INCH-POUND
MIL-A-24775(SH)
13 July 1992

MILITARY SPECIFICATION

AIR CONDITIONING FAN COIL UNITS, HORIZONTAL AND VERTICAL TYPES, NAVAL SHIPBOARD

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 horizontal and vertical type air conditioning fan coil units for use in heating, ventilating, and air conditioning (HVAC) systems aboard Naval ships.

1.2 Classification. The air conditioning fan coil units covered by this specification are of the following types, sizes, classes and as specified (see 6.2):

Type H - Horizontal, overhead mounting.
Type V - Vertical, bulkhead mounting.
Type NMH - Nonmagnetic construction, horizontal, overhead mounting.
Type NMV - Nonmagnetic construction, vertical, bulkhead mounting.

Item A - Cooling unit with heater.
Item B - Cooling unit without heater.

Sizes 1-8 - Based on capacity (British thermal units per hour in thousands (MBH)) values as specified in 3.4.2.

Heater KW - Based on heating (Kilowatt (kW)) values as specified in 3.4.2.

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, 2531 National Center Bldg 3, Washington, DC 20362-5160 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

Class RH - Right Handed - type DW chilled water coil.
Class LH - Left Handed - type DW chilled water coil.

Motor Protection LVP - Low Voltage Protection.
Motor Protection LVR - Low Voltage Release.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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).
QQ-P-35	- Passivation Treatments for Corrosion-Resistant Steel.
QQ-P-416	- Plating Cadmium (Electrodeposited).
TT-P-664	- Primer Coating Synthetic, Rust-Inhibiting, Lacquer Resisting.
TT-S-1657	- Sealing Compound-Single Component, Butyl Rubber Based, Solvent Release Type (for Buildings and Other Types of Construction).
PPP-F-320	- Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

MILITARY

MIL-P-116	- Preservation, Method of.
MIL-S-901	- Shock Test, H.I. (High-Impact) Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-E-917	- Electric Power Equipment, Basic Requirements (Naval Shipboard Use).
MIL-F-1183	- Fittings, Pipe, Cast Bronze, Silver-Brazing, General Specification for.
MIL-C-2212	- Contactors and Controllers, Electric Motor AC or DC, and Associated Switching Devices.
MIL-A-3316	- Adhesives, Fire-Resistant, Thermal Insulation.
MIL-L-3661	- Lampholders, Indicator Lights, Indicator-Light Housings, and Indicator-Light Lenses, General Specification for.
MIL-C-5015	- Connectors, Electrical, Circular Threaded, AN Type, General Specification for.
MIL-T-7928	- Terminals, Lug: Splices, Conductors: Crimp Style, Copper, General Specification for.
MIL-P-15024	- Plates, Tags and Bands for Identification of Equipment.
MIL-P-15024/5	- Plates, Identification.
MIL-M-15071	- Manuals, Technical: Equipments and Systems Content Requirements for.

MILITARY (Continued)

MIL-E-15090 - Enamel, Equipment, Light Gray (Formula No. 111).
MIL-F-15160 - Fuses: Instrument, Power, and Telephone (Nonindicating), Style F05.
DOD-P-15328 - Primer (Wash), Pretreatment (Formula No. 117 for Metals). (Metric)
MIL-T-16315 - Transformers, Power, Step-Down (Miscellaneous, Naval Shipboard Use).
MIL-F-16552 - Filters, Air Environmental Control System, Cleanable, Impingement (High Velocity Type).
MIL-M-17059 - Motors, 60-Cycle Alternating-Current, Fractional H.P. (Shipboard Use).
MIL-E-17555 - Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts): Packaging of.
MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated.
MIL-F-19207 - Fuseholders, Extractor Post Type, Blown Fuse Indicating and Non-Indicating General Specification for.
MIL-I-22023 - Insulation Felt, Thermal and Sound Absorbing Felt, Fibrous Glass, Flexible.
MIL-H-22594 - Heaters, Duct Type, Electric.
MIL-S-22885 - Switches, Push Button, Illuminated, General Specification for.
MIL-P-24441 - Paint, Epoxy-Polyamide General Specification for.
DOD-G-24508 - Grease, High Performance, Multipurpose. (Metric)
DOD-I-24688 - Insulation Panel, Thermal and Acoustic Absorptive, Open-Cell Polyimide Foam.
MIL-I-24703 - Insulation, Pipe, Polyphosphazene, Sheet and Tubular.
MIL-T-55164 - Terminal Boards, Molded, Barrier Screw and Stud Types, and Associated Accessories, General Specification for.
MIL-C-81751 - Coating, Metallic-Ceramic.
MIL-F-87090 - Foam, Combustion Retardant for Cushioning Supply Items Aboard Navy Ships.

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-889 - Dissimilar Metals.
MIL-STD-1310 - Shipboard Bonding, Grounding; and Other Techniques for Electromagnetic Compatibility and Safety.

MILITARY (Continued)

MIL-STD-1399, Section 300 - Interface Standard for Shipboard Systems Section 300, Electric Power, Alternating Current. (Metric)
MIL-STD-1472 - Human Engineering Design Criteria for Military Systems, Equipment and Facilities.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, BLDG. 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.

DRAWINGS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)
NAVSHIPS 805-1577080 - Air Filter Gages.

(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 - Piping Systems Brazed, Fabrication and Inspection.
0900-LP-003-8000 - Metals, Surface Inspection Acceptance Standards.

(Application for copies should be addressed to the Standardization Documents Order Desk, BLDG. 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 the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
A5.1 - Specification for Covered Carbon Steel Arc Welding Electrodes.

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
410 - Forced Circulation Air-Cooling and Air-Heating Coils.

(Application for copies should be addressed to the Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Suite 600, Arlington, VA 22209-2403, Attn: Publications Department.)

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

33 - Methods of Testing Forced Circulation Air Cooling and Air Heating Coils.

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, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Code.

Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

A 240 - Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Fusion Welded Unfired Pressure Vessels.

A 307 - Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.

A 385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip). (DoD adopted)

A 526 - Standard Specification for Steel Sheet Zinc Coated (Galvanized) by the Hot-Dip Process Commercial Quality.

A 527 - Standard Specification for Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.

A 569 - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality. (DoD adopted)

B 6 - Standard Specification for Zinc.

B 43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes. (DoD adopted)

B 75 - Standard Specification for Seamless Copper Tube. (Metric) (DoD adopted)

B 88 - Standard Specification for Seamless Copper Water Tube. (DoD adopted)

B 152 - Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar. (DoD adopted)

B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate. (DoD adopted)

B 211 - Standard Specification for Aluminum and Aluminum Alloy-Bar, Rod, and Wire. (DoD adopted)

B 344 - Standard Specification for Drawn or Rolled Nickel-Chromium and Nickel-Chromium-Iron Alloys for Electrical Heating Elements.

ASTM (Continued)

B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel. (DoD adopted)

C 1071 - Standard Specification for Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material). (DoD adopted)

D 2092 - Standard Practice for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Paint.

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

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

3.2 Reliability.

3.2.1 Operating life. Fan coil units shall have an operating life of 126,000 hours. The basis for design of replacement parts shall be 5 years of ship operation (21,000 hours).

3.2.2 Reliability analysis. The contractor shall analyze factors affecting reliability (see 6.3 and appendix A).

3.3 Materials. Materials for use in the construction of fan coil units shall be as specified in 3.3.1 through 3.3.10.5. The materials shall be free from defects that might affect the serviceability or appearance of the finished product.

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

3.3.2 Materials not specified. Commercial materials will be permitted for fan coil unit parts when Government specifications are not available. When not identified by Government specifications, steel and aluminum materials shall be identified by the American Society for Testing and Materials (ASTM), number or range of numbers, for example, ASTM A 385, or by Aluminum Association number, for example 5052.

3.3.3 Aluminum alloys. Aluminum alloys shall conform to the requirements of table I, except as noted in 3.3.1.

TABLE I. Aluminum alloy materials.

Material	ASTM Designation
Plate and sheet	ASTM B 209, Alloy 5052, H32 Temper 1/ ASTM B 209, Alloy 5086, H32 Temper ASTM B 209, Alloy 6061, T4 or T6 Temper ASTM B 209, Alloy 3003 H14 Temper 2/
Bars, shapes, rods, wire, and rivets	ASTM B 211, Alloy 5052, H32 Temper

1/ Preferred for welded assemblies.
2/ Preferred for nonmagnetic cabinet and internal baffling.

3.3.3.1 Tapped holes. Tapped holes in aluminum shall be avoided. When there is not a practical alternative, the thread shall be fitted with a corrosion-resistant steel helicoidal insert. The thread of the screw shall be coated upon assembly with a metallic-ceramic coating in accordance with MIL-C-81751. Any departures and non-use of corrosion resistant steel helicoidal inserts shall require approval by the Government on a case basis.

3.3.4 Steel parts. Parts fabricated of steel conforming to ASTM A 569 shall have a surface smoothness suitable for electroplating.

3.3.4.1 Fasteners. All bolts, nuts, studs, screws, and such fasteners shall be of corrosion-resistant material passivated in accordance with QQ-P-35 or of a material rendered adequately resistant to corrosion-fastener material shall be in accordance with ASTM A 307 carbon steel treated with two coats of primer per TT-P-664, 18-8 300 series stainless steel or brass-cadmium plated in accordance with QQ-P-416, type 1, class 3. Self-tapping sheet metal screws shall not be used.

3.3.5 Nonmagnetic construction. Unless otherwise specified (see 6.2), fan coil units of nonmagnetic construction shall conform to the requirements of 3.3.5 through 3.3.5.3. The cabinet unit, drain pan, mounting rails, filter, fans, fan motor bases, electrical components where available, grilles, and fasteners shall be constructed of nonmagnetic material. Nonmagnetic unit cabinets and mounting rails shall be constructed of 300 series corrosion-resistant steel in accordance with ASTM A 240 or aluminum and as specified in 3.4.4 and 3.4.4.1.

3.3.5.1 Permeability. Material which has a permeability of less than 2.0 in the final condition shall be considered nonmagnetic.

3.3.5.2 Motors. Motors (all frame sizes) shall be constructed of a minimum practicable quantity of ferromagnetic material, preferably limiting its use to magnetic circuits.

3.3.5.3 Cast iron. Cast iron shall not be used in any part of the fan coil units including the motors.

3.3.6 Dissimilar metals. Direct contact of electrolytically dissimilar metals, as defined in MIL-STD-889, shall be avoided to prevent electrolysis and destructive galvanic corrosion.

3.3.6.1 Fasteners. Fasteners shall be insulated from aluminum or aluminum alloys using bimetallic spacers or equal. Absorbent material shall not be used in contact with aluminum or aluminum alloys.

3.3.6.2 Surface contact. In addition to 3.3.6, aluminum or aluminum alloy faying surfaces in contact with similar or dissimilar metals shall be painted before assembly with a 1-mil coat of epoxy primer conforming to MIL-P-24441, formula 150, followed by a 2- to 3-mil top coat conforming to MIL-P-24441, formula 151.

3.3.7 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.

3.3.8 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 conform to MIL-STD-278. Welds shall be in accordance with NAVSEA 0900-LP-003-8000, section V (see 6.8).

3.3.8.1 Zinc-coated (galvanized) surfaces. Where zinc-coated steel is used for fabricating parts, 1.0 inch of the metallic zinc shall be removed from the expected toes to the welds of all joints and surfaces on which welds are to be deposited. In areas where the metallic zinc cannot be removed, and it is necessary to weld over the zinc-coated surfaces, electrodes type G6010 or G6011 shall be used in accordance with ANSI A5.1.

3.3.8.2 Brazing. Brazing procedures and qualification of the welder (brazer) shall be in accordance with NAVSEA 0900-LP-001-7000.

3.3.9 Corrosion protection. Corrosion-resistant steel (300 series), copper, and brass referenced herein shall be considered corrosion-resistant materials. Corrosion-resistant 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.

3.3.9.1 Corrosion protection methods. Parts fabricated from other than corrosion-resistant materials shall be protected against corrosion with chemical treatment, electrolytic processes, plating, or specified corrosion protection methods. Such processes include, but are not limited to the following:

(a) Hot-dipped galvanized sheets conforming to ASTM A 526 with a G90 coating classification plus a mill applied phosphate coating.
(b) Hot-dip galvanize in accordance with ASTM A 386, with the spelter conforming to "Prime Western" grade of ASTM B 6, or ASTM A 153, class B, as applicable.
(c) Electroplate zinc thickness in accordance with ASTM B 633, class FE/ZN25, service SC4, followed by chromic treatment in accordance with ASTM D 2092.
(d) Hot phosphoric acid treatment and a pretreatment primer (wash) coating conforming to DOD-P-15328, followed by a coating of primer conforming to MIL-P-24441 formula 150 (see 3.3.10.4).

3.3.10 Painting surface preparation and painting.

3.3.10.1 Welded or brazed surfaces. Welded or brazed surfaces to be painted shall be cleaned to the base metal and all traces of flux removed prior to painting. Flux removal shall be accomplished by brushing the welds while immersed in boiling water. For inaccessible welds, the part shall be cleaned by immersion in a cold solution of 10-percent sulfuric acid for 30 minutes, or a 5-percent solution of sulfuric acid held at 150 degrees Fahrenheit (°F) for 10 minutes. The acid shall contact both the inside and outside surfaces. The acid treatments shall be followed by a thorough rinse in clean, warm water to remove all traces of acid. If the presence of residual flux is questionable a test shall be conducted as follows to ensure that all traces of flux have been removed. Leach the surface with distilled water, and add a few drops of 5-percent silver nitrate solution to the leach. A white precipitate indicates the presence of flux.

3.3.10.2 Zinc coated (galvanized) surfaces. Zinc coated surfaces shall be treated with a cleaner consisting of phosphates, phosphoric acid, solvents, and wetting agents to enable the surface to be coated with a thin phosphate coating. Where the galvanized material has not been acquired in the treated condition, the solution shall be applied to the galvanized surface with a large brush and allowed to act for not less than 1 minute. The surface shall then be washed thoroughly with cold water, then hot water, and primer applied when dry. Care shall be taken to minimize handling the surface following coating and prior to the application of the primer.

3.3.10.3 Corrosion-resistant material surfaces. Corrosion-resistant material surfaces that are to be painted shall be cleaned with a nonflammable solvent. Welds shall be brushed with corrosion-resistant metal wire brushes.

3.3.10.4 Internal surface painting. Surfaces of all internal parts of materials other than corrosion-resistant materials, prior to assembly, shall be thoroughly hot phosphoric acid cleaned and coated as follows in addition to any protection method:

(a) One-quarter mil (minimum dry film thickness) to 3/4 mil (maximum dry film thickness) of pretreatment primer (wash) coating conforming to DOD-P-15328. Note: A mill applied phosphate coating precludes the need for the pretreatment primer (wash) coating.
(b) Two to 3 mil (minimum dry film thickness) of primer coating conforming to MIL-P-24441 formula 150, or two coats of red oxide primer per TT-P-664.

3.3.10.5 External surface painting. All external surfaces of a fan coil unit after being thoroughly cleaned shall be coated as follows:

(a) One-quarter mil (minimum dry film thickness) to 3/4 mil (maximum dry film thickness) of pretreatment primer (wash) coating conforming to DOD-P-15328. Note: A mill applied phosphate coating precludes the need for the pretreatment primer (wash) coating.
(b) Two to 3 mil (minimum dry film thickness) of primer coating conforming to MIL-P-24441 formula 150, or two coats of red oxide primer per TT-P-664.
(c) One mil (minimum dry film thickness) of top coating conforming to MIL-P-24441 formula 151, or two coats of gray enamel conforming to MIL-E-15090 formula 111.

3.4 Design and construction.

3.4.1 General. A fan coil unit shall be a complete assembly, ready for shipboard installation, that contains all components necessary for providing sufficient heating, air conditioning/cooling, and air recirculation required to satisfy compartment environmental design conditions (see 6.3 and appendix B). Each unit shall consist of the fan and the 2-speed fan motor, the air filter, optional inlet and outlet grilles, an optional electrical heater, thermal and acoustic insulation, a thermostat, electrical control relays, and a chilled water cooling coil. Type H units shall be designed for horizontal mounting to overhead decking. Type V units shall be designed for vertical mounting to bulkheads. Both types of fan coil units shall be capable of being installed with or without ductwork. The outlets may be used for zone air distribution with ductwork or for free air delivery without ductwork. The inlets may also be ducted or unducted for return air. Electrical creepage and clearance distances used in construction of fan coil units shall be in accordance with MIL-E-917.

3.4.2 Capacity. When not connected to ductwork fan coil unit capacities shall be as specified in table II and fans shall deliver the rated cubic feet per minute (ft^3/min) at the corresponding rated static pressure (inches of water at the outlet of the unit) corresponding to related rated cooling capacities as specified in table II. When connected to ductwork, fan coil units shall provide continuous operation at levels between 80 and 125 percent of their rated airflow as specified in table II. Selection information shall be as specified (see 6.3 and appendix C).

TABLE II. Fan coil unit capacity. 1/

Fan coil unit size	Rated values 2/ (Wet cooling coil)		Nominal capacity range	
	Airflow ft³/min (in. w.g.)	Capacity (MB)	Cooling 3/ (MBH) EDB (°F) 70 - 100 EWB (°F) 58 - 82	Heating (kW) Heater size
1	145 0	5.85	2.78-12.86	1.2, 2.2, 3.3
2	240 0	9.69	4.63-21.03	1.2, 2.2, 3.3
3	350 .25	15.28	7.27-34.39	1.75, 3.5, 5.25
4	530 .25	22.89	10.98-50.06	2.0, 4.0, 6.0
5	690 .25	30.50	14.66-66.01	2.0, 4.0, 6.0
6	950 1.0	39.91	18.94-90.44	3.0, 6.0, 9.0
7	1100 1.0	45.56	21.67-102.44	3.0, 6.0, 9.0
8	1650 1.0	72.92	34.80-161.35	3.0, 6.0, 9.0

1/ Abbreviations:
ft³/min = cubic feet per minute
in. w.g. = inches of water gauge, maximum external static pressure
r/min = revolutions per minute
MBH = Btu/h in thousands
Btu/h = British thermal units per hour
EDB = entering dry bulb air temperature
EWB = entering wet bulb air temperature
°F = degrees Fahrenheit
kW = kilowatts
gal/min = gallons per minute, chilled water flow rate

2/ Rated airflow and capacity shall be at design operating conditions, that is, high speed (1800 r/min), air EDB 80°F, and air EWB 67°F. Fan motors shall have two speeds. Low speed shall be 1200 r/min.

3/ Cooling capacity and cooling coil sizing shall be based on 45°F chilled water and a minimum waterside fouling factor of 0.0005. Cooling capacity shall be the required cooling coil load (MBH), at the specified cooling coil entering air conditions (EDB, EWB), in the section of the fan coil unit between the fan discharge and the cooling coil inlet. This load shall include compartment and replenishment air total heat loads (sensible and latent) and fan motor sensible heat.

3.4.2.1 Cooling coil sizing. The cooling coil of a fan coil unit shall be sized for a maximum chilled water flow rate of 3.6 gallons per minute per ton (gal/min/ton) of cooling, including fan motor heat, and a maximum pressure drop of 12 lb/in² across the coil (see appendix C, 4.7.2.1, and 4.7.2.2.2.1).

3.4.3 Fan coil unit components. The fan coil unit components shall be as covered in the following paragraphs:

Component	Paragraph
(a) Cabinet	3.4.4
(b) Mounting rails	3.4.4.1
(c) Thermal/acoustic insulation	3.4.4.2
(d) Access panels	3.4.4.3
(e) Air inlet/outlet (grilles optional)	3.4.5
Inlet grille	3.4.5.1
Outlet grille	3.4.5.2
(f) Air filter	3.4.6
(g) Static air pressure tap	3.4.7
(h) Fan motor	3.4.8
Ball bearings	3.4.8.1
Thermal protection	3.4.8.2
Motor mount	3.4.8.3
(i) Fan	3.4.9
Fan construction	3.4.9.1
Fan shaft	3.4.9.2
Resilient mounts	3.4.9.3
(j) Cooling coil	3.4.10
Right/left hand unit	3.4.10.1
Vent and drain valves	3.4.10.2
Drain pan	3.4.10.3
(k) Heater (optional)	3.4.11
Heater protection	3.4.11.1
Heater operation	3.4.11.2
Heating elements	3.4.11.3
Sheath and fins	3.4.11.3.1
Intermediate supports	3.4.11.4
(l) Control	3.4.12
Control circuitry	3.4.12.1
Fan motor contactor	3.4.12.2
Heater contactor	3.4.12.3
Thermostat	3.4.12.4
Miscellaneous electrical components	3.4.12.5
Electrical power cable entrance	3.4.12.6
Electrical wiring and connections	3.4.12.7
Grounding connections/electro-magnetic compatibility	3.4.12.8

3.4.4 Cabinet. The cabinet enclosure shall be constructed of No. 16 USS GA steel in accordance with ASTM A 526 or A 527. The frame or chassis shall be rigid and of adequate strength to support and maintain alignment of the assembled parts. The cabinet shall be designed to be hard mounted to the ship foundation without the need for external vibration isolators. Internal sheet metal parts other than stainless steel shall be protected as specified in 3.3.9.1 and all seams shall be caulked with butyl caulking in accordance with TT-S-1657. The

cabinet shall have standard features which permit left or right hand assembly of the cooling coil by the installing activity. All interior sheet metal components between the fan outlet bulkhead and the heater outlet bulkhead shall be 304 series stainless steel in accordance with ASTM A 240.

3.4.4.1 Mounting rails. Mounting rails shall be located on the top edge of cabinet sides for type H units, and on the back edge of cabinet sides for type V units. Mounting rails shall be constructed from material conforming to ASTM A 569 or ASTM A 526 or A 527 with sufficient strength to support individual units under high-impact shock in accordance with MIL-S-901 for grade A, class I, type A equipment. Mounting rails shall be predrilled as specified on figure 1 to standardize mounting for interchanging units.

3.4.4.2 Thermal and acoustic insulation. Surfaces of the cabinet or chassis that are subject to condensation shall be provided with internal insulation properly vapor sealed to prevent condensation under rated capacity conditions. The insulation surrounding heaters shall be protected from the possibility of overheating, and all edges and corners subject to physical damage and erosion shall be protected. Acoustic insulation shall be added where necessary to limit noise levels. The insulation shall be in accordance with DOD-I-24688, MIL-I-24703, MIL-I-22023, ASTM C 1071, or MIL-F-87090. The open-cell polyimide type conforming to DOD-I-24688 and the closed-cell polyphosphazene type conforming to MIL-I-24703 bonded with adhesive conforming to class 1, grade B of MIL-A-3316 are preferred where applicable.

3.4.4.3 Access panels. Provision shall be made to permit access to and removal of fan, fan motor, electric heater, electrical controls, and cooling coil through bolted, removable access panels. The access panels shall be formed and flanged and shall be interchangeable on fan coil units of the same type and size. Flanged surfaces which support removable panels and access openings shall be gasketed and airtight. Gaskets shall be of heat and moisture-resistant silicone rubber or neoprene. The access panels serving the cooling coil and heater shall be 304 stainless steel in accordance with ASTM A 240. All access panel bolts, washers, shall be 300 series stainless steel. Filters shall be removable through a hinged access panel with quick-acting captive fasteners to secure the panel in a closed position. Quick-acting captive fasteners shall not require a special tool to operate. The filter access shall be located in the inlet end section of the units and shall be provided with a handle to facilitate opening and closing. The handle shall be recessed flush with the cabinet surface.

3.4.5 Air inlet and outlet. Air shall enter each fan coil unit via the inlet end section and exit via the opposite end outlet section. Both the inlet and outlet shall have smooth flat surfaces with predrilled and tapped bolt holes, as shown on figures 2 and 3, for flanged duct connections. Unless otherwise specified (see 6.2), inlet and outlet grilles shall be optional.

3.4.5.1 Inlet grille. The inlet grille, if provided, shall be a commercial, standard size, heavy duty, fixed louvered grille with gasket. Louvers shall not rattle or vibrate when airflow is applied. The grille shall match the cabinet. If the unit is to be used with connecting duct, the grille shall be removed by the installing activity.

3.4.5.2 Outlet grille. The outlet grille, if provided, shall be as follows. For fan coil units H1, H2, V1, and V2, the outlet grille shall be a fixed louvered, linear grille. The outlet grille for all other units shall be of the double deflection type and shall permit adjustable, directional airflow in both horizontal and vertical planes. The grille shall match the cabinet. If the unit is to be used with connecting duct, the grille shall be removed by the installing activity.

3.4.6 Air filters. Air filters shall be provided for filtering all air entering the unit. The air filters shall be Navy standard, high velocity type in accordance with MIL-F-16552. The size and number of filters that are required for each assembly shall be as specified on figure 4. Provisions shall be made to hold the filters in place when the access door is opened.

3.4.7 Static air pressure tap. Fan coil units shall be provided with a static air pressure tap on the downstream side of the filters for permanent mounting of a differential pressure gauge in accordance with Drawing 805-1577080, or for checking static pressure with a portable differential pressure gauge. The tap shall consist of a gasketed, brass or corrosion resistant steel, 1/4-inch tube, straight bulkhead connection with sealing cap and protective cover suitable for permanent mounting to side of cabinet.

3.4.8 Fan motors. Fan motors shall be service A, designed for 65 degrees Celsius (°C) ambient temperature, 440-volt, 3-phase, 60-Hertz (Hz) continuous duty with drip-proof enclosure, two speeds (1800 and 1200 r/min), squirrel cage design, fan cooled, ball bearings, class B or F insulation, and designed in accordance with MIL-M-17059. A wiring terminal strip in the vicinity of fan motors or a motor terminal housing for electrical connection shall be provided to facilitate replacement of fan motors without disturbing other wiring.

3.4.8.1 Ball bearings. Motor ball bearings shall conform to FF-B-171, type 120 (cartridge type), with a C3 internal clearance. Bearings shall be prelubricated with grease conforming to DOD-G-24508 and shall be removable by pulling the inner race of the bearing using standard Navy shipboard tools.

3.4.8.2 Thermal protection. Motors shall be equipped with thermal protection which shall consist of a minimum of 3 thermal protectors (switches) to detect over-temperature. Thermal protectors shall be the automatic reset type with locked rotor temperature limit for class B insulation systems as approved by the Government. All electrical equipment shall be in accordance with MIL-E-917.

3.4.8.3 Motor mount. A positive method shall be provided to prevent motors from rotating in a frame/support/mount in such a manner as to not induce vibration to fan coil unit cabinet (see 3.4.9.3).

3.4.9 Fans. Fans shall be the centrifugal type with direct drive.

3.4.9.1 Fan construction. The centrifugal fan shall be double-inlet and have multiple, forward-curved, airfoil blades. The fan housing shall be constructed of steel or aluminum. Fan wheel shall be aluminum with size plated steel hubs and shall be designed for minimum tip speed of 3650 feet per minute (ft/min). The fan shall be statically and dynamically balanced and tested after being installed in the fan coil unit.

3.4.9.2 Fan shaft. Fan shall be direct driven with the fan wheel mounted on the motor shaft. The wheel shall be secured to the shaft by means of a key with cup point, socket setscrews or other methods approved by the Government.

3.4.9.3 Resilient mounts. A fan and motor assembly shall be vibro-isolated using design materials approved by the Government.

3.4.10 Cooling coil. The chilled water cooling coil shall be similar to the DW class, multiple U-tube (2-pass), finned element type having twin headers (1 supply and 1 return). The coil shall be 4 rows deep in direction of airflow having staggered elements in direction of airflow. The coil shall be designed with a minimum waterside fouling factor of 0.0005 and shall have a maximum allowable working pressure rating of 200 lb/in^2 gauge at 250°F, designated for chilled water application. The tubes shall be seamless copper tubing in accordance with ASTM B 75, 5/8-inch in diameter with a wall thickness of not less than 0.025 inch. When used in the construction of the coil, hairpin tubes shall meet the minimum wall thickness throughout the tube as specified above. The tubes shall be silver-brazed to the headers which shall be copper with a wall thickness in accordance with ASTM B 88, type M. The fins shall be of copper in accordance with ASTM B 152, not less than 0.006 inch thick and shall be spaced at 11 fins per linear inch except that fan coil unit size 8 have 12 fins per linear inch. The tubes shall be expanded into the fins with not less than 1800 lb/in^2 hydrostatic pressure to form a permanent bond. Brass or copper ferrules shall be provided where tubes pass through tube sheets in order to prevent wear and breakage because of shipboard vibration or expansion and contraction of the tubes. The chilled water supply and return connections shall be on the same end of the coil and shall be silver brazed in accordance with ASTM B 43, union connections conforming to MIL-F-1183 having a maximum water/oil/gas working pressure and temperature rating of 400 lb/in^2 gauge at 150°F. The frame, tube sheets and intermediate tube sheets shall be 300 series corrosion-resistant steel.

3.4.10.1 Right/left hand unit. The location of the chilled water supply and return connections of the cooling coil shall determine the orientation of the fan coil unit, when looking in the direction of the airflow with the unit in its normal operating position. Unless otherwise specified in 6.2, fan coil units shall be supplied right-handed. The cooling coil shall be field interchangeable from right to left hand.

3.4.10.2 Vent and drain valves. Cooling coil shall be equipped with 1/4-inch brass vent and drain petcock valves brazed in the coil inlet and outlet lines to eliminate breaking the chilled water inlet and outlet union connections for venting and draining purposes. Valves shall be accessible from outside the cabinet, through an auxiliary access, without removing the bolted access panel used for coil removal. The vent and drain shall terminate in the condensate drain pan.

3.4.10.3 Drain pan. Fan coil units shall have a condensate drain pan of sufficient depth to prevent spill-over when units are operated. All units shall meet this requirement when permanently inclined 15 degrees in any direction from the normal position. The drain pan shall be fitted with drains of not less than a 1.0 inch nominal pipe size (NPS) brass, in accordance with ASTM B 43, male connection on each end. The drain pan shall be series 300 corrosion-resistant steel and insulated.

3.4.11 Heater. Unless otherwise specified (see 6.2), electric heaters are optional and, if provided, shall be of the finned type and located downstream of the cooling coil. The kilowatt (kW) rating of heaters shall be as specified in table II. Heater frames, tube supports, or any sheet metal parts shall be 300 series corrosion-resistant steel.

3.4.11.1 Heater protection. The heater shall be provided with a thermal protector (over-temperature switch) with manual reset in accordance with MIL-E-917 for insulation materials. The manual reset shall be accessible from the outside of the fan coil unit. The switch shall be set to limit the surface temperature of the heating elements to a maximum of 750°F. The switch shall be suitable for pilot duty on 115-volt alternating current. The switch temperature sensing bulb shall be secured to a heating element with 2 clamps.

3.4.11.2 Heater operation. The heater shall provide continuous operation under normal shipboard environmental conditions, such as vibration and the presence of moisture in the air stream. Heaters shall operate in an environment up to 100 percent relative humidity and shall have 1 increment of heat. Heaters shall be designed for 3-phase operation and shall have 3, or a multiple of 3 elements of equal wattage so that a balanced 3-phase load is provided. Elements circuit strength shall withstand a dielectric voltage of 1880 volts. Heaters shall provide continuous operation at an airflow of 80 to 125 percent of the fan coil unit rated airflow as specified in table II.

3.4.11.3 Heating elements. Heating elements shall be in accordance with MIL-H-22594 requirements, including insulation resistance and dielectric strength.

3.4.11.3.1 Sheath and fins. Heating elements shall have the fins brazed to the sheath to provide good heat transfer and prevent vibration. Sheath and fins shall be nickel-copper alloy (monel) in accordance with ASTM B 344 or 300 series corrosion-resistant steel. Fin edges of the heating elements shall be free of burrs and shall not be bent back against the sheath of the heating element. Heater casing corners shall be smooth and square, and fasteners shall be in place and tight.

3.4.11.4 Intermediate supports. Intermediate supports shall be provided when the face dimension (dimension A of figure 4) exceeds 23 inches. The distance between the supports shall be not greater than 23 inches.

3.4.12 Control. Fan coil units shall have either low voltage protected (LVP) or low voltage release (LVR) electrical control circuitry. LVP units, figures 5 and 6, shall have independent manual start/stop pushbuttons (momentary contact type) accessible from the outside of the unit and so terminated as to allow remote start/stop pushbutton (momentary contact type) addition. Pushbuttons shall operate an internally mounted control relay with sealing control circuitry. When lost main electric power is restored, the unit shall require manual start-up. LVR units, figures 7 and 8, shall have manual on/off switch selection accessible from the outside of the unit and so, terminated as to allow remote start/stop pushbutton (maintained contact type) addition. When lost main electric power is restored, the unit shall automatically start-up unless the "off" switch position has been manually selected.

3.4.12.1 Control circuitry. Unless otherwise specified (see 6.2), fan coil units shall be LVP as specified in 3.4.12, control circuitry shall be designed for continuous airflow and as specified in electrical schematics, figures 5, 6, 7, and 8, give the following sequence of operation:

Entering air temperature (°F)	Unit operation (on rising temperature)
Below 72	Cooling and heating units - fans on high speed and heater on. Cooling only units - T_L not used, fans on low speed.
72 to 76	Cooling and heating units - fans on low speed and heater off. Cooling only units - remain on low speed.
77 to 81	Both units - fans on low speed and remote chilled water valve energized providing water to cooling coil.
82 and above	Both units - fans on high speed, and remote chilled water valve remains energized providing water to cooling coil.

NOTE: If optional humidistat is provided for cooling and heating units, the remote chilled water valve is energized anytime the relative humidity is above 55 percent (set point) regardless of temperature.

3.4.12.2 Fan motor contactor. Fan coil units shall have internally-mounted, dual-speed, motor contactors or power relays for fans in accordance with MIL-C-2212. Contactors or power relays shall be Government approved, with or without a separate enclosure, and of sufficient size to control the fan motor at high and low speeds.

3.4.12.3 Heater contactor. Fan coil units with heaters shall have an internally mounted contactor or power relay for the heater in accordance with MIL-C-2212. Contactor or power relay shall be Government approved, with or without a separate enclosure, and of sufficient size to control the largest heater, as specified in table II, for a fan coil unit size.

3.4.12.4 Thermostat. Fan coil units shall have an internally mounted, Government approved, three-stage thermostat capable of controlling, in sequence, the fan motor speed, the remote chilled water solenoid valve, and the internal optional heater (see figures 5, 6, 7, and 8). The thermostat temperature sensing bulb shall be mounted in the return air stream and the thermostat shall be accessible through an access panel.

3.4.12.5 Miscellaneous electrical components. Electrical components shall meet military specifications as follows (electrical components not identified to a military specification shall be in accordance with MIL-E-917):

Component	Specification
Transformers	MIL-T-16315
Relays	MIL-C-2212
Fuses	MIL-F-15160
Fuse holders	MIL-F-19207
Switches	MIL-S-22885
Lamp holders	MIL-L-3661
Wiring	MIL-E-917
Wire connectors	MIL-T-7928
Electrical connectors	MIL-C-5015

3.4.12.6 Electrical power cable entrance. A blank, gasketed plate shall be provided on each side of the fan coil unit in the general area of the control terminal strip to permit installation of a cable entrance by the installing activity.

3.4.12.7 Electrical wiring and connections. Wiring shall be neat and tied or clamped in a manner that supports and prevents chafing of the wire insulation because of vibration and shock. There shall be no splices in the wire and the connections shall be at the terminals of the devices or terminal strips. Wiring shall be clear of access panels and located out of the air stream whenever possible. Wiring shall be clear of areas that may require maintenance and shall be so routed within the cabinet that no damage will occur when drilling or assembling the units.

3.4.12.8 Grounding connections for electromagnetic compatibility. Fan coil units shall be grounded and bonded in accordance with MIL-STD-1310.

3.4.13 Interchangeability. Unless otherwise specified (see 6.2, all identically identified components shall be functionally and physically interchangeable without degradation of performance, reliability, or operating characteristics, and without selective assembly or modification except for calibration and adjustment. Repair parts shall be interchangeable with, and identically identified with, the parts they replace.

3.4.14 Human engineering. Human engineering design criteria and principles shall be applied in the design and construction of the fan coil unit to achieve safe, reliable, and effective performance by the operator and maintenance personnel while optimizing personnel skill requirements. MIL-STD-1472 shall be utilized as a guideline in applying human engineering design criteria for the fan coil unit.

3.4.15 Maintainability. The construction of fan coil units shall be as follows for maintainability:

(a) Air filters shall be accessible for cleaning, replacement, or both through a hinged access panel with a handle to facilitate opening and closing. Quick-acting fasteners shall secure the panel in the closed position.

(b) Fans and fan motors shall be accessible for servicing, testing, replacement, or for all three purposes by removal of a bolted access panel. A wiring terminal strip in the vicinity of fan motors or motor terminal housings shall be provided for electrical connection to facilitate replacement of fan motors without disturbing other wiring.

(c) Cooling coil shall be accessible for cleaning, or replacement, or both by removal of a bolted access panel. Coil cleaning shall be accomplished without removal of cooling coil. Cooling coil shall be accessible for venting, or draining, or both without removing the bolted access panel.

(d) Electric heater shall be accessible for servicing and testing by removal of an access panel.

(e) Wiring, terminals, and electrical connections shall be accessible for servicing and testing by removal of an access panel, without requiring the removal of fan, motor, heater, or other electrical components.

(f) Scheduled maintenance shall not be required more than once per week. The average elapsed time per week for scheduled maintenance shall not exceed 15 minutes.

3.4.15.1 Mean-time-to-repair (MTTR). The maintainability requirements of all shock grade A equipment expressed as MTTR shall be 1.3 hours.

3.5 Characteristics.

3.5.1 General. Fan coil units shall be self-contained units containing all necessary components for providing recirculated, conditioned air required to satisfy compartment environmental design conditions (see 6.3). They shall be either the horizontal type for horizontal mounting overhead or the vertical type for vertical mounting on a bulkhead. Each unit shall be served by the ship's air conditioning chilled water and electric power systems.

3.5.2 Operation. Fan coil units shall be constructed for continuous operation unless a low voltage condition, a temporary loss of voltage, or activation of the manual "stop" pushbutton or switch opens the electrical control circuitry turning off the unit.

3.5.2.1 Electric power service. Electric power supplied to the fan coil unit shall be 440-volt, 3-phase, 60-hertz alternating current and in accordance with MIL-STD-1399, section 300.

3.5.2.2 Chilled water service. Chilled water supplied to the cooling coil of the fan coil unit shall be at a temperature of 45°F.

3.5.3 Cooling coil leakage. The cooling coil shall show no leakage when tested as specified in 4.7.2.4.

3.5.4 Shock. Fan coil units shall pass the high-impact shock tests in accordance with MIL-S-901 for grade A, class I, type A equipment.

3.5.5 Vibration. Fan coil units shall withstand, without damage or malfunction, environmental vibrations in accordance with MIL-STD-167-1 for type I "environmental vibration" for frequencies up to and including 33 Hz. The rotating components of the fan coil units shall meet the balance requirements of MIL-STD-167-1 for type II vibration.

3.5.6 Airborne noise. Fan coil units shall be constructed so that the airborne noise sound power levels specified in table III are not exceeded.

TABLE III. Airborne noise sound power levels in decibels (dB), ref. 10^{-12} watts.

Fan coil unit size	Octave band center frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
1 through 8	82	79	76	73	70	67	64	61

3.6 Physical characteristics.

3.6.1 Types, sizes, and classes. Types, sizes, and classes, and so forth, of fan coil units shall be as specified in 1.2.

3.6.2 Weight. Fan coil unit weight shall be not greater than that specified on figure 4.

3.6.3 Physical dimensions. Fan coil unit physical dimensions shall be as specified on figure 4.

3.7 Identification.

3.7.1 Identification numbers. A National Stock Number (NSN) and Component Identification (CID) Number will be assigned by the Government after drawing approval. These numbers shall be used in shipping papers and shall appear on each identification plate.

3.7.2 Identification plate. Each fan coil unit shall be provided with an identification plate in accordance with MIL-P-15024 and MIL-P-15024/5, type A, B, D, F, or H, color style II, standard dimension size 10. The plate shall be located in a prominent location which is easily visible from the deck below the unit. The identification plate shall contain the following information:

(a) Item name.
(b) National stock number.
(c) Component identification number (CID).
(d) Contract order number.
(e) Manufacturer's name and Commercial and Government Entity (CAGE) number.
(f) Part or identifying number (PIN).
(g) Serial number.
(h) "U.S. Navy Property".

3.7.3 Safety label plates. Safety label plates, requesting electric power shut-off before removal of access plates for testing or maintenance, shall be installed in a visible location on the front of vertical units and on the underside of horizontal units.

3.7.4 Terminal boards and covers. Terminal boards and covers over equipment shall be marked in accordance with MIL-I-55164.

3.7.5 Wiring diagram. A reduced copy of the heater wiring diagram, either enclosed in a transparent, water-repellent envelope or printed on a plastic board, aluminum plate, or MIL-P-15024 label, shall be permanently attached to the inside of the enclosure access cover for indication of the electrical connections.

3.8 Workmanship. Sharp edges, burrs, and other imperfections shall be removed from parts subject to contact with personnel.

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 this 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 requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept 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. Coil units of each type and size (see 1.2) shall be subjected to the examinations and tests as specified in table IV.

4.4 Quality conformance inspection. Unless otherwise specified (see 6.2), quality conformance inspection shall consist of groups A and B tests and examinations as specified in table IV. A random sample of fan coil units shall be selected from production lots of fan coil units as specified in 4.4.2. If any sample unit fails any test or examination it shall be considered defective and shall be rejected (see 6.9).

TABLE IV. First article and quality conformance inspections.

Tests	Applicability type/size 1/	Requirement	Test method	First article inspection	Quality conformance inspection
Group A:					
General examination	All	2/	4.5	X	X
Inspection of packaging	All	3/	4.6		X
Dimensional verification	All	3.4.4.1, 3.4.5, 3.6.3	4.7.1.1	X	X
Maintainability verification	All	3.4.15	4.7.1.2	X	X
Weight verification	All	3.6.2	4.7.1.3	X	X
Safety verification	All	3.7.3	4.7.1.4	X	X
Group B:					
Capacities (rated)	All	3.4.2	4.7.2.1	X	
Condensation	All	3.4.2	4.7.2.1.1	X	
Fan performance	All	3.4.2	4.7.2.2.1	X	
Cooling performance	H5, H8	3.4.2	4.7.2.2.2	X	
Cooling coil sizing (pressure drop)	All	3.4.2.1	4.7.2.2.2.1	X	
Heater performance	All	3.4.11	4.7.2.2.3	X	
Over-temperature protection	All	3.4.11.1	4.7.2.2.3.1	X	
Circuit strength	All	3.4.11.2	4.7.2.2.3.2	X	X
Element characteristics	All	3.4.11.3	4.7.2.2.3.2.1	X	X
Unit operation	All	3.5.2	4.7.2.3	X	X
Coil leakage	All	3.5.3	4.7.2.4	X	X
Internally excited vibration	All	3.5.5	4.7.2.5	X	
Noise level	All	3.5.6	4.7.2.6	X	
Group C:					
Shock	H2, H5, H8, V2, V5, V8	3.5.4	4.7.3.1	X	
Environmental (external) vibration	H2, H5, H8, V2, V5, V8	3.5.5	4.7.3.2	X	

1/ Applies to sample fan coil unit of the type/size indicated.
2/ All applicable sections of section 3 not otherwise covered in this column.
3/ All of section 5.

4.4.1 Lot. A lot shall consist of all fan coil units of the same type and size produced under essentially the same conditions from the same production run and offered for inspection at one time, but shall not consist of more than 300 at any one time.

4.4.2 Sampling. Sample fan coil units of the same type and size shall be selected at random from each production lot of units as specified in table V for quality conformance inspection.

TABLE V. Sampling for quality conformance inspection.

Lot size number of units	Sample size number of units
1 to 13	All
14 to 40	13
41 to 110	22
111 to 300	30

4.5 General examination. Each sample fan coil unit selected for first article and quality conformance inspections shall be subjected to a general examination, after the applicable inspection, to confirm conformance to general specification requirements as to material, finish workmanship, safety, construction, assembly, dimensions, weight, marking and identification, and drawing requirements. The examination shall include the classification of defects delineated in table VI. This examination shall be limited to examinations that may be performed without disassembling of units in such a manner that the unit's performance, durability, or appearance would be affected. Any unit that contains one or more defects shall be rejected.

TABLE VI. Classification of defects.

Categories	Defects
Critical:	
1	None defined
Major:	
101	Type or size not as specified.
102	Incomplete, component parts missing [fan(s), motor(s), cooling coil, heater, filters, and so forth.]
103	Materials defective or not as specified.
104	Limiting dimensions, exceeded.
105	Welding incomplete, not free of cracks, nonfusion heavy porosity, heavy undercut, slag inclusions.
106	Insulation missing (thermal or acoustical).
107	Condensate drains or removable access panels not provided.
108	Similar parts not interchangeable.

TABLE VI. Classification of defects - Continued.

Categories	Defects
Major:	
109	Removable panel gaskets missing or defective.
110	Drawings not followed.
111	Grilles/guards missing, nonadjustable (as applicable).
112	Bolts, nuts, and screws not tight or missing.
113	Coil connections not as specified.
114	Painting (as applicable), nonconforming.
115	Marking, manufacturer's name not permanent, illegible, or not as specified.
116	Information or label plates (as applicable) missing.
117	Sharp edges and burrs not removed from parts subject to personnel contact.
118	Electrical equipment not as specified.
Minor:	
201	None defined.

4.6 Inspection of packaging. Sample packs, and the inspection of the packaging (preservation, packing, and marking) for shipment, stowage, and storage shall be as specified in section 5 and the documents specified herein.

4.7 Test sequence. The sequence for testing the fan coil unit shall be performed in the following order: (1) Group A test schedule (see 4.7.1.5); (2) Group B test schedule (see 4.7.2.6.2); and (3) Group C test schedule (see 4.7.3.3).

4.7.1 Group A tests.

4.7.1.1 Dimensional verification. Fan coil units shall be measured to verify compliance with 3.6.3, 3.4.4.1, and 3.4.5 dimensional requirements.

4.7.1.2 Maintainability verification. Information from selected unique test reports shall be reviewed to determine that the components conform to the requirements specified in 3.4.15. Service and access requirements shall be verified by demonstrating that the maintenance functions can be accomplished as specified herein (see 6.3).

4.7.1.3 Weight verification. Fan coil units shall be weighed (dry) to verify compliance with the weight shown on the assembly drawings. Units shall be weighed prior to crating and the actual dry weight determined. The weight of the cooling coil fluid shall be calculated, added to the actual dry weight, and the total weight determined.

4.7.1.4 Safety verification. Examination of the equipment shall be performed to determine that the equipment and personnel safety requirements of 3.7.3 and 3.5.1 have been satisfied.

4.7.1.5 Group A test schedule. The schedule for Group A tests shall be performed in the following order:

(a) Dimensional verification (see 4.7.1.1).
(b) Weight verification (see 4.7.1.3).
(c) Maintainability verification (see 4.7.1.2).
(d) Safety verification (see 4.7.1.4).

4.7.2 Group B tests.

4.7.2.1 Capacities. Capacity tests shall be conducted on one fan coil unit of each type and size, with the highest rated kW heater, to confirm rated capacities at conditions specified in table II. Capacity tests shall be conducted under the following conditions with the fan running at high speed:

Unit size	Entering air temp.	Entering water temp. (°F)	Gal/Min	Maximum external static pressure (in. w.g.)
1	80°F DB/67°F WB	45	1.9	0
2	80°F DB/67°F WB	45	3.0	0
3	80°F DB/67°F WB	45	4.8	.25
4	80°F DB/67°F WB	45	7.3	.25
5	80°F DB/67°F WB	45	9.5	.25
6	80°F DB/67°F WB	45	13.2	1.0
7	80°F DB/67°F WB	45	15.1	1.0
8	80°F DB/67°F WB	45	24.5	1.0

The following cooling capacity tests shall be performed when specified (see 6.2) with the unit inclined 15 degrees toward the motor end:

H-8 and V-8	80°F DB/67°F WB	45°F	24.5	1.0

Cooling capacity tests shall be conducted in accordance with ASHRAE 33 and ARI 410. The cooling capacities shall be not less than the rated capacities as specified in table II. Airflow through the fan coil unit shall be measured in accordance with ASHRAE 37 and the airflow at the cabinet outlet shall be within plus or minus 5 percent of the rated airflow as specified in table II. The airflow rating shall be determined at the ambient temperature and corrected for standard air. The water flow through the cooling coil shall be based on 45°F entering water temperature and the flow rate shall be 3.6 gal/min/ton of cooling with a water flow equivalent pressure drop across the coil of not greater than 12 lb/in^2. The test unit shall be placed into the Code Tester Air Loop and Chilled Water Circuit and operated until thermal equilibrium is attained. The test results shall be used to calculate the unit rated cooling capacity in accordance with ASHRAE 33 and ARI 410.

4.7.2.1.1 Condensation. Fan coil units subjected to capacity tests of 4.7.2.1 shall be fitted with plexi-glass access panels for a special test at 95°F EDB and 82°F EWB to determine if condensation forms on components downstream of the cooling coil and outside of drain pan drip area.

4.7.2.2 Performance. Government approved performance tests shall be conducted as specified in 4.7.2.2.1 through 4.7.2.2.3 on 1 size H5 and 1 size H8 fan coil unit, with the highest rated kW heater, to determine basic heat transfer parameters for conformance to nominal capacity ranges at conditions as specified in table II, and for development of selection information. The entering conditions shall be at enough points (including those specified in table II for nominal capacity ranges) to enable cooling capacity tables and airflow performance curves to be produced as selection information. Cooling capacity tests and airflow measurements shall be conducted in accordance with ASHRAE 33, ARI 410, and ASHRAE 51 respectively, and with the unit inclined 15 degrees in any direction from the normal horizontal position.

4.7.2.2.1 Fan performance. To determine the fan performance of fan coil units under various external static pressures at ambient temperatures, airflow test shall be conducted at both high and low fan speeds under the following conditions:

Unit size	Fan speed	Maximum external static pressure (in. w.g.)
1	High	0
	Low	0
2	High	0
	Low	0
3	High	0.10, .20, .25
	Low	.05, .10, .15
4	High	.10, .20, .25
	Low	.05, .10, .15
5	High	.10, .20, .25
	Low	.05, .10, .15
6	High	.25, .50, .75, 1.0
	Low	.10, .25, .50
7	High	.25, .50, .75, 1.0
	Low	.10, .25, .50
8	High	.25, .50, .75, 1.0
	Low	.10, .25, .50

The tests shall be conducted in accordance with ASHRAE 51. The unit shall be placed in the Code Tester Air Loop, as shown in ASHRAE 51, and equilibrium conditions established before each reading. Test information shall be taken after setting each external static pressure.

4.7.2.2.2 Cooling performance. To determine the cooling performance of fan coil units under various operating conditions, cooling capacity tests shall be conducted at 4 airflow rates under the following conditions for fully wet and fully dry air-side coil conditions with the fan running at high speed:

Unit model	Entering air temp.	Entering water temp. (°F)	Gal/Min	Maximum external static pressure (in. w.g.)
H-5	85°F DB/71°F WB	45	9.5	0, 0.1, 0.20, 0.25
H-5	95°F DB/65°F WB	50	9.5	0, 0.1, 0.2, 0.25
H-8	85°F DB/71°F WB	45	24.5	0.25, 0.5, 0.75, 1.0
H-8	95°F DB/65°F WB	50	24.5	0.25, 0.5, 0.75, 1.0

Cooling capacity tests shall be conducted in accordance with ASHRAE 33 and ARI 410 at 4 different face velocities. The test unit shall be placed into the Code Tester Air Loop and Chilled Water Circuit and operated until thermal equilibrium is attained. The duration of each test shall be 30 minutes after achieving equilibrium. Readings shall be taken at the 0, 10, 20, and 30 minute marks. The arithmetic average of these readings shall be used for test calculations. The test results shall be used to calculate the cooling capacity of all other sizes of fan coil units in accordance with ASHRAE 33 for provision of selection data. By using the unit cooling capacity data, air-side thermal resistance shall be calculated for each of the 4 airflow rates in accordance with ARI 410.

4.7.2.2.2.1 Isothermal water pressure drop. Water pressure drop through the chilled water cooling coil shall be determined under isothermal operating conditions. Water flow tests shall be conducted at 4 different water flow rates within the range per unit size specified below or up to a 12 lb/in^2 drop, whichever occurs first.

Unit size	Water flow rate range (gal/min)
1	0.5 to 6
2	1 to 8
3	2 to 12
4	3 to 16
5	4 to 20
6	5 to 28
7	6 to 32
8	10 to 50

4.7.2.2.3 Heater performance. The test unit shall be placed into the Code Tester Air Loop. The unit shall be operated with motor at high speed, electric heater on, and an entering air temperature of 70°F until thermal equilibrium is attained. The test shall continue for 30 minutes after achieving equilibrium. Readings shall be taken at the 0, 10, 20, and 30 minute marks. The arithmetic average of these readings shall be used for test calculations. The following readings shall be taken during testing.

(1) Barometric pressure, inches of mercury (in Hg)
(2) Entering air temperature (°F)

(a) EDB

(3) Leaving air temperature (°F)

(a) leaving dry bulb (LDB)
(b) leaving wet bulb (LWB)

(4) Ambient temperature (°F, AMB)
(5) External static pressure (in. w.g.)
(6) Nozzle pressure drop (in. w.g.)
(7) Pressure after nozzle (in. w.g.)
(8) Nozzle air temperature (°F)
(9) Nozzle area (ft^2)
(10) Heater kilowatts (kW)
(11) Heater voltage (V)
(12) Fan motor wattage (W)
(13) Fan speed (r/min)
(14) Fan motor voltage (V)
(15) Fan motor amperage (A)
(16) Humidity ratio, pound (lb)
(17) Humidity ratio at nozzle (lb)
(18) Airflow rate (lb/min)
(19) Airflow rate (ft^3/min)
(20) Specific gravity
(21) Density (lb/ft^3)
(22) Ext. S.P. (in. w.g.)
(23) Total air side capacity (Btu/h)
(24) Net air side capacity (Btu/h)
(25) Heater capacity (Btu/h)
(26) Average heating capacity (Btu/h)
(27) Average kW (kW)
(28) Heat balance (percent)
(29) Motor horsepower (hp)

4.7.2.2.3.1 Over-temperature protection. Heater shall be operated at rated airflow and voltage for 30 minutes with an entering air temperature of 70°F. The fan providing the air supply shall be shut off and the surface temperature of the heating element measured. The high limit surface temperature, at which the contacts of the over-temperature switch open, shall be not greater than 750°F. If the surface temperature does not exceed 750°F, the temperature at which the contacts open shall be taken.

4.7.2.2.3.2 Circuit strength. The heater elements shall be subjected to a dielectric voltage of 1880 volts, at a frequency of 60 Hz between each element and the frame, with all other electric circuits and the metal parts grounded. Each element shall withstand the above voltage for at least 1 minute. The test shall be conducted with the main electrical power disconnected and the heater at ambient room temperature.

4.7.2.2.3.2.1 Heater element tests. The following tests shall be performed by the manufacturer on the heater elements in accordance with MIL-H-22594:

(a) Moisture resistance tests.
(b) Dielectric strength tests.
(c) Accelerated life tests.
(d) Creepage and clearance tests.

4.7.2.3 Unit operation. The fan motor, electric heater, and electrical control circuitry of each fan coil unit shall be tested at rated voltage and current to determine whether the fan, motor, heater, and controls will operate as designed. Any fan coil unit in which any component fails to operate properly shall not be offered for delivery.

4.7.2.4 Cooling coil leakage. The cooling coil of each fan coil unit shall be tested in conformance with the standard hydrostatic test of ASME Boiler and Pressure Vessel Code (BPVC) at a minimum hydrostatic pressure of 300 lb/in^2 gauge (1.5 times the maximum allowable working pressure). This test shall be performed using clean fresh water. Where water would have a detrimental effect or present production problems, a pneumatic test in accordance with ASME BPVC using a minimum pneumatic pressure of 250 lb/in^2 gauge (1.25 times the maximum allowable working pressure) shall be performed. Any fan coil unit in which there is evidence of cooling coil leakage when tested shall not be offered for delivery.

4.7.2.5 Internally excited (self-excited) vibration. Fan coil units shall pass type II vibration tests in accordance with MIL-STD-167-1 for first and second order frequencies. The capability of the rotating components to meet the balance requirements of 3.5.5 shall be demonstrated in accordance with MIL-STD-167-1 for type II vibration for first and second order frequencies up to and including 33 Hz (see 6.3).

4.7.2.6 Noise level. These tests are defined as meter tests consisting of airborne noise sound power level determinations and testing by sound meter and shall be conducted as specified in 4.7.2.6.1.

4.7.2.6.1 Airborne noise. Sound pressure noise level tests shall be performed on each unit in accordance with MIL-STD-740-1 and converted to sound power determinations by computation to verify compliance with airborne noise sound power level requirement limits as specified in table III. Each unit shall be tested operating in its normal shipboard orientation at its design rated capacity and conditions as specified in table II. A test discharge duct with orifice device shall be used to create design external pressures where required.

4.7.2.7 Motor tests. The insulation resistance test and the dielectric strength test shall be conducted in accordance with MIL-M-17059.

4.7.2.8 Permeability tests. A permeability test of CRES material used in construction of fan coil unit shall be conducted in accordance with DOD-STD-2142, test P-01.

4.7.2.9 Group B test schedule. The schedule for Group B tests shall be performed in the following order, except 4.7.2.4 and 4.7.2.5.

(a) Motor tests (see 4.7.2.7).
(b) Permeability tests (see 4.7.2.8).
(c) The following tests shall be conducted concurrently. They are: Capacities (see 4.7.2.1), Condensation (see 4.7.2.1.1), Performance (see 4.7.2.2) (i.e., including 4.7.2.2.1 through 4.7.2.2.3) and Unit operation (see 4.7.2.3).
(d) Noise level (see 4.7.2.6). This includes 4.7.2.6.1.

4.7.3 Group C tests.

4.7.3.1 Shock. Fan coil units shall be grade A shock tested in accordance with MIL-S-901 for grade A, type A equipment (see 6.3). Both horizontal and vertical units shall be tested in the shipboard orientation. Testing shall be conducted on the largest fan coil unit of each configuration and extended to smaller units in accordance with MIL-S-901. Tests under group I shock blows shall be conducted with the chilled water cooling coil unit pressurized to maximum allowable design pressure, the fan operating at high speed, and the heater energized. Tests under group II shock blows shall be conducted with the unit de-energized and depressurized. The shock test shall be conducted prior to any other tests and further testing shall not be performed until the fan coil unit passes the shock test.

4.7.3.1.1 Criteria of acceptance. Compliance with the following requirements shall constitute successful completion of the shock test:

(a) No portion of the equipment shall come adrift or otherwise create a hazard to personnel.
(b) There shall be no evidence of leakage of the chilled water cooling coil or operational malfunction of the fan, motor, or heater.
(c) The fan coil unit shall pass a post shock test, functional test, and inspection in accordance with MIL-S-901. Post shock tests shall be completed prior to correcting any damage which may have occurred during the shock test.
(d) After shock testing, the cooling coil of the fan coil unit shall successfully pass a hydrostatic or pneumatic leakage test as specified in 4.7.2.4.

4.7.3.2 Environmental (externally excited) vibration. Fan coil units shall be subjected to type I environmental vibration tests in accordance with MIL-STD-167-1 (see 6.3). 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. Both horizontal and vertical units shall be tested in the shipboard orientation. This vibration test shall be conducted following shock testing of 4.7.3.1 including the cooling coil leakage test and before any other tests. Testing shall be conducted on the largest fan coil unit of each configuration and extended to smaller units. The fan coil unit shall not be damaged or malfunction be caused as a result of environmental vibration tests.

4.7.3.3 Group C tests. The schedule for Group C tests shall be performed in the following order:

(a) Internal excited (self-excited) vibration (see 4.7.2.5).
(b) Environmental (externally excited) vibration (see 4.7.3.2).
(c) Shock (see 4.7.3.1). This includes 4.7.3.1.1.
(d) Cooling coil leakage (see 4.7.2.4).

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 6.7.)

5.1 General.

5.1.1 Protecting cover. When specified (see 6.2), a light gauge metal protecting cover shall be provided to protect the fan coil unit in shipping, storage, and installation. The cover shall be bolted to the unit and shall be removed when unit is installed.

5.1.2 Filters. Air filters (see 3.4.6) shall be replaced with new filters after completion of unit testing.

5.1.3 Water cooling system preparation. The water cooling system shall be thoroughly drained and blown out by the application of clean, dry, compressed air. All openings shall be sealed to prevent entrance of dirt and moisture.

5.1.4 Painting and lubrication. Painting (see 3.3.10) surfaces on which the painting is damaged or defective shall be cleaned and repainted in accordance with the painting requirements (see 3.3.10). Watersides that are resistant to corrosion; where dissimilar materials shall not result in corrosion, or are painted (see 3.3.10.4) shall not require a contact preservative. Otherwise, watersides shall be protected by a coating of type P-21, MIL-P-116 preservative. Lubrication of all rotating joints, bearings and similar moving items requiring lubrication shall be thoroughly lubricated with the required service lubricant. Excess lubricants shall be removed prior to unit preservation.

5.1.5 Noise tested units. Units shall be mounted and shipped on resilient mounts, and other necessary precautions shall be taken to insure that the noise limitation (see 3.5.6) requirements are not degraded as a result of shipping, handling and storage.

5.1.6 Navy 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 interior (unit and intermediate) and exterior fiberboard boxes including interior packaging forms shall conform to the class-domestic/fire retardant or class-weather resistant/fire retardant materials requirements as specified (see 6.2), of PPP-F-320 and amendments thereto.

5.2 Packaging requirements. The packaging (preservation, packing and marking) requirements shall be in accordance with MIL-E-17555 for the level of preservation (A, B, C, or Commercial), the level of packing (A, B, C, or Commercial), and marking (see 5.2.1 herein) including bar coding and other packaging acquisitioning options therein, as specified (see 6.2). Unless otherwise specified (see 6.2), Method IIa shall apply for level A preservation.

5.2.1 Special markings.

5.2.1.1 Critical close tolerance equipment. Shipping containers and unpacked shipments of noise tested plants (see 3.4.5) shall be marked with the following:

CRITICAL, CLOSE TOLERANCE
OPERATIONS EQUIPMENT
HANDLE WITH CARE
DO NOT DROP OR SUBJECT
TO SHOCKS OR JARS

Markings shall be stencilled, red color, and applied on two sides and both ends of the container or shipment, letters shall be minimum 1-1/2 inches high, except for small containers with insufficient space, in which case letters shall be of such size as to be legible. In addition, arrows and the word "UP", center of balance, sling or lifting point markings shall apply.

6. NOTES

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

6.1 Intended use. Fan coil units specified herein are intended to be used as an alternative to built-up air conditioning recirculation systems of a ship's heating, ventilating, and air conditioning (HVAC) system. They provide heating, cooling, and air recirculation required to satisfy compartment environmental design conditions with a savings in space and weight over built-up systems. They are standardized by size, performance, mounting designs, and mounting and connecting dimensions.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification.
(b) Size, type, and class required (see 1.2).
(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) Whether first article inspection is required (see 3.1).
(e) Whether nonmagnetic fan coil units are required (see 3.3.5).
(f) Whether inlet and outlet grilles are required (see 3.4.5).
(g) Whether left hand unit is required (see 3.4.10.1).
(h) Whether an electric heater is required and FW rating (see 3.4.11).
(i) Whether low voltage release is required (see 3.4.12.1).

(j) Repair parts required (see 3.4.13).
(k) Quality conformance inspection if other than as specified (see 4.4).
(l) Whether inclined cooling test is required (see 4.7.2.1).
(m) Whether protection cover is required (see 5.1).
(n) Whether technical manuals are to be packaged (see 5.2).
(o) When a protective cover is required (see 5.1.1).
(p) When fire-retardant lumber and plywood is not required (see 5.1.6(a)).
(q) Class of fire-retardant fiberboard required (see 5.1.6(b)).
(r) Level of preservation, level of packing and other packaging acquisitioning options required (see 5.2).
(s) When Method IIa does not apply for level A preservation (see 5.2).

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 Descriptions (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
3.2.2 and appendix A	DI-R-7079	Reliability program plan	---
3.4.1 and appendix B	DI-DRPR-80651	Engineering drawings	Level 2
3.4.2 and appendix C	DI-GDRQ-80650	Design data and calculations	---
3.5.1	DI-E-2121	Certificate of compliance	---
3.5.1	UDI-H-26378	List, check, safety system	---
4.1.1	DI-QCIC-81110	Inspection and test plan	---
4.4	DI-T-2072	Reports, test	---
4.7.1.2	DI-MNTY-80832	Maintainability/test-ability demonstration test report	---
4.7.2.5 and 4.7.3.2	UDI-T-23762	Report, vibration testing	---
4.7.3.1	DI-ENVR-80708	Shock test	---

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 that 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), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.4.1 Technical manual validation. New and existing (changed or revised) technical manuals should be validated during manufacture, assembly, installation, or checkout of the equipment in accordance with the applicable Contract Data Requirements List (CDRL) item in the Statement of Work (SOW).

6.5 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first lot production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also 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 requirement 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. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

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

6.6.1 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.

6.7 Sub-contracted material and parts. The packaging or preparation for delivery 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.

6.8 Weld defects. Weld defects that exceeds the parameters established by NAVSEA 0900-LP-003-8000, section V, should be corrected through:

(a) Weld rework. A procedure that brings the part into total compliance with the drawing and specification requirements, does not diminish the thickness of the parent metal by more than 10 percent, and does not effect the parent metal surface by more than 1/32 inch for 15 percent of the weld length or 12 inches, whichever is the least. Rework actions are completed at the discretion of the manufacturer.

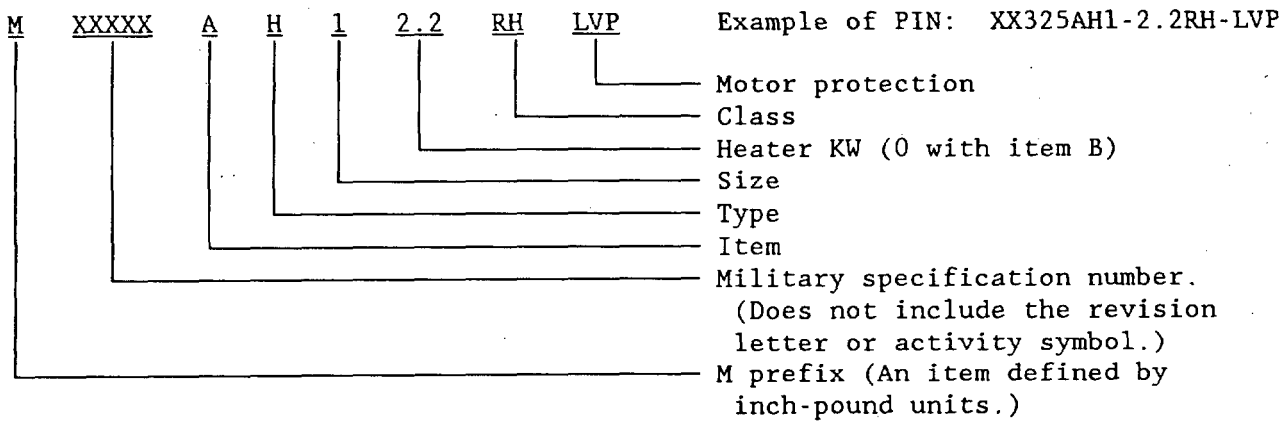
(b) Weld repairs. Repairs, to a Government approved procedure, should be made any time defects exceed the rework limits above. A repair action, if successfully completed, creates a serviceable yet not fully conforming unit. Weld repairs should be inspected through and accepted radiography in accordance with the acceptance standards of MIL-STD-278 for class M-2 machinery weld application.

6.9 Acceptance and rejection criteria. Lot acceptance and rejection criteria are as specified in table VII. Rejected units and lot should not be offered for delivery until corrective action has been taken. Final acceptance and shipment will be withheld until a re-examination has shown that the corrective action was successful.

TABLE VII. Lot acceptance and rejection criteria.

Lot size number of units	Sample size number of units	Defective units	
		Acceptance number	Rejection number
1 to 13	All	-	-
14 to 40	13	0	1
41 to 110	22	1	2
111 to 300	30	2	3

6.10 Part or identifying number (PIN). The PINs to be used for fan coil units acquired to this specification are constructed as follows:



6.11 Approval. Unless drawings for each contracting fan size have been previously approved and are within a three year time frame from the date of approval, the contractor is responsible to submit to the acquisition activity, for approval, the following: (1) two prints of fan coil unit assembly drawing; and (2) two prints of the motor drawing proposed for use with the fan coil unit.

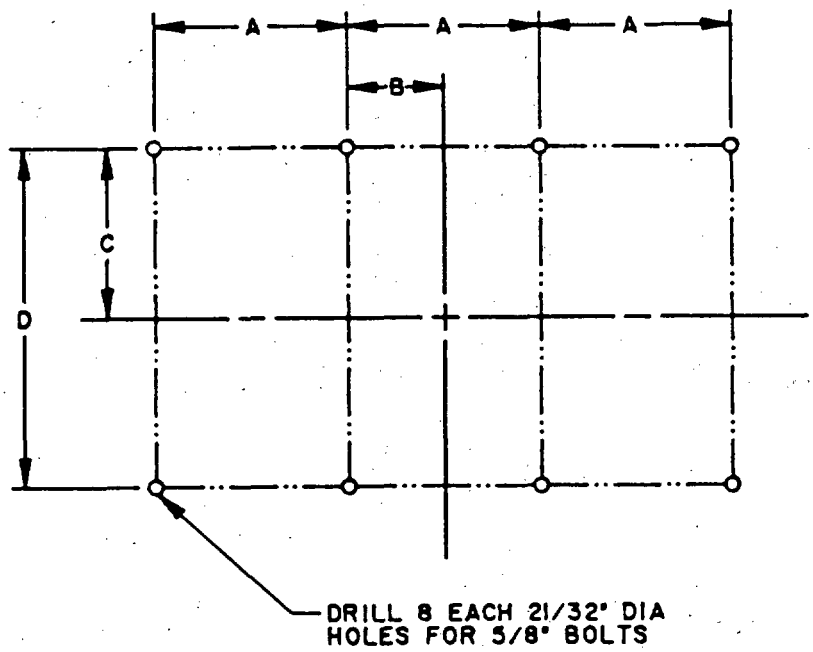
6.11.1 Final drawings. After comments on new drawings are approved, adjudicated or reconciled, the contractor is responsible to: (1) forward final fan coil and motor drawings to the acquisition activity; and (2) include special requirements of the contract or order prior to distribution of final drawings.

6.11.2 Identifying numbers. A national stock number (NSN) and a component identification number (CID No.) will be assigned by the Government after drawing approval. The contractor is responsible to: (1) identify these numbers in shipping papers; and (2) mark these numbers on each fan coil and motor identification plates.

6.12 Subject term (key word) listing.

Air filters
Chilled water
Contactors (relays)
Cooling coil (type DW)
Electric heater
Fan motor
Humidistat
HVAC (heating ventilating and air conditioning)
Thermostat

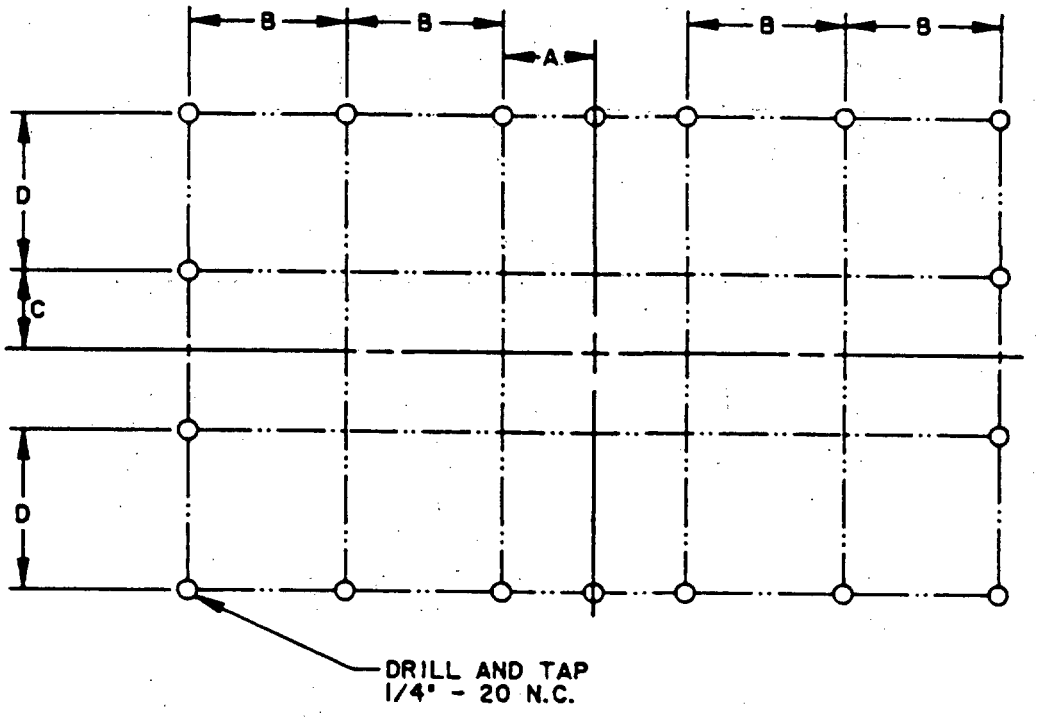
Preparing activity:
Navy - SH
(Project 4120-N323)



Mounting plan bolting pattern.

UNIT SIZE	DIMENSIONS (IN.)			
	A	B	C	D
1	15	7.5	13.5	27
2	15	7.5	13.5	27
3	16	8.0	14.5	29
4	16	8.0	19.0	38
5	16	8.0	23.0	46
6	16	8.0	20.5	41
7	16	8.0	27.0	54
8	16	8.0	32.0	64

FIGURE 1. Fan coil unit mounting plan.

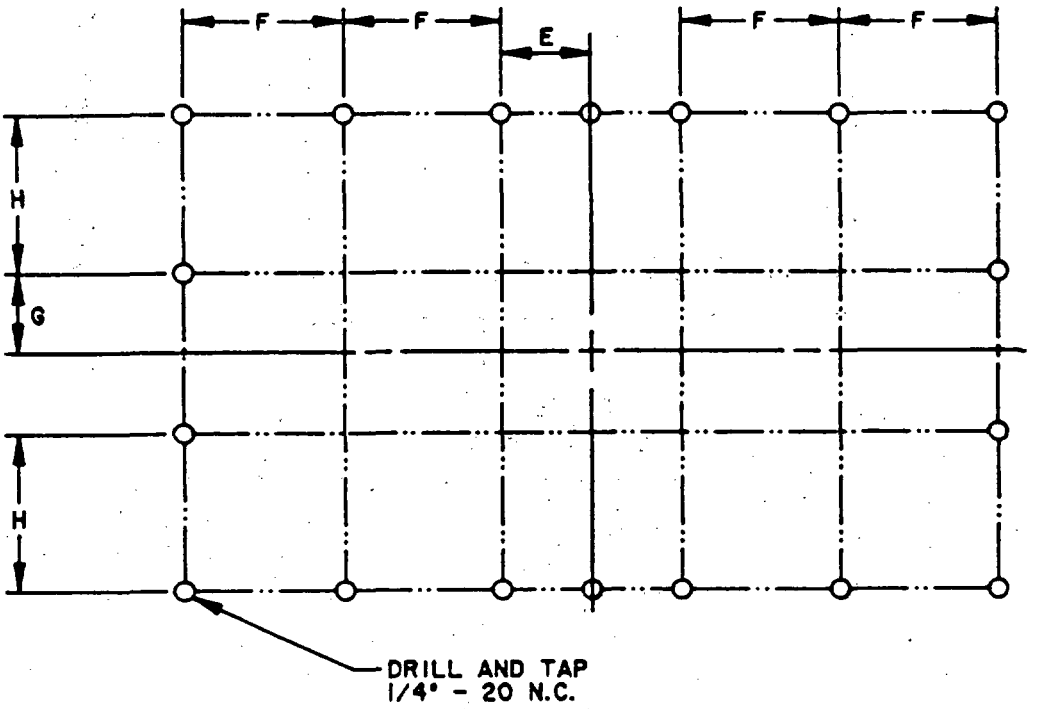


Inlet flange bolting pattern.

Unit size	Dimensions (in.) and values						
	A	B	No. of B spaces 1/	C	D	No. of D spaces 1/	Total no. of bolts
1	3.5	3	2	1.5	3	2	14
2	3.5	3	2	1.5	3	2	14
3	1.5	3	4	1.5	3	2	16
4	3.5 2/	3	8	1.5	3	2	26
5	3.5	3	8	1.5	3	2	26
6	3.5	3	8	1.5	3	4	30
7	2.5	3	12	1.5	3	4	38
8	3.5	3	14	1.5	3	4	42

1/ Number of spaces indicates number per side.
2/ No hole on centerline.

FIGURE 2. Fan coil unit flanged duct connections (inlet).

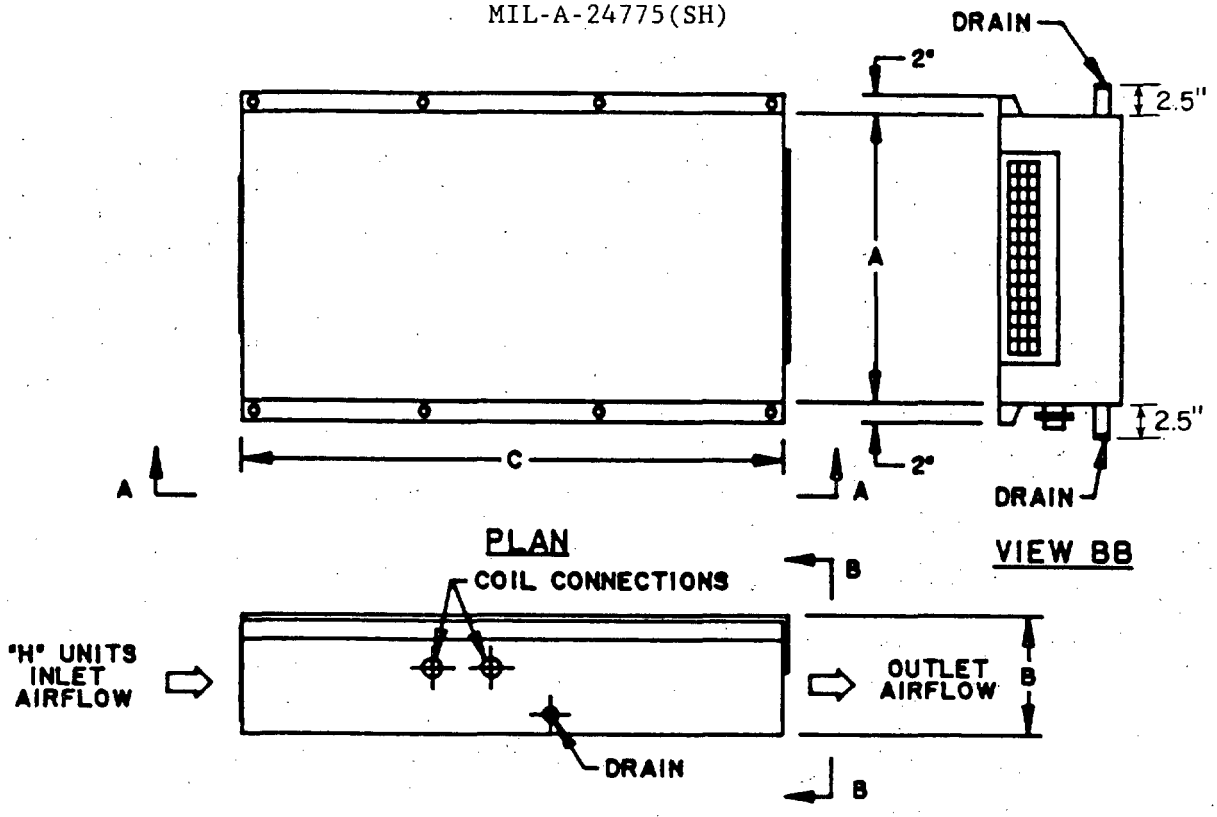


Outlet flange bolting pattern.

UNIT SIZE	DIMENSIONS (In.) AND VALUES						
	E	F	NO. OF F SPACES 1/	G 2/	H	NO. OF H SPACES 1/	TOTAL NO. OF BOLTS
1	2.37	3	6	1.69	0.0	0	18
2	2.37	3	6	1.69	0.0	0	18
3	3.50	3	6	℄	2.5	2	20
4	3.50	3	8	℄	3.0	2	24
5	2.50	3	12	℄	3.0	2	32
6	3.50	3	10	1.50	3.0	2	30
7	2.50	3	12	1.50	3.0	2	34
8	2.50	3	18	1.50	3.0	2	46

1/ Number of spaces indicates number per side.
2/ - bolt holes on centerline, no "G" dimension.

FIGURE 3. Fan coil unit flanged duct connections (outlet).



PHYSICAL LAYOUT 1/

UNIT SIZE	DIMENSIONS (In.)			WATER 2/ CONNECTION (In. NPS)	DRAIN 3/ CONNECTION (In. NPS)	UNIT 4/ WEIGHT (lb.)	FILTER	
	A	B	C				QUANTITY	SIZE
1	25	10	50	1/2	1	275	1	11 AF
2	25	10	50	1/2	1	285	1	11 AF
3	27	14	52	1/2	1	350	1	12 AF
4	36	14	52	1/2	1	420	2	12 AF
5	44	14	52	1/2	1	500	2	12 AF
6	39	17	52	1	1	500	3	12 AF
7	52	17	52	1	1	660	4	12 AF
8	62	17	52	1	1	780	5	12 AF

1/ Cooling coil shall be field reversible to allow left or right hand connection. Right hand connections shall be standard, unless left hand is required by 6.2.
2/ Supply and return water connection minimum inch nominal pipe size (in. nps) and as specified in 3.4.10. Connection insulation shall continue through casing to prevent thermal short between cold surface and casing. Vent and drain valves shall be provided as specified in 3.4.10.2.
3/ Drain connections as specified in 3.4.10.3.
4/ Maximum gross weight in pounds (lb) with water filled cooling coil and largest electric heater as specified in table II, installed.

FIGURE 4. Fan coil unit physical data.

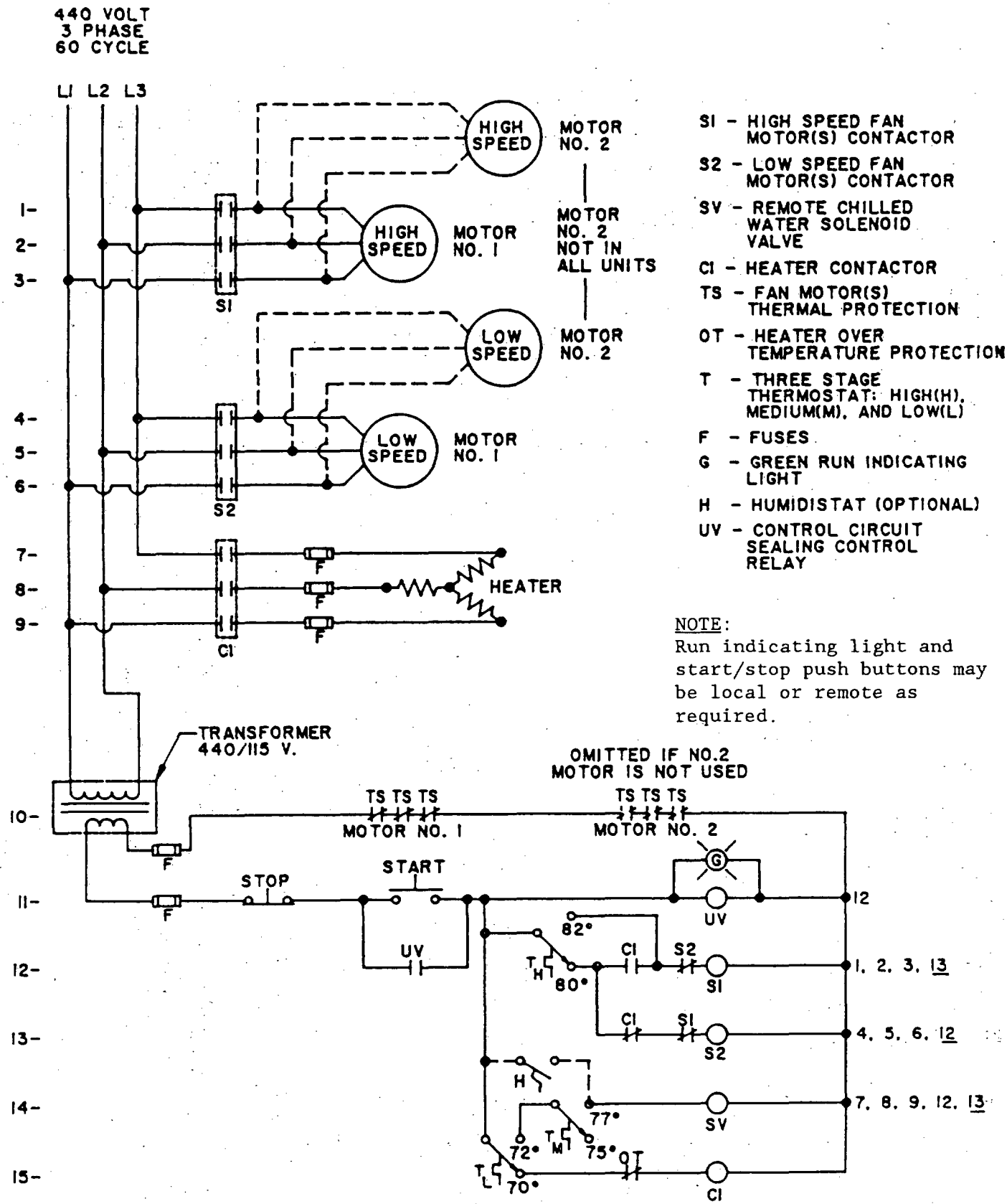


FIGURE 5. Fan coil unit electrical schematic, low voltage protection (LVP) (cooling and heating).

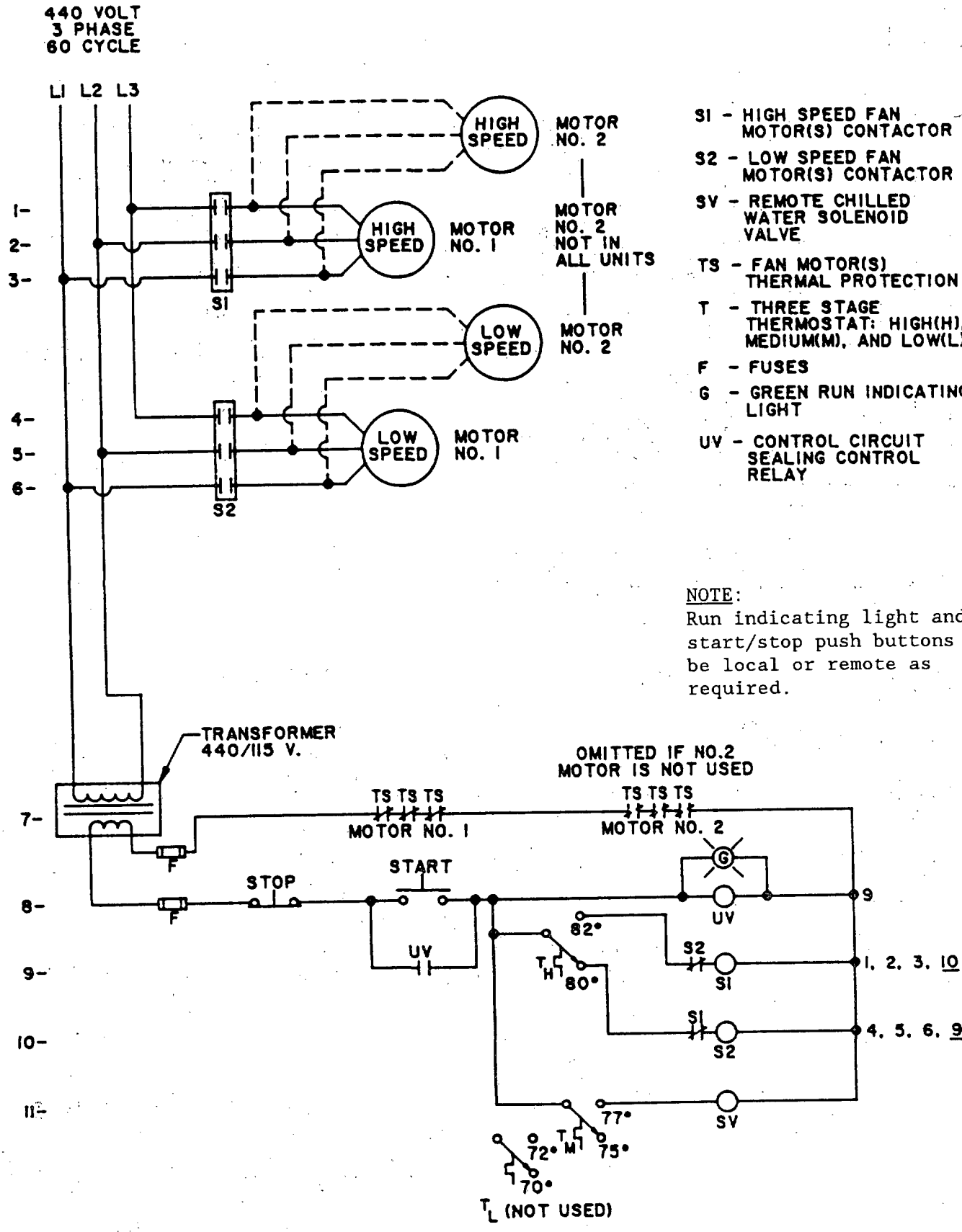


FIGURE 6. Fan coil unit electrical schematic, low voltage protection (LVP) (cooling only).

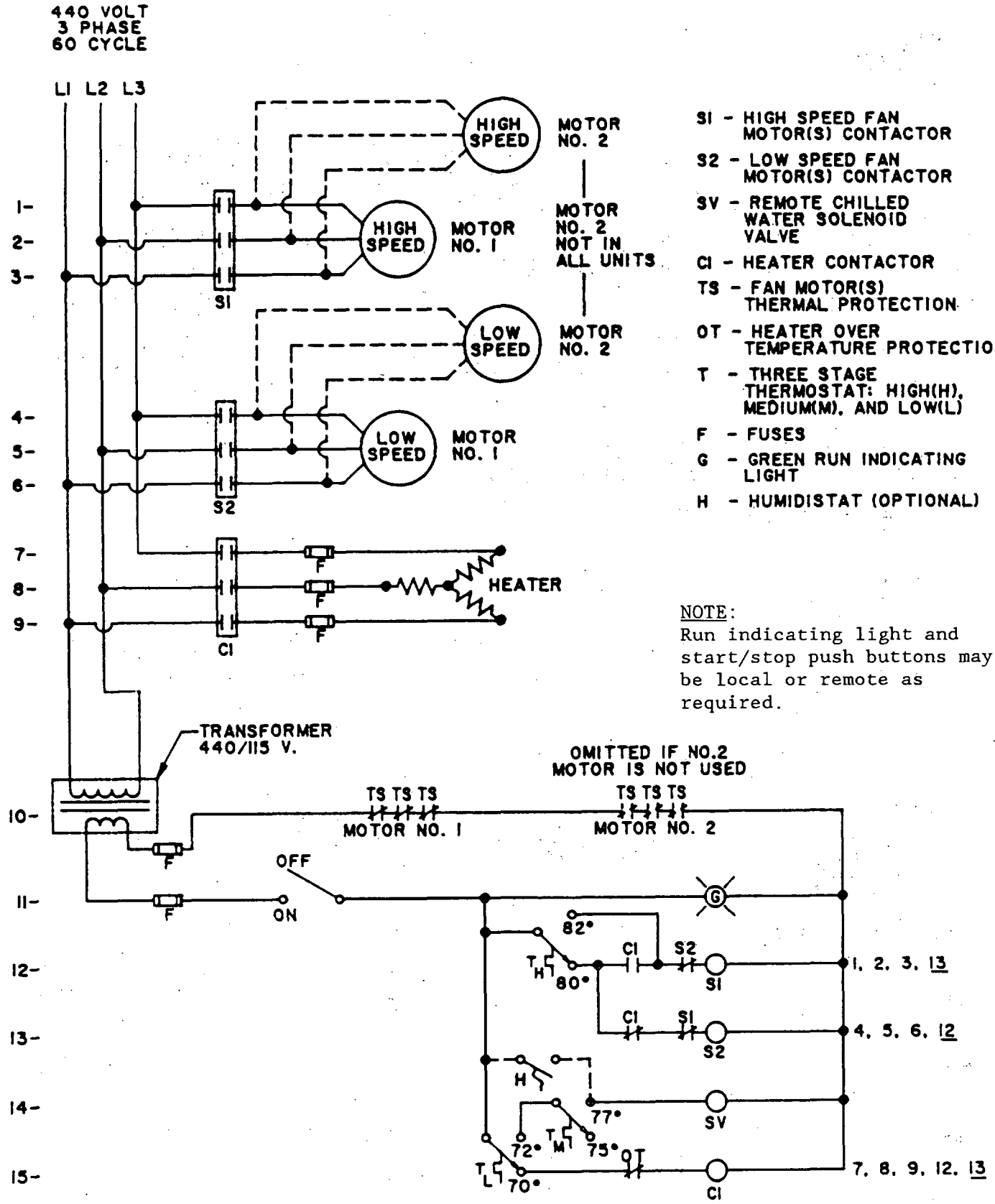


FIGURE 7. Fan coil unit electrical schematic, low voltage release (LVR) (cooling and heating).

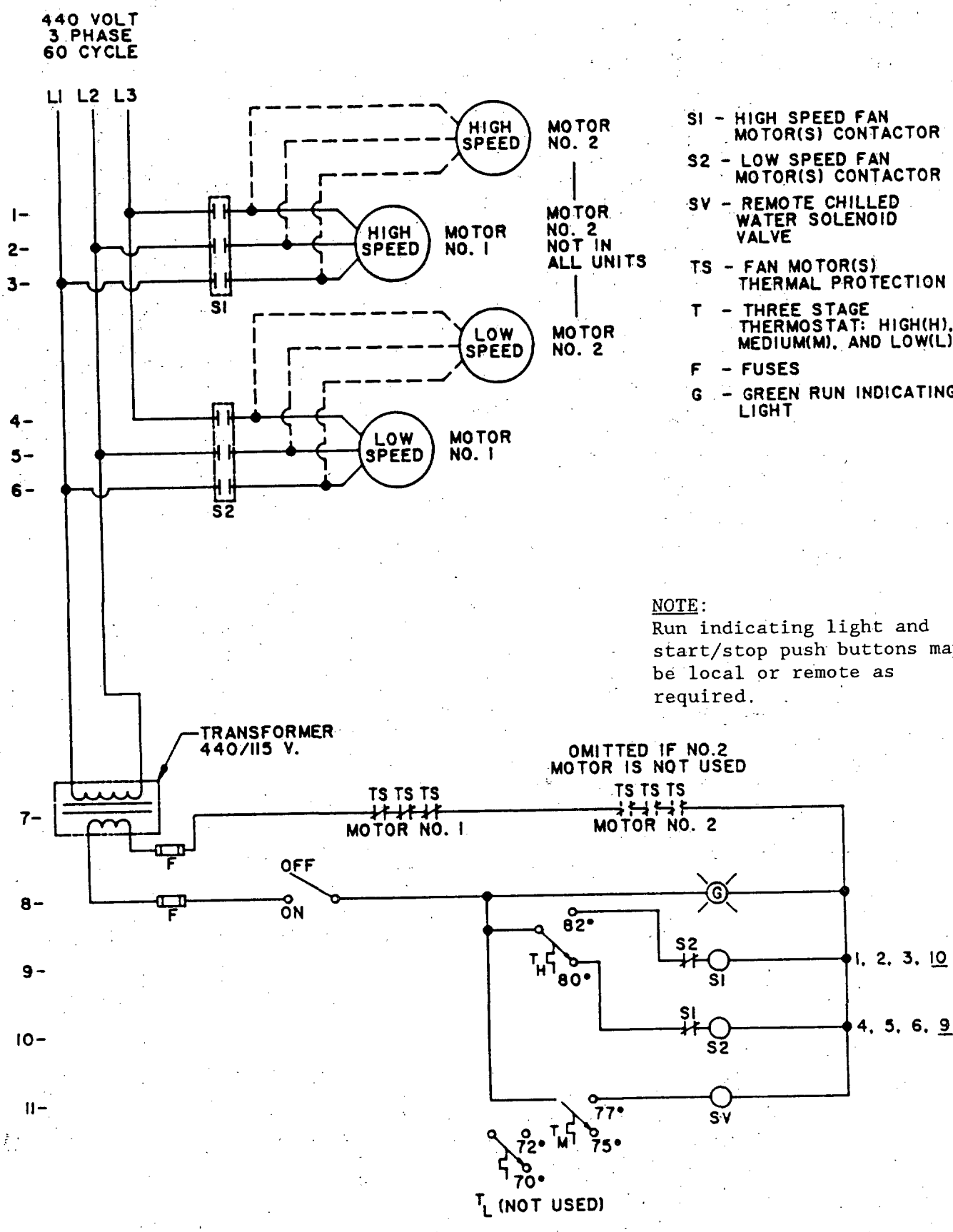


FIGURE 8. Fan coil unit electrical schematic, low voltage release (LVR) (cooling only).

APPENDIX A

RELIABILITY

10. SCOPE

10.1 Scope. This appendix covers the information and procedures necessary to ensure that the reliability requirements of this specification are met. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. RELIABILITY DATA

30.1 Reliability analysis. Reliability analysis shall be performed by manufacturers to determine that the equipment meets the Integrated Logistic Support (ILS) requirements of 3.2.2. Manufacturers shall maintain record data to indicate degree of conformance to ILS requirements. The reliability analysis shall include:

(a) A list of parts, which according to experience and judgment, are subject to wear, material deterioration, and service failures.
(b) Design features employed to attain the required service life of the parts, with consideration to shipboard environmental and resultant conditions. Design features include: choice of materials, compatibility of materials, repairability and accessibility, hardness, surface finishes, fits and clearances, corrosion control, equipment protection fail-safe features, internal and external operating temperatures, and suitability of the materials at these temperatures.
(c) Preventive maintenance and servicing requirements necessary for the achievement of reliable equipment. Any unusual steps or precautions necessary in carrying out maintenance and servicing requirements shall be pointed out.

30.2 Failure reporting, analysis, and feedback. The reliability assurance program shall incorporate a formalized system for recording, collecting, and analyzing all failures that occur during testing, installation, and operation through the tenure of the contract. Analysis shall be fed back to contractor's engineering, management, and production activities on a timely basis. Failure reports received from the using activity shall be integrated into this program for trouble analysis and for experience considerations for future design review.

APPENDIX B

ENGINEERING DRAWINGS TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix details the technical content required on assembly drawings and outline installation drawings for air conditioning fan coil units. This appendix is mandatory only when data item description DI-DRPR-80651 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. TECHNICAL CONTENT

30.1 Assembly drawings. Assembly drawings shall be provided for each of the following: complete fan coil unit, fan, fan motor, electric heater, cooling coil, electrical controls, filter, thermostat, and other components. Drawings shall illustrate design and construction, identify parts, and specify total weight of assembled parts. To show compliance with this specification, detail drawings shall be added to assembly drawings where necessary. Assembly drawings for the fan motor shall be prepared in accordance with the requirements of MIL-M-17059. Each assembly drawing shall indicate outline, mounting, attachments, connection methods and dimensions (including the size of fasteners and connections), and clearances for installation and servicing, plus supplemental data that will permit shipyard installation without the manufacturer's assistance.

30.2 Outline installation drawings. Outline installation drawings shall be provided for each size of fan coil unit. Contents of the outline shall be as follows:

(a) Dimensional front and plan views. Additional views showing overall and principle dimensions, detailed to establish the space limits in all directions required for installation and servicing (exclusive of space required for personnel). Clearances required to permit the opening and removal of removable access panels and any other operations necessary to obtain access to the equipment and clearances for withdrawal of parts or assemblies.
(b) Installation plans, including mounting plate details, drilling plans (with dimensions and tolerances), information regarding optional mounting methods, and the center of gravity.
(c) Location, type, and dimensions of chilled water connections, condensate drain connections, duct connections, access panels, air filter accesses, and electric service entrances.
(d) Wet and dry weight of complete unit (uncrated). Wet weight to include cooling coil full of water. Both wet and dry weight to include largest heater (if applicable).
(e) Any special instructions for hoisting, alignment, initial lubrication, installation or assembly, as necessary.

APPENDIX C

DESIGN DATA AND CALCULATIONS TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix details the section information required as specified in 3.4.2 herein. This appendix is mandatory only when data item description DI-GDRQ-80650 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. TECHNICAL CONTENT

30.1 Selection information. Selection information for each type and size of fan coil unit shall be developed and submitted, and shall contain the following:

(a) Performance curves showing total discharge static pressure at the outlet end section of the fan coil unit versus airflow ft^3/min at both fan motor speeds (1800 and 1200 r/min) and power input (kW/horsepower) to fan motor. Curves shall cover range from minimum airflow delivery to free airflow delivery.

(b) Performance tables showing the cooling coil load (MBH) representative of the fan coil unit cooling capacity as a function of the cooling coil entering air temperature conditions, from 70 to 100°F dry bulb (EDB) and 58 to 82°F wet bulb (EWB), at both fan speed rated airflows. The required cooling coil load shall include the air total heat loads (sensible and latent) and fan motor's sensible heat. Results shall be tabulated to show total heat and sensible heat separately. The cooling coil entering air conditions shall be the air temperature conditions in the section of the fan coil unit between the fan discharge and the cooing coil inlet. The cooling capacity as described shall be determined as a function of water flow in 0.5 gal/min increments for sizes 1 and 2; 1.0 gal/min increments for sizes 3, 4, and 5; 2.0 gal/min increments for sizes 6 and 7; and 4.0 gal/min increments for size 8. Minimum flow to the flow equivalent of 12 lb/in^2 pressure drop; entering air wet bulb temperature from 58 to 82°F in 2°F increments; entering air dry bulb temperature from 70 to 100°F at 5°F increments; entering water temperature from 40 to 50°F in 1°F increments, the water flow rate shall not exceed 3.6 gal/min/ton of cooling or a water flow pressure drop across the coil of 12 lb/in^2 or both; and airflow at two points between minimum airflow delivery and free airflow delivery for sizes 1 and 2 and at three points for sizes 3 through 8.

(c) Performance curves showing a chilled water cooling coil pressure drop as a function of water flow rate from 0.5 gal/min, or minimum recommended water flow rate to the maximum recommended water flow rate.

(d) Variations in any of the above for wet, less than 0.95 sensible heat factor (SHF), and dry, 0.95 and higher SHF, coil surfaces.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-A-24775(SH)	920713

3. DOCUMENT TITLE
AIR CONDITIONING FAN COIL UNITS, HORIZONTAL AND VERTICAL TYPES, NAVAL SHIPBOARD

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	b. TELEPHONE (Include Area Code) (1) Commercial	(2) AUTOVON
TECHNICAL POINT OF CONTACT: Mr. Tien M. Ngo, SEA 56Y11	703-602-7591	332-7591
c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND 55Z3 2531 NATIONAL CENTER BLDG 3 WASHINGTON, DC 20362-5160	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	