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## MILITARY SPECIFICATION

### BUILDING COMPONENTS, PANELIZED, PREFABRICATED

#### READY-CUT, RELOCATABLE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers panelized prefabricated modular building components for prefabricated, ready-cut, relocatable building with gabled roofs, vertical walls of variable lengths and heights.

1.2 Classification. Building components shall be for the following types, classes, and styles as specified (see 6.2).

- Type I - 24-foot wide (24-foot clear span) frameless building with load bearing walls that do not require an internal framework for structural support. Length erected in 4-foot increments.
- Type II - 36-foot wide (36-foot wide clear span) frameless building with load bearing walls that do not require an internal framework for structural support. Length erected in 4-foot increments.
- Type III - 48-foot wide (48-foot clean span) building with internal metal framework for structural support. Length erected in 20-foot increments.
- Type IV - 60-foot wide (60-foot clear span) building with internal metal framework for structural support. Length erected in 20-foot increments.
- Type V - 140-foot wide (two 44-foot clear side spans and one 52-foot clear center span) building with internal metal frame-work for structural support. Length erected in 20-foot increments.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer (Code 156), Naval Construction Battalion Center, Port Hueneme, CA 93043, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- Class 1 - 8-foot eave height.
- Class 2 - 10-foot eave height.
- Class 3 - 12-foot eave height.
  
- Style A - Plain wall panels.
- Style B - End wall panels.
- Style D - Roof panels.
- Style E - Gable panels.
- Style F - Window panels.
- Style G - Door panels.
- Style H - Gussets (for types I and II only).
- Style I - Shear frames (for types I and II only).
- Style J - Structural end frame, 20-foot long (for types III, IV, and V only).
- Style K - Structural intermediate frame, 20-foot long (for types III, IV, and V only).

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

- W-B-30 - Ballast, Fluorescent Lamp.
- W-C-375 - Circuit Breaker, Molded Case, Branch Circuit and Service.
- W-C-596 - Connector Plug, Receptacle and Cable Outlet, Electrical Power, General Specification for.
- W-C-596/12 - Connector, Receptacle, Electrical, General Purpose, Duplex, Hospital Grade Grounding, 2 Pole, 3 Wire, 15 Amperes, 125 Volts, 50/60 Hertz.
- W-F-1662 - Fixture, Lighting (Fluorescent Alternating-Current, Recessed and Surface Ceiling).
- W-L-00116 - Lamp, Fluorescent.
- W-P-115 - Panel, Power Distribution.
- W-S-896 - Switch, Toggle (Toggle and Lock), Flush Mounted.
- QQ-S-781 - Strapping, Steel, and Seals.
- PPP-B-601 - Boxes, Wood, Cleated-Plywood.
- PPP-B-621 - Boxes, Wood, Nailed and Lock-Corners.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-P-40 - Packaging and Packing of Hand Tools.
- PPP-T-97 - Tape, Pressure-Sensitive Adhesive, Filament Reinforced.

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- MIL-P-116 - Preservation, Methods of.
- MIL-V-173 - Varnish, Moisture and Fungus Resistant (for Treatment of Communications, Electronic, and Associated Equipment).
- MIL-B-3180 - Boilers and Related Equipment, Packaging of.
- MIL-R-3593 - Refrigeration and Cooling Equipment (Excluding Household Refrigerators), Packaging of.
- MIL-C-3774 - Crate, Wood, Open, 12,000 and 16,000 Pound Capacity.
- MIL-E-17555 - Electronic and Electrical Equipment, Accessories, and Repair Parts; Packaging and Packing of.
- MIL-B-26195 - Boxes, Wood-Cleated, Skidded, Load-Bearing Base.
- MIL-S-29175 - Switch, Thermostatic, Low Voltage, Non-(Setback/Setup) and Setback/Setup, Temperature Limiting: Heating Cooling, and Heating-Cooling.
- MIL-C-52950 - Crates, Wood, Open and Covered.

## STANDARDS

## FEDERAL

- FED-STD-141 - Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing.
- FED-STD-H28/2 - Unified Thread Form and Thread Series for Bolts, Screws, Nuts, Tapped Holes and General Applications.

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-810 - Environmental Test Methods.
- MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking, And Waterproofing, with Appropriate Test Methods.

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 - Building Code and Requirements for Reinforced Concrete.

(Application for copies should be addressed to the American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, MI 48129.)

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AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

Z97.1 - Performance Specification and Methods of Test for Safety Glazing Material Used in Buildings.

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A325 - High Strength Bolts for Structural Steel Joints.
- B117 - Salt Spray (Fog) Testing.
- C236 - Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
- C273 - Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores.
- C365 - Flatwise Compressive Strength of Sandwich Cores.
- C423 - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- C481 - Laboratory Aging of Sandwich Constructions.
- C635 - Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings.
- D968 - Abrasion Resistance of Organic Coatings by the Falling Abrasive Tester.
- D1781 - Climbing Drum Peel Test for Adhesives.
- E72 - Conducting Strength Test of Panels for Building Construction.
- E84 - Surface Burning Characteristics of Building Materials.
- E90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- E136 - Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
- E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- E413 - Determination of Sound Transmission Class.

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

1894 - General Purpose Series 1 Freight Containers Minimum Interior Dimensions.

(Applications for copies should be addressed to the International Organization for Standardization, One Rue De carembe, Case Postale 56, 1121 Geneva 20, Switzerland.)

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

Recommended Design Practices Manual.

(Application for copies should be addressed to the Metal Building Manufacturers Association, 2130 Keith Building, Cleveland, OH 44115.)

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

## NEMA STANDARDS.

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2110 L Street, N.W., Washington, DC 20037.)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

## No. 70 - National Electrical Code.

(Application for copies should be addressed to the National Fire Protection Association, Battery March Park, Quincy, MA 02269.)

## UNDERWRITERS LABORATORIES INC. (UL)

UL 167 - Smoke Detectors, Combustion-Products Type, for Fire-Protective Signaling Systems.

UL 168 - Smoke Detectors, Photoelectric Type for Fire-Protective Signaling Systems.

UL 943 - Ground Fault Circuit Interrupters.

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

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

## 3. REQUIREMENTS

3.1 Description. The panelized building components general arrangement, design, and other requirements shall be as specified herein. The building components shall include wall panels, roof panels, gussets, shear frames, structural end frames, structural intermediate frames, doors, windows, louver ventilators, fasteners, hardware, anchor bolts, and other items as listed or required to assemble a usable panelized building having a gable roof and vertical walls. Optional building components for a complete building shall include floor panel system, suspended ceiling, partitions, heating, mechanical ventilation, air conditioning, and electrical system and other items as listed or required and specified herein. Modularity and interchangeability of like panels shall be achieved. The Government has the options under this specification of procuring individual building components, building shells, or complete buildings with optional items (see 6.2).

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3.2 Standard commercial product. The prefabricated building shall, as a minimum, be in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the prefabricated building being furnished. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.3 First article. When specified (see 6.2), the contractor shall furnish one complete prefabricated building for first article inspection and approval (see 4.2.1 and 6.4).

3.3.1 Modified building for erection test of building components. The modified building for the erection test shall be complete and include all types, classes, and styles of components and specified auxiliary systems or subsystems being furnished. The test building shall be a 24-foot long building for type I components, a 36-foot long building, for type II components, and a 60-foot long building for types III, IV, and V components. The end walls and side walls shall be complete with all doors and window components. The modified test building shall be erected in accordance with instructions contained in the contractor's erection manual (see 6.3).

3.4 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible 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 are allowed under this specification unless otherwise specified.

3.4.1 Structural steel. Steel for structural and framing members shall be of suitable structural steel alloy having a yield strength of not less than 45,000 pound-force per square inch (psi) and sufficient section module to meet the required design criteria.

3.4.2 Steel sheeting. All steel sheeting for flashing roof and sides shall not be less than 26 gage, zinc coated, factory finished baked enamel.

3.4.3 Aluminum. Exterior or interior roof or wall panels shall have a thickness of not less than 0.024 inch.

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3.4.4 Excess panels. When specified (see 6.2), a maximum of six roof and six wall panels in excess of that required to erect the building shall be furnished with each building.

3.4.5 Fasteners.

3.4.5.1 Connectors and fasteners. Connectors and fasteners employed shall permit structural components to be coordinated with each other and with all adjacent and pertinent building components to insure building performance, structural integrity, workable details, clearances, tolerances and watertight joints.

3.4.5.2 Bolts. Bolts for joining structural frame members and column base clips shall be high-strength steel bolts conforming to ASTM A325, and shall be furnished with suitable nuts and plain washers. Bolt threads shall be in accordance with FED-STD-H28/2.

3.4.5.3 Excess fasteners. When specified (see 6.2), a quantity of fasteners in excess of that required to completely assemble each building shall be furnished with each building as follows: All bolts, nuts, and washers 1/2 inch in diameter and larger, 2 percent excess; all other fasteners 5 percent excess.

3.4.6 Dissimilar metals. Dissimilar metals which can be expected to experience galvanic corrosion shall not be placed in contact. Where such contact cannot be avoided, metals shall be isolated from one another by means of interposing insulating material.

3.4.7 Accessories. Metal accessories, such as flashing, trim, metal closures, strips, or caps shall be fabricated of material appropriate to the material used for roof and wall panels, but shall have a thickness not less than the minimum thickness specified for roof and wall exterior sheeting.

3.5 Design.

3.5.1 General. Components shall be designed so that they can be erected directly on a concrete slab or on footings with an integral floor system. The building components shall be complete with all windows, doors, fasteners, fittings, miscellaneous accessories, and all materials for complete assembly of prefabricated, relocatable panelized buildings. The components shall be so designed that upon removal of either end wall, a building may be expanded in length (along the long dimension) using applicable components. Type I and II buildings shall be expanded using roof panels, side-wall panels, ridge beams, and where required for structural integrity, gussets and shear frames. Type III, IV, and V buildings shall be supported by and expanded using structural end and intermediate frames spanned at 20-foot centers, composed of columns, girders, and purlins that bolt or structurally fasten together as a supporting rigid frame. All structural frames formed by columns, girders, and purlins shall be interchangeable. All building components shall satisfy the design criteria described herein. Building components shall be capable of being



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dismantled and re-erected at another site with minimum of effort and loss of materials. All frame members shall be shop fabricated for bolted field assembly. Special fits requiring field welding, cutting, or drilling shall not be permitted. All components shall be sized for shipment in shipping containers conforming to ISO 1894, designation IA.

3.5.1.1 Frameless building. Frameless buildings are defined as buildings with load bearing walls that do not require an internal framework for structural support. For structural integrity, buildings can be provided with gussets and shear frames provided neither of which, with the exception of vertical side wall members of shear frame, shall interfere with installation of suspended ceiling when specified (see 3.5.15 and 6.2).

3.5.1.2 Internal frame building. A building with internal metal framework for structural support which is erected prior to installation of wall and roof panels. All structural support members with exception of columns shall be designed to permit installation of suspended ceiling when specified (see 3.5.15 and 6.2), without cutting or fitting of ceiling panels except at columns.

3.5.2 Structural design. The contractor has the option of using steel or aluminum for structural application. Except as modified herein structural design shall be in accordance with the following:

- a. MBMA "Recommended Design Practices Manual".
- b. The Aluminum Association, Aluminum Construction Manual.

(1) "Engineering data for Aluminum Structures".

(2) "Specifications for Aluminum Structures".

3.5.2.1 Ridge beam. Ridge beam shall be extruded aluminum with required splice plate arrangement (see 3.5.1).

3.5.2.2 Gusset plates, splice plates, and connecting devices. All gusset plates, reinforcing plates, splice plates, and connecting plates shall be supplied precoordinated and predrilled.

3.5.3 Building use, life and relocatability. The assembled building components shall provide a building which shall operate for 5 years under weather conditions encountered in temperate environments whose temperatures range between -30 degree Fahrenheit (°F) and +120°F. The building components shall be capable of being dismantled, and re-erected at another site with minimum effort and loss or damage of components except fasteners. The components shall withstand complete disassembly, relocation, and reassembly not less than three cycles when tested as specified in 4.5.5.

3.5.3.1 Erection and relocation. The building envelope components consisting of wall and roof shall be capable of either erection or disassembly at the rate of 0.2 manhours per square foot of enclosed building area.



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3.5.4 Loads. Unless otherwise specified (see 6.2), building components and buildings constructed from building components shall be designed to withstand, in addition to the dead load of the structure, the following loads:

Snow load: 30 pound-force per square foot (psf).

Wind load: 25 psf.

Floor load: 80 psf.

Interior walls (partitions): 15 psf applied horizontally

Concentrated load: 600 pounds (lb) from any point on structural end frame or intermediate frame at column line.

3.5.5 Combined loads. Unless otherwise specified (see 6.2), building components and buildings constructed from building components shall be designed to withstand the following combinations of loads:

Dead load plus snow load.

Dead load plus wind load.

Dead load plus snow load plus one-half wind load.

Dead load plus wind load plus one-half snow load.

3.5.6 Deflection. The deflection of structural frames, ridge beams, gussets, shear frames, wall panels, roof panels, partitions, floor panels, closures, coverings, and similar units shall not exceed  $L/360$  under uniform design live loading on any section spanning two or more spans or  $L/120$  for single spans; both as computed and tested as specified in 4.5.1.4.1 on unfastened sections fully free to deflect.

3.5.7 Weathertightness. The assembled roof and wall panel systems shall be capable of being assembled into a weathertight leakproof structure. When tested as specified in 4.5.4.1, 4.5.4.2, 4.5.5.1, 4.5.5.1.1, and 4.5.5.1.2, the interior of the structure shall show no evidence of leakage or running water.

3.5.8 Foundation and floor. Unless otherwise specified (see 6.2), the design of the building components or a complete structure shall provide for installation on a concrete slab-on-grade. Furnishing of materials for concrete slab-on-grade is not a part of this specification; however, a design conforming to ACI 318 for the concrete slab-on-grade, thickened edge, or piers, as required to support building components or building under loads specified herein shall be provided. When specified (see 6.2), a raised integral floor system utilizing floor panels supported by lightweight open web metal joists on 4-foot centers shall be provided. The joists shall span approximately 12 feet between floor beams and be consistent with the dimensional modularity of the wall and the roof panels.

3.5.9 Wall, roof, and floor panels. Wall, roof, and floor panels shall be structural sandwich composites consisting of steel or aluminum facing, facings shall be of the same material on both sides of the panels. Panels shall be bonded to a 3/4-inch maximum cell size, 70 to 99 lb weight, corrosion resistant kraft paper honeycomb core, with a minimum of 11 percent phenolic

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resin impregnation by weight. Minimum thickness of panels shall be 3 inches. Wall and roof panels shall have stucco embossed facing. Floor panel shall have smooth facing (not embossed). The floor panels shall be supporting the floor, and roof and wall load as specified in 3.5.4. The honeycomb core cells shall be filled with a lightweight, flame-resistant insulation. The panels shall have formed edge connectors that are capable of being friction locked without mechanical fasteners using a full-length joint without through metal connectors. Joint locking shall allow lateral expansion and contraction and joints shall be waterproof. When tested as specified in 4.5.1.4.1, the sandwich composite shall show no evidence of permanent deformation, core failure, delamination, or buckling of facings.

3.5.9.1 U-factor of the panels. The U-factor of the wall, roof, and floor panels shall be not more than 0.15 British thermal units per hour per square foot °F when tested as specified in 4.5.1.4.2.

3.5.9.2 Honeycomb core.

3.5.9.2.1 Mechanical properties of the honeycomb core. The honeycomb core shall have the following mechanical properties when the core conforms to 3.5.9, and subjected to the temperature extremes specified in 3.5.3 and tested as specified in 4.5.1.1 and 4.5.1.2.

Dry compressive strength (flatwise)	90 psi.
Shear strength (flatwise)	27 psi.
Shear modulus (flatwise)	1,800 psi.

3.5.9.2.2 Wet strength. The honeycomb core shall have a wet strength of not less than 60 percent of the dry strength specified in 3.5.9.2.1 after being tested as specified in 4.5.1.3.

3.5.9.2.3 Flame spread rating. When tested as specified in 4.5.1.4.5 the honeycomb panel of production thickness shall have:

	<u>Finish panel</u>	<u>Core</u>
Flame spread	15 or less	25 or less
Fuel, contributed	0	15 or less
Smoke developed	50 or less	25 or less

3.5.9.2.4 Density. The density of the honeycomb material shall be within +10 percent of that specified (see 6.2).

3.5.9.3 Panel exposure resistance. When tested as specified in 4.5.1.4.3, panels shall show not more than 15 percent deterioration after being subjected to not less than six cycles of laboratory aging.

3.5.9.4 Panel coating. Panel exposed coating shall meet all the requirements when tested in accordance with 4.5.1.5.1 through 4.5.1.5.6.

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3.5.9.5 Panel adhesive. Panel adhesive shall be of a structural neoprene resin reactive semi-thermosetting type, capable of advancing and cross linking to form homogeneous layers between plies. Panel adhesive shall be tested or specified in 4.5.1.4.4.

3.5.9.6 Panel washcoat. Washcoat (prime coat) on interior panel side facing shall be compatible with panel adhesive (see 3.5.9.5).

3.5.10 Windows. Unless otherwise specified (see 6.2), windows shall be installed by the manufacturer and made an integral part of the window panel. Unless otherwise specified (see 6.2), windows shall be aluminum awning type, approximately 4-foot width by 4-foot height. All windows shall have an interior latch or locking device. Weather-stripping shall be provided on all windows. Window panels shall be subjected to tests of 4.5.5.1.2 and 4.5.5.2.1.

3.5.11 Glazing. Glazing for all windows shall conform to ANSI Z97.1. Glazing shall not be less than 0.125 inch thick.

3.5.12 Louvers. Unless otherwise specified (see 6.2), each building shall be furnished with a louvered opening in each end wall. The louvers size shall be as specified (see 6.2), and shall be positive closing and manually adjustable from the floor of the building. Louvered openings shall be furnished with insect screen. The number and location of louvers shall be as specified (see 6.2).

3.5.13 Insect screen. Unless otherwise specified (see 6.2), insect screen for screen doors, windows, and louvered openings shall be 18 by 14 mesh. Screens shall be fibrous glass, aluminum, or plastic. The screening shall be heat, flame, and mildew resistant. Screens shall be of the exterior type.

#### 3.5.14 Doors.

3.5.14.1 Exterior personnel doors. The manufacturer's heavy-duty metal doors shall be furnished. The doors shall be 3-foot by 7-foot and the thickness shall be not less than 1-3/4 inches. Glazing shall conform to the glazing requirements for windows. Hollow metal doors shall be filled with a lightweight, flame-resistant insulating material. Doors shall be properly gaged for 1-1/2 pair of hinges and drilled for lock sets. Each entrance door shall have an independent, flush type lock set with a flush type door pull, and a heavy-duty spring closing device. Three keys shall be provided for each locking unit. Unless otherwise specified (see 6.2), all doors shall open inward. When tested as specified in 4.5.5.2.1, the doors shall operate freely without sticking or binding.

3.5.14.2 Screen doors. When specified (see 6.2), each hinged building door opening shall be fitted with a screen door. Each screen door shall be furnished with one heavy-duty coil spring complete with attaching eye bolts, all to be either zinc or cadmium plated. Each screen door shall also have a flush pull, latch, and keeper. Each screen door shall have not less than 2 feet of screen door protector at the bottom. A push panel shall be provided

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at approximately mid-height to provide frame rigidity of the screen door, and to protect the screen. All screen doors shall open outward. When tested as specified in 4.5.5.2.1, the doors shall operate freely without sticking or binding.

3.5.14.3 Sliding panel doors. When specified (see 6.2), heavy-duty sliding panel doors shall be provided in one, or both type III, IV, and V style A end walls. The doors shall be hung from a track on rollers. A retainer channel shall be provided for installation at the base of the doors, and shall cover the entire travel of the doors. Doors shall be equipped with standard pull handles installed on both sides of the doors by a bolt-through method, (four handles per set of doors). Each door shall have a suitable interior locking device. Size of doors shall be as specified (see 6.2). When tested as specified in 4.5.5.2.1, the doors shall operate freely without sticking or binding.

3.5.15 Ceiling. When specified (see 6.2), a complete ceiling system shall be furnished. Ceiling system shall meet the requirements of 3.5.15.1 thru 3.5.15.11 when tested in accordance with 4.5.2.

3.5.15.1 Ceiling system. The ceiling system shall consist of a suspension system and acoustical material to locate bottom of ceiling 6 inches maximum below eave height on class 1 buildings and at specified height on class 2 and 3 buildings (see 6.2). The ceiling suspension system shall consist of a concealed assembly of structural members and such hardware and wall moldings as required to support the entire ceiling system. This ceiling suspension system shall support the ceiling system with a maximum deflection of  $L/360$  of the span. Type I and II buildings do not require trusses supporting the ceiling grid system; grid maybe wire hung from roof; ceiling shall be flat. The acoustical ceiling material shall constitute the other major component of the ceiling system. The acoustical material shall be standard size fiberglass acoustical tile (see 3.5.15.7). The ceiling system shall be capable of incorporating lighting, heating, ventilation, air conditioning, electronic, and electrical system components, as necessary. The system shall be completely integrated with the structural and mechanical elements, and shall be coordinated with the interior partitions.

3.5.15.2 Loading. The ceiling system structural support shall be of sufficient strength to obtain a heavy-duty rating.

3.5.15.3 Ceiling suspension assembly. The ceiling suspension assembly shall be a heavy-duty rated 2-foot by 4-foot exposed grid system, consistent with ASTM C635.

3.5.15.4 Fire hazard rating. All material in the ceiling system shall be noncombustible. Additionally, all material shall have a flame-spread rating of 25 or less, smoke-developed rating or 50 or less, and fuel contribution of zero, when tested in accordance with 4.5.1.4.5.

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3.5.15.5 Sound control. The acoustical ceiling system shall have a minimum sound transmission class of 30 when tested in accordance with 4.5.2.1.2.

3.5.15.6 Weight and dimensions. Maximum weight of any component of the system shall be kept to a minimum, consistent with other design criteria and the manufacturer's standard production methods. Dimensions shall be manufacturer's standard. Dimensional tolerances shall be within the limits specified in ASTM C635.

3.5.15.7 Acoustical ceiling material. The acoustical ceiling material shall be plastic coated fiberglass or mineral composition ceiling tile with mineral composition absorbent backing, class 25. Minimum thickness shall be 5/8 inch.

3.5.15.8 Installation and removal. The ceiling system covered by this specification shall be capable of being installed, taken down, and removal shall be accomplished in a reasonable time span.

3.5.15.9 Hardware. All hardware, including but not limited to hangers, splices, clips, hanger wire, and bolts shall be furnished in a heavy-duty type of the manufacturer's standard. All hardware necessary for the complete installation and operation of the system shall be supplied by the manufacturer.

3.5.15.10 Durability. Hanger wire under roof panels, where plenum is used for air circulation, shall be corrosion resistant.

3.5.15.11 Accessibility. System shall permit any acoustical tile or panel selected at random to be removed by moving or removing not more than 20 square feet of adjacent tiles or panels.

3.5.16 Interior partitions. When specified (see 6.2), relocatable partition system shall include floor-to-ceiling partitions for a complete building. Floor plan of partition system shall be as specified (see 6.2). Partition shall meet the requirements of 3.5.16.1 thru 3.5.16.14 when tested in accordance with 4.5.3.

3.5.16.1 Interior partition system. The system components shall include panels, fasteners, floor anchoring devices, and other items as listed or required to assemble a complete and usable interior wall partition system. Maximum panel weight shall be 150 lb. Minimum thickness of panels shall be 1-3/4 inches. Type, width, and height of panels shall be as specified (see 6.2). Each panel shall be capable of standing alone independent of other panels. The relocatable interior wall partition system shall be compatible with other currently available ceiling, heating, air-conditioning, and structural systems.

3.5.16.2 Panel material. Panels shall be sandwich construction type consisting of a honeycomb core material as specified in 3.5.9.2, bonded on both sides by steel or aluminum facings to form a structural laminate conforming to the dimensions required and meeting all design criteria.

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3.5.16.3 Loading. When tested as specified in 4.5.3.1.1, the ceiling height panels shall be capable of withstanding lateral loads of not less than 5 psf, applied normally to the surface of the erected panel. Each door panel shall be capable of withstanding a 17 foot-pound (ft-lb) door slam impact when tested as specified in 4.5.3.3.

3.5.16.4 Resistance to concentrated structural impact load. Partition shall show no evidence of permanent deformation, when tested as specified in 4.5.3.1.2. The panel shall meet the following requirements: (1) maximum instantaneous deflection is less than 1 inch; and (2) maximum permanent set is less than 0.10 inch.

3.5.16.5 Surface impact resistance. Partition surface shall show no evidence of damage or breakage, when tested as specified in 4.5.3.1.4.

3.5.16.6 Doors and door hardware. Doors shall be an integral part of the door panel. Doors shall be heavy duty, standard solid core size, and relocatable type. Door hardware shall be of manufacturer's standard.

3.5.16.7 Panel faces and finishes. All finishes shall be standard commercial finishes used by the manufacturer. Color shall be as specified (see 6.2).

3.5.16.8 Sound control. The interior wall partition system shall have a minimum sound transmission class relative to the panel type construction specified in 3.5.16.2, when tested as specified in 4.5.3.1.5.

3.5.16.9 Partition attachment at base. The method of attachment of the interior wall partition system to the floor shall produce minimum damage to the floor finish. Damage shall not occur to the structure due to fastening. A 4-inch base molding shall be provided. The base attachment shall be capable of adjusting vertically up to 1 inch in order to adapt to variations in floor surface.

3.5.16.10 Partition attachment at ceiling. The partition attachment at the ceiling shall be capable of adjusting to variations in ceiling height due to irregularities or deflection of the structure due to live loading. The ceiling attachment shall be capable for adjusting vertically up to 1 inch in order to adapt to variations in ceiling surface.

3.5.16.11 Corners. The partition corner details shall provide sufficient strength to assure that the wall is secure and complies with the requirements for lateral loads when none of the walls meeting at the corner fall directly beneath a support structural member.

3.5.16.12 Joints. All partitions shall be assembled in the same manner in any panelized building. Calking of joints between partition units will not be permitted.



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3.5.16.13 Erection and relocation. The relocatable, interior-wall partition system shall be capable of being installed, taken down, and relocated by two men. A typical 4-foot wide ceiling height panel in the middle of a wall, shall be capable of being replaced in 2 manhours. A 32-foot wall shall be capable of being taken down and relocated in 32 man-hours.

3.5.16.14 Attachment of accessory objects. Ceiling height panels shall be capable to sustain not less than 75 lb (25 pounds per-linear foot on a 3-foot long and 1-foot wide section) of attached objects on each side or on either side of the panel. The panels shall be stable when full load is imposed on one side and no load on the other side. Panels shall show no evidence of permanent deformation when tested in accordance with 4.5.3.1.3.

3.5.17 Electrical system. When specified (see 6.2), the building shall be provided with an electrical system consisting of convenience outlet receptacles, lighting, and power circuits for specified building cooling, heating, air conditioning, and ventilation. Electrical tubing shall be concealed within the panels with J-boxes for switches and receptacles, including J-boxes at the top of the panel above the ceiling system. The electrical system shall be tested as specified in 4.5.5.2.2.

3.5.17.1 Electrical system general requirements. The entire system shall be in accordance with NFPA No. 70 as minimum standards. All equipment shall conform to applicable NEMA standard and UL standards. All wiring shall conform to one of the following wiring methods described in NFPA No. 70, Articles 348 - ELECTRICAL METALLIC TUBING, or Article 352 - SURFACE RACEWAYS; except short leads to mechanical equipment which may be wired under Article 351 - LIQUIDTIGHT FLEXIBLE METAL CONDUIT. The electrical system shall include service entrance, service entrance conductors, and service equipment. Unless otherwise specified (see 6.2), the system shall be designed for operation from 60 Hertz, 3 wire, single phase, 120/240-volt electrical power. Service equipment and any other required panelboards shall conform to W-P-115 and all circuit protection shall consist of circuit breakers conforming to W-C-375. Ground Fault Circuit Interrupter (GFCI) device shall be used as required by NFPA No. 70. GFCI devices shall conform to UL 943.

3.5.17.1.1 Grounding. Grounding rod and grounding system shall be provided with each building electrical system.

3.5.17.2 Convenience outlet system. The convenience outlet system shall include duplex receptacle outlets on all interior wall surfaces so spaced that no usable space adjacent to the wall is more than 8 feet from an outlet located in the same continuous wall space. Outlets shall be NEMA Standard grounding type rated 15 ampere (A), 125 volt, 2 pole, 3 wire, connected to 20 A circuits having not more than six outlets per circuit. Receptacles shall conform to W-C-596 and W-C-596/12 and shall have provisions for both back and side wiring. Covers shall be stainless steel or plastic.

3.5.17.3 Lighting system. When an electrical system is specified (see 6.2), it shall include a complete lighting system with all fixtures and lamps. The system shall be tested as specified in 4.5.5.2.2 and 4.5.5.2.3.



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3.5.17.3.1 Illumination level. Unless otherwise specified (see 6.2), the average interior illumination level shall be 70 foot candles, measuring the light downward at any point on a horizontal plane 30 inch above the floor, when tested as specified in 4.5.5.2.3. The interior lighting illumination level shall be that obtained by the specified lamps and fixtures (see 3.5.17.3.5).

3.5.17.3.2 Color. Color shall be that of light from fluorescent warm white lamps, standard incandescent frosted white lamps, or high pressure sodium high intensity discharge lamps.

3.5.17.3.3 Switching. Each lighting circuit or appropriate portion thereof shall be switched at the lock side of the door controlling the area lighted. When partitions are specified, all lighting within a single space shall be controlled by switches located within the same space. Switches shall be alternating current toggle type with stainless steel covers conforming to W-S-896.

3.5.17.3.4 Lighting circuits. All lighting branch circuits shall be rated 20 A and the total connected rated load current of fixtures and ballasts on a single circuit shall not exceed 16 A.

3.5.17.3.5 Interior lighting fixtures. Interior lighting fixtures shall be one of the following types as specified.

3.5.17.3.5.1 Incandescent lighting. When specified (see 6.2), incandescent fixtures shall be of enclosed and gasketed (vaportight) for exposed outlet box use for 100 watt lamp.

3.5.17.3.5.2 Fluorescent lighting. When specified (see 6.2), fluorescent lighting fixtures shall be standard rapid start four-lamp recessed type, 2 feet by 4 feet, conforming to W-F-1662, type 1. Ballasts shall be Certified Ballast Manufacturers (CBM) certified by Electrical Testing Laboratories, Inc., and listed UL, and shall conform to W-B-30. Lamps shall be warm white F40T12, conforming to W-L-00116. Ballasts shall bear the CBM marking and UL listing mark.

3.5.17.3.6 Fixture spacing. Interior fixtures shall be mounted at regular spacings, in either direction parallel to the walls, not in excess of the dimensions from floor to mounting height.

3.5.17.3.7 Exterior lighting fixtures. When specified (see 6.2) exterior lighting shall be provided by a 100 watt vaportight exterior, wall mounted, incandescent fixture over each building entrance door.

3.5.17.3.8 Fixture mounting heights. Exterior fixtures shall be mounted not more than 2 feet above the center of the head of the door. Interior fixtures shall be mounted at or above eave height, or at ceiling height if a ceiling is specified (see 6.2).

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3.5.18 Smoke and fire detectors. All building shall be equipped with ionization and photo-electric detectors. Detectors shall conform to UL 167 and UL 168.

3.5.19 Fungus resistance. When specified (see 6.2), electrical components and circuit elements, including terminal and circuit connections, shall be coated with varnish conforming to MIL-V-173, except that:

- a. Components and elements inherently inert to fungi or in hermetically sealed enclosures need not be coated.
- b. Current-carrying contact surfaces, such as relay contact points, shall not be coated.

3.5.20 Environmental control equipment. When specified (see 6.2), the building shall include heating system, a cooling system, or both, and a ventilation system. The size of the systems shall be based on the specified building dimensions not allowing for any specific additions. Duct work required for such systems, complete with hangers and connectors shall be prefabricated and prefitted, completely assembled at the job site. Duct work shall be located just above save height or, if a ceiling is used, just above ceiling height, and laterally centered on the building. When both heating and cooling system are specified (see 6.2), one combination heating-cooling thermostat switch conforming to MIL-S-29175 shall control both. The equipment shall be NEMA certified and bear the UL listing mark. The systems shall be tested as specified in 4.5.5.2.4.

3.5.21 Caulking and sealants. All windows, doors, ventilator area junctures, building to foundation joints, and other similar building joints shall be completely sealed and leak free of water and air. If caulking is used, the caulking compound shall be the manufacturer's standard product; the caulking compound shall cure to a tack-free surface. Compounds requiring special pre-caulking preparation will not be acceptable, this does not include normal cleaning requirements, such as dusting and removal of oil, grease, and loose material. Other systems of sealing the building may be proposed.

### 3.6 Marking.

3.6.1 Identification marking. Identification shall be permanently and legibly marked directly on the door of each building or on a corrosion-resisting metal plate securely attached to the door of each building at the source of manufacturer. Identification shall include the manufacturer's model and serial number, name and trademark to be readily identifiable to the manufacturer.

3.6.2 Erection marks. The erection mark of each component, structural member or piece shall be placed on the item in the manner standard with the manufacturer.

3.7 Engineering design, data, and drawings. When specified (see 6.2) by the contract, engineering design data and drawings (see 6.3), shall be furnished to the Government within the time specified prior to the time the first produced building or building components are furnished.

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3.8 Erection and disassembly manual. When specified (see 6.2) by the contract, erection and disassembly manual (see 6.3) shall be furnished to the Government.

3.9 Cleaning, treatment, and painting. Surfaces normally painted in good commercial practice shall be cleaned, treated, and painted as specified herein. The color of the finish coat shall be as specified (see 6.2). Surfaces to be painted shall be cleaned and dried to insure that they are free from contaminants such as oil, grease, welding slag and spatter, loose mill scale, water, dirt, corrosion product, or any other contaminating substances. As soon as practicable after cleaning, and before any corrosion product or other contamination can result, the surfaces shall be prepared or treated to insure the adhesion of the coating system. The painting shall consist of at least one coat of primer and one finish coat. The primer shall be applied to a clean, dry surface as soon as practicable after cleaning and treating. Painting shall be with manufacturer's current materials according to manufacturer's current processes and the total dry film thickness shall be not less than 2.5 mils over the entire surface. The paint shall be free from runs, sags, orange peel, or other defects.

3.10 Erection tools. Tools other than normal field tools should not be required to erect and reassemble the building components in the field. When special tools are required, a set of tools shall be packed in an individual container and provided with each building. Recommended tool list shall be noted for each erection crew (4-man crew).

3.11 Workmanship.

3.11.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of size and shape.

3.11.2 Riveted connections. Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.11.3 Welding. Welding procedures shall be in accordance with a nationally recognized welding code. The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

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3.11.4 Bolted connections. Boltholes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

#### 4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

- a. First article inspection (see 4.2.1).
- b. Quality conformance inspection (ss 4.2.2).

4.2.1 First article inspection. When specified (see 6.2), first article inspection shall be performed on one complete building or module. This inspection shall include the examination of 4.4 and the tests in 4.5. The first article may be a standard production item from the contractor's current inventory provided the building or modules meet the requirements of this specification and is representative of the design, construction, and manufacturing technique applicable to the remaining building or modules to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection will be performed on each sample selected in accordance with 4.3. This inspection shall include the examination of 4.4 and the packaging inspection of 4.6.

4.3 Sampling. Sampling and inspection procedures shall be in accordance with MIL-STD-105. All complete buildings or modules offered for delivery at one time shall be considered a lot for the purpose of inspection. The inspection level shall be level S-2 and the Acceptable Quality Level shall be 4.0 percent defective. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for a complete reinspection. Resubmitted lots shall be reinspected using tightened inspection. If the rejected lot was screened, reinspection

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shall be limited to the defect causing rejection. If the lot was reprocessed, reinspection shall be performed for all defects. Rejected lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.4 Examination. The test erection unit and each sample selected in accordance with 4.3 shall be examined for compliance with the requirements of this specification. Any necessary correction or modification following failure to meet specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements, with particular emphasis on tolerances, fits, and interchangeability of like parts. Noncompliance with any specified requirement or presence of one or more defects preventing interchangeability or lessening performance of intended function of any component shall constitute a defect.

4.5 Tests. Tests shall be conducted as specified herein. Specification of test requirements does not preclude the use of other test fixtures if the mechanics of the system are duplicated for similar tests. Any failure of welds or mechanical joints or any permanent distortions in excess of that specified, or any other damage to any part of the item that would affect serviceability will be considered as failing to comply the requirements of this specification. Nonconformance with the requirements of Section 3 will constitute failure of the tests.

4.5.1 Honeycomb core tests.

4.5.1.1 Compressive strength of honeycomb core. The core shall be tested in accordance with ASTM C365, method A to determine its flatwise compressive strength (see 3.5.9.2.1).

4.5.1.2 Shear strength and shear modulus of honeycomb core. The core shall be tested in accordance with ASTM C273 to determine its flatwise shear strength and shear modulus (see 3.5.9.2.1).

4.5.1.3 Wet strength test. The honeycomb core shall be immersed in water at  $73^{\circ} +10^{\circ}\text{F}$  for at least 24 hours immediately prior to testing. Specimens which float shall be held under water by a loose net or screen, weighted just enough to submerge the specimens. One core specimen shall be tested in accordance with ASTM C365 to determine its wet flatwise compressive strength (see 3.5.9.2.2). Another core specimen shall be tested in accordance with ASTM C273 to determine its flatwise wet shear strength and wet shear modulus (see 3.5.9.2.2).

4.5.1.4 Sandwich panel tests.

4.5.1.4.1 Panel loading tests. Floor panels, roof panels, and wall panels shall be tested in accordance with ASTM E72. The panel deflection shall not exceed the requirement of 3.5.6 when tested under its design load (see 3.5.4, 3.5.5, and 3.5.9).

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4.5.1.4.2 Panel thermal conductivity test. Floor panels, roof panels, and wall panels shall be tested in accordance with ASTM C236 to determine the U-factor of the panels (see 3.5.9.1).

4.5.1.4.3 Panel exposure test. Full size panels shall be aged in accordance with ASTM C481, cycle A. Test specimens after aging in accordance with ASTM C273, ASTM C365, Method A, ASTM D1781 and ASTM E-72.

4.5.1.4.4 Panel adhesive test. The floor panels, roof panels, and wall panels shall be tested in accordance with ASTM D1781. The core materials shall fail before the bond of the adhesive to the core and facings.

4.5.1.4.5 Flame spread rating. The materials shall be tested in accordance with ASTM E84 to determine their flame spread rating (see 3.5.9.2.3 and 3.5.15.4).

4.5.1.5 Panel exterior coating tests.

4.5.1.5.1 Humidity resistance. Humidity resistance of the coating shall be tested in accordance with MIL-STD-810, method 507, procedure I. Evidence of leaking, dripping, or running flow of water in the interior of the building shall constitute failure of the test.

4.5.1.5.2 Salt spray resistance. Salt spray resistance of the coating shall be tested in accordance with ASTM B117, using 5 percent salt solution for 500 hours. After exposure of the sample for 500 hours, examine the sample with a magnifying glass for corrosion. A corroded area greater than 5 percent of the total area of the sample shall constitute failure of the test.

4.5.1.5.3 Impact flexibility. Impact flexibility of the coating shall be tested in accordance with FED-STD-141, Method 6226, except that the testing apparatus shall be a Gardner IG 1120 impact tester or equal. Any evidence of flaking, peeling, or loss of adhesion of the coating after being subjected to 144 inch lb by the impact tester shall constitute failure of the test.

4.5.1.5.4 Resistance to accelerated weathering. Resistance to accelerated weathering shall be tested in accordance with FED-STD-141, Method 6151, for 500 hours. The gloss of the outside coating shall not change more than 10 percent when tested in accordance with FED-STD-141, Method 6101, 60° gloss test. Gloss shall be tested before and after accelerated weathering. A change of more than 10 percent in the gloss shall constitute failure of these tests.

4.5.1.5.5 Coating flexibility. Flexibility of the finish coat shall be tested in accordance with FED-STD-141, Method 6221. Signs of flaking, cracking, or loss of adhesion when bent around a 1/8-inch mandrel shall constitute failure of the test.

4.5.1.5.6 Abrasion resistance. Abrasion resistance of the outside covering shall be tested in accordance with FED-STD-141, Method 6191, or ASTM D968, with not less than 20 liters of falling sand. After subjecting the



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sample to the falling sand, the diameter of the wear-through area shall not exceed 5/32 inch. A wear-through area greater than 5/32 inch shall constitute failure of the test.

4.5.2 Ceiling. When a ceiling system is specified (see 3.5.15), the following tests shall be conducted.

4.5.2.1 Ceiling materials.

4.5.2.1.1 Fire hazard test. All materials of the ceiling system shall be tested in accordance with ASTM E84 and E136.

4.5.2.1.2 Sound control test. The ceiling system shall be tested in accordance with ASTM C423 (see 3.5.15.5).

4.5.2.2 Assembly and disassembly of ceiling system. Failure of any component to fit or function properly, or to otherwise not comply with the requirements specified herein, shall be cause for rejection.

4.5.2.2.1 Ceiling assembly test. The contractor shall furnish all labor, materials, and facilities for the test assembly of one simulated complete ceiling system. The inspector will select, at random, the components for one ceiling system. The ceiling system shall be installed in the specified building as specified in 3.5.15.8. All components shall fit together without abnormal racking, bowing, bending, or deformation of parts.

4.5.2.2.2 Disassembly of ceiling system. The contractor shall provide all labor, facilities, and items necessary for disassembly, including treatment or touchup of damaged protective coatings, and replacement of damaged parts and fasteners. After disassembly and necessary repairs have been made and accepted, the test erection unit may be submitted as a completed production unit.

4.5.2.2.3 Accessibility test. The inspector shall pick a ceiling panel in the assembled ceiling to be removed. Moving or removal of more than 20 square feet of adjacent ceiling panels to remove the selected panel shall be cause for failure of the system.

4.5.2.2.4 Loading test. The suspension system of the assembled ceiling shall be loaded to simulate lighting, heating, ventilation, air-conditioning, electronic, and electrical systems attached to it. The system shall be tested in accordance with ASTM C635. The deflection of the system shall meet the requirements of 3.5.15.1.

4.5.3 Interior partitions. When an interior partition system is specified (see 3.5.16), tests 4.5.3.1.1 through 4.5.3.3 shall be performed.

4.5.3.1 Panel tests. Regular panels are interior partition panels without openings in them.



4.5.3.1.1 Uniformly distributed load test. Regular partition panels, 4 by 8 feet shall be tested in accordance with ASTM E72, traverse load-specimen horizontal, uniformly distributed loading method. The deflection shall not exceed the requirements of 3.5.6.

4.5.3.1.2 Resistance to concentrated structural impact load. Regular partition panels, 4 by 8 feet shall be tested in accordance with ASTM E72, impact load method-specimen horizontal. The panels shall meet the requirements of 3.5.16.4.

4.5.3.1.3 Accessory objects loading tests. One regular partition panel, 4 by 8 feet shall be erected and secured for simulated normal operation. A 3-foot long shelf, 1-foot wide, shall be attached to the panel 4 feet up from the bottom of the panel. A 25 psi load (including shelf dead load) shall be applied on the shelf 8 inches from the panel face. The panel shall remain in an upright position and the upper end of the panel shall deflect no more than 1/4 inch. The other face of the panel shall be loaded in the same manner, with the first load remaining in place. The panels shall show no evidence of permanent deformation or instability 1 hour after the load is applied (see 3.5.16.14).

4.5.3.1.4 Impact resistance. The test specimen shall be 6 by 6 inches by the nominal thickness of the material. The specimen with a decorative surface up, shall be clamped, fastened with adhesive tape around the edges, or bonded with adhesive by a 6 by 6 by 1/2-inch mild steel plate. An 8  $\pm$  1/2 ounce steel ball, 1-1/2  $\pm$  1/16 inches in diameter shall be dropped on the center of the specimen from a height of 18 inches. Each specimen shall sustain one dropball test without decorative surface fracture or break.

4.5.3.1.5 Sound control test. Partition panels shall be tested in accordance with ASTM E90 and ASTM E413. The panels shall meet the requirements of 3.5.16.8.

4.5.3.2 Assembly and disassembly of partition system. The partition erection and disassembly shall be conducted five times on the selected panels as specified in 4.5.3.2.1 through 4.5.3.2.2 and as required by 3.5.16. The replacement test shall be conducted once.

4.5.3.2.1 Partition erection test. The contractor shall furnish all labor, materials, and facilities for the test erection of one simulated complete partition system. All components shall fit together without abnormal racking, bowing, bending, or deformation of parts.

4.5.3.2.1.1 Replacement test. The inspector will select one random panel from the assembled panels to be replaced by the contractor. Removal of more than one additional panel to replace the selected panel shall constitute failure of the test. The time to replace shall meet the requirements of 3.5.16.13.

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4.5.3.2.2 Disassembly of partition system. The contractor shall provide all labor and items necessary for the test unit disassembly, including treatment or touchup of damaged protective coatings, and replacement of damaged parts and fasteners. After disassembly and necessary repairs have been made, the test erection unit may be submitted as a completed production unit. Failure of any component to fit or function properly, or otherwise not comply with the requirements specified herein, shall be cause for rejection on the basis of the sampling plan.

4.5.3.3 Partition door slamming test. Using a partition panel containing a door, perform the door slamming test. The test shall consist of 2,000 slam cycles, each cycle consisting of opening the door and slamming it shut. The door shall be opened 16 inches measured from lock edge of door to door frame. Slamming shall consist of pulling door shut with a force of 17 ft-lb applied perpendicular to the door opening and at a point on the door at midpoint vertically and within 5 inches of lock edge horizontally. The partition shall be considered to have met test if during any test cycle neither door, door frame, nor partition shall move more than 1/8 inch in any direction and if all return to original position after all cycles are completed.

4.5.4 Component tests. When complete buildings are not ordered, the following building component tests are required if the style is ordered. The contractor shall furnish all labor, materials, and facilities for the test assemblies. The inspector will select, at random, the components for each style ordered.

4.5.4.1 Style A, B, F, and G. A test wall shall be erected from the three panel components selected by the inspector. A separate wall for each style component ordered shall be tested. The wall shall include any internal structural framework required by its type for support. The wall shall be tested in accordance with ASTM E331. The pressure differential shall be a 2.86 lb force per square foot. Evidence of leaking, dripping, or running flow of water in the interior shall constitute failure of the test.

4.5.4.2 Style D. A test roof shall be erected from at least six panel components selected by the inspector. The panels shall be assembled on a frame in two rows of at least three panels per row simulating one side of a roof with a 4 to 1 slope. A spraying head arrangement capable of spraying water at a uniform rate shall be placed 2 feet above the top row of panels. The spray heads shall be spaced not more than 2 feet on centers for the full length of the assembly. Spray water on the roof components until a sheet flow of water approximately 1/8-inch deep is obtained over the roof surface. Maintain the flow of 15 minutes. Examine the underside of the roof for leaks. Evidence of leaking, dripping, or running flow on the underside shall constitute failure of the test.

4.5.5 Building erection test. When complete building is ordered, the erection test shall meet the requirements of 3.1. The test building shall be assembled and disassembled three times. The test building shall be a complete building including all specified auxiliary systems or subsystems. The

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building shall be on a stable level foundation or base structure. All components shall fit together without abnormal racking, bowing, bending, or deformation of parts. The contractor shall provide all labor, facilities, and items necessary for the test erection assembly and disassembly, including treatment of touchup of damaged protective coatings, and replacement of damaged parts and fasteners. After disassembly and necessary repairs have been made, the test erection unit may be submitted as a complete production unit. Failure of any component to fit or function properly, or to otherwise not comply with the requirements specified herein, shall be cause for rejection.

4.5.5.1 Weathertightness. The assembled modified building complete with the specified door and window panels shall be tested once as specified herein. The equipment for testing shall consist of spraying heads capable of spraying water at a uniform rate when suspended 2 feet above the ridge line or held 2 feet away from the walls of the building. The spray heads shall be spaced not more than 2 feet on centers for the full length of the building.

4.5.5.1.1 Roof. The spraying head shall be arranged on the roof in such a manner that the spray from the heads allows the water to flow in both directions from the ridge line. Water shall be sprayed on the building until a sheet flow of water approximately 1/8-inch deep is obtained over the roof surface. After the sheetflow of water develops, spraying shall continue for not less than 15 minutes. The interior of the building shall be examined for leaks. Evidence of leaking, dripping, or running flow of water in the interior of the building shall constitute failure of the test.

4.5.5.1.2 Sidewalls, endwalls, doors, and window. The spraying equipment shall be placed at the save of the building. Spray water directly on the building. When a sheet flow of approximately 1/8 inch is obtained, continue spraying for not less than 15 minutes. Examine the sidewalls, doors, windows, or other appurtenances in the sidewall for leakage. Repeat the above procedure until all sidewalls and endwalls have been tested. Evidence of leaking, dripping, or running flow of water in the interior of the building shall constitute failure of the test.

#### 4.5.5.2 Operational tests.

4.5.5.2.1 Doors, windows, ventilators, and shutters. All doors, windows, ventilators, and shutters shall be opened and closed not less than five times to demonstrate that they are easily operable. Difficulty in operation or inability to operate any doors, windows, ventilators, and shutters shall constitute failure of the test.

4.5.5.2.2 Electrical system. When an electrical system is provided, (see 3.5.17 and 6.2) all electrical equipment, and wiring shall be tested for proper operation and checked for conformance to NFPA No. 70 and applicable UL standards. Acceptable evidence of meeting the applicable UL standards shall be the UL listing mark affixed to the item certified or a certified test report from a nationally recognized independent testing laboratory acceptable

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to the contracting officer, stating that the item certified has been tested and conforms to the applicable UL standards. When a certified test report is submitted, it shall be furnished as specified in the contract (see 6.3). These tests and checks shall include disconnect test of circuit breakers, ground fault interruption test of GFCI devices, power circuits and grounding circuits continuity checks, and wiring accuracy checks of all circuits and electrical devices.

4.5.5.2.3 Lighting system. When applicable, install the lighting system and energize the system. Measure the quality of light produced by the luminaires at the specified distance above the floor at various locations within the building. Any quality of light measured that is less than the amount specified in 3.5.17.3.1 shall constitute failure of the test.

4.5.5.2.4 Environmental control equipment. When applicable, install the heating and cooling system and energize the system. Inability of the system to perform as designed shall constitute failure of the test.

4.6 Packaging inspection. The preservation, packing, and marking of the item shall be inspected to verify conformance to the requirements of section 5.

## 5. PACKAGING

5.1 Preservation. The preservation shall be level A or C as specified (see 6.2).

### 5.1.1 Level A.

5.1.1.1 Methods of preservation. Cleaning processed, drying procedures, preservatives, and methods of preservation specified in to following paragraphs are listed in MIL-P-116 and shall conform to the requirements of MIL-P-116 and any applicable specifications.

5.1.1.2 Cleaning and drying. Prior to the application of preservative compounds or paint, surfaces shall be cleaned by process C-1 and dried by any applicable procedure of MIL-P-116.

5.1.1.3 Unpainted surfaces. Unpainted and uncoated exposed ferrous metal surfaces of component parts of the building, shall be coated with type P-1 preservative. Joints of hinges shall be coated with type P-10 preservative.

5.1.1.4 Fasteners and accessories. Fasteners and accessories for one complete building shall be packaged method III.

5.1.1.5 Ventilators, louvers, and equipment door hardware. The items needed for one complete building shall be packaged method III.

5.1.1.6 Flashing, ducts, beam and girder connectors, struts, braces, rods, roof tie assemblies, and ridge end covers. These items of like description for one complete building shall be bundled together to form a nonshifting bundle which will provide convenient handling. The bundles shall be secured

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with tape conforming to PPP-T-97, type IV, or with soft annealed wire. The threaded surface of the rods shall be protected to prevent damage to the threads.

5.1.1.7 Ceiling panels and hangers. Ceiling panels and hangers for one complete building shall be packaged method III in fiberboard boxes conforming to PPP-B-636, class weather-resistant. Contents shall not exceed the size and weight limits of the applicable container selected.

5.1.1.8 Electrical lighting equipment. Electrical lighting equipment - e.g., switches, junction boxes, electrical panels, conduit, light, fixtures, thermostats, etc. - shall be preserved and packaged in accordance with the level A requirements of MIL-E-17555.

5.1.1.9 Heating equipment. Heating equipment shall be preserved in accordance with the level A requirements of MIL-B-3180.

5.1.1.10 Cooling Equipment. Cooling equipment shall be preserved method IIa in accordance with the level A requirements of MIL-R-3593.

5.1.1.11 Door and windows. The screen and panes in doors and windows shall be covered with a thick rigid material - e.g., plywood, hardboard, styrofoam, etc. - secured in place. Protruding parts - e.g., hinges, door lock sets - shall be cushioned to prevent damage.

5.1.1.12 Erection tools. Erection tools shall be preserved and packaged in accordance with the level A requirements of PPP-P-40.

5.1.1.13 Technical publications. The technical publications required for each building shall be preserved method IC-3.

5.1.1.14 Consolidated packaging. Technical publications and other small components required for one complete building and the protection of a container shall be consolidated and packaged in boxes conforming to PP-B-636, class weather-resistant. The contents shall be cushioned, blocked, and braced to prevent movement.

5.1.2 Level C. The complete building shall be preserved in accordance with the contractor's standard practice in a manner to prevent deterioration and damage.

5.2 Packing. The packing shall be level A or C as specified (see 6.2).

5.2.1 Level A. Only one complete unassembled building shall be packed as a set consisting of bundles, boxes, and crates. Components shall be arranged within each bundle, box, or crate to provide ease of erection of the building when removed. Sequence of packing shall conform to sequence of construction as nearly as possible, so all items needed for a particular assembly and operation are packed together, obviating the necessity to open, search, and

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expose the contents of particular bundles or containers to the weather merely to locate a few needed items. No container shall exceed the dimensions of 39 feet in length, 7 feet 6 inches in width, and 7 feet in height.

5.2.1.1 Doors, louvers, smokestacks, bundled components, and consolidated packages. These items shall be packed in boxes conforming to PPP-B-621 class 2; PPP-B-601, overseas type; or MIL-B-26195, type II, style and class optional, with plywood superstructure. The contents shall be cushioned, blocked, braced, and waterproofed with a shroud in accordance with MIL-STD-1186.

5.2.1.2 Structural members. Structural members, such as steel girders, purlins, and similar components shall be nested, arranged, and secured with bolts or steel straps, or a combination of both, to form compact nonshifting bundles. Suitable wood blocking shall be used, as required, under strapping to eliminate large voids or irregular shaped bundles. Strapping shall be 0.023- by 3/4-inch flat steel conforming to QQ-S-781, class 1, type 1, finish B. Strapping shall be stapled to any wood blocking provided. Strapping shall be spaced not to exceed approximately 36 inches on center, with end straps placed not more than 18 inches from each end. Metal edge protectors shall be used when strapping bears on edges of structural members in the bundles. Bundled structural members shall have wooded blocks secured to the bottom of the load to provide for handling by forklift and for stacking. The height of the bottom shall be not less than 2-1/2 inches. The bundles shall not exceed approximately 5,000 lb. When specified (see 6.2), the individual bundles shall be packed to provide minimum cubical size in crates conforming to MIL-C-52950, type III. The contents shall be locked, braced, or otherwise anchored in accordance with the appendix to the crate specification.

5.2.1.3 Panels (except ceiling panels). Roof, wall, floor, window, interior partitions, and door panels conforming to MIL-C-52950, type II or III, or MIL-C-3774, type I or II depending upon the size and weight of each load. Contents shall be waterproofed (with full shrouds), cushioned, anchored, and closed in accordance with the appendix to the applicable crate specification.

5.2.1.4 Ceiling panels and hangers. Ceiling panels and hangers shall be packed in boxes conforming to PPP-B-601, overseas type. The contents shall be cushioned, blocked, braced, and waterproofed with a shroud in accordance with MIL-STD-1186.

5.2.1.5 Gussets and shear frames. Gussets and shear frames shall be packed in crates conforming to MIL-C-52950, type II or III. The contents shall be anchored, cushioned, waterproofed, and closed in accordance with the appendix to the crate specification.

5.2.1.6 Cooling equipment. Cooling equipment shall be packed in accordance with the level A requirements of MIL-B-3180.



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5.2.1.7 Heating equipment. Heating equipment shall be packed in accordance with the level A requirements of MIL-B-3180.

5.2.2 Level C. The complete building shall be prepared for shipment in a manner which will insure arrival at destination in a satisfactory condition. Preparation for delivery shall comply with applicable carrier rules and regulations.

5.3 Marking. Marking shall be in accordance with MIL-STD-129. Special markings such as arrows, "UP", "FRAGILE", "CENTER OF BALANCE" shall apply to applicable containers.

## 6. NOTES

6.1 Intended use. Building components and building extension kits covered under this specification are intended to be used as advanced base structures for administrative offices, galleys, barracks, hospitals, light industrial shops, emergency shelters, and other similar usage. It is anticipated that these structures will require storage for as long as 10 years, be used under all types of weather conditions for 5 years or more after erection, and require relocation three to five times during their use life.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number, and data of this specification.
- b. Type, class, and style of building components required (see 1.2).
- c. When a complete building is required (see 3.1). (1) Length of building (see 3.1).
- d. When first article is required for inspection and approval (see 3.3, 4.2.1, and 6.4).
- e. When excess panels are to be furnished (see 3.4.4).
- f. When excess fasteners are to be furnished (see 3.4.5.3).
- g. Height of ceiling from floor when a ceiling system is required, (see 3.5.1.1, 3.5.1.2, 3.5.15, 3.5.15.1 and 3.5.17.3.8).
- h. When applied loads are to be other than as specified (see 3.5.4).
- i. When combined loads are to be other than as specified (see 3.5.5).
- j. When the floor slab design shall be other than as specified (see 3.5.8).
- k. Density of honeycomb material (see 3.5.9.2.4).
- l. When windows are to be installed other than by the manufacturer and type specified (see 3.5.10).
- m. When louvers are not required in end wall (see 3.5.12).
- n. Number and location of louvers (see 3.5.12).
- o. When insect screens shall be other than specified (see 3.5.13).
- p. When screen door is required for each door opening (see 3.5.14.2).
- q. When all doors open inwards (see 3.5.14.1).
- r. When sliding panel doors are required (see 3.5.14.3).
- s. Size of sliding panel doors (see 3.5.14.3).
- t. When a complete ceiling system shall be furnished (see 3.5.15).



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- u. When an interior partitions system is required (see 3.5.16).
  - (1) Floor plan of partition system (see 3.5.16).
  - (2) Type, width, and height of partition panels (see 3.5.16.1).
  - (3) Color of interior partition panels (see 3.5.16.7).
- v. When an electrical system shall be furnished (see 3.5.17 and 4.5.5.2.2).
- w. When the electrical system rating shall be other than specified (see 3.5.17.1).
- x. When lighting shall be other than specified (see 3.5.17.3).
- y. When the interior illumination level shall be other than specified (see 3.5.17.3.1).
- z. Type of interior lighting fixtures required (see 3.5.17.3.5.1 and 3.5.17.3.5.2).
  - aa. When exterior lighting shall be furnished (see 3.5.17.3.7).
  - bb. When electrical components are to be fungus-proofed (see 3.5.19).
  - cc. When interior fixture shall be mounted on ceiling height (see 3.5.17.3.8).
  - dd. When combination thermostat switch shall be furnished (see 3.5.20).
  - ee. When heating and/or cooling system shall be furnished (see 3.5.20).
  - ff. When the time frame for submission of engineering design data and drawing are required (see 3.7).
  - gg. When erection and disassembly manual shall be furnished (see 3.8).
  - hh. Color and type of finish coat (see 3.9).
  - ii. Level of preservation and level of packing required (see 5.1 and 5.2).
  - jj. When individual bundles shall be packed (see 5.2.1.2).

6.3 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved DD Form 1664, Data Item Description (DID), and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of paragraph 7-104.9(n) of the Defense Acquisition Regulations are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs:

<u>Paragraph No.</u>	<u>Data requirements title</u>	<u>Applicable DD-1664</u>
3.3.1 and 3.8	Manual Erection/Assembly	DI-M-24026B
3.7	Design Data and Calculations	DI-R-24040A
3.7	Engineering drawings and associated lists, level 3	DI-E-7031
3.5.5.2.2	Certificate of compliance	DI-E-2121

(Copies of Data Item Descriptions required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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6.4 First article. When a first article inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of one complete building. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

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

## Custodians:

Army - GL  
Navy - YD

## User Activity:

Army - CE

## Preparing Activity:

Navy - YD  
(Project 5410-N312)

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-B-28658D		2. DOCUMENT TITLE BUILDING COMPONENTS, PANELIZED, PREFABRICATED READY-CUT,	
3a. NAME OF SUBMITTING ORGANIZATION RELOCATABLE		4. TYPE OF ORGANIZATION (Mark one) <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
b. ADDRESS (Street, City, State, ZIP Code)			
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH THIS FORM, CUT ALONG THIS LINE)