuel, Aviation, Grades JP-4 and JP-5.
MIL-PRF-39012	-	Connectors, Coaxial, Radio Frequency: General Specification for.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Columbus, DSCC-VAT, P.O. Box 3990, Columbus, OH 43218-3990 or emailed to TubesAmps@dla.mil. Since contact information can change, you may want to verify the currency of this address information using ASSIST Online database http://assist.daps.dla.mil.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130 - Identification Marking of U. S. Military Property.
MIL-STD-810 - Test Method Standard for Environmental Engineering Considerations and Laboratory Tests.

(Copies of these documents are available online at http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

ASTM INTERNATIONAL

ASTM-B85 - Aluminum-Alloy Die Castings (DoD adopted).

(Applications for copies should be addressed to the ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or http://www.astm.org.)

IEEE INTERNATIONAL

IEEE 149 - Test Procedures for Antennas.

(Institute of Electrical and Electronic Engineers (IEEE) standards are available from IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331 or online at http://standards.ieee.org.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3 and approved by the responsible qualifying activity listed in 6.4.

3.3 Materials. Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used to enable the antennas to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of acceptance of the finished product.

3.3.1 Metals. Unless otherwise specified, the metals shall be as follows (see 3.1):

a. The base shall be aluminum alloy in accordance with ASTM-B85, alloy SC84B.

b. The cover shall be suitable material that will resist erosion of impinging particles at velocities up to Mach 2.

3.3.2 Nonflammable material. Materials shall be nonflammable when tested in accordance with accepted industry methods.

3.3.3 Fungus inert material. The antenna materials shall be fungus inert.

3.3.4 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of antenna components and of solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum 3 percent lead, by mass (see 6.5).

3.4 Design and construction. The antenna shall be of design and physical dimensions specified in the applicable specification sheet (see 3.1). The construction of the antenna shall be of either unit or two piece construction. The elements considered are the base and cover (radiating element).

3.4.1 Radio Frequency (RF) connectors. Connectors for a specific antenna shall be as required (see 3.1). Materials, design, and construction of the types listed below shall conform to the specifications as follows:

Type of RF connector	Specification
HN	MIL-DTL-3643
BNC	MIL-PRF-39012
Subminiature	Omni-spectra 260-2 or equivalent

3.4.1.1 Connector caps. All connectors shall be supplied with push-on plastic caps to prevent connector damage and the entrance of moisture and foreign material during storage.

3.4.2 Temperature operating range. The antenna shall operate without electrical or mechanical deterioration over the specified temperature range in accordance with the applicable specification sheet (see 3.1).

3.4.3 Seal (see 4.6). All openings of the antenna cavity shall be sealed to prevent air leakage during all changes in surface pressure encountered in air operations between pressure altitudes of 0 to 100,000 feet.

3.4.4 Static load (see 4.7). The mechanical strength of the antenna shall withstand a uniformly distributed side load in accordance with the applicable specification sheet (see 3.1).

3.4.5 Resistance to solvents (see 4.8). All materials used in construction shall withstand direct contact with aromatic fuels and hydraulic fluids without causing electrical or mechanical deterioration.

3.5 Environmental requirements. The antenna shall withstand the environmental test requirements of 4.5.7 without mechanical or electrical deterioration. Following each environmental test, the antennas shall meet the electrical requirements specified in 3.6.4 and 3.6.5.

3.5.1 High temperature. When tested as specified in 4.5.7.1, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.2 Temperature altitude. When tested as specified in 4.5.7.2, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.3 Temperature shock. When tested as specified in 4.5.7.3, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.4 Shock. When tested as specified in 4.5.7.4, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.5 Vibration. When tested as specified in 4.5.7.5, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.6 Humidity. When tested as specified in 4.5.7.6, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.7 Fungus. When tested as specified in 4.5.7.7, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.5.8 Salt fog. When tested as specified in 4.5.7.8, the antenna shall meet the electrical requirements of 3.6.4 and 3.6.5.

3.6 Electrical requirements.

3.6.1 Frequency. The antenna shall provide performance over a specified radio frequency band in accordance with the applicable specification sheet (see 3.1).

3.6.2 Polarization. When tested as specified in 4.5.6, the antenna shall transmit or receive vertically polarized signals. The axial ratios of polarization ellipses in the specified directions (see 4.5.6) shall be equal to or better than that obtained in each of the same directions from a vertically polarized quarter-wave stub antenna at any frequency specified herein.

3.6.3 Antenna impedance. The impedance of the antenna when measured as specified in 4.5.2 and when measured at the connection of the transmission line shall be such that the voltage standing wave ratio (VSWR) produced on the input radio frequency cable is in accordance with the applicable specification sheet (see 3.1).

3.6.4 Sampling probe impedance. When antennas are tested as specified in 4.5.3, the impedance of the probe shall be as specified in the applicable specification sheet (see 3.1).

3.6.5 Sampling probe attenuation. Unless otherwise specified (see 3.1), when tested as specified in 4.5.4, the attenuation of the signal measured at the connector of the probe when a signal is fed to the antenna at its RF connector shall measure between 16 dB and 19 dB (such as, 17.5 dB ± 1.5 dB) over the frequency range of 0.960 GHz to 1.220 GHz.

3.6.6 Radiation pattern. When tested as specified in 4.5.5, the gain of the antenna system in the region extending completely around the antenna, in azimuth (Φ), shall, at each zenith angle (Θ), be essentially omnidirectional with nulls no greater than 2.0 dB down from the maximum. The gain at all zenith angles from 45 degrees to 95 degrees shall not be more than 0.5 dB below the gain of a matched quarter-wave stub antenna in the same location (see figure 1).

3.6.7 Voltage standing wave ratio (VSWR). When antennas are tested as specified in 4.9, the VSWR (as referenced to a 50 ohm system) at the input of the radio frequency cable (the output is connected to the antenna input) shall be no greater than specified in the applicable specification sheet (see 3.1).

3.7 Ungrounded stub antenna. Unless otherwise specified in the specification sheet (see 3.1), the radiating element is not grounded to the base of the antenna.

3.8 Weight. The weight of the antenna shall be in accordance with the applicable specification sheet (see 3.1).

3.9 Marking. Antenna shall be marked in accordance with MIL-STD-130 and shall include the PIN (see 1.3), contract, serial number, date code (year, month) and manufacturer's code.

Example: PIN M25708/1-01
Type
Serial No. 1234
77 10 12345

3.10 Longevity. Design and construction shall provide a mean longevity of a minimum of 6,000 hours of operational service life.

3.11 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.12 Workmanship. Workmanship must be in accordance with accepted industry practice.

4. VERIFICATION

4.1 Classification of inspections. The inspections specified herein are classified as follows:

a. First article inspection (see 4.3).

b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, the antennas shall be tested at temperatures of 25°C ± 10°C, barometric pressure of 650 millimeters to 800 millimeters of mercury, and relative humidity of 45 percent to 90 percent.

4.3 First article inspection. First article inspection shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract under which it is granted, unless extended by the Government to other contracts. Due to similarity of items covered by specification sheets, a manufacturer may apply for first article approval on items that are not on the current contract. Approval may be granted by successfully performing first article tests on a combination of antennas. The combination shall be as specified (see 6.2).

4.3.1 Sample size. Six antennas shall be subjected to first article inspection as specified in table III.

4.3.2 Inspection routine. Each sample shall be subjected to the inspections specified in table I in the order shown.

TABLE I. First article inspection.

Inspection	Requirement paragraph	Test method paragraph
Visual and mechanical inspection 1/	3.1, 3.3, 3.4, 3.7, 3.8, 3.9, 3.10, and 3.11	4.5.1
Antenna impedance	3.6.3	4.5.2
Sampling probe impedance	3.6.4	4.5.3
Sampling probe attenuation	3.6.5	4.5.4
Radiation pattern	3.6.6	4.5.5
VSWR	3.6.7	4.9
Polarization	3.6.2	4.5.6
High temperature	3.5.1	4.5.7.1
Temperature altitude	3.5.2	4.5.7.2
Temperature shock	3.5.3	4.5.7.3
Shock	3.5.4	4.5.7.4
Vibration	3.5.5	4.5.7.5
Humidity	3.5.6	4.5.7.6
Fungus	3.5.7	4.5.7.7
Salt fog	3.5.8	4.5.7.8
Seal test	3.4.3	4.6
Static load	3.4.4	4.7
Resistance to solvents	3.4.5	4.8

1/ Marking defects are based on visual examination only and shall be charged only for illegible, incomplete, or incorrect marking.

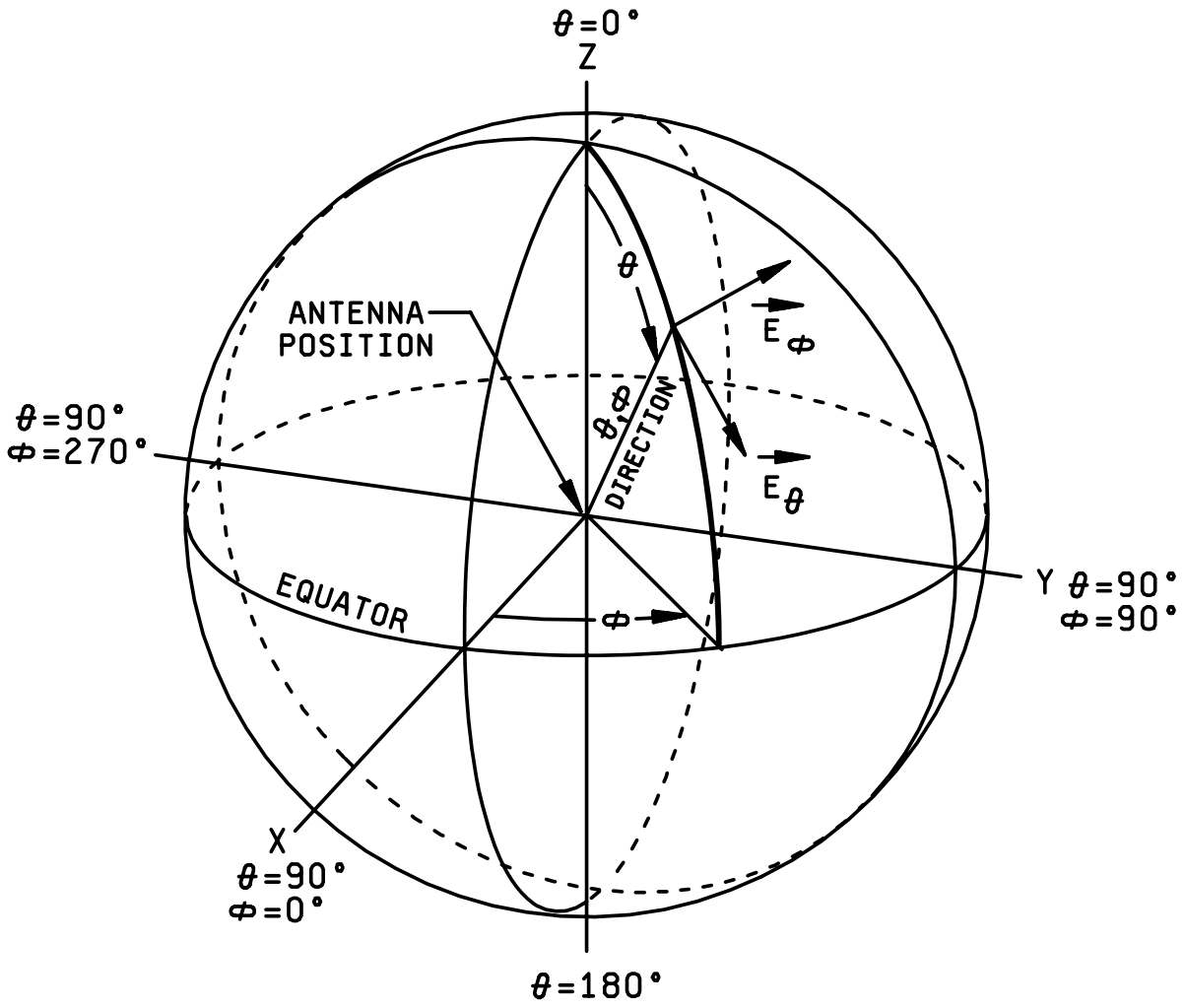


FIGURE 1. Standard spherical coordinate system used in antenna measurements.

4.4 Conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection (see 4.4.1.2).

4.4.1.1 Inspection lot. An inspection lot shall consist of all antennas of a particular style (see 3.1) from a production line or lines, produced essentially under the same conditions and offered for inspection during a single work month.

4.4.1.2 Group A inspection. Group A inspection shall consist of the examinations, and tests specified in table II, in the order shown.

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph
Visual and mechanical inspection examination - - - - - -	3.1, 3.3, 3.4, 3.7, 3.8, 3.9, 3.10, and 3.11	4.5.1
Antenna impedance- -	3.6.3	4.5.2
Sampling probe impedance - - - - - - - - - - - - - - - - - - -	3.6.4	4.5.3
Sampling probe attenuation - - - - - - - - - - - - - - - - - - -	3.6.5	4.5.4
VSWR -	3.6.7	4.9

4.4.1.2.1 Sampling plan. Statistical sampling and inspection shall be performed on an inspection lot basis with a random sample of units selected in accordance with table III. The acceptance levels shall be based upon the zero defective sampling plan. No failures shall be permitted.

TABLE III. Group A sampling plan.

Lot size	Sample size
1 - 13	100 percent
14 - 150	13
151 - 280	20
281 - 500	29
501 - 1,200	34
1,201 - 3,200	42
3,201 - 10,000	50
10,001 - 35,000	60
35,001 - 150,000	74
150,001 - 500,000	90
500,001 and over	102

4.4.2 Periodic inspection. Periodic inspection shall consist of group B. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.4.2.1.2), delivery of products which have passed group A shall not be delayed pending the results of these periodic inspections.

4.4.2.1 Group B inspection. For individual acquisitions involving small quantities of antennas in a short period of time, conduct of group B testing shall be at the option of the procuring activity (see 6.4) and of the acquisition contract (see 6.2). Group B inspection shall consist of the tests specified in table IV, in the order shown. Group B inspection shall be made on six sample units which have been subjected to and have passed group A inspection.

4.4.2.1.1 Sampling plan. Sample units shall be selected every 6 months. Upon passing this inspection, the supplier may select sample units every 12 months. If the second level of sampling is passed two successive times, the supplier may select sample units every 24 months. In the event of a failure, sampling shall revert to the 6-month interval.

TABLE IV. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Radiation pattern	3.6.6	4.5.5
Polarization	3.6.2	4.5.6
High temperature	3.5.1	4.5.7.1
Temperature altitude	3.5.2	4.5.7.2
Temperature shock	3.5.3	4.5.7.3
Shock	3.5.4	4.5.7.4
Vibration	3.5.5	4.5.7.5
Humidity	3.5.6	4.5.7.6
Salt fog	3.5.8	4.5.7.8
Seal test	3.4.3	4.6
Static load	3.4.4	4.7
Resistance to solvents	3.4.5	4.8

4.4.2.1.2 Noncompliance. If a sample fails to pass group B inspection, the manufacturer shall notify the design activity (see 6.4) of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the preparing activity, has been taken. After corrective action has been taken, group B inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the preparing activity (see 6.4)). Group A inspection may be reinstated; however, final acceptance and shipment shall be withheld until the group B re-inspection has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant design activity (see 6.4).

4.5 Methods of examination and test.

4.5.1 Visual and mechanical. Antennas shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with applicable requirements (see 3.1, 3.3, 3.4, 3.7, 3.8, 3.9, 3.10, and 3.11).

4.5.2 Antenna impedance (see 3.6.3). Impedance measurements shall be made with antenna installed flush in the center of a 4-foot diameter circular ground plane using an approved slotted-line method, such as Hewlett-Packard Model 805A or equal, with a bolometer pickup. The impedance of the antenna shall be measured over the frequency range (see 3.1) at intervals no greater than 25 MHz. (Sweep frequency techniques may be used.) The cable length between the antenna and the measuring device shall not be greater than 6 feet. VSWR measurements of the antenna shall be made after environmental tests as well as temperature extremes.

4.5.3 Sampling probe impedance (see 3.6.4). The impedance of the sampling probe shall be measured in accordance with 4.5.2 over the specified frequency range (see 3.1).

4.5.4 Sampling probe attenuation measurements (see 3.6.5). Attenuation measurements shall be made with the signal source connected through a 50-ohm calibrated RF attenuator to the antenna connector and the output of the sampling probe connected to the calibrated receiving detector. The output of the probe shall be noted on the detector, after which, the antenna and probe shall be removed from the circuit and a suitable connector-adapter substituted therefore. Without changing power or sensitivity, the attenuator shall be adjusted to produce the reading noted previously on the detector. The difference in reading, in dB, on the attenuator with and without the antenna and probe in place shall be the probe attenuation. All radio frequency interconnections shall be made by means of nominal 50-ohm coaxial cables (and connectors) and mismatch of both the signal generator and the detector used for making the measurements shall be reduced as low as practicable. The attenuation of the antenna shall be measured over the frequency range (see 3.1) at intervals no greater than 25 MHz. The attenuation measurement system shall have an accuracy of 0.01 dB per dB or better. (Sweep frequency techniques may be used.) The cable length between the antenna and the measuring device shall not be greater than 6 feet. Each antenna shall be subjected to the attenuation tests both before and after completion of the environmental tests specified in 4.5.7.

4.5.5 Radiation pattern (see 3.6.6). Measurements of the radiation pattern shall be made with the antenna mounted flush in the center of a 4-foot diameter circular ground plane in the XY plane of figure 1 and the antenna blade is in the XZ plane with the top of the blade in the direction of increasing Z, its normal mounting configuration, assuming the ground plane represents the aircraft skin. The patterns shall be made on a continuously recording radio range of the automatic type. Care shall be taken to avoid errors due to reflections from nearby objects, including earth. Azimuth patterns shall be made at zenith angles of 20, 40, 60, 70, 80, 90, and 95 degrees; the angle of maximum radiation; and any other angle deemed advisable. Vertical patterns shall be made in the longitudinal and transverse planes relative to the horizontal dimensions of the antenna. Like patterns shall be made for comparison, using the same test power levels on a matched quarter-wave stub antenna except that a single vertical pattern will suffice. Unless otherwise precluded by acquiring activity contract, the design of the quarter-wave stub antenna and matching section shall be approved by the acquiring activity prior to manufacture. Unless otherwise specified the above tests shall be made at frequencies of 0.960 GHz, 1.050 GHz, and 1.200 GHz (see 3.1), but need not be repeated after environmental exposure.

4.5.6 Polarization test (see 3.6.2). Polarization tests shall be conducted in the continuously recording radio range in the same manner as the tests for radiation pattern, in accordance with one of the standard methods discussed in chapter 11 of IEEE Std 149-1979. Polarization tests need to be made at only one frequency (1,050 MHz). For each test antenna, the axial ration of the polarization ellipse shall be determined in each of the following directions (θ, φ) degrees: (90, 0), (90, 90), (90,180), (90, 270), (60, 0), (60, 90), (60, 180), (60, 270), (30, 0), (30, 90), (30, 180), (30, 270). The measurements shall then be repeated on a quarter-wave stub antenna mounted at the same location, at identical power levels and sensitivities.

4.5.7 Environmental test requirements (see 3.5). Environmental tests shall be in accordance with MIL-STD-810 in the sequence shown herein. Following each environmental test, the antennas shall meet the requirements of sampling probe impedance (see 4.5.3) and sampling probe attenuation (see 4.5.4).

4.5.7.1 High temperature (see 3.5.1). The sample antennas shall be placed within a chamber and the internal temperature shall be raised to 250°C (482°F). The antenna shall remain in this environment for 2 hours; at the end of this time, the antenna shall be removed from the chamber and immediately measured for VSWR (see 4.9).

4.5.7.2 Temperature altitude (see 3.5.2). MIL-STD-810 method 520 shall be tailored for variations in temperature and altitude only. This test shall not include vibration or humidity environments. Test conditions:

Step	Temperature (°C)	Altitude (ft)	Time
1	-62	site	2 hours
2	-54	site	---
3	-54	80,000	---
4	-10	site	---
5	Standard ambient conditions		
6	125	site	16 hours
7	95	site	4 hours
8	125	site	30 minutes
9	150	site	10 minutes
10	60	50,000	4 hours
11	90	50,000	30 minutes
12	-10	100,000	4 hours
13	20	100,000	30 minutes
14	45	100,000	10 minutes
15	Standard ambient conditions		

Step 1. With antenna de-energized, adjust chamber to step 1 conditions listed above. After antenna temperature is stabilized, maintain conditions for 2 hours.

Step 2. With antenna de-energized, adjust chamber to step 2 conditions, and maintain. After antenna temperature is stabilized, operate antenna at lowest specified input voltage. The antenna shall operate satisfactorily immediately following the specified warm-up time. All characteristics likely to be affected by low temperature shall be checked first. If time to check exceeds 15 minutes beyond the warm-up time, the test item shall again be stabilized at the step 2 temperature and the operational check continued.

Step 3. With antenna de-energized, adjust chamber to step 3 temperature and stabilize antenna temperature. Energize the antenna at highest specified input voltage and adjust chamber pressure to step 3 altitude. At step 3 pressure and temperature, the antenna shall be checked for satisfactory operation.

Step 4. With antenna de-energized, adjust chamber to step 4 conditions. After antenna temperature has stabilized, open chamber door and permit frost to form (use artificial moisture, if required) on antenna. The door shall remain open long enough for the frost to melt, but not long enough for the moisture to evaporate. The chamber door shall be closed and the test item operated at the highest specified input voltage to ascertain satisfactory operation immediately following the specified warm-up time. The antenna shall be energized and de-energized at least three times.

Step 5. Adjust the chamber to standard ambient conditions. After antenna temperature has stabilized, an operational and performance check of the antenna shall be made.

Step 6. With antenna de-energized, adjust chamber to step 6 conditions. Stabilize antenna temperature and maintain for 16 hours. Visually inspect, if practicable.

Step 7. With antenna de-energized, adjust chamber to step 7 conditions. After antenna temperature is stabilized, while maintaining chamber temperature, operate the antenna continuously at the highest specified input voltage for 4 hours, recording thermal sensor readings of antenna temperature every 30 minutes. At the end of the 4 hour time period, while maintaining the test conditions, the test item shall be checked for satisfactory operation.

Step 8. With antenna de-energized, adjust chamber to step 8 conditions. After antenna temperature has stabilized, the antenna shall be operated at the highest specified input voltage for four time periods each of 30 minute duration. The first three time periods of operation shall be followed by a 15 minute period with antenna de-energized. The test item shall be checked for satisfactory operation during each operating time period. Thermal sensor readings of antenna temperature shall be recorded every 10 minutes of antenna operation.

Step 9. With antenna de-energized, adjust chamber to step 9 conditions. After antenna temperature is stabilized, antenna shall be operated at the highest specified input voltage for four time periods each of 10 minutes. The first three periods of operation shall be followed by a 15 minute period with the antenna de-energized. Check antenna for satisfactory operation during each operating time period. Thermal sensor readings of antenna temperature shall be recorded at the beginning and the end of each operating period.

Step 10. With antenna de-energized, adjust chamber temperature to step 10 conditions. Stabilize antenna temperature. Operate antenna at highest specified input voltage, and adjust chamber pressure to step 10 altitude. Maintain test conditions for 4 hours. Thermal sensor readings of antenna temperature shall be recorded every 30 minutes. At the end of the 4 hour period, while maintaining test conditions, the antenna will be checked for satisfactory operation.

Step 11. With test item de-energized, adjust chamber temperature to step 11 conditions. The antenna temperature shall be stabilized and the antenna energized at the highest specified input voltage, while chamber pressure is adjusted to simulate step 11 altitude. The antenna shall be operated for 4 time periods each of 30 minutes. The first three time periods of operation shall be followed by 15 minutes of operation, followed by a 15 minutes with the antenna de-energized. The test item shall be checked for satisfactory operation during each operating time period. Thermal sensor readings of antenna temperature shall be recorded every 10 minutes of antenna operation.

Step 12. With the antenna de-energized, adjust chamber temperature to step 12 conditions (following steps where a change in temperature at low pressure is required, the pressure may be increased to ambient before changing temperature and then returned to the required pressure following temperature stabilization.) The antenna temperature shall be stabilized and the antenna shall be energized at the highest specified input voltage and chamber pressure adjusted to step 12 conditions. Maintain for step 12 duration. Thermal sensor readings of antenna temperature shall be recorded every 30 minutes. At end of 4 hours, while maintaining test conditions, check antenna for satisfactory operation.

Step 13. With the antenna de-energized, adjust the chamber temperature to step 13 conditions and maintain. The antenna temperature shall be stabilized. The antenna shall be energized at the highest specified input voltage and the chamber pressure adjusted to step 13 altitude. The antenna shall be operated for four time periods de-energized. The antenna shall be checked for satisfactory operation during each operating period of 30 minutes. The first three time periods shall be followed by a 15-minute period with the antenna. Thermal sensor readings shall be recorded every 10 minutes of antenna operation.

Step 14. With antenna de-energized, adjust chamber temperature to step 14 conditions (following steps where a change in temperature at low pressure is required, pressure may be increased to ambient before changing the temperature and then returned to the required pressure following temperature stabilization) and maintain. Antenna temperature shall be stabilized. The antenna shall be energized at the highest specified input voltage and chamber pressure adjusted to step 14 altitude. The antenna shall be operated four time periods each of 10-minute duration and shall be followed by a 15-minute period with the antenna de-energized. The antenna shall be checked for satisfactory operation during each operating period. Thermal sensor readings of antenna temperature shall be recorded at the beginning and end of each operating time period.

Step 15. Adjust chamber test conditions to standard ambient. After the antenna temperature has stabilized, an operational and performance check of the antenna shall be made. Results shall be compared with performance before temperature-altitude test.

4.5.7.3 Temperature shock (see 3.5.3). Test in accordance with MIL-STD-810 method 503 using the following procedure:

Step 1: Prepare the antenna and raise chamber temperature to 65.4°C (150°F). Maintain for a period of not less than 4 hours or until the antenna temperature stabilizes.

Step 2: At the conclusion of this time period, transfer the antenna, within 5 minutes, to a cold chamber with internal chamber temperature stabilized at -57°C (-70°F).

Step 3: The antenna shall be exposed to the step 2 temperature for a period of not less than 4 hours or until the antenna temperature stabilizes.

Step 4: At the conclusion of this time period, the antenna shall, within 5 minutes, be returned to the high temperature chamber maintained at 65.4°C (150°F).

Step 5: The antenna shall be exposed to this high temperature for a period of not less than 4 hours or until the antenna stabilizes at chamber temperature.

Step 6: Repeat steps 2 through 5.

Step 7: Repeat steps 2 and 3.

Step 8: Return the antenna to standard ambient conditions and stabilize.

Step 9: Operate and inspect the antenna and compare performance with that before test exposure.

Pretest data requirements and failure criteria shall be specified in the equipment specification.

4.5.7.4 Shock (see 3.5.4). MIL-STD-810 method 516.

a. Procedure: Three shocks in each direction applied along three orthogonal axes of the antenna (total of 18 shocks).

b. Terminal sawtooth pulse, 20 g's peak, 11 ms duration.

c. Operation not required during test.

4.5.7.5 Vibration (see 3.5.5). MIL-STD-810 method 514.

Vibration test procedure: The sinusoidal vibration shall be applied along each of three mutually orthogonal axes of the antenna. The acceleration levels or double amplitudes (see figure 2) shall be maintained at the antenna mounting points (mounted without vibration isolators). When input vibration is measured at more than one central point, the control signal shall be the average of all the accelerometers.

(1) Resonance search. Resonant frequencies of the antenna shall be determined by varying the frequency of applied vibration slowly through the specified range at reduced test levels but with sufficient amplitude to excite the item. Sinusoidal resonance search may be performed using the test level and cycling time specified for sinusoidal cycling test, provided the resonance search time is included in the required cycling time.

(2) Resonance dwell. The antenna shall be vibrated along each axis at the most severe resonant frequencies determined. Dwell time at each resonance frequency shall be 30 minutes (per axis) If more than four significant resonance frequencies are found for any one axis, the four most severe resonant frequencies shall be chosen for dwell test. If a change in resonant frequency occurs during the test, its time of occurrence shall be recorded and immediately the frequency shall be adjusted to maintain the peak resonance conditions. The final resonant frequency shall be recorded.

(3) Cycling. The antenna shall be vibrated along each axis in accordance with test levels of figure 2. Sinusoidal cycling time (per axis) shall be 3 hours less dwell time. Sweep time 5 - 500 - 5 Hz shall be 15 minutes. The frequency of applied vibration shall be swept over the specified range logarithmically in accordance with figure 2. The specified sweep time is that of an ascending plus a descending sweep.

4.5.7.6 Humidity (see 3.5.6). MIL-STD-810 method 507.

a. Procedure I.

b. Ten 24-hours cycles, then operational test at 30°C and 85 percent relative humidity.

c.

Humidity test cycle	Temperature	Relative humidity
0 - 2 hours	Gradual increase from ambient to +65°C (+149°F)	Gradual increase from uncontrolled to 95 +5, -3 percent
2 - 8 hours	Maintain +65°C (+149°F)	Maintain 95 +5, -3 percent
8 - 24 hours	Gradual decrease to +30°C (+86°F)	Maintain ≥ 85 percent

Apply the test for a total of ten 24-hours cycles, then operational test at 30°C and 85 percent relative humidity.

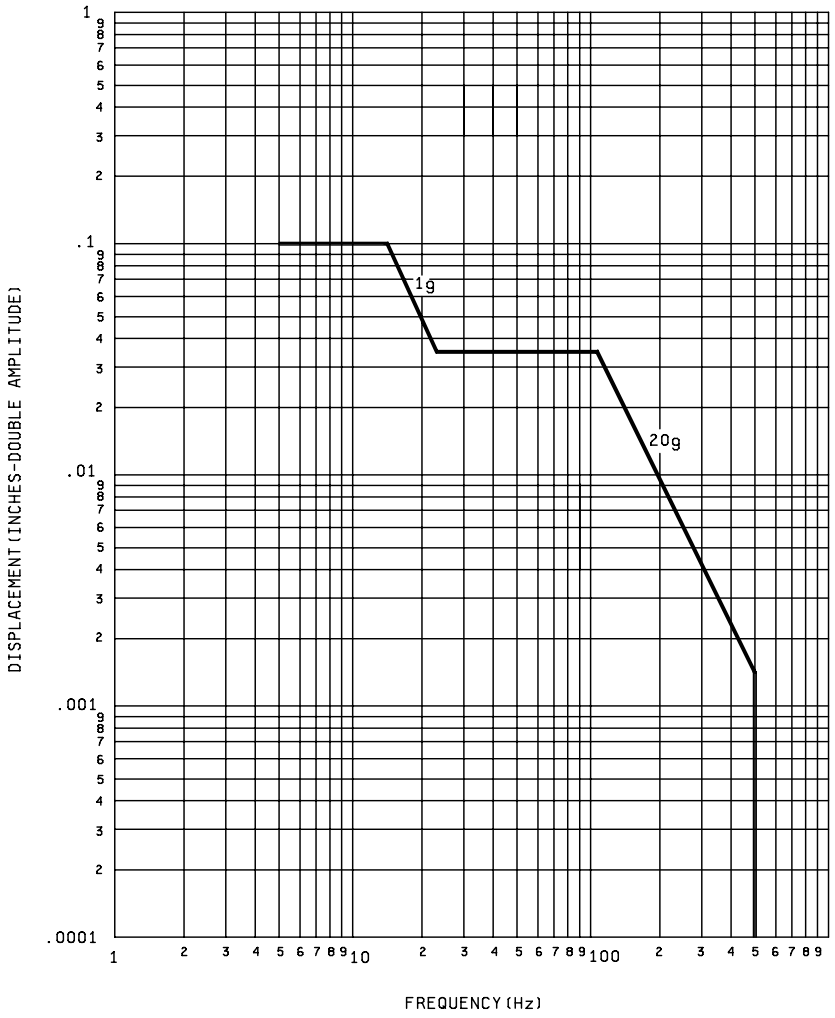


FIGURE 2. Vibration test curve.

4.5.7.7 Fungus (see 3.5.7). The manufacturer shall certify that all materials are fungus resistant or perform the test specified in MIL-STD-810 method 508.

4.5.7.8 Salt fog (see 3.5.8). MIL-STD-810 method 509, in accordance with test apparatus and procedures detailed in method 509, section II, including procedure I. The following details shall be specified in the equipment specification:

a. Pretest data required.

b. Failure criteria.

c. Applicable salt solution, if other than 5 percent.

d. Salt fog exposure period, if other than 48 hours.

e. Drying period, if other than 48 hours.

f. Inspection and operation after 24 hours of salt fog exposure where buildup of salt deposits are critical to the proper operation of the test item.

g. If operation of electrical system is required.

4.6 Seal test (see 3.4.3). All samples shall be subjected to seal test by altitude chamber method. The antennas shall be fully submerged in a water-filled, transparent container. The test antenna connectors may be covered with a mating cap simulating the mating connection. The chamber shall be evacuated to a pressure 1.06 inches of mercury simulating an altitude of 75,000 feet and remain there for a minimum of 5 minutes. The chamber pressure shall then be raised to 2.5 inches of mercury simulating an altitude of 57,000 feet and maintained at that condition for a minimum of 10 minutes. Then the chamber pressure shall be raised to standard atmospheric pressure for 1 hour. Upon seal test completion, antennas shall be removed and all excess moisture wiped from the antenna. Any evidence of leakage either by a flow of bubbles during evacuation or subsequent entrance of water shall be considered a failure. Immediately after examination, the antenna shall meet the requirements of the impedance test (see 4.5.2) and of the VSWR test (see 4.9). VSWR shall be as specified in the applicable specification sheet (see 3.1).

4.7 Static load test (see 3.4.4). A static load as specified in accordance with the specification sheet (see 3.1), shall be imposed on the antenna. The antenna shall be normally mounted on a fixture and an air bladder draped on one side similar to figure 3. The bladder shall then be inflated until it is just making contact with the antenna surface. An air pressure reading shall then be taken and the internal air pressure shall then be increased to the specified pressure in accordance with the applicable specification sheet (see 3.1) and held for 5 minutes. The pressure shall then be released and the same procedure repeated on the opposite side. This shall be considered as one cycle. The test shall be two cycles in duration. Upon completion of the second cycle, the antenna shall be removed and carefully examined for deformation and structural failure. Impedance test (see 4.5.2) shall be made and VSWR shall be as specified in the applicable specification sheet (see 3.1).

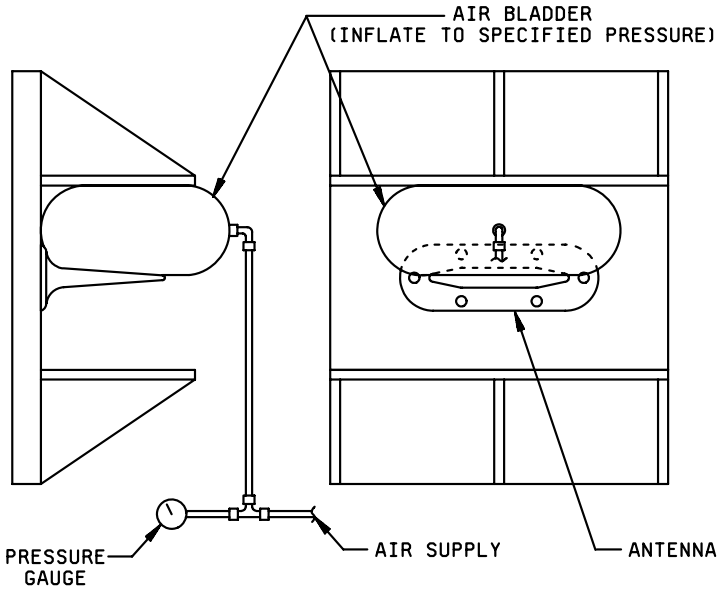


FIGURE 3. Static load test.

4.8 Resistance to solvents (see 3.4.5). Completely immerse the sample antenna in each test liquid [aviation turbine fuel grade JP-5 (MIL-DTL-5624) and hydraulic fluid (MIL-DTL-5606) for 24 hours. Upon removal, shake or wipe excess surface liquid from the antenna. Impedance test (see 4.5.2) shall be made and VSWR shall be as specified in the applicable specification sheet (see 3.1).

4.9 VSWR (see 3.6.7). The VSWR of the antenna shall be measured as specified in 4.9.1, 4.9.2, or 4.9.3. The antenna shall be mounted flush in the center of a 4-foot diameter circular ground plane. Precautions shall be taken to insure that the reflected energy does not effect the VSWR measurements greater than 4 percent of the maximum VSWR specified in the applicable specification sheet (see 3.1). The overall accuracy of VSWR measurements shall be such that the (absolute VSWR) = (measured VSWR) $\pm$ 0.08 (maximum specified VSWR-1). VSWR measurements shall be made before and after each environmental test specified in 4.5.7.

4.9.1 Slotted line method. VSWR measurements shall be made over the frequency range specified in the applicable specification sheet (see 3.1) at increments not greater than 25 MHz. The measured data shall be recorded.

4.9.2 Swept slotted line method. VSWR measurements shall be recorded by an X-Y recorder. The trace shall be an X-Y plot of VSWR versus frequency plotted with a limit of 1 octave per plot at a minimum sweep rate of 30 seconds per frequency band. If the antenna under test exhibits an abrupt change in VSWR, the sweep rate shall be further slowed to assure that the pin of the X-Y recorder can follow these changes. The trace shall be marked at frequency increments of not greater than 25 MHz and labeled at not greater than four times the increment. The plot shall display a nomograph that converts dB/cm to VSWR, and shall identify the antenna, the test data, the general and detail procedure and the maximum allowable VSWR. Using the VSWR trace, the VSWR shall be tabulated at the frequency increment. Prior to accomplishing the VSWR measurement, adjustments should be made to insure that the frequency and sweep width of sweep signal generator are set to the desired bandwidth within the limitation of the equipment. Precaution shall be taken to insure that the X-sensitivity of the recorder is adjusted to accommodate the entire sweep and that the plot will be approximately in the center of the graph paper for the entire frequency range.

4.9.3 Reflectometer method. When using the reflectometer method for measuring VSWR, a complete curve shall be recorded by an X-Y recorder. Calibration curves that represent the maximum VSWR to be measured and the limits of the bands of doubt (see 6.3.2) shall be plotted on the graph paper. Curves shall be plotted with a limit of 1 octave per plot. VSWR calibration curves shall be plotted on the graph paper. Curves shall be plotted with a limit of 1 octave per plot. VSWR calibration curves shall be plotted in increment of 0.1 between VSWR limits of 1.1:1 and 1.9:1, and 0.2 above a VSWR of 1.2:1 and grid markers along the horizontal axis to represent 100 MHz frequency increments. Prior to accomplishing VSWR measurements, the maximum VSWR calibration curve shall be re-checked to insure repeatability of the curve. If values of VSWR are within the band of doubt, the VSWR shall be measured using the slotted line method (see 4.9.1) in sufficiently close increments to define a smooth curve structure, but at increments not greater than specified in 4.9.1, or the VSWR shall be measured by the reflectometer method using the expanded reflectometer scale to define an expanded curve covering the entire paper.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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 antenna is a radiation element having an essentially omnidirectional, vertically polarized, radiation pattern intended for use with airborne identification beacon and TACAN sets. The antenna is military unique since it must survive and meet performance requirements while mounted on military aircraft, throughout mission, lifecycle, worldwide environments.

6.2 Ordering data. Acquisition documents must specify the following:

a. Title, number, date of this specification with the applicable specification sheet and the complete PIN (see 3.1 and 1.3).

b First article samples and tests.

(1) Number of first article samples and combination of antennas, if applicable.

(2) Point of inspection.

(3) Requirement for concurrent delivery of each sample and its test data. The acquiring activity should be given at least 10 days prior notice when the first article tests are to be conducted so that they may be supervised or witnessed, if desired, by a Government representative.

(4) Requirement for periodic group B testing (see 4.4.2 and 4.4.2.1).

c. Packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Antenna. An antenna for the purpose of this document is an assembly of components including input terminal mounting provisions and radomes required to radiate or receive electromagnetic energy.

6.3.2 Band of doubt. A VSWR value is considered to be in the band of doubt if the measured VSWR = (the maximum allowable) VSWR ± 0.08 (the maximum allowable VSWR-1). If VSWR values are within the band of doubt, a frequency band of ± 10 percent must be investigated about the point.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors, whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.2), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers (see 3.3.4). For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.6. Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmentally Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals is available on their website at http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm. Further information is available at the following EPA site: http://www.epa.gov/epaoswer/hazwaste/minimize/. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of the materials on the list should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.7 Subject term (key word) listing.

Altitude	Radiation
Attenuation	Salt fog
Fungus	Seal
Impedance	Shock
Nonflammable	Solvents
Polarization	VSWR

6.8 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - AS
Air Force - 11
DLA - CC

Preparing activity:
DLA - CC

(Project 5985-2008-015)

Review activities:
Army - AV
Air Force - 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.