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MIL-A-19865C(SH)
20 March 1990

SUPERSEDING
MIL-A-19865B(SHIPS)
28 April 1967

MILITARY SPECIFICATION

AIR CONDITIONER, MECHANICALLY REFRIGERATED

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers mechanically refrigerated air conditioners for Naval shipboard use in air circulation, air cooling, and dehumidification.

1.2 Classification. The air conditioners must be of the following types, services, and arrangements as specified (see 6.2).

Type I	–	Drip-proof protected
Type II	–	Explosion-proof enclosed
Service 1	–	440 volts alternating current (Vac) 60 hertz (Hz)
Service 2	–	230 volts direct current (Vdc)
Service 3	–	115 Vdc
Arrangement A	–	With air discharge plenum
Arrangement B	–	Without air discharge plenum

2. APPLICABLE DOCUMENTS

2.1 Government documents.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4120

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2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

FF-B-171	Bearings, Ball, Annular (General Purpose)
PPP-F-320	Fiberboard: Corrugrated and Solid, Sheet Stock (Container Grade) and Cut Shapes
QQ-C-390	Copper Alloy Castings (Including Cast Bar)
QQ-N-281	Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections
TT-P-645	Primer, Paint, Zinc-Molybdate, Alkyd Type
TT-P-664	Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC Compliant

MILITARY

MIL-P-116	Preservation, Methods of
MIL-S-901	Shock Tests, HI (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for
MIL-F-1183	Fittings, Pipe, Cast Bronze, Silver-Brazing, General Specification for
MIL-S-1222	Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts
MIL-E-2036	Enclosures for Electric and Electronic Equipment, Naval Shipboard
MIL-C-2212	Controllers, Electric Motor AC or DC, and Associated Switching Devices
MIL-P-15024	Plates, Tags and Bands for Identification of Equipment

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MIL-P-15024/5	Plates, Identification
MIL-E-15090	Enamel, Equipment, Light-Gray (Formula No. 111)
DOD-P-15328	Primer (Wash), Pretreatment (Formula No. 117 for Metals); (Metric)
MIL-C-15726	Copper-Nickel Alloy, Sheet, Plate, Strip, Bar, Rod and Wire
MS 16142	Boss, Gasket Seal Straight Thread Tube Fitting, Standard Dimensions for
MIL-T-16420	Tube, Copper-Nickel Alloy, Seamless and Welded (Copper Alloy Numbers 715 and 706)
MIL-B-16541	Bronze, Valve: Castings
MIL-W-16878	Wire, Electrical, Insulated, General Specification
MIL-W-16878/4	Wire, Electrical, Polotetraflouroethylene (PTFE) Insulated, 200 °C, 600 Volts, Extruded Insulation
MIL-M-17059	Motors, 60-Cycle, Alternating-Current, Fractional HP, Shipboard Use
MIL-M-17060	Motors, 60-Hertz, Alternating-Current, Integral-Horsepower, (Shipboard Use)
MIL-M-17413	Motors, Direct Current, Integral HP, Naval Shipboard
MIL-M-17556	Motor, Direct-Current, Fractional HP (Shipboard Use)
MIL-A-18001	Anodes, Corrosion Preventive, Zinc; Slab Disc and Rod Shaped
MS 18229	Plug for "O" Ring Gasket
MIL-L-19140	Lumber and Plywood, Fire-Retardant Treated
MIL-A-19521	Anodes, Corrosion Preventive, Zinc, and Plugs, Zinc Anode Retaining; Design of and Installation in Shipboard Condensers and Heat Exchangers
MIL-F-20042	Flanges, Pipe and Bulkhead, Bronze (Silver Brazing)

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MIL-G-21610	Gaskets, Heat Exchanger, Various Cross Section Rings, Synthetic Rubber
MIL-T-22214	Tube, Condenser and Heat Exchanger with Integral Fins (UNS Alloy Nos. C71500, C70600, C12200)
MIL-P-24423	Propulsion and Auxiliary Control Consoles and Associated Control and Instrumentation Equipment, Naval Shipboard Use, Basic Design Requirements

STANDARDS

MILITARY

MIL-STD-167-1	Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
MIL-STD-278	Welding and Casting Standard
MIL-STD-740-1	Airborne Sound Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-740-2	Structureborne Vibratory Acceleration Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-785	Reliability Program for System and Equipment Development and Production
MIL-STD-882	System Safety Program Requirements
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking and Waterproofing; with Appropriate Test Methods
MIL-STD-2073-1	DOD Material Procedures for Development and Application of Packaging Requirements

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 **Other Government documents, drawings, and publications.** The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

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DRAWINGS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

810-841499 Strainer, Bronze 200 PSI at 425 °F Maximum

(Application for copies should be addressed to: Commander, Portsmouth Naval Shipyard, Code 202.2, Portsmouth, NH 03801.)

PUBLICATIONS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

0900-LP-001-7000 Fabrication and Inspection of Brazed Piping Systems

0908-LP-000-3010 Surface Ship Shock Design Criteria

(Application for copies should be addressed to the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 **Non-Government publications.** The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of documents cited in the solicitation (see 6.2).

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

210 Standard for Unitary Air-Conditioning Equipment; (DOD adopted)

(Application for copies should be addressed to the Air-Conditioning and Refrigeration Institute, 1501 Wilson Blvd., Arlington, VA 22209.)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

15 Safety Code for Mechanical Refrigeration

37 Methods of Testing for Rating Unitary Air-Conditioning and Heat Pump Equipment

(Application for copies should be addressed to the American Society of Heating, Refrigerating and Air Conditioning Engineers, 1791 Tullie Circle, NE, Atlanta, GA 30329.)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 276	Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes; (DOD adopted)
A 569	Standard Specification for Steel Carbon (0.15 Maximum Percent), Hot Rolled Sheet and Strip, Commercial Quality
B 16	Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines; (DOD adopted)
B 61	Standard Specification for Steam or Valve Bronze Castings; (DOD adopted)
B 75	Standard Specification for Seamless Copper Tube; (DOD adopted)
B 148	Standard Specification for Aluminum-Bronze Sand Castings
B 209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; (DOD adopted)
D 3951	Standard Practice for Commercial Packaging; (DOD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

C504	Standard for Rubber-Seated Butterfly Valves; (DOD adopted)

(Application for copies should be addressed to the American Water Works Association, 666 W. Quincy Avenue, Denver, CO 80235.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

MG 1	Motors and Generators; (DOD adopted)
ICS 1	General Standards for Industrial Control and Systems

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.)

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UNDERWRITERS LABORATORIES, INC. (UL)

465 Standard for Safety, Central Cooling Air Conditioners

873 Standard for Safety Temperature-Indicating and Regulating Equipment

(Applications for copies should be addressed to the Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 **Order of precedence.** In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 **General.** Air conditioners covered by this specification shall consist of a condensing unit section and an air handling/evaporator section and a motor controller. An air discharge plenum shall be included, if specified (see 1.2 and 6.2.4). These air conditioners shall be self-contained and shall perform as specified herein when connected to cooling water, drainage, and electric power in accordance with UL 465 and ARI 210. The refrigerant systems shall be constructed in accordance with the requirements of ASHRAE 15. Welding shall be in accordance with MIL-STD-278 except radiography is not required. Qualification of brazers shall be in accordance with NAVSEA 0900-LP-001-7000. Qualification of welders shall be in accordance with MIl-STD-278.

3.2 **First article.** When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.5) in accordance with 4.3.

3.3 **Reliability.** The minimum acceptable mean-time-between-failure (MTBF) for each air conditioner shall be 10,000 operating hours.

3.3.1 **Air conditioner failure.** Failure of an air conditioner shall be defined as any event which requires unit down for corrective maintenance that requires more than 2 hours to perform. Any corrective maintenance that may be completed by a ship's force in less than 2 hours, and is supported by on board repair parts and tools, shall not be considered to be a failure.

3.4 **Materials.** Materials shall be as specified herein for the systems and components the appropriate application of which is accepted by NAVSEA in conjunction with first article tests. The use of alternate materials shall not be permitted unless such alternate materials have been successfully tested during the air conditioner first article tests or have been accepted as alternate

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materials by NAVSEA. The materials shall be free from any defects that might affect the serviceability or appearance of the finished product. The material identification shall include the commercial, industrial, Federal or Military specification to which the material conforms, and shall indicate the type, grade, or class of the material if such classification is delineated in the applicable material specification.

3.4.1 Mercury restriction. Mercury and mercury-containing instruments, except fluorescent or necessary vapor lighting, shall not be used in the manufacture or testing of any item used in these air conditioners (see 6.3 and 6.10).

3.4.2 Other dangerous materials. Materials which may produce dangerous gases or cause other harmful effects under conditions, including fire, encountered in Naval shipboard service shall not be used (see 6.10). Magnesium and its alloys shall not be used in the manufacture of the air conditioners or in any component parts.

3.4.3 Corrosion protection. Corrosion-resisting steel, copper, brass, bronze, chromium, copper-nickel, and copper-nickel alloys as specified herein are considered corrosion-resisting materials. Where corrosion-resisting steel is used, it shall be type 304, 316, or 347 in accordance with ASTM A 276. Corrosion-resisting steel, when fabricated by any method that tends to reduce corrosion-resisting properties, shall be normalized to restore those properties before being used in the assembly of any unit (see 4.5).

3.4.3.1 Non-corrosion-resisting materials. Parts other than corrosion-resisting materials shall be protected against corrosion by the use of chemicals, electrolytic processes, plating, or paints and enamels.

3.4.3.2 Fastenings or fittings. Bolts, nuts, studs, pins, screws, and such other fastenings or fittings shall be of corrosion-resisting material. Self-tapping screws with machine screw threads may be used in the cabinet assembly. Sheet metal screws with sheet metal threads shall not be permitted.

3.4.4 Galvanic corrosion. Unless otherwise specified (see 6.2), direct contact of electrolytically dissimilar materials shall be avoided to prevent galvanic corrosion.

3.4.5 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

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3.5 **Construction.** Unless otherwise specified (see 6.2), each air conditioner shall consist of a condensing unit, an air handling/evaporator section, and an air discharge plenum (see 6.3). Every component, including interconnecting wiring and piping, shall be enclosed within the cabinet, except where external mounting is permitted by this specification. The air conditioner shall be factory assembled, complete, self-contained, with the refrigerant system and components dehydrated and charged with the operating quantities of refrigerant and oil. The air conditioner shall be ready for operation after removal of the shipping protection, opening of valves, adjustment of belts, and connection to services. Valves, controls, and equipment subject to service and repair shall be readily accessible for servicing through removable panels. Where panels are provided for access to equipment, machine screws may be used for fastening.

3.5.1 **Refrigerant system.** Every component, including piping, controls, and accessories of the refrigerant system, shall be constructed for use with Refrigerant-22 (monochlorodifluoromethane).

3.5.2 **Safety.** System safety requirements shall be in accordance with MIL-STD-882 (see 6.3). To ensure maximum protection for the operating and maintenance personnel against hazards and accidents, the air conditioner shall incorporate the following safeguards and protective features:

a. Exposed moving and rotating parts shall be covered by removable guards of expanded metal or similar sturdy serviceable material.

b. Components with exposed operating surface temperatures in excess of 52 °C (125 °F) that are within easy grasp, or that are susceptible to being inadvertently touched in everyday operating tasks, shall have those high temperature surfaces suitably insulated or covered with metallic guards.

c. Exposed edges shall be generously rounded and made smooth to prevent cutting edges and sharp corners.

d. Insulated connectors and plugs of the electric current carrying conductors shall be constructed in such a way that they will not constitute an electrical shock or residual discharge hazard when they are disconnected for maintenance and repair.

e. Controls and switches shall be recessed from the outer sides of the enclosure to preclude accidental contact or breakage.

3.5.3 **Ease of maintenance.** The air conditioner shall have a mean-time-to-repair of 8 hours and a mean-time-between-corrective maintenance (MTBCM) of 8,000 hours. Air conditioners shall be constructed so they may be easily maintained, disassembled, repaired, and reassembled (see 4.7.7). Maintenance operations shall be made straightforward and simple with proper regard given to the fact that maintenance often will be performed under adverse conditions with the ship at sea far from normal sources of supply and performed by maintenance personnel who are not seasoned mechanics. Criteria for ease of maintenance shall include parts standardization and interchangeability as specified below:

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3.5.3.1 Parts standardization. The air conditioner construction shall standardize, as far as practicable, those components, fasteners, and items used in manufacture so as to reduce the number of sizes and kinds of items which are generally similar. To the maximum extent possible, the contractor shall use standard, commercially available parts. For example: An air conditioner incorporating grade 8, 1/4-20 UNC-2 inch bolts in one location and grade 5, 1/4-20 UNC-2 inch bolts in another location should standardize on grade 8 1/4-20 UNC-2 inch bolts. O-Ring material shall be standardized to the maximum extent possible. O-Ring diameters and sizes shall be those commonly available from industrial supply houses. Parts shall not be standardized where standardization will result in any improper use.

3.5.3.2 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength.

3.6 Rated capacity. Air conditioners shall be supplied in standard capacities as specified (see 6.2). The standard capacities are the following:

Size 2	–	minimum capacity 24,000 British thermal units (Btus) per hour
Size 3	–	minimum capacity 36,000 Btus per hour
Size 5	–	minimum capacity 60,000 Btus per hour
Size 7-1/2	–	minimum capacity 90,000 Btus per hour.

3.6.1 Piping system. The construction of the piping system for shock shall include inlet and outlet condenser water piping of the proper diameter, Schedule 40 copper-nickel pipe, extending horizontally 12 inches outside of the air conditioner cabinet, cantilevered from the air conditioner inlet and outlet water connections. Construction shall also include the proper size and type of drain piping attached to and extended from the drain connection of the air conditioner. The drain piping shall extend through the cabinet down to the deck level. It may be attached to the air conditioner cabinet or deck.

3.7 Dimensions. Maximum dimensions of the air conditioner cabinets including mounting brackets and plenums shall be as shown in table I.

3.8 Air conditioner components.

3.8.1 Compressor. The compressor shall be of the open type for service 2 and 3 air conditioners and of the hermetic type for service 1 air conditioners. Provision shall be made for adequate lubrication of the rubbing and wearing surfaces including operation under ship motion as specified in 3.15. Compressors shall be provided with a crankcase heater. Crankcase heaters shall be replaceable without having to remove oil or refrigerant from the compressor and shall be arranged to provide compressor oil heating before start-up and at any time the compressor is in the off cycle. Compressors shall be provided with suction and discharge compressor service shutoff valves and means for charging.

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TABLE I. *Cabinets and plenum dimensions.*

Size	Height	Width	Depth
	Cabinet without plenum		
2	65 inches	36 inches	22 inches
3	65 inches	40 inches	24 inches
5	65 inches	45 inches	25 inches
7-1/2	65 inches	48 inches	25 inches
	Plenums		
2	10 inches	36 inches	22 inches
3	10 inches	40 inches	24 inches
5	10 inches	45 inches	25 inches
7-1/2	10 inches	48 inches	25 inches

3.8.1.1 **Open compressor.** The open compressor shall be of the single acting, reciprocating type. The shaft seal and main bearings shall be replaceable in their entirety without the necessity of replacing or refurbishing the crankshaft or crankcase. Compressor speeds for open compressors shall not exceed 1800 revolutions per minute (r/min).

3.8.1.2 **Hermetic compressor.** The hermetic compressor shall be of the reciprocating type. Provision shall be made for adequate lubrication of all rubbing and wearing surfaces including operation under ship motion (see 3.15).

3.8.2 **Condenser.** The condenser shall be seawater cooled and constructed in accordance with the criteria shown in table II. The condenser shall be sized so that the compressor motor shall not be overloaded when the air conditioner is experiencing overload conditions (see 4.7.6.1). The condenser shall be a shell and tube construction with water in the tubes and refrigerant in the shell and shall have an even number of water passes. The condenser shall be mechanically cleanable in place with removable water boxes or heads to permit tubes to be examined, cleaned, or replaced as necessary. The condenser shall be cleanable from either side of the cabinet. Means shall be provided to remove entrained air from each inlet pass. Condenser heat drains shall be provided. Zinc anodes in accordance with MIL-A-19521 shall be installed in the condenser heads (seawater side). The zinc material shall be in accordance with MIL-A-18001. The anodes shall be replaceable without removing the condenser heads. Condenser head depth, measured normal to the tube sheet, shall be not less than one half of the inside diameter (id) of the head measured parallel to the tube sheet. Head volume shall be maximized by having a cylindrical rather than a hemispheric shape. The internal shape of the water box shall be streamlined to minimize turbulence. In multi-pass condensers, the joint between the partition edge and the face of the tube sheet shall be provided with a gasket in accordance with type 1 of MIL-G-21610. The condenser shall be provided with a means for purging air and non-condensable gases and a relief valve to

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prevent over-pressurization of the refrigerant side. The tube sheets shall be constructed of copper-nickel (90-10) in accordance with MIL-C-15726 and shall be a minimum of 1 inch thick. The tube sheets shall be machined and grooved to accommodate tubes expanded at both ends of the condenser. Tube holes shall be deburred and rounded off to a radius of 1/16 inch-45 degrees to remove the corner, except that on the water inlet end of the tubes on the outer (water) side of the tube sheet the tube holes shall be belled and tubes finished flush with the tube sheet. The condenser heads shall be constructed of valve bronze in accordance with ASTM B 61, or nickel-aluminum-bronze in accordance with ASTM B 148, alloy 95800, heat treated at 649 °C (1200 °F) for 1 hour to inhibit de-aluminization as prescribed in AWWA C504. The tubes shall be 3/4-inch outside diameter (od), constructed of copper-nickel (90-10) in accordance with MIL-T-22214. The tubes shall be extruded fin type with minimum wall thickness, at the root of the fin portion, of 0.049 inch. This id of the tubes shall not be corrugated, finned or otherwise modified to enhance heat transfer. Drain and vent fittings and zinc anode holders shall be nickel-copper (70-30) in accordance with QQ-N-281. Vent and drain fittings and anode holders shall be O-ring plug straight thread in accordance with MS 18229 to suit boss tapped in accordance with MS 16142. Bolting material, including bolts, studs and nuts, used to fasten water heads shall be in accordance with grades 400, 405, 510, 544, 632, 655 or 661 of MIL-S-1222.

TABLE II. *Air conditioner rating conditions.*

Maximum seawater design pressure	200 lb/in^2	
Seawater entering pressure	35 to 50 lb/in^2	
Seawater entering temperature	95 °F	
Seawater velocity through condenser tubes	6.0 feet per second (maximum)	
Refrigerant condensing temperature	115 °F (maximum)	
Ambient temperature (entering air)	80 °F dry bulb 67 °F wet bulb	
Air quantity and static pressure	*Air quantity*	*External static pressure*
Size 2 air conditioner	600 ft^3/min (minimum)	1.0 inch water
Size 3 air conditioner	900 ft^3/min	1.0 inch water
Size 5 air conditioner	1500 ft^3/min	1.0 inch water
Size 7-1/2 air conditioner	2250 ft^3/min	1.0 inch water
Cooling effect ratio (sensible cooling effect to net total cooling effect)	65 to 70 percent	
Overload conditions		
Seawater entering temperature	100 °F	
Ambient temperature (entering air)	1000 °F drybulb 85 °F wet bulb	

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3.8.3 **Liquid receiver.** The liquid receiver shall have an internal volume at least 25 percent greater than the volume of the complete refrigerant charge. The receiver shall contain an outlet shutoff valve and pressure relief device approved by the Command or agency concerned. Where a fusible plug is furnished, the plug shall melt at a temperature not less than 127 °C (250 °F) and not greater than 149 °C (300 °F). The receiver may be made integral with the condenser if the above requirements are met. If receiver is integral with condenser, a fusible plug cannot be used.

3.8.4 **Cooling coil.** The cooling coil (evaporator) shall be of finned-tube construction and shall be composed of copper tubes, in accordance with ASTM B 75, alloy C12200, and nonferrous metal fins. Fins shall be firmly bonded to the tube. The fins shall be at least 0.010 inch thick, with fin spacing 10 to 14 fins per inch. Fins shall have drawn collars at all tube holes. Tube sheets and tube support plates shall include copper ferrules for tube penetrations. Intermediate tube support plates shall be used and the tube length between tube supports shall be not greater than 24 inches. Fittings and joints shall be silver brazed. A drip pan and drain for collecting the condensate shall be furnished (see 3.8.9.1).

3.8.5 **Water-regulating valves.** A water-regulating valve shall be provided at the outlet to each condenser. The valve shall be direct-acting or pilot-controlled actuated by condenser gas pressure to modulate the flow of water required for the condenser. The valve shall be selected to regulate the water flow from shutoff to required capacity within a maximum operating gas pressure rise of 40 pounds per square inch (lb/in^2). The valve shall be adjustable within an operating range of 180 to 260 lb/in^2 refrigerant gas pressure. The capacity of the water-regulating valve shall at least equal the water requirement of the condenser, based on available inlet water pressure of 35 lbs/in^2 and a pressure drop across the valve of not more than 10 lbs/in^2. The valve size shall be not less than 1/2-inch nominal pipe size (nps). The valve shall withstand seawater inlet pressures up to 200 lb/in^2. The valve shall be constructed of nonferrous or corrosion-resisting material. The valve body shall be made of valve bronze in accordance with MIL-B-16541 or alloy C92200 in accordance with QQ-C-390. The internal metal parts subject to corrosion or erosion shall be made of nickel-copper in accordance with QQ-N-281. The valve disc shall be a conicle tapered configuration, proportioning type for smooth actuation and flow regulation under partial load, cold seawater, or high inlet water pressure conditions. The valve shall have either flanged connections in accordance with MIL-F-20042 or union ends in accordance with MIL-F-1183. The valve shall be constructed to prevent the entry of seawater into the refrigerant system in the event of derangement. The water regulating valve shall be located within the air conditioning cabinet so that no refrigerant piping or connections are outside the cabinet enclosure.

3.8.6 **Strainer.** A strainer in accordance with Drawing 803-841499 shall protect the condenser and water regulating valve. The strainer shall be not less than 3/4-inch nps. However, it shall be sized as to not restrict seawater flow during overload conditions. The strainer shall be shipped loose for installation in the seawater piping during air conditioner installation.

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3.8.7 Expansion valve. Refrigerant flow to the cooling coil (evaporator) shall be controlled by a thermostatic expansion valve. The valve shall be an adjustable superheat, externally equalized type. The valve body shall be of cast or forged brass or bronze and the inlet and outlet connections shall be an integral part of the valve body.

3.8.8 Piping. Any piping necessary for the operation of the equipment shall be provided up to and including fittings at each unit required for interconnection to supplementary service. Exterior connection fittings shall be capped or plugged to safeguard against damage before installation. Piping connection shall be arranged in such a manner as not to impair the vibration isolation properties of vibration absorption-type mounts. Piping shall be securely supported to minimize strain and vibration and shall be protected against abrasion from adjacent metal parts. Piping connections other than mechanical shall be silver brazed. The water regulating valve shall be installed in the condenser water discharge line and shall be readily accessible for adjustment and maintenance. Condenser water supply piping and drain piping shall be in accordance with MIL-T-16420, alloy 706 type I, class 200, grade 1. Water pipe fittings and seawater service connections shall be 90-10 copper-nickel, valve bronze in accordance with ASTM B 61 or monel, QQ-N-281. No tapered pipe threads shall be used anywhere in the unit. Refrigerant piping shall have readily accessible test fittings for high and low pressure and for charging and draining refrigerant. Refrigerant pipe fittings shall be in accordance with ASTM B 16. Refrigerant piping and evaporator condensate drain tube shall be copper in accordance with ASTM B 75, alloy 12200.

3.8.8.1 Disposable dehydrator. A disposable dehydrator shall be provided in the refrigerant circuit. The dehydrator shall be equipped with an auxiliary screen or other protective means at the dehydrator outlet to prevent passage of the dehydrating agent in the event of rupture of the cartridge screen outlet. The desiccant shall be silica gel, activated alumina, or a type satisfactory to the contracting activity concerned.

3.8.8.2 Strainer. A fine mesh (80 to 100 mesh) strainer shall be located upstream from the expansion device.

3.8.8.3 Moisture indicator. A combination sight flow moisture indicator shall be installed between the strainer and the expansion valve. The moisture indicator elements shall be replaceable without removing the body from the refrigerant piping.

3.8.9 Cabinet. The cabinet enclosure shall be constructed of steel or aluminum protected against corrosion. Aluminum shall be ASTM B 209, alloy 5052, temper H-32 1/4 hard. Steel shall be low carbon steel, ASTM A 569 or equivalent. The cabinet shall incorporate framing, chassis, and support for any component of the air conditioner. The cabinet, framing, and chassis shall support and maintain proper alignment and arrangement of every component under the operational conditions as specified in 3.11 and 3.15. The air handling section of the cabinet shall be constructed for front air intake and top air discharge. The air intake shall be provided with a protective grill. The front of the machinery compartment shall be provided with a removable panel for servicing the equipment. The back of the machinery compartment shall be enclosed with an

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expanded metal screen for service 2 and service 3 air conditioners. Corrosion protection of the cabinet shall be accomplished by cleaning and drying of the metal and application of pretreatment primer in accordance with DOD-P-15328, zinc chromate primer in accordance with TT-P-645 formula 84, or red oxide primer in accordance with TT-P-664, and light gray enamel in accordance with MIL-E-15090 class 2. No wood shall be used in the cabinet. Brackets or integral frame members shall be provided for mounting and fastening the air conditioner to a deck foundation.

3.8.9.1 **Drip pan.** A condensate drip pan shall collect condensate from the cooling coil (evaporator). The pan shall be constructed from corrosion-resistant material. The pan shall have depth and baffles and multiple drain outlets to prevent overflow of the condensate and provide for draining of the condensate under conditions as specified in 3.15. The drip pan outlets shall be interconnected to a common drain tube.

3.8.10 **Plenum.** An air discharge plenum shall be provided when specified (see 6.2). The plenum shall be detachable and constructed to mount on top of the cabinet. The plenum shall contain air guide vanes and louvers as required for directing the air flow. The outlet louvers shall permit adjustable directional air flow in both horizontal and vertical planes. Corrosion protection of the plenum shall be identical to that for the cabinet.

3.8.11 **Insulation.** Thermal insulation shall be applied as necessary to the cabinet, piping, and components to prevent sweating, dripping, running off, or blowing off of moisture under conditions specified in 4.7.6.2. Acoustical insulation shall be applied to minimize the transmission of noise generated by the air conditioner to surrounding areas. For service 1 noise criteria, see 4.7.6.4.

3.8.12 **Air-circulating equipment.** Air-circulating equipment shall include a fan, fan motor, drive, motor control and air filters. The unit shall have the capacity for circulating air through the air conditioning unit at not less than 25 cubic feet per minute (ft^3/min) per 1000 Btu per hour.

3.8.12.1 **Delivery of air.** The unit shall deliver the amount of air as shown in table II when it is used in conjunction with an external duct system and the additional resistance in the air stream due to this external duct system is that as shown in table II (see 4.7.6.3).

3.8.13 **Fans.** Fans shall be of the centrifugal type and be quiet in operation. They shall be secured to shafts and shall be supported by not less than two self-aligning bearings. Bearings shall be replaceable permanently lubricated ball bearing type in accordance with FF-B-171. Bearings shall be replaceable without removal of the blower from the front or sides of the unit after removal of the service panel. Fans shall have a V-belt drive.

3.8.13.1 **Fan motors.** Fan motors shall have variable pitch pulleys and adjustable base or rail in order to adjust belt tension.

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3.8.14 Air filter. Air filters shall be arranged to filter ventilation or recirculated air before it enters the evaporator. Filters shall be of the permanent washable type. Materials used in the construction of the filters shall be corrosion-resisting as specified in 3.4.3 or aluminum. The air filters shall be arranged so they shall not come in contact with condensate from the cooling coils.

3.8.15 *Electrical equipment.* The electrical equipment shall be in accordance with NEMA MG 1 and NEMA ICS 1 and MIL-M-17059, MIL-M-17060, MIL-M-17413, and MIL-M-17556 and shall operate in a 50 °C (122 °F) ambient temperature. No portion of the electrical circuit shall be grounded. The frames or enclosures of all electrical components shall be grounded to the frame of the air conditioning unit to eliminate hazard from shorts or grounds within the equipment. Equipment shall be furnished only for the power supply specified (see 6.2). The air conditioner shall be provided with a motor controller for remote mounting (see 3.8.15.2). Wire for interconnection of electrical components shall be in accordance with MIL-W-16878 and MIL-W-16878/4.

3.8.15.1 Motors. All compressor motors shall start the compressor with the maximum refrigerant pressure differential. An unloading device may be used to meet this requirement, if needed. Motors shall be constant speed, continuous duty, with a maximum speed of 3,600 r/min, and shall be for the power supply specified (see 1,2 and 6.2).

3.8.15.1.1 Hermetic motors. Hermetic motors shall be in accordance with NEMA MG 1. The temperature rise of motors in accordance with NEMA MG 1 shall not exceed 70 °C (158 °F) and shall be provided with built-in thermal protectors installed in accordance with NEMA MG 1.

3.8.15.1.2 Other motors. Other motors shall be in accordance with MIL-M-17059, MIL-M-17060, MIL-M-17413, and MIL-M-17556, as applicable, and shall be service C, constant speed, continuous duty, squirrel cage induction motors for 50 °C (122 °F) ambient temperature, class B or F insulation with winding temperature rise not to exceed 70 °C (158 °F) above ambient, and shall use ball bearings in accordance with FF-B-171 with bearing temperature rise, outer ring of bearing not to exceed 40 °C (104 °F) above ambient. The stator windings shall be insulated and varnish treated to provide a "sealed insulation system." The sealed insulation system shall be accomplished by a manufacturer who shall be certified as required by MIL-M-17060. The motors shall be drip-proof or explosion-proof enclosed, as specified in 3.12 (see 6.2). For 440-volt 3-phase motors, the efficiency shall be not less than the value as shown in table III for the size motor provided. Where the motor horsepower (hp) is not listed, the efficiency value for the next lower hp shall be used.

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TABLE III. *Motor efficiency.*

Motor hp	Efficiency (percent)
15.00	91
10.00	90
07.50	90
05.00	89
03.00	88
02.00	87
01.50	86
01.00	86
00.75	86
00.50	82
00.33	80
00.25	79
less than 00.25	70

3.8.15.2 Motor controls. Enclosure of the compressor and fan motor controllers shall be one of the following types, as specified (see 6.2):

a. Drip-proof (45 degrees), watertight, submersible (15 feet)
b. Explosion-proof (class I, group D)
c. Splash-proof.

Motor controllers shall be constructed to be installed remotely from the air conditioners. A warning plate shall be mounted on the enclosure with the following engraving in prominent red letters:

WARNING

DANGER HIGH VOLTAGE

For hermetic units, overload relays shall be in addition to, and coordinated with, thermal protectors built into the motor. Fans shall be protected with an overload relay or built-in thermal protector. The compressor shall not start or run unless the fan is operating and the compressor shall stop if the fan motor circuit is interrupted. A time delay circuit shall be provided to prevent restarting of the compressor manually or automatically within 5 minutes of having been stopped for any reason. Delay shall not preclude initial starting of the air conditioner.

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3.8.15.2.1 Motor controllers. The motor controllers shall be in accordance with MIL-C-2212. Across-the-line controllers are permissible for dc motors rated up to 1 hp provided the motor is constructed for across-the-line starting and that the inrush current (as determined by dividing the terminal volts by armature circuit resistance of the motor) does not exceed 10 times the motor nameplate current. Motor controllers for dc motors with hp ratings over 1 hp shall be of a reduced voltage type start.

3.8.15.3 Controls. A selector switch shall permit operation of the fan only, or of the fan and refrigerating equipment. High pressure and low pressure safety switches and a temperature control shall be provided. The selector switch shall be of a three-position type with an off position to secure both the fan and refrigerating equipment. The temperature control shall provide for automatic compressor control. It shall provide for manual adjustment and operate within a temperature range of 18 to 29 °C (65 to 85 °F), with a plus or minus 2.8 °C (5 °F) tolerance. The selector switch shall be readily accessible. The temperature control shall be located within the machinery compartment. The unit shall have separate pressure switches properly set to stop the compressor when the refrigerant discharge pressure rises too high, or suction pressure becomes too low. The pressure controls shall be individual units of the lock open, manual reset type. Pressure and temperature controls shall be in accordance with UL 873. A terminal block or blocks shall be provided with the remote motor controller enclosure for the interconnection of all electrical circuits. The internal wiring within the air conditioner cabinet shall be completed to an enclosure containing the necessary terminal blocks, within the cabinet, for interconnection to the motor controller enclosure. Control switches or other electrical devices located external to the motor controller enclosure shall not have protruding or unprotected electrical connection lugs or terminals. Control switches requiring mechanical adjustment shall not be located within the motor controller enclosure unless provision is made so that the necessary adjustments can be made without removing the enclosure cover. When these control switches are located within the air conditioner cabinet, they shall be mounted directly or indirectly, by means of mounting brackets or mounting plates, to the cabinet structure to minimize the effect of vibration from the rotating machinery. They shall be located to minimize the possibility of personnel coming in contact with line electrical parts when servicing the controls.

3.9 Identification plates. Identification plates shall be made of brass (type A), aluminum, or corrosion-resisting steel (type H) in accordance with MIL-P-15024 and MIL-P-15024/5. Information plates shall be made of laminated plastic (type F), aluminum, or corrosion-resisting steel (type H) in accordance with MIL-P-15024 and MIL-P-15024/5. The identification plate shall be located in the front of the machinery compartment. Identification plates shall be secured to equipment with electrolytically compatible fasteners and shall contain the following information:

a. Name of equipment: Air conditioner

b. Manufacturer's name and address

c. Manufacturer's model, type, capacity

d. Manufacturer's serial number

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e. Date of manufacture

f. Government or shipbuilder's contract or purchase order number

g. Specification number and appropriate type, service, class, size (cooling capacity), and power supply

h. Component identification number (CID)

i. National stock number.

3.9.1 Warning plate. In addition to the identification plate, equipment for explosion-proof applications shall have a warning plate. The warning plate shall be located on the front of the cabinet. Lettering shall be readily legible, reading as follows:

CAUTION

THIS EQUIPMENT IS FOR EXPLOSION-PROOF APPLICATION. DISCONNECT POWER SUPPLY BEFORE OPENING ELECTRICAL BOX COVERS. DO NOT ENERGIZE UNLESS THE EQUIPMENT IS FULLY ASSEMBLED AND ALL ELECTRICAL ENCLOSURES ARE PROPERLY CLOSED.

3.10 Shock resistance. Each air conditioner and its components shall be shock resistant in accordance with MIL-S-901 for grade B, deck mounted, class II, medium weight, type A equipment (see 4.7.1).

3.11 Vibration. The air conditioner shall meet the type I vibration requirements in accordance with MIL-STD-167-1 (see 4.7.2).

3.12 Explosion proof. The air conditioner shall meet the requirements of MIL-E-2036 (see 4.7.3).

3.13 Airborne noise. The air conditioner and controls furnished under this specification shall meet grade D noise requirements in accordance with MIL-STD-740-1 (see 4.7.6.4).

3.14 Structureborne noise. When specified (see 6.2) the air conditioner and controls shall meet the structureborne noise requirements (such as type III) in accordance with MIL-STD-740-2.

3.15 Ship inclination. The air conditioner shall operate on a surface ship while withstanding 15 degrees permanent, or 45 degrees cyclic, inclination (see 4.7.4).

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3.16 Capacity. Air conditioner shall deliver not less than its specified capacity when operating at the rating conditions as shown in table II. The net capacity shall be exclusive of all electrical energy (heat energy) required to operate the compressor, fan, and so forth (see 4.7.5).

3.17 Performance. Under rated conditions, the air conditioning unit shall have a minimum performance factor of 10 Btu per hour per watt based on net capacity and total watts input to the unit (see 4.7.6).

3.17.1 Overload. The temperature rise for motors shall not exceed the permissible temperature rise in the applicable motor specification, or 70 °C for motors in accordance with NEMA MG 1 (see 4.7.6.1).

3.17.2 Condensation. The air conditioner shall operate without dripping, running, or blow-off of moisture either inside or outside the cabinet (see 4.7.6.2).

3.17.3 Air delivery. The air flow quantity shall be not less than specified in table II (see 4.7.6.3).

3.18 Pressure. Every refrigerant-containing component shall withstand a pressure of 300 lb/in^2 (see 4.8.1).

3.19 Leakage. The refrigerating high side and low side system shall be resistant to leakage (see 4.8.2).

3.20 Water system pressure. The seawater piping system shall be leak resistant (see 4.8.3).

3.21 Insulation motor resistance. The insulation motor resistance test shall be conducted on the air conditioner in accordance with the insulation resistance test specified in MIL-P-24423 (see 4.8.4).

3.22 Dielectric strength. The electrical equipment and wiring shall meet the requirements of 4.8.5.

3.23 Operation. The air conditioner shall operate under the conditions specified herein with a minimum of attention. Operation shall automatically maintain the environmental conditions for which the equipment is set as specified in table II (see 4.8.6).

3.24 Service life. The air conditioner and its components shall have a trouble-free operating life of not less than 50,000 hours when subjected to any or all of the shipboard conditions specified herein. Such performance shall be obtained with a minimum and reasonable degree of preventive and corrective maintenance (see 3.5.3).

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

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program (see 6.3). The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to the requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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

a. First article inspection (see 4.3)
b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of the tests and examinations as specified in 4.5 and 4.7 through 4.7.7 (see 6.3).

4.3.1 Sampling for first article inspection. The first air conditioner of each type, service, and size produced under the contract or order shall be selected for testing.

4.3.2 First article after test. The first article which has been subjected to the tests and examinations specified in 4.6 and found to be satisfactory may be offered for delivery subject to the following:

a. Any repairs or modifications found necessary as a result of the first article tests and examinations have been proven satisfactory by retesting.

b. The air conditioner is not degraded in any way.

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c. Equipment which has been subjected to the high-impact shock and vibration tests and has successfully passed these tests shall be considered acceptable for such service as the Command or agency concerned may authorize. However, before being offered for delivery, such equipment shall be reconditioned by the contractor as follows:

(1) Minor deformation including alignment. (Minor deformations are defined as those which do not cause rejection of the air conditioner under high-impact shock or vibration tests but which are in excess of the air conditioner dimensional tolerance specified on the applicable drawings.)

(2) Bearings shall be replaced.

(3) Each part shall be carefully examined by the contractor and any part which does not meet the original specifications shall be replaced.

(4) Equipment shall be cleaned, leak tested, and dehydrated in accordance with the requirements specified herein.

(5) Reconditioned equipment shall be retested as applicable in accordance with the quality conformance tests as specified in 4.8. Reconditioned shock and vibration tested equipment shall be tested for capacity.

d. Concurrence of the contracting activity.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the tests and examinations as specified in 4.5 and 4.8 through 4.8.6 (see 6.3).

4.4.1 Lot. All air conditioners of the same type, service, and size offered for delivery at one time shall be considered a lot.

4.5 Visual inspection. Each sample unit selected shall be examined for adjustments, fits, leaks, material, finish, and general conformance to this specification and as follows:

a. The external fittings shall be properly secured (see 3.8.8).

b. Bolts, nuts, and screws shall be tight; equipment and parts shall be properly fastened and secured.

c. No parts shall be fractured, split, torn, dented, or otherwise damaged such as to affect serviceability.

d. There shall be no sharp or ragged edges on the sheeting that may be injurious to personnel.

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e. Cold lines shall be properly insulated (see 3.8.11).

f. The limiting and mounting dimensions shall be in accordance with drawings and table I.

g. The temperature control shall be properly set and functioning (see 3.8.15.3).

h. The selector switch shall operate satisfactorily (see 3.8.15.3).

i. There shall not be any dripping, running, or blowing off of moisture (see 4.7.6.2).

j. The low pressure and high pressure switch shall be functioning and properly set in accordance with the manufacturer's specification (see 3.8.15.3).

l. There shall be no refrigerant leakage at any brazed, welded, or mechanical joint as measured using an electronic halide leak detector adjusted to detect a leak of 1/2 ounce per year.

4.6 First article test procedures.

4.6.1 General. Before testing, the air conditioner shall have successfully passed the visual evaluation specified in 4.5. For first article tests, fresh water may be used in lieu of seawater for cooling. Whereas some tests may be conducted concurrently, the shock test, inclined operation test, and vibration test shall be performed separately.

4.6.1.1 Test failure. Failure of the air conditioner to pass any of the tests or examinations specified herein shall constitute rejection of the air conditioner. The resumption of tests and examinations will be considered by the contracting activity after receipt of information substantiating that the deficiencies found have been corrected satisfactorily.

4.7 Tests.

4.7.1 Shock. One complete air conditioner of each type, service, size, and design shall be subjected to the high-impact shock tests (see 6.3) in accordance with MIL-S-901 for grade B, class I equipment, except for the following:

a. No resilient mounts shall be used externally to the air conditioner for mounting the air conditioner to the deck.

b. The air conditioner shall be operating during each shock blow unless it became inoperative during the previous blow. Electric power and seawater shall be applied to the air conditioner during each shock blow even if it has become inoperative. The air conditioner shall be subject to the complete series of shock blows or until it fails the acceptance criteria as specified.

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4.7.1.1 Acceptance criteria. The air conditioner shall be considered acceptable for high-shock application unless the following conditions occurred during, or were evident at the conclusion of, the test:

a. Dislodgement or displacement of any piece, part, or component in such a manner that would be hazardous to personnel in the vicinity of the air conditioner or cause an electrical short circuit

b. The shearing or tearing of metallic parts that would create projections or sharp edges

c. Where the equipment is constructed to be explosion-proof, any fracture or distortion that reduces the explosion-proof characteristics of the equipment

d. Any refrigerant or seawater leakage.

4.7.1.2 Guidance. Guidance regarding shock tests and design of shock resistant naval equipment can be found in NAVSHIPS 0908-LP-000-3010 and MIL-S-901.

4.7.2 Vibration. One complete air conditioner of each type, service, and size shall be subjected to the type I environmental vibration tests (see 6.3) in accordance with MIL-STD-167-1 (see 3.11). Where the equipment is constructed to be explosion-proof, any deformity resulting from the test that would reduce the explosion-proof characteristics of the equipment shall be cause for rejection.

4.7.3 Explosion-proof. One complete air conditioner of each type II, service, and size shall be tested to establish conformance to explosion-proof requirements as specified in 3.12. Explosion-proof testing shall be in accordance with MIL-E-2036.

4.7.4 Inclination. The unit shall be inclined at an angle of 15 degrees each side of the vertical in each of two vertical planes at right angles to each other and operated at least 1 hour or cycled at 45 degrees for one hour, under applied rating conditions as specified in table II and 4.7.5. The information shall be monitored at 10-minute intervals throughout the test. The unit shall be acceptable if there is no spillage of fluids inside or outside the cabinet, no abnormal noise and no loss of capacity.

4.7.5 Capacity rating. Capacity rating tests shall be conducted in accordance with the procedures and requirements indicated in ASHRAE 37 and ARI 210. A standard rating test shall be conducted using standard rating conditions in accordance with ARI 210. An application rating test shall be conducted using the operating conditions as shown in table II.

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4.7.6 **Performance.** Each air conditioning unit to be tested shall be given the continuous-operating tests as specified in 4.7.6.1 through 4.7.6.3 under the average temperature conditions as indicated with a tolerance of plus or minus 1 °F dry bulb, plus or minus 1/2 °F wet bulb, and plus or minus 1 °F condenser water temperature. Observations and readings shall be taken at intervals not greater than 10 minutes.

4.7.6.1 **Overload.** The unit shall be operated with 100 °F dry bulb temperature, 85 °F wet bulb temperature unit-ambient-air and room air entering-air-inlet and 100 °F water to the condenser. The test shall be continued until steady conditions have been observed for not less than 4 hours. The unit shall operate normally without any interruption caused by tripping of motor-overload devices, without damage to motors due to overheating, and without injury to any other component part from any operational cause. The temperature rise of the compressor motor winding shall be determined at the end of this test. The temperature rise shall be not greater than that as specified in 3.8.15.1. The temperature rise of the windings shall be measured and computed by the resistance method. In addition, the air conditioner shall be tested to determine actual capacity under overload conditions as shown in table II.

4.7.6.2 **Condensation.** The unit shall be operated continuously for 4 hours with 95 °F condenser inlet water, 80 °F dry bulb temperature and 75 °F wet bulb temperature unit-ambient-air and room air entering-air-inlet. The air conditioning unit shall perform satisfactorily during the test without dripping, running, or blowing-off of moisture either inside or outside the cabinet.

4.7.6.3 **Air delivery.** The unit shall be provided with a means of restricting the outlet air to produce the minimum outlet resistance as specified in 3.8.12.1. The air flow quantity shall be not less than that specified in table II.

4.7.6.4 **Noise test.** The unit shall be tested in accordance with the peak A-weighted sound pressure level measurement procedure and at the measurement locations specified in MIL-STD-740-1) (see 3.13). The acceptable sound pressure levels shall be as shown in table IV.

TABLE IV. *Sound pressure levels.*

Octave band center frequency, (Hz)	Decibels (Ref. 0.0002 micro bar)
31.5	75
63	72
125	69
250	66
500	63
1000	60
2000	57
4000	54
8000	51

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4.7.6.4.1 Acceptance criteria. The unit is acceptable if the sound pressure level at each frequency is equal to or less than that indicated in 4.7.6.4.

4.7.7 Maintainability demonstration. The first production unit shall be inspected after testing and the capability to maintain, disassemble, and repair the unit shall be demonstrated to a Government representative (see 6.3). The unit shall be disassembled, all bearings replaced, and reassembled. The controls and instruments shall be removed and replaced at the discretion and direction of the Government representative. The demonstration shall show that access and replacement of components is possible without personnel hazard. The demonstration shall be conducted with other than expert mechanics.

4.7.7.1 Degree of disassembly and reassembly. The degree of disassembly and reassembly shall include, but not be restricted to, the following items, where applicable:

a. Low and high pressure control switches
b. Temperature control switch
c. Sight glass, filters, strainers, screens, and dehydrator
d. Valves, expansion valve, water regulating valve
e. Condenser
f. Fan and fan motor
g. Compressor unit assembly.

4.7.7.2 Exceptions. Items of the following nature need not to be performed:

a. Destruction of material such as disassembly of electronic components or removal of condenser tubes

b. Boring, grinding, and other shaping repair procedures

c. Unbrazing connections to remove components.

4.8 Quality conformance. The tests specified in 4.8.1 through 4.8.7 shall be conducted on each air conditioner produced under the contract or purchase order.

4.8.1 Pressure. Each refrigerant-containing component shall withstand a test pressure of 300 lb/in^2 for R-22 (see 3.18). The test pressure shall be attained by first charging R-22 into the unit to raise the pressure to 30 lb/in^2. Dry nitrogen shall be used to raise the pressure to the final test pressure.

4.8.2 Leakage test. The refrigerating high side and low side system shall be tested to determine tightness and resistance to leakage at a minimum gas pressure of 300 lb/in^2 for R-22 systems (see 3.19). The leak testing equipment shall detect refrigerant leaks of 1/2 ounce of refrigerant per year. Any leaks found shall be repaired and the system retested until leak free.

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4.8.3 **Water system pressure test.** The seawater piping system, including all components, shall be tested at a hydrostatic pressure of 300 lb/in^2 (see 3.20). Any leaks found shall be repaired and the system retested until leak-free.

4.8.4 **Insulation resistance test (see 3.21).** The motor shall be at ambient temperature. The measuring of insulation shall be made by connecting the three line terminals together, manually closing the line and fan contactors and measuring the resistance between terminals and ground. The insulation resistance shall be measured with a 500 V insulation-resistance-meter. The time of test voltage application shall be not less than 60 seconds.

4.8.5 **Dielectric strength test.** The electrical equipment and wiring shall withstand for a period of 1 minute a dielectric ac, root-mean-square (rms) test voltage or 1900 volts for the ac unit and 1500 volts for the dc unit (see 3.22). The test voltage for all other electrical equipment and wiring shall be two times the operating voltage plus 1000 volts.

4.8.6 **Operating tests.** Each air conditioner shall be operated for a period of at least 1 hour with controls set to allow continuous compressor operation as shown in table II (see 3.23). During this test, inlet air temperature to the evaporator shall be not less than 75 °F dry bulb. The electrical power input shall be continuously monitored and recorded during this test. At the conclusion of this operation test, the entire refrigerant circuit connections under refrigerant pressure shall be tested to determine leakage (see 4.8.2). In the event of leakage, the leaks shall be repaired and the operating test shall be repeated.

4.8.6.1 **Controls.** During this test it shall be verified that the controls are adjusted and functioning properly.

4.8.7 **Electrical power.** The electrical power input shall be recorded during operating tests and compared with the input of all other units which have been tested. If any unit requires 7 percent more power than the average of all the acceptable units, it shall be rejected.

4.8.8 **Acceptance criteria.** Production units failing to meet the tests specified in 4.8.1 through 4.8.7 shall be repaired, defective parts and components replaced, and be retested until specification requirements are met before offering the air conditioner for acceptance.

4.8.9 **Production reliability acceptance test.** A production reliability acceptance test (PRAT) shall be conducted in accordance with MIL-STD-785, task 304, to ensure that the air conditioner meets the requirements of 3.2 (see 6.3). The air conditioner shall be operated for 500 hours with a 24-hour non-operative period every 100 hours of operation. (For the quality conformance inspection the air conditioner shall be required to operate only for one 100-hour period.) The air conditioner shall be operated in all conditions of list, trim, roll, and pitch in accordance with 3.16. The air conditioner shall be in the AUTO mode during the test. This test may be run concurrently with any other applicable test.

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4.9 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing, and marking for shipment, stowage, and storage shall be in accordance with the requirements of section 5 and the documents specified therein (see 6.2 and 6.3).

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.8.)

5.1 General.

5.1.1 Navy shipboard stowage fire-retardant requirements.

a. *Treated Lumber and Plywood.* Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping containers and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B	Type II – weather resistant Category 1 – general use
Level C	Type I – non-weather resistant Category 1 – general use.

b. *Fiberboard.* Fiberboard used in the construction of class-domestic, non-weather resistant fiberboard, cleated fiberboard boxes including interior packaging forms shall meet the flame spread index and the specific optic density requirements of PPP-F-320 and amendments thereto.

c. Cushioning and wrapping materials. The use of excelsior, newspaper, shredded paper (all types), and similar hygroscopic or nonneutral materials and all types of loose fill materials for packaging applications such as cushioning, fill, stuffing, and dunnage is prohibited. Materials selected for cushioning and wrapping shall have properties (characteristics) for resistance to fire (see 6.9). Cushioning or wrapping materials as applicable, shall be provided to prevent item and package damage and to prevent free movement of the container contents.

5.2 Preservation. Preservation shall be level A or commercial as specified (see 6.2).

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5.2.1 **Level A.** Each complete unit (see 3.5) shall be unit protected in accordance with method I requirements of MIL-P-116 and as follows: exterior unpainted ferrous metal surfaces shall be coated with P-19 preservative in accordance with MIL-P-116. The water cooling system shall be thoroughly drained and blown out by the application of clean, dry compressed air. To prevent the entrance of foreign material, all openings shall be sealed with the use of metal or plastic plugs or waterproof pressure-sensitive tape. Drive belts shall be removed, exposed uncoated ferrous metal surfaces of pulleys and shafts shall be cleaned and coated with primer in accordance with TT-P-664. When the primer is thoroughly dry, drive belts shall be remounted in place with tension on the belts relaxed.

5.2.3 **Commercial.** Commercial preservation shall be in accordance with ASTM D 3951.

5.3 **Packing.** Packing shall be Level A, B, C, or commercial as specified (see 6.2).

5.3.1 **General.** Shipping containers shall contain identical quantities of identical material and shall be of minimum weight and cube, similar construction, and of uniform size.

5.3.2 **Level A, B, and C containers.** Material preserved as specified (see 5.2) shall be packed in shipping containers, cleated plywood or nailed and locked corner boxes or covered crates, for the level of packing specified (see 6.2), in accordance with MIL-STD-2073-1, appendix C, table VII. Unless otherwise specified (see 6.2), container selection shall be at the contractor's option.

5.3.2.1 **Closure, gross weight, and waterproofing.**

5.3.2.1.1 **Closure.** Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that class MIL-STD-2073-1, weather resistant fiberboard boxes shall be closed in accordance with method V, and reinforced with nonmetallic or tape banding, and non-weather resistant fiberboard boxes shall be closed in accordance with Method I using pressure sensitive tape.

5.3.2.1.2 **Weight.** Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIl-STD-2073-1 and the applicable container specification or appendix thereto.

5.3.2.1.3 **Waterproofing.** Unless otherwise specified (see 6.2), level A and when specified (see 6.2), level B shipping containers shall be provided with caseliners, linings, wraps, or shrouds in accordance with the waterproofing requirements of MIL-STD-1186.

5.3.3 **Commercial.** Material preserved as specified (see 6.2) shall be packed for shipment in accordance with ASTM D 3951 and herein.

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5.3.3.1 **Container modification.** Shipping containers exceeding 2 pounds gross weight shall be provided with the minimum of 3- by 4-inch nominal wood skids laid flat, or a skid- or sill-type base that will support the material and facilitate handling by mechanical handling equipment during shipment.

5.4 **Marking.** Marking shall be as specified in 5.4.1.

5.4.1 **Level A, B, C, and commercial.** In addition to any special marking required (see 6.2), level A, B, and C interior packs and shipping containers shall be marked in accordance with MIL-STD-2073-1, appendix F, and commercial interior packs and shipping containers shall be marked in accordance with ASTM D 3951. In addition, bar coding shall be applied in accordance with the marking requirements of MIL-STD-2073-1, and the shipment marking information shall be provided on interior packages and exterior shipping containers and shall include the following:

a. Nomenclature
b. National stock number
c. Manufacturer's part number
d. Size
e. Contract or order number
f. Contractor's name
g. Destination.

5.5 **Technical manuals.** Technical manuals which accompany shipment shall be packaged in a transparent waterproof plastic bag, minimum four mil thick. Closure shall be by heat sealing. The copy(s) of the manual shall be placed in the shipping container housing the main unit. Packing lists shall indicate which container contains the technical manual(s) and shall state the approximate location therein. The manual shall be readily accessible when the container is opened. Technical manuals, when shipped in bulk quantities, shall not be individually wrapped, but shall be packed in accordance with the requirements of the applicable technical manual specifications.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 **Intended use.** These air conditioners are intended for Naval shipboard use in compartments and areas where central system air conditioning is not provided.

6.2 **Acquisition requirements.** Acquisition documents should specify the following:

a. Title, number, and date of this specification
b. Type, service, class, capacity, and size required (see 1.2 and 3.6)

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c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2)

d. If air discharge plenum is required (3.1, 3.5, and 3.8.10)

e. When first article inspection is required (see 3.2)

f When direct contact of electrolytically dissimilar materials is permitted (see 3.4.4)

g. Type of power supply for equipment and motors (see 3.8.15 and 3.8.15.1)

h. When drip-proof protected or explosion-proof equipment is required (see 3.8.15.1 and 3.8.15.2)

i. Structureborne noise criteria if required (see 3.14)

j. Packaging data requirements (see 4.9)

l. Preservation requirements (see 5.2)

m. Packing requirements (see 5.3)

n. When applicable waterproofing is not required (see 5.3.2.1.3)

o. Marking and special marking requirements (see 5.4.1).

6.3 **Consideration of data requirements.** The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Description (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference paragraph	DID number	DID title	Suggested tailoring
3.4.1 and 4.1.1	DI-E-2121	Certificate of Compliance	–
3.5	DI-DRPR-81000	Product Drawings, and Associated Lists	–
3.5.2	DI-SAFT-80102	Safety Assessment Report	–
4.3	DI-MISC-80678	Certification/Data Report	10.3.1 does not apply
4.3	UDI-T-23732	Procedures, Test	–

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Reference paragraph	DID number	DID title	Suggested tailoring
4.4	DI-T-2072	Reports, Test	–
4.7.1	DI-ENVR-80708	Shock Test Report	–
4.7.2	UDI-T-23762	Report, Vibration Testing	–
4.7.7	DI-MNTY-80832	Maintainability/Testability Demonstration Test Report	–
4.8.9	DI-RELI-80250	Reliability Test Plan	–
4.8.9	DI-RELI-80251	Reliability Test Procedures	–
4.8.9	DI-RELI-80252	Reliability Test Reports	–
4.9	DI-PACK-80120	Preservation and Packing Data	–

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards, which have been cleared and listed in DOD 5010.12-L Acquisition Management Systems and Data Requirements Control List (AMSDL), must be listed on a separate Contract Data Requirements List (DD Form 1423), included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.5 First article. When a first article inspection is required, the item should be a first article sample. The first article should consist of one unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

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6.6 **Definitions.** Terms and phrases used throughout this specification are defined as follows:

6.6.1 **Air discharge plenum.** The air discharge plenum is an enclosure (housing) containing guide vanes and a grill or louvers in the outlet opening for directing the airflow.

6.6.2 **Air handling/evaporator section.** The air handling/evaporator section is an enclosed component consisting of an air filter, fan with drive motor, evaporator (cooling coil), refrigerant flow control, and condensate collector and drain.

6.6.3 **Condensing unit.** The condensing unit is an assembly of refrigerating components, consisting of a compressor with a drive motor, condenser, receiver, operating and safety controls, and interconnecting piping and wiring. The controls should include a condenser water regulating valve, high and low refrigerant pressure switches, refrigerant relief device, and motor overload protection.

6.6.4 **Cooling effect.** The net room sensible cooling effect of a unit is defined as the difference between the net total cooling effect and the dehumidifying effect, expressed in Btu per hour. The net total cooling effect is the total useful capacity of the unit for removing heat from the space to be treated, expressed in Btu per hour. The net dehumidifying effect is the difference between the moisture content in pounds per hour of the entering and leaving air, multiplied by 1060, expressed in Btu per hour.

6.7 **Provisioning.** Provisioning Technical Documentation (PTD), spare parts, and repair parts should be furnished as specified in the contract.

6.7.1 When ordering spare parts or repair parts for the equipment covered by this specification, the contract should state that such spare parts and repair parts should meet the same requirements and quality assurance provisions as the parts used in the manufacture of the equipment. Packaging for such parts should also be specified.

6.8 **Sub-contracted material and parts.** The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.9 **Cushioning and wrapping materials (see 5.1.1.c).** Materials having properties for resistance to fire and acceptable for use within unit packs and shipping containers for Navy shipboard stowage furniture item(s) acquisitions are:

Material	Specification
Paper, Kraft Treated (Fire-resistant)	A-A-1894
Paper, Kraft, Wrapping	UU-P-268, Type II, Grade C or D

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Material	Specification
Fiberboard	PPP-F-320, Class-Domestic/Fire-retardant
Plastic Film, Flexible, Cellular	PPP-C-795, Class 3 – Fire-retardant
Polystyrene Expanded, Resilient	PPP-C-850, Grade SE
Plastic, Open Cell, Cushioning	PPP-C-1842, Type I, Style B
Bound Fiber	PPP-C-1120, Type III or IV, Class C
Rubber, Latex Foam	MIL-R-5001, Grade A
Rubber, Celluar	MIL-R-6130, Grade A
Fibrous Glass	MIL-C-17435
Polystyrene Foam	MIL-P-19644, Type II
Rubber, Cellular, Synthetic	MIL-R-20092, Class 5
Polyurethane Foam	MIL-P-26514
Polyurethane Foam Flexible, Open Cell	MIL-F-81334
Foam, Combustion, Retardant for Cushioning Supply Items Aboard Navy Ships	MIL-F-87090 (SA)

6.10 Approval. The approval of the contracting activity concerned is required for the use of mercury and mercury-containing instruments (see 3.4.1) and other dangerous materials (see 3.4.2).

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6.11 Subject term (key word) listing.

Air discharge plenum
Compressor
Condensing unit
Evaporator
Liquid receiver

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

Preparing activity:
Navy - SH
(Project 4120-N305)

*U.S. GOVERNMENT PRINTING OFFICE: 1991—504-034/50218

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-A-19865C(SH)	2. DOCUMENT DATE (YYMMDD) 20 March 1991

3. DOCUMENT TITLE
AIR CONDITIONER, MECHANICALLY REFRIGERATED

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact(TPOC): Mr. Francis Charney (SEA 56Y35) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial: TPOC: 703-602-0273 (2) AUTOVON: 8-332-0273
c. ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command Department of the Navy (SEA 55Z3) Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340