

MIL-S-81478C(AS)
1 April 1985
~~SUPERSEDING~~
MIL-S-81478B(AS)
18 January 1979

MILITARY SPECIFICATION

SONOBUOY AN/SSQ-57A

This specification is approved for use by the Naval Air Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE.

1.1 Scope. This specification establishes the design, performance, and acceptance requirements for the AN/SSQ-57A Sonobuoy herein referred to as the sonobuoy. The sonobuoy relays, by FM VHF radio transmission, sounds in the audio frequency range initially received by a cable-suspended hydrophone system. The sonobuoy is an aircraft launched, expendable floating device, intended for the purpose of detecting underwater acoustical energy radiated by submarines.

2. APPLICABLE DOCUMENTS.

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions,) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, Systems Engineering and Standardization Department (SESD) Code 93, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-S-81478C(AS)

SPECIFICATIONS

Military

MIL-T-18303

Test Procedures, Preproduction and Inspection for Aircraft Electronic Equipment, Format for

STANDARDS

Military

MIL-STD-105

Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-129

Marking for Shipment and Storage

MIL-STD-454

Electronic Equipment, General Requirements for

MIL-STD-461

Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference

DOD-STD-480

Configuration Control - Engineering Changes, Deviations and Waivers

MIL-STD-785

Requirements for Reliability Program

MIL-STD-1385

Preclusion of Ordnance Hazards in Electromagnetic Fields; General Requirements for

HANDBOOKS

Military

H107

Inspection and Quality Control, Single-Level Continuous Sampling Procedures and Tables for Inspection by Attributes (Handbook H107)

2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

PUBLICATIONS

NSRDC Report 3721

Analysis of the two dimensional steady state behavior of extensible free floating cable system, Oct 71

NADC Report 80178-30

A modification to the free floating extensible cable system computer model (FF2E), 7 May 80

MIL-S-81478C(AS)

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| NAC Report TR-2359 | Update to the Free Floating Two-Dimensional Extension Cable System Model (FF2E) |
| 3054-ETP-1924 | Environmental Tests for Sonobuoys |
| STF-TP-101 | Manual of Sonobuoy Test Procedures |
| STP-3062-1-1 | Operator's Handbook for Sonobuoy Antenna Test Range |
| STP-3062-5 | Operator's Handbook for Acoustic Test Facility |
| STP-3062-19 | AN/SSQ-41B Sonobuoy Production Standard Hydrophone Calibration/Recall Procedures |
| SPD-9 | Simulated Ocean Testing for Mechanically Induced Noise |
| SPD-10 | Requirements for Performance Verification and Safety Certification of Sonobuoys Containing Lithium Batteries |
| SPD-13 | Sonobuoy Decelerator Effective Drag Area, Ballistic Coefficient and Parachute Construction Requirements |
| SPD-14 | Sonobuoy Air Descent Control System Safety Certification |
| SPD-15 | Production Sonobuoy Program Marking Requirements |
| 49CFR | Combined Federal Register, Title 49 |

(Copies of specifications, standards, handbook, drawing and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS.

3.1 First article. When specified in the contract, a sample shall be subjected to first article inspection (see 4.4, 6.2.1 and 6.3).

3.2 Product configuration identification (PCI). The equipment covered by this specification is designated as a configuration item, which requires PCI in the form of technical documentation (see 6.2.2). The documentation shall be used as the basis for configuration control in accordance with DoD-STD-480.

MIL-S-81478C(AS)

The technical documentation shall consist of specifications and detailed production drawings under the custody and control of the contractor. All changes to the approved equipment PCI shall be made in accordance with the contract. The approved equipment PCI shall be determined as follows:

- a. The contractor shall establish a preliminary PCI upon submission of first article samples. The approved PCI shall be the documented configuration of the approved first article samples.
- b. When first article is not required, the approved PCI shall be the documented configuration of the last acceptable lot produced on the previous contract.
- c. The approved PCI for the air descent mechanism shall be the documented configuration, safety certified in accordance with SPD-14.
- d. The approved PCI for the Lithium based power supply, if used, shall be the documented configuration, safety certified in accordance with SPD-10.
- e. The approved PCI for the lower subassembly suspension system shall be the documented configuration, tested in accordance with SPD-9.

3.3 Reliability.

3.3.1 Reliability program. When specified in the contract, the contractor shall conduct a reliability program in accordance with MIL-STD-785 and the contract (see 6.2.1).

3.3.2 Quantitative requirements. The reliability of the sonobuoy is specified as the probability of operation in accordance with the requirements of this specification and the contract and shall be 0.90. The minimum acceptable reliability will be demonstrated during production acceptance testing by successful completion of the aircraft drop tests of 4.5.3.

3.3.3 Performance maintenance program. Sample units from each lot will be tested to evaluate specification compliance for parameters not normally tested during aircraft drop tests. Results of these tests shall become a part of the contractor's reliability program.

3.3.4 Failure reporting and corrective action. The contractor shall maintain a system for initiating failure reports, analyzing failures, and implementing corrective actions in accordance with MIL-STD-785 and the contract (see 6.2.1). Failure analysis reports for any sonobuoy which fails during aircraft drop tests or performance maintenance tests shall be prepared and submitted to the procuring activity (see 6.2.2).

3.4 Environmental requirements.

3.4.1 Standard conditions. The following conditions represent laboratory bench test conditions:

MIL-S-81478C(AS)

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|----------------------------|--|
| a. Ambient Air Temperature | 25 ± 10°C |
| b. Water Temperature | 25 +10°C -15 |
| c. Altitude | Normal Ground |
| d. Humidity | Room Ambient up to 90 percent Relative Humidity (RH) |
| e. Input Power | External power source that is equivalent to the impedance- voltage-time-characteristics of the sonobuoy's internal battery power supply in its operating environment. |

3.4.2 Service conditions.

3.4.2.1 Non-operating. The sonobuoy shall operate as specified after exposure to any combination or sequence of the non-operating service conditions specified in 3.4.2.1.1 through 3.4.2.1.11.

3.4.2.1.1 Vibration. Random vibration with the power spectral density levels identified in figure 1 and a duration of one hour in each of three mutually perpendicular axis in accordance with the requirements of 3054-ETP-1924.

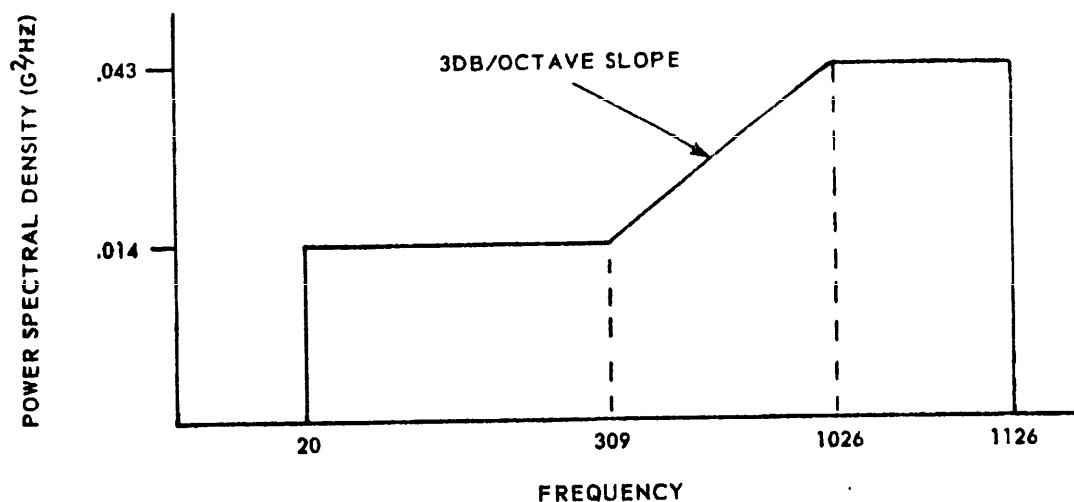


FIGURE 1. Random vibration with power spectral density levels.

3.4.2.1.2 Shock. Three 100 g's half-sine impacts to the bottom end of the unit and seven 50 g's half-sine impacts in the other axes in accordance with the requirements specified in 3054-ETP-1924 for shock testing.

3.4.2.1.3 Salt atmosphere. A salt fog atmosphere prepared from a five percent salt solution at 35°C for 48 hours in accordance with the requirements specified in 3054-ETP-1924 for salt spray testing.

3.4.2.1.4 Humidity/temperature. Ten-day cycling envelope of figure 2 in accordance with the procedure specified in 3054-ETP-1924 for humidity/temperature testing.

3.4.2.1.5 Temperature/altitude. Range of -60°C to +70°C at sea level atmospheric pressure to -60°C to +35°C at 12,200 meters altitude atmospheric pressure in accordance with the procedures specified in 3054-ETP-1924 for temperature and altitude testing.

3.4.2.1.6 Fungus. Fungus cultures at 29°C combined with 95 percent relative humidity for 14 days in accordance with the requirements specified in 3054-ETP-1924 for fungus testing.

3.4.2.1.7 Thermal shock. Sudden temperature changes within the range of +70°C to -60°C in accordance with the requirements specified in 3054-ETP-1924 for temperature shock testing.

3.4.2.1.8 Storage life. The sonobuoy in sealed packaging as specified in 5.1 and exposed to the temperature and humidity conditions specified in figure 2 for five years. The sonobuoy, outside all packaging shall be exposed to a temperature of +35°C and 90 percent relative humidity for 90 days.

3.4.2.1.9 Packaging interface testing. Packaging interface testing required by packaging and palletization requirements of 5.1 and 5.2.

3.4.2.1.10 Electromagnetic radiation. The electromagnetic radiation shall be as specified in MIL-STD-1385.

3.4.2.1.11 Launch envelope. Launching at any combination of altitude and airspeed within the launch envelope described in figure 3. The sonobuoy shall be capable of loading, unloading, and launching from P-3, S-3, SH-2, SH-3 and SH-60B type aircraft launcher system without damaging the aircraft or the sonobuoy.

3.4.2.2 Operating. The sonobuoy shall operate as specified during exposure to the operating service conditions specified in 3.4.2.2.1 through 3.4.2.2.2.

3.4.2.2.1 Sea environment. Sea water having a salinity of 1.5 to 3.6 percent by weight and over a temperature range of 0° to +35°C at the surface. Sea water having a salinity of 2.3 to 3.6 percent by weight and over a temperature range of 3° to 30°C 15 meters or more below the surface. Sea state conditions of 0 through 5 (international scale) with a constant surface wind velocity of 56 kilometers per hour (km/h) maximum and surface wind gusts of 74 km/h maximum. The differential current between any two points along the deployed

MIL-S-81478C(AS)

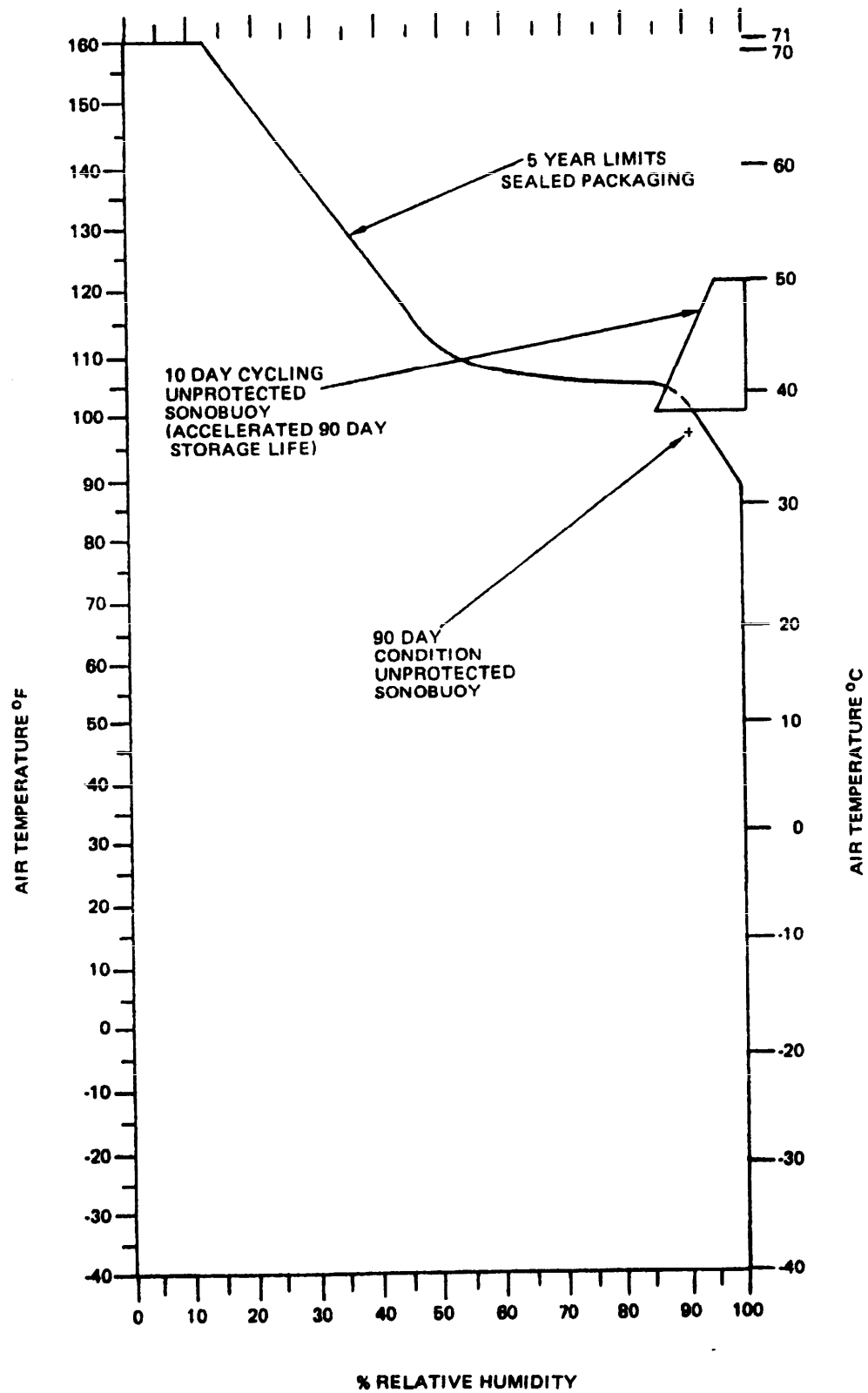
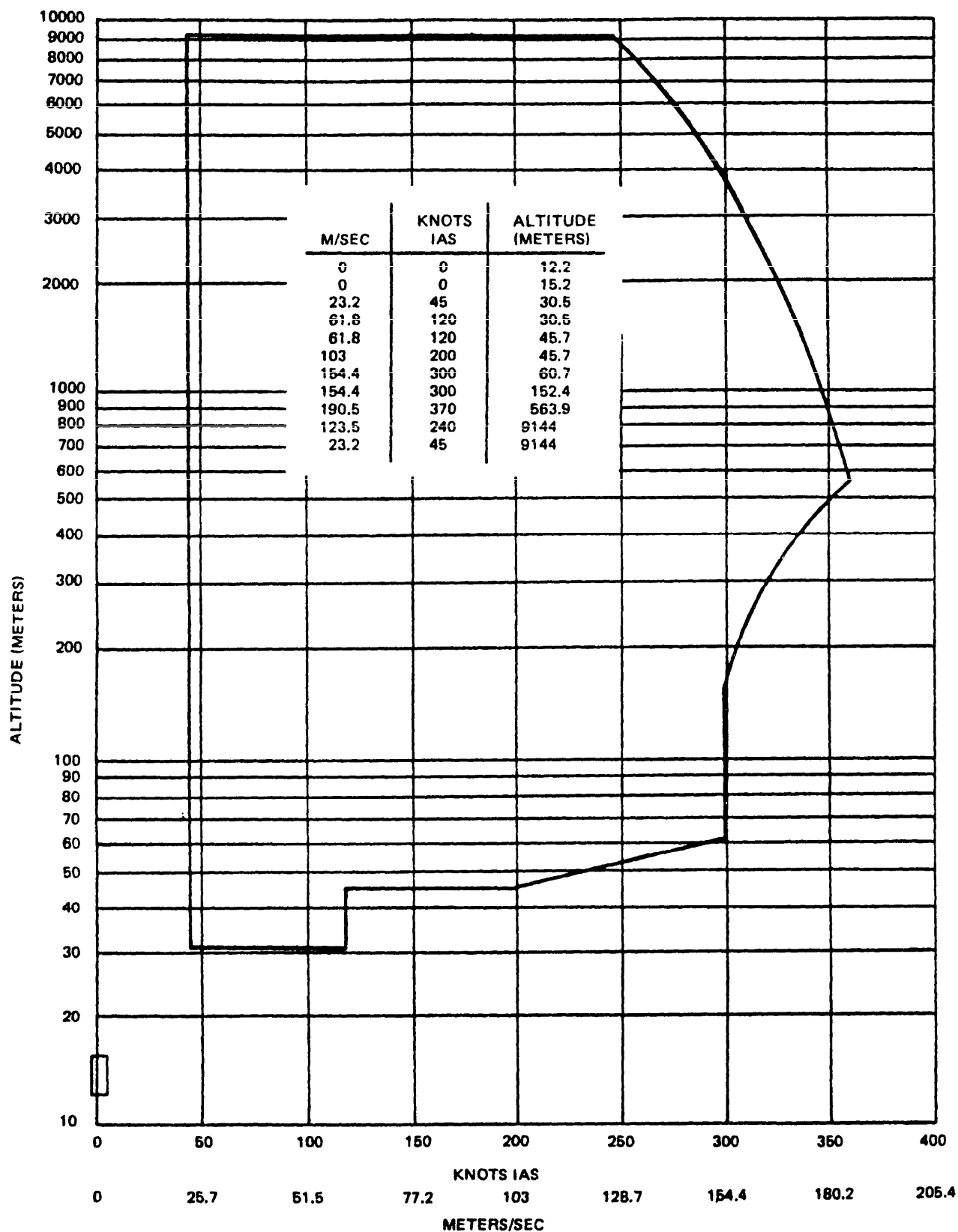


FIGURE 2. Humidity/temperature envelope.

MIL-S-81478C(AS)

FIGURE 3. Altitude/speed launch envelope.

MIL-S-81478C(AS)

sonobuoy shall be equal to or less than that depicted by the two dimensional current profile of figure 4.

3.4.2.2.2 Activation temperature shock. The sonobuoy stabilized at -20°C to $+55^{\circ}\text{C}$ and entering 0° to $+35^{\circ}\text{C}$ sea water in accordance with the requirements specified in 3054-ETP-1924 for cold and hot activation testing.

3.5 Mechanical requirements.

3.5.1 Nomenclature. Nomenclature shall be as specified in the contract (see 6.2.1).

3.5.2 Form factor. The sonobuoy shall have a maximum outside diameter of $123.82 + 0.00 - 3.18$ millimeters (mm) and an overall length of $914.39 + 3.18 - 4.74$ mm. The sonobuoy shall pass through a right circular test cylinder having an inside diameter of $125.400 + 0.400 - 0.000$ mm and length of 1.2 meters. No force other than gravity shall be required to cause passage of the sonobuoy through the test cylinder when placed in a vertical position. Any irregularities on the external surface shall not damage the aircraft launcher. External dimensions of the sonobuoy shall either conform to the above or shall be the same as previously approved during first article testing. All contractor initiated changes to the external dimensions as previously first article qualified and not in compliance with the above dimensions shall be submitted as Class I ECPs for approval by the procuring activity in accordance with the contract (see 6.2.2).

3.5.3 Weight. The maximum weight of the sonobuoy shall be not greater than 9.0 kilograms (kg).

3.5.4 Finish. Parts shall not evidence corrosion which results in the failure of the sonobuoy to meet any specification requirements after any combination of environmental conditions specified in this specification.

3.5.5 Marking. The sonobuoy shall be marked with the information specified in 3.5.5.1 through 3.5.5.8.

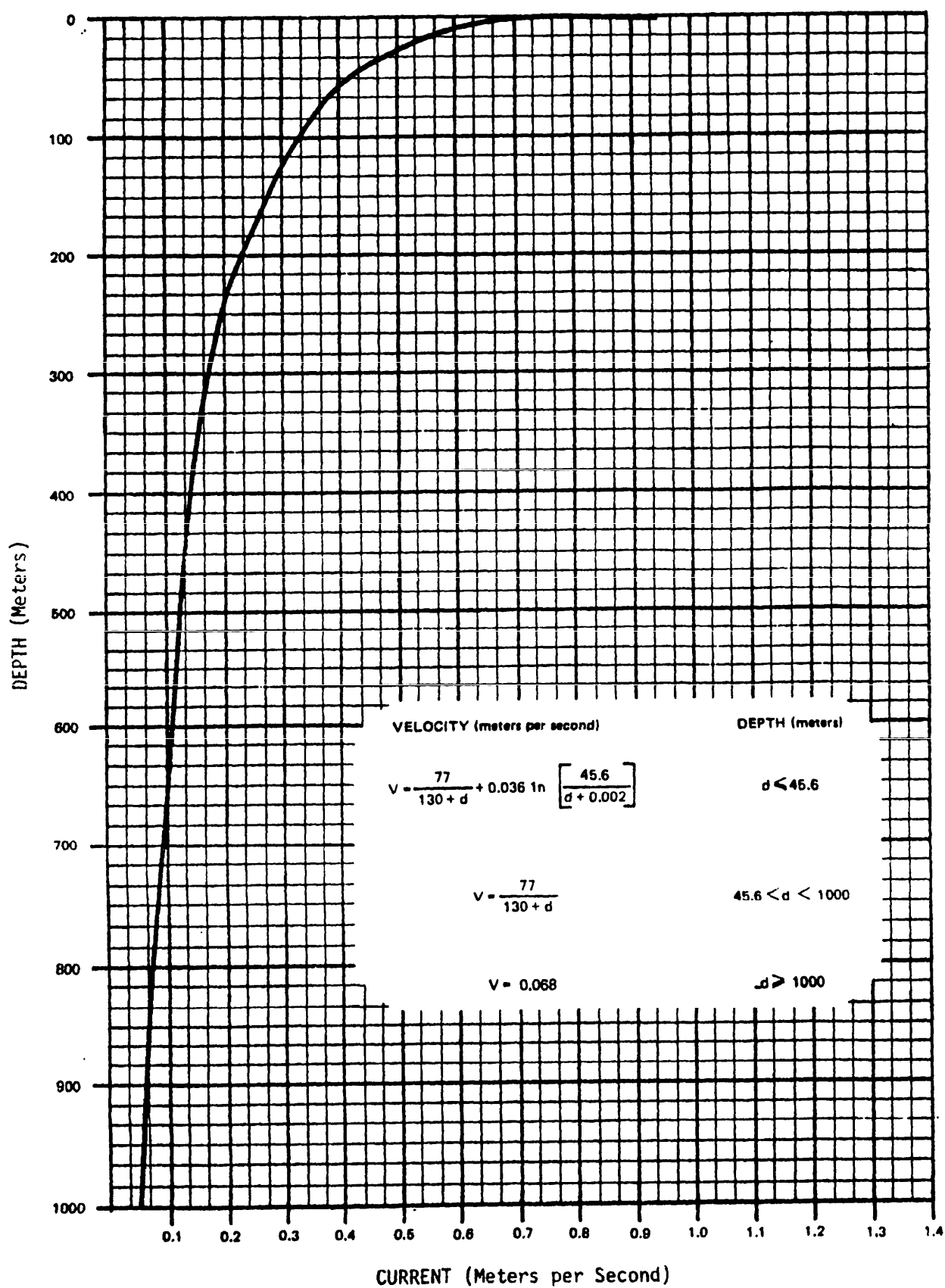
3.5.5.1 Sonobuoy identification, housing. The sonobuoy housing, approximately midway between the sonobuoy ends, shall be marked with the nomenclature, Naval Ammunition Logistics Code (NALC), contract number, lot number, contractor's Federal Supply Code for Manufacturers (FSCM), serial number, and sonobuoy gross weight in accordance with SPD-15.

3.5.5.2 Transmitter channel number. The sonobuoy housing, approximately midway between the sonobuoy ends, shall be marked with the transmitter channel number (see 3.6.4.1) in accordance with SPD-15.

3.5.5.3 Sonobuoy identification, end. The ends of the sonobuoy shall be marked with the sonobuoy abbreviated nomenclature, transmitter channel number and the NALC number in accordance with SPD-15.

3.5.5.4 Manual setting identification. The sonobuoy housing, at the operating life and hydrophone depth controls, shall be marked to clearly identify the life and depth positions and shall be marked with control actuation instructions in accordance with SPD-15.

MIL-S-81478C (AS)

FIGURE 4. Two-dimensional current profile.

MIL-S-81478C(AS)

3.5.5.5 Sonobuoy hazardous material marking. When a sonobuoy contains hazardous material as defined by paragraph 171.8 of Title 49 of the Code of Federal Regulations (49CFR), the sonobuoy shall be marked in accordance with Department of the Navy requirements.

3.5.5.6 Sonobuoy non-explosive ammunition marking. The sonobuoy housing shall be marked with a warning in accordance with SPD-15 when the sonobuoy contains a class C explosive electric squib in accordance with 49CFR paragraph 173.100 (j) and the sonobuoy (packaged in the container to be used in shipment) has successfully completed non-explosive ammunition testing in accordance with 49CFR paragraph 173.55.

3.5.5.7 Air descent control system instructions. The activator shall be marked with a warning in accordance with SPD-15 when the activator is spring loaded. The retainer or surface in the immediate area shall be marked with actuation instructions in accordance with SPD-15.

3.5.5.8 Bar code marking. The sonobuoy housing, adjacent to the sonobuoy identification marking, shall be marked with two bar codes in accordance with SPD-15. The information contained in one bar code shall include the National Item Identification Number (NIIN), U.S. Navy ownership code and material condition code. The information contained in the other bar code shall include a modified ammunition lot number (manufacturer, date, configuration, and lot information), a shelf life date, and the quantity of sonobuoys.

3.5.6 Test receptacles. Test connections shall be provided for electrical bench testing of the assembled sonobuoy. Access to the test connections shall be possible without deformation of mechanical parts or major disassembly of the sonobuoy; however, the air descent control device may be removed and the watertight integrity may be violated for this testing. If the watertight integrity is broken, it shall be restored using simple hand tools after testing is complete. The test connections shall provide the capability for:

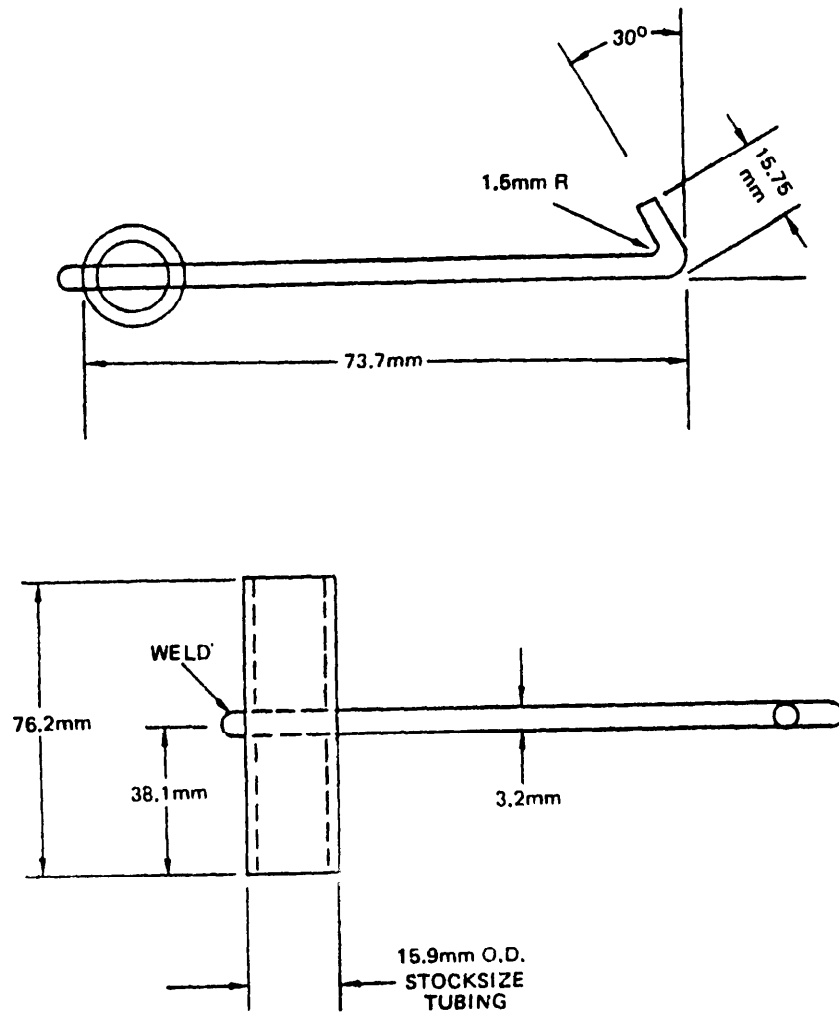
- a. Applying necessary external electrical power for testing.
- b. Performing quality conformance inspection specified in 4.5.

3.5.7 Downloading tool access. The sonobuoy bottom plate shall be provided with a 12 mm minimum diameter hole. The shape, depth, and location of the hole shall allow the sonobuoy to be hooked and lifted from a top-loaded aircraft launcher using the tool shown in figure 5.

3.5.8 Compatibility with packaging. The sonobuoy shall be compatible with the packaging and palletization specified in 5.1.

3.5.9 Air descent control system. A system shall be provided to control the air descent of the sonobuoy when the sonobuoy is launched at any point within the launch envelope specified in figure 3. The system shall not interfere with sonobuoy performance as otherwise specified herein. The system shall be compatible with and certified safe, in accordance with SPD-14, for all sonobuoy launch tube systems in the P-3A/B/C, S-3A, SH-2F, SH-3H, and SH-60B aircraft. The system shall include the hardware and physical properties as specified in 3.5.9.1 through 3.5.9.2.1.

MIL-S-81478C(AS)

FIGURE 5. Downloading tool.

MIL-S-81478C(AS)

3.5.9.1 Hardware. The air descent control system hardware shall include the decelerator, activator, captivator, retainer, outer housing, and all intermediate parts required to interconnect the above hardware ultimately to the outer housing.

3.5.9.1.1 Decelerator. The decelerator shall have a known effective drag area as determined by wind tunnel testing. The overall length of the decelerator, assembled to the sonobuoy and extended in the maximum possible condition, shall not exceed 0.92 meters. The decelerator shall have a redundant attachment feature to prevent separation of the decelerator from the sonobuoy should a single attachment point fail. The decelerator shall be located at the end of the sonobuoy that exits the SLC first during launching. The decelerator shall fully deploy within 0.8 seconds after the sonobuoy clears the aircraft launch tube at airspeeds greater than 150 knots IAS. Effective drag areas, ballistic coefficient calculation, and construction requirements for parachute decelerators shall be in accordance with SPD-13.

3.5.9.1.2 Activator. The activator shall initiate decelerator deployment during launching regardless of the sonobuoy's orientation with respect to the air stream. The activator shall not inadvertently deploy while the sonobuoy is carried in a SH-3H launch tube with the decelerator end up. The activator shall not inadvertently deploy while the sonobuoy is loaded, carried, or downloaded in a P-3A/B pneumatic launch tube with the decelerator end down and the captivator removed. Special marking on the sonobuoy is required when the activator is spring loaded (see 3.5.5.7).

3.5.9.1.3 Captivator. The captivator shall secure the activator, thereby preventing initiation of decelerator deployment, until the sonobuoy has cleared the SLC regardless of the sonobuoy's orientation with respect to the air stream at airspeeds up to and including 150 knots IAS. The captivator shall perform as specified for up to one hour as might happen if a sonobuoy was only partially launched from a helicopter horizontal launch tube. The captivator shall be removable by hand and without tools to facilitate sonobuoy use in P-3A/B and SH-3H aircraft launch tubes. The captivator shall not interfere with the operation of the activator.

3.5.9.1.4 Retainer. The retainer shall secure the activator, thereby preventing initiation of decelerator deployment, when handling the sonobuoy outside of the SLC. The retainer shall be capable of engagement or disengagement by hand and without tools. Special marking on the sonobuoy is required when the retainer must be engaged or disengaged (see 3.5.5.7). The retainer shall not interfere with the operation of the activator when the retainer is positioned for launch as directed by special marking and as shipped in the SLC.

3.5.9.2 Physical properties. The air descent control system physical properties shall include the sonobuoy weight, center of gravity in the major axis, and the ballistic coefficient.

3.5.9.2.1 Ballistic coefficient. The ballistic coefficient is defined as the weight of the sonobuoy divided by the sonobuoy effective drag area. The sonobuoy effective drag area is the combination of deployed decelerator and

sonobuoy canister effective drag areas. The ballistic coefficient for the sonobuoy with a deployed decelerator shall be 60.0 ± 4.9 Kg per squared meter.

3.5.10 Flotation system. The sonobuoy shall have a flotation system which maintains positive buoyancy in the deployed configuration for the operating life.

3.5.11 Scuttling system. The sonobuoy shall have a scuttling system which automatically scuttles the sonobuoy within 30 hours following water entry but not during the operating life. The sonobuoy shall include a means to prevent the collapse of sonobuoy housings due to hydrostatic pressure after the buoy has scuttled.

3.5.12 Watertight integrity. The electronic sections and flotation system shall be watertight throughout the operating life of the sonobuoy.

3.5.13 Hydrophone and suspension system. The exterior of the hydrophone shall be substantially black.

3.5.13.1 Operating depth. The hydrophone and suspension system shall maintain an operating depth, selectable prior to launch, as specified in 3.5.13.1.1 through 3.5.13.1.2. Operating depth is defined as the vertical distance from the mean ocean surface to the center of the acoustic receiver array. Program FF2E shall be used to analytically determine the operating depth for the two dimensional current profile (see publications NSRDC Report 3721, NADC Report 80178-30 and NAC Report TR-2359).

3.5.13.1.1 Shallow depth. With no relative flow, the operating depth shall be 20 ± 2 meters (m). When the sonobuoy is deployed in the two dimensional current profile shown in figure 4, the operating depth shall be 20, +2, -3 m.

3.5.13.1.2 Deep depth. With no relative flow, the operating depth shall be 120 ± 12 m. When the sonobuoy is deployed within the two dimensional current profile shown in figure 4, the operating depth shall be 120, +12, -30 m.

3.5.13.2 Deployment time. With respect to the time of water entry, the hydrophone and suspension system deployment times shall be as specified in 3.5.13.2.1 through 3.5.13.2.2.

3.5.13.2.1 Shallow depth. To specified depth within 60 seconds.

3.5.13.2.2 Deep depth. To specified depth within 100 seconds.

3.5.14 Selectable controls. Controls shall be provided to enable manual selection without mechanical assistance of depth and life settings. Each control shall be capable of a minimum of 50 selections. When a sonobuoy launch container is provided at the time of manufacture, a means shall be provided for alignment of controls and launching container access ports. The setting positions shall be detented (or equivalent) to give a positive feel at each position to preclude the possibility of setting in-between positions, and to prevent a change in setting resulting from service use, including: handling, loading, deployment from aircraft, free flight, water impact, and the water environments. Positive stops shall limit the setting mechanism to

MIL-S-81478C(AS)

prevent damage. The setting position shall be such that it can be visibly verified through the launcher assembly.

3.5.15 Frequency response data. Data describing the particular sonic system frequency response of each sonobuoy shall be supplied in accordance with the contract (see 6.2.1 and 6.2.2). The data shall be obtained by summing the measured hydrophone response and the measured electronics response at discrete frequencies. A constant value for hydrophone response at frequencies below 1 KHz may be used in lieu of actual measurements if the hydrophone response is flat within ± 1 dB below 1 KHz. Hydrophone response at frequencies above 10 KHz shall be measured in the horizontal plane with the hydrophone in its deployed orientation and at a reference angle chosen by the contractor. The contractor shall be able to repeat his own data within ± 1 dB.

3.6 Electrical requirements.

3.6.1 Power supply. All power shall be supplied by self-contained power supplies. If lithium batteries are used, the batteries shall comply with the requirements of 49CFR paragraph 173.206 (f) to allow unrestricted transportation, storage and disposal of the lithium battery/sonobuoy assembly. Lithium battery assemblies shall be certified safe when tested in accordance with SPD-10.

3.6.2 Operating life. The sonobuoy shall have a continuous operating life of 1 hour, $+20$, -0 minutes for the 1 hour setting, 3 hours, $+45$, -0 minutes for the 3 hour setting, or 8 hours, $+4$, -0 hours for the 8 hour setting. Operating life is defined as the elapsed time from water entry until cessation of RF transmission. The sonobuoy shall operate within the specified performance criteria during the operating life.

3.6.3 Antenna system. An antenna system shall be provided and shall operate as specified for all VHF carrier frequencies listed in 3.6.4.1. The antenna system shall fully erect within 60 seconds following water entry. The sonobuoy shall meet the requirements specified herein and in STP-3062-1-1.

3.6.3.1 Vertical beam pattern. The vertical beam pattern of the antenna system at the assigned VHF channel frequency shall have a single major lobe between the angles of 0° to 90° of elevation measured relative to a reference plane normal to the major axis of the sonobuoy. The pattern shall have a null at 90° from the reference plane which is at least 20 decibels (dB) below the maximum amplitude of the major lobe. The beam width of the pattern shall be defined by the -3 dB points which shall occur at elevation angles of less than 3° and greater than 15° with respect to the reference plane. In addition, variations in the pattern with respect to the maximum of the major lobe shall be not greater than 16 dB between 0.5° and 3° elevation and 12 dB between 15° and 60° elevation.

3.6.3.2 Horizontal beam pattern. The horizontal beam pattern of the antenna system at the assigned VHF channel frequency shall be omnidirectional within ± 1 dB for all elevation angles within the vertical beam pattern defined by the -3 dB points of 3.6.3.1.

MIL-S-81478C(AS)

3.6.4 VHF transmitter.

3.6.4.1 VHF frequency. The VHF transmitter shall operate on one of the 31 VHF channels spaced 375 kilohertz (KHz) apart in the frequency range of 162.25 to 173.50 megahertz (MHz). Each individual sonobuoy shall be preset at the time of manufacture to one of these channel frequencies as specified in the contract (see 6.2.1). The channel number and frequency assignments shall be as shown in Table I. In the absence of modulation the VHF transmitter carrier frequency shall be within ± 25 KHz of assigned channel frequency.

3.6.4.2 VHF power output. The VHF transmitter shall deliver a power output of at least 1.0 watt RMS on the assigned channel frequency to the antenna system. For test purposes, power may be measured into a test load that is electrically equivalent to the antenna and its transmission line.

3.6.4.3 VHF commencement and cessation. VHF transmission at the assigned VHF frequency, with a power output of 0.5 watt rms minimum shall commence within 60 seconds following water entry. VHF transmission with a power output of 1.0 watt rms minimum shall commence within 180 seconds following water entry and shall continue for the duration of the operating life. VHF transmission shall cease at 1 hour, +20, -0 minutes for the 1 hour setting, 3 hours, +45, -0 minutes for the 3 hour setting, or 8 hours, +4, -0 hours for the 8 hour setting following water entry.

3.6.4.3.1 VHF drop out. VHF carrier drop out shall be permissible a maximum of five percent of the time. In addition, for elevation angles greater than three degrees, as defined in 3.6.3.1, the duration of the drop out shall be not greater than three seconds. For the purpose of this specification, a VHF drop out is defined as a six dB or greater reduction in VHF power from the levels defined in 3.6.4.4.

3.6.4.4 Radiated signal power density. The sonobuoy shall radiate a VHF signal on the assigned channel frequency having a power density of at least 83 milliwatts per square meter when measured at the maximum amplitude of the major lobe of the radiation pattern specified in 3.6.3.1 at a test distance of one meter. The far field power density shall be in accordance with the power levels specified in table I of STF-TP-101, Vol II.

3.6.4.5 Spurious radiation. No components of the spurious radiation spectrum shall be greater than a level of -40 dB relative to the major lobe power density of the signal radiated on the VHF carrier frequency.

3.6.4.6 VHF carrier modulation. The VHF carrier shall be capable of being frequency modulated by signals in the frequency range of 10 Hz to 20 KHz. The maximum VHF carrier frequency deviation shall not be greater than 105 KHz, when subjected to a voltage level 15 dB above that required to produce 75 KHz deviation.

3.6.4.6.1 Symmetry. Frequency modulation of the VHF carrier shall be symmetrical within ± 20 percent, when a modulating signal with amplitude sufficient to produce ± 75 KHz peak frequency deviation is applied to the transmitter modulator. The modulating signal shall be in the frequency range of 10-20000 Hz inclusive.

MIL-S-81478C(AS)

TABLE I. Channel number and frequency assignment.

| VHF Channel | VHF Carrier Frequency (MHz) | VHF Channel | VHF Carrier Frequency (MHz) |
|-------------|-----------------------------|-------------|-----------------------------|
| 1 | 162.250 | 17 | 162.625 |
| 2 | 163.000 | 18 | 163.375 |
| 3 | 163.750 | 19 | 164.125 |
| 4 | 164.500 | 20 | 164.875 |
| 5 | 165.250 | 21 | 165.625 |
| 6 | 166.000 | 22 | 166.375 |
| 7 | 166.750 | 23 | 167.125 |
| 8 | 167.500 | 24 | 167.875 |
| 9 | 168.250 | 25 | 168.625 |
| 10 | 169.000 | 26 | 169.375 |
| 11 | 169.750 | 27 | 170.125 |
| 12 | 170.500 | 28 | 170.875 |
| 13 | 171.250 | 29 | 171.625 |
| 14 | 172.000 | 30 | 172.375 |
| 15 | 172.750 | 31 | 173.125 |
| 16 | 173.500 | | |

3.6.4.6.2 Distortion. The maximum total harmonic distortion generated by the sonic receive system appearing at the output of the VHF transmitter shall be not greater than the limits specified in table II. The sonic receive system is defined as being all the elements that pass acoustic energy from the ocean through the sonobuoy VHF transmitter.

TABLE II. Sonic receiver system distortion limit

| FM Carrier Deviation (KHz) | Input Frequency (Hz) | Distortion (Percent) |
|----------------------------|----------------------|----------------------|
| 40 | 10-20000 | 5 |
| 75 | 10-20000 | 10 |

3.6.4.7 Mechanically induced noise. With the input of the transmitter terminated in an impedance equivalent to the output impedance of the previous stage, the spectrum level of any noise generated by the transmitter when the sonobuoy is subjected to the conditions of 3.4.2.2.1 shall be not greater than -51 dB relative to 19 Kilohertz deviation for the frequency range of 10-500 Hz.

3.7 Acoustic requirements.

3.7.1 Sonic receive system. The sonic receive system is defined as being all the elements that pass acoustic energy from the ocean through the sonobuoy VHF transmitter. The sonobuoy shall meet the requirements specified herein and in STP-3062-5.

MIL-S-81478C(AS)

3.7.1.1 Frequency response. The frequency response of the sonic receive system, relative to the response at 100 Hz, shall be within the envelope of figure 6. Reference point "A" of figure 6 is the measured acoustic sensitivity of the sonic receive system at 100 Hz and shall be located within the tolerance limits specified in 3.7.1.2.

3.7.1.2 Acoustic sensitivity. A VHF carrier frequency deviation of ± 19 KHz shall result when the hydrophone is placed in a sound field at 100 Hz having a RMS sound pressure level of 116 ± 2 dB above one micropascal. A positive VHF carrier frequency deviation shall result from an increase in sound pressure level and a negative frequency deviation shall result from a decrease in sound pressure level.

3.7.1.3 Noise. Any unwanted signals attributable to the sonobuoy which pass through any part of the sonic receive system and produce a frequency deviation of the VHF transmitted carrier shall meet the requirements specified in 3.7.1.3.1 and 3.7.1.3.2.

3.7.1.3.1 Electrically induced. The following electrical noise limits shall not be exceeded with the sonobuoy under the standard conditions of 3.4.1.

- a. With the acoustic receiver transducer replaced by an equivalent electrical impedance, the spectrum level of the electrical noise produced by the sonobuoy and the test load shall be not greater than the spectrum level of figure 7.

3.7.1.3.2 Mechanically induced. Carrier frequency deviation, caused by the per-cycle noise energy generated within the frequency band of 10 to 500 Hz as a result of mechanical excitation of the sonobuoy shall be not greater than the frequency deviation equivalent to the sound pressure level of figure 8. The sonobuoy shall meet the requirements specified herein when tested in accordance with STF-TP-101 and SPD-9.

3.7.1.4 Receiver directivity. The hydrophone shall be omnidirectional within ± 1 dB in the frequency range of 10 Hz to 10 KHz.

3.7.1.5 Production standards. Production standard hydrophones, used in determining the sensitivity of production hydrophones, shall be calibrated in accordance with STP-3062-19.

3.7.1.6 Receiver response. The hydrophone response shall be flat within ± 1 dB in the frequency range of 10 Hz to 10 KHz.

3.7.1.7 Phase uniformity. Uniformity among sonobuoys shall be such that the phase shift of the demodulated outputs of any two sonobuoys shall be within a 22 degree envelope as specified below at the reference frequencies of 50, 100, and 500 Hz.

- a. The phase shift between a sinusoidal pressure variation impressed on the hydrophone and the resulting RF carrier deviation is specified as follows: Zero degree of the pressure sine wave is specified as the point where the instantaneous carrier frequency crosses the average carrier frequency in an increasing carrier frequency direction. A phase shift angle is specified as

MIL-S-81478C(AS)

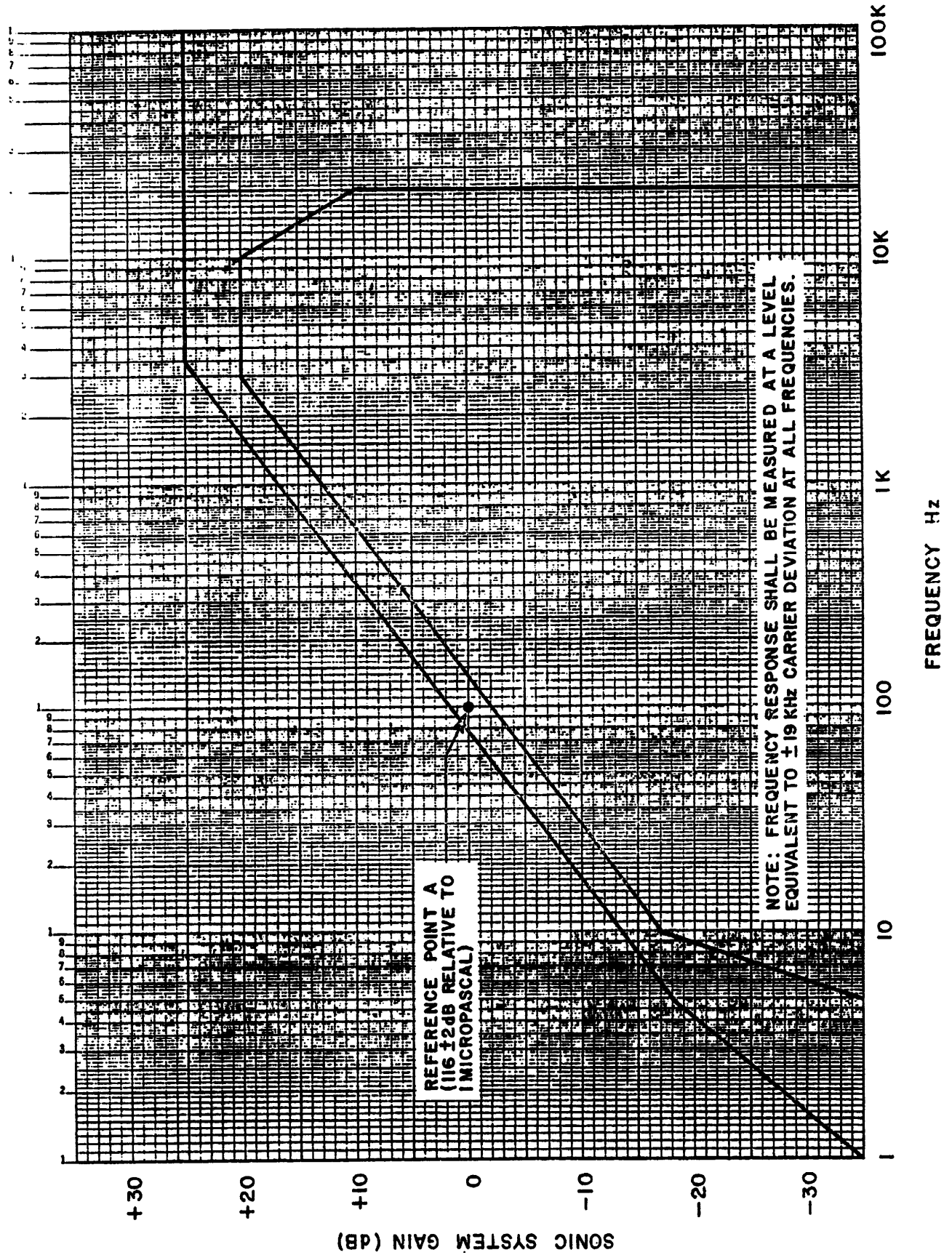


FIGURE 6. Sonic system response

MIL-S-81478C(AS)

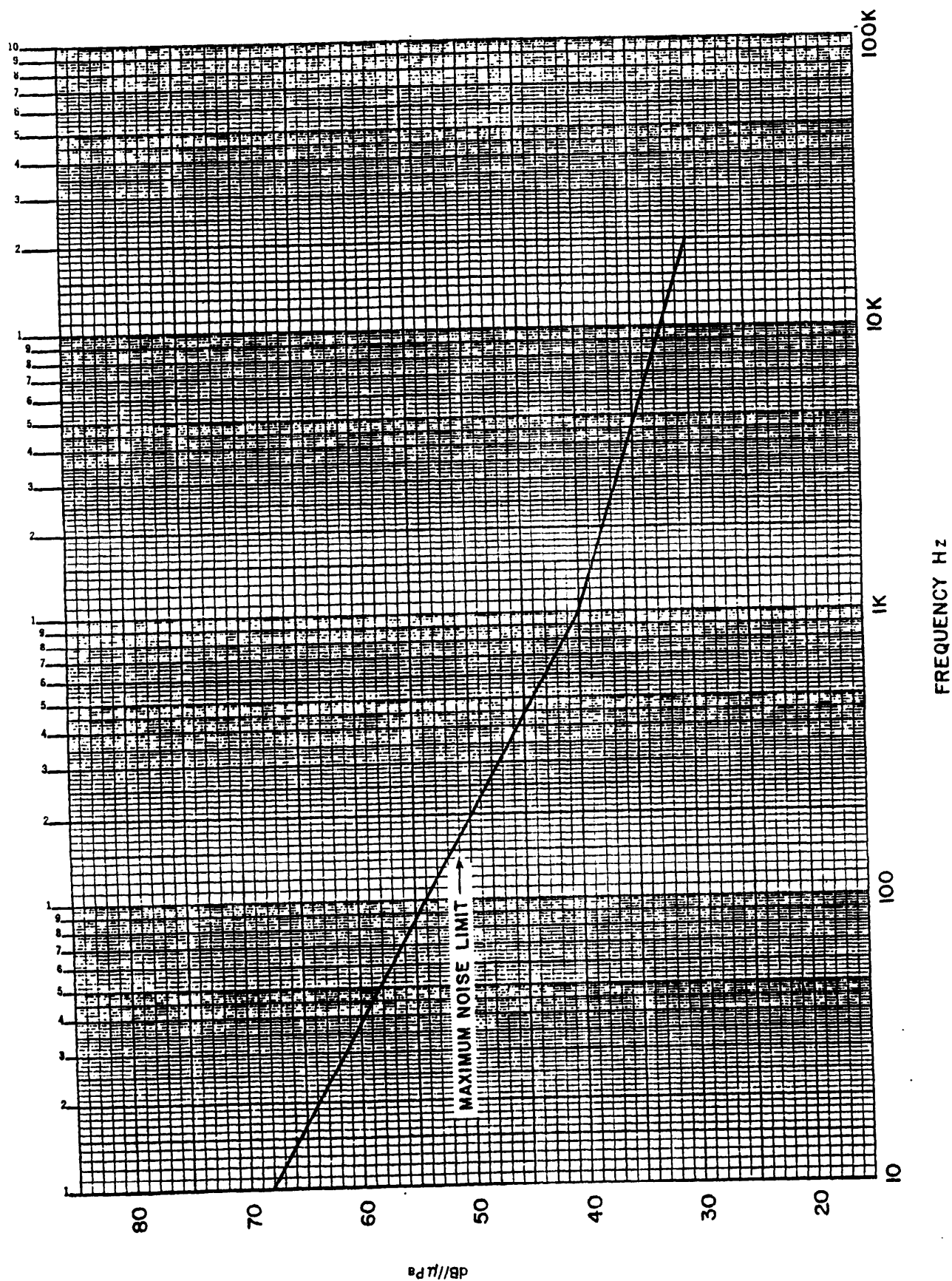
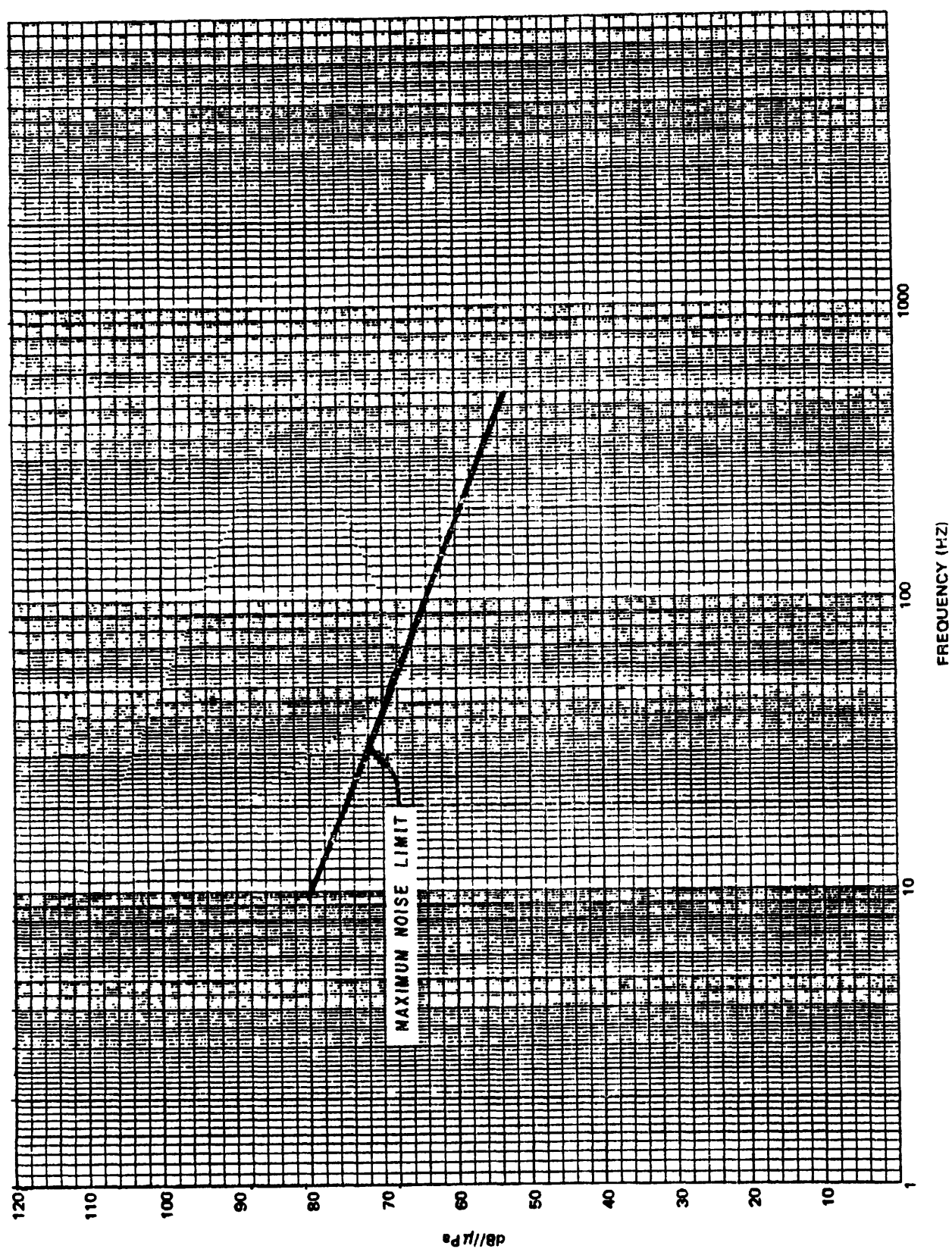


FIGURE 7. Electrical noise spectrum

MIL-S-81478C(AS)

FIGURE 8. Mechanically induced noise spectrum

MIL-S-81478C(AS)

the number of degrees the carrier deviation sine wave lags the input pressure sine wave.

b. For each of the reference modulation frequencies of Table III, the contractor shall select a 22° envelope of phase shift within the extremes listed in Table III, and shall thereafter maintain the phase uniformity above.

TABLE III. Modulation frequencies vs phase shift extremes

| Frequency Hz | Phase Shift Extremes (degrees) |
|-----------------|-----------------------------------|
| 50 | 55 to 95 |
| 100 | 50 to 90 |
| 500 | 30 to 80 |

3.8 Safety. The sonobuoy design shall provide for safety in the categories specified in 3.8.1 through 3.8.4. Changes to the sonobuoy which affect safety shall be in accordance with the contract.

3.8.1 Personnel. The sonobuoy shall be so constructed that personnel cannot be cut by screws or sharp edges. Parts which store energy or that are acted on by stored energy shall not release energy inadvertently or shall be of small mass and shaped such that they do not constitute a hazard.

3.8.2 Shipping. All parts and products of the sonobuoy shall be restrained within the confines of the packaging specified in the contract (see 5.1 and 6.2.1) under shipping and storing conditions.

3.8.3 Launching. The sonobuoy shall not be a hazard to the aircraft or crew when launched.

3.8.4 Potentially hazardous material or devices. The sonobuoy may utilize potentially hazardous material and devices; however, the application of these materials and devices shall conform to specific guidelines established by the government. The sonobuoy may not utilize electric squibs or other class explosives unless the sonobuoy, packaged in the container to be used in shipment, has successfully completed non-explosive ammunition testing in accordance with 49CFR paragraph 173.55. The procuring activity will provide these guidelines as requested by the contractor. Any sonobuoy containing lithium battery assemblies shall be certified safe when tested in accordance with the procedures of SPD-10.

3.9 Quality and workmanship.

3.9.1 Quality program. When specified in the contract, the contractor shall conduct a quality program in accordance with the specification referenced in the contract (see 6.2.1). When specified in the contract, the contractor shall prepare a Product Assurance Program Plan (PAPP) for review and acceptance by the procuring activity (see 6.2.2).

3.9.2 Workmanship. Workmanship shall be in accordance with the contractor developed standards based on MIL-STD-454, requirement 9.

MIL-S-81478C(AS)

4. QUALITY ASSURANCE PROVISIONS.

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. The contractor shall insure that test and inspection facilities of sufficient accuracy, quality and quantity are established and maintained to permit performance of required inspections.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Contractor demonstration (see 4.3)
- b. First article inspection (see 4.4)
- c. Quality conformance inspection (see 4.5)
 - (1) Individual inspections (see 4.5.1)
 - (2) Sampling inspections (see 4.5.2)
 - (3) Aircraft drop tests (see 4.5.3)
- d. Performance maintenance inspections (see 4.6)

4.3 Contractor demonstration. When specified in the contract, contractor demonstration tests shall be conducted by the contractor. Tests shall be conducted under the approved test procedures of 4.8. Data obtained by the contractor in conducting these tests shall be included with the sonobuoys submitted for first article tests. Contractors not having adequate facilities to conduct all required tests shall obtain the services of a commercial testing laboratory acceptable to the procuring activity (see 6.2.1).

4.4 First article inspections. When specified in the contract, first article inspections shall be conducted at the first article test activity designated by the procuring activity (see 6.2.1). These inspections shall include aircraft drop tests and any other tests necessary to assure compliance with this specification. Whenever possible, the first article sonobuoys shall be manufactured using the methods, procedures, parts, and materials intended for use on production equipments. Otherwise, the methods, procedures, parts, and materials used shall be functionally representative of the configuration identified as the product baseline. The number of sonobuoys required shall be as specified in the contract. These tests may be conducted in increments. Deficiencies disclosed in any increment shall be corrected prior to submission of subsequent increments. Whole sonobuoys or specific parts of sonobuoys may be returned to the contractor for his use in failure analysis. Production of

MIL-S-81478C(AS)

sonobuoys prior to completion of first article tests and granting of first article approval shall be done at the contractor's own risk.

4.4.1 Accessory material. In addition to the equipments submitted for first article tests, the contractor shall also submit accessory material such as connectors, cables, and include data (excluding avionics equipment) necessary to perform first article tests.

4.5 Quality conformance inspections. Acceptance of the production equipments shall be on a lot basis after satisfactory completion of the tests specified in 4.5.1 through 4.5.1.3. The contractor shall furnish all equipments and shall be responsible for accomplishing individual and sampling tests. The procuring activity will conduct aircraft drop tests. All inspection and testing at the contractor's plant shall be monitored by the cognizant government representative. When specified in the contract, the contractor shall prepare and have available test reports showing results for all individual and sampling tests required by this specification. The report shall be signed by an authorized representative of the contractor or laboratory, as applicable (see 6.2.2). Acceptance or approval of material during the course of manufacture shall in no case be considered a guarantee of the acceptance of the finished product.

4.5.1 Individual inspection. Each sonobuoy shall be subjected to individual inspections. These inspections shall be adequate to determine compliance with the requirements of material, workmanship, and operational adequacy. As a minimum, each equipment shall be subjected to the following:

- a. Examination of Product (see 4.5.1.1)
- b. Operational Test (see 4.5.1.2)

4.5.1.1 Examination of product. Each sonobuoy shall be carefully examined to determine that the requirements for material and workmanship have been met.

4.5.1.2 Operational test. Each sonobuoy shall be operated for such time as may be necessary to permit the measured parameter to stabilize and shall then be tested for compliance with the requirements specified in table IV under the standard conditions. These tests shall be conducted at the highest assembly level which precludes disassembly in order to accomplish the test.

TABLE IV. Operational tests

| Test | Applicable Paragraph |
|------------------------------|----------------------|
| VHF Transmitter Frequency | 3.6.4.1 |
| VHF Transmitter Power Output | 3.6.4.2 |
| Functional Operation | 4.5.1.3 |

4.5.1.3 Functional operation. A sound pressure in the frequency range of 10 Hz to 20 KHz shall be impressed upon the hydrophone. The sound pressure shall be processed by the sonobuoy and transmitted through an RF link to suitable

MIL-S-81478C(AS)

equipment capable of receiving and demodulating the modulated RF signal. In lieu of an RF link, the sonobuoy output may be monitored at a test receptacle while a continuity check is made to verify that the antenna is functional.

4.5.2 Sampling inspection. Sampling inspection shall be conducted on a subplot consisting of 151 sonobuoys or more. Sampling inspection may be conducted without the air descent mechanism in place. Assembled sonobuoys shall be selected for inspection in accordance with MIL-STD-105, Normal Inspection, Level II, Single Sampling Plan, and shall be accepted or rejected in accordance with the procedures of MIL-STD-105, Acceptable Quality Level (AQL) 1.5 percent defective. In lieu of subplot sampling, continuous sampling in accordance with CSP-1 Sampling Plan, Option (b) of H-107 may be used with Inspection Level II and AQL of 1.5 percent. The production interval shall be not greater than two months. The sampling frequency code letters E, F, G, H, and I are the only code letters which may be used. The rules and procedures for administration shall be as specified in Handbook H-107. A break in the homogeneity requirement of Handbook H-107 is defined as follows:

- a. Any interruptions, other than those due to the end of shift, day, or workweek, to the production process that may affect the measured characteristic(s) of the specified sampling tests is considered a break in homogeneity.
- b. Any engineering change (Class II, preliminary Class I, or Class I) that may affect the measured characteristic(s) of the specified sampling tests is considered a break in homogeneity.
- c. Each sonobuoy tested shall be operated for such time as may be necessary to permit its temperature to stabilize and shall then be tested for compliance with the requirements of table V under standard conditions. In lieu of the Inspection Level II specified, 100 percent or any other increased level of inspection is allowable.

TABLE V. Sampling tests.

| Test <u>1</u> / | Applicable Paragraph |
|--|----------------------|
| Watertight Integrity (Subassembly Level) | 3.5.12 |
| Transmitted Frequency | 3.6.4.1 |
| Transmitter Power Output (Actual power measurement not required if test identified in test procedure is made for indication of specified power output) | 3.6.4.2 |
| Functional Operation | 4.5.1.3 |

1/ Sonobuoys which have successfully passed the sampling tests shall be returned to the subplot from which they were selected.

MIL-S-81478C(AS)

4.5.3 Aircraft drop tests. Aircraft drop tests will be conducted on a production lot sample of sonobuoys as specified in the contract. The completely assembled sonobuoys will be randomly selected from a production lot by the cognizant government representative in accordance with MIL-STD-105, Inspection Level I and the contract. The sample will be submitted to the test activity designated by the procuring activity (see 6.2.1). The samples will be evaluated to the performance requirements of this specification in accordance with STF-TP-101 and the contract. Defects will be classified as critical, major, or minor in accordance with MIL-STD-105 and as specified in STF-TP-101 and the contract.

4.5.3.1 Lot acceptance. The cognizant government representative will be notified of the acceptability of each production lot when its representative sample has completed the aircraft drop tests. Upon receiving such notification, the cognizant government representative will accept or reject the entire lot. Lot acceptance is conditional on delivery in specified packaging. In the event the cognizant government representative is not notified of the test results and the action to be taken, within the time specified in the contract, the entire lot will be accepted. The date of submission is defined as the date of shipment of the sample from the contractor's plant. Notification of shipment will be as specified in the contract (see 6.2.1).

4.5.3.2 Lot rejection. A production lot represented by the sample under test shall be rejected if the number of defective sonobuoys observed for that sample exceeds the contractual limit.

4.5.3.3 Production lot samples. Production lot samples representing satisfactory production lots shall be accepted as fulfilling part of the contractual quantity requirements. Samples representing unsatisfactory production lots shall not be accepted.

4.6 Performance maintenance inspection. Performance maintenance inspections will be conducted by the first article test activity on production equipments not expended in aircraft drop tests. These inspections may duplicate any tests previously conducted during first article tests. Defective units may be returned to the contractor providing 90 days has not elapsed since acceptance of the last lot of the contract. The contractor shall perform a failure analysis of all returned units and shall identify corrective action. The failure analysis reports shall be provided to the procuring activity in accordance with the contract (see 6.2.2).

4.7 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with section 5 and the contract.

4.8 Inspection procedures. The procedures used for conducting contractor demonstration, individual and sampling inspections shall be prepared and submitted for acceptance by the procuring activity (see 6.2.1). MIL-T-18303 shall be used to the extent specified in the contract for preparation of the procedures.

MIL-S-81478C(AS)

5. PACKAGING.

5.1 Preservation and packaging. The requirements of the contract shall apply (see 6.2.1).

5.2 Marking. The packaging shall be marked in accordance with SPD-15. The government identification numbers shall be as specified in the contract (see 6.2.1).

6. NOTES.

6.1 Intended use. The AN/SSQ-57A sonobuoy is an aircraft launched, expendable, self-actuating device. It is used to detect sounds in the sonic frequency range and relay this information by a VHF link to airborne equipment.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Contractor first article inspection requirements (see 3.1, 4.4)
- c. Requirements for the reliability program (see 3.3.1)
- d. Requirements for failure analysis reports (see 3.3.4)
- e. Nomenclature assignment (see 3.5.1)
- f. Requirements for frequency response data (see 3.5.15)
- g. Distribution of channel frequencies (see 3.6.4.1)
- h. Requirements for the quality program (see 3.9.1)
- i. Contractor demonstration requirements (see 4.3)
- j. Designation of the first article and aircraft drop test facilities (see 4.4, 4.5.3)
- k. Instructions for submitting notification of shipment of aircraft drop test samples and the maximum time allowed for the Government to test lot samples (see 4.5.3.1)
- l. Instructions for submittal of contractor demonstration, individual and sampling test procedures (see 4.8)
- m. Requirements for packaging including marking and assignment of government identification numbers (see 5.1, 5.2).

MIL-S-81478C(AS)

6.2.2 Data requirements. When this specification is used in an acquisition which incorporate a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of FAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

| Paragraph No. | Data Requirements | Applicable DID No. |
|---------------|---|--------------------|
| 3.2 | Data, Design | UDI-E-21338 |
| 3.3.4 | Report, Corrective Action | UDI-T-23719 |
| 3.3.4, 4.6 | Report, Failure | DI-R-7039 |
| 3.5.2, 3.8 | Engineering Change Proposals (ECP) and Request for Deviations and Waivers | DI-E-2037 |
| 3.5.15 | Report, Test | DI-T-5247 |
| 3.9.1 | Plan, Product Assurance Program (PAPP) | DI-R-1700 |
| 4.5 | Procedure, Quality Conformance Tests | UDI-T-21347 |

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L., Vol. II AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.3 First article. The first article should consist of the number of unit(s) specified in the contract. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations and approval of the first article documents.

6.4 Associated equipment. The AN/SSQ-57A is used with the following equipment:

- a. Radio Receiving Set, AN/ARR-72, AN/ARR-75, and AN/ARR-76
- b. Aircraft Data Processor AN/AQA-7, AN/AQA-7(V), OL-82/AYS

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity
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(Project 5845-N083)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)*

| | | | |
|---|--|--|--|
| 1. DOCUMENT NUMBER MTI-S-81478C(AS) | | 2. DOCUMENT TITLE Sonobuoy AN/SSO-57A. Specification For | |
| 3a. NAME OF SUBMITTING ORGANIZATION | | 4. TYPE OF ORGANIZATION (Mark one) | |
| b. ADDRESS (Street, City, State, ZIP Code) | | <input type="checkbox"/> VENDOR | |
| | | <input type="checkbox"/> USER | |
| | | <input type="checkbox"/> MANUFACTURER | |
| | | <input type="checkbox"/> OTHER (Specify) _____ | |
| 5. PROBLEM AREAS | | | |
| a. Paragraph Number and Wording | | | |
| b. Recommended Wording | | | |
| c. Reason/Rationale for Recommendation | | | |
| 6. REMARKS | | | |
| 7a. NAME OF SUBMITTER (Last, First, MI) - Optional | | 8. WORK TELEPHONE NUMBER (Include Area Code) - Optional | |
| c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional | | 9. DATE OF SUBMISSION (YYMMDD) | |

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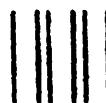
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