

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM  
**08/11**

PART 1 GENERAL

1.1 REFERENCES

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. Contractor may substitute compatible Telecommunications Industry Association (TIA) or UL standards, as approved by the Contracting Officer's representative.

THE JAPANESE ELECTRIC WIRE & CABLE MAKERS' ASSOCIATION (JCMA)

JCS 5507 (2010) LAN Twisted Pair Cable

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS C 3665-1-1 (2007) Tests on electric and optical fibre cables under fire conditions -- Part 1-1: Test for vertical flame propagation for a single insulated wire or cable -- Apparatus

JIS C 5964-4 (2014) Fiber optic connector interfaces -- Part 4: Type SC connector family (F04 Type)

JIS C 5964-4-100 (2018) Fiber optic connector interfaces -- Part 4-100: Type SC connector family -- Simplified receptacle SC-PC connector interfaces (F16 type)

JIS C 5964-18 (2014) Fiber optic connector interfaces -- Part 18: Type MT-RJ connector family (F19 type)

JIS C 5964-20 (2015) Fiber optic connector interfaces -- Part 20: Type LC connector family

JIS C 6011-1 (2015) Mechanical structures for electronic equipment -- Tests for IEC 60917 and IEC 60297 series -- Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor conditions

JIS C 6012-3-100 (2015) Mechanical structures for electronic equipment -- Dimensions of mechanical structures of the 482.6 mm (19 in) series -- Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets

JIS C 6185-2 (2014) Optical time-domain reflectometers

	(OTDR) -- Part 2: Calibration of OTDR for single mode fibers
JIS C 6185-3	(2014) Optical time-domain reflectometers (OTDR) -- Part 3: Calibration of OTDR for multimode fibers
JIS C 6820	(2018) General rules of optical fibers
JIS C 6850	(2006) General rules of optical fiber cables
JIS C 6870-2	(2021) Indoor optical fiber cables -- Part 2: Sectional specification
JIS C 8435	(2022) Boxes And Box Covers Of Plastic Conduits
JIS C 60364-4-42	(2022) Electrical installations of buildings -- Part 4-42: Protection for safety -- Protection against thermal effects
JIS C 60364-5-54	(2006; R 2015) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 61300-2-2	(2011) Fiber optic interconnecting devices and passive components -- Basic test and measurement procedures -- Part 2-2: Tests -- Mating durability
JIS K 6911	(2006; R 2021) Thermosetting plastic general test method
JIS X 5150	(R2016) Information Technology-Generic Cabling for Customer Premises

UNDERWRITERS LABORATORIES (UL)

UL 1666	(2007; Reprint Jun 2012) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP), apply to this section with additions and modifications specified herein.

### 1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in JIS X 5150, JCS 5507, JIS C 6820, JIS C 6850, and herein.

#### 1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates.  
(International expression for main cross-connect (MC).)

#### 1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

#### 1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

#### 1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

#### 1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

#### 1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

#### 1.3.7 Open Cable

Cabling that is not run in a raceway as defined by applicable codes and standards. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

#### 1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

#### 1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

#### 1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star.[ The interbuilding backbone system provides connectivity between the campus distributors and is specified in Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).] Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.[ The telecommunications contractor must coordinate with the NMCI/COSC/NGEN contractor concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with the NMCI/COSC/NGEN contractor.]

#### 1.5 SUBMITTALS

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.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Telecommunications drawings; G[, [\_\_\_\_\_]]

Telecommunications Space Drawings; G[, [\_\_\_\_\_]]

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

##### SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G[, [\_\_\_\_\_]]

Patch panels; G[, [\_\_\_\_\_]]

Telecommunications outlet/connector assemblies; G[, [\_\_\_\_\_]]

Equipment support frame; G[, [\_\_\_\_\_]]

[Connector blocks; G[, [\_\_\_\_\_]]]

SD-06 Test Reports

Telecommunications cabling testing;

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5;

SD-11 Closeout Submittals

Record Documentation;

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 279 by 432 mm in size using a minimum scale of one mm per 100 mm[, except as specified otherwise]. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Drawings

Provide[ registered communications distribution designer (RCDD) approved,] drawings in accordance with applicable codes and standards. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's[, BD's], and FD's to the telecommunications work area outlets.[ Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, CD's, BD's, FD's, and the EF and ER for telecommunications keyed to floor plans by room number. Mount the laminated schematic in the EF telecommunications space as directed by the Contracting Officer.] The following drawings shall be provided as a minimum:

- a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.
- b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.

- c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

#### 1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and [cabinet][, rack][, backboard][ and] wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

#### 1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

##### 1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

##### 1.6.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of [3][\_\_\_\_\_] years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using [optical fiber and ]copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

#### 1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of [3][\_\_\_\_\_] years experience in the manufacturing, assembly, and factory testing of components which comply with JIS X 5150, JCS 5507 and JIS C 6820 and JIS C 6850.

#### 1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, [60][\_\_\_\_\_] days prior to the proposed test date. Include procedures for certification, validation, and testing.

#### 1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in

these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

#### 1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, noncondensing.

#### 1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### 1.10 MAINTENANCE

##### 1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package



5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than [2] [\_\_\_\_\_] months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration.

#### 1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided[ in hard copy format][ on electronic media using Windows based computer cable management software.][ A licensed copy of the cable management software including documentation, shall be provided.] Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided. The cable records shall [include only the required data fields][include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility ]. Include manufacture date of cable with submittal.
- b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided. Documentation shall include the required data fields[ as a minimum][ only].

### PART 2 PRODUCTS

#### 2.1 COMPONENTS

Components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be listed or third party independent testing laboratory certified, and shall comply with applicable codes and standards and conform to the requirements specified herein.

#### 2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with JIS X 5150 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.3 TELECOMMUNICATIONS CABLING

Cabling shall be listed for the application and shall comply with JIS X 5150, JCS 5507, JIS C 6820 and JIS C 6850. Provide a labeling system for cabling as required. Ship cable on reels or in boxes bearing manufacture date for for unshielded twisted pair (UTP) in accordance with JCS 5507[ and optical fiber cables in accordance with JIS C 6870-2] for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

### [2.3.1 Backbone Cabling

#### [2.3.1.1 Backbone Copper

Copper backbone cable shall be solid conductor, 0.2 sqmm, 100 ohm, [100] [\_\_\_\_]-pair, Category 3, UTP, in accordance with JCS 5507, JIS X 5150, JCS 5507 and JCS 5000 series, formed into [25][10] pair binder groups covered with a[ gray][ \_\_\_\_] thermoplastic jacket[ and overall metallic shield]. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular length marking intervals in accordance with JCS 5507. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG)communications rated cabling as required. Substitution of a higher rated cable shall be permitted upon approval prior to installation.

#### ] [2.3.1.2 Backbone Optical Fiber

Provide in accordance with JIS C 6870-2, JIS C 6820, JIS C 6850, UL 1666 and JIS C 3665-1-1. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 1 meter.

Provide the number of strands indicated, (but not less than 12 strands between the main telecommunication room and each of the other telecommunication rooms), of single-mode(OS1), tight buffered fiber optic cable.

[Provide tight buffered fiber optic multimode, [50/125-um diameter laser optimized(OM3)][50/125-um diameter(OM2)][62.5/125-um diameter(OM1)] cable as indicated.]

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted. The cable cordage jacket, fiber, unit, and group color shall be in accordance with JIS X 5150.

Provide plenum (OFNP) riser (OFNR) , or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted . The cable cordage jacket, fiber, unit, and group color shall be in accordance with JIS X 5150.

#### ] [2.3.2 Horizontal Cabling

Provide horizontal cable and performance characteristics in accordance with JIS X 5150.

#### 2.3.2.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with JCS 5507, and JIS X 5150. Provide four each individually twisted pair, minimum size 0.2 sqmm conductors, Category 6, with a [blue] [ ] thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with JCS 5507. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling as required per application. Substitution of a higher rated cable shall be permitted. Cables installed in conduit within and under slabs shall be listed and labeled for wet locations. [Provide residential Category 6 cabling as required.]

#### [2.3.2.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with JIS C 6870-2 and JIS C 6820 and JIS C 6850. Cable shall be tight buffered, [multimode, 50/125-um diameter laser optimized, OM3][, ][multimode, 50/125-um diameter, OM2][multimode, 62.5/125-um diameter, OM1][single-mode, 8/125-um diameter, OS1]. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 1 meter.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted. Cables installed in conduit within and under slabs be listed and labeled for wet locations. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group in accordance with JIS X 5150.

#### ]2.3.3 Work Area Cabling

##### 2.3.3.1 Work Area Copper

Provide work area copper cable in accordance with JCS 5507, with a [blue,][ ] thermoplastic jacket.

##### [2.3.3.2 Work Area Optical Fiber

Provide optical work area cable in accordance with JIS C 6820 and JIS C 6850.

#### ]2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility[ and telecommunication equipment room[s]] to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with [base][facility] standards.

##### 2.4.1 Backboards

Provide void-free, interior grade A-C plywood 19 mm thick[1200 by 2400 mm] [as indicated]. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible.[ Paint applied over fire retardant backboard shall be UL 723 and JIS C 60364-4-42 fire retardant paint.

Provide label including paint manufacturer, date painted, UL listing and name of Installer. When painted, paint label and fire stamp shall be clearly visible.] Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

#### [2.4.2 Equipment Support Frame

Provide in accordance with JIS C 6011-1 and JIS C 6012-3-100.

- [ a. Bracket, wall mounted, 8 gauge aluminum. Provide hinged bracket compatible with [482.6 mm][584 mm] panel mounting.
- ][b. Racks, floor mounted modular type, [16 gauge steel][ or ][11 gauge aluminum] construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[ and a surge protected power strip with 6 duplex 20 amp receptacles]. Rack shall be compatible with[ 482.6 mm][ 584 mm] panel mounting.
- ][c. Cabinets, freestanding modular type, [16 gauge steel][ or ][11 gauge aluminum] construction , minimum, treated to resist corrosion. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for leveling. Cabinet shall be vented in the roof and rear door. Cabinet shall have cable access in the roof and base and be compatible with[ 482.6 mm][ 584 mm] panel mounting. Provide cabinet with grounding bar[,][ [rack][roof] mounted 15 cu. m fan with filter ][ and][ a surge protected power strip with 6 duplex 20 amp receptacles].[ All cabinets shall be keyed alike.]
- ][d. Cabinets, wall-mounted modular type, [16 gauge steel][ or ][11 gauge aluminum] construction , minimum, treated to resist corrosion. Cabinet shall have have lockable front[ and rear] door[s], louvered side panels,[ 7 cu. m [roof][rack] mounted fan, ] ground lug, and top and bottom cable access. Cabinet shall be compatible with[ 482.6 mm][ 584 mm] panel mounting.[ All cabinets shall be keyed alike.][ A [duplex AC outlet][surge protected power strip with 6 duplex 20 amp receptacles] shall be provided within the cabinet.]

#### ]][2.4.3 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.

#### ]][2.4.4 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on[ [482.6][584] mm equipment[ racks][ cabinets]][ and ][ telecommunications backboards]. Cable guides of ring or bracket type devices[ mounted on [rack][cabinet] panels][backboard] for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws,[ and ][ or ]nuts and lockwashers.

#### ]][2.4.5 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus [25][\_\_\_\_\_] percent spare. Provide pre-connectorized

[optical fiber][ and ][copper] patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified.[ Provide fiber optic patch cables with crossover orientation in accordance with JIS C 6820 and JIS C 6850]. Patch cords shall meet minimum performance requirements specified in JIS X 5150, JCS 5507 [ and JIS C 6820 and JIS C 6850] for cables, cable length and hardware specified.

#### 2.4.5.1 Modular to 110 Block Patch Panel

Provide in accordance with JIS X 5150 and JCS 5507. Panels shall be third party verified[ and shall comply with EIA/TIACategory 6 requirements]. Panel shall be constructed of 2.2 mm minimum aluminum and shall be [cabinet][rack][wall] mounted and compatible with JIS C 6012-3-100 [ 482.6 mm][ 584 mm] equipment[ cabinet][ rack]. Panel shall provide [48][\_\_\_\_\_] non-keyed, 8-pin modular ports, wired to [T568A][T568B]. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

#### [2.4.5.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of[ [16][18] gauge steel][ or][ 11 gauge aluminum] minimum and shall be [cabinet][rack][wall] mounted and compatible with a JIS C 6012-3-100[ 482.6 mm][ 584 mm] equipment rack. Each panel shall provide [12][\_\_\_\_\_] [multimode][single-mode] adapters as [ duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,] [duplex SC in accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic][MT-RJ in accordance with JIS C 5964-18 with thermoplastic][ST in accordance with with metallic] alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 203 mm deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

#### ][2.4.6 Optical Fiber Distribution Panel

[Cabinet][Rack][Wall] mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with JIS C 6012-3-100 utilizing[ [16][18] gauge steel][ or][ 11 gauge aluminum] minimum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides, splice tray and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide[ [12][\_\_\_\_\_] multimode][ and][ [12][\_\_\_\_\_] single-mode] pigtailed and adapters. Provide adapters as [ duplex LC with zirconia ceramic] [ duplex SC with zirconia ceramic][ MT-RJ with thermoplastic][ ST with metallic] alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS.

### ]2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

#### 2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with JIS X 5150 and JCS 5507. UTP outlet/connectors shall be JIS X 5150 listed, non-keyed, 8-pin modular,

constructed of high impact rated thermoplastic housing and shall be third party verified[ and shall comply with JCS 5507 Category 6 requirements.] Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired [T568A][ or ][T568B][as indicated]. UTP outlet/connectors shall comply with JCS 5507 for [200] [\_\_\_\_\_] mating cycles.[ UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.]

#### 2.5.2 Optical Fiber Adapters(Couplers)

Provide optical fiber adapters suitable for[ duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,][ duplex SC in Accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic alignment sleeves,] [ MT-RJ in accordance with JIS C 5964-18 with thermoplastic alignment sleeves,][ and][ ST with metallic alignment sleeves] as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with JIS C 61300-2-2 for [500][\_\_\_\_\_] mating cycles.

#### 2.5.3 Optical Fiber Connectors

Provide in accordance with JIS C 61300-2-2.[ Optical fiber connectors shall be[ duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,] [ duplex SC in accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic][ MT-RJ in accordance with JIS C 5964-18 with thermoplastic][ ST in accordance with with metallic] ferrule, epoxyless[ crimp style] compatible with[ [62.5/125][50/125] multimode][8/125 single-mode] fiber. The connectors shall provide a maximum attenuation of 0.3 dB at[ 850][ 1300][ 1310][ 1550] nm with less than a 0.2 dB change after 500 mating cycles.]

#### 2.5.4 Cover Plates

Telecommunications cover plates shall comply with JIS C 8435, and JIS X 5150, [JCS 5507], [JIS C 6820 and JIS C 6850]; [flush][ or ][oversized] design constructed of [high impact thermoplastic material [[ivory][white][brown] in color][to match color of receptacle/switch cover plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM]][302 stainless material][ or ][brass material]. Provide labeling in accordance with the paragraph LABELING in this section.

### [2.6 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

Provide MUTOA(s) in accordance with JIS X 5150.

### ]2.7 TERMINAL CABINETS

Construct of zinc-coated sheet steel,[ 915 by 610 by 150 mm deep][as indicated]. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 16 mm backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panelboards. Provide label and identification systems for telecommunications wiring and components.

### ]2.8 GROUNDING AND BONDING PRODUCTS

Provide in accordance with JIS C 60364-5-54. Components shall be

identified as required by applicable codes and standards. Provide ground rods, bonding conductors, and grounding busbars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.9 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

## 2.10 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

## 2.11 FIELD FABRICATED NAMEPLATES

JIS K 6911. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm thick, white with [black] [\_\_\_\_\_] center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm. Lettering shall be a minimum of 6.35 mm high normal block style.

## 2.12 TESTS, INSPECTIONS, AND VERIFICATIONS

### 2.12.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with JIS X 5150, JCS 5507, JIS C 6820 and JIS C 6850[, JIS C 6185-2 for single mode optical fiber ][, and JIS C 6185-3 for multimode optical fiber] cables.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with JIS X 5150, JCS 5507, [JIS C 6820 and JIS C 6850, ], and UL standards as applicable. Provide cabling in a star topology network.[ Provide residential cabling in a star wiring architecture from the distribution device as required.] Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.[ Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.]

#### 3.1.1 Cabling

Install [UTP,][ and][ optical fiber] telecommunications cabling system as detailed in JIS X 5150, [JCS 5507, ] [JIS C 6820 and JIS C 6850, Appendix

A)[ and applicable codes and standards for residential cabling]. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 110 N pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

#### [3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Install in accordance with JIS X 5150, JCS 5507 [ and ]JIS C 6820 and JIS C 6850, Appendix A]. Do not exceed cable pull tensions recommended by the manufacturer.[ Copper cable not in a wireway or pathway shall be suspended a minimum of [200][\_\_\_\_\_] mm above ceilings by cable supports no greater than [1.5][\_\_\_\_\_] m apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm shall be maintained when such placement cannot be avoided.]

Plenum cable shall be used where open cables are routed through plenum areas. Cable routed exposed under raised floors shall be plenum rated. Plenum cables shall comply with flammability plenum requirements per applicable codes and standards. Install cabling after the flooring system has been installed in raised floor areas.[ Cable [1.8][\_\_\_\_\_] meters long shall be neatly coiled not less than [300][\_\_\_\_\_] mm in diameter below each feed point in raised floor areas.]

#### ]3.1.1.2 Backbone Cable

- a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in indicated pathways, between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in telecommunications rooms and telecommunications equipment rooms as indicated on drawings.
- b. Optical fiber Backbone Cable. Install intrabuilding backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 250 mm leaving strength members exposed for approximately 250 mm. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

#### 3.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than 12 mm from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 3 m in the telecommunications room, and 304 mm in the work area outlet.



### 3.1.2 Pathway Installations

Provide in accordance with JIS X 5150. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### [3.1.3 Service Entrance Conduit, Overhead

Provide service entrance overhead as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

#### ] [3.1.4 Service Entrance Conduit, Underground

Provide service entrance underground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### ] 3.1.5 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only [CMP] [and] [OFNP] type cable shall be installed in a plenum.

### 3.1.6 Work Area Outlets

#### 3.1.6.1 Terminations

Terminate UTP cable in accordance with JIS X 5150, JCS 5507 and wiring configuration as specified. [Terminate fiber optic cables in accordance with JIS C 6820 and JIS C 6850]

#### 3.1.6.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

#### 3.1.6.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 304 mm of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

#### 3.1.6.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

#### [3.1.6.5 Multi-User Telecommunications Outlet Assembly (MUTOA)

Run horizontal cable in the ceiling or underneath the floor and terminate each cable on a MUTOA in each individual zone. MUTOAs shall not be located in ceiling spaces, or any obstructed area. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOAs shall be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA shall be limited to serving a maximum of twelve work areas. Maximum work area cable length requirements shall also be taken into account. MUTOAs must be labeled to include the maximum length of work area cables. MUTOA labeling is in addition to the labeling, or other applicable cabling administration standards. Work area cables extending

from the MUTOA to the work area device must also be uniquely identified and labeled.

#### ]3.1.7 Telecommunications Space Termination

Install termination hardware required for [Category 6][ and ][optical fiber] system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

##### [3.1.7.1 Connector Blocks

Connector blocks shall be [cabinet][rack][wall] mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with JIS X 5150.

##### ]3.1.7.2 Patch Panels

Patch panels shall be mounted [in equipment [cabinets]][racks][on the plywood backboard] with sufficient ports to accommodate the installed cable plant plus [25][\_\_\_\_\_] percent spares.

- [ a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel [with cable ties][as recommended by the manufacturer] to prevent movement of the cable.
- ] [b. Fiber Optic Patch Panel. Fiber optic cable loop shall be [ [900][\_\_\_\_\_] mm in length][provided as recommended by the manufacturer]. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

##### ] [3.1.7.3 Equipment Support Frames

Install in accordance with JIS X 5150:

- [a. Bracket, wall mounted. Mount bracket to plywood backboard in accordance with manufacturer's recommendations. Mount rack so height of highest panel does not exceed 1980 mm above floor.]
- [b. Racks, floor mounted modular type. Permanently anchor rack to the floor in accordance with manufacturer's recommendations.]
- [c. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets.[ Mount rack mounted fan in [roof][base] of cabinet.]]
- [d. Cabinets, wall-mounted modular type. Mount cabinet to plywood backboard in accordance with manufacturer's recommendations. Mount cabinet so height of highest panel does not exceed 1980 mm above floor.]

#### ]3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

### 3.1.9 Grounding and Bonding

Provide in accordance with JIS C 60364-5-54 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 3.2 LABELING

### 3.2.1 Labels

Provide labeling in accordance with applicable codes and standards. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using[ thermal ink transfer process][ laser printer] [\_\_\_\_\_].

### 3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers.

### 3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers.

## 3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

## 3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

## 3.5 TESTING

### 3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with JIS X 5150, [JCS 5507], [JIS C 6820 and JIS C 6850]. Test equipment shall conform to JIS X 5150. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

#### 3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in

telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with JIS X 5150, JCS 5507, [JIS C 6820 and JIS C 6850], [ and ][applicable codes and standardsfor residential cabling]. Visually confirm [ Category 6,] marking of outlets, cover plates, outlet/connectors, and patch panels.

#### 3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

[[For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with JIS C 6820 and JIS C 6850 and JIS C 6850 and JIS C 6185-3 using[ Method A, Optical Power Meter and Light Source][ Method B, OTDR] for multimode optical fiber.][ For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with JIS C 6820 and JIS C 6850 and JIS C 6185-2 using[ Method A, Optical Power Meter and Light Source][ Method B, OTDR] for single-mode optical fiber.] Perform verification acceptance tests.]

#### 3.5.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

- [ a. Perform Category 6 link tests in accordance with JIS X 5150 and JCS 5507. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
- ] [. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with JIS C 6820 and JIS C 6850.

#### ]3.5.1.4 Final Verification Tests

Perform verification tests for UTP[ and optical fiber] systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

- [ a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.
  - ] [b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- ] -- End of Section --