

MIL-R-81355B(AS)

1 October, 1968

~~Superseding~~

MIL-R-81355A(AS)

1 February 1967

## MILITARY SPECIFICATION

### RECORDER, BATHYTHERMOGRAPH DATA

RO-308/SSQ-36

This specification has been approved by the  
Naval Air Systems Command, Department of the Navy

#### 1. SCOPE -

1.1 Scope - The equipment covered by this specification shall provide a permanent record of the temperature profile of sea water from sea level to a depth of 1,000 feet. The equipment shall be used in naval aircraft for the purposes of oceanographic research and anti-submarine warfare.

1.2 Classification - The equipment covered by this specification shall consist of the item listed in paragraph 6.8.

1.3 Associated Equipment - This equipment shall operate with the associated equipment listed in paragraph 6.9.

#### 2. APPLICABLE DOCUMENTS-

2.1 General - The following documents of the issue in effect on the date of invitation for bids form a part of this specification to the extent specified herein:

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## SPECIFICATIONS

Military

MIL-W-5088	Wiring; Aircraft, Installation of
MIL-E-5400	Electronic Equipment, Aircraft, General Specification for
MIL-T-5422	Testing, Environmental, Aircraft Electronic Equipment
MIL-I-6181	Interference Control Requirements, Aircraft Equipment
MIL-C-6781	Control Panel; Aircraft Equipment, Rack or Console Mounted
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Pre- paration for Delivery of
MIL-T-18303	Test Procedures; Preproduction and Acceptance for Aircraft Electronic Equipment, Format for
MIL-N-18307	Nomenclature and Nameplates for Aeronautical Electronic and Assoc- iated Equipment
MIL-F-25173	Fastener, Control Panel, Aircraft Equipment

Naval Air Systems Command

AR-5	Microelectronic Devices used in Avionics Equipment, Procedures for Selection and Approval of
AR-10	Maintainability of Avionic Equipment and Systems, General Requirements for

## STANDARDS

Military

MIL STD 704	Electric Power, Aircraft, Characteristics and Utilization of
MIL STD 781	Reliability Tests, Exponential Distribution

Federal

FED-STD-595	Colors
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## PUBLICATIONS

### Naval Air Systems Command

EI-504

Avionics Installation Instructions for  
Recorder, Bathythermograph Data  
RO-308/SSQ-36

2.1.1 Availability of Documents - When requesting specifications, standards, drawings, and publications, refer to both title and number. Copies of this specification and applicable specifications required by contractors in connection with specific procurement functions, may be obtained upon application to the Commanding Officer, Naval Supply Depot, Code 105, 5801 Tabor Avenue, Philadelphia, Pennsylvania, 19120.

## 3. REQUIREMENTS

3.1 Preproduction - This specification makes provision for preproduction testing.

3.2 Parts and Materials - In the selection of parts and materials, fulfillment of major design objectives shall be the prime consideration. In so doing, the following shall govern:

- (a) Microelectronic technology shall be considered and microelectronic items shall conform to requirements specified herein.
- (b) Other parts and materials requirements shall conform to Specification MIL-E-5400.
- (c) Nonrepairable subassemblies, as outlined in Specification MIL-E-5400, shall be used when practicable. The general size of the subassembly and the amount of circuitry to be included therein, shall be approved by the procuring activity. Nonrepairable subassemblies must be reliable. ( See 6.5 )
- (d) When previously produced models of this equipment did not use nonrepairable subassemblies, the design shall not be changed to employ nonrepairable assemblies without the approval of the procuring activity.

3.2.1 Nonstandard Parts and Materials Approval - Approval for the use of nonstandard parts and materials ( including electron tubes, transistors and diodes ) shall be obtained as outlined in Specification MIL-E-5400.

3.2.2 Microelectronic Modular Assemblies - When used, Microelectronic Modular Assemblies shall meet the requirements of specification AR-5

3.2.3 Modules - The electronic portions of the equipment shall be modularized. Maintenance modules shall normally be considered repairable.

3.3 Design and Construction - The equipment shall conform with all the applicable requirements of Specification MIL-E-5400 for design, construction, and workmanship, except as otherwise specified herein.

3.3.1 Total Weight - The total weight of the equipment, excluding cables, shall be a minimum consistent with good design and shall not exceed 11 pounds.

3.3.2 Reliability -

3.3.2.1 Operational Stability - The equipment shall operate with satisfactory performance, continuously or intermittently for a period of at least 200 hours without the necessity for readjustment of any controls which are inaccessible to the operator during normal use.

3.3.2.2 Operating Life - The equipment shall have a total operating life of 1000 hours with reasonable servicing and replacement of parts. Parts requiring scheduled replacement shall be specified by the contractor.

3.3.2.3 Reliability in Mean Time Between Failure (MTBF) - The equipment shall have 200 hours of mean ( operating ) time between failures when tested and accepted as outlined under the requirements of 4.4.3.

3.3.3 Cabling and Connections -

3.3.3.2 Interconnection Cabling- The equipment shall be capable of satisfactory operation using external wiring in accordance with the applicable requirements of Specification MIL-W-5088. The external wiring shall be unshielded, except that a minimum number of the individual wires may be shielded when demonstrated as necessary to meet interference control requirements and provided the assembly of the cable to its plugs may be easily accomplished. External cables and that portion of the connector attached to the cables shall not be supplied as part of the equipment.

\*3.3.4 Control Panels - The equipment shall conform to the applicable requirements of Specification MIL-C-6781 except that the panel shall be gray, per Federal Standard 595 ( Color # 36231 ), and shall have white lights. The configuration of all panels must be approved by the procuring activity prior to preproduction testing.

**3.3.5 Interchangeability of Reordered Equipment** - For reordered equipment interchangeability shall exist between units and all replaceable assemblies, subassemblies, and parts of a designated model of any previously manufactured equipment, supplied or designated by the procuring activity.

**3.3.6 Interference Control** - The generation of radio interference by the equipment and the vulnerability of the equipment to radio interference shall be controlled within the limits of Specification MIL-I-6181.

**3.3.7 Maintenance Provisions and Field Testing** - Provisions for maintenance and field testing shall be as specified in paragraphs 3.2 and 3.4.1 of Specification AR-10. Specific test points and test facilities shall be provided to the greatest extent practicable for ease of field testing and maintenance.

**3.3.8 Nomenclature and Nameplates** - Nomenclature assignment and nameplate approval for equipment identification shall be in accordance with Specification MIL-N-18307.

**3.3.9 Standard Conditions** - The following conditions shall be used to establish normal performance characteristics under standard conditions and for making laboratory bench tests:

Temperature	Room ambient (25°C ±5°C)
Altitude	Normal ground
Vibration	None
Humidity	Room ambient up to 90% relative humidity
Input power voltage	115± 1.0 V AC and 27.5 ± 0.5 V DC

**3.3.10 Service Conditions** - The equipment shall operate satisfactorily under any of the environmental service conditions or reasonable combination of these conditions as specified in Specification MIL-E-5400 for Class 1A equipment, except as modified herein:

**3.3.10.1 Vibration** - The equipment shall operate satisfactorily when subjected to the vibration requirements of Curves I and IV of Specification MIL-E-5400.

**3.3.10.2 Temperature** - The equipment shall operate satisfactorily within the following limits of temperature:

- (a) -30° to +55°C continuous operation at sea level
- (b) -35° to +66°C for 30 minutes maximum operation

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3.3.10.3 Humidity- The humidity requirements of Specification MIL-T-5422 shall not apply to the chart paper.

3.3.11 Warm-Up Time - The time required for the equipment to warm-up prior to operation, shall be kept to a minimum and shall not exceed 0.5 minutes under standard conditions and 1.0 minutes at extreme service conditions.

3.3.12 Primary Input Power Requirements - The equipment shall meet all applicable requirements of MIL-STD 704 and shall give specified performance from the following power sources with characteristics as defined in MIL-STD 704 having limits as specified therein. The power required shall not exceed the specified amounts.

(a) AC Power ( Single Phase ), 115 V, Category "B"  
7.0 VA

(b) DC Power 28 V, Category "B" 1.0 amp.

3.3.12.1 Degraded Performance - Degraded performance will be permitted for voltage transients not exceeding 0.5 seconds during normal electric system operation. Operation shall return to normal with no resulting damage to the equipment.

3.4 Performance - Unless otherwise specified, values set forth to establish the requirements of satisfactory performance apply to performance under both standard and extreme service and input power conditions. When reduced performance under the extreme conditions is acceptable, tolerances or values setting forth acceptable variations from the performance under the standard conditions will be specified.

3.4.1 Operation - The equipment shall convert sea water temperature information provided by the AN/SSQ-36 Bathythermograph Buoy - Transmitter Set ( BT Buoy ) and AN/ARR-72 Radio Receiving Set ( ARR-72 Radio ) to two output forms as follows:

(a) A permanent record of the temperature profile from sea level to a depth of 1,000 feet, recorded on pressure sensitive chart paper.

(b) A parallel mode, 8 bit, binary coded data word shall be generated by the equipment and delivered to the aircraft Data Processing System.

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3.4.1.1 Signal Source - The BT Buoy is dropped from an aircraft in the target area. Sea water is utilized as the activating agent and after an initial, predictable delay, the BT Buoy releases a temperature sensing probe ( TS Probe ). The TS Probe is the variable element in a frequency generating circuit. A radio frequency signal, transmitted by the BT Buoy is modulated at a frequency correlated to the temperature of the water. On board the aircraft, the ARR-72 Radio is tuned to the BT Buoy carrier frequency. Water temperature information is converted to an audio frequency signal and delivered to the RO-308/SSQ-36.

3.4.1.2 Mode of Operation - The equipment shall be placed in the AUTOMATIC START mode prior to the release of a BT Buoy. In the AUTOMATIC START mode of operation, circuitry integral to the equipment shall be active, but the recording chart shall not be in motion and the data word " Enter Line " shall be inhibited. Upon receipt of a valid signal from the ARR-72 Radio, the recording chart drive mechanism shall be energized and the "Enter Line " inhibit shall be removed. (See 3.5.1.9 ).

3.4.1.3 Built In Test Facilities - A rapid check capability of equipment calibration ( CAL CHECK ) and meter movement ( METER CHECK ) shall be incorporated in the equipment. This capability augmented by a binary word readout displayed by the aircraft Data Processing System permits the operator to quickly ascertain that the equipment is operating properly.

#### 3.4.2 Accuracy

3.4.2.1 Recording Medium - The chart temperature reading shall be accurate within  $\pm 1.0^\circ \text{F}$  of the temperature derived from the formula given in 3.4.3. For temperature gradients greater than  $10^\circ \text{F}/100$  feet, the chart temperature reading shall be accurate within  $\pm 1.0^\circ \text{F}$  of the temperature derived from the formula presented in 3.4.3. For temperature gradients of less than  $5^\circ \text{F}/100$  feet, the relative error shall be less than  $\pm 5^\circ \text{F}/100$  feet. The temperature gradient relative error ( degrees/feet ) in the frequency converter - recorder system shall be within  $\pm 10\%$  of the true gradient for all temperature gradients between  $5^\circ \text{F}/100$  feet and  $10^\circ \text{F}/100$  feet.

3.4.2.2 Binary Coded Data Word - The binary coded data word generated by the equipment shall be accurate within  $\pm 0.5^\circ \text{F}$  of the temperature derived from the formula presented in 3.4.3 when the following bit weights are applied:

<u>BIT</u>	<u>WEIGHT</u>
1	$0.5^\circ \text{F}$
2	$1.0^\circ \text{F}$
3	$2.0^\circ \text{F}$
4	$4.0^\circ \text{F}$
5	$8.0^\circ \text{F}$
6	$16^\circ \text{F}$
7	$32^\circ \text{F}$
8	$64^\circ \text{F}$

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3.4.3 Frequency Characteristics - The equipment shall be capable of providing a permanent record of the temperature versus depth profile of sea water and a concurrent binary coded data word, for the temperature range of 28° to 95° F from sinusoidal input signals. The input signal frequency range shall be 1360 Hz to 2700 Hz. The formula to convert input signal frequency (f) in Hz to temperature readout (T) in degrees Fahrenheit is as follows:

$$T = \frac{f-800}{20}$$

Conversely, the formula to convert temperature readout to applied frequency is  $f = 20T + 800$ .

3.4.4 Sensitivity - The equipment shall operate satisfactorily with input signals within the range of 0.5 volt RMS to 3.0 volt RMS.

3.5 Detail Requirements -

3.5.1 Recorder, Bathythermograph Data - The recorder shall meet the following requirements.

3.5.1.1 Form Factor - The recorder shall be enclosed in a case meeting the applicable requirements of Specification MIL-C-6781. The case shall be suitable for rack mounting in an aircraft in accordance with Specification MIL-F-25173. Case dimensions shall be as stated in Handbook EI-504.

3.5.1.2 Contents - The equipment shall contain the following subassemblies and circuits:

- (a) Input Amplifier
- (b) Receiver Noise
- (c) Enable - Inhibit Circuit
- (d) Calibrate Signal Generator, and Meter Check
- (e) Frequency to DC Converter
- (f) Analog to Digital Converter ( A/D Converter )



- (g) Automatic Start
- (h) Strip Chart Recorder

3.5.1.3 Input Amplifier - The input amplifier shall provide an equipment input impedance of 20 K ohms or greater and shall amplify the applied signal.

3.5.1.4 Receiver Noise - In the absence of a signal input, the receiver noise shall not cause the stylus to deflect in excess of 25% of full scale from its minimum temperature indication. For this requirement, it may be assumed that the receiver noise will be white noise contained in the spectrum of 100 Hz to 40 kHz, having gaussian distribution of amplitudes with an RMS value of 1.5 volts.

\* 3.5.1.5 Enable - Inhibit Circuit - The presence of a valid signal shall be recognized by the enable-inhibit circuit. Under no-signal conditions, this circuit shall provide an inhibit which blocks the Data Word Enter Line. The presence of a valid signal will remove the inhibit. ( See 3.5.1.8 ).

\* 3.5.1.6 Calibrate Signal Generator and Meter Check -

3.5.1.6.1 Functional Requirement - The equipment shall contain instrumentation to:

- (a) Verify calibration
- (b) Check recorder stylus movement
- (c) Facilitate fault localization

3.5.1.6.2 Verify Calibration - A 2560 Hz  $\pm$  0.1% signal shall be derived from a precision tuning fork oscillator. This signal, when internally applied to the equipment input ( See 3.5.1.11 ) shall cause the recording mechanism and the binary coded data word output to indicate a temperature of 88° F  $\pm$  1° F (  $\pm$  0.5° F for the binary coded data word. )

## NOTE

The 2560 Hz calibrate signal is also utilized as a clock frequency by the A/D converter (see 3.5.1.8).

3.5.1.6.3 Check Recorder Stylus Movement - The equipment shall contain facilities to verify free movement of the recorder stylus (see 3.5.1.11). An internally set voltage, when applied to the Strip Chart Recorder circuit shall cause the stylus to indicate a temperature between 25° and 30°F.

3.5.1.6.4 Facilitate Fault Localization - Front panel controls and the facilities described in 3.5.1.6.2 and 3.5.1.6.3 shall provide the equipment operator with a convenient means of determining that all features are operational. In the event of a malfunction these facilities shall provide sufficient data to indicate the required organizational maintenance.

3.5.1.7 Frequency to DC Converter -

3.5.1.7.1 Function - The Frequency to DC converter shall accept an audio frequency signal indicative of water temperature, and shall convert this data into an analog output voltage for purposes of producing a chart record of sea water temperature versus depth information.

3.5.1.7.2 Output Load - The Frequency to DC converter shall be capable of operating with satisfactory performance into a resistive recorder load of 100 ohms.

3.5.1.7.3 Initiation of Signal - The Frequency to DC converter shall provide an output signal simultaneously with the receipt of an input signal.

\* 3.5.1.8 Analog to Digital Converter -

3.5.1.8.1 Functional Requirement - The equipment shall incorporate an 8 bit encoder to convert variable frequency ( a function of measured temperature ) into a pure binary output for use by the aircraft Data Processing System. The digital output shall be related to temperature as delineated in 3.4.3.

3.5.1.8.2 Data Word - The Data Word will be presented on eight twisted pairs of lines and shall consist of the following:

<u>BIT</u>	<u>WEIGHT</u>
1	0.5° F
2	1.0° F
3	2.0° F
4	4.0° F
5	8.0° F
6	16° F
7	32° F
8	64° F

3.5.1.8.3 Logical States - A logical One (1) is equal to 0 volts + 0.5 - 0. A logical Zero is equal to +4 volts  $\pm$  1 volt.

3.5.1.8.4 Mode of Presentation - The Data Word will be gated to the output lines in a parallel mode at the end of each scaling operation, 100 milliseconds before raising the Enter Line to the logical One (1) state. The Data Word will be taken to the logical Zero state at the same time the Enter Line is taken to the logical Zero state.

3.5.1.8.5 Enter Line - When the Data Word is ready for readout by the aircraft Data Processing System, the Enter Line will be set to the logical One (1) state for a period of not less than 100 milliseconds. The application of the Enter Line signal will be delayed for a sufficient period of time to assure stabilization of the binary word voltages. The Enter Line signal will be applied to a separate twisted pair line.

3.5.1.8.6 Binary Word Repetition Rate - The Repetition Rate for The Binary Word shall be 0.8 seconds.

3.5.1.8.7 Output Load Impedance - The output of the Analog to Digital Converter shall be capable of driving a DC load of 2,000 ohms and an AC load consisting of 130 ohms resistive in series with a .01 mfd capacitor through 100 feet of twisted pair shielded line. ( The capacitance of the twisted pair is 3,000 pf. ).

3.5.1.8.8 Rise and Fall Times - The rise and fall times of the Enter Line signal ( measured at the output terminals ) shall not exceed one microsecond. The rise and fall times of the data word bits ( measured at the output terminals ) shall not exceed 25 microseconds.

3.5.1.8.9 Acknowledge Signal - No Acknowledge signal from the aircraft Data Processing System will be utilized. However, terminals shall be provided for this input as a " growth factor ".

3.5.1.8.10 Binary Word Definition - A true statement shall be indicated by a logical One and a false statement by a logical Zero.

Example: (Least significant bit left)

(°F)	(0.5)	(1)	(2)	(4)	(8)	(16)	(32)	(64)
BIT	1	2	3	4	5	6	7	8
Statement	1	1	0	0	1	0	0	1

Example Temperature equals 73.5°F

#### \* 3.5.1.9 Automatic Start -

3.5.1.9.1 Performance Details, Strip Chart Recorder - The equipment shall incorporate circuitry to automatically energize the strip chart recorder drive system upon the initial receipt of a valid signal from the ARR-72 Radio. The strip chart recorder drive system shall not be energized during the receipt of broad band receiver noise preceding the initial valid signal. When the strip chart recorder drive system is once energized by the application of a valid signal, it shall remain so until the equipment is manually switched off.

3.5.1.9.2 Performance Details, Analog to Digital Converter - In the presence of broad band receiver noise, and with no valid signal at the equipment input, the Enter Line of the Analog to Digital converter shall be set to the logical Zero state. Upon the receipt of a valid signal, the Enter Line shall assume its preprogrammed status of being raised to the logical One state at a repetition rate of 0.8 seconds for a period of not less than 0.1 seconds.

3.5.1.10 Strip Chart Recorder - The strip chart recorder shall record the analog output voltage of the frequency to DC converter which is proportional to the sea water temperature in the range of 28°F to 95°F.

3.5.1.10.1 Chart Advance Rate - The Strip chart shall advance at a rate of  $90 \pm 2\%$  inches per hour when energized, using a 400 Hz nominal supply

3.5.1.10.2 Drive Motor - The strip chart drive motor shall operate on a nominal power of 115 V AC, 400 Hz power.

3.5.1.10.3 Writing Rate - The stylus shall provide impressions (dots) at the minimum rate of 5 dots every four seconds.

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3.5.1.10.4 Chart Paper - The chart paper shall be a minimum of 2-1/2 inches wide and ~~shall be 65~~ + 5 - 0 feet long. The viewing portion shall feed upward ( toward the top of the recorder ).

3.5.1.10.4.1 Graduations - The printed portions of the chart paper shall be graduated across into 75 divisions, each division representing 1° F. Every fifth division shall be accented. The printed portion of the chart shall be graduated lengthwise along the paper by a division every 0.25 inches.

3.5.1.10.4.2 Numbering - The chart paper shall have numbers 3/32 inch minimum height, for the indication of temperature. The temperature range shall be 25° F to 100 ° F from left to right with markings every 15 ° F ( every third accented division ). The temperature indication shall be displayed at intervals to permit constant correlation through the viewing window. The chart paper shall have numbers, 3/32 inch minimum height, along the left hand edge. The numbering shall be cyclic, from one to ten ( reading from top to bottom ) spaced 1/2 inch apart ( Every other 0.25 inch division ).

3.5.1.10.5 Chart Paper Release - Provisions shall be made for manual release of the chart paper drive to enable the chart paper to be manually advanced.

\* 3.5.1.10.5.1 Chart Paper Tear Off - A cutting edge transverse to the chart paper shall be provided so that the paper may be severed. The edge shall be so positioned that the chart paper end will not pull back inside the front panel after it has been torn off.

3.5.1.10.6 Access Window - An access window shall be provided on the front panel of the recorder to permit manual marking of the chart paper. The width of the access window shall not be less than the width of the paper and not less than 1 1/2 inches in height.

\* 3.5.1.11 Controls - Front panel controls shall be marked and identified in accordance with the requirements of Specification MIL-C-6781. The following controls shall be provided:

<u>Control</u>	<u>Identification</u>
(a) Paper Release	PAPER RELEASE
(b) Power Switch	AUTO-OFF-MANUAL
(c) Function Switch	METER CHECK - OPERATE-CAL CHECK

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3.5.1.12 Electrical Connections - Connections to external circuits shall be provided as delineated in Handbook EI-504.

3.6 Design Data - No data is required by this specification ( other than reports accompanying samples submitted for testing ), or by applicable documents unless specified in the contract or order.

### 4. QUALITY ASSURANCE PROVISIONS -

4.1 Responsibility for Inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 Classification of Tests - Items covered by this specification shall be subjected to the following tests to determine compliance with all applicable requirements:

- (a) Preproduction ( First Article ) Tests
- (b) Initial Production Tests
- (c) Acceptance Tests

4.2 Preproduction ( First Article ) Tests - Preproduction tests shall be made on an equipment representative of the production equipments to be supplied under the contract. Preproduction tests shall be accomplished under the approved test procedure of 4.5. The Government inspector and the procuring activity shall be advised when tests are to be conducted so that a representative may be designated to witness or supervise the tests when so desired. Contractors not having adequate facilities to conduct all required tests shall obtain the services of a commercial testing laboratory acceptable to the Government.

4.2.1 Preproduction ( First Article ) Test Data - The contractor shall submit all data collected in conducting these tests to the procuring activity for review and approval. On first production contracts, this data shall include a list of all electrical and electronic parts giving their specified voltage, current and temperature rating and the applied circuit voltage, current and ambient and surface temperatures. The ambient and surface temperature shall be obtained under the extreme high temperature operating condition.

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4.2.2 Scope of Tests - Preproduction tests shall include all tests deemed necessary by the procuring activity to determine that the equipment meets all the requirements of this specification and the contract. Preproduction tests shall include environmental tests in accordance with the procedures of Specification MIL-T-5422 and interference tests in accordance with Specification MIL-I-6181.

4.2.3 Preproduction ( First Article ) Approval - Approval of the preproduction sample shall be by the procuring activity upon satisfactory completion of all tests. No production equipments shall be delivered prior to the approval of the preproduction sample. Prefabrication of production equipment prior to the approval of the preproduction sample is at the contractor's own risk. The approved preproduction sample shall be retained by the contractor for his use in the fabrication and testing of equipment to be submitted for acceptance. The preproduction sample shall not be considered as one of the equipments under the contract.

4.2.4 Production Equipments - Equipments supplied under the contract shall in all respects, including design, construction, workmanship, performance and quality, be equivalent to the approved preproduction sample. Each equipment shall be capable of successfully passing the same tests as imposed on the preproduction sample. Evidence of non-compliance with the above shall constitute cause for rejection and for equipment already accepted by the Government, it shall be the obligation of the contractor to make necessary corrections as approved by the procuring activity.

4.3 Initial Production Tests - One of the first ten production equipments shall be selected and sent at the contractor's expense to a designated Government laboratory for tests. This equipment shall be selected by the procuring activity after the equipment has successfully passed all individual tests. The preproduction sample shall not be selected for this test.

4.3.1 Scope of Tests - This equipment may be subjected to any and all tests the procuring activity deems necessary to assure that the production equipment is equivalent to the previously approved preproduction sample in design, materials, construction, workmanship, performance, and quality, and that it meets all applicable requirements.

4.3.2 Accessory Material - In addition to the complete equipment submitted for Initial Production Tests, the contractor shall also submit such accessory material and data necessary to test the equipment.

4.3.3 Initial Production Sample Approval - Approval of the Initial Production Sample shall be by the procuring activity upon satisfactory completion of all tests. Any design, material or performance defect made evident during



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this test shall be corrected by the contractor to the satisfaction of the procuring activity. Failure of the Initial Production Sample to pass any of the tests shall be cause for deliveries of equipment under the contract to cease until proper corrective action is approved and accomplished. Corrective action shall also be accomplished on equipment previously accepted when requested by the procuring activity.

4.3.4 Reconditioning of Initial Production Test Sample - On completion of the Initial Production Test, the contractor may submit the Initial Production Test Sample for acceptance under the contract, provided he replaces all worn or damaged items.

4.4 Acceptance Tests - The contractor shall furnish all samples and shall be responsible for accomplishing the acceptance tests. All inspection and testing shall be under the supervision of the Government inspector. Contractors not having testing facilities satisfactory to the procuring activity shall engage the service of a commercial testing laboratory acceptable to the procuring activity. The contractor shall furnish test reports showing quantitative results for all acceptance tests. Such reports shall be signed by an authorized representative of the contractor of laboratory, as applicable. Acceptance or approval of material during the course of manufacture shall not be construed as a guarantee of the acceptance of the finished product. Acceptance tests shall consist of the following:

- (a) Individual Tests
- (b) Sampling Tests
- (c) Reliability Assurance Tests
- (d) Special Tests

4.4.1 Individual Tests - Each equipment submitted for acceptance shall be subjected to the individual tests. These tests shall be adequate to determine compliance with the requirements of material, workmanship, operational adequacy and reliability. As a minimum, each equipment accepted shall have passed the following tests:

- (a) Examination of Product
- (b) Operational Test
- (c) Manufacturing Run-In Test

4.4.1.1 Examination of Product - Each equipment shall be examined carefully to determine that the material and workmanship requirements have been met.



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4.4.1.2 Operational Test - Each equipment shall be operated long enough to permit the equipment temperature to stabilize and to check sufficient characteristics and record adequate data to assure satisfactory equipment operation.

4.4.1.3 Manufacturing Run In Test - Each equipment shall be operated under the conditions specified herein for a period of 1 hour without failure. A failure shall be defined as anything which causes malfunctioning of the equipment. Only those adjustments will be permitted which can be made by using such controls and adjustments that are accessible to the operator during the normal use of the equipment.

#### NOTE

This test shall not be required if a reliability test is selected that requires a burn in test for all equipment.

Temperature	Ambient room
Humidity	Ambient room
Vibration	Any selected frequency within the range of 20 to 30 cps (excluding resonant points) and a minimum amplitude of $\pm 3$ g's

The equipment shall be vibrated (without vibration isolators) for a period of 10 minutes prior to the beginning of the one hour period of operation. Where feasible, the equipment shall be operated during this vibration period for the purpose of detecting flaws and imperfect workmanship. Operation within the specified limits of satisfactory performance is not necessarily required during the vibration period. The direction of vibration should be vertical to the normal mounting plane for 5 minutes and lateral to the plane for 5 minutes. Where it is not feasible to vibrate the equipment in two directions the vertical direction shall be used. During the one hour period of operation following the 10 minute vibration period, the equipment shall be mechanically cycled periodically through its various phases of operation. Should a failure occur, it should be repaired and the test started over, except that the 10 minute vibration period need not be repeated when it is certain the failure was not a result of the vibration. Should repetitive failures occur, corrective action shall be taken to eliminate this defect from future equipment. A record shall be kept of all failures.

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4.4.2 Sampling Tests - Equipments selected for sampling tests shall first have passed the individual tests. Equipments shall be selected for sampling tests by the Government inspector in accordance with the following: (Sampling tests shall be conducted only when Reliability Assurance Tests of 4.4.3 are deleted by contractual action.)

<u>Quantity of Equipments Offered for Acceptance</u>	<u>Quantity to be Selected for Sampling Test</u>
First 10	0
Next 50	1
Next 75	1
Next 100	1
	1 for each additional 200 or fraction thereof

## NOTE

If by contract action the Initial Production Test (4.3) is deleted a Sample Test shall be conducted on one equipment from the first 10 produced.

4.4.2.1 Scope of Tests - As a minimum, each equipment selected for sampling tests shall be subjected to the following tests:

- (a) Complete operational test at ambient room conditions, making all necessary measurements to assure that all applicable specification requirements have been met.
- (b) Operational test at certain environmental conditions. The conditions may vary for each equipment tested and should be based on results of the preproduction, initial production, individual and special tests.
- (c) Manufacturing run in test specified in 4.4.1.3 except that the test duration shall be 120 hours with no restriction on the number of failures. However, each failure shall be analyzed as to cause and remedial action necessary to reduce the possibility of its recurrence in future equipment.

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- \* 4.4.3 Reliability Assurance Tests - Reliability Assurance Tests shall be conducted using MIL STD 781. Tests as required by both the Qualification Phase and the Sampling Phase shall be conducted.

4.4.3.1 Qualification Phase - Prior to the acceptance of equipments under the contract or order, a minimum of two (2) equipments shall be tested as outlined in MIL STD 781, under the section entitled "Qualification Phase of Production Reliability Tests". The maximum number of equipments to be used shall be those listed in Table 5 of MIL STD 781. For the Qualification Phase, Test Level E shall be used with the following modifications. The Accept-Reject Criteria for Test Plan 4 shall be used.

Temperature	-30°C to +55°C (-22°F to +131°F)
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Temperature Cycling	Time to stabilize at low temperature followed by time to stabilize at high temperature, plus four hours.
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4.4.3.2 Reliability Sampling Phase Tests - The production equipment shall be tested as outlined in MIL STD 781 (as modified herein), under the Section entitled "Sampling Phase of Production Reliability Tests". For the Sampling Phase (or All-Equipment Test), Test Level E as modified by paragraph 4.4.3.1 shall be used.

4.4.3.2.1 All Equipment Test - Each equipment produced shall be tested for 20 hours. Prior to the 20 hour test on each equipment, an additional burn in period may be used at the option of the contractor. If the burn in period is to be used the details thereof must be included in the approved test procedures. To determine whether the MTBF is being met at any time during the contract, the operating test hours and the failures thereon (not counting burn in failures or burn in operating time) shall be totaled and the results compared with the reject line of Test Plan 4 of MIL STD 781. (Extend the line as necessary to accommodate the data.) These totals shall accumulate so that at any one time the experience from the beginning of the contract is included. At the conclusion of each month the test results shall be sent to the procuring activity and to the Naval Air Systems Command, Attn: Avionics Division. At any time that the current totals of test hours and test failures plotted on Test Plan 4 curves show a reject situation, the procuring activity shall be notified. The procuring activity reserves the right to stop the acceptance of equipment at any time that a reject situation exists pending a review of the contractor's efforts to improve the equipment, the equipment parts, the equipment workmanship, etc., so that the entire compilation will show other than a reject decision.

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4.4.3.3 Test Details - The test details such as the length of the test cycle, the length of the heat portion of the cycle, the performance characteristics to be measured, special failure criteria, preventive maintenance to be allowed during the test, etc., shall be part of the test procedures to be submitted and approved by the procuring activity prior to the beginning of the Qualification Test Phase of the Reliability Assurance Tests.

4.4.4 Special Tests - Special tests shall be conducted on a quantity of equipments for the purpose of checking the effect of any design or material change on the performance of the equipment and to assure adequate quality control. The equipment selected for special tests may be selected from equipments previously subjected to the sampling or reliability assurance tests.

4.4.4.1 Special Test Schedule - Selection of equipments for special tests shall be made as follows:

- (a) On an early equipment after an engineering or material change.
- (b) Whenever failure reports or other information indicate that additional tests are required. (This will be determined by the procuring activity.)

4.4.4.2 Scope of Tests - Special tests shall consist of such tests as approved by the procuring activity. Test procedures previously approved for the pre-production tests shall be used where applicable. When not applicable, the contractor shall prepare a test procedure and submit it to the procuring activity for approval prior to conducting the tests.

4.4.5 Equipment Failure - Should a failure occur during either the sampling, reliability assurance or special tests, the following action shall be taken:

- (a) Determine the cause of failure
- (b) Determine if the failure is an isolated case or design defect.
- (c) Submit to the procuring activity for approval, proposed corrective action intended to reduce the possibility of the same failure(s) occurring in future tests.
- (d) Where practical, include a test in the individual test to check all equipment for this requirement until reasonable assurance is obtained that the defect has been satisfactorily corrected.

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4.5 Test Procedures - The procedures used for conducting pre-production tests, and acceptance tests shall be prepared by the contractor and submitted to the procuring activity for review and approval. The right is reserved by the procuring activity of the Government inspector to modify the tests or require any additional tests deemed necessary to determine compliance with the requirements of this specification or the contract. Specification MIL-T-18303 shall be used as a guide for preparation of test procedures. When approved test procedures are available from previous contracts, such procedures will be provided and may be used when their use is approved by the procuring activity. However, the right is reserved by the procuring activity to require modification of such procedures, including additional tests, when deemed necessary.

4.6 Reconditioning of Tested Equipment - Equipment which has been subjected to initial production acceptance tests shall be reconditioned by the contractor by replacing all worn or damaged items. After reworking, the contractor shall resubmit the equipment for acceptance.

4.7 Presubmission Testing - No item, part or complete equipment shall be submitted by the contractor until it has been previously tested and inspected by the contractor and found to comply, to the best of his knowledge and belief, with all applicable requirements.

4.8 Rejection and Retest - Equipment which has been rejected may be reworked or have parts replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Government inspector.

## 5. PREPARATION FOR DELIVERY -

5.1 General - All major units and parts of the equipment shall be preserved, packaged, packed and marked for the level of shipment specified in the contract or order in accordance with Specification MIL-E-17555.

## 6. NOTES -

\* 6.1 Intended Use - The equipment covered by this specification is intended for use in Naval aircraft during ASW operations and for oceanographic research ( See 3.4 ).

\* 6.2 Ordering Data - Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

(a) Title, number, and data of this specification.

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- (b) Selection of applicable levels of packaging and packing (See 5.1 )
- (c) Data Requirements ( See 3.6 )
- (d) Sampling Tests ( See 4.4.2 ), Test Data (See 4.2.1 ), Failure Report ( See 4.4.5 ), Test Procedures ( See 4.5 )

6.3 Precedence of Documents - When the requirements of the contract, this specification, or applicable subsidiary specifications are in conflict, the following precedence shall apply:

- (a) Contract - The contract shall have precedence over any specification.
- (b) This Specification - This specification shall have precedence over all applicable subsidiary specifications. Any deviation from this specification, or from subsidiary specifications where applicable, shall be specifically approved in writing by the procuring activity.
- (c) Referenced Specifications - Any referenced specification shall have precedence over all applicable subsidiary specifications referenced therein. All referenced specifications shall apply to the extent specified.

6.4 Performance Objectives - Minimum size and weight, simplicity of operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of this specification are objectives which shall be considered in the production of this equipment. Where it appears a substantial reduction in size and weight or improvement in simplicity of design, performance, ease of maintenance or reliability will result from the use of materials, parts and processes other than those specified in Specification MIL-E-5400, it is desired their use be investigated. When investigation shows advantages can be realized, a request for approval shall be submitted to the procuring activity for consideration. Each request shall be accompanied by complete supporting information.

6.5 Non-Repairable Subassemblies - As a general rule, non-repairable subassemblies should be encapsulated or hermetically sealed. The number of connections internal to the subassembly should be held to a minimum. Detail parts tolerances and ratings should be so selected that the life of the subassembly is greater than that of a similar repairable one. With few exceptions, ( such as high voltage power supplies ), the non-repairable subassembly should evidence a Mean-Time-to-Failure greater than 5,000 hours, and for many applications, this figure must be nearer 50,000 hours.



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6.6 Type Designations - The parentheses ( ) when used in the equipment type designation, will be deleted or replaced by either a number or letter furnished by the procuring activity upon application by the contractor for assignment of nomenclature in accordance with 3.3.8. The complete type number shall be used on nameplates, shipping records and instructions books, as applicable.

6.7 Revisions - In specification revisions and superseding amendments, an asterisk "\*" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been 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 as written, irrespective of the asterisk notations and relationship to the last previous issue.

6.8 Items of Equipment - The equipment covered by this specification shall consist of the following:

Recorder, Bathythermograph Data  
RO-308/SSQ-36

\* 6.9 Associated Equipment - The equipment shall operate with the following associated equipment:

AN/ARR-72 Sonobuoy Receiver  
AN/SSQ-36 Bathythermograph Transmitter Set  
AN/AYA-8 Data Processing System

6.9.1 Special Support Equipment - the following item of Special Support Equipment shall be utilized at the Intermediate and Higher Maintenance Facilities.

Harness Assembly, Test Bench  
( AN/nomenclature pending )

\* 6.10 Performance Characteristics to be Measured -

(a)	Sensitivity	( para. 3.4.4 )
(b)	Accuracy	( para. 3.4.2 )
(c)	Initiation of Signal	( para. 3.5.1.7.3 and 3.5.1.9 )
(d)	Chart Advance Rate	( para. 3.5.1.10.1 )
(e)	Writing Rate	( para. 3.5.1.10.3 )

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<p align="center"><b>INSTRUCTIONS</b></p> <p>This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).</p>		
SPECIFICATION MIL-R-81355B(AS) RECORDER, BATHYTHERMOGRAPH DATA RO-308/SSQ-36		
ORGANIZATION (Of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
C. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
D. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE



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