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SUPERSEDING
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MILITARY SPECIFICATION
DIRECTION FINDER GROUP AN/ARA-50
GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the requirements for one type of direction finding equipment, designated Direction Finder Group AN/ARA-50.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: WR-ALC/MMEDTA, Robins AFB, GA 31096-5609 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC: 5826

SPECIFICATIONS

MILITARY

MIL-E-5400 -Electronic Equipment, Airborne, General Specification for
MIL-T-5422 -Testing, Environmental, Aircraft Electronic Equipment
MIL-M-7793 -Meter, Time Totalizing, 380 to 420 Hz, General Specifications for
MIL-P-9024 -Packaging, materials Handling and Transportability, System and System Segments, General Specification for
MIL-F-15160 -Fuses; Instrument, Power and Telephone
MIL-R-22659 -Radio Sets AN/ARC-51A( ) and AN/ARC-51B( )
MIL-R-23767 -Receiving Set, Radio AN/ARR-69
MIL-I-25992 -Indicator, Bearing-Distance-Heading ID-526A/ARN
MIL-I-27848 -Horizontal Situation Indicator AQU/4/A
MIL-T-28800 -Test Equipment For Use With Electronic and Fire Control Systems, General Specification For
MIL-A-83364 -Antenna AS-2755/ARA

STANDARDS

FEDERAL

FED-STD-5 -Standard Guides for Preparation of Proposed Item Logistics Data Records

MILITARY

MIL-STD-129 -Marking for Shipment and Storage
MIL-STD-415 -Test Points and Test Facilities Design, Standards For
MIL-STD-470 -Maintainability Program Requirements (For Systems and Equipment)
MIL-STD-471 -Maintainability Demonstration
MIL-STD-704 -Electronic Power, Aircraft Characteristics and Utilization Of
MIL-STD-781 -Reliability Test Exponential Distribution
MIL-STD-785 -Requirements For Reliability Program (Systems and Equipment)
MIL-STD-810 -Environmental Test Methods and Engineering Guidelines
MIL-STD-826 -Electromagnetic Interference Test Requirements and Test Methods
MIL-STD-831 -Test Reports, Preparation Of
MIL-STD-2073/1A -DoD Materiel Procedures for Development & Application of Packaging Requirements

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

SYSTEMS ENGINEERING GROUP EXHIBIT

SEBY-63-1 -Radio Set AN/ARC-109

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification however, shall supercede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Preproduction. This specification makes provisions for preproduction testing.

3.2 Units. The Direction Finder Group (DFG) AN/ARN-50 shall consist of:

Item No.	Qty	Description	See Requirement
1	1	Antenna AS-909/ARA-48	3.6.1
2	1	Amplifier-Relay Assembly AM-3624/ ARA-50, containing:	3.6.2
	1	Electronic Control Amplifier AM-1779/ARA-48	
	1	Relay Assembly RE-339/ARA-48	
	1	Interconnecting Box J-942/ARA-50	
	1	Cover CW-455/ARA-50	
3	1	Mounting MT-1955/ARA-50	3.6.3
4	1	Antenna AS-2755/ARA	3.6.4

Note: AN/ARA-50 installation consists of either item numbers 1, 2 and 3 or 2, 3and 4.

3.2.1 Associated equipment. The DFG shall operate and be compatible with the following associated equipment:

a. Radio Sets AN/ARC-51 (MIL-R-22659), AN/ARC-109 (Exhibit SEBY63-1) or approved equivalent.

b. Indicator Bearing-Distance-Heading ID-526A/ARN (MIL-I-25992) or approved equivalent.

c. Horizontal Situation Indicator (MIL-I-27848).

d. Console controls. The equipment shall be operated by Control, Radio Set C-6287/ARC-51 or the approved equivalent remote control associated with UHF receiver being employed.

e. Auxiliary receiver, AN/ARR-69 or approved equivalent (MIL-R-23767).

3.3 General specification. The requirements of MIL-E-5400 shall apply as requirements of this specification, with additions or exceptions to the paragraphs of MIL-E-5400, as identified by similarity of paragraph headings, called out herein. When the two documents conflict, this specification shall govern.

3.3.1 Classification. The direction finder group shall operate at class 2 altitude requirements as defined in MIL-E-5400 and over the temperature ranges specified herein.

3.3.2 Materials, parts, and processes.

3.3.2.1 Definitions.

3.3.2.1.1 Approval of nonstandard parts and materials. Nonstandard parts and materials approved shall be based upon the requirements specified in MIL-E-5400 for a category III equipment contract, with exceptions specified herein.

3.3.2.1.1.1 Approval requests other than tubes and semi-conductors, nonstandard parts. Unless specifically requested by the procuring activity, submittal of approval requests for the use of nonstandard parts and materials (other than tubes and semiconductors) shall not be required. However, the contractor shall test all nonstandard parts and maintain a file of test data and engineering justification for the applications of such parts. The file of test data shall be accessible to engineering personnel of the procuring activity for their review as deemed necessary by such personnel. The number of the contractor's test report shall appear under the manufacturer's part number on the part data sheet. (See sample sheet in MIL-E-5400.)

3.3.2.1.1.2 Approval requests for use of nonstandard tubes and semi-conductors. Approval requests for the use of nonstandard and nonpreferred tubes and semiconductors shall be submitted in accordance with the requirements of MIL-E-5400.

3.3.2.1.2 Preliminary list of electronic parts. The preliminary parts list shall include all parts and materials affecting the electrical characteristics of the equipment and shall be used as a checklist for determining compliance with parts, material, and process requirements of MIL-E-5400. In addition to the requirements of MIL-E-5400, the preliminary parts list shall include the following:

a. Prime contractor's name and part number.

b. Accurate identifying information in accordance with FED-STD-5.

c. Accurate description of the part or material to include the following:

(1) Number of the standard specification (MIL, EIA, etc.) under which the part or material was manufactured.

(2) Electrical and mechanical rating.

(3) Special features of construction.

(4) Materials used (type, grade, composition, etc.).

(5) Type of insulation, dielectric, etc.

(6) Type of finish or covering.

(7) Details of spring materials, contacts, etc.

(8) Details of tropicalization process.

3.3.2.2 Finishes.

3.3.2.2.1 Cases and front panels. Cases and front panels of equipment installed in the cockpit shall have a black wrinkle finish.

3.3.2.3 Meters (electrical indicating instruments). Only ruggedized meters shall be acceptable.

3.3.2.3.1 Time totalizing meter. A time totalizing meter in accordance with MIL-M-7793 shall be provided on the amplifier-relay assembly.

3.3.2.4 Tubes (electron) and solid state devices. Electron tubes shall not be used in the design of the DFG.

3.3.2.5 Materials. Recycled and recovered raw materials should be used to the maximum extent possible in lieu of virgin raw materials as long as these materials do not jeopardize the intended use and fully comply with all contract requirements. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. None of the above shall be interpreted to mean that the use of used or rebuilt products will be allowed.

3.3.3 Design and construction.

3.3.3.1 Cooling. All equipment components shall be cooled by free convection under the conditions of surrounding environment defined by figure 1, curves A and B.

3.3.3.2 Interference. Interference control requirements shall be in accordance with MIL-STD-826, equipment class AM. Electronic interference shall be controlled in the basic design of all units of the AN/ARA-50 direction finder group. The equipment shall also be designed to minimize susceptibility to interference from external sources.

3.3.3.3 Reliability, longevity, and maintainability.

3.3.3.3.1 Reliability and longevity. The contractor shall establish and conduct a reliability assurance program in accordance with MIL-STD-785. Reliability and longevity of the DFG shall be determined in accordance with the requirements of MIL-STD-781.

3.3.3.3.1.1 Mean-time-between failures (MTBF). The specified MTBF of the direction finder group shall be 1000 hours.

3.3.3.3.1.2 Longevity. Longevity of the direction finder group shall be no less than 2000 hours before wearout failures occur or the equipment consistently fails to meet the MTBF index.

3.3.3.3.2 Maintainability design requirements. The contractor shall establish a maintainability program in accordance with MIL-STD-470. Maintainability demonstration requirements shall be in accordance with MIL-STD-471.

3.3.3.3.2.1 Quantitative. The mean active maintenance downtime at organizational and field levels of the DFG shall not exceed 2 hours.

3.3.3.4 Maintenance provisions.

3.3.3.4.1 Operational checkout provisions. When required, special or unique items of test equipment shall be developed in accordance with Specification MIL-T-28800 and shall be provided by the contractor.

3.3.3.4.2 Chassis test points. Test points shall be included in the design of the AM-1779/ARA-48 electronic control amplifier and shall be in accordance with MIL-STD-415.

3.3.3.4.3 Case. The equipment in or out of the case, shall be so constructed that no damage to any unit or any undue distortion to any structural member will be caused by placing any flat side of the equipment on a flat surface.

3.3.3.5 Orientation. Unless otherwise specified, units that require mountings with vibration isolators shall be designed for normal installation with the mountings below the units. Nonisolated units designed for mounting directly to the aircraft structure shall permit installatin in any orientation.

3.3.3.6 Overload protection. If used, fuses shall be style f02 in accordance with MIL-F-15160.

3.3.3.7 Service conditions (electrical). The direction finder group shall be designated as a category B utilization equipment in accordance with MIL-STD-704. The contractor shall include any protective measures necessary to prevent equipment damage due to the loss of one or more voltages supplied by the aircraft.

3.3.3.7.1 Power requirement conditions. The DFG shall maintain specified performance under "normal" power conditions as defined in MIL-STD-704. No performance requirements shall be maintained under "abnormal" or "emergency" conditions as defined in MIL-STD-704.

3.3.3.7.2 Equipment power input. The DFG shall deliver the performance specified herein when operated from the power in table I.

TABLE I. Equipment power input.

Nominal Voltage	Power Consumed Average	Power Consumed Short Time (Maximum)
115 VAC	35 watts	48.4 watts
26 VAC 400 Hz Single phase	10.2 va	14.5 watts
28 VDC	10 watts	15 watts

3.3.3.8 Service conditions (environmental). Class 2 equipment requirements of MIL-E-5400 shall apply, except as specified herein.

3.3.3.8.1 Temperature-altitude combination.

3.3.3.8.1.1 Surrounding air temperature.

a. Nonoperating exposure (nonoperational aircraft). The DFG shall withstand extended exposure to surrounding air temperatures while in dead storage, either "on the shelf" or installed in nonoperational aircraft, as follows:

(1) Amplifier-relay: -80°F to +185°F (-62°C to +85°C).

(2) Antenna: -80°F to +185°F (-62°C to +85°C).

b. Operating and nonoperating exposure (operational aircraft). The DFG shall withstand extended nonoperating exposure as well as deliver specified performance, on the bench and when installed in operational aircraft, when subjected to the ranges of surrounding air temperatures indicated below. Cooling shall be by free convection during bench operation and inflight. These ranges shall apply for altitudes from 0 to 65,000 feet, reference figure 1.

(1) Antenna: -65°F to +212°F (-54°C to +100°C).

(2) Amplifier-relay: -65°F to +160°F (-54°C to +71°C).

c. Transient characteristics. The temperature of the air surrounding any unit may vary at a rate as high as 3°F per second within the applicable range.

3.3.3.8.1.2 Surrounding air pressure. The air pressure surrounding the equipment may be assumed equal to free stream static pressure.

a. In-bay equipment (antenna and amplifier-relay): 14.7 to 0.82 psia.

b. Transient characteristics: The surrounding air pressure may vary at rates as high as 0.25 psi per second.

c. Pressurization: No DFG unit shall require pressurization from the aircraft.

3.3.3.8.2 Vibration.

3.3.3.8.2.1 Equipment normally mounted (simulating aircraft installation). When normally mounted, the DFG shall meet the requirements of this specification when subjected to continuous vibration as specified in MIL-E-5400.

3.3.3.8.2.2 Equipment with vibration isolators removed. This requirement of MIL-E-5400 shall apply.

3.3.3.8.3 Acceleration loads.

3.3.3.8.3.1 Structural loads. All parts of the airplane shall be subjected to transient and steady-state accelerations during flights, landing, take-off and ground handling operations. The load factors developed on DFG units during these conditions are as follows:

a. Vertical accelerations: +8g, -4g.

b. Side accelerations: 4g to be combined with a 5g down inertia load.

c. Forward acting inertia load: 4.0g to be combined with a 5g down inertia load.

d. Aft acting inertia load: 5.0g, to be combined with 2.0g down inertia load.

3.3.3.8.3.2 Limit load factors. All units shall be capable of withstanding the limit load factors of 3.3.3.8.3.1 without structural or functional damage. Some degradation of accuracy may be permitted during the application of these loads, but full accuracy shall be immediately restored upon removal of these loads. A limit load factor of + or - 10.0g applied individually along the three axes shall be used unless exceeded by the load factors specified in 3.3.3.8.3.1.

3.3.3.8.3.3 Ultimate load factors. All equipment installation packages and associated mounting provisions shall have sufficient static strength to withstand at least the limit load factors of 3.3.3.8.3.2 multiplied by 1.5. The installation shall have sufficient static strength to withstand 15.0g acting individually along the three axes or the loads of 3.3.3.8.3.2 multiplied by 1.5, whichever is greater.

3.3.4 Interchangeability. The interchangeability requirements specified in MIL-E-5400 shall be extended to require interchangeability of modular units

of this equipment with those of the latest model of previously produced equipment. It shall also be a requirement of this specification that when units are removed and replaced on the flight line, neither these units nor the equipment of which the units become a part shall require adjustment on installation. All necessary unit adjustments shall be made in the shop prior to installation of the unit in the aircraft.

3.4 Design and construction. The Direction Finder Group AN/ARA-50 shall be a lightweight airborne automatic direction finding equipment. When used in conjunction with the accessory equipment listed under 3.2.1, this equipment shall be capable of providing the following:

a. Continuous indication, in degrees, of the relative direction of arrival of voice modulated, tone modulated or modulated signals in the frequency range of 225 to 400 MHz.

b. Means for the simultaneous aural reception of such signals.

c. Automatic switchover to the communications antenna during transmission periods of the communication receiver-transmitter to prevent damage to the direction finder antenna.

3.4.1 Equipment connectors.

3.4.1.1 Antenna connectors.

3.4.1.1.1 R-f connector. The antenna shall have a type SC receptacle (Industrial Products Co. No. 82600 or approved equivalent) for the antenna connection to the transmission line.

3.4.1.1.2 Power connector. The antenna shall have one power receptacle (Bentin type PT02A-16-26P or approved equivalent) for connection by cable to the amplifier module, the relay module, and the bearing-distance-heading indicator. The pin assignments shall be as in table II.

TABLE II. Antenna power receptacle pin assignments.

Pin	Assignment	Pin	Assignment
A	Synchro xmtr rotor-H	P	Synchro xmtr rotor-C, stator-Z
B	Synchro xmtr stator-X	R	Spare
C	Synchro xmtr stator-Y	S	Spare
D	DFG 100 Hz excitation 1	T	Spare
E	DFG 100 Hz excitation 2	U	Jumper to V (internal)
F	Spare	V	Jumper U (internal)
G	Spare	W	115VAC, 400Hz input
H	Spare	X	Ground
J	Spare	Y	Spare
K	DFG rate generator-1	Z	Spare
L	DFG rate generator-2	a	Spare
M	DFG - motor control	b	Spare
N	115VAC 0 3 input	c	Spare

3.4.1.2 Amplifier module.

3.4.1.2.1 Power connector. The amplifier shall have a standard module power connector (Cannon type DA-150 or approved equivalent) with pin assignments as in table III.

TABLE III. Power connector pin assignments.

Pin	Assignment	Pin	Assignment
1	Audio input	10	Rate generator 2
2	Rate generator 1	11	Spare
3	Spare	12	100Hz excitation 1
4	27.5VDC input	13	100Hz excitation 2
5	Spare	14	Motor control
6	Ground	15	115VAC input
7	Motor control		
8	115VAC input		
9	Ground shield		

3.4.1.3 Relay module.

3.4.1.3.1 R-f connectors. The relay modules shall have four r-f receptacles (Industrial Products Co. type 22550 or approved equivalent) for cross-connection to the DFG antenna, a communications receiver or receivers. Connector functions shall be as follows:

a. P1: To comm ant.

b. P2: To aux rcvr.

c. P3: To DFG ant.

d. P4: To comm rcvr.

3.4.1.3.2 Power connections. The relay module shall have two power connectors (Cannon type DE-9P or approved equivalent) with pin assignment as follows:

a. P5:

1: Not used.
2: DFG control for K1 and K2.
3: +27VDC input.
4: Not used.
5: Not used.
6: Not used.
7: 27.5 VDC output to DFG off-on
8: Ground, shield.
9: Ground, shield.

b. P6:

1: On-off control for K4.
2: 27.5VDC output to control amplifier.
3: 27.5VDC input to DFG off-on relay.
4: 115VAC output to DFG antenna.
5: 115VAC input to DFG off-on relay.
6: On-off control for K3.
7: Ground controlled by K3.
8: Ground controlled by K2.
9: Ground controlled by K2.

3.4.1.4 Amplifier-Relay Assembly.

3.4.1.4.1 R-f connectors.

3.4.1.4.1.1 Antenna connectors. The amplifier-relay assembly shall have two series BNC Bulkhead Jack connectors, type UG-909A/U (RF Products No. 74868 or approved equivalent) for connection to the antenna and UHF antennas.

3.4.1.4.1.2 Mating r-f connectors to coaxial switch. Four r-f connectors (Industrial Products Co. 22475 or approved equivalent) shall be provided in the amplifier-relay assembly for mating to the coaxial switch r-f connectors.

3.4.1.4.2. Power connectors.

3.4.1.4.2.1 Power connectors to control amplifier. The amplifier-relay assembly shall include a power connector (Canon DAF-15S or approved equivalent)to provide electrical connections to the control amplifier. Pin assignment shall be as specified in 3.4.1.2.1.

3.4.1.4.2.2 Power connectors to coaxial switch. The amplifier-relay assembly shall include power connectors (Cannon DEF-9S or approved equivalent) to provide electrical connections to the coaxial switch. Pin assignments shall be as specified in 3.4.1.3.2.

3.4.1.4.2.3 Main power connectors. The amplifier-relay assembly shall have one power plug (Cannon DPA-L24C2-34P2 or approved equivalent) for electrical connection to the input receptacle of the control amplifier and coaxial switch input receptacles. Pin assignments shall be as follows:

TABLE IV. Amplifier-relay power plug pin assignment.

Pin	Assignment	Pin	Assignment
A1	Receiver nr 1 antenna input	12	Receiver nr 2 receiver time constant control
1	Receiver nr 1 audio signal		
2	Receiver nr 2 audio signal	13	Spare
3	Receiver nr 1 time constant control	14	Motor control
5	Rate signal	15	28VDC input from supply
6	Rate signal	16	Coaxial switch transfer control
7	Shield ground		

8	Ground	17	6.3V 100Hz
9	Spare	18	6.3V 100Hz
10	DFG on-off	19	Spare
11	Receiver nr 2 sensitivity control	20	115V 400Hz to antenna
		21	115V 400Hz from antenna
		22	115V 400Hz from supply
		A2	Receiver nr 2 antenna input

3.4.2 Fail-safe design. The direction finder group shall incorporate "fail-safe" design features. Malfunctioning of the equipment shall in no way contribute to the destruction of that equipment or any part of the weapon system which would result in loss of life.

3.5 Performance.

3.5.1 Sensitivity and range. The equipment shall provide the direction finding performance specified herein when the antenna is subjected to vertically polarized r-f fields in the frequency range of 225 to 400MHZ with field strengths from 50 microvolts/meter to 0.3V/meter and modulation percentages up to 30 percent at 1000Hz.

3.5.2 Accuracy of indication. The rms value of the differences between the indicated readings and the true bearing at 36 equally spaced points around the azimuth shall not exceed $\pm$ .5° under standard conditions and $\pm$ 7° under service conditions. This accuracy limit includes the associated indicator loads of 3.5.5.

3.5.3 Overshoot. When seeking a bearing, the indicator shall not overshoot the ultimate bearing by more than 15°.

3.5.4 Hunting. The hunting of the indicator shall not exceed the limits of figure 2. Hunting is defined as the repeated momentary deviation of the indicator needle from its proper position.

3.5.5 Lag. The indicated bearing shall not lag the actual bearing by more than 5° when the actual bearing is changing at a rate of 3° per second. The 5° shall be in addition to the accuracy of indication tolerance.

3.5.6 Speed of response. Under standard conditions the equipment shall be capable of seeking out a new bearing at a rate of not less than 30° per second when this new bearing occurs in the section bound by azimuths of 50° and 179° relative to the initial bearing; and at a rate of not less than 12° per second when the new bearing occurs in a sector bound by azimuths of 10° and 50°. This includes the time required for the indicator to stablize on the new bearing. Under service conditions the speed of response shall be 25° per second and 10° per second respectively.

3.6 Details of units.

3.6.1 Antenna AS-909/ARA-48. The antenna component shall contain the following:

a. Receiving element.

b. 115V, 400Hz motor for positioning the element.

c. RF rotating joint.

d. High speed coaxial lobing switch.

e. Synchro transmitter.

f. Appropriate gears.

g. Rate generator.

The antenna component shall be designed in accordance with figure 3.

3.6.1.1 A-c motor. The ac motor shall be capable of rotating the receiving element to the cardioid null at the rate specified in the speed-of-response requirements.

3.6.1.2 Rotating element. The rotating element shall be kept at the same r-f potential as the housing by spring contacts such that the fuselage of the aircraft will provide a suitable ground plane.

3.6.1.3 Synchro transmitter output. The synchro transmitter output shall be capable of driving one pointer load in each of two associated indicators listed under 3.2.1.

3.6.1.4 Rate generator. The rate generator shall provide damping for the antenna servo positioning system.

3.6.1.5 Field pattern. The antenna field pattern shall approximate a cardioid shape when the antenna is properly terminated. By switching the termination of the antenna from one end to the other a mirror image of the field pattern shall be obtained. This switching of the field pattern caused the antenna r-f output to be square-wave modulated. The resulting square wave signal, after being acted upon by other components, shall be utilized by a phase sensitive motor to position the antenna to the antenna pattern crossover point. The r-f square wave modulation shall decrease to a null at this point.

3.6.1.6 Antenna gain. The minimum gain of the antenna in the direction of maximum sensitivity shall not be less than 20 db below that of a lossless matched quarter wavelength stub at any frequency within the 225 to 400MHz range.

3.6.1.7 VSWR. A maximum VSWR of 3:1 shall be obtainef for the antenna when each of the two ends of the receiving element are terminated by the coaxial lobing switch. The ratio of the two VSWR readings shall not be greater than 5.5:1.

3.6.2 Amplifier-Relay Assembly AM-3624/ARA-50. The amplifier-relay assembly shall conform to figure 4.

3.6.2.1 Amplifier module. This transistorized module shall synchronously filter and amplify the square-wave signal demodulated by the associated receiver. This signal shall control a saturable transformer and provide a 400Hz output signal phased to rotate the antenna toward the null position. Circuitry shall be included to utilize the antenna rate generator damping voltage for reducing the servo system hunting and overshoot. A square-wave oscillator shall be included to provide power for the antena lobing switch and the rate generator control winding as well as the synchronous filter and phase detecting circuits within the amplifier.

3.6.2.1.1 Square-wave oscillator frequency. The square-wave oscillator frequency shall be 75 to 200Hz.

3.6.2.2 Relay module. This module shall contain a DPDT coaxial crossover switch for connecting the associated communications transmitter-receiver to either the communications antenna or DFG antenna. It shall be operated by completing the circuit ground with the transmitter receiver control or by the push-to-talk switch so that transmission shall always be with the communication antenna. The relay shall be operated by a 28VDC.

3.6.2.2.1 VSWR. The VSWR of the relay module shall not be more than 1.3:1 with a resistive 50-ohm termination.

3.6.3 Mounting MT-1955/ARA-50. This mounting shall contain the necessary shock mounts for the amplifier-relay assembly and shall conform to figure 5.

3.6.4 Antenna AS-2755/ARA. The AS-2755/ARA antenna shall be used in AN/ARA-50 DFG installations requiring an antenna that is rotated 90 from normal orientation. The requirements for the AS-2755/ARA antenna shall be in accordance with MIL-A-83364.

3.7 Weight. The weight of the Direction Finder Group AN/ARA-50 shall be kept to a minimum and shall not exceed the following:

a. Antenna AS-909/ARA-48: 10 pounds (4.53 Kg).

b. Amplifier-Relay Assembly AM-3624/ARA-50 including mounting MT-1955/ARA-50: 6.5 pounds (2.94 Kg).

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.

4.2 Document confliction. The quality assurances provisions of MIL-E-5400 and the requirements specified herein shall be applicable to this specification. When the two documents conflict, this specification shall govern.

4.2.1 Classification of tests. The inspection and testing of the direction finder group shall be classified as follows:

a. Preproduction testing.

b. Acceptance tests.

4.3 Test conditions. Unless otherwise specified, the equipment shall be subjected to the tests under the following test conditions:

a. Ambient air:
Temperature: 60°F to 90°F (16°C to 32°C)
Pressure: Prevailing laboratory conditions

b. Vibration: None

c. Humidity: Room ambient

d. Warm-up time: 5 minutes maximum

e. Input power:
115VAC, 400Hz, nominal
27.5VDC nominal
26VAC, 400Hz, nominal

f. The transistors or magnetic elements used shall be selected at random from representative types.

4.4 Preproduction testing.

4.4.1 Preproduction test samples. The preproduction test samples shall consist of models representative of the production equipment. They shall be tested under the test conditions specified herein and at the point designated by the contract.

4.4.1.1 Sampling instructions. The contractor shall conduct tests on 8 preproduction sample equipments to determine that the design of the equipments meet the requirements specified herein. The contractors's test shall be conducted in accordance with the test procedures specified herein.

4.4.1.1.1 Testing schedule. Three of the sample equipments shall be processed as in table V, VI and VII (See para d.). A minimum of 5 preproduction

samples shall be tested for reliability in accordance with the requirements of 4.6.7. Two of the 5 samples shall be continually tested for longevity in accordance with the requirements of 4.6.7.

TABLE V. Sample number 1 test.

Test	Applicable Paragraph
Examination of product	4.6.1
Functional tests	4.6.2
Environmental tests as foll:	4.6.3
Shock Salt spray Explosion Sand and dust	
Interference	4.6.5

TABLE VI. Sample number 2 tests.

Test	Applicable Paragraph
Examination of product	4.6.1
Functional tests	4.6.2
Environmental tests as follows:	4.6.3
Temperature-altitude Humidity Vibration	
Acceleration	4.6.3.2

TABLE VII. Sample number 3 tests.

Test	Applicable Paragraph
Examination of product	4.6.1
Functional tests	4.6.2
Power variation tests	4.6.4
Field tests	4.6.6

4.4.2 Preproduction tests. Preproduction tests shall consist of the tests specified under 4.6, subject to the test conditions specified herein.

4.5 Acceptance tests. Acceptance tests shall consist of individual tests and reliability acceptance tests.

4.5.1 Individual tests. Each Direction Finder Group shall be subjected to the following tests in table VIII as described under 4.6, Test methods, of this specification:

TABLE VIII. Individual tests.

Test	Applicable Paragraph
Examination of product	4.6.1
Functional tests	4.6.2

4.5.2 Reliability acceptance test. The first 10 direction finder equipments of the production run shall be used for reliability demonstration. The reliability testing shall be in accordance with test level F of MIL-STD-781. The test group shall be continually tested until an accept or reject decision is reached.

4.5.2.1 Rejection and retest. Accept-reject criteria for sampling plan equipments shall be in accordance with test plan XXVII of MIL-STD-781. No equipment from the production run of which the test group is a part shall be shipped until an accept decision has been reached on that test group.

4.5.3 Defects in equipments already accepted. The investigation of a test failure could indicate that defects may exist in equipments already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

4.6 Test methods.

4.6.1 Examination of product. The DFG shall be visually inspected to verify that the materials, design and construction, necessary mechanical measurements marking and workmanship comply with the requirements of this specification.

4.6.2 Functional tests. The procedures and application of functional tests to determine proper performance and compliance with the requirements of this specification shall be prepared by the contractor and subject to approval by the procuring activity. The functional tests, as applicable shall be conducted prior to, during, and after the environmental tests specified herein. Unless otherwise specified, the functional tests shall be conducted on the complete equipment.

4.6.2.1 R-f operational test. Satisfactory operation shall be observed under r-f signal conditions at 225.0, 311.0 and 397.0MHz.

4.6.2.2 Accuracy and sensitivity test. The system ability to return to the same heading from opposite directions with minimum signal strength shall be checked.

4.6.2.3 Speed of response test. Speed of rotation for the system from starting points 178° and 50° removed and for both counter-clockwise and clockwise directions shall be checked.

4.6.2.4 Hunting test. The hunting of the indicator needle at 0° and 180° shall be observed.

4.6.2.5 Overshoot. The needle travel beyond the final heading when the antenna is assuming a bearing from a position 180° removed shall be observed.

4.6.2.6 Lag. The lag of the indicator needle when the antenna reference signal source is rotated at a speed of 3° per second shall be noted.

4.6.2.7 Coaxial relay. The DPDT coaxial switch contained in the relay module for proper crossover switching shall be tested.

4.6.2.8 VSWR. The VSWR of the antenna with the r-f chopper in each of the two positions at frequencies of 225, 311, and 397MHZ shall be measured. The VSWR of the relay module r-f inputs for the energized and unergized conditions at frequencies of 225, 311, and 397 MHz shall be measured.

4.6.3. Environmental test. The following environmental tests on DFG shall be conducted in accordance with class 2 requirements of MIL-T 5422 with the exceptions and additions called out herein. When the two documents conflict, this specification shall govern.

4.6.3.1 Waived tests. The fungus resistance test, and sand and dust test shall not apply; all other tests specified in MIL-T-5422 shall be required.

4.6.3.2 Temperature and altitude test.

4.6.3.2.1 General. The equipment shall be placed in a test chamber in the "as installed" condition unless otherwise stated in the individual test procedures. The term "as installed" shall be interpreted as including the applicable cooling or heating provisions. At least the following data, as applicable, shall be recorded for each unit during the temperature and altitude tests:

a. Operating surface or reference temperatures of the critical components and piece-parts.

b. Electrical heat dissipation.

c. Surrounding air temperature and pressure.

d. Functional parameters.

4.6.3.2.2 Stabilized operation tests. The equipment shall be tested as in table IX while operating in the maximum heat dissipating mode. Data per paragraph 4.6.3.1.1.1 shall be recorded after temperature stabilization for each test.

TABLE IX. Stabilized operation tests.

Unit	Surrounding Air Temperature	Surrounding Air Pressure (psia)	Test duration
Amplifier-relay	160°F (70°C)	0.83	Stabilization plus 1 hour
Antenna	212°F (100°C)	0.83	Stabilization plus 1 hour

4.6.3.2.3 Inoperative storage and warm-up test.

a. With the equipment nonoperating, the test chamber conditions shall be adjusted to -80°F (-62°C) at room ambient pressure. The equipment temperature shall be stabilized and maintained for at least 2 hours. Where it is possible without changing the temperature conditions, the equipment shall be visually inspected to determine whether or not deterioration that would impair future operation has occured.

b. With the equipment nonoperating, the chamber conditions shall shall be adjusted to -65°F (-54°C) at room ambient pressure. After the equipment temperature has stabilized, the equipment shall be turned on at the lowest specified voltage. The equipment shall operate satisfactorily; i.e., deliver specified performance with the 5 minute warm-up time. Following stabilization, the equipment shall be turned on and off three times and rechecked for satisfactory operation (See subparagraphs (1) and (2) below).

(1) Satisfactory operation within the specified warm-up time shall be determined by checking to see that the applicable performance characteristics appear normal and meet specification requirements.

(2) All characteristics that are likely to be affected by low temperatures shall be checked first. Should the time required to check the equipment exceed 15 minutes beyond warm-up time, the equipment shall again be stabilized at -65°F (-54°C) and the operational check continued.

c. With the amplifier-relay nonoperating, the chamber temperature shall be stabilized and maintained for at least 16 hours. At the conclusion of this period, the equipment shall be inspected in accordance with 4.6.2 and when practicable, visually inspected to determine the extent of any deterioration.

d. With the antenna component nonoperating, the chamber conditions shall be adjusted to 212°F (100°C) at room ambient pressure The chamber temperature shall be stabilized and maintained for at least 16 hours. At the conclusion of this period, the equipment shall be inspected in accordance with 4.6.2 and when practicable, visually inspected to determine the extent of any deterioration.

4.6.3.3 Vibration test.

a. The vibration test shall be conducted on the amplifier-relay at room ambient temperatures for both resonant and cycling tests.

b. The vibration test shall be conducted on the antenna for both resonant and cycling tests at room ambient temperature.

c. Equipment shall be tested in its normally mounted condition, including vibration isolators in place.

d. The test specimen shall function and remain within operational requirements during the entire test.

4.6.3.4 Functional tests. Functional tests shall be conducted in accordance with the requirements of the detail part specification during application of the acceleration. There shall be no mechanical failures or malfunctions due to the applied acceleration.

4.6.3.5 Explosion-proof test. The explosion proof test shall be conducted in accordance with procedure I.

4.6.3.6 Acceleration test. Acceleration tests to determine structural or functional compliance with the load factor requirements of 3.3.3.8.3 shall be conducted on critical parts. Critical parts are defined as relays or comparable mechanical devices that are sensitive to force levels in the range of the limit loads specified in 3.3.3.8.3. Acceleration tests shall be performed in accordance with method 513.3 of MIL-STD-810 and as specified herein. The highest limit load factors along the three airplane axes (vertical, lateral, fore and aft) as determined from 3.3.3.8.3 shall be applied individually. Orientation of the equipment on the centrifuge shall be such as to achieve these factors consistent with the orientation of the equipment in the airplane.

4.6.4 Power variation test. Functional test of 4.6.2 shall be conducted on the DFG during the following simultaneous conditions:

a. Maximum voltage on all power lines and maximum frequency on a-c lines.

b. Minimum voltage on all power lines and minimum frequency on a-c power lines.

4.6.4.1 Under-voltages test. The line voltages shall be reduced from standard conditions to zero and then back to standard conditions over a period of 5 minutes. Check to see if any damage has resulted to any units.

4.6.4.2 Power characteristics test. The DFG units shall be tested to demonstrate compatibility with the requirements of power as specified under 3.3.3.7.

4.6.5 Interference test. The interference test shall be performed in accordance with MIL-STD-826, equipment class AM.

4.6.6 Field tests. The DFG shall be field-tested at an outdoor site free from reflections. The antenna shall be mounted to an aluminum ground plane eight feet in diameter and then connected for normal operation. The transmitting source shall be capable of radiating both cw and 30 percent 1000Hz modulation at levels producing 50 microvolt/meter and 0.3 volt/meter at the DFG antenna site. The transmissions shall be at the frequencies listed below and shall be vertically polarized. Functional tests (see 4.6.2) shall be conducted on the equipment at both minimum and maximum field strengths at frequencies of 225, 311, and 397MHz.

4.6.7 Reliability and longevity test. The reliability and longevity test shall be conducted in accordance with test level F of MIL-STD-781. The testing shall be approximately divided equally between three chamber temperatures; -54°C, room ambient, and +71°C.

4.6.7.1 Reliability test. Test plan XXVI of MIL-STD-781 shall be used for the preproduction reliability test.

4.6.7.2 Longevity test. The equipment shall be subjected to a longevity test to determine compliance with the requirements of 3.3.3.3.1.2. Test Plan XXVIII of MIL-STD-781 shall be used for the longevity test.

4.7 Maintainability demonstration. Maintainability test and demonstration shall be in accordance with MIL-STD-471, method 5.

4.8 Design data and material.

4.8.1 Preproduction test report. The contractor shall prepare a preproduction test report in accordance with MIL-STD-831.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging.

5.1.1 Level A. Each direction finder group shall be preserved and packaged in accordance with the requirements of MIL-STD-2073/1A and MIL-P-9024. Levels of preservation, packaging, and packing will be determined in accordance with Table III, MIL-P-9024.

5.2 Marking. Marking of all unit containers, intermediate containers, shipping containers and unitized leads shall be in accordance with MIL-STD-129

6. NOTES

6.1 Intended use. The AN/ARA-50 direction finder group covered by this specification is intended to provide a capability for the aircraft to home-in and to obtain a bearing on another aircraft or ground station operating in the UHF spectrum.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.

b. Stock number.

c. Level of packaging and preservation shall be level A unless otherwise specified by the procuring activity.

d. Preproduction samples and tests.

(1) Number of preproduction samples.

(2) Point of inspection.

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

6.3 Patent notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

6.4 Subject term (key word) listing.

Airborne
Amplifier
Antenna
Assembly
Bearing
Box
Console

Control
Cover
Direction
Distance
Element
Finder
Group
Heading
Horizontal
Indicator
Interconnecting
Mounting
Radio
Receiver
Relay
Rotating
Synchro

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

Custodian:
Air Force - 99

Preparing Activity:
Air Force - 84

Agent:
Air Force - 99

(project 5826-F194)

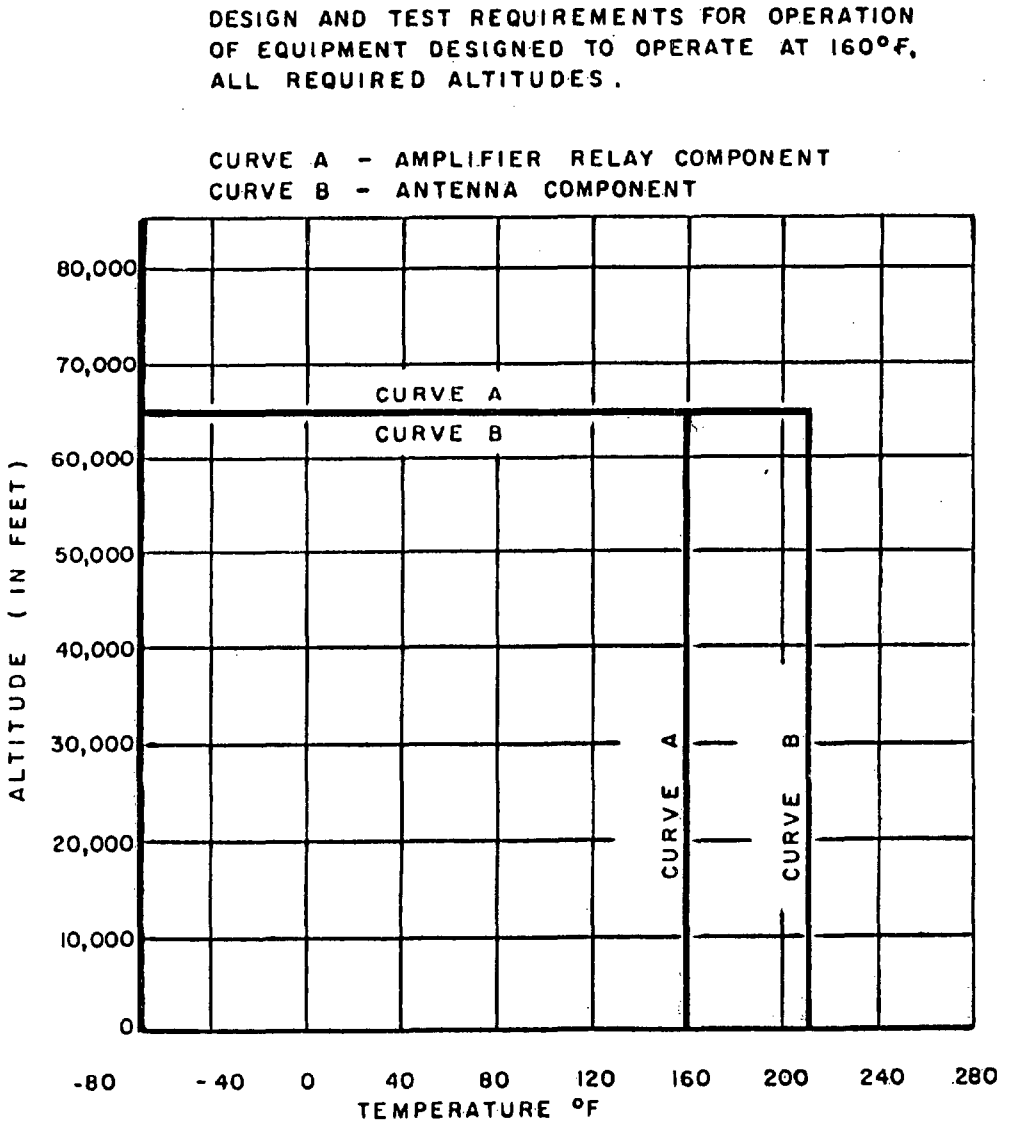

FIGURE 1. Operarional requirements (temperature vs altitude

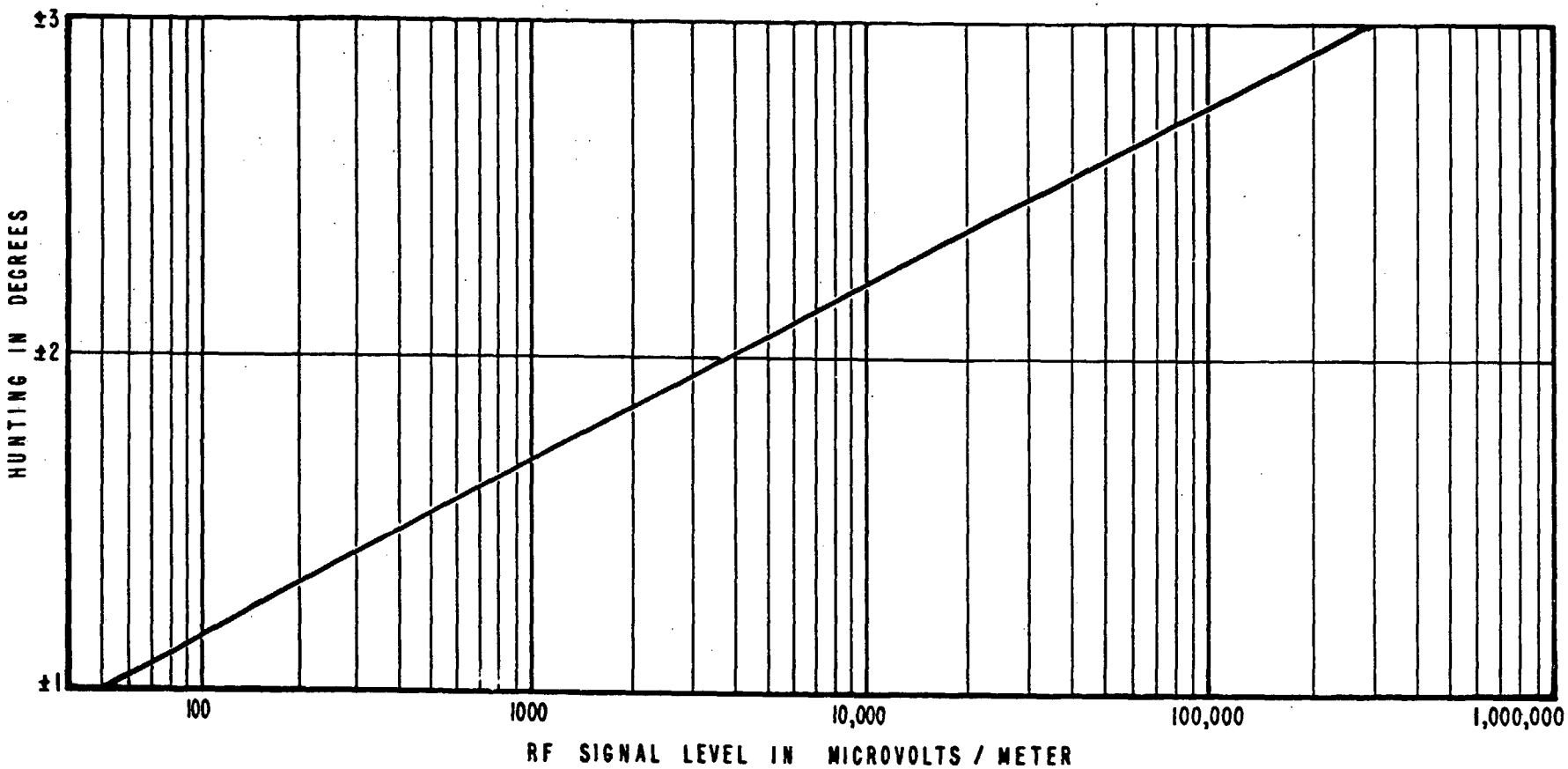

FIGURE 2. Limits of indicator hunting vs field strength

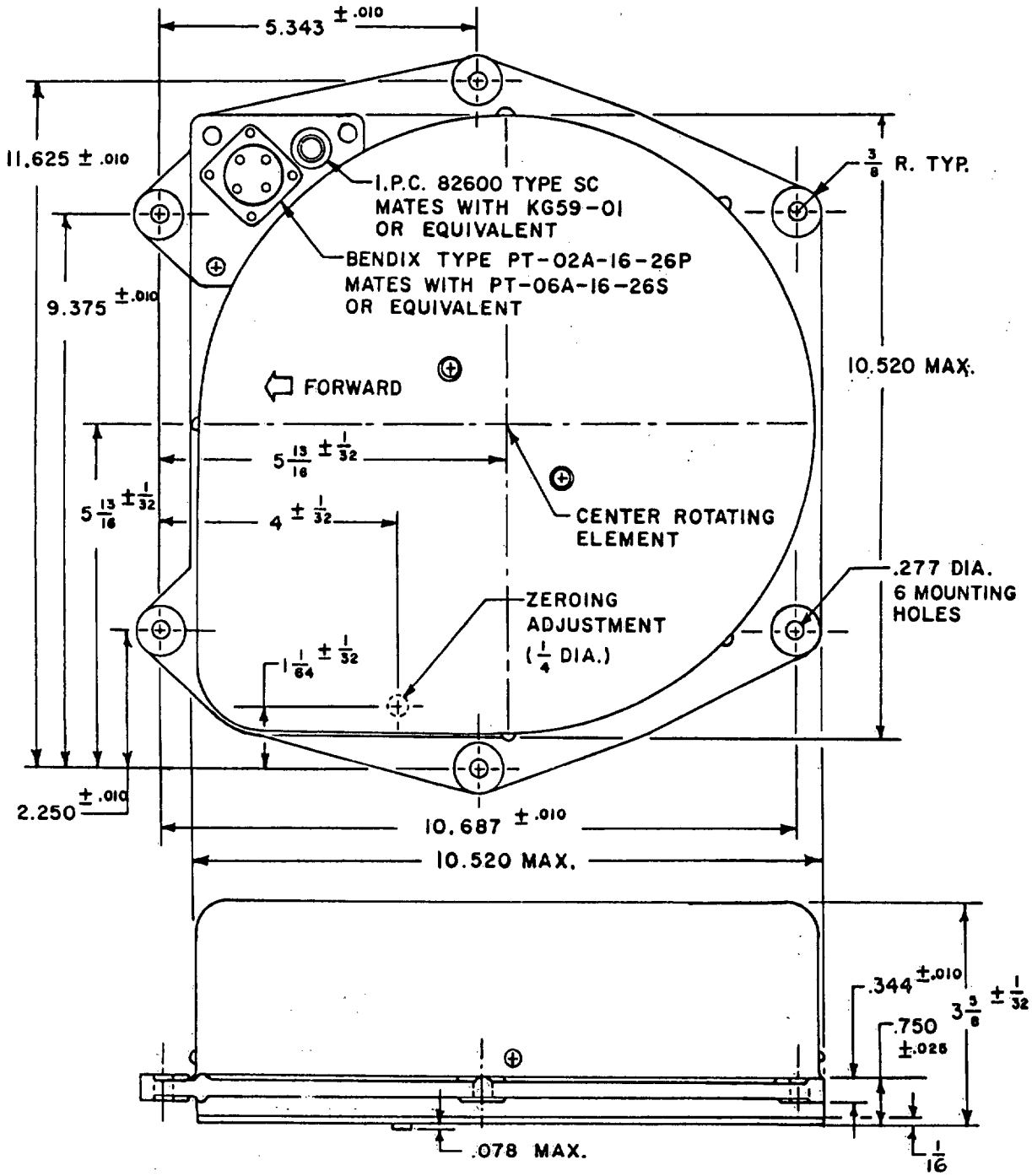

FIGURE 3. Antenna AS-909/ARA-48

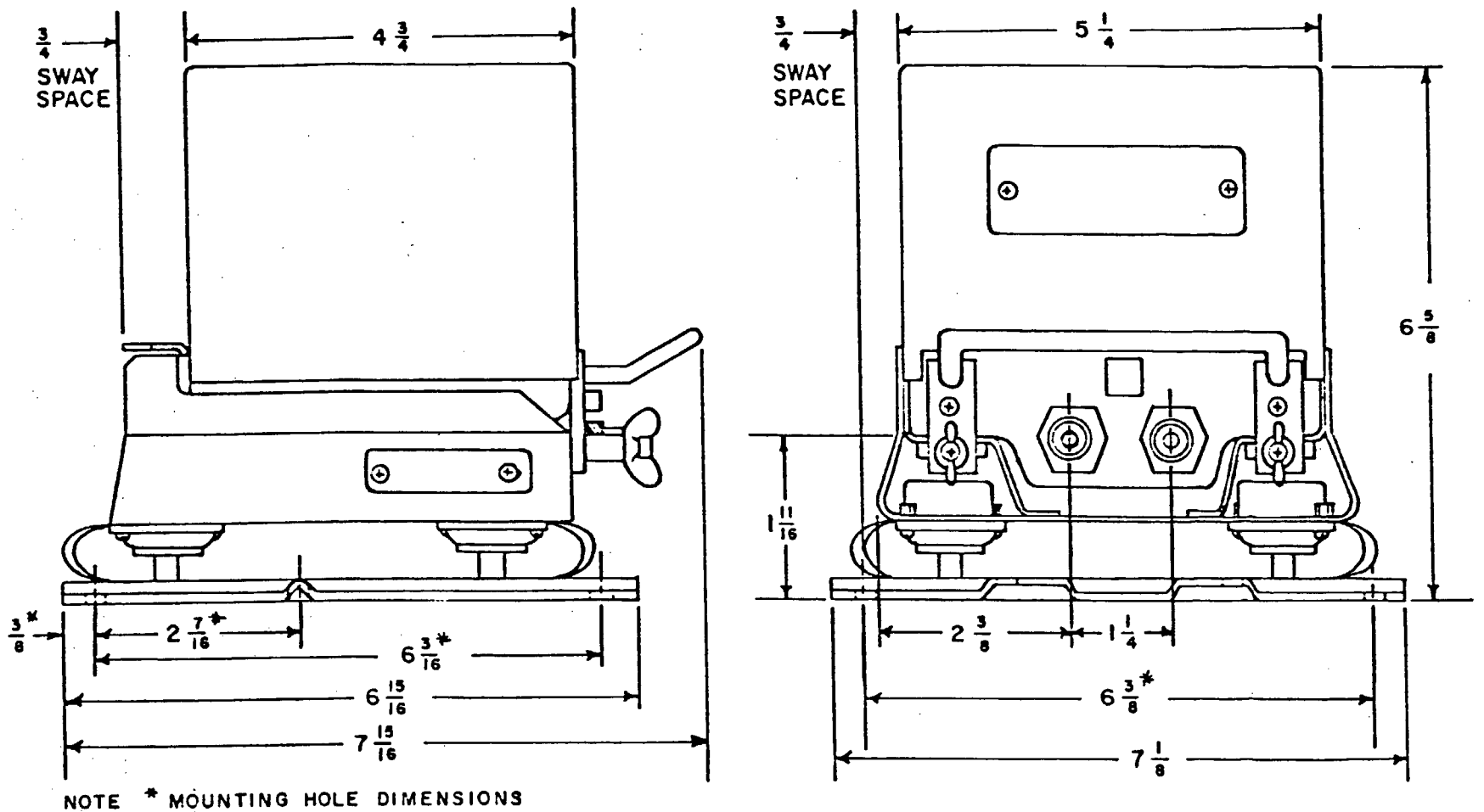

FIGURE 4. Amplifier-relay assembly AM-3624/ARA-50

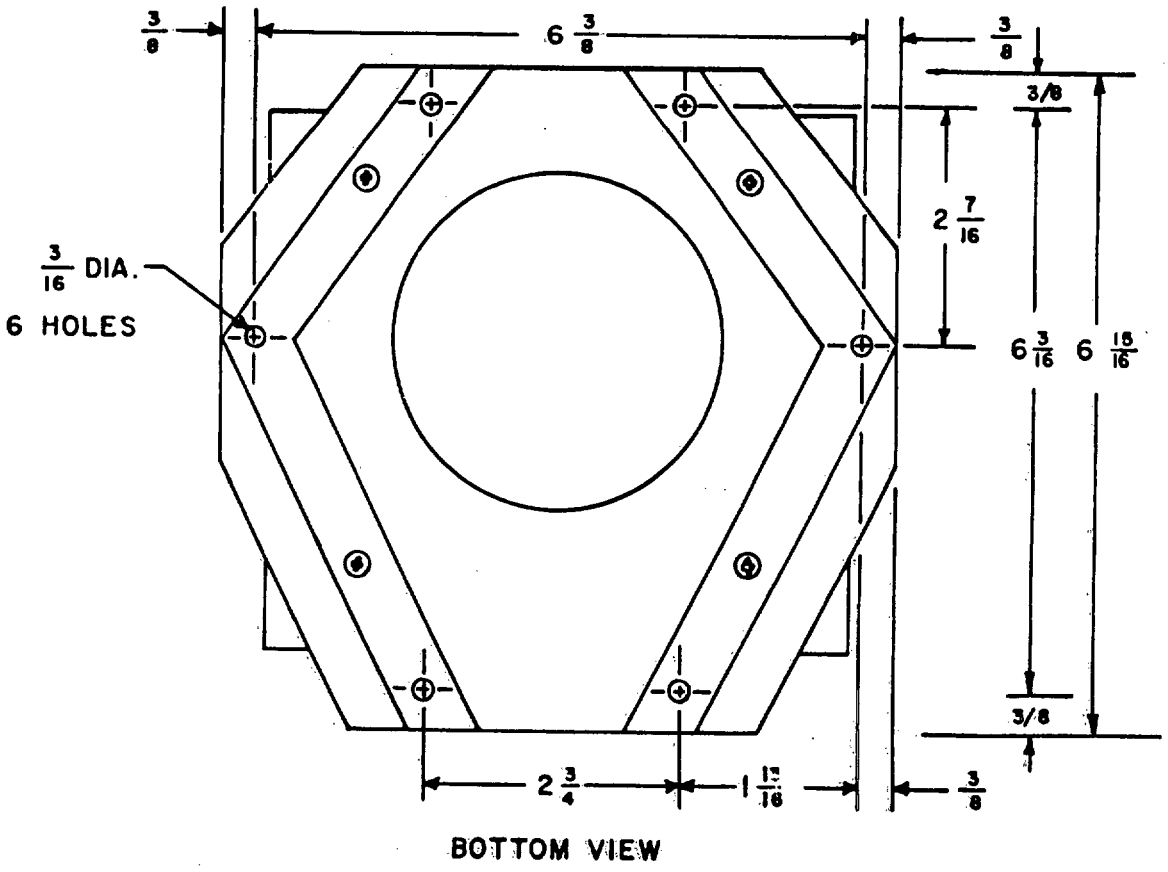

FIGURE 5. Mounting MT-1955/ARA-50

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-D-38402A(USAF)	DIRECTION FINDER GROUP AN/ARA-50 GENERAL SPEC FOR

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ 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	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.