INCH-POUND

MIL-PRF-23798D(SH)
13 December 2004

SUPERSEDING
MIL-A-23798C(SH)
6 March 1995

PERFORMANCE SPECIFICATION

AIR CONDITIONER, FAN-COIL ASSEMBLY

This specification is approved for use by the 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 prefabricated fan-coil assemblies for use in conjunction with a chilled water system for air conditioning spaces onboard Naval surface ships.

1.2 Classification. The fan-coil assemblies are of the following types, sizes, and capacities and compositions, as specified (see 6.2):

1.2.1 Types. The types of air conditioning fan-coil assemblies are as follows:

Type II - Three-section unit consisting of a cooling coil section, fan-motor section, and air distribution plenum section (HI Shock)

Type III - Two-section unit consisting of a cooling coil section and fan-motor section (HI Shock)

1.2.2 Sizes. The sizes of air conditioning fan-coil assemblies are as follows:

Size	Nominal Capacity [1/]
21	31,300 British thermal units per hour (Btu/h)
22	51,200 Btu/h
23	77,600 Btu/h
24	99,800 Btu/h
25	151,300 Btu/h

Note:

[1/] See 3.12 and Table I for conditions.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navsea.navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

1.2.3 Grades. The grades of air conditioning fan-coil assemblies are as follows:

HI Shock -

Type X - (Non-HI-Shock unit)

1.2.4 Composition. The composition of air conditioning fan-coil assemblies is as follows:

M - Magnetic

N - Nonmagnetic

1.3 Part or identifying number (PIN). PINs to be used for prefabricated fan-coil assemblies acquired to this specification are created as follows:

M	**23798**	-	**X**	**XX**	**X**	**X**
Prefix for Military Specification	Specification Number		Type (see code below)	Size (see code below)	Grade (see code below)	Composition (see code below)

Type Code		Size Code		Grade Code		Composition Code	
Type	Code	Size	Code	Grade	Code	Composition	Code
II	A	21	21	High-shock	H	M	M
III	B	22	22	Type X	X	N	N
		23	23				
		24	24				
		25	25				

Examples: M23798-A21HM
M23798-B24XN

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

TT-P-645	-	Primer, Paint, Zinc-Molybdate, Alkyd Type
MIL-S-901	-	Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements For
MIL-DTL-15090	-	Enamel, Equipment, Light Gray (Navy Formula No. 111)

DOD-P-15328 - Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric)

MIL-PRF-16552 - Filters, Air Environmental Control System, Cleanable, Impingement (High Velocity Type)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited)

MIL-STD-889 - Dissimilar Metals

MIL-STD-1399-300 - Interface Standard for Shipboard Systems, Electric Power, Alternating Current (Metric)

MIL-STD-2142 - Magnetic Silencing Characteristics, Measurement of (Metric)

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 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 of these documents are those cited in the solicitation or contract.

NAVSEA TECHNICAL PUBLICATION

S9074-AR-GIB-010/278 - Requirements for Fabrication, Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels

(Copies of this document are available from the Naval Inventory Control Point, 700 Robbins Avenue, Attn: Code 0862 (Cash Sale), Philadelphia, PA 19111, or www.nll.navsup.navy.mil.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 300 - Reverberant Room Method for Sound Testing of Fans (DoD adopted)

(Copies of this document are available from the Air Movement and Control Association, Inc., 30 West University Drive, Arlington Heights, IL 60004 or online at www.amca.org.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ANSI/ABMA STD-4 - Tolerance Definitions and Gaging Practices for Ball and Roller Bearings

ANSI/ABMA STD-9 - Load Ratings and Fatigue Life for Ball Bearings

ANSI/ABMA STD-13 - Rolling Bearing Vibration and Noise (Methods of Measuring)

ANSI/ABMA STD-15 - Ball Bearings with Spherical Outside Surfaces and Extended Inner Ring Width (Includes Eccentric Locking Collars)

ANSI/ABMA/ISO 3290 - Rolling Bearings - Balls - Dimensions and Tolerances (DoD adopted)

(Copies of these documents are available from the American Bearing Manufacturers Association, Inc., 1101 Connecticut Ave., NW, Suite 700, Washington, DC 20036 or online at www.abma-dc.org.)

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

ASHRAE 33 - Methods of Testing Forced Circulation Air Cooling and Air Heating Coils (DoD adopted)

ASHRAE 37 - Methods of Testing for Rating Unitary Air-Conditioning and Heat Pump Equipment (DoD adopted)

(Copies of this document are available from the American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329 or online at www.ashrae.org.)

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1 - Welding Procedure and Performance Qualification, Standard For (DoD adopted)

AWS B2.2 - Brazing Procedure and Performance Qualification, Standard For (DoD adopted)

(Copies of these documents are available from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33216 or online at www.aws.org.)

ASTM INTERNATIONAL

ASTM A123 - Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products (DoD adopted)

ASTM B6 - Standard Specification for Zinc-AASHTO No. M120-77 (DoD adopted)

ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DoD adopted)

ASTM D2092 - Standard Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting (DoD adopted)

ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials (DoD adopted)

ASTM F1166 - Standard Practice for Human Engineering Design for Marine Systems, Equipment and Facilities (DoD adopted)

(Copies of these documents are available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or online at www.astm.org.)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE STD 45 - IEEE Recommended Practice for Electric Installations on Shipboard (DoD adopted)

(Copies of these documents are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331 or online at www.ieee.org.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 - Motors and Generators (DoD adopted)

(Copies of these documents are available from the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209 or online at www.nema.org.)

RUBBER MANUFACTURERS ASSOCIATION (RMA)/MECHANICAL POWER TRANSMISSION ASSOCIATION (MPTA)/RUBBER ASSOCIATION OF CANADA (RAC)

IP-20 - Specifications for Drives Using Classical V-Belts and Sheaves (Joint RMA/MPTA/RAC)

IP-25 - Specifications for Drives Using Variable Speed V-Belts (Joint RMA/MPTA/RAC)

(Copies of these documents are available from the Rubber Manufacturers Association, 1400 K Street, NW, Suite 900, Washington, DC 20005 or online at www.rma.org.)

2.4 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. Cast iron shall not be used in fan-coil assembly nor shall cast iron be used in motors, which are components of the fan-coil assembly. Gray cast iron may be used for the fan and motor sheaves. Materials for fan-coil assemblies shall be corrosion-resistant or material shall be protected against corrosion after fabrication. Material degraded during the fabrication process shall be normalized to restore those properties before assembled in any fan-coil assembly. Selected materials shall be capable of meeting all of the operational and environmental requirements specified herein.

3.2.1 Corrosion protection. Corrosion-resisting steel, galvanized steel, copper, and brass referenced herein are considered corrosion-resisting materials. Corrosion resisting steel, when fabricated by any method that tends to reduce corrosion-resisting properties, shall be normalized to restore those properties before being assembled in any unit.

3.2.1.1 Corrosion protection methods. Parts fabricated from other than corrosion-resisting materials shall be protected against corrosion after fabrication with chemicals, electrolytic processes, plating or paints. The following methods while not restrictive are considered corrosion protection methods when properly applied.

a. Hot-dipped galvanized in accordance with ASTM A123 with the spelter conforming to grade 5 of ASTM B6.

b. Electroplating with zinc in accordance with type LS of ASTM B633 followed by a phosphate treatment conforming to method A of ASTM D2092.

c. Hot phosphoric or chromic acid treatment, or a coating of primer in accordance with DOD-P-15328 followed by two coats of primer conforming to TT-P-645.

3.2.2 Hazardous material. Materials for use in the construction of fan-coil assemblies shall have no effect on the health of personnel when the materials are used for intended purpose. Regardless of other requirements, materials and parts containing asbestos, cadmium, lithium, mercury, or radioactive material shall not be used.

3.2.3 Fasteners. Material for all bolts, nuts, studs, screws and similar fasteners shall be corrosion-resistant passivated, or of a material rendered resistant to corrosion. Sheet metal screws shall not be used. Galling shall be prevented. Tapped holes shall be reinforced where shearing of thread can occur.

3.2.4 Dissimilar metals. Fan-coil assembly and components shall not degrade due to electrolysis in accordance with MIL-STD-889.

3.2.5 Nonmagnetic material. When nonmagnetic fan-coil assemblies are specified (see 6.2), parts shall be fabricated of nonmagnetic material, which has a maximum relative permeability of less than 2.0 after fabrication.

3.2.6 Motor material. Motor material shall conform to the requirements of IEEE STD 45 or NEMA MG 1, as applicable, for nonmagnetic motors.

3.2.7 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Painting. The color of the fan-coil assembly shall be Light Gray, Navy Formula 111 of MIL-DTL-15090.

3.4 Welding and allied processes. Surfaces of parts to be welded or brazed shall be free from rust, scale, paint, grease, and other foreign matter. Welding and allied processes shall be performed by personnel certified to AWS B2.1 and B2.2. NAVSEA Technical Publication S9074-AR-GIB-010/278 shall be used for guidance.

3.5 Identification plates. Each fan-coil shall be provided with a permanently attached corrosion-resistant identification plate. Method of attachment of the identification plate shall be corrosion-resistant. The plate shall contain the following information:

a. National stock number (NSN)
b. Manufacturer's name, commercial and government entity (CAGE), and part number
c. PIN code
d. Contract or order number

3.6 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.

3.7 Operating life. The equipment shall have an operating life of 175,000 hours (continuously) except for replaceable parts such as bearings and V-belts. Replaceable parts other than the V-belts shall provide continuous operation for 35,000 hours before replacement is necessary. V-belts shall provide continuous operation for not less than 17,000 hours before replacement is necessary.

3.8 Workmanship. The fan-coil assembly shall be free from defects that affect appearance and operation. The tube sheets of the cooling coil shall not crack due to punching or forming, and fin collars shall not crack when forming tubes into collars. Fin edges of the cooling coil shall be free of burrs and shall not be bent. Sharp edges, burrs, and other imperfections shall be removed from all parts subject to contact with personnel to prevent cuts during repair and maintenance. Cabinet corners shall be square and fasteners shall be in place and secured.

3.9 Human engineering. The fan-coil assembly shall be arranged so as to achieve safe, reliable, and effective performance by the operator and maintenance personnel and to optimize personnel skill requirements. ASTM F1166 shall be utilized as a guideline in applying human engineering design criteria for the fan-motor unit.

3.10 Maintainability. The fan-coil assembly shall be constructed so that (see 4.6.8):

a. Fan and motor are removable.
b. V-belt is removable and replaceable.
c. Fan bearings and motor bearings are removable and replaceable.
d. Air filter is removable and replaceable.
e. Belt tension and sheave diameter are adjustable.
f. Cooling coil is removable.
g. All the above, except removal of air filter, shall be accomplished by using commonly available tools and without removal of attached ducting, disassembly of the fan-coil assembly, or removal from foundation. Quick acting fasteners requiring no tools shall be used for removal of air filter.

3.11 Design requirements. Each assembly shall consist of a fan and motor, a cooling coil for chilled water, and air filters mounted on and enclosed in a cabinet. The cabinet shall be equipped with thermal insulation and treated for noise attenuation, and shall be constructed for deck mounting. The cabinet shall also incorporate a provision to enable connection to supply and return ducts in the upper portion of the assembly and ready for installation and connection to a power source, drainage, and chilled water supply and return.

3.11.1 Size. The size of fan-coil assemblies shall be limited to those listed in Table I.

3.11.2 Cooling coil. A chilled water coil shall be provided having nonferrous tubes, fins, and headers, due to the exposure to salt water environment. The face area of the cooling coil for each size assembly shall be not less than that shown on Figure 1. The cooling coil shall be at least 6 rows deep in direction of airflow. The tubes shall have a minimum wall thickness of 0.025 inch throughout tube. The fins shall be not less than 0.010 inch thick and shall be uniformly spaced. The number of fins per linear inch of tube shall be not less than 7 or more than 12. Coil design shall be such as to prevent wear and breakage caused by shipboard vibration or expansion and contraction of tubes. The chilled water supply and return connections shall be on the same end of the coil and shall be fitted with union connections capable of test pressure of 300 lb/in^2 gauge.

3.11.2.1 Cooling coil vent and drain. The cooling coil shall be provided with means for venting and draining the coil. The vent shall be accessible and shall drain to the internal drain pan. Draining the coil shall be completed by a means other than breaking of the chilled water union connections.

3.11.3 Air filters. Air filters shall be provided for filtering all air entering the assembly. The air filters shall be in accordance with MIL-PRF-16552. Unless otherwise specified (see 6.2), air filters shall be removable through the front of the cabinet. Air filters shall be removable via an access panel held in the closed position by means of quick acting fasteners requiring no tools to operate. Air filters shall be removable without requiring power to the fan-coil assembly to be secured. There shall be no danger to personnel of electrical energy or mechanical hazard when removing or installing filters.

3.11.4 Thermal insulation. All internal surfaces of the cabinet or chassis that are subject to condensation shall be provided with insulation to prevent dripping or a continuous flow of moisture under rated capacity conditions. Insulation shall be of a non-halogenated closed cell type and shall not produce toxic smoke when exposed to a fire.

3.11.5 Acoustic insulation. Where acoustic insulation is required, it shall be such that it will satisfy both thermal and airborne noise requirements. Acoustic insulation shall not produce toxic smoke when exposed to a fire.

3.11.6 Fan. The fan used in the assembly shall be a belt-driven centrifugal fan. Unless otherwise specified (see 6.2), the fan shall produce an available total discharge pressure of 2 inches of water at the outlet of the fan-coil assembly at rated CFM delivery. The fan-motor horsepower for each assembly shall not exceed that specified in Table I when total discharge pressure is 2 inches of water or less. All rotating parts of the fan shall be designed to have a factor of safety of not less than eight based on the ultimate tensile strength of the material involved. The bearing shall be in accordance with ANSI/ABMA standards 4, 9, 13, 15, and ANSI/ABMA/ISO 3290. Bearing shall be capable of being locked onto the fan shaft and provided with a means for removal and/or replacement. The fan shall be statically and dynamically balanced and tested after being installed in the assembly.

3.11.7 Fan drive. The fan drive shall be multiple V-belt drive and shall include the fan pulley, matched V-belts, and motor pulley. V-belts, fan pulley, and motor shall be selected in accordance with ANSI/RMA Standards IP-20 and IP-25. The drive pulley shall be an adjustable positive locking pulley. Adjustment of pulley shall allow for at least a 30-percent variation in fan speed. The pulleys shall be balanced. The V-belts shall be selected for at least 150 percent of motor horsepower at rated capacity conditions. A positive action single point belt adjustment device shall be provided to permit adjustment of belt tension. A locking device to prevent loosening of belt tension shall be provided.

TABLE I. Capacity rating (nominal).

Fan-coil assembly	Cooling coil air and water flow for rated capacity			Fan	External static pressure, type III units only
Sizes	Capacity (Btu/h)	Air (SCFM)	Water (gal/min)	Motor horsepower (max)	External static pressure (in w.g.)
21	31,300	620	9	1½	2
22	51,200	1035	16	3	2
23	77,600	1540	23	5	2
24	99,800	2065	31	5	2
25	151,300	3080	44	7½	2

3.11.8 Type II, fan-coil assembly. The type II fan-coil assembly shall be a three-section unit consisting of a cooling coil section, which shall be the base of the unit, a fan-motor section, which shall be on top of the cooling coil section, and the air distribution plenum section on top. Each section shall be not greater than 25 inches in height, and when assembled together, the overall height of the unit shall be not greater than 75 inches. The overall width and depth of each assembled unit shall be not greater than the dimensions shown on Figure 1.

3.11.8.1 Cabinet. The cabinet enclosure of each section shall be constructed of a material equivalent in strength to 0.074-inch steel. The cabinet frame shall be rigid and of a strength to support and maintain alignment of the assembled parts. The cooling coil section shall be fitted with at least four reinforced pads, one at each corner of the section, for securing the assembled fan-coil assembly by bolting to a structural foundation.

3.11.8.2 Cooling coil section. The cooling coil section shall consist of a cooling coil and a condensate pan with a drain of 1-inch nominal pipe size (nps) on each end. Condensate pan shall be constructed to prevent slosh over when unit is tilted 15 degrees. Connection to the condensate drains shall be possible without the removal of an access panel. The cooling coil shall be serviceable through a front access panel. Provision shall be made to permit access to and removal of the cooling coil without disassembly of the fan-coil assembly. Provision shall be made to permit making a left-hand or right-hand assembly of the cooling coil by the installing activity after delivery. Removable panels, if used, shall use capture type fasteners and shall be airtight when installed. Unless otherwise specified (see 6.2), the fan-coil assembly shall be delivered with the chilled water supply and return connections of the cooling coil to the right when facing the front of the assembled fan-coil. A tapped hole shall be provided for ⅜-inch bolt on bottom right back of unit for attachment of grounding strap.

3.11.8.3 Fan-motor section. The fan-motor section shall consist of a centrifugal fan, fan drive, electric motor, fan and motor base with resilient mounts, and air filters. Provision shall be made to permit access to and removal of the fan. Removable panels, if used, shall use captive type fasteners, and shall be airtight when installed. Provisions shall be made to permit access to the air filters, fan drive and the fan-motor, service and adjust the fan belts and pulley, and remove the fan pulley and the fan motor without disassembly of the fan-coil assembly.

3.11.8.4 Air distribution plenum section. The air distribution plenum section shall include a single air inlet located on top of the cabinet. Provisions shall be made in the air distribution plenum for one air outlet on the top and one on each end. The inside dimensions of the air inlet and each of the air outlets shall be as shown on Figure 1. Three options are available in the air distribution plenum section: the air inlets and outlets shall have smooth flat surfaces for attachment of flanged duct connections, each air outlet shall be supplied with a grille, or a coverplate shall be supplied that harmonizes with the cabinet enclosure. The grille shall be constructed to permit adjustable directional airflow in both horizontal and vertical planes. Unless otherwise specified (see 6.2), the fan-coil assembly shall be supplied with coverplates. The coverplates shall be gasketed.

3.11.8.5 Static air pressure tap. Fan-coil assemblies shall be provided with a static air pressure tap on the downstream side of the filters for permanent mounting of a differential pressure gauge or for checking static air pressure with a portable differential pressure gauge. The tap shall consist of a gasketed, brass or corrosion-resistant steel, ¼-inch tube, straight bulkhead connection with sealing cap and protective cover suitable for permanent mounting to side of cabinet.

3.11.9 Type III, fan-coil assembly. The type III fan-coil assembly shall be a two-section unit consisting of a cooling coil section which shall be the base of the assembled unit and a fan-motor section on top. Each section shall be not greater than 25 inches in height, and when assembled together, the overall height of the unit shall be not greater than 50 inches. The overall width and depth of each assembled unit shall be not greater than the dimensions shown on Figure 1.

3.11.9.1 Cabinet. The cabinet shall be in accordance with 3.11.8.1.

3.11.9.2 Cooling coil section. The cooling coil section shall be as specified in 3.11.8.2.

3.11.9.3 Fan-motor section. The fan-motor section shall be as specified in 3.11.8.3, and shall have a single air inlet, and a single air outlet located on top of the cabinet. The inside dimensions of the air inlet and the air outlet shall be as shown on Figure 1. The air inlets and outlets shall have smooth flat surfaces for attachment of flanged duct connections.

3.11.9.4 Static air pressure tap. A static air pressure tap shall be provided in accordance with 3.11.8.5.

3.12 Performance. The performance of the fan-coil assembly for a given airflow at specified dry bulb (DB) and wet bulb (WB) air temperatures entering the cabinet and a specific water temperature at a flow of 3.6 gal/min/ton through the cooling coil shall be as specified in Table II through Table VI, as applicable. Tolerances for airflow and water flow shall be as specified in 3.12.1. The entering water temperature, the entering DB air temperature, and the entering and leaving WB air temperatures shall be within plus or minus 0.5 degrees of that specified in the applicable table.

3.12.1 Nominal capacity rating. The nominal capacity rating of the fan-coil assembly cooling coil shall be at least equal to that specified in Table I, based on 80 °F DB temperature and 67 °F WB air temperature entering the cabinet with 50.6 °F WB air temperature leaving the coil when the entering water is 45 °F. The airflow at the cabinet outlet shall be within plus or minus 5 percent of the rated airflow specified in Table I. The water flow through the coil shall be within plus or minus 5 percent of the rated water flow specified in Table I.

3.12.2 Inclined operation. Fan-coil assembly shall operate when permanently inclined 15 degrees from the normal vertical position in any direction (see Figure 1).

3.12.3 Electrical requirements.

3.12.3.1 Power requirements. Unless otherwise specified, electric motors shall operate on 440-volt, three-phase, 60-Hz power with the characteristics described in MIL-STD-1399-300.

3.12.3.2 Ambient temperature. All electrical components shall be designed for continuous operation in a maximum of 50 °C ambient temperature.

3.12.3.3 Electrical motors. Motors for fan-coil assemblies shall be in accordance with IEEE STD 45. Motors specified to be Grade A shock qualified in 6.2, shall be continuous duty HI shock qualified in accordance with MIL-S-901. Motors for use in non-HI shock fan-coil assemblies (Type X) shall be commercial marine motors in accordance with IEEE STD 45. Maximum horsepower shall not exceed values shown in Table I.

3.12.3.4 Cable entrance. Provisions shall be made for the entry of electrical cables to the fan-motor section of the fan-coil assembly.

TABLE II. Size 21 performance (3.6 gal/min/ton).

Chilled water (°F)	Entering air DB (°F)	Entering air WB (°F)	SCFM					
			400		620 [3/]		760	
			MBH [1/]	WB	MBH	WB	MBH	WB
45	70 [2/]	58.0 [2/]	10.7 [2/]	48.0	15.5 [2/]	48.5	18.4 [2/]	49.0
		60.0	15.0	48.5	21.5	49.5	25.2	50.0
		64.0	17.5	48.5	25.3	50.0	29.7	50.5
		66.0 [2/]	20.2 [2/]	49.0	29.3 [2/]	50.0	34.3 [2/]	51.0
	80 [2/ 3/]	62.0 [2/]	15.6 [2/]	48.0	22.8 [2/]	49.0	27.0 [2/]	49.0
		67.0 [3/]	21.6	48.5	31.3 [3/]	50.0	36.7	51.0
		70.0	25.9	49.0	37.8	50.5	44.4	51.5
		72.5 [2/]	29.8 [2/]	49.0	43.4 [2/]	51.0	51.2 [2/]	51.5
	100 [2/]	68.5 [2/]	24.4 [2/]	48.0	36.1 [2/]	49.0	40.9 [2/]	51.0
		76.0	35.5	49.0	51.5	51.5	61.2	52.5
		81.5	45.4	49.5	66.5	52.0	78.7	53.5
		83.5 [2/]	49.4 [2/]	50.0	72.3 [2/]	52.5	85.8 [2/]	54.0

Notes:

[1/] Thousands, Btu/h

[2/] Test points

[3/] 620 Nominal rating point

TABLE III. Size 22 performance (3.6 gal/min/ton).

Chilled water (°F)	Entering air DB (°F)	Entering air WB (°F)	SCFM					
			800		1035 [3/]		1260	
			MBH [1/]	WB	MBH	WB	MBH	WB
45	70 [2/]	58.0 [2/]	20.6 [2/]	48.5	25.7 [2/]	49.0	30.1 [2/]	49.0
		62.0	28.7	49.0	35.1	50.0	41.0	50.5
		64.0	33.7	49.5	41.6	50.0	48.3	51.0
		66.0	38.9 [2/]	49.5	48.2 [2/]	50.5	56.1 [2/]	51.0
	80 [2/ 3/]	62.0 [2/]	30.1 [2/]	48.5	37.4 [2/]	49.0	44.0 [2/]	49.5
		67.0	41.6	49.5	51.2 [3/]	50.5	59.9	51.0
		70.0	49.9	50.0	61.5	51.0	72.2	51.5
		72.5 [2/]	57.4 [2/]	50.0	70.8 [2/]	51.5	83.0 [2/]	52.5
	100 [2/]	68.5 [2/]	47.4 [2/]	49.0	56.2 [2/]	51.0	67.1 [2/]	51.0
		76.0	68.5	50.5	84.5	52.0	99.5	53.0
		81.5	87.4	51.5	108.5	53.0	128.2	54.0
		83.5 [2/]	95.4 [2/]	51.5	117.9 [2/]	53.5	138.8 [2/]	55.0

Notes:

[1/] Thousands, Btu/h

[2/] Test points

[3/] 1035 Nominal rating point

TABLE IV. Size 23 performance (3.6 gal/min/ton).

Chilled water (°F)	Entering air DB (°F)	Entering air WB (°F)	SCFM					
			1000		1540 [3/]		1880	
			MBH [1/]	WB	MBH	WB	MBH	WB
45	70 [2/]	58.0 [2/]	26.9 [2/]	48.0	39.0 [2/]	48.5	45.6 [2/]	49.0
		62.0	37.6	48.5	53.4	50.0	62.4	50.0
		64.0	44.1	48.5	62.9	50.5	63.5	50.5
		66.0 [2/]	50.5 [2/]	49.0	72.9 [2/]	50.0	84.9 [2/]	51.0
	80 [2/ 3/]	62.0 [2/]	38.9 [2/]	48.0	56.6 [2/]	48.5	66.8 [2/]	49.0
		67.0 [3/]	54.1	48.5	77.6 [3/]	50.0	90.9	51.0
		70.0	64.8	49.0	92.8	50.5	109.2	51.5
		72.5 [2/]	74.2 [2/]	49.0	107.2 [2/]	51.0	125.3 [2/]	52.0
	100 [2/]	68.5 [2/]	60.7 [2/]	46.0	84.2 [2/]	51.0	100.7 [2/]	51.0
		76.0	88.2	49.5	127.5	51.5	150.5	52.5
		81.5	113.2	50.0	163.7	52.5	192.1	54.0
		83.5 [2/]	122.5 [2/]	50.5	177.4 [2/]	53.0	203.0 [2/]	55.5

Notes:

[1/] Thousands, Btu/h

[2/] Test points

[3/] 1540 Nominal rating point

TABLE V. Size 24 performance (3.6 gal/min/ton).

Chilled water (°F)	Entering air DB (°F)	Entering air WB (°F)	SCFM					
			1500		2065 [3/]		2550	
			MBH [1/]	WB	MBH	WB	MBH	WB
45	70 [2/]	58.0 [2/]	38.5 [2/]	48.5	47.7 [2/]	49.5	56.9 [2/]	50.0
		62.0	52.6	49.5	67.2	50.5	78.8	51.0
		64.0	61.8	49.5	79.4	50.5	93.2	51.5
		66.0 [2/]	72.1 [2/]	49.5	92.5 [2/]	51.0	108.7 [2/]	51.5
	80 [2/ 3/]	62.0 [2/]	56.8 [2/]	48.5	74.1 [2/]	49.0	84.1 [2/]	50.5
		67.0 [3/]	76.9	49.5	99.8 [3/]	51.0	117.7	51.5
		70.0	93.0	50.0	120.7	51.5	143.1	52.0
		72.5 [2/]	107.6 [2/]	50.0	140.0 [2/]	51.5	165.0 [2/]	52.5
	100 [2/]	68.5 [2/]	90.0 [2/]	48.5	113.8 [2/]	50.5	137.5 [2/]	50.5
		76.0	128.9	50.0	168.0	52.0	197.7	53.5
		81.5	154.7	50.5	203.1	52.5	240.5	54.0
		83.5 [2/]	180.0 [2/]	51.0	235.4 [2/]	53.5	277.8 [2/]	55.0

Notes:

[1/] Thousands, Btu/h

[2/] Test points

[3/] 2065 Nominal rating point

TABLE VI. Size 25 performance (3.6 gal/min/ton).

Chilled water (°F)	Entering air DB (°F)	Entering air WB (°F)	SCFM					
			2300		3080 3/		3800	
			MBH 1/	WB	MBH	WB	MBH	WB
45	70 2/	58.0 2/	60.0 2/	48.5	75.8 2/	48.5	86.1 2/	49.5
		62.0	81.5	49.5	103.0	50.0	119.4	51.0
		64.0	96.5	49.5	121.6	50.5	142.3	51.0
		66.0 2/	111.4 2/	49.5	141.5 2/	50.5	165.0 2/	51.5
	80 2/ 3/	62.0 2/	87.6 2/	48.5	112.1 2/	49.0	126.5 2/	50.0
		67.0 3/	119.6	49.5	151.3 3/	50.5	178.4	51.5
		70.0	144.3	49.5	183.2	51.0	216.3	52.0
		72.5 2/	166.5 2/	50.0	210.9 2/	51.5	248.9 2/	52.5
	100 2/	68.5 2/	138.9 2/	48.5	170.7 2/	50.0	206.5 2/	50.5
		76.0	199.4	50.0	252.6	51.5	300.2	53.0
		81.5	255.7	50.5	327.4	52.5	388.8	54.0
		83.5 2/	277.8 2/	51.0	354.8 2/	53.0	420.3 2/	54.5

Notes:

1/ Thousands, Btu/h

2/ Test points

3/ 3080 Nominal rating point

3.13 Environmental conditions.

3.13.1 Shock. Unless otherwise specified (see 6.2), fan-coil assemblies shall pass the high impact shock tests specified in 4.6.1. Internal shock and vibration mounts shall be provided in conjunction with the mounting arrangement for the fan and motor assembly. The mounts shall be the captive type.

3.13.2 Vibration. Unless otherwise specified (see 6.2), fan-coil assemblies shall withstand without damage or malfunction environmental vibrations as specified in 4.6.2 in accordance with MIL-STD-167-1 for type I "environmental vibration" for frequencies up to and including 33 Hz.

3.13.3 Airborne noise. The total sound power level for a type II or a type III fan-coil assembly shall not exceed the levels specified in Table VII when tested in accordance with procedures defined in 4.6.4.

3.13.4 Replenishment air. Replenishment air introduced into unit is sea air at 40 °F to 95 °F.

3.13.5 Ambient air. Perform in accordance with the requirements herein under ambient temperatures between 40 °F and 95 °F.

TABLE VII. Total sound power level dB referenced to 10^{-12} watts.

Octave band center frequency (Hz)								
Size	63	125	250	500	1000	2000	4000	8000
21	77	74	71	68	65	62	59	56
22	80	77	74	71	68	65	62	59
23	83	80	78	74	71	68	65	62
24	86	83	80	77	74	71	68	65
25	89	86	83	80	77	74	71	68

4. VERIFICATION

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

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall be performed on each size fan-coil assembly when a first article sample is required (see 3.1). This inspection shall include the examination of 4.4 and the tests of Table VIII.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.4 and the tests of Table VIII.

4.4 Examination. Each fan-coil assembly shall be examined for compliance with the requirements specified in 3.2 through 3.13. Any redesign or modification of the contractor's standard product to comply with the specified requirements, or any necessary redesign or modification following failure to meet the specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Non-compliance with any specified requirements or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.6 Tests. Tests shall be conducted in accordance with 4.6.1 through 4.6.8.

4.6.1 Shock test. The fan-coil assembly shall be shock tested on the medium-weight machine as specified for grade A shock of MIL-S-901 (see 6.2). The fan-coil assembly shall be operated at rated voltage and current, rated airflow, and a hydrostatic pressure of at least 100 pounds per square inch (lb/in^2) gauge shall be maintained on the cooling coil of the unit during the shock tests. Evidence of fragmentation or missile effect of parts, deformation that will cause active interference between parts, failure to operate, or leakage of the cooling coil shall be cause for rejection.

4.6.2 Vibration tests. The fan-coil assembly shall be subjected to type I vibration tests in accordance with MIL-STD-167-1 (see 6.2). The exploratory vibration test specified in MIL-STD-167-1 shall include frequencies up to and including 33 Hz at the table amplitude specified therein. The rotating components of the fan-coil units shall meet the balance requirements of MIL-STD-167-1 for type II vibration. Any unit which fails to meet any requirements shall be rejected.

4.6.3 Performance tests. Performance tests shall be as specified in 4.6.3.1 through 4.6.3.3.

TABLE VIII. Test agenda.

Applicability of test to fan-coil assembly				
Tests	**Requirement**	**Test**	**First Article**	**Conformance**
Shock	3.13.1	4.6.1	HI Shock	-----
Vibration	3.13.2	4.6.2	√	-----
Performance	3.12 & 3.12.1	4.6.3	√	-----
Airborne Noise	3.13.3	4.6.4	√	-----
Nonmagnetic	3.2.5	4.6.5	Only non-magnetic units	-----
Motor	3.12.3	4.6.6	√	√
Leakage	3.11.2	4.6.7	√	√
Maintainability	3.10	4.6.8	√	-----

4.6.3.1 Capacity tests. The capacity of each type and size fan-coil assembly shall be determined at the conditions specified in 3.12.1 and at 45 °F chilled water temperature for the Note 2 points on Table II through Table VI. The airflow through the fan-coil assembly shall be measured in accordance with ASHRAE 37. The capacity tests of the cooling coil installed in the assembly shall be conducted in accordance with ASHRAE 33.

4.6.3.2 Flexibility and range tests. The leaving WB temperature and capacity (BTU/HR) for each type and size fan-coil assembly shall be determined at the conditions specified in 3.11.6 and 4.6.3.1. Airflow measurement and cooling coil tests shall be conducted as specified in 4.6.3.1. At least one test shall be conducted with the unit inclined 15 degrees from the normal vertical position in any direction.

4.6.3.3 Limitation tests. The maximum acceptable operating limits (see Table II through Table VI) of each type and size of fan-coil assembly shall be established without exceeding the total sound power levels specified in Table VII limitations and without carryover of cooling coil condensate.

4.6.4 Airborne noise. Measurement of sound pressure levels (octave band, flat, unweighted) and computation of sound power levels (octave band) shall be in accordance with procedures and instrumentation requirements defined in AMCA 300, and amendments to those procedures as identified herein. Procedures of AMCA 300 shall be modified to substitute the term “fan-coil assembly” in place of the word “fan”. All sound measuring instrumentation shall be laboratory calibrated within one year of the date of test, excluding the reference sound source which shall comply with the laboratory calibration requirements stated in AMCA 300. A random incidence response microphone and a type I (precision) sound level meter conforming to the requirements of AMCA 300 shall be used. The fan-coil assembly shall be operated at fan speed providing nominal airflow delivery conditions for the size unit under test (see Table II through Table VI, herein), based upon internal pressure drop and fan performance curves. For a type III fan-coil assembly an external static pressure of 2 in. w.g. shall be maintained at all times. When duct sections are attached to a fan-coil assembly to facilitate testing, they shall be attached to the fan-coil assembly with flexible duct connectors. Duct sections shall be rigid, heavy gauge metal ducts and/or non-perforated, double wall ducts to eliminate noise contributions transmitted through duct walls. When a duct section is attached to a fan-coil assembly to facilitate measurements, the duct section shall have the same interior, open cross sectional dimensions as the opening in the fan-coil assembly to which it is attached. There shall be no exposed sound absorbing material on the interior or exterior surfaces of the attached ducts.

4.6.4.1 Total sound power levels for a type II fan-coil assembly. Test and calculation procedures to determine total sound power for a type II fan-coil assembly shall be performed in accordance with Figure 1 of AMCA 300. The cover plate shall be removed from the air inlet opening. The cover plate shall be removed from the air outlet opening in the top surface only. No duct sections shall be attached to the fan-coil assembly.

4.6.4.2 Total sound power levels for a type III fan-coil assembly. Test and calculation procedures to determine total sound power levels for a type III fan-coil assembly shall be performed in accordance with Figure 1 of AMCA 300, or Appendix H of AMCA 300 installation type B: free inlet/ducted outlet, when a discharge duct and an orifice plate are installed to achieve design pressure. When an orifice plate is installed, it shall be a quiet type which does not produce excessive flow-induced noise. When a discharge duct is installed to achieve an external static pressure of 2 in. w.g., a short section of duct containing one 90-degree elbow shall be attached to the air outlet located in the top of the fan-coil assembly. The interior open cross sectional dimensions of the duct, including elbow shall be identical to those of the air outlet (discharge) opening of the fan-coil assembly. The length of the duct shall be such that the discharge end of the duct does not extend more than 1 ft. beyond the rear vertical edge of the casing of the fan-coil assembly. No portion of the duct shall extend more than 2.5 ft. above the top horizontal edge of the fan-coil assembly. The cover plate shall be removed from the air inlet. The microphone travel shall be such that a direct line of sight between the microphone and the inlet air opening and/or the outlet air opening shall be maintained.

4.6.5 Permeability tests. A permeability test of nonmagnetic material use in construction of fan-coil assembly shall be conducted in accordance with MIL-STD-2142, Test 501 (see 3.2.5).

4.6.6 Motor tests.

a. The insulation resistance test and the dielectric strength test shall be conducted in accordance with IEEE STD 45.

b. The fan-motor of each fan-coil assembly shall be tested at rated voltage and current to determine whether the fan and motor will operate. Any fan-coil assembly in which the motor or the fan and motor fails to operate, shall be rejected.

4.6.7 Leakage test. The cooling coil of each fan-coil assembly shall be tested at a hydrostatic or pneumatic pressure of at least 300 lb/in^2 gauge. When tested there shall be no cooling coil leakage in the fan-coil assembly.

4.6.8 Maintainability demonstration. The first production unit shall be examined after testing, and the capability to maintain, disassemble, and repair the unit shall be demonstrated. The demonstration shall be conducted utilizing the recommended tools and with other than expert mechanics. Evidence that maintainability of the fan-coil assembly cannot be accomplished by other than expert mechanics shall be cause for failure of the demonstration. The maintainability demonstration shall include but not be limited to the following (see 4.7):

a. Replacement of fan bearing.
b. Replacement of V-belts.
c. Replacement of fan-motor.
d. Replacement of motor bearing.
e. Removal of air filters for servicing and replacement.
f. Adjustment and locking of adjustable motor sheave.
g. Replacement of cooling coil.
h. Servicing of cooling coil.

4.7 Test schedule. The schedule for testing the fan-coil assembly shall be performed as shown in Table VIII.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The fan-coil assembly is intended for use in lieu of a fan room with built-up system on board. It is designed for ready connection to a chilled water system, a drainage system, an air distribution system, and a power source. The belt drive for the centrifugal fan is intended to permit selection of capacity to fit application depending on the use or extent of ductwork required. The adjustable motor pulley is specified to permit ready selection of fan speed to fit specific application. Type II fan-coil assemblies should be specified when no duct sections are to be attached to the unit when it is placed in service. Type III fan-coil assemblies should be specified when one or more duct sections are to be attached to the air inlet or to the air outlet of the fan-coil assembly when it is placed in service.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. Type, size, and capacity required (see 1.2).
c. When first article is required (see 3.1).
d. Whether nonmagnetic fan-coil assemblies are required (see 3.2.5).
e. Air filters removable from other side than front of the cabinet (see 3.11.3).
f. Fan pressure requirement, if other than specified (see 3.11.6).

g. Whether left hand assembly is required (see 3.11.8.2).
h. Whether grilles or coverplates are required (see 3.11.8.4).
i. Whether HI shock or non-HI shock is required (see 3.13.1).
j. Whether vibration is required (see 3.13.2).
k. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Centrifugal fan
Chilled water
Cooling coil
Dehumidifying
Heat exchanger
Heat transfer
HVAC
Ventilation

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

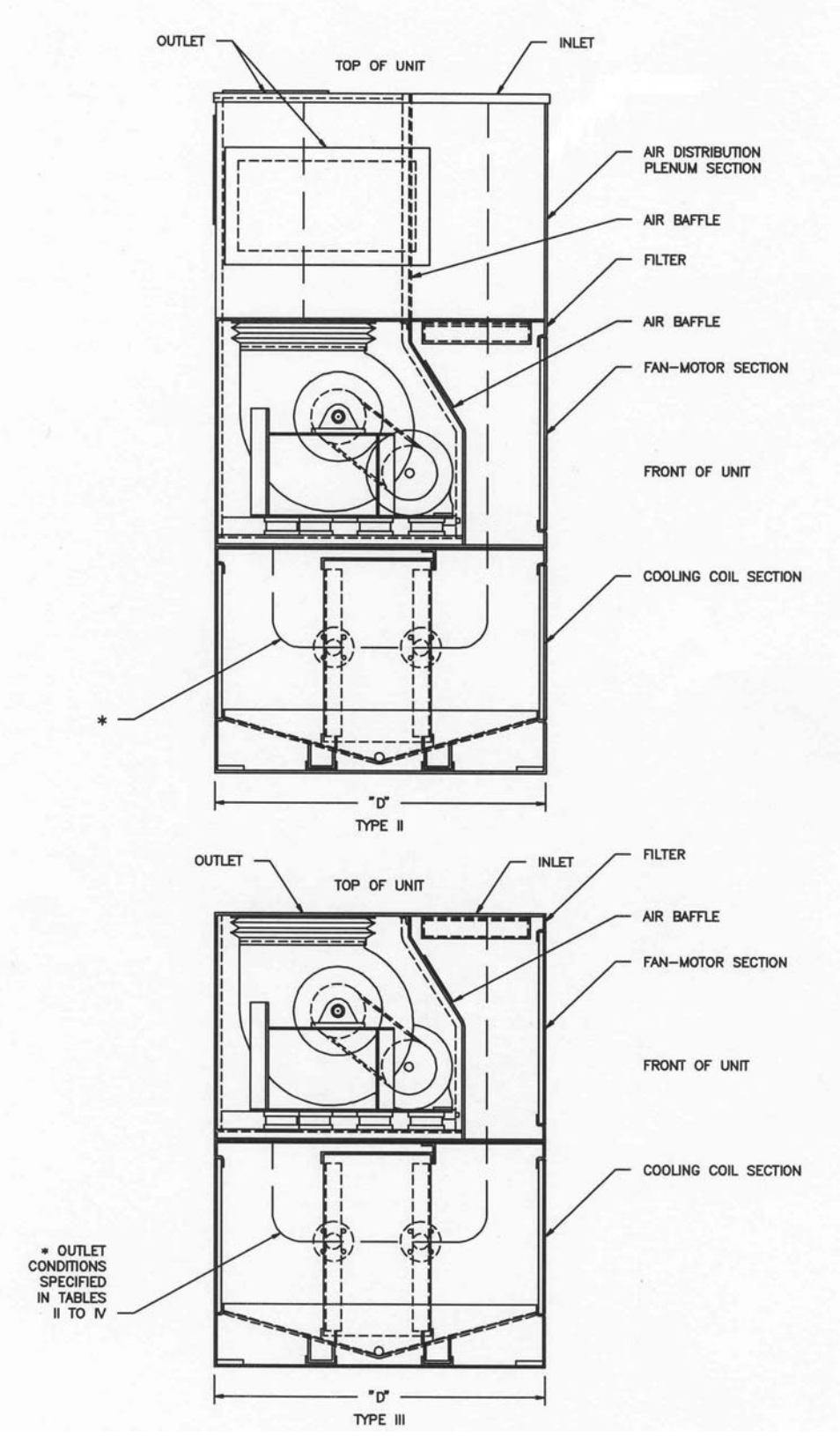
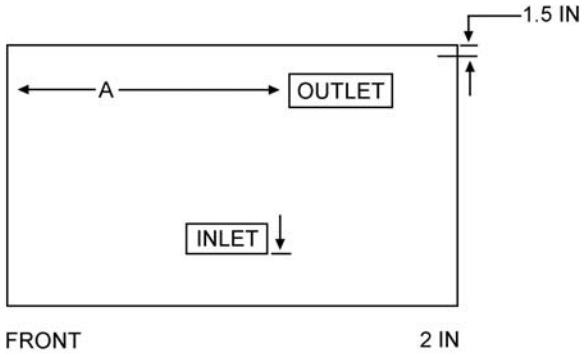


FIGURE 1. Fan-coil assemblies. (sheet 1 of 4)

Type II outlets to be centered in top of unit.

Type II and III inlets to be centered.

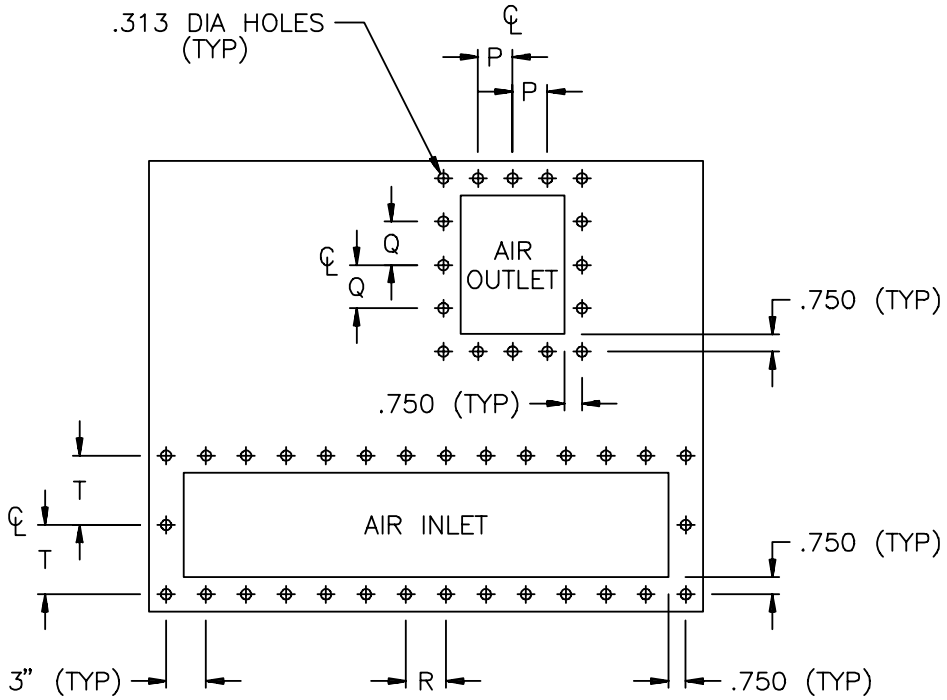
TYPE III
Shown



Size	21	22	23	24	25
Type III only A (inches ± ⅛)	24⅜	23⁹⁄₁₆	24¾	23⅛	25⅝

Physical data							
	Maximum cabinet		Inlet/outlet dimensions (inches ± ⅛)				
Fan-coil assembly	Dimensions (inches)		Type II outlets		Type III outlets	Type II, III inlets	Min face area (sq ft)
Sizes	Width	Depth	Top	Ends	Top	Top	Cooling coil
21	44	28	36 x 10	14 x 10	9¼ x 8⅝	38 x 6	1.5
22	44	28	36 x 10	14 x 10	10⅞ x 10⅜	38 x 6	2.5
23	48	32	42 x 10	18 x 10	12½ x 10⅜	29¾ x 12	3.7
24	51	37	44 x 12	24 x 10	16¾ x 12	40⁹⁄₁₆ x 12	4.2
25	56	37	48 x 12	24 x 10	16¾ x 12	39⅜ x 17½	6.2

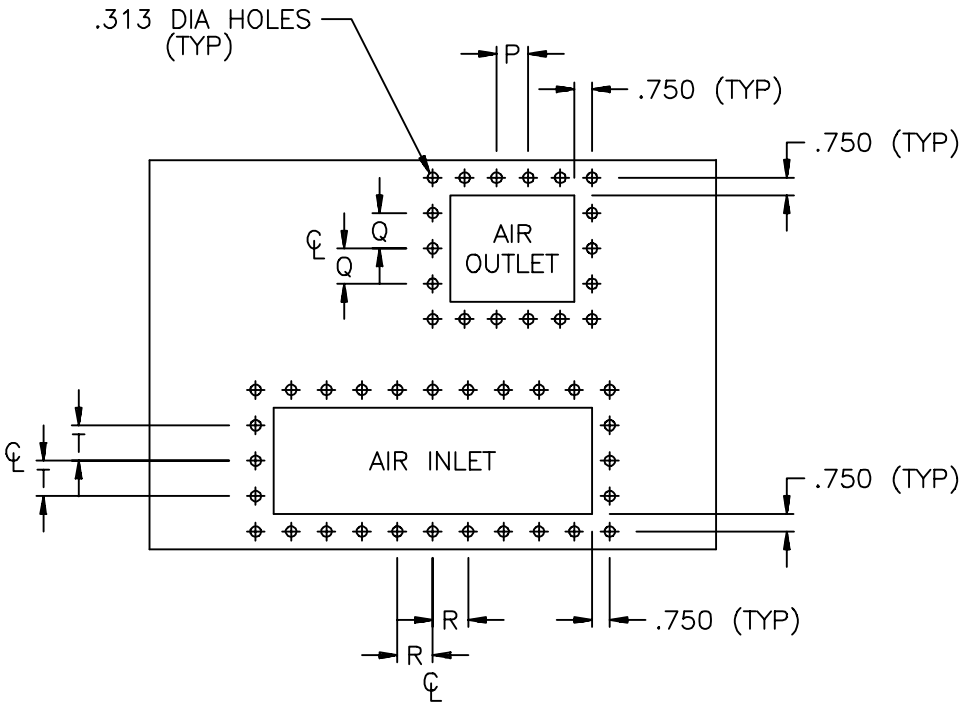
FIGURE 1. Fan-coil assemblies – Continued.



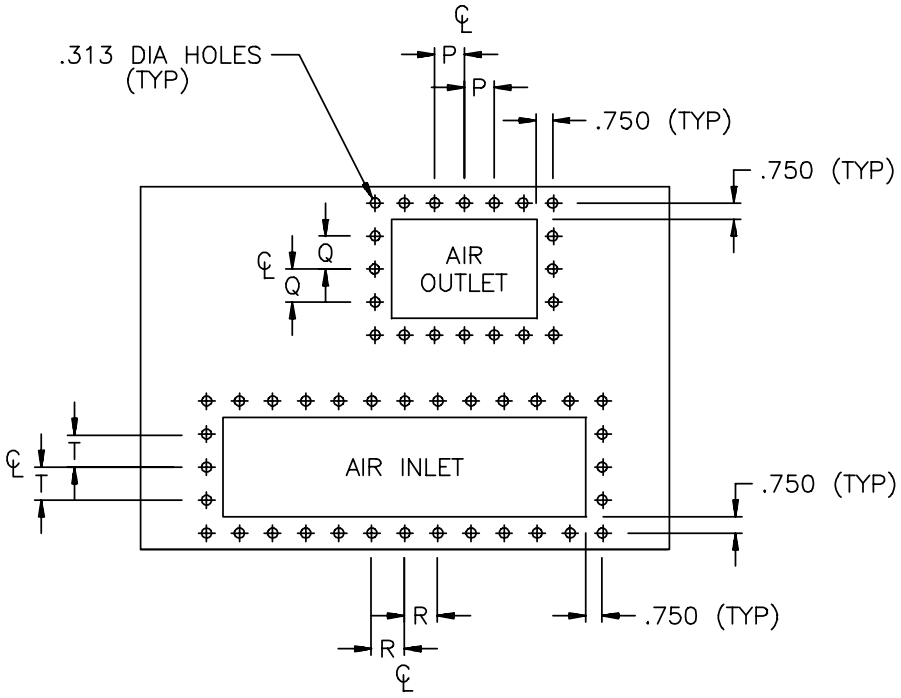
TOP VIEW – BOLTING PATTERNS
(SIZES 21 & 22)

Size of unit	Dimensions (inches ± 1/16)			
	P	Q	R	T
21	2.375	2.063	3.500	3.750
22	3.188	2.938	3.500	3.750
23	2.00	2.938	3.625	3.750
24	3.125	3.750	2.031	3.750
25	3.125	3.750	2.438	3.500

FIGURE 1. Fan-coil assemblies – Continued.



TOP VIEW – BOLTING PATTERNS
(SIZE 23)



TOP VIEW – BOLTING PATTERNS
(SIZE 24 & 25)

FIGURE 1. Fan-coil assemblies – Continued.

Preparing Activity:
Navy - SH
(Project 4120-1052-000)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.