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MILITARY SPECIFICATION

AIR CONDITIONER A/M32C-10A AIR CYCLE FOR AIRCRAFT GROUND SUPPORT

1. SCOPE

1.1 This specification covers one type of air conditioner, designated A/M32C-10A.

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 this specification to the extent specified herein:

SPECIFICATIONS

Federal

F-F-300	Filter, Air Conditioning, Viscous-Impingement and Dry Types, Cleanable
WW-C-621	Coupling Assembly, Hose, (Fire, Woven-jacketed, Rubber or Cambric-Lined and Unlined Linen)
ZZ-H-451	Hose, Fire, Woven-jacketed, Rubber- or Cambric-Lined, With Couplings

Military

MIL-R-3593	Refrigeration And Cooling Equipment (Excluding Household Refrigerators) Packaging Of
MIL-L-6085	Lubricating Oil, Instrument, Aircraft, Low Volatility
MIL-F-7194	Filter, Reciprocating Engine, Induction Air, Aircraft
MIL-M-8090	Mobility, Towed Aerospace Ground Equipment, General Requirements For
MIL-A-8421	Air Transportability Requirements, General Specification For
MIL-G-38195	Generator Set-Power Unit A/M32A-60
MIL-D-38386	Duct Assembly, Ground, Conditioned Air, Insulated, Flexible

STANDARDS

Military

MIL-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Standards And Specifications, Order Of Precedence For The Selection Of
MIL-STD-281	Automobile, Trucks, Truck-Tractors, Trailers And Trailer Dollies, Preservation And Packaging Of
MIL-STD-705	Generator Sets, Engine-Driven, Methods of Tests And Instructions
MIL-STD-808	Finishes, Protective And Codes For Finishing Schemes For Ground And Ground Support Equipment
MIL-STD-810	Environmental Test Methods
MIL-STD-831	Test Reports, Preparation Of
MIL-STD-889	Dissimilar Metals
MS33656	Fitting End, Standard Dimensions For Flared Tube Connection And Gasket Seal
MS33740	Nipple, Pneumatic Starting, 3 Inch ID, Outline Dimensions Of

DRAWINGS

Air Force

54B9323	Adapter, 3.500 In. Hose, Disconnect Coupling, Pneumatic Starting
64C1004	Connector - Hose, Male
64C1005	Connector - Hose, Female
64C1006	Packing - Preformed

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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 date of invitation for bids or request for proposal shall apply.

American Society of Mechanical Engineers

ASME Power Test Code 19.5:4

Supplements on Instruments and Apparatus

Part 2, Pressure Measurements; Chapters 1, 2, and 4

Part 3, Temperature Measurement; Chapter 6

Part 4, Head Measuring Apparatus

Part 5, Measurements of Quantity of Materials

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, New York 10017.)

American National Standards Institute, Inc

S1.4 General Purpose Sound Level Meters
Z24.10 Octave-Band Filter Set for the Analysis of Noise and Other Sounds

(Application for copies should be addressed to the American National Standards Institute, Incorporated; 1430 Broadway; New York, New York 10018.)

American Society of Heating, Refrigerating, and Air Conditioning Engineers, Incorporated

ASHRAE Guide and Data Book
ASHRAE Standard Methods of Rating and Testing Air Conditioners

(Application for copies should be addressed to the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Incorporated; 345 East 47th Street; New York, New York 10017.)

3. REQUIREMENTS

3.1 Preproduction. This specification makes provisions for preproduction testing.

3.2 Components. The air conditioner shall consist of the following major components and all necessary accessory equipment:

Description	See Requirement
Turbine assembly	3.7.1
Heat exchanger	3.7.2
Ambient air filter	3.7.3
High-pressure air filter	3.7.4
Water separators	3.7.5
Lubrication system	3.7.6
Instrument and control panel	3.7.7

Description	See Requirement
Operational controls	3.7.8
Primary air ducts	3.7.9
High-pressure air hose	3.7.10
Bleed air inlet connections	3.7.11
Primary air outlets	3.7.12
High-pressure air outlet	3.7.13
Enclosure	3.7.14
Trailer chassis	3.7.15.

* 3.3 Selection of standards and specifications. Standards and specifications for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.4 Materials

3.4.1 Fungusproof materials. Materials that are nutrients for fungi shall not be used where it is practical to avoid them. Where used and not hermetically sealed, they shall be treated with a fungicidal agent. However, if they will be used in a hermetically sealed enclosure, fungicidal treatment will not be necessary.

3.4.2 Metals. Metals shall be of the corrosion-resistant type or treated to resist corrosion due to fuels, salt spray, or atmospheric conditions likely to be met in storage or normal service.

* 3.4.2.1 Dissimilar metals. Unless protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.4.3 Lightweight materials. Wherever practical, lightweight high-strength materials shall be used in the construction of the air conditioner.

3.4.4 Gasketing and insulating materials. Where rubber or similar gasketing and insulating materials are used, they shall be compounded to insure their oil resistance and, where practicable, their ability to withstand low temperatures.

3.5 Design and construction. The air conditioner shall be so designed and constructed that no parts will work loose in service. It shall be built to withstand the stresses, jars, vibrations, and other conditions incident to shipping, storage, installation, and service.

3.5.1 Reliability. The air conditioner shall have a mean-time-between-failures (MTBF) of not less than 435 hours at a confidence factor of 0.90. (See 6.3.1 and 6.3.1.1.)

3.5.2 Maintainability. The air conditioner design and construction shall minimize maintenance time and the possibility of human failures. The following provisions shall apply:

3.5.2.1 Accessibility. The air conditioner shall be so designed and constructed that the following actions may be accomplished without removing additional components or their subassemblies (other than panels) in not more than the time indicated:

a. Water separator servicing - 15 minutes

b. Control replacement - 30 minutes

c. Turbine assembly replacement - 1 hour

d. Oil tank check and refill - 5 minutes.

3.5.2.2 Clearances. To the maximum practicable extent, maintainability provisions shall incorporate features insuring operating clearances for facilitating maintenance and servicing at low ambient temperatures by personnel wearing heavy gloves or mittens and handicapped by bulky clothing and footgear.

3.5.2.3 Overtorquing. Intricate locking devices, controls, and threaded fastenings that can be easily overtorqued by personnel lacking feel through thick gloves or numbness shall be avoided where possible.

3.5.2.4 Access openings. Covers or plates that must be removed for component adjustments or for component or part removal shall be equipped with quick-disconnect fastenings.

3.5.3 Foolproofness. Where improper installation of an item could cause malfunction of the item or the equipment in which it is installed, an unsymmetrical mounting means shall be provided where practical. That mounting shall allow the item to be installed only in its proper operating position. If an unsymmetrical mounting means is not practical, the item shall be so mounted that its proper operating position can be readily and visibly determined by service maintenance personnel.

* 3.5.4 Compatibility with A/M32A-60A generator set-power unit. The air conditioner shall be designed and constructed for compatibility with the

A/M32A-60A generator set-power unit, while using its turbine engine bleed air. The design, construction, modification, and retesting of the air conditioner shall be such as to permit satisfactory completion of the test specified in 4.6.11. Modification of the A/M32A-60A generator set-power unit will not be permitted to accomplish the compatibility demonstration of the air conditioner to the generator set-power unit. (See 6.2.)

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* 3.5.5 Source of energy. The air conditioner shall be designed to operate from a single source of energy such as turbine engine bleed air from the A/M32A-60A generator set-power unit.

3.5.6 Operating life. The air conditioner shall be designed and constructed to operate continuously for 10,000 hours in the cooling mode without major overhaul and repair and without loss of efficiency during that period. The operational period may start after an initial storage period not exceeding 2 years.

3.5.7 Inlet air supply. The air conditioner shall be designed for supply air conditions at sea level operations as specified in table I.

3.5.8 Mobility. The air conditioner, mounted on its trailer chassis, shall have type II, group A mobility in accordance with MIL-M-8090, with the exceptions and additions specified herein.

3.5.9 Air transportability. Air transportability shall be in accordance with MIL-A-8421.

3.5.10 Hoisting. The air conditioner shall be equipped with provisions for hoisting. Tiedown rings conforming to MIL-A-8421 may be used for hoisting.

3.5.11 Detachable fittings. Wherever practicable, readily detachable- and attachable-type fittings in mechanical components shall be used to permit rapid component removal and replacement.

3.5.12 Locking devices. All screws, pins, bolts, et cetera, shall be furnished with locking devices. Safety wire, self-locking nuts, cotter pins, and lock-washers will be acceptable.

3.5.13 Common parts. Maximum practical use shall be made of interchangeable hardware and fastening devices. The number of types and sizes of bolts, screws, nuts, washers, and similar common parts shall be held to a minimum.

*TABLE I. Supply Air Conditions

Condition	Ambient	Supply Air Conditions			
		Pounds Per Minute	Grains Per Pound of Dry Air	PSIG	°F
1	125°F dry-bulb and 75°F wet-bulb	95	50	36	485
2	100°F dry-bulb and 85°F wet-bulb	105	160	38	460
3	0°F dry-bulb	150	--	42	330
4	-65°F dry-bulb	190	--	43	250
5	97°F dry-bulb and 87°F wet-bulb	105	180	38.5	455
6	125°F dry-bulb and 75°F wet-bulb	65	50	36	485
7	100°F dry-bulb and 85°F wet-bulb	70	160	38	460
† 8	100°F dry-bulb and 63°F wet-bulb	84	50	28	460

† Represents condition at 6,000 feet altitude

3.6 Performance

3.6.1 Ambient operating range. The air conditioner shall be capable of starting and supplying cooled or heated air within the range of ambient conditions shown on figure 1.

* 3.6.2 Primary cooling. The air conditioner shall be capable of delivering 56 ppm (pounds per minute) of 50°F dry-bulb air at 3 psig (pounds per square inch gage) at conditions 1, 2, and 8 as specified in table I. The air conditioner shall also be capable of selected delivery of 25 ppm of 50°F air at 3 psig at conditions 6 and 7 as specified in table I. All measurements shall be made at the air conditioner outlet. Supply airflows shall be limited to the values specified in table I.

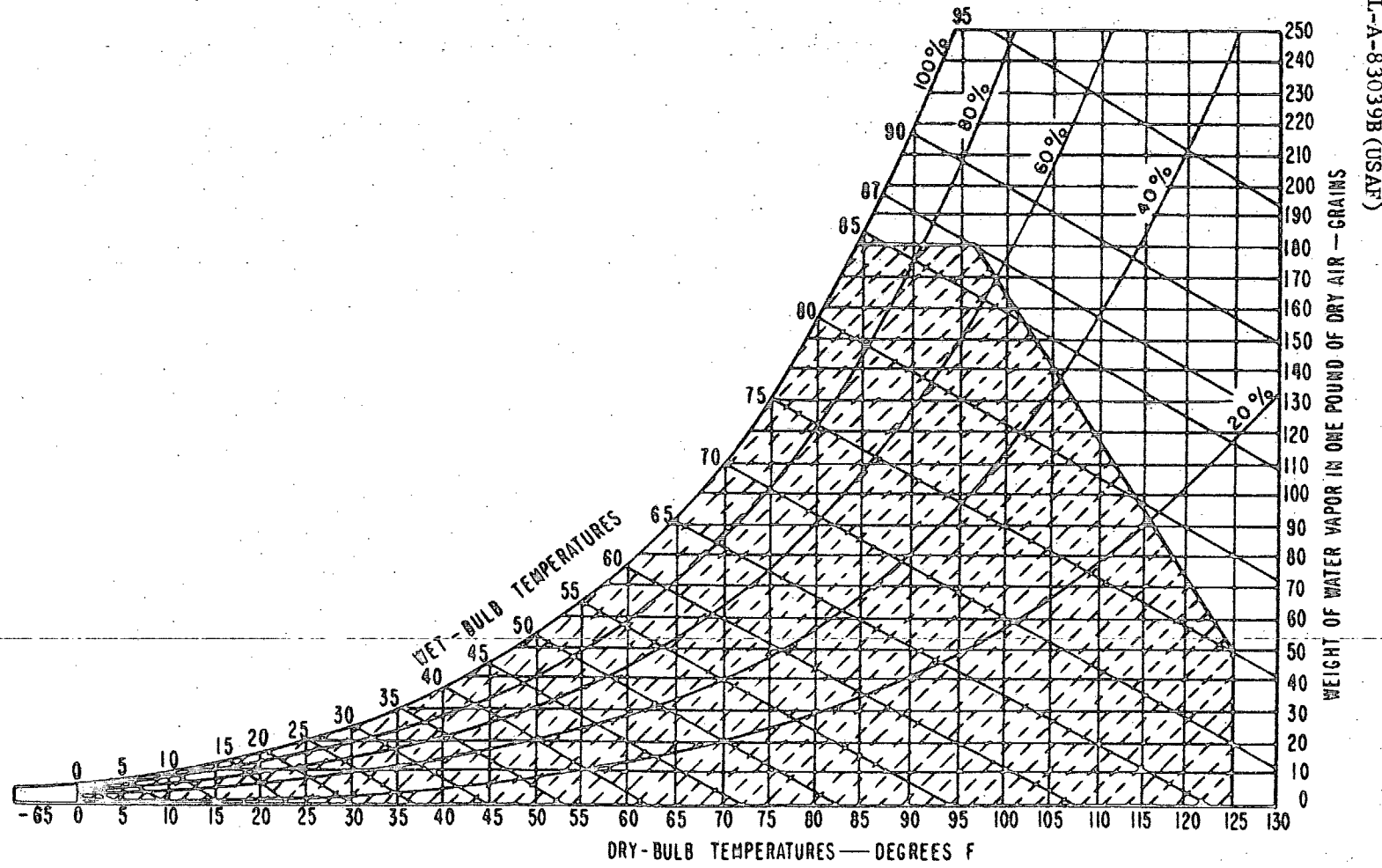

FIGURE 1. Ambient Range for Operation

3.6.2.1 Primary cooling airflow regulation. The flow rate of the delivered air shall be adjustable between 20 and 100 percent of rated flow in accordance with 3.6.2 against 0 to 3 psig static pressure. The cooling air dry-bulb temperature shall be selectable between 50°F dry-bulb and 85°F dry-bulb.

* 3.6.3 High-pressure cooling. The air conditioner shall be capable of delivering either 6 ppm or 15 ppm at 20 psig and at a selectable delivery temperature between 55° and 110°F at each of the conditions specified in table I. All measurements shall be made at the air conditioner outlet.

3.6.3.1 High pressure airflow regulation. The flow rate of the delivered air shall be adjustable between 0 and 15 ppm against 5 to 20 psig static pressure. The air delivered at the outlet of the air conditioner shall have a maximum relative humidity of 95 percent with no entrained water at any of the conditions specified in table I.

* 3.6.4 Combined primary and high-pressure cooling. A bypass duct shall be provided to optionally duct high-pressure airflow, after filtration, into the primary air circuit so that the combined flow (71 ppm at 52°F) is delivered at the primary air outlets at each of the conditions specified in table I.

* 3.6.5 Heating. The air conditioner shall be capable of delivering heated air (primary air only) between 60°F dry-bulb and 200°F dry-bulb, at conditions 3 and 4 as specified in table I. Airflow shall be controlled and limited to the cooling airflow rates and pressures specified in 3.6.2 and 3.6.2.1.

3.6.6 Dehumidification. A dehumidification capability shall be included as part of the air conditioner. When operating at condition 5 as specified in table I and from 20 to 100 percent of rated flow, the air delivered at the outlet of the air conditioner shall have a maximum relative humidity of 95 percent with no entrained water. There shall be no entrained moisture in the delivered primary and high pressure air at any point within the operating range of the air conditioner (see figure 1).

3.6.7 Environmental exposure. The air conditioner shall conform to all requirements specified herein after being exposed to the following environmental conditions:

a. Storage (nonoperating) temperatures ranging from -80° to +160°F

b. Relative humidity up to 100 percent, including conditions wherein condensation takes place in the form of water and frost

c. Pressures ranging from 30 to 3.4 inches Hg (mercury), approximately an altitude of 50,000 feet

d. Exposure to salt-water sea atmosphere

e. Vibration incident to service use

f. Fungus growth as encountered in tropical climates

g. Radiant energy as found under natural conditions

h. Rainfall as encountered in any locale

i. Sand and dust particles as encountered in desert areas

j. Shock forces as anticipated in transport.

3.6.8 Tilted position. The air conditioner shall be capable of operating in accordance with 4.6.7 when its normal operating plane is at an angle of 8-1/2 degrees in any direction from the true horizontal.

3.7 Details of components

3.7.1 Turbine assembly. A protective shield shall be provided in the turbine assembly plane of rotation to adequately contain fragments from those elements which may fail at high rotational speeds.

3.7.2 Heat exchanger. The heat exchanger air intake shall be protected by means of 1/2- to 3/4-inch mesh screens to prevent the entrance of large foreign objects.

3.7.2.1 Operating pressure. Heat exchanger and plenums exposed to bleed air pressure shall be designed and individually tested to withstand 1-1/2 times the maximum operating pressure at stabilized maximum operating temperature.

* 3.7.2.2 Rupture section. The low pressure side of the system shall be protected from rupture due to abnormal buildup of pressure by the inclusion of a flexible duct section, or other pressure relief means, which has a maximum pressure rating above normal operating pressure, but below the pressure rating of downstream components.

3.7.3 Ambient air filter. A permanent-type filter conforming to F-F-300 shall be provided at the ambient air inlet to the heat exchanger. A commercially standard size filter shall be selected with maximum possible face area and thickness. The filter pressure drop shall be sufficiently low to allow operation of the air conditioner with or without the filter in place without causing deviation from the reliability and performance requirements of this specification.

3.7.4 High-pressure air filter. A Type I filter conforming to MIL-F-7194 with a minimum efficiency of 90 percent shall be provided in the internal high-pressure duct system. Access shall be provided to permit ready removal and replacement of the filter.

3.7.5 Water separators. One or more separators shall be installed on the air conditioner to remove entrained moisture from the conditioned air discharge. Provisions shall be incorporated for externally discharging the moisture.

3.7.5.1 Water separator coalescer. Access means shall be provided to allow changing of the coalescer without removal of the water separator or any other components or subassemblies.

3.7.6 Lubrication system. The air conditioner shall incorporate a self-contained lubricating system utilizing oil in accordance with MIL-L-6085. The capacity of the reservoir shall be sufficient for 50 hours of operation without refill. Seals shall be provided to prevent the discharged conditioned air from becoming contaminated with oil from the lubricating system. If oil coolers are necessary, they shall be an internal part of the air conditioner. The coolers and intercoolers shall utilize the same air intake and discharge.

3.7.6.1 Oil tank. The oil tank shall incorporate the following features:

3.7.6.1.1 Oil-filler opening. The oil-filler opening and drains shall be located to prevent water from collecting and draining into the tank and liquids around the opening from spilling into the enclosure or on any components. Special funnels shall not be required for filling the tank.

3.7.6.1.2 Oil drains. All oil drains shall be so located at the lowest point of each oil reservoir that when the air conditioner is on a horizontal plane or tilted in any position 8-1/2 degrees from horizontal, the oil will completely drain from the reservoir. The space under each drain opening shall be sufficient for a container suitable for catching the oil.

3.7.6.2 Oil level sight glass. A sight glass shall be provided and located in such a manner that the oil level may be readily observed from the operator's position without removal of panels or covers.

3.7.7 Instrument and control panel. All instruments and controls shall be installed on a single composite instrument and control panel. The panel shall be weathertight.

3.7.7.1 Instruments. At least the following instruments shall be included on the instrument and control panel:

a. Primary discharge air temperature indicator (°F)

b. Primary discharge pressure gage (psig)

c. Primary airflow meter (ppm)

d. Hourmeter

e. High-pressure discharge air temperature indicator (°F)

f. High-pressure discharge pressure gage (psig)

g. High-pressure airflow meter (ppm).

3.7.7.1.1 Hourmeter. The hourmeter shall be driven either pneumatically or magnetically. If driven pneumatically, the pressure used shall be the bleed air pressure at the air conditioner inlet. The accuracy of the hourmeter shall be ±5 percent when measured at condition 2 as specified in table I. The hourmeter shall be designed to record to 10,000 hours.

3.7.7.2 Controls. The airflow control specified in 3.7.8.1, the temperature control specified in 3.7.8.2, the pressure relief control specified in 3.7.8.3, and the bleed air economy control specified in 3.7.8.7 shall be located on the control panel.

3.7.8 Operational controls. The air conditioner shall be provided with the following controls:

3.7.8.1 Primary airflow control. A control shall be provided to permit manual selection of the total airflow desired through the discharge opening. The control shall be graduated in increments of 10 percent of full load from 20 to 100 percent. The accuracy of the control shall be ±10 percent of full load.

3.7.8.2 Primary temperature control. A control shall be provided to permit selection of discharge air temperature within the range of 47° to 200°F dry-bulb. An arrow shall indicate the control knob rotation required to obtain outlet temperatures ranging from cold to hot. The temperature control system shall maintain the selected discharge temperature independent of changes in delivery flow rates and backpressures.

3.7.8.3 Primary pressure relief control. A pressure relief control shall be provided in the air conditioner to permit the manual selection of maximum air delivery pressure through the range of 1 to 4 psig. The control shall be marked in increments of 0.5 psig. The control shall be accurate to within ±5.0 percent of maximum allowed pressure (4 psig).

3.7.8.4 Primary sequencing control. If more than one rotating assembly is utilized to obtain the required performance, a turbine sequencing control shall be provided for single- or multiple-turbine operation.

3.7.8.5 Primary reheat control. The reheat control shall have a minimum setting to protect continuously against relative humidity of the delivered air exceeding 95 percent.

3.7.8.6 Primary anti-ice control. An anti-ice control shall be provided to prevent air entering the water separator from dropping below 35°F. Anti-ice screens may be used, if necessary.

3.7.8.7 Bleed air economy control. A control shall be provided to select bleed air requirements in accordance with either conditions 1 and 2 or conditions 6 and 7 of table I.

3.7.8.8 High-pressure airflow control. A control shall be provided to permit manual selection of the airflow desired through the high-pressure delivery connection. Control shall be such that the airflow will be maintained within ±5 percent for various conditions of ambient temperature when operating against a resistance which results in 20 psig delivery pressure at a flow of 15 ppm.

3.7.8.9 High-pressure relief control. A pressure relief control shall be provided in the air conditioner to permit the manual selection of maximum air delivery pressure through the range of 5 to 25 psig. The control knob shall be marked in increments of 0.5 psig. The control shall be accurate to within ±5 percent of maximum allowable pressure (25 psig).

3.7.8.10 High-pressure temperature control. A control shall be provided to permit selection of discharge air temperature within the range of 70° to 110°F dry-bulb. An arrow shall indicate the control knob rotation required to obtain outlet temperatures ranging from minimum to maximum. The temperature control system shall maintain the selected discharge temperature within ±5° during a 20°F ambient temperature change anywhere within the operating range (see figure 1).

3.7.8.11 High-pressure shutoff valve. A manual valve shall be provided to open or shut off high-pressure air delivery.

* 3.7.8.12 Combined primary and high-pressure shutoff valve. A manual valve shall be provided to open and shut off the bypass duct. The valve shall be easily operated after opening an access door.

3.7.9 Primary air ducts

3.7.9.1 Flexible air ducts. The air conditioner shall be equipped with four insulated air ducts in accordance with MIL-D-38386. Each duct shall be 15 feet

in length and of 8-inch nominal diameter. The ducts shall incorporate a male connection in accordance with Drawing 64C1004 on one end. The other end of the duct shall incorporate a female connection in accordance with Drawing 64C1005 so that the ducts can be connected in series. The female end of the ducts shall connect to the air conditioner discharge opening.

3.7.9.2 Seal. The seal provided shall be a part of the male coupling which is in accordance with Drawing 64C1006.

3.7.9.3 Storage provisions. The ducts shall be compressible to 25 percent of their extended length for storage. Each duct shall be provided with a rack for ease of handling and storage. The rack or container shall be a part of the enclosure or shall be easily stored within the enclosure in a fixed position. A protective cover shall be provided to prevent rain and dust from entering the ducts.

* 3.7.10 High-pressure air hose. The air conditioner shall be equipped with one air hose 50 feet in length. The hose shall be in accordance with ZZ-H-451, type III, class B, size 1-1/2. The male end of the hose shall be furnished with an adapter and a connector. The adapter shall fit the male coupling of the hose and the threaded end of the connector. The connector shall conform to E. B. Wiggins, Incorporated, 5000 Triggs Street, Los Angeles, California 90022; part No. GSS-151-33-HP, or equal. The complete hose assembly shall be designed to withstand a continuous internal pressure of 50 psig. The hose assembly shall also withstand a tensile pull of 150 pounds when the force is applied to the end connections. A quick-disconnect cover shall be provided at the Wiggins connector end of the hose, fastened to the hose by means of a safety chain.

3.7.10.1 High-pressure hose rack. A storage rack shall be provided at one end to permit manually wrapping the high-pressure hose within the end dimensions of the air conditioner. The hose shall be adequately secured for storage and transport.

3.7.11 Bleed air inlet connections. The bleed air inlet connections shall be in accordance with Drawing 54B9323. A nipple shall be attached by a Marmon clamp, or equal. The nipple shall be made in accordance with MS33740 on the quick-disconnect end and to mate with an adapter conforming to Drawing 54B9323 at the opposite end. A protective cover shall be provided. The inlet connection shall be so designed that external duct loads will not be transmitted into the internal components of the unit. The location of the inlet shall give optimum accessibility for connecting the bleed air hose.

* 3.7.12 Primary air outlets. The air conditioner shall have two primary air outlets in accordance with Drawing 64C1004 so that conditioned air (heated or cooled) can be delivered to external flexible ducts. The openings shall be provided with quick-disconnect covers for sealing as desired. The covers shall be fastened to the enclosure by means of safety chains.

* 3.7.13 High-pressure air outlet. A male outlet fitting shall be provided which mates with the end of the high-pressure hose which has a female coupling conforming to WW-C-621. A safety-chained cover shall be provided which is designed to withstand a pressure of at least 100 psig.

3.7.14 Enclosure. The air conditioner shall be fully enclosed in a lightweight metallic enclosure. Structural members and panels shall be rigidly constructed of aluminum. The enclosure shall be designed to exclude wind-driven snow, rain, and dust from the interior of the enclosure when the doors are closed. The enclosure shall be provided with drip channels or constructed to prevent the entry of rain or melting snow.

3.7.14.1 Internal ducts. Air ducts shall be provided in the enclosure for guiding air through the various assemblies. The ducts shall be constructed of lightweight material, and all bends and turns shall be internally smooth. Duct intersections shall insure proper, uniform mixing of the various air-streams, where applicable.

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* 3.7.14.2 Doors and covers. The enclosure shall be so designed that components and assemblies can be easily removed therefrom. The enclosure shall be fitted with doors and covers, adequately reinforced and stiffened. They shall be provided with positive flush latches or fasteners. The doors and covers shall provide complete access to all components.

3.7.15 Trailer chassis. The air conditioner shall be furnished with a trailer chassis (see 3.5.8).

3.8 Part numbering of interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

* 3.9 Noise level. The noise level generated by the air conditioner shall not exceed sound pressure levels of 85 decibels (ref 0.0002 microbar) in any of the eight frequency (octave) bands of 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz (cycles per second) at both the operator's position and at all measurement positions on the 25-foot radius circle when measured as specified in 4.6.8.

* 3.10 Dimensions. The dimensions of the air conditioner, exclusive of the drawbar provisions and rear pintle, shall not exceed the following:

	Inches
Length	69
Height	69
Width	70.

3.10.1 Dimensional tolerances. Dimensions and tolerances not specified shall be as close as is consistent with the best shop practices. Where dimensions and tolerances may affect the interchangeability, operation, or performance of the air conditioner, they shall be held or limited accordingly.

* 3.11 Weight. The weight of the complete air conditioner, trailer, and external ducts shall not exceed 1,325 pounds.

3.12 Finishes and protective coatings

3.12.1 Cleaning, painting, plating, chemical films, and chemical treatments. All cleaning, painting, plating, chemical films, and chemical treatments shall be in accordance with MIL-STD-808. The procedures specified herein shall be utilized.

3.12.2 Finishes. Finishes for application to equipment or parts thereof shall be in accordance with the following MIL-STD-808 codes for type I exposure:

Ferrous metals F-103

Aluminum and aluminum alloys F-300

Magnesium alloys F-400

Cadmium- or zinc-plated surfaces . . . . . F-221.

3.12.2.1 Finishing colors. Final paint films shall be in accordance with MIL-STD-808. Exterior and interior coats shall be film designation DG.

3.13 Operational markings

3.13.1 Operating instructions. Brief operating instructions shall be provided on an internal surface of the instrument panel door. The instructions shall be such that oil, dirt, water, et cetera, will not affect their legibility.

3.13.2 Tank markings. The type of oil to be used and the tank capacity shall be printed or stenciled on or near the oil tank cap.

* 3.13.3 Warning. The following information shall be stenciled on the enclosure in a conspicuous location near the bleed air inlet connection in 1/2-inch-high red letters:

DO NOT CONNECT TO AN AIR SOURCE GREATER THAN 45 PSIG.

3.14 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.15 Workmanship. Particular attention shall be given to alignment of parts and tightness of assembly screws and bolts, et cetera.

3.15.1 Riveting. Riveting operations shall be performed to insure tightness and satisfactory heading of rivets.

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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of the air conditioner shall be classified as follows:

a. Preproduction testing . . . . . See 4.4

b. Acceptance tests . . . . . See 4.5.

4.3 Test conditions

4.3.1 Methods of testing shall be determined, instruments selected and calibrated, and tests run in accordance with the ASHRAE standard entitled Methods of Rating and Testing Air Conditioners.

4.3.1.1 Nozzles or orifices. Airflow shall be measured by means of smooth-approach nozzles or flat-plate orifices conforming to ASME Code 19.5:4. Other apparatus such as pitot tubes, rotameters, et cetera, may be used only when specifically approved by the procuring activity. The rate of airflow shall be expressed in terms of pounds per minute (ppm).

4.3.1.2 Psychrometric chart. Humidity and enthalpy of air leaving the air conditioner shall be determined from an ASHRAE Psychrometric Chart (ASHRAE-Guide and Data Book) from readings of wet- and dry-bulb temperatures. Air velocity over the wet-bulb thermometer shall be sufficient to insure reasonable accuracy. The thermometers shall be so arranged that the air passing over the wet bulb will not subsequently pass over the dry bulb. The wick of the wet bulb shall be kept wet with distilled water only and shall be replaced whenever a perceptible quantity of oil, dirt, incrustation, or other foreign substance has accumulated thereon.

4.3.1.3 Mecurial barometer. Barometric pressure shall be measured by means of a mercurial barometer at the same elevation as the test. The pressure shall be corrected for the temperature of the scale and mercury and for variation in gravity resulting from the location of the barometer with regard to elevation and latitude. Readings obtained from aneroid barometers will not be acceptable.

4.3.1.4 Thermocouples and potentiometers. Temperatures shall be measured by means of appropriately located thermocouples and properly calibrated potentiometers. Insofar as practicable, thermocouples shall be insulated from contact with other metals. Temperatures shall be expressed in degrees Fahrenheit. Laboratory-type mercury thermometers will be permissible if used correctly in the application.

4.3.1.5 Liquid manometers. Insofar as practicable, pressure and pressure differentials shall be measured by means of liquid manometers. Pressures exceeding the range of conventional liquid manometers shall be measured by means of properly calibrated Bourdon-tube gages. Gages shall be of laboratory type having a dial diameter of not less than 4 inches.

4.3.2 Readings. Readings of all pertinent pressures, temperatures, rotational speeds, and other data necessary in demonstrating compliance with applicable portions of section 3 shall be recorded at intervals not exceeding 30 minutes during all tests specified herein.

4.3.3 Preliminary run-in. Any preliminary run-in specified by the manufacturer shall be performed prior to submission of the air conditioner for testing. A certified log of all preliminary running time shall be included in the air conditioner log.

4.4 Preproduction testing (see 6.2)

4.4.1 Test samples. Two air conditioners shall be subjected to the preproduction tests specified in 4.4.3.

4.4.2 Test report. Upon completion of the preproduction tests, a preproduction test report in accordance with MIL-STD-831 shall be prepared and three complete copies of the report furnished to the procuring activity.

4.4.3 Preproduction tests. The preproduction tests shall consist of all the tests specified under 4.6. The test samples shall be allocated to the preproduction tests as follows and tested as described under 4.6:

Sample No. 1

Examination of product . . . . . See 4.6.1

Operational tests . . . . . See 4.6.2

Acceleration loadings . . . . . See 4.6.4

Performance and endurance tests (1,000 hours) . . . . . See 4.6.5

Portability test . . . . . See 4.6.6

Sample No. 2

Examination of product . . . . . See 4.6.1

Operational tests . . . . . See 4.6.2

Acceptance performance tests . . . . . See 4.6.3

Tilted position test . . . . . See 4.6.7

Noise level test . . . . . See 4.6.8

Environmental tests . . . . . See 4.6.9

Accessibility test . . . . . See 4.6.10

Compatibility tests . . . . . See 4.6.11

Mobility tests . . . . . See 4.6.12

High-pressure hose test . . . . . See 4.6.13.

4.5 Acceptance tests. The acceptance tests shall consist of the following:

a. Individual tests . . . . . See 4.5.1

b. Periodic sampling plan and test . . . . . See 4.5.2.

4.5.1 Individual tests. Each air conditioner shall be subjected to the following tests as described under 4.6:

a. Examination of product . . . . . See 4.6.1

b. Operational tests . . . . . See 4.6.2.

4.5.2 Periodic sampling plan and test. One air conditioner shall be selected at random from the first 10 and one from each subsequent 10 or fraction thereof produced and subjected to the test specified in 4.6.3.

4.5.2.1 Rejection and retest. When an item selected from a production run fails to meet the specification, items still on hand or later produced shall not be accepted until the extent and cause of failure have been determined and appropriately corrected. The contractor shall explain to the Government representative the cause of failure and the action taken to preclude recurrence. After correction, all of the tests shall be repeated.

4.5.2.2 Individual tests may continue. For production reasons, individual tests or other sampling plans may be continued pending the investigation of a sampling test failure. Final acceptance of items on hand or items produced later shall not be made until it is determined that all items meet all the requirements of the specification.

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

4.6 Test methods

4.6.1 Examination of product. The air conditioner shall be inspected to determine compliance with the requirements specified herein with respect to materials, workmanship, dimensions, marking, and finishes.

4.6.2 Operational tests. The air conditioner shall be subjected to and shall satisfactorily complete the tests specified in 4.6.2.1 through 4.6.2.6. Individual records of all operational tests shall be maintained.

4.6.2.1 Preliminary check run. The air conditioner shall be operated as follows at conditions 2 and 7 as specified in table I:

Output Flow

100 percent output flow at 50°F, 3 psig (condition 2)
60 percent output flow at 50°F, 3 psig (condition 2)
20 percent output flow at 50°F, 3 psig (condition 7).

4.6.2.1.1 For each run at the loadings specified in 4.6.2.1, instrumentation shall be provided and readings taken. The output shall be not less than that specified in 3.6.2 and 3.6.3.

4.6.2.2 Starting test. The air conditioner shall be tested for satisfactory starting at 3 psig discharge duct pressure by five consecutive starts. Shutdown shall be made immediately after operational speed is reached. All restarts, except one shall be made after 0 rpm (revolution per minute) is reached. One start shall be initiated while the turbine-fan is rolling to a stop.

4.6.2.3 Normal operational check. The air conditioner shall be started and operated with the discharge duct backpressure at 3 psig. At this condition and with the temperature control set to give 47°F, the flow shall be varied from 100 to 60 to 20 percent. The same procedure shall be repeated for discharge duct backpressures of 2.0, 1.5, 1.0, 0.5, and 0.25 psig. The discharge air temperatures and pressure shall not fluctuate during the test.

4.6.2.4 Pressure-relief valve check. The discharge backpressure shall be varied to completely check operation of the pressure relief control valve. Operation shall conform to 3.7.8.3.

4.6.2.5 Anti-ice controls. Operation of the anti-ice controls shall be tested as recommended by the manufacturer and approved by the procuring activity.

4.6.2.6 Maximum pressure-temperature test. All heat exchangers and plenums which are exposed to bleed air pressure shall be individually subjected to a maximum temperature-maximum pressure test. This test may be conducted on the components prior to assembly or after assembly into the unit. The bleed air side shall be subjected to 56 psig with air at 460°F flowing. Air at a maximum of 100°F shall be flowed through the secondary side. The test shall consist of one cycle of sufficient length that all metal temperatures stabilize at maximum.

4.6.3 Acceptance performance tests. The air conditioner shall be subjected to and shall satisfactorily complete the tests specified in 4.6.3.1 and 4.6.3.2.

4.6.3.1 The air conditioner shall be operated at condition 2 as specified in table I for 2 hours. It shall be demonstrated that the air conditioner meets the requirements specified in 3.6.2 and 3.6.3 throughout this test. At the end of the test, all safety controls shall be checked for effectiveness. The air conditioner shall exhibit no malfunctioning, air leaks, rough operation, vibration, or other irregularities as a result of this test.

4.6.3.2 The air conditioner shall be operated at condition 3 as specified in table I for 2 hours. It shall be demonstrated that the air conditioner meets the requirements specified in 3.6.3 and 3.6.5 throughout the test. At the end

of the test, all safety controls shall be checked for effectiveness. The air conditioner shall exhibit no malfunctioning, air leaks, rough operation, vibration, or other irregularities as a result of this test.

4.6.4 Acceleration loadings. The air conditioner shall be secured by the tie down provisions required by 3.5.9 and subjected to acceleration tests in accordance with MIL-A-8421. Upon completion of the flight and taxiing load tests (3g) and prior to the emergency landing load tests, the air conditioner shall be subjected to the tests specified in 4.6.5.

* 4.6.5 Performance and endurance tests (1,000 hours). The air conditioner shall pass an endurance test of not less than 1,000 hours of operation. Upon completion of the tests, the performance of the air conditioner shall be represented in the form of tables from which performance can be read for operational conditions within the operational envelope. The total test time shall be allocated as follows:

a. Combined performance and endurance test of 240 hours

b. Endurance test of 760 hours.

* 4.6.5.1 Performance and endurance (240 hours). The 240-hour portion of the performance and endurance test shall be conducted as follows:

* 4.6.5.1.1 Hot-dry ambient conditions (40 hours). The air conditioner shall be supplied with air which has 50 or more grains of moisture per pound of dry air at conditions 1 and 6 as specified in table I and operated in a 125°F ambient chamber. Performance data shall be recorded for 40 hours at 3 psig air delivery pressure and a rated capacity shall be as specified in 3.6.2 and 3.6.3 simultaneously, and as specified in 3.6.4.

4.6.5.1.2 Normal rated summer-day ambient conditions (78 hours). The air conditioner shall be supplied with air containing 160 or more grains of moisture per pound of dry air at conditions 2 and 7 as specified in table I and operated in a 100°F dry-bulb ambient chamber. Performance data shall be recorded for 40 hours at various air delivery pressures between 0 and 3 psig. The capacity shall be as specified in 3.6.2 and 3.6.3. Data shall be recorded for an additional 38 hours at various air delivery pressures, with various reduced flow rates.

4.6.5.1.3 Varied ambient (80 hours). The air conditioner shall be operated at various conditions between 0°F dry-bulb and 50 percent relative humidity and 125°F dry-bulb and 75°F wet-bulb. The air supply shall be varied as desired to complete performance characteristics of the pack. Output conditions shall be recorded at 3 psig-full flow and approximately 0 psig-full flow for primary air, simultaneously with 15 psig-full flow high-pressure air.

4.6.5.1.4 Altitude capacity (2 hours). The air conditioner shall be operated at condition 8 as specified in table I for 2 hours. It shall be demonstrated that the air conditioner meets the requirements specified in 3.6.2 and 3.6.3.

4.6.5.1.5 Dehumidification test (20 hours). The air conditioner shall be operated for 5 hours at 20, 50, 75, and 100 percent of rated airflow at condition 5 and shall meet the requirements of 3.6.6. In all cases, data recording shall start at the time the air conditioner is started or the controls are reset to provide a new set of operating conditions.

4.6.5.1.6 Heating test (20 hours). The air conditioner shall be operated in the heating mode at the prevailing room or ambient temperature for 10 hours each at conditions 3 and 4 (see table I). The requirements of 3.6.5 shall be met.

* 4.6.5.2 Endurance test (760 hours). The air conditioner shall be operated an additional 760 hours with an ambient condition of 75°F dry-bulb or greater. The air supplied to the air conditioner shall contain a minimum of 76 grains of moisture per pound of dry air.

4.6.5.3 Performance check. During the 1,000 hours of testing, a performance check shall be conducted on the air conditioner under condition 1 as specified in table I at intervals of 100 hours of operation. Upon completion of 1,000 hours of testing, the air conditioner shall meet the performance requirements of 3.6.2 and 3.6.3.

4.6.6 Portability test. Hoisting and tiedown provisions shall be satisfactorily demonstrated.

4.6.7 Tilted position test. The air conditioner shall be tilted in four different positions, 90 degrees apart, at an angle of 8-1/2 degrees to the true horizontal plane and checked to determine that the conditions specified in 3.6.2 and 3.6.3 are met during tilt. Upon conclusion of this test, the air conditioner shall be examined for damage and checked for proper operation.

* 4.6.8 Noise level test. The criteria specified in 3.9 give the maximum levels for the operator's position and for locations at 25 feet. The test setup shall be as shown on figure 2. The levels for the operator's position shall be measured at head level (5 feet 8 inches) in the area where the operator is located. The measurement shall be made by slowly moving the measuring microphone in a circle 2 feet in diameter centered on the most probable position for an operator. The levels at 25 feet shall be determined from measurements at head level on a circle 25 feet in radius, centered on the geometrical center of the unit. Noise readings for each octave band shall be taken at 12 positions on the circle equally spaced every 30 degrees. All noise

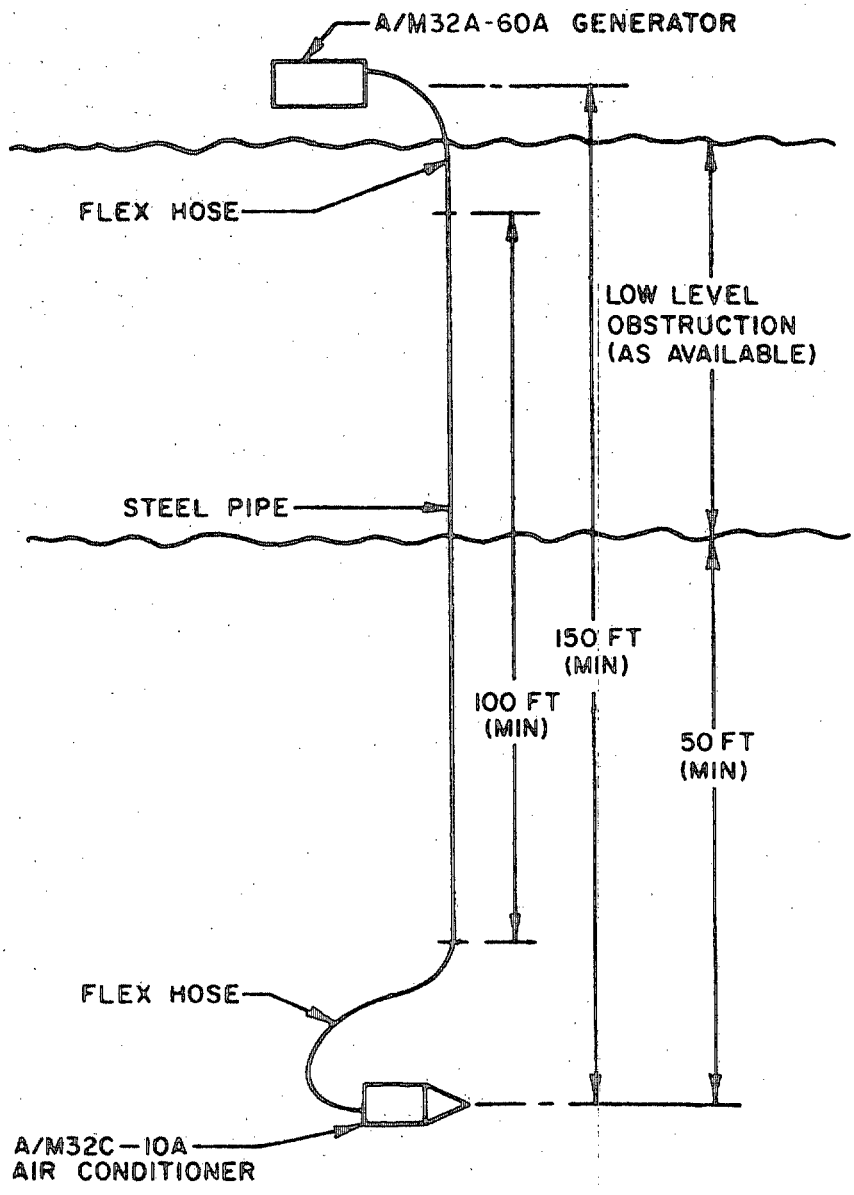

*FIGURE 2. Noise Level Test Setup

measurements shall be made with all air conditioner components operating and with the unit delivering a minimum of 50 ppm of 47°F air. No single reading shall exceed the criteria specified in 3.9. All acoustic measurements shall be made with equipment in accordance with ANSI Standards S1.4 and Z24.10. The flat frequency response (C weighting network) of the sound level meter shall be used in making the measurements. No correction shall be made for the background noise level resulting from operation of the A/M32A-60A generator.

4.6.9 Environmental tests. The tests specified in table II shall be conducted in accordance with the specified procedures of MIL-STD-810.

*TABLE II. Environmental Tests

Test Method No.	Method Title	Procedure
501	High Temperature	I
502	Low Temperature	I
505[1]	Sunshine	I
506	Rain	I
507	Humidity	I
508[1]	Fungus	I
509	Salt Fog	I[2]
510	Dust	I
514	Vibration	I[3]
516	Shock	II

[1]Tests may be performed on representative material and paint samples in lieu of testing the complete air conditioner.

[2]Access doors and covers that would normally be open during operation shall be left open throughout the test.

[3]The testing shall be limited to the turbine assembly and shall be conducted in accordance with catagory f, procedure I, curve Y. The test setup shall simulate the installation in the air conditioner and must be approved by the procuring activity.

4.6.10 Accessibility test. The air conditioner components and water separator shall be individually removed and replaced. The time required and the procedure followed in removing and replacing each component shall be recorded. (See 3.5.2.1.)

* 4.6.11 Generator set-power unit compatibility tests. Tests shall be conducted to insure compatibility of the air conditioner with the A/M32A-60A generator set-power unit while using its turbine bleed air. While providing cooling effects as specified for condition 1 of table I in 3.6.2 and 3.6.3, the air conditioner shall not adversely affect the power generation quality as required by MIL-G-38195, paragraph entitled Frequency Control System, and Alternating-Current Voltage Regulator. This shall be demonstrated by testing in accordance with test methods 614.1 and 608.1 of MIL-STD-705 (see MIL-G-38195, paragraph entitled Electrical Tests). During this testing, the generating kilowatt capacity shall be not less than 50 percent of rated. (See 6.2.)

* 4.6.12 Mobility tests. The trailer, with air conditioner mounted, shall be tested in accordance with type II, group A as specified in MIL-M-8090.

4.6.13 High-pressure hose test. The hose assembly, complete with connectors, shall be subjected to the internal pressure of 50 psig for 4 hours. A 150-pound tensile pull shall then be applied at the end connectors for a minimum of 5 minutes.

4.6.14 Reliability demonstration. Satisfactory completion without failure of all tests required herein will be considered to demonstrate acceptable compliance with the quantitative reliability requirements of this specification.

4.7 Inspection of the preservation, packaging, packing, and marking for shipment and storage. The inspection of the preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5, or the documents specified herein.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packing (see 6.2)

5.1.1 Levels A and C. The air conditioner unit shall be preserved in accordance with MIL-R-3593.

5.2 Packing (see 6.2)

5.2.1 Levels A, B, and C. The trailer-mounted air-conditioner unit, component parts, and repair parts shall be packed in accordance with MIL-STD-281.

5.3 Shipment marking. In addition to any special marking required (see 6.2), packages, shipping containers, and unboxed (mobile) units shall be marked in accordance with MIL-STD-129. The shipment marking nomenclature shall be:

Air Conditioner A/M32C-10A
Air Cycle for Aircraft Ground Support.

6. NOTES

6.1 Intended use. The A/M32C-10A air conditioner is intended for cooling or heating personnel, cargo, and electronic compartments in aircraft during ground servicing and checkout by connection to the aircraft airborne duct system.

* 6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification

b. Whether an A/M32A-60A generator set-power unit is to be loaned by the Government (or not) and conditions for the contractor's obtaining of these items (see 3.5.4 and 4.6.11).

c. Location and conditions for preproduction testing (see 4.4)

d. Required levels of preservation, packaging, and packing (see 5.1 and 5.2)

e. Special shipment marking (see 5.3).

6.3 Definitions. For the purpose of this specification, the following definitions will apply:

6.3.1 MTBF. MTBF is the average (arithmetic mean) of the operating time between failures or the mean-time-between-failures. Note that the point estimate of MTBF from demonstration data (the sum of the test operating time divided by the number of counted failures) is larger than the MTBFmin. demonstrated at a specified confidence as described below. Note also that the MTBFmin. considered acceptable and to be demonstrated is often lower than the MTBF reasonably expected and attainable within the current state-of-the-art.

6.3.1.1 MTBF demonstrated. If the instantaneous failure rate can be assumed constant, that is, not a function of accumulated operating time, the lower confidence limit on the MTBF from demonstration data can be calculated as twice the accumulated test operating time divided by the value of Chi Squared at 2r plus 2 degrees of freedom, where r is the number of failures counted

as reliability failures. This calculation from test data gives the lowest or minimum MTBF that is expected from the item at the specified confidence or assurance. This minimum MTBF (MTBFmin.) is considered that demonstrated by test. For no failures and 0.9 confidence, the following relationship applies:

$$\text{MTBFmin.} = \frac{\text{accumulated test operating time}}{2.3}$$

6.4 Identification of changes. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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c. Reason/Rationale for Recommendation:

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