

MIL-S-55556A(EL)
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MILITARY SPECIFICATION

SPECIFICATION, INSTALLATION AND ACCEPTANCE TESTING OF ELECTRONICS EQUIPMENT IN AIRCRAFT, PREPARATION OF

1. SCOPE

1.1 This specification provides instructions and methods for the preparation of installation and test specifications for airborne electronic equipment intended for use in aircraft.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

UU-P-561 Paper, Tracing

STANDARDS

MILITARY

MIL-STD-12 Abbreviations for Use on Drawings and in
 Technical Type Publications
 MIL-STD-15 Electrical and Electronic Symbols
 MIL-STD-106 Mathematical Symbols

HANDBOOK

MILITARY

MIL-HDBK-172 Military Standardization Handbook
 Electronic Test Equipment

PUBLICATIONS

DEFENSE STANDARDI-
 ZATION MANUAL
 4120.3-M Standardization Policies, Procedures and
 Instructions

MISC

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(Copies of documents required by the contractor in connection with a specific procurement function shall be obtained from the contracting officer. Both the number or symbol and title of the document should be included in the request for copies.)

2.2 Other publications. - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

ASA Y.32.16

Electrical and Electronic Reference Designations

(Application for copies should be addressed to the United States of America Standards Institute, 10 East 40th Street, New York, New York 10016.)

3. REQUIREMENTS

3.1 General. - The contractor shall prepare and furnish to the procuring activity a specification which defines the aircraft electronic equipment installation and testing instructions and requirements as specified herein. Should preparation of the specification be subcontracted, the prime contractor shall notify the reviewing and approving activity (in writing) of the name and address of the subcontractor preparing the proposed specification. The prime responsibility for the production of a complete and satisfactory document is that of the contractor who has agreed to furnish the specification requirements of the contract.

3.1.1 Approval of documents

3.1.1.1 Submission of material

3.1.1.2 Preliminary draft. - Six copies of a preliminary draft specification prepared in accordance with this specification shall be submitted to the procuring activity for review within 30 days of the date of contract award or as otherwise specified by the contracting officer.

3.1.1.3 Revised draft. - Six copies of a revised draft specification shall be submitted for review as required and stipulated by the procuring activity.

3.1.1.4 Final draft. - Unless otherwise specified by the procuring activity, the final draft of the specification and four copies of the revised draft shall be submitted to the procuring activity prior to the thirtieth (30) calendar day preceding submission of the first equipment for quality conformance inspection. The final vellum drawings of the figures and illustrations shall be submitted flat or rolled and in no case folded.

3.1.1.5 Equipment changes. - If a change is made to the equipment prior to final acceptance and approval of the specification, the contractor shall correct the draft, as necessary, and submit the revised document to the procuring activity in accordance with 3.1.1.

3.1.1.6 Acceptance. - Final acceptance of the specification shall be determined by the procuring activity in accordance with the procedures specified in 4.2.

3.1.2 Standards. - MIL-STD-12, MIL-STD-15, MIL-STD-106 and ASA Y.32.16 shall be used, as applicable, to govern the use of symbols, abbreviations and reference designations.

3.1.3 Level of writing. - The language style requirements specified in 4120.3-M shall apply.

3.1.4 Text. - The text shall be unbound typewritten and single spaced. Each page shall have a 3/4 inch margin top, bottom and sides with a maximum line length of six and one-half inches. Typing shall be on one side of the page only. Draft copies may be good ozalid, multilith, blue-line or equivalent reproductions. The reproducible text shall be on 8 inch by 10 1/2 inch vellum sheets.

3.1.5 Figures and illustrations. - Figures and illustrations which are included as part of the specification shall be prepared on 8 inch by 10 1/2 inch vellum sheets or multiple sizes thereof, which can be reproduced and inserted as folded sheets suitable for binding with 8 inch by 10 1/2 inch sheets. Lettering shall be typewritten or equal. Margins shall be as specified in 3.1.4 as a minimum with printing on one side of the sheet only. The figures and illustrations shall be neat, clean and free from smears. Lines and characters shall be sharp, clear, durable, undistorted and provide good contrast with the background, which shall be clear. (See figures 1 thru 9)

3.2 Specification. - The specification format and contents shall be in accordance with 4120.3-M and as specified herein.

3.2.1 Heading. - The following example shall be used as guidance for preparing the specification heading:

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(EXAMPLE)		
CLASSIFICATION	MIL-I	(EL)
<p>"WARNING: This material contains information affecting the national defense of the United States within the meaning of the espionage laws, title 18, U.S.C., secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law." (Omit if specification draft does not contain classified information.)</p>		
<p>NOTE: This draft, dated _____, prepared by the US Army Electronics Command has not been approved and is subject to modification.</p>		
DO NOT USE FOR PROCUREMENT PURPOSES		
MILITARY SPECIFICATION		
INSTALLATION AND ACCEPTANCE TESTING OF (EQUIPMENT NOMENCLATURE) IN ARMY AIRCRAFT		

3.2.2 Section 1, SCOPE. - Section 1 of the specification shall be in accordance with the following example. The contractor shall substitute the indicated information where specified by parenthesis.

(EXAMPLE)	
1. SCOPE	
<p>1.1 This specification provides installation, equipment performance, engineering and production approval instructions and requirements for installation and testing of (equipment nomenclature) and associated equipment in prototype and production model aircraft.</p>	

3.2.3 Section 2, APPLICABLE DOCUMENTS. - Section 2 of the specification shall include a complete listing of all documents which form a part of the specification. References shall be confined to documents which are currently available in approved form at the time of issuance of the specification. Documents listed under 2.1 shall consist of Government controlled issues such as Federal and Military specifications, standards, drawings and Government publications, or other publications promulgated by commercial organizations and other nongovernmental agencies as applicable. Documents shall be listed in accordance with 4120.3-M. The contractor shall substitute the indicated information where specified by parenthesis. The following example shall be used as guidance for preparing section 2.

(EXAMPLE)

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

(Number or symbol) (Title of specification)

MILITARY

(Number or symbol) (Title of specification)

STANDARDS

MILITARY

(Number or symbol) (Title of standard)

(List here all documents referred to in sections 3 and 4 of the prepared specification.)

3.2.4 Section 3, REQUIREMENTS. - Section 3 of the specification shall specify all requirements necessary to insure the designated aircraft electronic equipment is installed satisfactorily and performs in a manner which will demonstrate the equipment design capability. The procedures and techniques specified shall be economically feasible and of minimum complexity. The specific requirements shall include but not be limited to the following categories:

- a. General requirements.
- b. Installation requirements.
- c. Bench test requirements.
- d. Engineering approval preflight, flight and EMC requirements.
- e. Production approval preflight, flight and EMC requirements.
- f. Other requirements as necessary.

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3.2.4.1 General requirements. - The general category shall include all requirements which affect two or more of the specified requirement categories or are otherwise general in nature. The following example shall be used as guidance in the preparation of the general requirements. The contractor shall substitute the indicated information where specified by parenthesis.

(EXAMPLE)

3. REQUIREMENTS

3.1 General

3.1.1 Acceptance. - Any installation of (equipment nomenclature) which is in accordance with MIL-I-8700 and the requirements of this specification shall be considered acceptable. Such acceptance, however, does not constitute safety-of-flight approval.

3.1.2 Responsibility for miscellaneous components. - The contractor shall furnish and install all required plugs, cables, brackets, connectors, junction boxes, terminal boards, circuit breakers, switches, relays, wiring, shafts, lamps and miscellaneous items to complete satisfactory installation and operation of the (equipment nomenclature). All contractor furnished electronic equipment shall be in accordance with the applicable electromagnetic interference and compatibility requirements in MIL-STD-461 and the requirements in MIL-E-5400 for Class I-A equipment designed for operation in both aircraft and helicopters.

3.1.3 Quality assurance. - The contractor shall perform all examinations and tests specified in section 4 to insure compliance with the applicable requirements of section 3.

3.1.4 Radio frequency assignment - The contractor shall request from the procuring activity a radio frequency assignment for which he has no assignment and is otherwise necessary to verify that the (equipment nomenclature) performance is in accordance with the requirements specified herein. Receipt of radio frequency assignments from the procuring activity does not relieve the contractor of any responsibility for obtaining a Federal Communications license to operate equipment radiating electromagnetic energy.

3.1.5 Reports. - The contractor shall prepare and submit to the procuring activity all reports and other supplementary data as specified by the contracting officer.

3.1.6 Check-off list. - (See Figure 1) The contractor shall record the results of the applicable examinations and tests specified in section 4 on an appropriate check-off list similar to the examples shown in Figures 1-A, 1-B and 1-C. The contractor shall prepare a check-off list for each (equipment nomenclature) installed in an aircraft and maintain a file of these records for reference, as necessary, by the procuring activity.

3.1.7 Equipment failure. - Except as specified in 3.1.8, if the equipment fails to comply with the requirements of 3.3, the requirements and procedures specified in MIL-I-8700 shall govern with the exception that replacement of component parts shall be made only upon specific written approval by the procuring activity. The applicable "Unserviceable Materiel Report" shall be utilized when reporting equipment failure. Shipping instructions for the faulty equipment and distribution requirements for the equipment failure report shall be specified by the contracting officer.

3.1.8 Equipment under warranty. - The equipment repair procedures specified in MIL-I-8700 are not authorized for Government furnished equipment which is under warranty by the equipment manufacturer. Disposition and reporting of faulty equipment shall be as specified in 3.1.7.

3.1.9 Procuring activity approval. - In all cases where approval by the procuring activity is specified, the contractor shall be in receipt of said approval prior to conducting any tests, inspections or otherwise utilizing the proposed equipment or procedures.

3.1.10 Test equipment calibration. - The contractor shall prepare a statement which identifies the test equipment utilized in the performance of the tests specified in section 4. The statement shall include certification of the test equipment calibration in accordance with MIL-C-45662 and be forwarded to the procuring activity as supplementary data to the applicable test report.

3.1.11 Electronic sub-system certification. - The contractor shall prepare a statement which certifies that all aircraft installed electronic sub-systems which are utilized in the performance of the tests specified in section 4 are in accordance with the applicable specifications. The statement shall be forwarded to the procuring activity as supplementary data to the applicable test reports.

3.1.12 Data recording. - The contractor shall utilize an instrumentation system including a recording media which will

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provide "permanent" analog recordings of all calibration and raw data collected while performing the engineering flight tests specified herein. The recordings shall be edited and appropriately annotated for identification, correlation and comments pertaining to nebulous responses. The recordings shall be submitted to the procuring activity as supplementary data to the applicable test report in accordance with 3.1.5.

3.1.13 Instrumentation. - The instrumentation system application and techniques utilized to collect the engineering flight test data shall be fully disclosed and forwarded to the procuring activity as supplementary data to the applicable test report. The range and accuracy (including transducer and printout errors) of each recorded signal shall be adequate for comprehensive evaluation of the parameter(s) being measured. The supplementary data shall include but not be limited to the following:

- a. Recording media (Block diagram including component identification numbers.)
- b. Transducer and/or signal source parameters.
- c. Signal conditioning for each signal (schematic).
- d. Preflight and post-flight calibration techniques.
- e. Calibration test equipment list with calibration certification.
- f. Instrumentation system range and accuracy certification for each recorded signal.
- g. Calibration curves necessary for complete analysis of each recorded signal.
- h. Other data as required.

3.1.14 Electromagnetic compatibility. - Interference control and test plans shall be prepared by the contractor in accordance with MIL-E-6051 and MIL-STD-463 and submitted to the procuring activity for approval. After receipt of approval, the contractor shall conduct the tests specified in 4.3 to demonstrate compliance with MIL-E-6051 and to insure interference free operation of the (equipment nomenclature) after installation in an aircraft. A contractor prepared electromagnetic compatibility test report shall be forwarded to the procuring activity as directed by the contracting officer. EMI/EMC characteristics of the (equipment nomenclature) which verify compliance with the applicable requirements of MIL-STD-461 will be provided by the procuring activity as required.

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3.1.15 Equipment to be tested. - The equipment listed in Table I shall meet the requirements specified herein. Whenever the model or detail specification for a particular aircraft provides a list not in agreement with Table I, the list in the aircraft specification shall govern. (List in Table I all equipment and associated components for which performance tests are specified. A sample Table I format is shown below.)

TABLE I

ELECTRONIC EQUIPMENT TO BE TESTED
for (Equipment Nomenclature)

EQUIPMENT DESIGNATION	PART NR. OR NOMENCLATURE	NR. OF UNITS REQUIRED	WT. PER UNIT (POUNDS)	UNIT HEAT DISSIPATION (MAX)	REFERENCE PARAGRAPH
Transmitter	T-00/ARC-00	1	15	650 Watts	3.3.3

3.1.16 Additional equipment required. - In addition to the equipment listed in Table I, the following equipment, listed in Table II, is required for a complete installation of the (equipment nomenclature). (A sample Table II format follows.)

TABLE II

ELECTRONIC EQUIPMENT ASSEMBLY TABLE
for (Equipment Nomenclature)

EQUIPMENT DESIGNATION	PART NR. OR NOMENCLATURE	NR. OF UNITS REQUIRED	WT. PER UNIT (POUNDS)	REFERENCE PARAGRAPH	REMARKS
Mount	MT-00/ARC-00	1	0.75	3.2.15.()	
Switch Assy	S-00	1	0.03	3.2.15.()	Contractor Furnished

3.1.17 Test equipment required. - The following test equipment or equipment of equal or superior characteristics, shall be used in the performance of the tests specified herein. Items which are considered unique to the equipment under test and which may be loaned

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to the aircraft contractor by the Electronics Command are marked with an asterisk. Other items may be supplied in special circumstances, but in all cases such circumstances must be justified by the contractor and approved by the Electronics Command (A sample Table III format follows.)

TABLE III
TEST EQUIPMENT AND ACCESSORIES

NAME	PURPOSE	PREFERRED TYPE	
		TYPE DESIGNATION	CHARACTERISTICS
Sine Wave Generator	Sync Range Test	TS-382A/U	20 Hz to 200 kHz in 4 bands + 2% Output 0 to 100 mv.
Pulse Generator	Polarity Switch Test	SG-30/UP	0.2 -15 us Pulse Positive and Negative Output 20 Hz to 20 kHz Repetition rate.
Oscillo-graph	Utility Gate Test	AN/USM-24	.05 v p-p per inch 2 Hz to 8 MHz Amplitude Calibration + 5% Driven Sweep
Crystal Calibrator	Sweep Calibration Accuracy Test	TS-810/U	Pulses at repetition rates of 1 MHz, 100 kHz, 10 kHz, 100 Hz, 1 Hz.
Instrumentation System	Data Recording	(To be approved by procuring activity.)	
Special Test Equipment		(To be approved by procuring activity.)	

(List all test equipment, including any special test equipment, necessary to conduct all tests required herein. MIL-HDBK-172 should be used as a guide for selecting standard test equipment.)

3.2.4.2 Installation. - The installation requirements shall include all information necessary to design a satisfactory installation of the specified equipment, either independent of or integrated with other equipment which constitute the aircraft electronic configuration. The specification text shall include, but not be limited to, information such as environmental limitations, electromagnetic compatibility, auxiliary equipment and/or accessory requirements, safety precautions and human factors considerations. The installation requirements shall include, as applicable, but not be limited to, the sub-paragraphs shown in the following example:

(EXAMPLE)

3.2 Installation (See 4.4). - All Government furnished aircraft equipment and contractor furnished equipment shall be installed in accordance with MIL-I-8700 and as specified herein.

3.2.1 Electrical wiring. - (See Figures 2 and 3) All electrical wiring required for installation of (equipment nomenclature) in an aircraft shall be in accordance with MIL-W-5088 and as specified herein.

3.2.2 Electrical bonding. - Electrical bonding shall be in accordance with MIL-B-5087 and as specified herein. Refinishing of bonded surfaces shall be in accordance with the applicable requirements of MIL-F-14072.

3.2.3 Antennas. - Installation, design and location of airborne antennas shall be in accordance with MIL-STD-877 and as specified herein.

3.2.4 Control panels. - All contractor furnished rack or console mounted control panels shall be in accordance with MIL-C-6781 and as specified herein.

3.2.5 Mountings. - All contractor furnished cases, mounting bases and vibration mounts shall be in accordance with MIL-C-172 except that the transmissibility in each of the three mutually perpendicular principal axes of the mounting base shall not exceed three (3).

3.2.6 Precautions. - (Insert any general precautionary statements which would be beneficial in installing the equipment. See following sample statements.)

- a. Do not disconnect or connect any connector or remove or replace any components while power is applied to equipment.

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- b. Extreme care must be taken to prevent entrance of noncontained fuel, oil or other foreign substances into the compartment in which the equipment is installed.

3.2.7 Input requirements

3.2.7.1 Electrical. - The (equipment nomenclature) has been designed to provide reliable performance when supplied with electrical input power with characteristics as defined in MIL-STD-704 and limits as specified below:

a. AC Power (Single Phase)

(1) 115 Volt Variable Frequency

Voltage limits _____ to _____ volts
 Frequency limits _____ to _____ Hz
 Power _____ VA

(2) 115 Volt Constant Frequency

Voltage limits _____ to _____ volts
 Frequency limits _____ to _____ Hz
 Power _____ VA

b. DC Power

Voltage limits _____ to _____ volts
 Power _____ watts

(List above the total input power required for the equipment specifying the amount, voltage and frequency range for each type of power required. Secondary power generated within the equipment should not be listed.)

3.2.7.2 Mechanical. -

3.2.7.3 Pneumatic. -

3.2.7.4 Hydraulic. -

(List additional paragraphs, as required, to cover all applicable input requirements. Include reduced performance requirements, if applicable.)

3.2.8 Environmental requirements. - The (equipment nomenclature) components comply with the environmental requirements for

Class 1-A equipment designed for operation in both helicopters and aircraft as specified in MIL-E-5400 where indicated by "C" (compliance) in Tables IV-A (operating) and IV-B (non-operating). The environmental limits of those components marked "NC" (non-compliance) are specified in 3.2.14. Components of the (equipment nomenclature) shall be installed within the limits specified. (Columns I through XI of Tables IV-A and IV-B shall be utilized to indicate compliance or non-compliance with the specified requirements of MIL-E-5400 by entering "C" in the appropriate column to indicate compliance and "NC" to indicate non-compliance.)

3.2.9 Equipment heat dissipation. - Heat dissipation data for each unit of equipment is given in Table I. The total heat dissipation of the equipment is as follows:

(Insert a complete listing of all applicable data.)

<u>Condition</u>	<u>Watts</u>
Standby	_____
Normal operation	_____
Emergency operation	_____

3.2.10 Total weight. - The total weight of the equipment exclusive of cables is _____ pounds. The weight and center of gravity of the individual units is as specified in Table I and Figure _____ respectively.

3.2.11 Location considerations. - Every consideration shall be given in the location of equipment and in the design of installation details to promote operator efficiency and ease of adjustment and replacement. These considerations shall not be compromised to facilitate aircraft production techniques. (List here any general restrictions and precautions to be considered in selecting a location for the equipment.)

3.2.12 Pressurization. - (See Figure 9) (If the equipment is designed for pressurized operation or will be installed in pressurized compartments, explain the nature of the pressurization requirements. Specify the provisions which must be made by the installing activity to meet the pressurization requirement. Pressurization details for individual units may be included under 3.2.14.)

3.2.13 Cooling. - (See Figure 8) (If special cooling provisions are required for the equipment, explain the nature of the cooling requirement. Specify the provisions which must be made by the installing activity to meet the cooling requirement. Details of cooling for individual units may be included under 3.2.14.)

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OPERATING ENVIRONMENTAL SERVICE CONDITIONS

EQUIPMENT DESIGNATION	PART NUMBER OR NOMENCLATURE	I TEMPERATURE	II ALTITUDE	III TEMPERATURE ALTITUDE COMBINATION	IV HUMIDITY	V VIBRATION		VI SHOCK		VIII FUNGUS	IX CAL. ATMS-PHERE	X EXPL. STD. PARAG. 1.4	XI INTER-FERENCE
						NORMALLY MOUNTED	WITH ISOLATORS REMOVED	EQUIPMENT MOUNT	MOUNTING BASE				

NOTE:
SPECIFIC SERVICE CONDITIONS SHALL BE COMPATIBLE WITH THE REQUIREMENTS SPECIFIED IN THE APPLICABLE REVISION OF MIL-E-5400.

NOTE: "C" denotes compliance and "NC" denotes non-compliance with specified requirements for Class 1-A equipment designed for operation in both helicopters and aircraft as specified in MIL-E-5400.

TABLE IV - A

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3.2.14 Detailed requirements. - (See Figures 4 through 7) (Insert a separate paragraph or group of paragraphs, in logical order, for each individual major unit specifying all detailed installation requirements including restrictions as to location for that unit. Include detailed environmental information for any unit which does not meet the environmental requirements for Class I-A equipment designed for operation in helicopters and aircraft specified in MIL-E-5400 as shown in Tables IV-A (Operating) and IV-B (Non-operating) of this specification. The following sample format shall be used to list environmental limitations specified in MIL-E-5400.)

(Insert applicable information if significant: List operating and non-operating limits separately.)

Temperature (degrees F)	_____
Altitude	Up to _____ ft.
Temperature-Altitude	Figure _____ of MIL-E-5400
Humidity (percent RH)	_____ %
Shock (#g's-duration)	_____ g; _____ millisecc
Vibration	
Normally mounted	
X axis	_____ DA from _____ to _____ Hz
Y axis	_____ DA from _____ to _____ Hz
Z axis	_____ DA from _____ to _____ Hz
With isolators removed	_____ DA from _____ to _____ Hz
	in any directions.

The equipment (is-is not) explosion proof as defined in MIL-E-5400. (If not, specify restrictions.)

The equipment (is-is not) in accordance with (the applicable EMI requirement.) (If not, specify restrictions.)

3.2.4.2.1 Installation drawings. - Installation drawings shall be furnished and included as figures in the specification. The drawings (figures) shall be the original vellums. The material shall be in conformance with UU-P-561, Type III. Legibility and contrast shall be such that each mark is totally and clearly visible. The letters and numbers shall be no smaller than 1/16 inch to insure readability. The drawing size and margins shall be as specified in 3.1.5. The following types of drawings shall be furnished and shall contain the type of information shown on the sample drawings:

a. Outline drawings (See Figures 4,5,6 & 7) for each unit assembled on its mounting base. These drawings shall show:

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- (1) Overall dimensions.
- (2) Accurate location and clear identification of all controls, marking, protuberances, vents, etc.
- (3) Clear indication of method of mounting to the supporting structure.
- (4) Clearances required to accommodate shock mount sway, to provide necessary air circulation, to permit detachment of components necessary for equipment removal, and to provide access to components for in-place adjustments.
- (5) Weight of each unit, with and without its mount, the center of gravity of each unit on its mount.
- (6) Heat dissipation of each unit.
- (7) Size and location of all mounting holes (including size of mounting hardware).

b. Views as necessary of each unit showing the surfaces on which in-place adjustments must be made or disconnections for removal be accomplished. Where clarity will not be sacrificed, these views may be included in the "Outline" drawings described in a. above.

c. External Wiring Diagram (See Figure 2) showing all electrical, mechanical and other connections between all units of an equipment, and between the equipment and other equipments of the aircraft. This drawing shall conform to the sample external wiring diagram.

d. Cabling Diagram (See Figure 3) showing all cabling and locations of all connections and controls. Each unit shall be identified by its assigned nomenclature. All plugs and receptacles shall be identified. The drawing shall conform to the sample cabling diagram.

e. Cooling and Pressurization Charts (See Figures 8 & 9) shall be included, when applicable, showing graphically the required air flow at various temperature levels for cooling and the air flow rate for various pressure levels for pressurization requirements. The charts shall conform to the enclosed samples.

3.2.4.3 Bench test requirements. - The bench test requirements shall include all general information, charts, diagrams, reference to the applicable detailed step-by-step test procedures in section 4 of the specification and

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the minimum acceptable performance limits necessary to insure the equipment operates satisfactorily and has not been damaged in shipping and handling. Specific requirements shall be selected with an aim toward keeping the bench testing time to a minimum while including those requirements which are most likely to indicate faulty operation and are necessary to insure acceptable performance of major parameters, controls, adjustments, etc. The following example shall be used as guidance in the preparation of the bench test requirements.

(EXAMPLE)

3.3 Bench test requirements. - Unless otherwise specified, the applicable tests in section 4 shall be conducted on all equipments comprising the (equipment nomenclature) to insure compliance with the following requirements. Compliance with the specified bench test requirements shall be verified prior to installation in an aircraft.

3.3.1 Test Bench (See 4.5.1). - A permanently located bench or test rack shall be provided within a screen or RF shielded room for mounting the (equipment nomenclature) components and specified test equipment. The arrangement shall provide easy access to the component parts and adjustments. The test rack shall be completely cabled simulating the normal aircraft installation. The input power source(s) shall be capable of providing power within the limits specified in 3.2.7.

3.3.2 Equipment condition (See 4.5.2). - The equipment shall be free of dust, dirt, foreign or packing material and any external or internal damage. All external controls shall operate freely and properly.

3.3.3 Transmitter power output (See 4.5.3). - With the transmitter operating into the specified load, a minimum of 10 watts of RF power shall be delivered into the antenna load with a transmitter input voltage as specified in 3.2.7.

3.3.4 (List here a separate paragraph for each bench test requirement. The paragraph shall include the paragraph number, title, reference to applicable test procedure paragraph of section 4, general conditions under which performance is measured and the minimum acceptable performance limits.)

3.2.4.4 Engineering approval requirements. - The engineering approval requirements shall include all general information, charts, diagrams, reference to applicable detailed test procedures in section 4 of the specification

and the minimum acceptable performance limits necessary to insure the equipment units have been installed and integrated properly and demonstrate the design capability. The sequence of requirements shall be coordinated with the test procedure sequence of section 4 to keep the testing time to a minimum by taking full advantage of the functional test results and test equipment set-up of the preceding test(s). The following example shall be used as guidance in the preparation of engineering approval requirements.

(EXAMPLE)

3.4 Engineering approval requirements. - Engineering approval is required prior to final acceptance by the procuring activity of the (equipment nomenclature) installation and operation. The applicable tests specified in section 4 shall be conducted on a prototype or first production model aircraft of a given contract and on the first aircraft following a major change in either the aircraft or the equipment installation design to insure compliance with the engineering approval requirements specified herein. The aircraft selected shall be fully configured (electronics, armament, armor plating, etc.) as specified in the aircraft contract unless otherwise approved by the procuring activity. If the installation is part of a retrofit program, all applicable MWO's shall be applied prior to conducting the engineering approval tests. Engineering approval requirements shall consist of preflight, flight and EMC requirements specified in 3.4.1 through 3.4.3.

3.4.1 Preflight. - Compliance with the following preflight requirements shall be verified prior to determining compliance with the flight requirements specified in 3.4.2 and after verification of bench test requirements specified in 3.3 to insure the equipment installation and operation is in accordance with the following preflight requirements. Engineering preflight tests specified in 4.6.1 shall be performed with (equipment nomenclature) installed in the aircraft in accordance with 3.2. The tests specified in 4.6 shall be conducted at a location which is free of electromagnetic energy reflecting surfaces such as buildings, other aircraft, etc. and where the electromagnetic environment level is not more than 4 db above the receiver internal background level. Any test site which does not meet these requirements shall not be utilized without prior approval of the procuring activity.

3.4.1.1 Power sources

3.4.1.1.1 Electrical power source (See 4.6.1.1.1). - Electrical power shall be obtained from the aircraft (primary, essential, emergency) dc bus. The supply voltage measured at the input terminals of the (equipment nomenclature) shall be 27.0 ± 0.5 volts dc.

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3.4.1.1.2 Mechanical power source (See 4.6.1.1.2). - (List here and in succeeding paragraphs all other power source requirements which are essential for normal operation of the equipment and the acceptable limits at specific measurement points.)

3.4.1.2 Transmitter power output (See 4.6.1.2). - With the transmitter operating into the specified antenna, a minimum of 10 watts of RF power shall be delivered into the antenna load with a transmitter input voltage as specified in 3.4.1.1.1.

3.4.1.3 (List here a separate paragraph for each preflight requirement. The paragraph shall include the paragraph number, title, reference to applicable test procedure paragraph of section 4, general conditions under which performance is measured and the minimum acceptable performance limits.)

3.4.2 Flight. - Compliance with the following flight requirements shall be verified after compliance with the preflight requirements specified in 3.4.1 has been verified. Engineering flight tests specified in 4.6.2 shall be performed to insure the (equipment nomenclature) performance is in accordance with the following flight requirements while all the "normal" in-flight equipments in the aircraft are functioning.

3.4.2.1 Communication antenna pattern (See 4.6.2.1). - At a range of 10 nautical miles and at an altitude of 1,200 feet, the antenna installation shall demonstrate a gain equal to or greater than that of an isotropic radiator in free space with equal input power and have a 360° pattern in which no more than 50% of the pattern peaks are more than 10 db above the pattern minimum.

3.4.2.2 (List here a separate paragraph for each additional flight requirement. The paragraph shall include the paragraph number, title, reference to applicable test procedure paragraph of section 4, general conditions under which performance is measured and the minimum acceptable performance limits.)

3.4.3 Electromagnetic compatibility (See 4.3). - Compliance with the complete functional electrical-electronic requirements specified in the USAECOM approved, contractor prepared EMC control and EMC test plan required in 3.1.14 shall be verified.

3.2.4.5 Production approval requirements. - The production approval requirements shall be limited by comparison to the engineering approval requirements and shall include all general information, charts, diagrams, reference to applicable detailed test procedures in section 4 of the specification and the minimum acceptable performance limits necessary to insure there has been no degradation of the acceptable equipment performance during the production

phase of the aircraft contract. The sequence of requirements shall be coordinated with the test procedure sequence of section 4 to keep the testing time to a minimum by taking full advantage of the functional test results and test equipment set-up of the preceding test(s). The following example shall be used as guidance in the preparation of production approval requirements.

(EXAMPLE)

3.5 Production approval requirements. - Production approval is required prior to final acceptance by the procuring activity of the (equipment nomenclature) installation and operation. The applicable tests specified in section 4 shall be conducted on every aircraft submitted for acceptance to insure compliance with the production approval requirements specified herein. The aircraft shall be fully configured (electronics, armament, camouflage, etc.) as specified in the aircraft contract unless otherwise approved by the procuring activity. If the installation is part of a retrofit program, all applicable MWO's shall be applied prior to conducting the production approval tests. Production approval requirements shall consist of preflight, flight and EMC requirements specified in 3.5.1 through 3.5.3.

3.5.1 Preflight. - Compliance with the following preflight requirements shall be verified prior to determining compliance with the flight requirements specified in 3.5.2 and after verification of bench test requirements specified in 3.3. Production preflight tests in 4.7.1 shall be performed with (equipment nomenclature) installed in the aircraft in accordance with 3.2 to insure the equipment installation and operation is in accordance with the following preflight requirements. The tests specified in 4.7.1 shall be conducted at a location which is free of electromagnetic energy reflecting surfaces such as buildings, other aircraft, etc. and where the electromagnetic environment level is not more than 4 db above the receiver internal background level. Any test site which does not meet these requirements shall not be utilized without prior approval of the procuring activity.

3.5.1.1 General. - Production preflight requirements shall be verified on every aircraft submitted for acceptance and shall consist of those requirements specified in (list applicable requirement paragraph numbers selected from 3.4.1).

3.5.1.2 (List here and in succeeding paragraphs any additional production preflight requirements. The paragraph shall include the paragraph number, title, reference to applicable test procedure paragraph of section 4, general conditions under which performance is measured and the minimum acceptable performance limits.)

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3.5.2 Flight. - Compliance with the following flight requirements shall be verified after compliance with the preflight requirements specified in 3.5.1 has been verified. Production flight test specified in 4.7.2 shall be performed to insure the (equipment nomenclature) performance is in accordance with the following flight requirements while all "normal" in-flight equipments in the aircraft are functioning.

3.5.2.1 Communications range (See 4.7.2.1). - Throughout a range of from 0 to 20 nautical miles at an altitude of 1,200 feet, the (equipment nomenclature) shall demonstrate a communications readability X strength capability of 3 X 5 or better. (See Table V)

TABLE V

Audio Readability

- 1 - Unreadable
- 2 - Barely readable, occasional words missing
- 3 - Readable but occasionally difficult
- 4 - Readable with no difficulty
- 5 - Perfectly readable

Strength of Signal

- 1 - Faint to very weak
- 2 - Weak to fair
- 3 - Fair to good
- 4 - Good to moderately strong
- 5 - Strong to extremely strong

3.5.2.2 (List here a separate paragraph for each additional flight requirement. The paragraph shall include the paragraph number, title, reference to applicable test procedure paragraph of section 4, general conditions under which performance is measured and the minimum acceptable performance limits.)

3.5.3 Electromagnetic compatibility (See 4.3). - Compliance with the limited functional electrical-electronic requirements specified in the USAECOM approved, contractor prepared EMC control and EMC test plan required in 3.1.14 shall be verified.

3.2.5 Section 4, QUALITY ASSURANCE PROVISIONS. - Section 4 of the specification shall include all the examinations and tests to be performed in order to verify that the equipment installation and performance conforms to the requirements of section 3 of the specification. The

testing procedures and techniques specified shall be economically feasible and of minimum complexity. The following example shall be used as guidance in the preparation of section 4 with the exception of 4.1 which is mandatory for inclusion in the specification.

(EXAMPLE)

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the contractor 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 Classification of examinations and tests. - The examinations and tests required to assure conformance with the requirements of section 3 are classified as follows:

- a. Electromagnetic compatibility tests
- b. Installation examination
- c. Bench tests
- d. Engineering approval tests
- e. Production approval tests

4.3 Electromagnetic compatibility tests. - Under the test conditions and procedures specified in the USAECOM approved, contractor prepared EMC control and EMC test plans, demonstrate compliance with 3.4.3 and 3.5.3.

4.4 Installation examination. - All (equipment nomenclature) electronic equipment, whether Government furnished or contractor furnished, which is installed by the contractor shall be examined to determine compliance with 3.2.

4.5 Bench tests

4.5.1 Input Power. - All power sources shall be in compliance with 3.3.1.

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4.5.2 Visual and mechanical inspection. - Except as specified in 3.1.8, all equipment shall be inspected for external and internal damage. Remove all dust, dirt, foreign or packing material. Check all external controls to see that they operate freely and properly. Remove equipment covers and examine for foreign material, and loose or damaged parts for compliance with 3.3.2. Clean, tighten, repair and report in accordance with 3.1.7.

4.5.3 Transmitter power output. - Using the test set-up as shown in figure (), check the transmitter, as specified, for compliance with 3.3.3 at the following frequencies in the sequence shown. (List applicable equipment frequencies and the detailed step-by-step test procedure to insure the equipment operates satisfactorily.)

	<u>MHZ</u>		<u>MHz</u>		<u>MHz</u>		<u>MHz</u>
(1)	30.00	(4)	37.20	(7)	50.55	(10)	63.85
(2)	34.10	(5)	44.45	(8)	55.65	(11)	67.95
(3)	40.30	(6)	38.00	(9)	59.75	(12)	69.95

4.5.3.1 (List here the detailed step-by-step test procedure to verify compliance with 3.3.3).

4.5.4 (List here and in succeeding paragraphs all conditions of test and test procedure to determine compliance with related bench test requirement paragraphs of section 3.)

4.6 Engineering approval tests

4.6.1 Preflight tests

4.6.1.1 Power sources

4.6.1.1.1 Electrical power source. - With all electrical equipment which is connected to the same bus as the (equipment nomenclature) turned "ON" and operating in the normal manner, place the (equipment nomenclature) in the "transmit" mode of operation. Under this condition, measure the dc input voltage level at (specify point of measurement for each probe) with (voltmeter nomenclature) to determine compliance with 3.4.1.1.1.

4.6.1.1.2 Mechanical power source. - (List here and in succeeding paragraphs all tests and testing procedures to determine compliance with other power source requirements specified in 3.4.1.1.2 and subsequent paragraphs.)

4.6.1.2 Transmitter power output. - Connect wattmeter (wattmeter nomenclature) in the antenna cable between receiver-transmitter (receiver-transmitter nomenclature) and antenna (antenna nomenclature). Key the transmitter and record the transmitter power output at 31.00, 50.50 and 68.95 MHz to determine compliance with 3.4.1.2.

4.6.1.3 (List here and in succeeding paragraphs all conditions of test and testing procedure to determine compliance with the related paragraphs of section 3.)

4.6.2 Flight tests.

4.6.2.1 Communication antenna pattern. - The communication antenna pattern test shall be conducted with the (equipment nomenclature) controls set for the communication mode of operation. The test site shall include a clearly identifiable ground station and a ground reference point located 20 to 25 nautical miles from the ground station. The aircraft shall transmit a test signal at each test frequency and the specified data shall be recorded at the receiving location. The following instructions shall apply when conducting the test to determine compliance with 3.4.2.1.

- a. Test procedure. - Fly the specified flight pattern over the ground reference point while recording the specified data. A flight test is required at each test frequency. The data collected at each test frequency shall be appropriately averaged, edited and presented in the indicated graphic format (including test conditions information) in accordance with 3.1.5. The specified calibration curves shall be submitted with the report as supplementary data.
- b. Flight pattern. - Fixed wing aircraft shall fly three "cloverleaf" patterns over the ground reference point in heading increments of 15 degrees. Rotary wing aircraft shall fly six "circular" (3 CW and 3 CCW) patterns (pattern diameter = 0.5 mile maximum; bank angle = 5 degree maximum) using the ground reference point as the center of the pattern.

Range - 10 to 15 nautical miles

Altitude - 1,200 feet

Location - over ground reference point

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- c. Test frequencies. - A minimum of 5 frequencies, one selected from each 20% segment of the (equipment nomenclature) operational frequency spectrum.
- d. Calibration curves. - Calibration curves shall be included in the flight test report showing the relationship between the recording media indication and the following parameters:
- (1) Received field strength (microvolts)
 - (2) Aircraft heading
- NOTE: The number of calibration steps shall be adequate for comprehensive data reduction and analysis.
- e. Data requirements. - As a minimum, data signals proportional to received signal strength and aircraft heading shall be recorded. The contractor shall record any additional data dictated by the recording media or techniques employed or otherwise needed for complete performance analysis of the system(s) being evaluated.
- f. Data presentation. - A polar graph of antenna field strength in db (use isotropic level = 0 db) versus aircraft relative bearing (0 degree relative bearing shall be considered as a point on the forward section of a line through the longitudinal axis of the aircraft) in 15 degree increments shall be submitted for each specified test frequency.

NOTE: Use 0 db = 1 microvolt/meter when computing isotropic antenna level and when converting the recorded field strength levels to db. Appropriate corrections must be applied to the computed isotropic antenna field strength level for effects due to earth gain factors, antenna gain, line losses, deviation from datum point, etc.

4.7 Production approval tests. -

4.7.1 Preflight tests. -

4.7.1.1 (List here and in succeeding paragraphs all conditions of test and testing procedure to determine compliance with the related production flight requirement paragraphs of section 3.)

4.7.2 Flight tests

4.7.2.1 Communication range. - The communication capability shall be monitored while the aircraft is flown away from and then toward the ground station at an altitude of 1,200 feet and a range of 0 to 20 nautical miles. The tests shall be conducted at 30.00, 50.55 and 69.95 MHz to determine compliance with 3.5.2.1.

4.7.2.2 (List here and in succeeding paragraphs all conditions of test and testing procedure to determine compliance with the related production flight requirement paragraphs of section 3.)

3.2.6 Section 5, PREPARATION FOR DELIVERY. - Section 5 of the specification shall be as shown in the following example.

(EXAMPLE)

5. PREPARATION FOR DELIVERY

5.1 This section is not applicable to this specification.

3.2.7 Section 6, NOTES. - Section 6 of the specification shall contain information of a general or explanatory nature, and no requirements shall appear herein. The following example shall be used as guidance in the preparation of section 6.

(EXAMPLE)

6. NOTES

6.1 Intended use. - The purpose of this specification is to provide and specify installation instructions and requirements, performance requirements and quality assurance procedures to prohibit serious installation design discrepancies and to insure desirable performance characteristics are achieved when the (equipment nomenclature) is installed in an aircraft.

6.2 Definitions

6.2.1 Contractor. - The word "contractor" as used herein refers to the aircraft manufacturer or other activity responsible for the installation and performance of the quality assurance requirements of (equipment nomenclature.)

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6.2.2 (List here a separate paragraph which defines each word or phrase used in the text which may be ambiguous or may require a clear understanding for effective installation and testing of the specified airborne electronic equipment.)

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the contractor 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 Approval of documents

4.2.1 Review and rejection. - Drafts submitted for review will be returned to the contractor for corrections, deletion, or additions, as necessary until they are in conformance with requirements specified in 3.1.1.6. Resubmission of drafts shall be made in accordance with instructions furnished by the procuring activity.

4.2.2 Acceptance and approval of documents. - Final approval of the specification shall be by letter of acceptance and approval. Any letter of acknowledgement of receipt of material shall not be construed as a waiver of review or as an approval of the material submitted as being in conformance with this document. Any approval given during preparation of the documents, or approval for shipment of any reproduced publication resulting therefrom, shall not be considered as a guarantee of the final acceptance of the completed documents.

5. PREPARATION FOR DELIVERY

5.1 The specified documents shall be packaged securely and safely, and shall be hand delivered or forwarded by registered mail directly as instructed in 3.1.1. Classified material shall be packaged and delivered in accordance with current security regulations.

6. NOTES

6.1 Intended use. - The purpose of this specification is to establish uniform practices for the preparation of "Installation and Acceptance Testing of Electronic Equipment in Aircraft" specifications.

6.2 Inaccurate and incomplete information causes delay in acceptance of the documents and frequently results in the return for correction. Time and effort will be saved for both the contractor and the Government if each document and drawing is as complete and correct as possible when submitted for approval.

6.3 Technical assistance. - The contractor is advised to communicate promptly with the procuring activity to facilitate the preparation of an accurate and complete proposed specification.

6.4 Symbols are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:

Army - EL

Preparing Activity:

Army - EL

Project Number MISC-A846

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CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

Control-Indicator ID-000/APS-00
 Receiver-Transmitter RT-000/APS-00
 Power Supply PP-000/APS-00
 Control, Radar Set C-000/APS-00

Serial No. _____
 Serial No. _____
 Serial No. _____
 Serial No. _____

'ENCH TESTS

TESTS CONDUCTED BY: _____ DATE: _____

APPLICABLE PARAGRAPH	TESTS	MINIMUM STANDARD	REMARKS
4.5.1	<u>Input Power</u> <u>Voltage</u> a. 30 AC _____ Hz b. 10 AC _____ Hz c. DC <u>Power</u> a. 30 _____ Hz b. 10 _____ Hz c. DC	115/200 + 1 volt 115 + 0.5 volt 27.5 + 0.5 volt 2000 VA 600 VA 250 watts	
4.5.()	<u>Control Indicator</u> <u>Low Voltage Power Supply</u> J2302 J2306 J2308 J2309 J2310	300 + 3 150 + 1.3 100 + 1 -680 + 30 -300 + 3	
4.5.()	<u>Pulse Repetition Rate</u>	30 + 1	
4.5.()	<u>Altitude Counter</u>	10 + 1	
4.5.()	<u>Receivers</u>		
4.5.()	<u>AFC Operations</u>		
4.5.()	<u>Receiver Sensitivity</u>	100 db	
4.5.()	<u>Receiver Control Check</u>		
4.5.()	<u>Transmitter</u>		
4.5.()	<u>Magnetron Current</u>	15 MA	
4.5.()	<u>Power Output</u>	50 KW Peak	

FIGURE 1-A. CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

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CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

ENGINEERING APPROVAL TESTS TEST CONDUCTED BY: _____ DATE: _____

INSTALLED IN _____ AIRCRAFT TAIL NO. _____

APPLICABLE PARAGRAPH	TEST	MINIMUM STANDARDS	REMARKS

FIGURE 1-B. CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

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CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

PRODUCTION APPROVAL TESTS

TEST CONDUCTED BY: _____

DATE: _____

INSTALLED IN _____

AIRCRAFT TAIL NO. _____

APPLICABLE PARAGRAPH	TEST	MINIMUM STANDARDS	REMARKS

FIGURE 1-C. CHECK-OFF LIST FOR TEST OF (EQUIPMENT NOMENCLATURE)

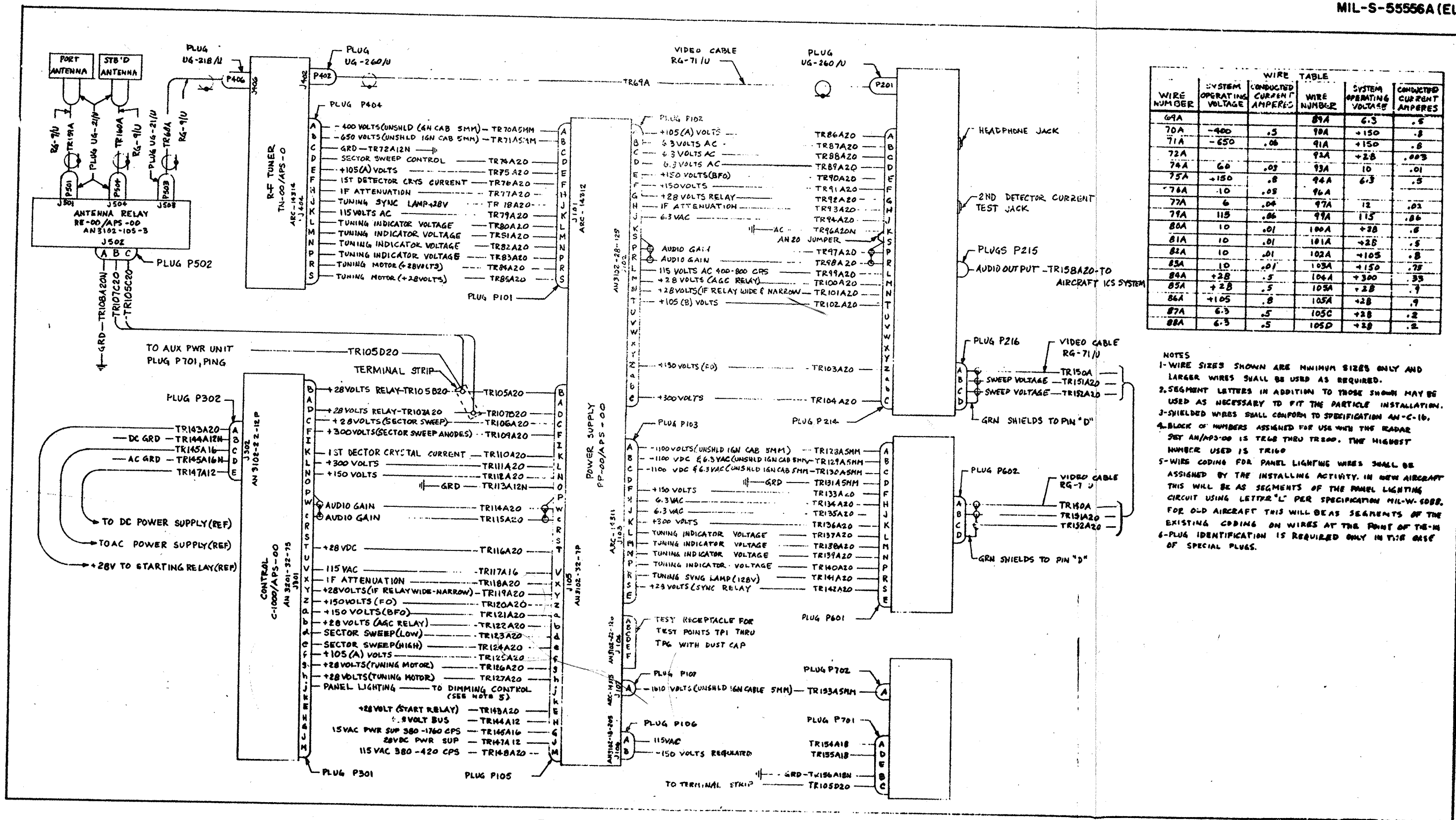
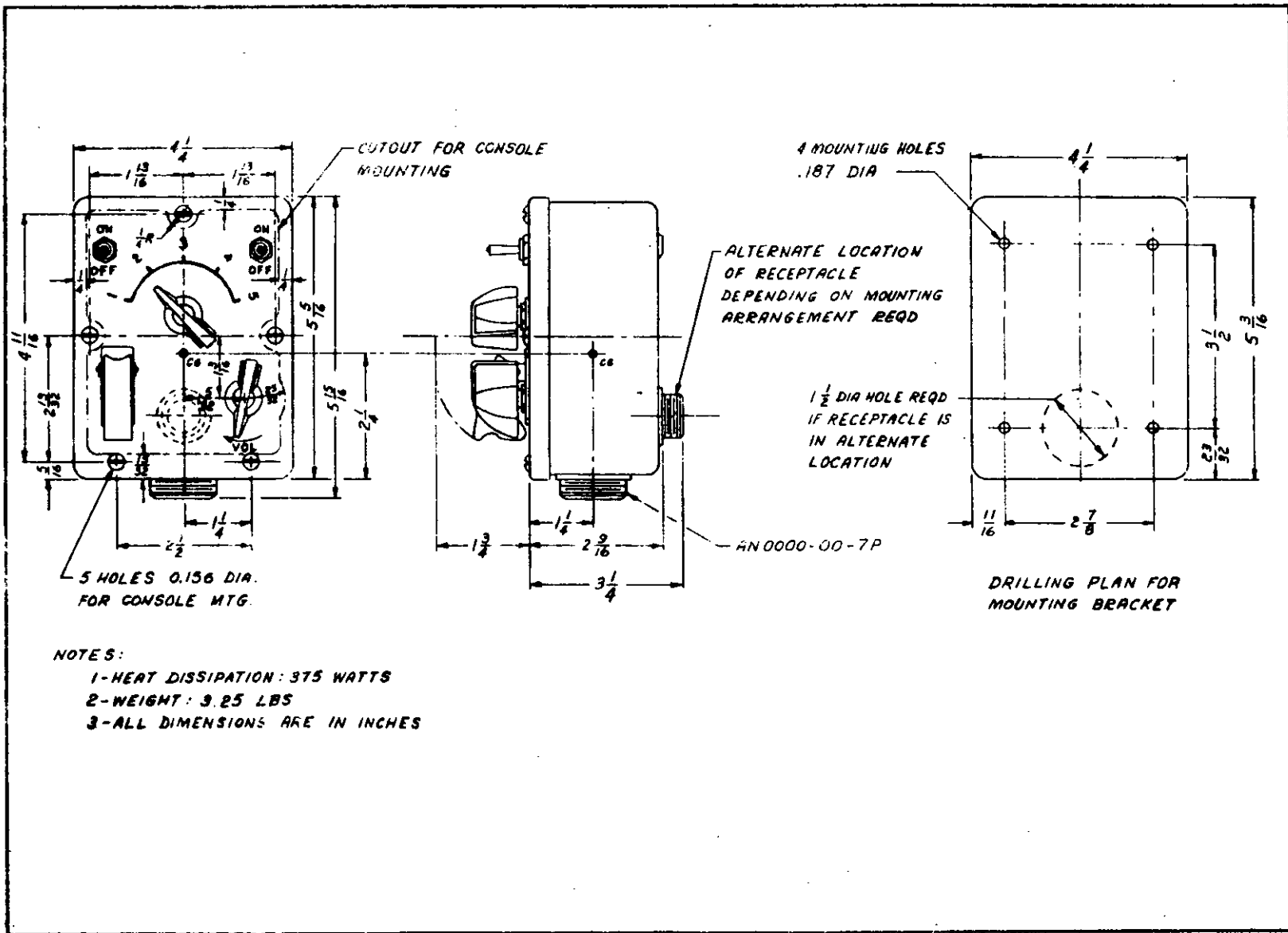


FIGURE 2. AN/APS-00 RADAR SET, EXTERNAL WIRING

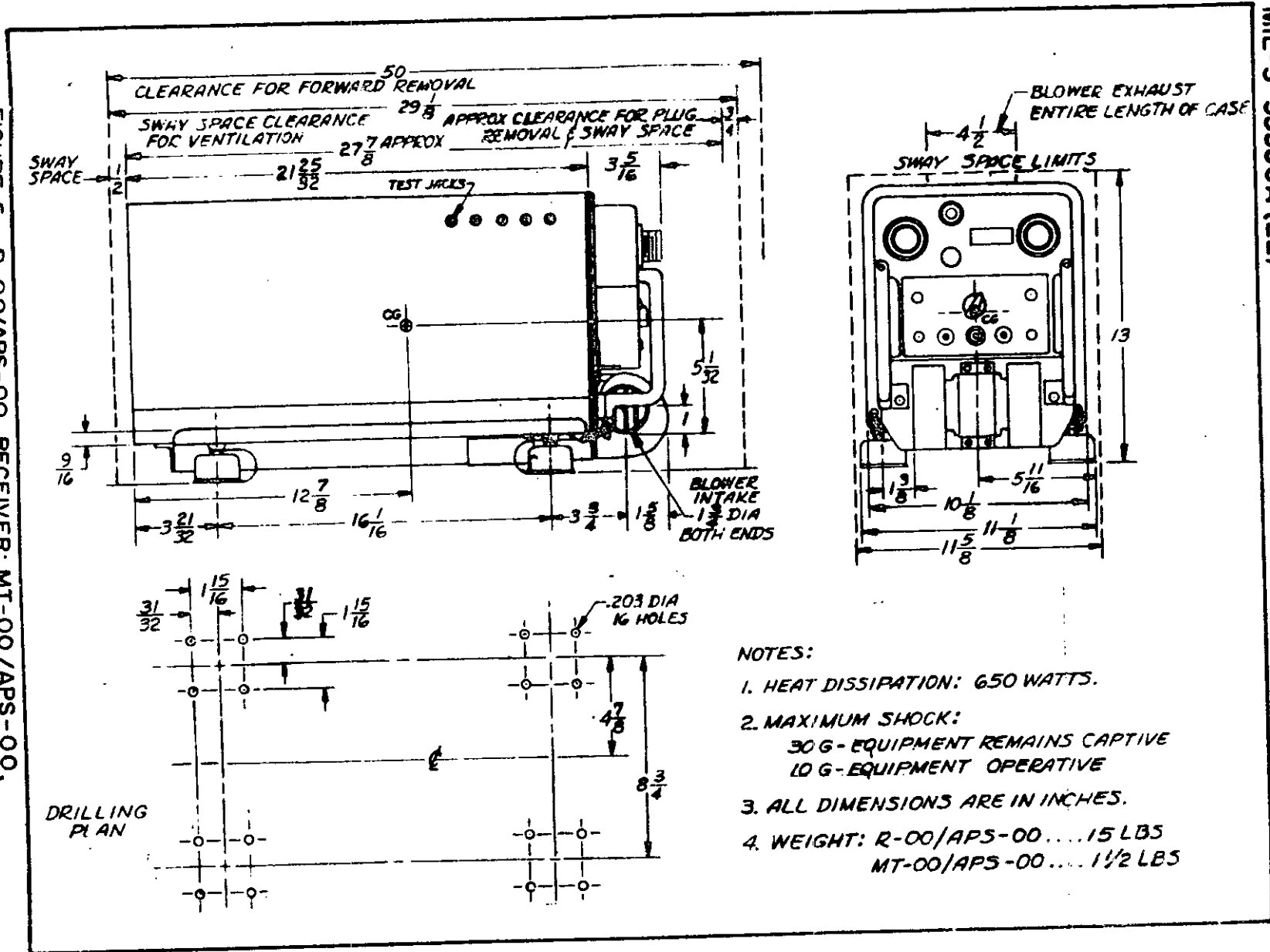
FIGURE 4. C-00/APS-00, CONTROL OUTLINE DIMENSIONS



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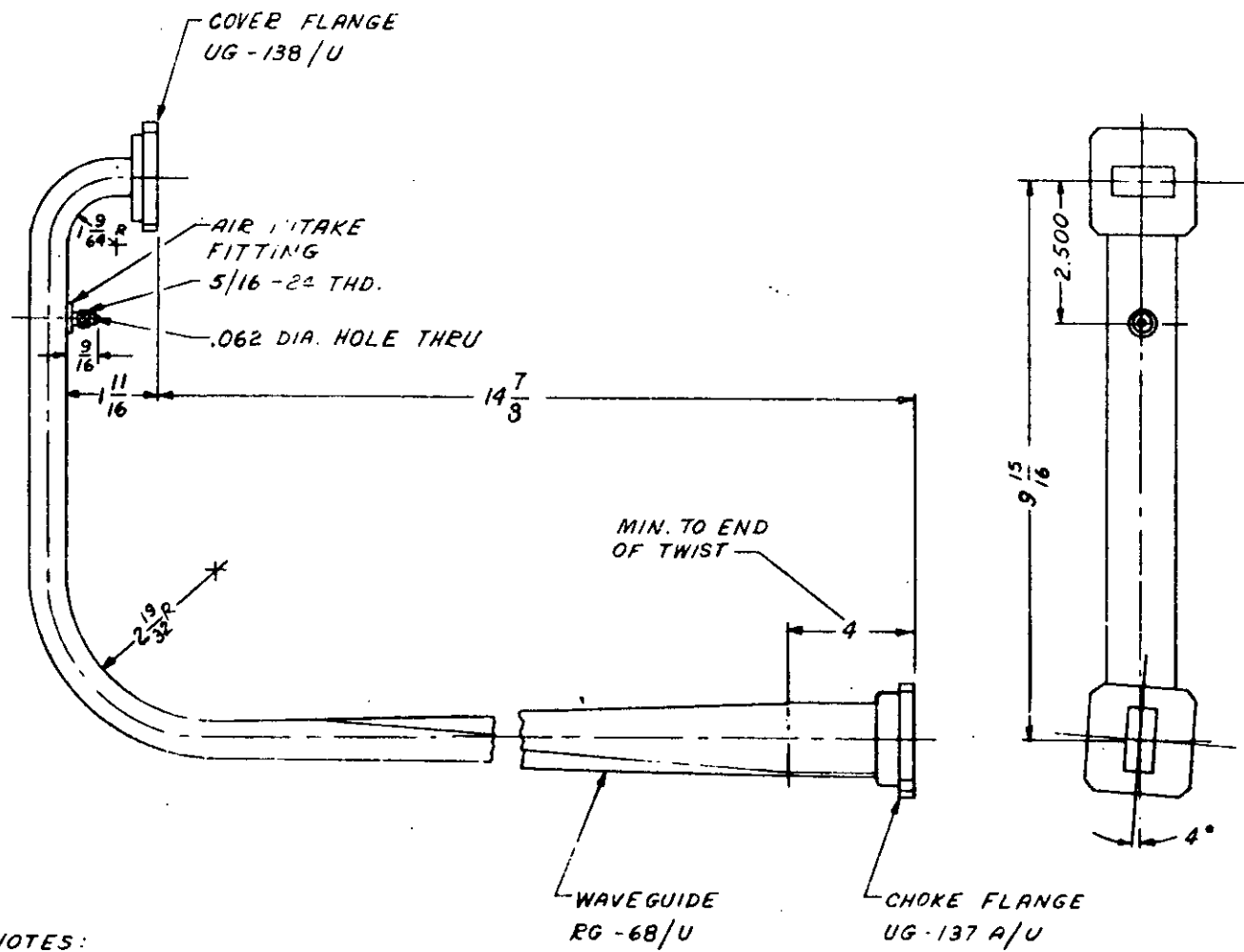
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FIGURE 5 R-00/APS-00, RECEIVER; MT-00/APS-00, MOUNTING OUTLINE DIMENSIONS



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FIGURE 6 WAVEGUIDE, RIGID OUTLINE DIMENSIONS



NOTES:

- 1- WEIGHT: 1/2 POUND
- 2- ALL DIMENSIONS ARE IN INCHES

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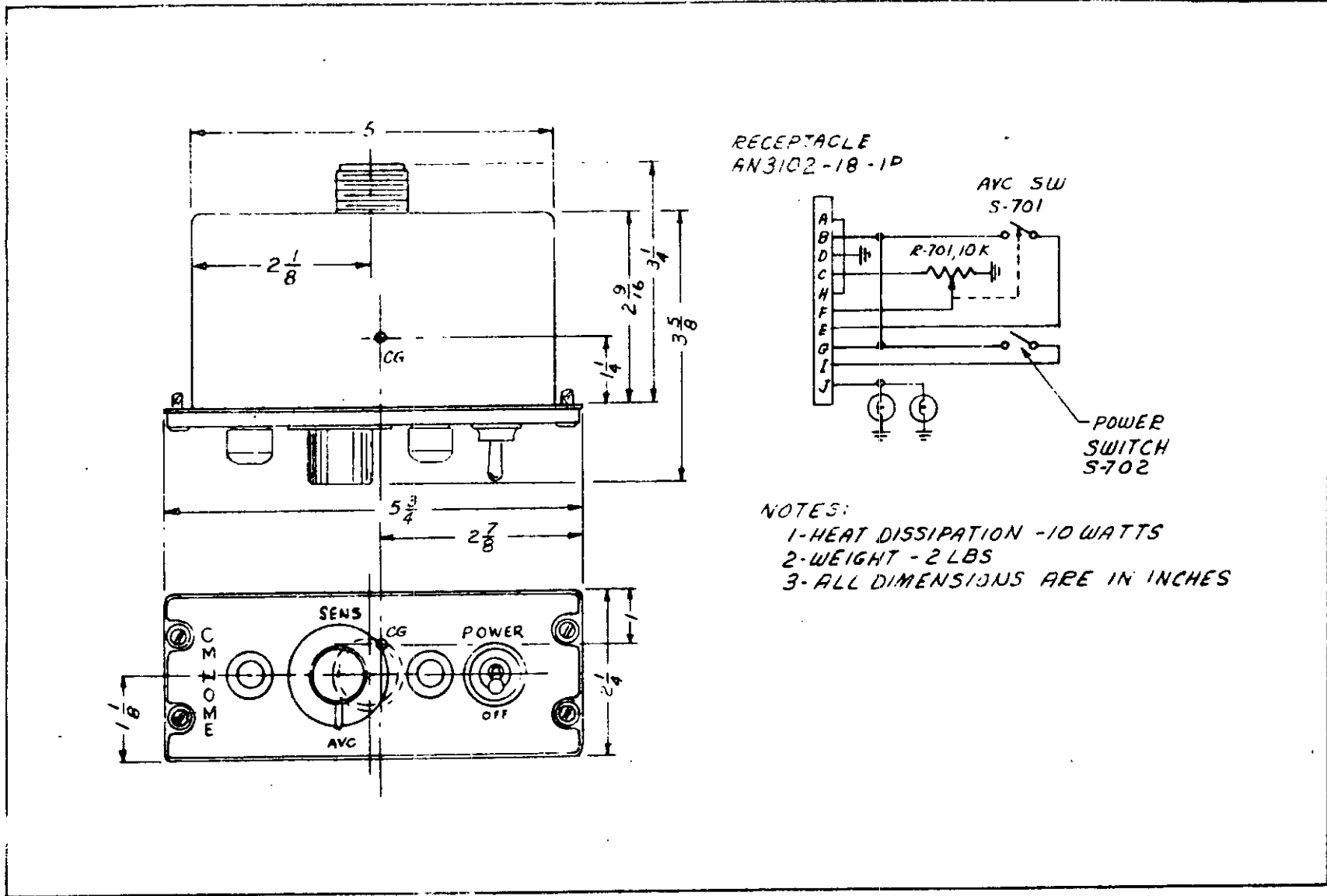


FIGURE 7. C-00/APS-00, CONTROL OUTLINE DIMENSIONS

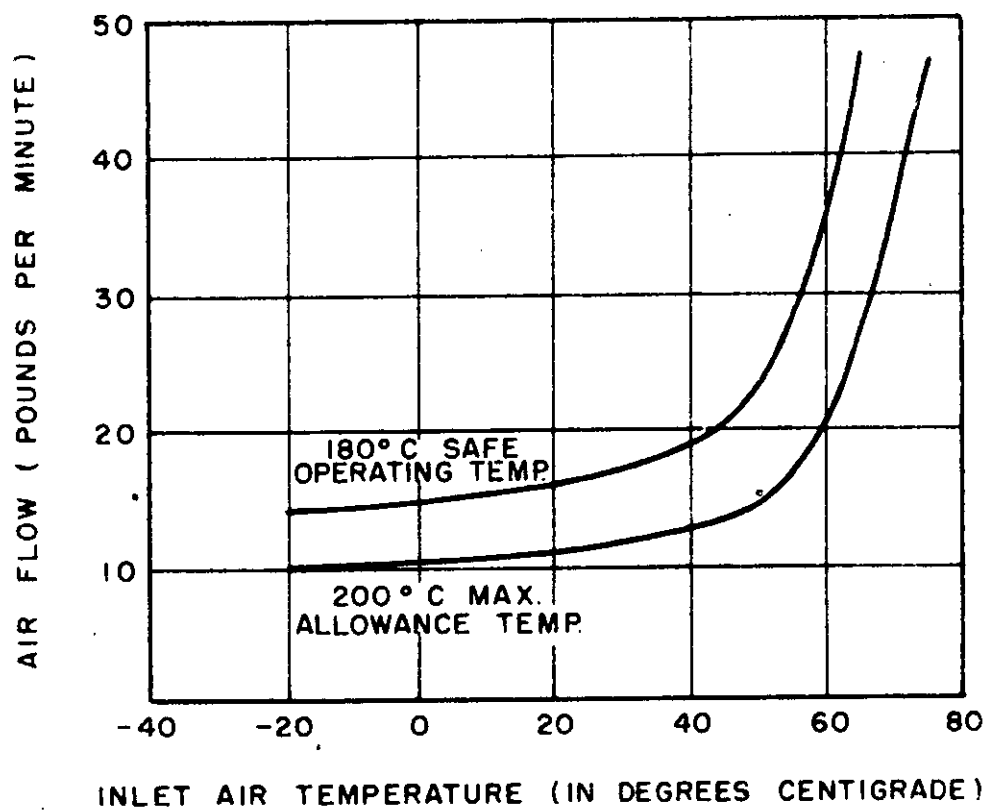


FIGURE 8. RT-000/APS-00 RECEIVER-TRANSMITTER, RADAR COOLING REQUIREMENTS

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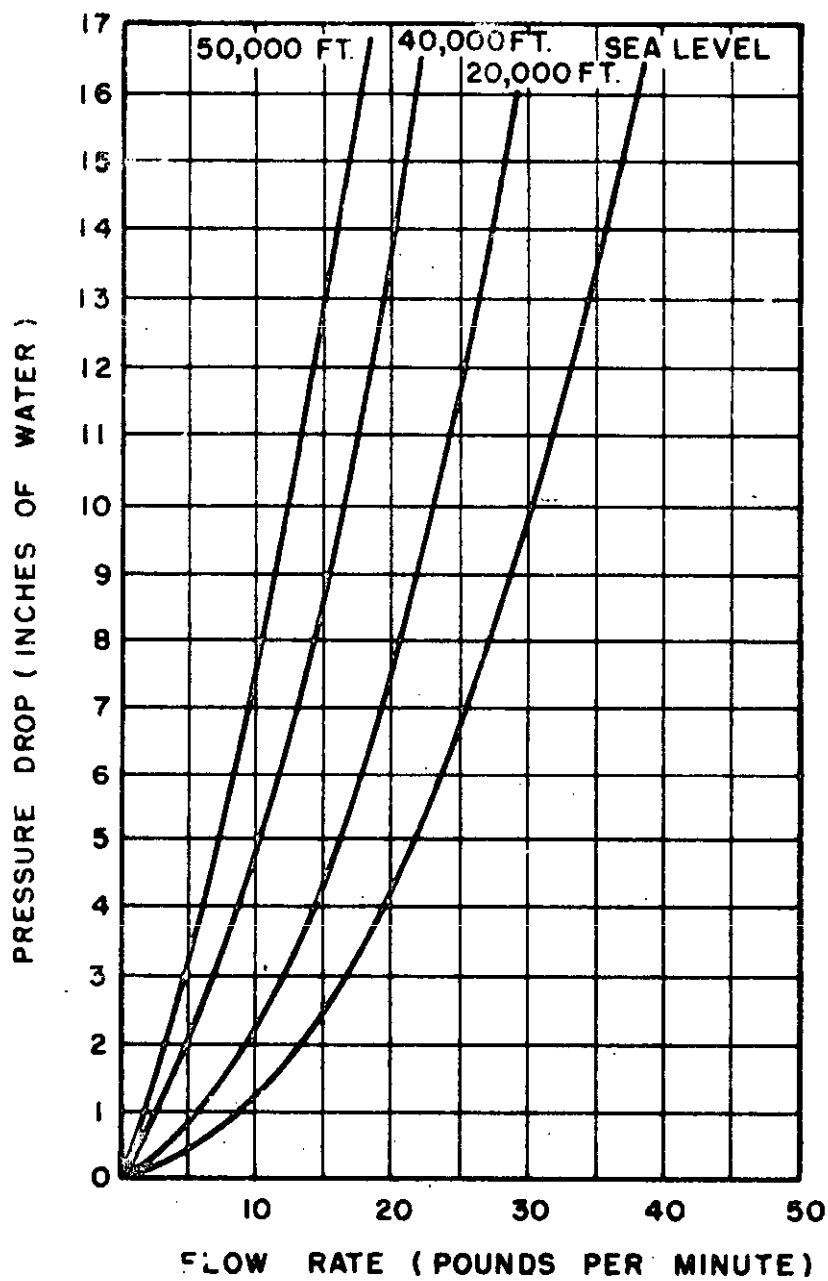


FIGURE 9 RT-000/APS-00 RECEIVER-TRANSMITTER, RADAR
PRESSURE CHART

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DEPARTMENT OF THE ARMY

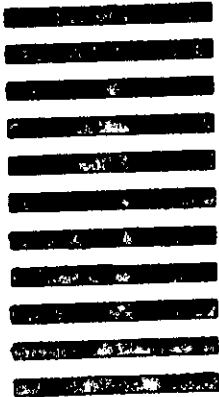


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