
USACE / NAVFAC / AFCEA UFGS-12705 (November 2003)

Preparing Activity: USACE Superseding
UFGS-12705 (June 2001)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Latest change indicated by CHG tags

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SECTION 12705

FURNITURE SYSTEMS

11/03

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SECTION 12705

FURNITURE SYSTEMS 11/03

NOTE: This guide specification covers the requirements for furniture systems which include panel-supported, stackable panel, spine wall and desk-supported furniture systems.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

NOTE: Various provisions of this guide specification may be irrelevant to or in conflict with the requirements of any given project. The guide should be carefully tailored to fit the needs of each specific application. Portions must be deleted, if not applicable, and additional material inserted where necessary to adequately delineate requirements. Brackets and blanks identify provisions which involve alternates; the editor must select and/or insert the appropriate requirements.

1.1 REFERENCES

NOTE: Issue (date) of references included in
project specifications need not be more current than
provided by the latest guide specification. Use of
SpecsIntact automated reference checking is
recommended for projects based on older guide
specifications.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Glazing Materials
Used in Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS,
Kind FT Coated and Uncoated Glass

ASTM C 423 (2002a) Sound Absorption and Sound
Absorption Coefficients by the
Reverberation Room Method

ASTM E 290 (1997a) Bend Testing of Material for
Ductility

ASTM E 84 (2003) Surface Burning Characteristics of
Building Materials

BIFMA INTERNATIONAL (BIFMA)

BIFMA X5.5 (1998) Desk Products

BIFMA X5.6 (2003) Panel Systems

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-569-A (2001) Commercial Building Standard for
Telecommunications Pathways and Spaces**

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WD 1 (1999) General Color Requirements for
Wiring Devices

NEMA WD 6 (2002) Wiring Devices - Dimensional
Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2003) Life Safety Code

NFPA 255 (2000) Method of Test of Surface Burning

Characteristics of Building Materials

NFPA 265 (2002) Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1286 (1999; Rev thru Oct 2002) Office Furnishings

UL 723 (2003) Test for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings[; G][; G, [____]]
Installation[; G][; G, [____]]

Drawings showing the proposed workstation installation at a scale of 1:100 (1/4 inch = 1 foot) 1/4 inch = 1 foot, unless otherwise specified.

SD-03 Product Data

Installation Instructions[; G][; G, [____]]

Manufacturer's product and construction specifications which provide technical data for furniture system and components specified, including task lighting and illumination performance information. Literature shall include adequate information to verify that the proposed product meets the specification.

Warranty

Two copies of the warranty.

Workstations

Complete listing of part/model numbers for all components to be furnished, including names and codes of components referenced on updated drawings.

SD-04 Samples

Workstations[; G][; G, [____]]

Four sets of the finish samples listed below. The Government reserves the right to reject any finish samples that do not satisfy the construction or color requirements. The Contractor shall submit additional samples as required to obtain final approval. Work shall not proceed without sample approval in writing from the Contracting Officer.

a. Panel tackboard and flipper door fabric. Minimum 150 x 150 mm 6 x 6 inches with label designating the manufacturer, color, fiber content, fabric weight, fire rating, and use (panel and/or tackboard).

b. Panel, spine wall, work surface, modesty panel, and component finish. Minimum 60 x 75 mm 2-1/2 x 3 inches with label designating the manufacturer, material composition, thickness, color, and finish.

c. Task lights.

d. Panel and spine wall glazing. Glazing samples with label designating the material and safety ratings.

SD-06 Test Reports

Selected Components[; G][; G, [____]]

Panel Acoustics[; G][; G, [____]]
Fire Safety[; G][; G, [____]]
Electrical System[; G][; G, [____]]

One complete set of test reports for the proposed system.

SD-07 Certificates

Workstations

Two complete sets of certificates attesting that the proposed workstation meets specified requirements. The certificate shall be dated after the award of contract, shall name the project, and shall list specific requirements being certified.

SD-10 Operation and Maintenance Data

Assembly Manuals[; G][; G, [____]]

Three sets of assembly manuals describing assembly and reconfiguration procedures.

Maintenance Manuals[; G][; G, [____]]
Cleaning[; G][; G, [____]]

Three sets of maintenance manuals describing proper cleaning and minor repair procedures.

Electrical System[; G][; G, [____]]

Three sets of electrical system manuals describing the functions, configuration, and maintenance of the electrical system (power [, communications] [, data]). This material may be included in the above 2 manuals at the Contractor's option.

1.3 WORKSTATIONS

1.3.1 General Requirements

This specification establishes the minimum requirements for the acquisition and installation of a complete and usable system of workstations composed of panels, stacking panel-frames, spine walls, freestanding work surfaces or base units, supporting components, electrical hardware, communications, special electrical features, and accessories. Workstation requirements and configurations shall be in accordance with the furniture layout and typical workstation types shown in drawings and specified herein. Components, and hardware shall be provided by a single manufacturer and shall be a standard product as shown in the most recent published price lists or amendments. Electrical components shall be products of a single manufacturer to the extent practicable (different types of components may be of different manufacturers, but all units of a given component shall be from a single source). The completed installation shall comply with NFPA 70 and NFPA 101.

The Contractor shall coordinate the work of this section with that to be performed under other sections. This specification may include items which are not manufactured by the furniture manufacturer; any such items shall be furnished by the Contractor under this section.

1.3.2 Detail Drawings

Drawings showing communications, electronic data processing (EDP) and local area network (LAN) locations may be provided as a separate submittal from remaining workstation drawings. Drawing requirements, which are the furniture manufacturer's responsibility, shall be provided as a single submittal. Electronic drawings shall be provided to the user for future re-configuration in the software package requested by the user. The electronic drawings shall include all modifications made during installation. As a minimum, the Contractor shall submit the following:

- a. Overall reference drawings: Drawings showing workstation locations and overall plan view within each floor. The scale shall be [1:400 (1/16 inch = 1 foot) 1/16 inch = 1 foot] [1:200 (1/8 inch = 1 foot) 1/8 inch = 1 foot]. Layouts shall reflect field verified conditions.
- b. Installation drawings: Drawings showing workstations, panels, spine walls, components, and plan view within each floor. Workstations shall be identified by workstation type. Scale of drawings shall be identical to Architectural plans. Installation drawings shall reflect field verified conditions.
- c. Workstation elevations: Dimensioned workstation elevations showing each type of workstation with panel frame [and spine wall frame] configurations and all components identified with manufacturer's catalog numbers. Elevations shall be drawn at 1:50 (1/2 inch = 1 foot) 1/2 inch = 1 foot scale.
- d. Panel drawings: Panel [and Spine Wall] drawings showing panel [and spine wall] locations and critical dimensions from finished face of walls, columns, panels, including clearances and aisle widths. Assemblies shall be keyed to a legend which shall include width, height, configuration and composition of frame covers finishes and fabrics (if different selections exist within a project), power or nonpower, connectors and wall mount hardware. Drawings shall reflect field verified conditions.
- e. Electrical drawings: Drawings showing power provisions including type and location of feeder components (service entry poles, base or ceiling feeds), activated outlets and other electrical components. Wiring configuration (circuiting, switching, internal and external connections) shall be identified and a legend provided as applicable.
- f. Wire management capacity drawings.
- g. Communication drawings showing telephone provisions: Drawings indicating the type and location of feeder components and outlets with wiring configuration identified where applicable.
- h. Communication drawings showing electronic data processing provisions: Drawings indicating the type and location of feeder components, outlets, or accessories with wiring configuration identified where applicable.
- i. Communication drawings showing local area network provisions: Drawings indicating the type and location of feeder components and data outlets with extra ports for future expansion

with wiring configuration identified where applicable.

j. Reflected ceiling plan for projects specified with power poles.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked thereon. Components shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

1.5 PATTERN AND COLOR

NOTE: Include a reference to Section 09915 COLOR SCHEDULE or drawings for all items requiring a finish color. This includes the following items when applicable: Work surfaces, Pedestals and Drawers, Flipper Doors, Tackboards, Panel Supported Storage, Panels, Stacking Panel Frames, Spine walls, Screens, Connectors, Trim and Accessories. Specify both sides of panels, stacking panel frames and spine walls.

Pattern and color of finishes and fabrics for panels [and spine walls], components, and trim shall be [in accordance with Section 09915 COLOR SCHEDULE] [as shown on the drawings] [_____].

1.6 ALTERNATE DESIGN

NOTE: Minor differences exist among different manufacturer's product. This paragraph pertaining to an "alternate design" was written in order not to exclude a manufacturer when an equally acceptable solution is proposed. List minimum requirements if applicable to the project. Examples of minimum project requirements might include: minimum linear footage of overhead storage, limitation of number of panel widths, and non-handed components.

Manufacturers who are unable to provide workstations that conform exactly to the furniture layouts and typical workstation types shown in the contract drawings, may submit alternate designs for consideration by the Contracting Officer. Alternate designs must meet or exceed the following criteria. Alternate designs that are submitted but do not meet these criteria will be rejected.

1.6.1 Workstation Size and Configuration

The alternate design shall provide workstations and components of the same basic size and configuration shown, with only the sizes of the individual components within the workstation changed to meet the standard product of the manufacturer.

1.6.2 Component Requirements

The types of components or elements utilized shall be as shown on the drawings and as specified in PART 2 PRODUCTS of this specification.

1.6.3 Layout

The storage capacity, number of workstations accommodated, width of aisles, or workstation configuration shall not be reduced.

1.6.4 Wiring Configuration

Alternate configurations must support the circuiting and connection capabilities identified under the provisions pertaining to power distribution of paragraph ELECTRICAL. Generally any alternate will be acceptable which involves only a variation in size or quantity that exceeds the specified configuration.

1.7 WARRANTY

The Contractor shall warrant the furniture systems for a period of 10 years with the following exceptions: fabrics and other covering materials, and paper handling products shall be guaranteed for 3 years, and task lights shall be warranted for 2 years. [Electromagnetic ballasts shall be warranted for 2 years.] [Electronic ballasts shall be warranted for 3 years.] [The electronic ballast warranty shall include a \$10 labor allowance for each ballast.] Warranties shall be signed by the authorized representative of the manufacturer. Warranties accompanied by document authenticating the signer as an authorized representative of the guarantor, shall be presented to the Contracting Officer upon the completion of the project. The Contractor shall guarantee that the workstation products and installation are free from any defects in material and workmanship from the date of delivery.

PART 2 PRODUCTS

NOTE: The designer must ascertain that the combination of products specified are not proprietary and that they can be provided by several manufacturers. The workstation layout shall conform to NFPA 101, and for buildings not excluded by TI 800-01 Design Criteria shall be accessible in accordance with 36 CFR 1191. Considerations for height adjustable work surfaces and storage design shall be made when ADA conformance within the workstation is required. The use of existing reconditioned furniture systems shall be considered when appropriate.

2.1 PERFORMANCE AND SAFETY REQUIREMENTS

Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Panels, spine walls, frames and frame covers, connection system, work surfaces, pedestals, shelf units, flipper door units, lateral files, locks, accessories, and miscellaneous hardware shall meet testing as specified. ISO 9001 certified manufacturers

may perform in-house testing. Manufacturers not ISO 9001 qualified shall be required to produce testing by an independent testing laboratory. Component specific requirements are listed in appropriate paragraphs.

2.1.1.1 Selected Components

Workstations shall conform to the requirements of BIFMA X5.5 and BIFMA X5.6 with the following exceptions: Panels, spine walls and panel, or spine wall supported components shall be tested and pass in accordance with the requirements of BIFMA X5.6 and representative items shall be selected for testing based on worst case situations (i.e., the deepest and widest work surface or shelf). The keyboard drawer or shelf test shall be performed applying a 19 kg 50 lb load to the center of the keyboard shelf for a period of 5 minutes. Any loosening of attachments, permanent deflection or damage to the operation of the drawer or shelf will be cause for rejection.

2.1.1.2 Panel Acoustics

NOTE: Acoustical panels and acoustical frame covers will not be used when panel-hung storage units cover more than half the panel surface. In these situations the acoustical advantage is lost and the stronger non-acoustical unit is less expensive.

Acoustical performance ratings should be based upon the workstation design. While NRC and STC ratings contribute to overall acoustical performance, the acoustical role of panels is relatively minimal in the overall environment when compared to sound absorptive properties of other finish surfaces. In addition, panel hung components greatly reduce the quantity of acoustical contributing area. For this reason, acoustical panels and acoustical frame covers will not be used behind storage components, nor will acoustical frame covers be used lower than 750 mm (30 inches) above the floor. Most major manufacturers do not comply with the higher 0.80 NRC and 24 STC without providing their more costly high performance panels. The designer must determine if the additional acoustical performance is worth the added cost to the Government. Designer must coordinate NRC and STC requirements for panel heights above 1200 mm (48 inches).

Delete paragraph if acoustical panels are not required.

Acoustical panels shall have a minimum noise reduction coefficient (NRC) of [0.65] [0.80] [_____] when tested in accordance with ASTM C 423 and a minimum sound transfer coefficient (STC) of [14] [20] [24] [26] [_____] when tested in accordance with ASTM E 290. The test shall be conducted on the entire assembled panel, full face area (the complete core, adhesive, decorative fabric, frame and joining components).

2.1.1.3 Fire Safety

NOTE: Select flame spread and smoke development in accordance with MIL-HDBK 1008C. Verify that flame spread and smoke development ratings can be met with fabric specified.

Components shall meet requirements for flame spread and smoke development as specified by NFPA 101 except as follows. Testing shall have been conducted in accordance with either ASTM E 84, UL 723, or NFPA 255 on the entire assembled panel and each different combination of fabric and interior construction. In addition, fabric shall meet the requirements of NFPA 265. Panel flame spread shall not exceed [[25 for Class A] [75 for Class B] [200 for Class C]] and panel smoke development shall not exceed 450 for Class A, B and C.

2.1.4 General Safety

Workstation products shall be free of rough or sharp edges. [Panel and spine wall supported components shall have a positive, integral locking device which secures components without the use of additional screws or clamps to prevent the components from being accidentally pulled or knocked off the panels.] [Desk-based workstation components shall have the option for a positive, integral locking device that secures components to the base units.]

2.1.5 Electrical System

Task lights shall be UL approved and shall meet the requirements of NFPA 70. The electrical system shall meet the requirements of UL 1286.

2.1.6 Panel Glazing

NOTE: Curved glazed panels should not be specified since most products utilize an acrylic glazing. Acrylic glazing is not acceptable since it does not meet flame spread and smoke development requirements.

Tempered glass shall conform to ASTM C 1048, Kind FT, Condition A, Type I, [Class 1 Transparent] [Class 3 - Light reducing, tinted or translucent].

2.2 [PANEL SYSTEM] [SPINE WALL SYSTEM] [DESK-BASED SYSTEMS]

NOTE: A spine wall system may be used in combination with a panel system. In these applications, the spine wall serves as the core of a cluster of workstations. Spine wall systems can be used with other manufacturer's panel systems.

2.2.1 Panel System

Accessories and appurtenances for a completely finished panel assembly shall be supplied complete with the system. The system shall be capable of structurally supporting cantilevered work surfaces, shelves, files, and other components in the configurations shown on the drawings. The panel system shall be capable of structurally supporting more than one fully

loaded component per panel per side. Panels shall be either tackable or capable of accommodating fabric covered tackboards. The panel system shall be available in a variety of nominal widths and heights as designated on the drawings. Heights shall be measured from the finished floor to the top of the panel. Powered and nonpowered panels shall be compatible in height. Panel heights shall be coordinated with the HVAC and electrical designs. The Contractor shall submit Assembly Manuals as specified in the Submittals paragraph.

2.2.2 Stacking Panel-Frame System

Accessories and appurtenances for a completely finished panel assembly shall be supplied complete with the system. The system shall be capable of structurally supporting cantilevered work surfaces, shelves, files, and other components in the configurations shown on the drawings. The panel system shall be capable of structurally supporting more than 1 fully loaded component per panel per side. Panels shall be either tackable or capable of accommodating fabric covered tackboards. The system shall be capable of lowering or raising the overall panel assembly height, at horizontal connections, by either removing or adding panel-frames on-site without disturbing adjacent panel components. The panel system shall be available in a variety of nominal widths and heights as designated on the drawings and shall be vertically stackable. Heights shall be measured from the finished floor to the top of the panel assembly. Panel heights shall be coordinated with the HVAC and electrical designs.

2.2.3 Spine Wall System

Accessories and appurtenances for a completely finished spine wall assembly shall be supplied complete with the system. The wall system shall be capable of structurally supporting cantilevered work surfaces, shelves, files, and other components in the configurations shown on the drawings, as well as allow various off module attachment locations horizontally for these components. The spine wall system shall be capable of structurally supporting more than one fully loaded component per panel per side. It shall be available in a variety of nominal widths and heights as designated on the drawings. [Wall height may be lowered or raised at horizontal connections by either removing or adding wall tiles on-site without disturbing adjacent wall components.] Heights shall be measured from the finished floor to the top of the panel. Wall heights shall be coordinated with the HVAC and electrical designs. Electrical and data management will be easily accessible by removable wall covers which can be removed while workstation components are still attached. Cables shall be laid in the system, not threaded through the frame.

2.2.4 Desk-Based Systems

Accessories and appurtenances for a completely finished desk-based assembly shall be supplied complete with the system. The desk-based system shall be free-standing and independent of panel system support. It shall be capable of structurally supporting work surfaces, shelves, and other components in the configurations shown on the drawings. The system shall be available in a variety of nominal widths as defined on drawings.

2.2.5 Finishes

NOTE: Specify a finish and fabric for applicable items. Include fabric content, ex: 50% Nylon, 50%

Wool. The designer must verify that fabric content, pattern, and color specified are not proprietary and that several manufacturers can provide a similar product to that specified.

Filler trim incurs added cost and should be omitted unless it is desired for aesthetic reasons.

a. The panels shall be available in the following options: [acoustical,] [non-acoustical,] [safety glazed,] [open frame] [____]. Exposed panel trim shall have a [factory baked enamel or epoxy powder] [wood,] finish. [Filler trim shall either match the panel trim or be fabric covered to match the panel fabric.] [Filler trim shall not be provided.] Each fabric-faced panel shall have a seamless width of fabric stretched over the entire face of the panel and the color of each fabric utilized shall be consistent throughout the installation. Curved panels may use adhesives on curved sections. The fabric shall be attached securely and continuously along the entire perimeter of the panel and shall allow for easy removal and replacement in the field (with the exception of curved panels). Fabric shall be factory installed and panel fabric content shall be [____].

b. The stacking panel-frames shall accommodate covers which are available in the following options: [safety glazed,] [acoustical,] [open pass through frames,] [wood veneer,] [upholstered,] [laminate/vinyl,] [cable access channels,] [rail organizer,] [marker surface,] [tackable surface,] [work tools accommodation,] [____]. [Frame covers may have different options on either side of the frame.] Exposed panel trim shall have a [factory baked enamel or epoxy powder] [wood] finish. [Filler trim shall either match the panel trim or be fabric covered to match the panel fabric.] [Filler trim shall not be provided.] Each upholstered frame cover shall have a seamless width of fabric stretched over the entire face of the cover, and the color of each fabric used shall be consistent throughout the installation. The fabric shall be attached securely and continuously along the entire perimeter of the cover and shall allow for easy removal and replacement in the field. Fabric shall be factory installed and panel fabric content shall be [____].

c. The spine wall frames shall accommodate covers which are available in the following options: [safety glazed,] [painted] [acoustical] [wood veneer] [upholstered] [laminate/vinyl] [tackable surface] [marker surface] [paper management] [vertical storage] [cable access] [____]. Frame covers may have different options on either side of the frame. Exposed trim shall have a [factory baked enamel or epoxy powder] [wood] [metal] finish. Spine wall covers must be easily removable even while panels and workstation components are attached. Each fabric-faced frame cover shall have a seamless width of fabric stretched over the entire face of the cover, and the color of each fabric used shall be consistent throughout the installation. The fabric shall be attached securely and continuously along the entire perimeter of the cover and shall allow for easy removal and replacement in the field. Fabric shall be factory installed and have a content of [____].

2.2.6 Raceways

Raceways shall be an integral part of the panel and spine wall. Panels and spine walls, whether powered or nonpowered, shall be provided with a

raceway cover. Magnet held base covers will not be accepted.

2.2.7 Leveling Glides

The system shall provide precise alignment of adjacent panels and spine walls and shall include leveling glides to compensate for uneven floors. On panel-to-panel products, each panel shall have 2 leveling glides. On panel-to-post products each connector shall contain a leveling glide. On stacking panel frames each vertical panel assembly shall have two leveling guides. A minimum 20 mm 3/4 inch adjustment range is required for all systems.

2.2.8 Panel and Spine Wall Connection System

**NOTE: Delete connection of 2 panels for setting the
panels at any angle if not required. This
connection limits sources.**

The panel and spine wall system shall have connectors which accommodate a variety of configurations as shown on the drawings. A straight line connection of 2 panels (180 degrees), corner connection of 2 panels (90 degrees), T connection of 3 panels (90 degrees), cross connection of 4 panels (all 90 degrees), and a connection of 2 panels for setting the panels at any angle. The connector system shall provide tight connections with continuous visual and acoustical seals. All two-way and T connections should have plastic, painted metal, fabric or wood finish to match system. The connector system shall allow removal of a single panel or spine wall within a typical workstation configuration, without requiring disassembly of the workstation or removal of adjacent panels or spine walls. The connector system shall provide for connection of panels or spine walls of similar or dissimilar heights. When stacking panel frames are specified, taller panel assemblies of adjacent dissimilar height panel assemblies shall be provided with trim pieces to finish the exposed edge. Right angle (90 degree) connections between panels shall not interfere with the capability to hang work surfaces and other components on any adjacent panel. The connector system shall provide, as required, for the continuation of electrical and communications wiring within workstations and from workstation to workstation. Filler posts shall be level with the panel or spine wall top rail.

2.2.9 Wall Mounted Panels

Wall-mount accessories shall be used when it is necessary to attach panels or vertical panel-frame assemblies to the building walls. Wall panels shall have structural support as required.

2.2.10 Glazed Panels

Glazed panel inserts shall be comprised of tempered glass in accordance with ANSI Z97.1. Acrylic glazing will not be accepted.

2.2.11 Door Panels

Door panels shall have a rigid metal frame with rails, a threshold, and a [wood] [laminated] [safety glazed] [_____] clad door adaptable to either hand swing. Door panels shall be of a dimension that will allow for a 810 mm 32 inch clear opening. Door panels shall include connectors, hinges,

and [brushed chrome] [epoxy powder] [baked enamel] finished ADA compliant door knob.

2.3 WORK SURFACES

Work surfaces shall be constructed to prevent warpage. [Work surfaces shall be either fully supported from the panels [or spine wall] or supported jointly by the panels [or spine wall] and supplemental legs, pedestals, or furniture end panels. Supplemental end supports shall be used only under work surfaces when the work station configuration does not permit full support by the panels [or spine wall]. Metal support brackets shall be used to support work surfaces from the panels [or spine wall], provide metal-to-metal fitting to the vertical uprights of the panels [or spine wall], shall be vertically adjustable, and shall lock the work surfaces in place without panel [or spine wall] modifications.] [Work surfaces shall be fully floor supported with legs, pedestals, or furniture end panels.] Abutting work surfaces shall mate closely and be at equal heights when used in side-by-side configurations in order to provide a continuous and level work surface. Work surfaces shall either have pre-drilled holes to accommodate storage components, pedestals and additional supports, or holes shall be able to be drilled at the job site to accommodate these items. Work surfaces shall be provided in sizes and configurations shown on the drawings. Work surfaces shall be available in nominal depths of [510 mm 20 inches,] [and] [610 mm 24 inches,] [and] [760 mm 30 inches,] plus or minus 50 mm 2 inches, nominal lengths from 610 to 1830 mm 24 to 72 inches, and a nominal thickness from 25 to 45 mm 1 to 1-3/4 inches. Work surfaces shall be height adjustable in 25 to 40 mm 1 to 1 1/2 inch increments from 630 to 1040 mm 25 to 41 inches above the finished floor. Work surfaces abutting at equal heights shall provide a continuous and level work surface. [Corner work surfaces,] [peninsula work surfaces,] [and] [counter/transaction work surfaces] shall be provided as shown on the drawings and shall include hardware necessary to provide firm and rigid support.

2.3.1 Finishes

The work surfaces shall have a finished top surface of [high pressure plastic laminate], [veneer] and shall have a smoothly finished underside. The work surface shall not be affected by ordinary household solvents, acids, alcohols, or salt solutions, and shall be capable of being cleaned with ordinary household cleaning solutions. Metal support brackets shall match the color and finish of trim. Edges shall be [post formed or vinyl molding] [solid wood].

2.4 PEDESTALS

Drawer configurations and pedestal height shall be as shown on the drawings. The deepest possible pedestal shall be provided for each work surface size specified.

2.4.1 Construction

With the exception of drawer fronts, pedestals and drawers shall be of steel construction. Drawer faces shall be securely attached to the drawer front.

2.4.2 Finishes

The finish of steel surfaces shall be a factory baked enamel finish or

powder coated. Drawer fronts shall be [either steel, plastic laminate, or molded plastic] [veneer].

2.4.3 Drawer Requirements

NOTE: Delete reference to 380 mm (15 inch) high EDP drawers if not required.

Pedestals shall be field interchangeable from left to right, and right to left, and shall retain the pedestal locking system capability. Pedestals shall be designed to protect wires from being damaged by drawer operation. Pedestals shall be work surface hung, or shall support work surfaces, or shall be free standing; as shown. Drawers shall stay securely closed when in the closed position and each drawer shall contain a safety catch to prevent accidental removal when fully open. File drawers shall have either a cradle type or full extension ball bearing suspension with hanging folder frames or compressor dividers. File drawers shall be 305 mm 12 inch high. Box drawers shall be provided with [pencil trays] [and] [stationary trays]. All EDP file drawers shall be 380 mm 15 inch high and shall accommodate EDP printout sheets. Center pencil drawer shall be mounted under the work surface and shall contain a removable pencil tray.

2.5 STORAGE

[Flipper door cabinets,] [shelf units] [and] [lateral files] shall be provided in the sizes and configurations shown on the drawings. [Flipper door] [and] [shelf unit] cabinets shall accommodate task lighting and shall have a [depth to accommodate a standard three ring binder] [and] [minimum 380 mm 15 inch depth to accommodate computer printouts].

2.5.1 Shelf Unit Construction

The shelf pan shall be of metal construction with formed edges. Shelf supporting end panels shall be constructed of metal, high density particle board, molded phenolic resin, or molded melamine. Shelf units shall accommodate relocatable shelf dividers.

2.5.2 Flipper Door Unit Construction

Flipper door unit shall be of equal construction to shelf units. Units shall remain securely fastened when in the locked position. Doors shall utilize a suspension system.

2.5.3 Lateral File Unit Construction

Lateral files shall be of steel construction. File fronts, top and end panels shall be of equal construction to shelf units. File drawers shall have full extension ball bearing drawer slides or rack and pinion suspension. File drawers shall have hanging folder frames, compressor dividers or rails and shall be capable of hanging side-to-side or front-to-back.

2.5.4 Finish

NOTE: Designer should not remove an option for a factory baked enamel flipper door from this

paragraph since a limited number of manufacturers offer a fabric flipper door. If fabric flipper doors are not desired for maintenance reasons, the fabric option may be eliminated since a metal flipper door is readily available.

Shelves and dividers and top dust cover shall have a factory baked enamel finish. Shelf supporting end panels shall have either a factory baked enamel or laminate finish. Shelf bottom shall match end panel color. Metal doors shall have an exterior finish of factory baked enamel or a factory installed fabric covering and an interior finish of factory baked enamel. Metal drawers shall have a factory baked enamel finish. Fabric content of flipper doors shall be [____]. [[Flipper doors] [and lateral files] shall have a wood veneer surface.]

2.6 ACCESSORIES

2.6.1 Coat Storage

One [panel] [spine wall] mounted coat hook per workstation occupant shall be provided at each workstation.

2.6.2 Keyboard Tray

NOTE: Delete reference to wrist supports if not required.

Work surfaces shall be capable of accepting [an articulating keyboard] [a keyboard shelf] on workstations as shown on the drawings. The keyboard tray shall have the capability to be fully recessed under the work surface and extend to give the user full access to the keyboard. Side travel rotation shall be a 180-degree swing. The keyboard tray shall have tilting capability and shall contain a wrist support. It should also include a mouse pad at the same level as the keyboard, and accommodate either right or left-handed users.

2.6.3 Computer Turntables

Turntables shall be provided on workstations as shown on the drawings. Turntables shall contain a stop mechanism to prevent tangled cords.

2.6.4 Tackboards

Fabric shall be factory installed and fabric content of tackboards shall be [____]. Location and size shall be as shown on the drawings.

2.6.5 Erasable Marker Boards

Marker boards shall have a white writing surface which can be easily written on and erased and shall be unaffected by common marker board cleaning/conditioning agents and shall contain a storage tray. Size and location shall be as shown on the drawings.

2.6.6 Paper Management Unit

Paper management units shall be provided as indicated on the drawings.

These units shall be constructed of coated steel or injection molded plastic and shall accommodate either legal or letter size lengths. Unit shall not be freestanding and shall be provided as shown on the drawings.

2.6.7 Wall Mounted Components

Wall tracks shall be utilized when components are shown attached directly to wall surfaces. Tracks shall be of heavy duty extruded metal. Finish and color of tracks shall match the panel trim. Vertically aligned tracks shall be slotted on 25 mm 1 inch centers in heights required. Slot spacing shall match slot spacing for wall panels.

2.6.8 CPU Holder

A mounting device shall be provided to support the computer hard drive. Desk top and floor locations are not acceptable.

2.7 MISCELLANEOUS HARDWARE

Brackets, supports, hangers, clips, panel supported legs, connectors, adjustable feet, cover plates, stabilizers, and other miscellaneous hardware shall be provided.

2.8 LOCKS AND KEYING

NOTE: The quantity of different key operations required is dependent on the size of the project. The number specified should not exceed the quantity of workstations. The maximum quantity utilized shall not exceed 150.

Drawers, flipper door cabinets, and lateral files shall have keyed locks, unless otherwise noted. Field changeable lock cylinders shall be provided with a minimum of [100] [_____] different key options. Each workstation shall be individually keyed and locks within a workstation shall be keyed alike. Drawers within a pedestal shall be lockable either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal. Central file and storage units which are grouped together but are not a part of a workstation shall be keyed alike unless otherwise specified. Door panels shall have keyed [door knob] [_____] set. Two keys shall be provided for each lock or 2 keys per workstation when keyed alike, and 3 master keys shall be provided per area as shown on the contract drawings. Keys and lock cylinders shall be numbered for ease of replacement. Locks shall be clearly labeled with a key number, except for those manufacturers who have removal format locks.

2.9 ELECTRICAL

NOTE: It is recommended that the type of cabling assembly (wiring, harnesses, or buses) be left as a Contractor selection unless necessary to restrict for compatibility with existing equipment.

Both powered and nonpowered panels [and spine walls] shall have base raceways capable of distributing power circuits, [communication cables]

[and] [data lines]. Nonpowered bases shall be capable of easy field conversion to powered base without requiring the panel [spine wall] to be dismantled or removed from the workstation. The system shall use copper [cable assemblies,] [wiring harnesses] [or] [electrified bus] and shall meet requirements of UL 1286 and NFPA 70, Article 605. Conductors shall consist of 20 amp [90] [75] degree C, #12 AWG wires (unless indicated otherwise) or the equivalent in the bus configuration. The label or listing of Underwriter's Laboratories, Inc. will be accepted as evidence that the material or equipment conforms to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency shall be submitted indicating that the items have been tested in accordance with required procedures of UL and that the materials and equipment comply with contract requirements. Electrical work not addressed in this section shall conform to the requirements of Section 16402 INTERIOR DISTRIBUTION SYSTEM.

2.9.1 Panel Raceways

NOTE: Raceways are available in various locations, such as base, desk height and top-of-panel. Revise to meet project requirements.

When specifying desk height raceways the overhead storage unit requirements should be carefully coordinated.

Panels shall have hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. The raceway shall not extend past either [panel face][frame cover] by more than 13 mm 1/2 inch. Metal or plastic covers which attach securely to the raceway shall be provided as required and shall match the finish and color of the panel trim. Raceways [in full size over 610 mm 24 inches powered panels] [on panel frames] shall have a minimum of 2 knockouts (doors) per side for electrical connections or outlets as indicated elsewhere. Other raceways must be flush with [panel face][frame covers].

2.9.2 Spine Wall

Spine walls must be able to support lay-in cabling and have a large capacity for power and data. The interior of the spine wall frame shall provide ample space for storing excess wires and fiber optic cables. Power and data systems shall be easily accessed in the spine wall without having to move return panels or components. The spine wall system must have the ability to provide power to a wall-attached panel system and/or an adjacent desk system. Raceways shall be located in numerous locations such as the base, beltline, and below and above the beltline. Spine wall frames shall have hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. The base raceway shall not extend past the spine wall face by more than 13 mm 1/2 inch. Other raceways must be flush with the wall face. Metal or plastic raceways covers shall match the finish and color of the panel trim, unless otherwise stated. A termination center or utility closet may be utilized in the wall or at the end of a spine wall run.

2.9.3 Power Distribution

NOTE: The 8-wire system should be utilized for applications serving mixed loads including electronic data processing equipment. Since EDP equipment generates high levels of harmonics (* see footnote below), a full size neutral should be provided for each EDP circuit. Alternately, it is recommended that the phase conductor not be loaded to more than 12A or that an oversized neutral be specified. To minimize interference from electronic noise to sensitive data processing components, the EDP equipment should be placed on the dedicated circuits.

In the absence of other criteria, use of an isolated ground conductor is not recommended for the EDP circuits (See IEEE Std. 1100). If the amount of EDP load is extensive and the conventional load is minimal, a modified 8-wire system should be provided. The preferred configuration would be 3 phases, 3 neutrals, an EDP ground, and a conventional ground. Non-EDP load should be connected to one phase, one neutral, and the conventional ground. The other two phases and neutrals and EDP ground should be dedicated for EDP type loads.

As a second choice the 8 wires could be designated as follows: 3 dedicated phase, 1 dedicated oversize neutral (#10 with 14 amp maximum phase loading), and isolated ground, a conventional phase, neutral, and ground conductor. The non-EDP load should be placed on the conventional conductors. (An 8-wire configuration with 3 phases, 3 neutrals, an isolated ground, and a conventional ground could also be used. Non-EDP load should be connected to the conventional ground and least loaded phase conductor.)

The 5-wire system may be used if no EDP loads are to be supplied. The 6-wire system is a less reliable, hybrid configuration in which EDP and non-EDP loads use a shared neutral. It could also be used for Air Force shared ground applications with the isolated ground connector either disconnected or interconnected with the equipment ground.

Non-linear loads such as computers, copiers, laser printers, electronic lighting ballasts, and uninterruptible power supplies cause harmonic distortion on power distribution systems. The majority of workstation loads are non-linear, harmonic producing loads. Designers must ensure that the building power distribution equipment can support these non-linear loads. IEEE Std 519 and 1100 provide details concerning the causes, effects, and means of compensation for non-linear, harmonic

producing loads on power systems. Harmonic compensation may include, but is not limited to: specifying K-rated transformers, derating transformers, oversizing neutrals to 200% of the ampacity of the phase conductors or phase bus, using phase conductors and terminals with higher ampacities and/or higher temperature ratings, supplying non-linear loads from dedicated isolation transformers, and installing shunt filters. See UGGS-16415A for further guidance.

Surge suppression and power conditioning receptacle modules are available. However power conditioning for specific loads (particularly portable equipment) is normally a User responsibility and is not furnished as part of the construction contract. The Air Force has identified specific responsibilities of the user and suppliers of end-use equipment. (See Air Force ETL 89-6 for specific criteria or verify specific requirements for electrical support.)

Power distribution shall be provided as indicated on the drawings. The panels [and] [spine wall] shall have an internal [power] [and] [communications] raceway and the capability of disconnecting and connecting external circuits to the electrified raceway in the panel [and] [spine wall]. The communications receiving raceway shall have capacity for at least [six] [twelve] [twenty] 4-pair category 5 cables. Power and communications wiring may share a common wireway if a metal divider is included to ensure electrical isolation. Doors or access openings shall be included for entry of communications cable. The electrified power raceway shall be of the [8-wire] [6-wire] [or] [5-wire] configuration indicated. [Unless otherwise indicated, conductors of the 8-wire system shall be allocated as follows: the three-phase system shall have one equipment ground, one isolated ground, [one neutral] [one oversized (133% minimum) neutral], and two each dedicated phase.] [Unless otherwise indicated, conductors of the 8-wire system shall be allocated as follows: the three-phase system shall have one equipment ground, one isolated ground, [one neutral per phase] [one oversized (133% minimum) neutral per phase], and one each dedicated phase.]

2.9.3.1 Receptacles

NOTE: 15 AMP receptacles are the current industry standard. If 20 amp receptacles are required, the channel depth for the receptacle may have to be increased. Coordinate with the panel and/or spine wall thickness.

Power receptacles shall be provided in the powered panels [and spine walls]. Devices shall be placed at the locations indicated on the plans and shall be connected to the designated circuits. [Electrical outlets should have the ability to be hung at [200 mm 8-inch] [multiple] [_____] vertical increments throughout the frame via power harnesses.] Unless otherwise indicated, receptacles shall be [15 amp (NEMA 5-15R)] [20 amp (NEMA 5-20R)] commercial grade conforming to NEMA WD 1 and NEMA WD 6. If receptacles are not interchangeable or will not permit field adjustment of

phase and circuit selection, 10 percent spare devices of each type shown on these plans shall be furnished. [All] [General use] receptacles shall be of the duplex configuration; unless otherwise indicated, special use receptacles shall be of the simplex configuration with the blade/pin arrangement identified on the plans. The color of receptacle bodies shall be coordinated with the color of the panel [and spine wall] trim. Isolated ground receptacles shall [be orange] [or] [have distinct markings] [be of a different color than other receptacles]. Field applied identification shall be permanent; stick-on or non-setting adhesives shall not be used. A minimum of [5] [_____] receptacle removal tools shall be provided for systems that require special tools for proper receptacle removal.

2.9.3.2 Power Cabling Variations

The paragraph Power Distribution has identified specific cabling configurations. Since universal conventions have not been established, variant configurations available from various manufacturers will be considered. Alternates shall allow the same circuiting, device connections, neutral and ground separation, and upstream feeder connections as shown on the plans. Variations shall be approved in advance. See paragraph ALTERNATE DESIGN. Examples of acceptable variations include:

- a. Use of 1 oversized neutral in lieu of 2 or 3 specified neutrals (neutral must have 150 percent minimum of phase conductor ampacity, i.e. #10 TW neutral if replacing 2 #12 TW conductors; 173 percent and #8 if replacing 3 neutrals) or vice versa.
- b. Providing a 6-wire system in lieu of a 5-wire system shown on plans.
- c. Use of a manufacturer's configuration which allocates individual conductors differently, but which has the same quantity of conductors and allows devices to be physically connected in the field as shown on the plans. It is not necessary that the manufacturer's labeling codes or terminology match the designations used on project plans or in the specifications; however, neutrals and grounds shall have insulation color coded per standard practice or be provided with tags, colored tape, colored ribbons or similar identification. (The reference to "dedicated" conductors in this specification pertains to circuit connections upstream and load connections downstream of panels; it is not necessary that manufacturer's designations correspond.)

2.9.4 Electrical Connections

NOTE: The direct wired configurations should be suitable for most applications. All wiring should be contained within raceways or wireways. The exposed cord/plug arrangement should not be used, unless specifically requested by the user. If used, ensure that the design conforms to the limitations of Article 605-8 of NFPA 70.

Code-enforcing personnel in some areas require separate hard wired junction box interfaces from building services to furniture system installations. If the facility will be under their jurisdiction, the design must conform and the junction box

configuration must be provided in lieu of the direct wired. If the facility will not be under local jurisdiction, the direct wired configuration could be provided per User request; however, it is preferred that the Government design be consistent with local practice. If top entry service poles are used for power interfacing, the junction box configuration is preferred for all locations.

2.9.4.1 Internal Connections

NOTE: Some local codes require hardwired connections with the panels and/or spine walls. If local codes are to be followed, this item will need to be verified.

Internal panel-to-panel [spine wall-to-spine wall] [spine wall-to-panel] power connections shall utilize [straight or flexible plug/receptacle connector assemblies] [hardwired connections] and shall be installed to provide the powered configurations shown on the drawings.

2.9.4.2 Connections to Building Services

External [power] [and] [communications] services shall be supplied to the panels [spine walls] via [direct-wired [top] [base] entry modules.] [hard wired [top] [base] entry junction box assemblies.] [Wiring from building services shall be extended to the entry modules or panel [spine wall] bases in metal conduit or tubing or in flexible liquidtight conduit 1830 mm 6 foot maximum.] [Wiring from building services shall be extended to junction box assemblies in metal conduit or tubing. Wiring from junction boxes shall be flexible liquid-tight conduit 1830 mm 6 foot maximum or in metal conduit or tubing.] Cord and plug assemblies shall not be used for any portion of external links. [Base feed modules shall plug into the end or either side of the raceway at receptacle doors.] [Top entry [modules] [junction box assemblies] shall extend the [power] [and] [communications] wiring into service entry poles attached to the electrified panels.] External wiring shall conform to Section 16402 INTERIOR DISTRIBUTION SYSTEM.

2.9.5 Wire Management

Wire management capability shall be provided at all workstations. Actual wire management capacity shall accommodate all cable types specified, including the applicable manufacturer required bending radius at corners. Raceways and interfaces to the raceways shall be designed to accommodate the bend radius as shown in EIA ANSI/TIA/EIA-569-A for Category [5] [_____] [and] [fiber optic cables] communication wiring [whichever is greater]. The capability may be accomplished by cable access cutouts (1 minimum per work surface), covered wire management troughs in vertical end panels, horizontal wiring troughs, internal midpanel (beltline) raceways, or rear gaps (between the back edge of the work surface and the facing support panel). Grommet kits or another suitable finish arrangement shall be provided for all cable cutouts. Accessories for an externally mounted vertical and horizontal wire management and concealment system shall be provided [as indicated on the contract drawings] [as recommended by the manufacturer]. Horizontal wire managers shall be supplied for mounting under all work surfaces. The wire managers shall be attached either to the

underside of the work surface or to the vertical panel [and spine wall] without damaging the face. Exposed or loose wiring will not be acceptable.

Wire managers shall be prefinished and shall secure, conceal, and accommodate outlet cords as well as electrical and communications wiring. Wire channels shall match color of panel [and spine wall] trim, attach by means of clip-on attachment, and shall conceal wires routed vertically. Power wiring shall be separated from communication wiring by use of separate raceways or by placement of channels in joint use troughs or wireways.

2.9.6 Circuit Layout

The circuit layout for workstations shall be as shown on the drawings. Devices shall be connected to the designated circuits in the neutral and ground configurations indicated. Connections shall be made to the building electrical distribution system as shown on the contract drawings and in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM.

2.9.7 Service Entry Poles

NOTE: Coordinate requirements with paragraph Power Distribution.

Service poles shall be provided as indicated on the contract drawings and shall be capable of minimally accommodating the [8-wire] [6-wire] [5-wire] power configuration described in paragraph Powered Panels and the equivalent of [six] [twelve] [twenty] 4-pair category 5 cables. Poles shall have metal barriers or channels to separate power and communications wiring. Pole dimensions shall be allowed to be equal to maximum panel [spine wall] thickness. The pole finish and color shall [match the finish and color of the panel [spine wall] trim] [conform to requirements shown on the plans]. Designated poles shall have the capability of being opened along the vertical access to permit the lay-in of wiring. Each pole shall have a wiring interface, an end cap and a ceiling trim plate which extends a minimum of 40 mm 1-1/2 inches from all sides of the pole. Poles for power service shall include a junction box either as part of the pole assembly or in a field installed configuration. Service poles shall be securely attached to the panels [spine wall] and shall be installed plumb. Wiring and interface components shall be provided as required to connect the building power supply to power poles.

2.9.8 Task Lighting

Task light size and placement shall be provided as indicated on the contract drawings. Such lights shall be a standard component of the manufacturer's workstation products. The ends of the task light length shall not extend beyond the edges of the overhead unit. Task lights shall have structurally sound mounting devices which will prevent accidental displacement, but will allow easy removal and replacement when necessary. Fixtures shall be UL approved for use in the configurations indicated on the drawings.

2.9.8.1 Luminaire Configuration

NOTE: The lamp and ballast types should be indicated on the drawings. Use of electronic

ballasts and T8 lamps is strongly encouraged as a means of meeting energy conservation goals for the building. Although there are no national standards for electronic ballasts, technical requirements are covered in Section 16402 INTERIOR DISTRIBUTION SYSTEM. Electronic ballasts are the most efficient fluorescent ballasts, eliminate visual flicker and are quiet. When used, the electrical design must consider the harmonics and electromagnetic energy generated by these ballasts. Specific areas which should not have electronic ballasts are medical electronic equipment areas and areas equipped with infrared remote control or security devices. It is important to inform Users of the benefits and risks of electronic ballasts and to involve them in the decision regarding their use.

Luminaires shall be the fluorescent type and shall have prismatic lenses, baffles, or reflector systems configured to minimize glare by shielding the lamp from the view of a seated user. Task lights for each workstation shall provide a minimum of [810] [650] lx [75] [60] foot candles of light (horizontally measured), without veiling reflections, on the work surface directly below and a maximum of 500 mm 20 inches from the fixture. All diffusers, grilles or other coverings shall be easily removable to permit cleaning and relamping. Fixtures shall be provided with energy efficient ballasts and lamps as indicated. If the type is not identified on the plans, F32T8 lamps in 1220 mm 4 foot units with electronic ballasts shall be used. Each luminaire shall have an easily accessible on-off switch and one rapid-start ballast. A variable intensity control is acceptable if the low setting is equivalent to "off" with zero energy consumption. Multiple switching is also acceptable. Ganged fixtures or shared ballasts shall not be used. Lamps and ballasts shall conform to the requirements of Section 16402 INTERIOR DISTRIBUTION SYSTEM.

2.9.8.2 Wiring

NOTE: If the facility will be under the jurisdiction of a city code, verify requirements. Some locations require hard wired connections.

Each fixture shall have a 1830 mm 6 foot minimum, factory installed, heavy duty electrical cordset with a grounded plug. Direct or hard wire connections are not acceptable. Unless otherwise indicated, cords shall be concealed. Cord concealment shall be built-in within panels [and spine walls] or shall utilize field installed, manufacturer approved accessories.

Cords may be extended through dedicated channels located at any point within panels [and spine walls] or may be placed in vertical slots or in the space between panels [and spine walls] if held in place by retainers and concealed by a cover plate. Vertical wire managers shall be prefinished and cut to size and shall extend from the task light level down to the top of the work surface below the task light. Each manager shall be attached to a panel vertical edge or connector strip without damage to the surfaces.

2.9.9 Communications

Communications wiring shall be extended to, and installed in, the electrified panels [and spine walls] as shown on the plans. Communications outlets shall be installed at designated locations. Communications work may be performed in conjunction with the installation of workstations or may be separately executed at the Contractor's option; however, equipment, materials, and installation shall conform to the requirements of [Section 16402 INTERIOR DISTRIBUTION SYSTEM] [Section 16710 BUILDING TELECOMMUNICATIONS CABLING SYSTEM] [_____] and all interfaces must be properly coordinated.

2.9.10 Special Systems

NOTE: Include this paragraph only in projects where requirements for shielded facilities (TEMPEST, Red/Black, EMP, etc.) and secure wiring have been called out in project criteria. Specific requirements for cable arrangement, separation of Red/Black lines, etc., need to be verified for each project. Provide metal raceway, channels, etc. throughout. Separation distances required for exposed cable or wiring in nonmetallic raceways are much greater than for wiring installed in totally enclosed metal raceway. Site specific details and/or notes should be prepared for each project.

Designated raceway systems shall provide management for secure and nonsecure power, computer and telecommunications cabling. Secure distribution shall be separated from nonsecure distribution [in accordance with details shown on the plans] [by running secure lines along top located raceway and nonsecure along the bottom of the workstation panel [and spine wall]].

PART 3 EXECUTION

3.1 INSTALLATION

The workstations shall be installed by certified installers in accordance with manufacturer's recommended installation instructions. Workstation components shall be installed level, plumb, square, and with proper alignment with adjoining furniture. The components shall be securely interconnected and securely attached to the building where required. Three sets of special tools and equipment necessary for the relocation of panels and other components shall be furnished.

3.2 CLEANING

Upon completion of installation, all products shall be cleaned and polished and the area shall be left in a clean and neat condition. Any defects in material and installation shall be repaired, and damaged products that cannot be satisfactorily repaired shall be replaced. The Contractor shall submit Maintenance Manuals as specified in the Submittals paragraph.

-- End of Section --